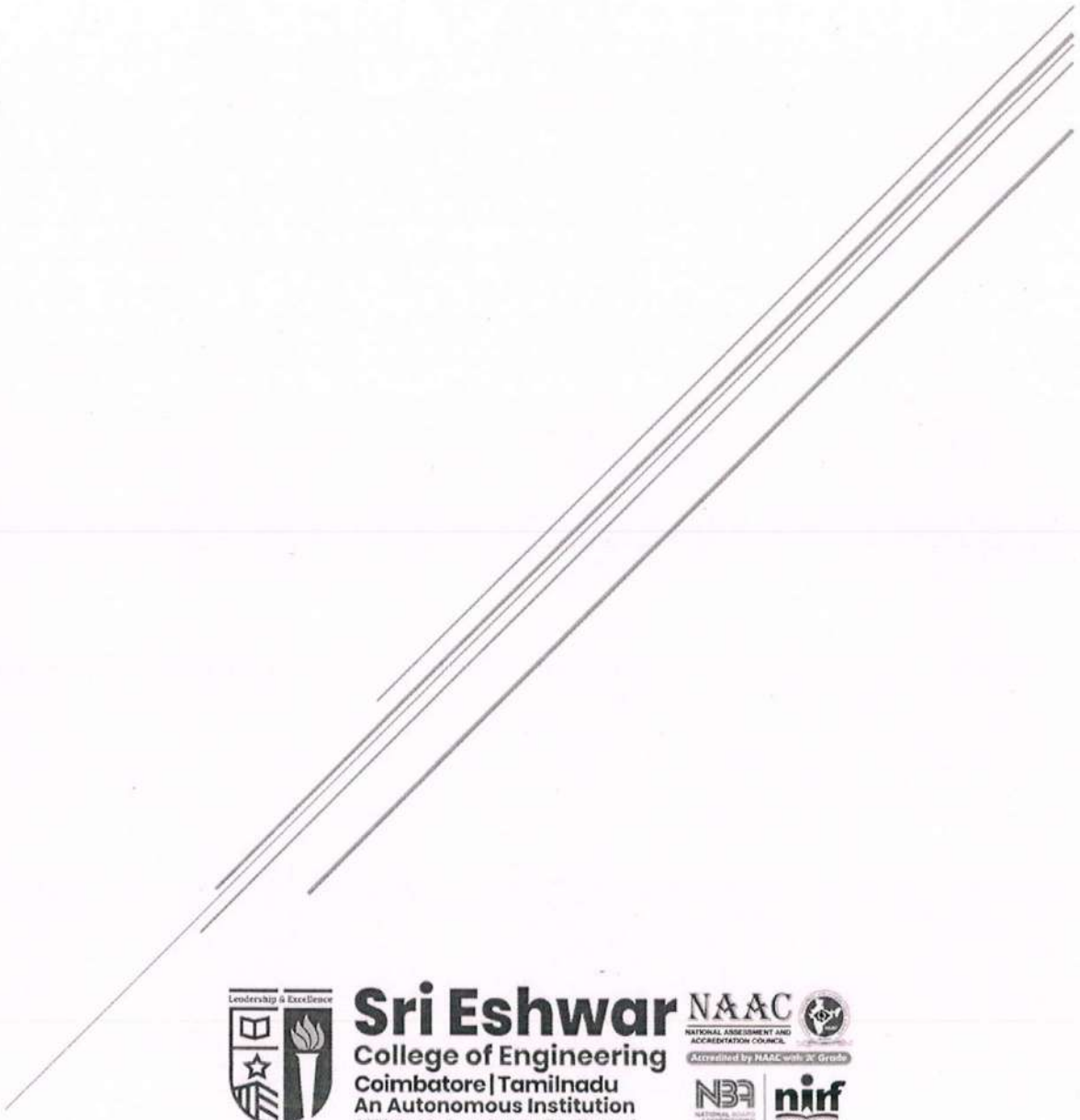
B.E. (Electrical and Electronics Engineering)

CURRICULUM AND SYLLABUS HANDBOOK

Regulation 2019 (Revised)

Approved by Academic Council on 14.10.2024

2024 – 2025



Sri Eshwar College of Engineering
Coimbatore | Tamilnadu
An Autonomous Institution
Affiliated to Anna University, Chennai

1.0 Vision, Mission and Core Values of the Institution

Vision

"To be recognized as a premier institution, grooming students into globally acknowledged engineering professionals."

Mission

We will achieve the Vision by:

- ✓ Providing outcome and value-based engineering education
- ✓ Nurturing research and entrepreneurial culture
- ✓ Enabling students to be industry-ready and fulfil their career aspirations
- ✓ Grooming students through behavioural and leadership training programs
- ✓ Making students socially responsible

Core Values

The following core values of Sri Eshwar College of Engineering are closely aligned with its vision and mission, supporting the college's goal of developing well-rounded, globally capable, and socially responsible engineering professionals:

1. Pursuit of Excellence
2. Culture of Innovation
3. Spirit of Collaboration
4. Commitment to Integrity
5. Embrace of Inclusivity
6. Dedication to Lifelong Learning
7. Responsibility to Society

2.0 Vision and Mission of the Department

Vision

"To become a centre of excellence that focusses on Embedded Systems, Industrial Automation, Electronic Design and Automation domains and evolve as an integrated facility provider for academic services that include research and innovation that are practically useful to society."

Mission

M1: Evolve curriculum and delivery approaches to provide broad and wide exposure to gain knowledge in their field of study.

M2: Provide opportunities to enhance domain knowledge and skills required for the programs offered.

M3: Establish connections with local, national and global experts to share, utilize and exchange domain expertise

M4: Conduct Outreach activities for the society that involve the use of electrical engineering solutions to address societal challenges.

M5: Create and provide a conducive ecosystem and facilities for offering education related to electrical and electronics engineering.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

3.0 B.E. (EEE) Program Educational Objectives (PEOs)

PEO1: Graduates will take up careers in Electrical and Electronics Engineering like design and manufacture of Electrical and Electronic and its related systems and involve in carrying out engineering projects.

PEO2: Graduates will engage in a post-graduate program in the field of Electrical and Electronics Engineering Sciences and Management Sciences leading to academic and research careers.

PEO3: Graduates will take up entrepreneurship as a career.

4.0 Knowledge and Attitude Profile (WK)

WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

WK2: Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

WK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

WK6: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

WK7: Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

WK8: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

WK9: Ethics, inclusive behaviour and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

5.0 B.E. (EEE) Program Outcomes (POs)

PO1: **Engineering Knowledge**: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialisation as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: **Problem Analysis**: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: **Design/Development of Solutions**: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: **Conduct Investigations of Complex Problems**: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: **Engineering Tool Usage**: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: **The Engineer and The World**: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to the economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: **Ethics**: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: **Individual and Collaborative Teamwork**: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: **Communication**: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: **Project Management and Finance**: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: **Life-Long Learning**: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

6.0 B.E. (EEE) Program Specific Outcomes (PSOs)

PSO1: Design, analyse and control the energy conversion systems and power systems integrated with renewable energy ensuring sustainable and ethical engineering solutions.

PSO2: Design, implement and optimize embedded systems and PLC for industrial automation ensuring the development of efficient, reliable and advanced automation solutions.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

7.0 B.E. (EEE) Program Curriculum

7.1 Curriculum Structure

The curriculum structure includes the following course categories:

The curriculum structure includes the following course categories:

Humanities and Social Sciences (HS): Technical English, Foreign Languages, Management & Engineering Ethics, and Engineering Economics.

Basic Sciences (BS): Mathematics, Physics, and Chemistry.

Engineering Sciences (ES): Materials Science, Workshop Practices, Drawing, and Fundamentals of Electrical, Electronics, Mechanical, and Computer Engineering.

Professional Core (PC): Courses specific to the chosen specialisation or branch.

Professional Electives (PE): Elective courses within the chosen specialisation (Vertical).

Open Electives (OE): Courses from other technical or emerging subject areas.

Project Work (PW): Projects involving Design Thinking (Product/Software Development Life Cycle), Innovative/Multidisciplinary Projects, Industry Projects, and other project work.

Employability Enhancement Courses (EM): Personality Development, Verbal and Soft Skills, Advanced Logical Thinking, and Industry or External Internships.

Mandatory Courses (MC): Heritage of Tamils (**HSMC**), Tamils and Technology (**HSMC**), Environmental Science, and Universal Human Values.

Optional Courses (OC): NCC Credit Course Level I, NCC Credit Course Level II, NCC Credit Course Level III and Honours Courses.

Student Induction Programme (SIP)

The Student Induction Programme (SIP) is an essential three-week orientation tailored for first-year undergraduate students enrolled in BE/B.Tech programs. Held annually, this programme is designed to facilitate a smooth transition from secondary education to collegiate life, ensuring that students effectively integrate into both the academic and social environments of the institution.

Program Components

- ✓ Universal Human Values
- ✓ Health
- ✓ Department Familiarization
- ✓ Interactive Lectures
- ✓ Proficiency Modules
- ✓ Local Visits
- ✓ Cultural Activities

The SIP plays a pivotal role in setting the stage for a successful and fulfilling college experience, providing students with the tools and support necessary for a smooth transition into their academic and social life.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

7.2 B.E. - EEE Curriculum

Outcome Based Education (OBE) with Choice Based Credit System (CBCS)

Regulation 2019 (Revised)

Semester I

Sl. No.	Course Code	Course Name	Category	Periods/ Week			TC	C
				L	T	P		
Theory Courses								
1	R19MA101	Matrix Algebra and Calculus	BS	3	1	0	4	4
2	R19PH102	Semiconductor Physics	BS	3	0	0	3	3
3	R19CS101	Problem Solving using C	ES	3	0	0	3	3
4	R19ME101	Engineering Graphics	ES	1	0	4	5	3
Theory cum Practical Course								
5	R19HS151	Technical English	HS	2	0	2	4	3
Practical Courses								
6	R19PH112	Semiconductor Physics Laboratory	BS	0	0	2	2	1
7	R19GE111	Engineering Practices Laboratory	ES	0	0	4	4	2
8	R19CS111	Problem Solving using C Laboratory	ES	0	0	4	4	2
Professional Development Course								
9	R19EM101	Soft Skills	EM	0	0	2	2	1
Total				**12**	**1**	**18**	**31**	**22**

Semester II

Sl. No.	Course Code	Course Name	Category	Periods/ Week			TC	C
				L	T	P		
Theory Courses								
1	R19MA102	Advanced Calculus and Complex Variables	BS	3	1	0	4	4
2	R19CY101	Engineering Chemistry	BS	3	0	0	3	3
3	R19CS201	Data Structures	ES	3	0	0	3	3
4	R19CS104	Application Design and Development	ES	2	2	0	4	4
5	R19EE103	Circuit Theory	PC	3	1	0	4	4
Theory cum Practical Course								
6	R19HS55X	Language Elective	HS	2	0	2	4	3
Practical Courses								
7	R19CY111	Chemistry Laboratory	BS	0	0	2	2	1
8	R19CS211	Data Structures Laboratory	ES	0	0	4	4	2
9	R19EE111	Electric Circuits Laboratory	PC	0	0	2	2	1
Mandatory Course								
10	R19MC101	தமிழர் மரபு / Heritage of Tamils	HSMC	1	0	0	1	1
Total				**17**	**4**	**10**	**31**	**26**

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Semester III

Sl. No.	Course Code	Course Name	Cate-gory	Periods/ Week			TC	C
				L	T	P		
Theory Courses								
1	R19MA201	Transforms and Partial Differential Equations	BS	3	1	0	4	4
2	R19CS207	Algorithmic Design Techniques	ES	3	0	0	3	3
3	R19CS203	Object Oriented Programming using Java	ES	3	0	0	3	3
4	R19EE201	Field Theory	PC	3	1	0	4	4
5	R19EE202	Linear Integrated Circuits and Digital Electronics	PC	3	0	0	3	3
6	R19XXXXX	Open Elective I*	OE	3	0	0	3	3
Practical Courses								
7	R19CS213	Object Oriented Programming using Java Lab	ES	0	0	2	2	1
8	R19CS217	Algorithmic Design Techniques Laboratory	ES	0	0	2	2	1
9	R19EE211	Linear Integrated Circuits and Digital Electronics Laboratory	PC	0	0	2	2	1
Professional Development Course								
10	R19EM201	Logical Thinking	EM	0	0	2	2	1
Mandatory Course								
11	R19MC102	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	HSMC	1	0	0	1	1
Total				**19**	**2**	**8**	**29**	**25**

Semester IV

Sl. No.	Course Code	Course Name	Cate -gory	Periods/ Week			TC	C
				L	T	P		
Theory Courses								
1	R19MA205	Statistics and Numerical Methods	BS	3	1	0	4	4
2	R19EE203	Electrical Machines – I	PC	2	1	0	3	3
3	R19EE204	Control Systems	PC	3	1	0	4	4
4	R19EE205	Measurements and Instrumentation	PC	3	0	0	3	3
5	R19XXXXX	Open Elective II*	OE	3	0	0	3	3
Theory cum Practical Course								
6	R19EE251	Microprocessors and Microcontrollers	PC	3	0	2	5	4
Practical Courses								
7	R19EE212	Electrical Machines Laboratory – I	PC	0	0	3	3	1.5
8	R19EE213	Control and Instrumentation Laboratory	PC	0	0	3	3	1.5
Project Work								
9	R19EE281	Project with Design Thinking (Product/Software Development Life Cycle)	PW	0	0	2	2	1
Professional Development Courses								
10	R19EM202	Advanced Logical Thinking	EM	0	0	2	2	1
11	R19EM203	Summer Internship	EM	-	-	-	-	NC
Mandatory Course								
12	R19MC201	Environmental Science	MC	1	0	0	1	NC
Total				**18**	**3**	**12**	**33**	**26**

* - Electives Structure: 3 0 0 3 / 2 0 2 3.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Semester V

Sl. No.	Course Code	Course Name	Category	Periods/ Week			TC	C
				L	T	P		
Theory Courses								
1	R19EE301	Electrical Machines – II	PC	2	1	0	3	3
2	R19EE302	Generation, Transmission and Distribution	PC	3	1	0	4	4
3	R19EE303	Power Electronics	PC	3	0	0	3	3
4	R19EE304	Embedded Systems	PC	3	0	0	3	3
5	R19EE5XX	Professional Elective I	PE	3	0	0	3	3
6	R19XXXXX	Open Elective III*	OE	3	0	0	3	3
Practical Courses								
7	R19EE311	Electrical Machines Laboratory – II	PC	0	0	3	3	1.5
8	R19EE312	Power Electronics Laboratory	PC	0	0	3	3	1.5
Mandatory Course								
9	R19MC202	Indian Constitution and Tradition	MC	1	0	0	1	NC
Total				**18**	**2**	**6**	**26**	**22**

* - Electives Structure: 3 0 0 3 / 2 0 2 3.

Semester VI

Sl. No.	Course Code	Course Name	Category	Periods/ Week			TC	C
				L	T	P		
Theory Courses								
1	R19EE305	Power System Analysis and Stability	PC	3	1	0	4	4
2	R19EE306	Solid State Drives	PC	3	0	0	3	3
3	R19EE307	Internet of Things for Electrical Engineers	PC	3	0	0	3	3
4	R19AM303	Artificial Intelligence and Machine Learning	PC	3	0	0	3	3
5	R19EE5XX	Professional Elective II	PE	3	0	0	3	3
Practical Courses								
7	R19EE313	Power Systems Laboratory	PC	0	0	2	2	1
8	R19AM312	Artificial Intelligence and Machine Learning Laboratory	PC	0	0	2	2	1
Project Work								
9	R19EE381	Innovative / Multi-Disciplinary Project	PW	0	0	2	2	1
Total				**15**	**1**	**6**	**22**	**19**

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Semester VII

Sl. No.	Course Code	Course Name	Category	Periods/ Week			TC	C
				L	T	P		
Theory Courses								
1	R19HS401	Principles of Management and Professional Ethics	HS	3	0	0	3	3
2	R19EE401	Digital Power System Protection and Switchgear	PC	3	0	0	3	3
3	R19EE5XX	Professional Elective III	PE	3	0	0	3	3
Project Work								
4	R19EE481	Project Work – Phase I	PW	0	0	6	6	3
Total				**9**	**0**	**6**	**15**	**12**

Semester VIII

Sl. No.	Course Code	Course Name	Category	Periods/ Week			TC	C
				L	T	P		
Theory Courses								
1	R19EE5XX	Professional Elective IV	PE	3	0	0	3	3
Project Work								
2	R19EE482	Project Work – Phase II	PW	0	0	16	16	8
Total				**3**	**0**	**16**	**19**	**11**

L→Lecture; T→Tutorial; P→Practical; TC→Total Classes/wk; C→Credit.

Credit Summary*

Sl. No.	Course Category	Credits per Semester								Credits	Credit %
		I	II	III	IV	V	VI	VII	VIII		
1	**HS**	3	3	-	-	-	-	3	-	9	5.5
2	**BS**	8	8	4	4	-	-	-	-	24	14.7
3	**ES**	10	9	8	-	-	-	-	-	27	16.6
4	**PC**	-	5	8	17	16	15	3	-	64	39.3
5	**PE**	-	-	-	-	3	3	3	3	12	7.4
6	**OE**	-	-	3	3	3	-	-	-	9	5.5
7	**PW**	-	-	-	1	-	1	3	8	13	8.0
8	**EM**	1	-	1	1√	-	-	-	-	3	1.8
9	**MC**	-	-	-	√	√	-	-	-	-	-
10	**HSMC**	-	1	1	-	-	-	-	-	2	1.2
Total		**22**	**26**	**25**	**26**	**22**	**19**	**12**	**11**	**163**	**100**

Total Number of Credits: 163

* Excluding Honors Courses

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

7.3 Professional Elective Courses: Verticals

Vertical 1	Vertical 2	Vertical 3	Vertical 4	Vertical 5	Vertical 6	Vertical 7
Embedded Systems and Automation	**Electric Vehicle Technology**	**Green Technology**	**Power Systems Engineering**	**Power Electronics and Drives**	**Electrical Energy Engineering**	**Artificial Intelligence and Data Science for Electrical Engineers**
R19EE511 Embedded Controllers and Applications	R19EE521 Electric Vehicle Architecture and Technology	R19EE531 Renewable Energy Systems	R19EE541 Power System Operation and Control	R19EE551 Advanced Power Semiconductor Devices	R19EE561 Utilisation of Electrical Energy	R19EE571 Artificial Intelligence in Electrical Engineering
R19EE512 Linux Architecture and Device Drivers	R19EE522 Design of Motor and Power Converter for EV	R19EE532 Design of Solar Photovoltaic Systems	R19EE542 Power System Transients	R19EE552 Modern Power Converters	R19EE562 Energy Auditing and Management	R19EE572 Generative AI for Electrical Engineering
R19EE513 Embedded Networked Systems	R19EE523 Power Management for Electric Vehicles	R19EE533 Grid Integration of Renewable Energy Systems	R19EE543 High Voltage Engineering	R19EE553 Flexible AC Transmission Systems	R19EE563 Energy Conservation Practices	R19EE573 Electrical Data Warehousing and Mining
R19EE514 Embedded and Real-Time Systems	R19EE524 Design of EV Charging Systems	R19EE534 Power Electronics for Renewable Energy Systems	R19EE544 HVDC and FACTS	R19EE554 Power Quality	R19EE564 Distributed Generation and Microgrid	R19EE574 Foundations of Machine Learning and Deep Learning for Electrical Engineers
R19EE515 PLC and SCADA	R19EE525 Electric Vehicle Mechanics and Control	R19EE535 Wind Energy Conversion System	R19EE545 Power System Planning and Reliability	R19EE555 Application of Power Electronics to Power Systems	R19EE565 Smart Grid	R19EE575 IoT Data Processing and Analysis
R19EE516 Sensors and Automation	R19EE526 Prospects and Challenges for Electric Vehicles	R19EE536 Smart Energy Systems	R19EE546 AI Applications to Power Systems	R19EE556 SMPS and UPS	R19EE566 Fuel Cells and Battery Management Systems	R19EE576 Computer Vision for Electrical Engineers
R19EE517 Principles of Robotics	R19EE527 IoT for EV Applications	R19EE537 Advanced Energy Systems Technology	R19EE547 Substation Engineering and Automation	R19EE557 Digital Controller for Power Electronics	R19EE567 Special Electrical Machines	R19EE577 Data Visualization and Data Exploration for Electrical Engineering

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

7.4 Professional Elective Courses with Credits:

Sl. No.	Course Code	Course Name	Category	Periods/ Week			TC	C
				L	T	P		
Vertical 1 – Embedded Systems and Automation								
1	R19EE511	Embedded Controllers and Applications	PE	3	0	0	3	3
2	R19EE512	Linux Architecture and Device Drivers	PE	3	0	0	3	3
3	R19EE513	Embedded Networked Systems	PE	3	0	0	3	3
4	R19EE514	Embedded and Real-Time Systems	PE	3	0	0	3	3
5	R19EE515	PLC and SCADA	PE	3	0	0	3	3
6	R19EE516	Sensors and Automation	PE	3	0	0	3	3
7	R19EE517	Principles of Robotics	PE	3	0	0	3	3
Vertical 2 – Electric Vehicle Technology								
1	R19EE521	Electric Vehicle Architecture and Technology	PE	3	0	0	3	3
2	R19EE522	Design of Motor and Power Converter for EV	PE	3	0	0	3	3
3	R19EE523	Power Management for Electric Vehicles	PE	3	0	0	3	3
4	R19EE524	Design of EV Charging Systems	PE	3	0	0	3	3
5	R19EE525	Electric Vehicle Mechanics and Control	PE	3	0	0	3	3
6	R19EE526	Prospects and Challenges for Electric Vehicles	PE	3	0	0	3	3
7	R19EE527	IoT for EV Applications	PE	3	0	0	3	3
Vertical 3 – Green Technology								
1	R19EE531	Renewable Energy Systems	PE	3	0	0	3	3
2	R19EE53	Design of Solar Photovoltaic Systems	PE	3	0	0	3	3
3	R19EE533	Grid Integration of Renewable Energy Systems	PE	3	0	0	3	3
4	R19EE534	Power Electronics for Renewable Energy Systems	PE	3	0	0	3	3
5	R19EE535	Wind Energy Conversion System	PE	3	0	0	3	3
6	R19EE536	Smart Energy Systems	PE	3	0	0	3	3
7	R19EE537	Advanced Energy Systems Technology	PE	3	0	0	3	3
Vertical 4 – Power Systems Engineering								
1	R19EE541	Power System Operation and Control	PE	3	0	0	3	3
2	R19EE542	Power System Transients	PE	3	0	0	3	3
3	R19EE543	High Voltage Engineering	PE	3	0	0	3	3
4	R19EE544	HVDC and FACTS	PE	3	0	0	3	3
5	R19EE545	Power System Planning and Reliability	PE	3	0	0	3	3
6	R19EE546	AI Applications to Power Systems	PE	3	0	0	3	3
7	R19EE547	Substation Engineering and Automation	PE	3	0	0	3	3
Vertical 5 – Power Electronics and Drives								
1	R19EE551	Advanced Power Semiconductor Devices	PE	3	0	0	3	3
2	R19EE552	Modern Power Converters	PE	3	0	0	3	3
3	R19EE553	Flexible AC Transmission Systems	PE	3	0	0	3	3
4	R19EE554	Power Quality	PE	3	0	0	3	3
5	R19EE555	Application of Power Electronics to Power Systems	PE	3	0	0	3	3
6	R19EE556	SMPS and UPS	PE	3	0	0	3	3
7	R19EE557	Digital Controller for Power Electronics	PE	3	0	0	3	3

Chairman, Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Sl. No.	Course Code	Course Name	Category	Periods/ Week			TC	C
				L	T	P		
Vertical 6 – Electrical Energy Engineering								
1	R19EE561	Utilisation of Electrical Energy	PE	3	0	0	3	3
2	R19EE562	Energy Auditing and Management	PE	3	0	0	3	3
3	R19EE563	Energy Conservation Practices	PE	3	0	0	3	3
4	R19EE564	Distributed Generation and Microgrid	PE	3	0	0	3	3
5	R19EE565	Smart Grid	PE	3	0	0	3	3
6	R19EE566	Fuel Cells and Battery Management Systems	PE	3	0	0	3	3
7	R19EE567	Special Electrical Machines	PE	3	0	0	3	3
Vertical 7 – Artificial Intelligence and Data Science for Electrical Engineers								
1	R19EE571	Artificial Intelligence in Electrical Engineering	PE	3	0	0	3	3
2	R19EE572	Generative AI for Electrical Engineering	PE	3	0	0	3	3
3	R19EE573	Electrical Data Warehousing and Mining	PE	3	0	0	3	3
4	R19EE574	Foundations of Machine Learning and Deep Learning for Electrical Engineers	PE	3	0	0	3	3
5	R19EE575	IoT Data Processing and Analysis	PE	3	0	0	3	3
6	R19EE576	Computer Vision for Electrical Engineers	PE	3	0	0	3	3
7	R19EE577	Data Visualization and Data Exploration for Electrical Engineering	PE	3	0	0	3	3

7.5 Open Electives (OE):

Sl. No.	Course Code	Course Name	Category	Periods/ Week			TC	C
				L	T	P		
1	R19AD651	Data Science Essentials	OE	2	0	2	4	3
2	R19AD652	Exploratory Data Analysis and Visualization	OE	2	0	2	4	3
3	R19AD653	Machine Learning Techniques	OE	3	0	0	3	3
4	R19AD654	Foundations of Artificial Intelligence	OE	3	0	0	3	3
5	R19CC651	Network Protocols	OE	2	0	2	4	3
6	R19CC601	High Speed Networks	OE	3	0	0	3	3
7	R19CC602	Introduction to Industrial Networking	OE	3	0	0	3	3
8	R19CC603	Basics of Mobile Communication	OE	3	0	0	3	3
9	R19CC604	Introduction to Wireless Communication Networks	OE	3	0	0	3	3
10	R19CB601	Algorithmic Trading Strategies	OE	3	0	0	3	3
11	R19CB602	Business Simulation	OE	3	0	0	3	3
12	R19CB603	Principles of Taxation	OE	3	0	0	3	3
13	R19CB604	Strategic Business Leader	OE	3	0	0	3	3
14	R19CB605	Information Systems Control and Audit	OE	3	0	0	3	3
15	R19CS651	Application Development using Java	OE	2	0	2	4	3
16	R19CS652	Database Technologies	OE	2	0	2	4	3
17	R19CS653	Full Stack Technologies	OE	2	0	2	4	3
18	R19CS654	Fundamentals of Python Programming	OE	2	0	2	4	3

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202

Sl. No.	Course Code	Course Name	Category	Periods/ Week			TC	C
				L	T	P		
19	R19CS655	Competitive Coding Techniques	OE	2	0	2	4	3
20	R19AM601	Deep Learning Models	OE	3	0	0	3	3
21	R19AM602	Video and Speech Analytics	OE	3	0	0	3	3
22	R19AM603	Industrial Machine Learning	OE	3	0	0	3	3
23	R19AM604	Machine Learning for Smart Cities	OE	3	0	0	3	3
24	R19EC601	Discrete Time Signal Processing	OE	3	0	0	3	3
25	R19EC602	Principles of Analog and Digital Communication	OE	3	0	0	3	3
26	R19EC603	Digital Systems and VLSI Design	OE	3	0	0	3	3
27	R19EC604	Introduction to IoT	OE	3	0	0	3	3
28	R19EC605	Basics of Biomedical Instrumentation	OE	3	0	0	3	3
29	R19EC606	Introduction to Image processing	OE	3	0	0	3	3
30	R19EC607	Microcontroller and Embedded Systems	OE	3	0	0	3	3
31	R19EC608	Introduction to Wireless Sensor Networks	OE	3	0	0	3	3
32	R19EC609	Introduction to Robotics and Automation	OE	3	0	0	3	3
33	R19EC610	Medical Electronics	OE	3	0	0	3	3
34	R19IT601	Basic of Software Engineering	OE	3	0	0	3	3
35	R19IT602	Web Programming	OE	3	0	0	3	3
36	R19IT603	Basics of Software Testing	OE	3	0	0	3	3
37	R19IT604	Introduction to Block Chain Technology	OE	3	0	0	3	3
38	R19IT605	Soft Computing Technologies	OE	3	0	0	3	3
39	R19IT606	Fundamentals of IT Infrastructure Management	OE	3	0	0	3	3
40	R19IT607	Mobile Application Development	OE	3	0	0	3	3
41	R19IT651	Basics of Cloud Technology	OE	2	0	2	4	3
42	R19IT652	Introduction to Computer Networks	OE	2	0	2	4	3
43	R19IT653	Game Programming Fundamentals	OE	2	0	2	4	3
44	R19ME601	Product Design and Innovation	OE	3	0	0	3	3
45	R19ME602	3D Printing and Tooling	OE	3	0	0	3	3
46	R19ME603	Quality Management	OE	3	0	0	3	3
47	R19ME604	Enterprise Resource Planning	OE	3	0	0	3	3
48	R19ME605	Micro Electro Mechanical Systems	OE	3	0	0	3	3
49	R19ME606	Quality Control Tools and Techniques	OE	3	0	0	3	3
50	R19ME607	World Class Manufacturing	OE	3	0	0	3	3
51	R19ME608	Industrial Safety Engineering	OE	3	0	0	3	3
52	R19ME609	Introduction to Industry 4.0	OE	3	0	0	3	3
53	R19ME610	Lean Six Sigma and Supply Chain Management	OE	3	0	0	3	3
54	R19ME611	Business Organization and Development	OE	3	0	0	3	3
55	R19ME612	Product Distribution and Promotion Management	OE	3	0	0	3	3
56	R19ME613	Business Ethics, Corporate Social Responsibilities and Governance	OE	3	0	0	3	3
57	R19PH601	Laser Technology	OE	3	0	0	3	3
58	R19PH602	Nano Materials and Applications	OE	3	0	0	3	3
59	R19PH603	Physics for Solar PV System	OE	3	0	0	3	3

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Sl. No.	Course Code	Course Name	Cate-gory	Periods/ Week			TC	C
				L	T	P		
60	R19PH604	Medical Physics	OE	3	0	0	3	3
61	R19CY601	Chemical Sensors and Biosensors	OE	3	0	0	3	3
62	R19CY602	Energy Storing Devices	OE	3	0	0	3	3
63	R19CY603	Chemistry Forensic Science	OE	3	0	0	3	3
64	R19CY604	Industrial and Material Chemistry	OE	3	0	0	3	3
65	R19HS601	English for Competitive Examinations	OE	3	0	0	3	3
66	R19HS602	Personality Development and Interpersonal Skills	OE	3	0	0	3	3
67	R19HS603	Communication Techniques for Employability	OE	3	0	0	3	3
68	R19HS604	Mass Communication	OE	3	0	0	3	3

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

8.0. B.E (EEE) SYLLABUS

SEMESTER I

R19MA101	Matrix Algebra and Calculus	L	T	P	C
		3	1	0	4

1. Course Description:

Matrix algebra and calculus are fundamental mathematical subjects that find widespread applications in various fields, including physics, engineering, computer science, economics and more. Differential calculus emphasizes the understanding of rates of change and how they relate to the slopes of curves. Integration spreads its wings in finding areas under curves, volumes of solids of revolution, and applications in engineering. The course enhances critical thinking and analytical skills.

2. Course Objectives:

1. Explore matrix techniques and its applications.
2. Enhance thier knowledge in infinite series and their convergence.
3. Familiarize the student with functions of several variables and its extremum.
4. Cultivate knowledge in double integration.
5. Inculcate the knowledge of triple integrals and their applications.

3. Syllabus

Unit – I: Matrices

Eigen values and eigen vectors: Eigen values and eigen vectors of a real matrix; Properties; Cayley Hamilton theorem (statement only); Orthogonal transformation: Orthogonal transformation of a symmetric matrix to diagonal form, reduction of quadratic form to canonical form by orthogonal transformation.

Unit – II: Sequences and Series

Sequences: Definition and examples; Series: Types and convergence, series of positive terms; Tests of convergence: Comparison test, integral test and D'Alembert's ratio test; Alternating series: Leibnitz's test, Series of positive and negative terms, absolute and conditional convergence.

Unit – III: Multivariable Calculus

Functions of several variables: Partial derivatives, total derivative, differentiation of implicit functions, Jacobian, properties of Jacobians, Taylor's series, maxima and minima of functions of two variables, Lagrange's method of undetermined multipliers.

Unit – IV: Double Integration

Double integrals: Evaluation of double integrals, change of order of integration, double integrals in polar coordinates, area enclosed by plane curves.

Unit – V: Integration and its Application

Triple integrals: Evaluation of triple integrals, Volume as triple integral: simple problems, volume of solid, Gamma and Beta functions.

Text Books:

1. Grewal. B. S, "Higher Engineering Mathem`1atics", 44th Edition, Khanna Publications, Delhi, 2015.
2. Erwin Kreyszig, "Advanced Modern Engineering Mathematics", 10th Edition, John Wiley and Sons (Asia) Ltd, Singapore, 2017.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

References:

Reference Books:

1. H. K. Dass, "Advanced Engineering Mathematics", S. Chand & Company LTD, New Delhi, Reprint 2009.
2. John Bird, "Higher Engineering Mathematics", An imprint of Elsevier, Burlington, Reprint 2010.
3. Bali. N. P and Manish Goyal, "A Text book of Engineering Mathematics", 8th Edition, Laxmi publications Ltd, 2011.
4. Veerarajan. T, "Engineering Mathematics", 3rd edition, Tata Mc Graw Hill Education Pvt. Ltd, New Delhi, 2011.

Journals:

1. International Journal of Integral calculus.
2. International journal of Multivariable calculus.

Video Reference:

1. https://www.simplilearn.com/introduction-to-derivatives-rrt3co36vd364-video
2. https://www.khanacademy.org/math/ calculus-home/ integration-techniques-calc/trigonometric-substitution -calc /v /integrals-trig-substitution-1
3. http://www.dnatube.com/video/11238/What-Are-Conic-Sections
4. https://www.youtube.com/watch?v=AjmWR4kRtVk

MOOC / NPTEL / SWAYAM Courses:

1. nptel.ac.in/courses/111104092/
2. http://www.cdeep.iitb.ac.in/webpage_data/nptel /Core %20Science/Mathematics%20I/ TOC-middle-M14.html

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19MA101.1	Determine inverse, higher integral powers by Cayley Hamilton theorem and convert quadratic form to canonical form by orthogonal transformation.
R19MA101.2	Test the convergence or divergence of series of positive terms and alternating series by various techniques.
R19MA101.3	Classify the extreme values of functions of two variables and functional dependence.
R19MA101.4	Apply integration concepts to compute area of the given surfaces, integrals in cartesian and polar coordinates.
R19MA101.5	Apply triple integration concepts to compute volume of the given surfaces and solid structure and area, volume of the surface using Gamma and Beta functions.

R19PH102	Semiconductor Physics	L	T	P	C
		3	0	0	3

1. Course Description:

This course addresses the basics and principles of semiconductor devices. It covers fundamental aspects of semiconductor physics necessary for understanding operation principles and characteristics of semiconductor diodes, rectifiers, transistors and power electronics. It provides a broad background for advanced courses in electronics, photonics and integrated circuit design.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

2. Course Objectives:

1. To teach the basics and electronic properties of semiconductor materials and to study its structure and methods of synthesis.
2. To impart knowledge and to solve problems based on circuits with Diodes, BJT and FET in different configurations.
3. To educate the working principle of special semiconductor devices and to utilize in modern semiconductor based devices.

3. Syllabus

Unit – I: Crystal Physics

Single crystalline, polycrystalline and amorphous materials; unit cell, crystal systems, Bravais lattices, Miller indices: directions and planes in a crystal; inter-planar distance for a cubic crystal; coordination number and packing factor for SC, BCC, FCC, HCP and diamond structures; crystal imperfections: point defects, line defects; Burger vectors; Growth of single crystals: Bridgman and Czochralski methods.

Unit – II: PN Junction Diode

Energy band theory of crystals: Insulators, conductors, and metals; PN Junction as a diode: Unbiased Diode, Forward Bias, Reverse Bias; Current components in a PN diode; Volt-Ampere Characteristics; PN diode switching times; Breakdown diodes; PN Junction diode as a rectifier.

Unit – III: Special Semiconductor Devices

Circuit symbol, construction, operation and V-I characteristics: Schottky barrier diode; Zener diode; LED; SCR; DIAC; TRIAC; Photo diode and photo transistor; Opto Coupler; Zener diode as a voltage regulator.

Unit – IV: Bipolar Junction Transistor

Unbiased Transistor, NPN Transistor operation, Input and Output characteristics of CE, CB, and CC configurations, h parameter model for CE, CB, and CC configurations; Need for biasing; AC and DC Load lines; Biasing methods for BJT: Fixed bias, Collector to base bias, Voltage divider bias ; BJT as a switch.

Unit – V: Special Semiconductor Devices

Junction Field Effect Transistor: construction, operation, Drain and Transfer characteristics; MOSFET: Enhancement MOSFET, Depletion MOSFET, Drain and Transfer characteristics; Biasing methods for FET: Fixed bias, Self bias, Voltage divider bias.

Text Books:

1. Kasap S.O, "Principles of Electronic Materials and Devices", McGraw-Hill Education, 3rd Edition, 2007.
2. Umesh K Mishra and Jasprit Singh, "Semiconductor Device Physics and Design", Springer, 2nd Edition, 2008.
3. PillaiS.O, "Solid State Physics", New age International Publishers, 7th Edition, 2015.

References:

Reference Books:

1. Avathanulu M.N and Kshirsagar P.G, "Engineering Physics", S.Chand and company, 11th Edition 2014.
2. Jacob Millman, Christos C, Halkias and SatyabrataJit, "Electronic Devices and Circuits", 2nd Edition, Tata McGrawHill, 2010.
3. Salivahanan S, "Electronic Devices", Tata McGraw- Hill, 2ndEdition, 2018.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

4. Donald A Neaman, "Semiconductor Physics and Devices", Tata McGrawHill Inc., 3rdEdition, 2007.
5. Robert Boylestad and Louis Nashelsky, "Electron Devices and Circuit Theory", Pearson Prentice Hall, 10th Edition, July 2008.

Journals:

1. Materials Science in Semiconductor Processing
2. Journal of Semiconductors
3. Journal of Semiconductor Devices and Circuits
4. Journal of Materials Science: Materials in Electronics
5. Journal of Semiconducting Engineering
6. Journal of Physics and Chemistry of Solids
7. IEEE Transactions on Electron Devices.
8. IEEE Transactions on Semiconductor Manufacturing.

Web Resources:

1. https://www.youtube.com/watch?v=Fbyd5xVMMaM
2. https://youtu.be/e1vb-4RaOKA
3. https://youtu.be/rf-GIy7yjt8
4. https://youtu.be/SjeK1nkiFvI
5. https://youtu.be/7G1sR-3_5uA

MOOC / NPTEL / SWAYAM Courses:

1. https://nptel.ac.in/courses/115102025
2. https://archive.nptel.ac.in/courses/108/108/108108122/
3. https://archive.nptel.ac.in/courses/108/106/108106181/

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19PH102.1	Infer the crystal basics, their structures and different crystal growth techniques.
R19PH102.2	Illustrate the theory, construction, and operation of diode.
R19PH102.3	Illustrate the theory, construction, and operation of special semiconductor devices.
R19PH102.4	Examine the operation and biasing methods of BJT.
R19PH102.5	Examine the operation and biasing methods of FET.

R19CS101	Problem Solving using C	L	T	P	C
		3	0	0	3

1. Course Description:

This course introduces students to the fundamental concepts of programming using the C language. The course covers essential topics such as basic C programming constructs, conditional and looping statements, modular programming, and advanced concepts like pointers, arrays and structures. Through theoretical lectures, practical demonstrations, and coding exercises, students will develop problem-solving skills and learn how to design and implement efficient algorithms to solve a variety of complex problems.

1. Course Objectives:

1. Equip students with the skills to write robust, readable, and maintainable code for diverse applications.

2. Instruct students on utilizing control structures and functions to manage program flow, make informed decisions, and automate repetitive tasks.
3. Enhance students' abilities in optimizing memory usage and promoting code reusability.
4. Guide students in efficiently organizing and processing data, enabling them to write clean, well-structured code that addresses real-world challenges.
5. Train the students in effectively working with strings, user-defined data types, and file operations.

2. Syllabus

Unit – I: C Fundamentals

Basic computer organization, Problem-solving techniques, Algorithm, Flowchart, Pseudocode; Introduction to C programming: Phases of a C program, Features of C, Keywords, Variable Name, Scope, Declaration, Coding Standards, Data Types and sizes: integer, float and character types, constants, Formatted I/O, Operators, Bitwise Manipulations, Expression Evaluation, Type Conversions, Preprocessor Directives

Unit – II: Control Structures

Conditional and Branching Statements: if, if-else, else-if ladder, nested-if, switch constructs, range using switch, Looping constructs: for, while, do-while -break and continue- goto and Label

Unit – III: Pointers and Functions

Pointer – Types of Pointers: NULL, Dangling, Generic Pointers, Wild pointer, Arithmetic Operations in Pointer, Pointer to pointer, Functions: The anatomy of a function, Types of functions, Pointers and Function Arguments: Call by Value and Call by Reference, Function Pointers, return statement, Recursion, Storage Classes.

Unit – IV: Arrays

Arrays: Declaring and initializing 1D arrays, Two-dimensional arrays, Multi-dimensional arrays, Variable Length Arrays, Dynamic Memory Allocation, Passing 1D and 2D Array as arguments, Pointers and Arrays, Array of pointers

Unit – V: Strings, User-Defined Data Types and Files

Strings: Introduction – string handling functions, Two-dimensional array of strings, Structure: Basics of structure- Nested structures–Array of structures – Pointer to structures – Unions – Bit Fields-Files: Basics–File Functions – Random Access Files

Text Books:

1. Herbert Schildt, "C – The Complete Reference", Tata McGraw Hill Publishing Company, New Delhi, 2017.
2. Kernighan B. W. and Ritchie D. M., "C Programming Language (ANSI C)", Prentice Hall of India Private Limited, New Delhi, 2010.

References:

Reference Books:

1. Deitel and Deitel, "C How to Program", Pearson Education, New Delhi, 2011.
2. Simple Program Design: A Step-by-Step Approach, Fifth Edition by Lesley Anne Robertson.

Video References:

1. https://www.youtube.com/watch?v=EjavYOFoJJ0&list=PLdo5W4Nhv31a8UcMN9-35ghv8qyFWD 9_S
2. https://www.youtube.com/watch?v=irqbmMNs2Bo

Chairman – Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641202.

MOOC/NPTEL /SWAYAM Courses:
1. https://onlinecourses.nptel.ac.in/noc22_cs40/preview
2. https://onlinecourses.nptel.ac.in/noc23_cs53/preview

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19CS101.1	Understand problem-solving techniques and typical programming constructs C
R19CS101.2	Apply looping and conditional constructs to solve real-world problems
R19CS101.3	Apply arrays and functions effectively to address complex programming challenges
R19CS101.4	Understand and apply best practices in pointers, memory allocation and error handling for modular programming efficiency
R19CS101.5	Choose and implement complex data structures using structures and Unions, applying advanced file operations in C for effective problem-solving

R19ME101	Engineering Graphics	L	T	P	C
		1	0	4	3

1. Course Description:

This course provides a comprehensive introduction to engineering drawing techniques, emphasizing fundamental principles such as orthographic projection, dimensioning, and geometric construction. Students will learn to create accurate and detailed engineering drawings manually and using Computer-Aided Design (CAD) software. Through practical exercises, students will develop proficiency in visual communication and problem-solving skills essential for engineering design and drafting. This course will also cover industry standards and conventions, ensuring students are prepared for professional practice.

2. Course Objectives:

1. Develop proficiency in fundamental drawing techniques, including line work, dimensioning, and geometric construction, to accurately represent engineering designs on paper and digitally.
2. Understand and apply orthographic projection methods to generate multiple views (e.g., plan, elevation, section) of engineering objects, ensuring clear and precise communication of design intent.
3. Learn to create isometric projections to represent three-dimensional objects with equal foreshortening along each axis, facilitating visualization and understanding.
4. Gain an introduction to perspective projection techniques to accurately depict depth and spatial relationships in engineering drawings.

3. Syllabus

Unit – I: Free Hand Sketching and Curves

Introduction

Importance of graphics in engineering applications; Use of drafting instruments; BIS conventions and specifications: Size, layout, folding of drawing sheets, Lettering, dimensioning.

Free Hand sketching; Visualization principles; Representation of Three-Dimensional objects; Layout of views; Application of freehand sketching.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Curves

Conics: Construction of ellipse, parabola and hyperbola by eccentricity method; Construction of cycloid; construction of involutes of square and circle; Applications: Engineering Curves

Computer Aided Drafting (Demonstration Only)

Study the Basics of 2D and 3D modelling; Lettering, title block drafting; and DWG file development using any CAD software

Unit – II: Projection of Points, Lines and Surfaces

Projection: Points, Straight lines located in the first quadrant using the rotating line method; Traces; Projection of plane surfaces: polygonal lamina, circular lamina; Applications: Projection of points, lines, surfaces.

Computer Aided Drafting (Demonstration Only)

Drafting of simple geometrics: Lines, planes, simple 2D drawings.

Unit – III: Projection of Solids

Projections of simple solids: Prism, Pyramid, Cylinder and Cone; Drawing views when the axis of the solid is inclined to one reference plane by rotating object method; Applications: Projection of solids.

Unit – IV: Sections and Development

Section of simple solids: Simple vertical position, when the cutting plane is inclined to one of the principal planes, perpendicular to the other; Obtaining true shape of section; Development of lateral surfaces: Truncated prisms, pyramids, cylinders, cones; Applications: sections of solids, development of lateral surfaces.

Unit – V: Isometric and Perspective Projection

Principles of isometric projection; isometric scale; Isometric projections (Simple, Truncated): Prisms, pyramids, cylinders, cones, a combination of two solid objects in simple vertical positions; Perspective projection (Visual ray method): Prisms, pyramids, cylinders, cone; Applications: Isometric projection, perspective projection.

Computer Aided Drafting (Demonstration Only)

Introduction to computer-aided drafting, dimensioning using appropriate software; 2D drawing commands: Zoom, Picture editing commands, Dimensioning, Isometric drawing, Isoplanes, 3D drafting; Plotting of drawing; Practice: Projection of lines, planes, solids; Isometric view practice: prisms, pyramids, cylinders, cones.

Text Books:

1. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2019.
2. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2019.

References:

Reference Books:

1. Bhatt N.D, "Machine Drawing", Charotar Publishing House, 1st Edition, 2010.
2. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, 1st Edition, 2008.
3. Gopalakrishna K.R., "Machine Drawing in first angle projection, Subhas Stores, Bangalore, 1st Edition, 2007.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

4. K Leo Dev Wins., "Engineering Drawing", Pearson (Wins) Publications, Latest Edition, 2019.
5. Luzzader, Warren.J. and Duff, John M., "Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
6. N S Parthasarathy and Vela Murali, "Engineering Graphics", Oxford University, Press, New Delhi, 2015.

Publication of Bureau of Indian Standards:

1. IS 10711 – 2001: Technical products Documentation – Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

Special points applicable to University Examinations on Engineering Graphics:

1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use an appropriate scale to fit the solution within an A3 size.
4. The examination will be conducted in appropriate sessions on the same day

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19ME101.1	Perform freehand sketching of geometrical constructions representing multiple views of objects to enhance visualization and communication skills.
R19ME101.2	Prepare orthographic views using projection methods, and interpret technical drawings for engineering communication.
R19ME101.3	Draw the projection of solids ensuing accurate representation and visualization of 3D objects in engineering drawings.
R19ME101.4	Develop and interpret the sectional views of the solids in a given cutting plane.
R19ME101.5	Prepare isometric view and evaluate the perspective projection for the given solids.

R19HS151	Technical English	L	T	P	C
		2	0	2	3

1. Course Description:

This course aims to educate the first-year B.E/B. Tech students in basic principles of the English language, facilitate them to use vocabulary in different academic and professional contexts. It also cultivates their LSRW skills, namely listening, speaking, reading and writing skills thereby improving their proficiency in oral and written communication in technical English. It also covers all the areas of grammar, word formation, summarizing, and report writing, which are necessary for the students of engineering sciences.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

2. Course Objectives:

1. Enable learners of Engineering and Technology to develop their basic communication skills in English.
2. Emphasize especially the development of speaking skills amongst learners of Engineering and Technology.
3. Ensure that learners use electronic media such as the Internet and supplement the learning materials used in the classroom.
4. Inculcate the habit of reading and writing leading to effective and efficient communication.

3. Syllabus

Unit – I: Basic Language Development

Reading: Types of Reading, Skimming and Scanning, Reading Comprehension;

Writing: Word Formation, Sequence Words, Types of Sentences, Hints Development, Informal Letters – Congratulating, apologizing, etc.;

Grammar: Parts of Speech, Articles, Tenses.

Unit – II: Different Strategies of Reading

Reading: Articles from Newspapers & Magazines, Cloze Exercises

Writing: Instructions, Recommendations, Paragraph Writing

Grammar: Homonyms, Homophones, Homographs, Subject–Verb Agreement, Modal Verbs, Question Types, Wh-type, Yes/ No and Tag Questions.

Unit – III: Group Interaction

Reading: Reading for Specific Information & Identifying Lexical and Contextual Meaning

Writing: Formal Letters—Seeking Permission for Industrial Visit, Letter of Invitation (acceptance/declination), Jumbled Sentences

Grammar: Cause and Effect Expressions, Purpose & Function, Compound Nouns.

Unit – IV: Introduction to Effective Writing

Reading: Summarizing, Paraphrasing, Note Making

Writing: Business Letters (Enquiry, Calling for Quotations & Placing Orders), Email-Etiquette, Writing Emails, Free Writing on any given topic

Grammar: Phrasal Verbs, Single Sentence Definitions.

Unit – V: Technical Writing Practice

Reading: Reading Practice based on Competitive Examinations

Writing: Preparing Transcript for a Speech, Pictorial Representation (Charts – Flowcharts, Pie Charts, Bar Charts, Tabular Column, etc.)

Grammar: Single Word Substitute, Abbreviations & Acronyms, Spotting Errors.

List of Exercises:

1. Listening - Listening Types - Listening to Audio files and answering
2. Listening - Listening for specific information – Listening to announcements and Radio Broadcasts

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

3. Listening - Listening to TED Talks & News Reading from English News Channels (CNN, NDTV, India Today etc.)
4. Listening - Listening Comprehension and answering accordingly.
5. Listening - Listening to Eminent personality interviews & other forms of interviews
6. Speaking - Introducing oneself & family - Role Play
7. Speaking – Extempore - Just A Minute (JAM) Sessions
8. Speaking - Group Discussion
9. Speaking - Narrating a story
10. Speaking – Compering, Welcome Address & Vote of Thanks

Text Books:

1. Jack C. Richards, "Interchange Student's Book 1", Cambridge University Press; Fourth Edition, 2015.
2. S. N. Mahalakshmi, "Technical English for Engineers", V. K. Publications; Chennai, Eighth Edition, 2020.

References:

Reference Books:

1. Rizvi M.Ashraf, "Effective Technical Communication", Tata McGraw Hill Publishing Company; New Delhi, 2015.
2. Andrea J.Rutherfoord, "Pearson Education" Inc. and The Darling Kindersley Publishing Inc., 2020.
3. Raman, Meenakshi and Sharma, Sangeetha "Technical Communication Principles and Practice", 4. Oxford University Press; New Delhi, 2019.
4. Richards C. Jack, "Interchange", Fourth edition; Cambridge University Press, 2020.
5. Butterfield, Jeff, "Soft skills for Everyone", Sixth Indian Reprint, 2018.

Video References:

1. https://www.youtube.com/watch?v=tBtc6rpcMz4
2. https://www.youtube.com/watch?v=Ll23cChDSKE
3. https://www.youtube.com/watch?v=fyAtyAdCStM

Web References:

1. https://leo.stcloudstate.edu/grammar/subverag.html
2. http://www.learningdifferences.com/Main%20Page/Topics/Compound%20Word%20Lists/Compound_Word_%20Lists_complete.htm
3. http://examples.yourdictionary.com/examples-of-active-and-passive-voice.html
4. http://www.perfectyourenglish.com/grammar/numeral-adjectives.htm
5. https://en.wikipedia.org/wiki/Commonly_misspelled_English_words
6. https://www.englisch-hilfen.de/en/grammar/if.htm
7. http://www.englishforeveryone.org/Topics/Reading-Comprehension.html

MOOC / NPTEL / SWAYAM Courses:

1. https://www.udemy.com/topic/communication-skills/free/
2. https://www.bbc.co.uk/learningenglish/english/course/how-to-speak-english

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19HS151.1	Apply basic reading techniques, construct clear sentences for informal correspondence, and enhance grammar and listening skills for effective communication.

Chairman, Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19HS151.2	Analyze complex texts, formulate precise instructions and recommendations, and utilize advanced grammar in spoken communication.
R19HS151.3	Simplify specific and contextual information, compose formal letters, and actively engage in group discussions.
R19HS151.4	Interpret and take notes proficiently, compose professional documents and emails, and demonstrate strong listening skills.
R19HS151.5	Analyze and create detailed technical documents and visual aids, and deliver formal presentations and conduct interviews with confidence.

R19PH112	Semiconductor Physics Laboratory	L	T	P	C
		0	0	2	1

1. Course Description:

The laboratory course provides an experimental foundation for the theoretical concepts introduced in the lectures. The aim of this laboratory is to get the students familiar with specialized experimental techniques and to distinguish between inferences based on theory and the outcomes of experiments used in investigation of semiconductors.

2. Course Objectives:

1. To understand the basic concepts of electrical and electronic circuits and devices.
2. To understand the application and usage of circuits and devices in electrical and electronics circuits.
3. To analyze the characteristics of electronic devices with various input and configuration.
4. To develop the simulation knowledge, error rectification and self-learning through virtual laboratory.
5. To develop knowledge in the field of electrical and electronics circuits for the technical competitive exam through search in web link.

3. Syllabus:

List of Laboratory Experiments / Exercises:

(Any FIVE Experiments)

1. a) Study of electrical parameters necessary to carry out electronic experiments.
   b) Study of passive components and measuring equipment used in electronics experiments.
2. Connect the circuit of PN Junction diode to study the V-I characteristics of the given diode.
3. Develop a circuit to study the V-I Characteristics of a Zener diode.
4. Design a circuit to show that Zener Diode acts as Voltage regulator.
5. Develop a circuit to analyse the Input and Output Characteristics of BJT in Common Emitter configuration.
6. Design a circuit and infer that BJT acts as a switch.
7. Design a circuit to study the drain and transfer characteristics of FET.

Text Books:

1. Lab Manual prepared by Physics Department.

References:

Reference Books:

1. Paul Scherz, "Practical Electronics for Inventors", MGH, 4/e, 2016

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

2. V. K Mehta, Rohit Mehta, "Principles of Electronics", S.Chand Publications, 12/e, 2014
3. John Hughes, "Practical Electronics – Components and Techniques", Oreilly, 2015
4. Robert Boylestad, Louis Nashelsky, "Electronic devices and Circuit theory", Pearson, 11/e, 2015

Journals:

1. International Journal of Electrical Engineering & Education
2. IEEE Transactions on Education
3. Photoelectroconversion by Semiconductors: A Physical Chemistry Experiment

Web Resources:

1. https://youtu.be/eQYyLt8pPf0
2. https://youtu.be/Nds6Qrd6k40
3. https://youtu.be/sKr8FNKvpqo
4. https://youtu.be/ZT868yaj0S0
5. https://youtu.be/gQprn-8tYyQ

MOOC / NPTEL / SWAYAM Courses:

1. Introduction to Semiconductor Devices (https://youtu.be/VkKw1PMMhiI)
2. Integrated Circuits, MOSFETs, Op-Amps and their Applications (https://youtu.be/ DRTfxpom4OU)

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19PH112.1	Understand the basics of crystals, their structures and different crystal growth techniques.
R19PH112.2	Comprehend the theory, construction, and operation of diode.
R19PH112.3	Comprehend the theory, construction, and operation of special semiconductor diodes.
R19PH112.4	Analyze the biasing in BJT to study the flow of current and stability of operation.
R19PH112.5	Analyze the biasing in FET devices to study the flow of current and stability of operation.

R19GE111	Engineering Practices Laboratory	L	T	P	C
		0	0	4	2

1. Course Description:

The Engineering Practices Laboratory provides hands-on experience and practical training for students to apply theoretical knowledge in engineering disciplines through experiments and projects. The course plays a crucial role in fostering practical skills, enhancing problem-solving abilities, and bridging the gap between theoretical learning and real-world engineering applications. The course equips engineers with practical skills, critical thinking abilities, and hands-on experience essential for tackling real-world challenges and succeeding in their future careers.

2. Course Objectives:

1. To provide exposure to the students with hands on experience on various basic engineering practices in Computer Science, Mechanical, Electrical and Electronics Engineering.
2. To enhance the problem-solving abilities of the students by bridging the gap between the theoretical learning and real-world engineering application.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

3. Syllabus

Group A (Computer Science & Mechanical)

Computer Science and Engineering Practices

Assembly & Disassembly

1. Identifying components of disassembling and assembling the PC

Troubleshooting:

1. Basic H/W and S/W troubleshooting

Mechanical Engineering Practices

Plumbing

1. Construction of pipeline using fittings: joints, gate valves, taps, reducers; examine the functions of the plumbing tools.
2. Develop plumbing connection of a residential building involving minor troubleshooting

Basic Machining

1. Inspect the dimension of the given work piece after executing simple lathe operations

Rapid Prototyping

1. Additive Manufacturing of 3D component without support structure
2. Additive Manufacturing of 3D component with support structure

Study and assemble/ maintenance the following (Demonstration only):

1. Different types of pumps, Dynamic: Centrifugal pump, Submersible pump; Positive Displacement: Reciprocating Pump.
2. Experimental learning on basic connections with minor troubleshooting of Refrigeration System.
3. Experimental learning on basic connections with minor troubleshooting of Air-Conditioning System.

Group B (Electrical & Electronics)

Electrical Engineering Practices

a) UPS Connection - Hands on exercise on basic electrical connections with UPS Connection
b) Domestic Wiring - Hands on exercise on basic domestic wiring
c) Safety Precautions - Hands on exercise on electrical earthing and safety precautions
d) Renewable Energy - Design of Solar PV System for Residence (Study)

Electronics Engineering Practices

a) Soldering - Study of Electronic Components & Equipment – Soldering Practice
b) Electronics - Study of components of Smart phones
c) Automation Projects - Projects on home automation

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19GE111.1	Perform the basic troubleshooting of the PC including assembly and disassembly.
R19GE111.2	Identify minor plumbing troubleshooting in residential buildings and develop 3D component by additive manufacturing.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19GE111.3	Inspect work piece after executing basic machining operations like turning, drilling & tapping and minor troubleshooting, maintenance task in an AC & pump/motor.
R19GE111.4	Perform basic domestic wiring of a residential building with provision of inverter and safety measures and Design solar PV System for residence.
R19GE111.5	Execute basic home automation projects.

R19CS111	Problem Solving using C Laboratory	L	T	P	C
		0	0	4	2

1. Course Description:

The Problem Solving Using C Laboratory is a practical course designed to complement theoretical knowledge with hands-on experience in programming using the C language. Through a series of laboratory sessions, students will delve into the basic concepts of C programming, including conditional and looping statements, modular programming, and advanced topics such as pointers, arrays, and structures. By actively engaging in coding exercises and projects, students will develop problem-solving skills, algorithmic thinking, and proficiency in implementing efficient solutions to various computational problems.

2. Course Objectives:

1. Instruct students on developing robust, readable, and maintainable code for a variety of applications.
2. Teach students to effectively use control structures and functions to manage program flow, make decisions, and automate repetitive tasks.
3. Enhance students' ability to optimize memory usage and promote code reusability in their programs.
4. Guide students in organizing and processing data efficiently, enabling them to write clean, structured code that addresses real-world problems.
5. Train students in working proficiently with strings, user-defined data types, and file operations.

3. List of Experiments:

1. Develop flow charts and solve simple real-life or scientific or technical problems (Traffic signal control / Water level controller / Temperature control system / Automatic washing machine control system / Automatic Street light control system / Electricity Billing / Retail shop billing /Computing Electrical Current in Three Phase AC circuits) (Minimum 3 problems) (CO1)
2. Implementation of applications of input and output statements. (Integer, char, Float, string input and output, ASCII value of character, User details) (CO1)
3. Implementation operators and expressions (Centigrade to Fahrenheit, Quotient and Remainder, Kilometres per hour to miles per hour, Hour and Minutes, Profit Calculator) (CO1)
4. Implementation of real-time applications using conditional statements. (Vowel or Consonant, Eligible for casting vote, Leap year or not, Display the description for the given grade, Display number of days in a month, Calculator, Triangle type, Roots of a quadratic equation) (CO1)
5. Implementation of technical applications using iterative loops (Display first N natural numbers, Read N numbers and find their sum and average, find cube of the number up to a given integer, Multiplication table, Sum of N natural numbers, Sum of N natural odd numbers, Pattern printing) (CO2)
6. Implementation of the one-dimensional array (Display the array elements, Elements in reverse order, Sum of array elements, make a copy of array elements, Maximum and minimum, odd sum and even sum) (CO2)
7. Implementation of a two-dimensional and multi-dimensional array (sum, subtraction, transpose, multiplication, frequency of even numbers, print diagonals, sum of diagonal elements, compare) (CO2)

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

8. Implementation of Functions in the program (Factorial, largest number, area of shape, sum of digits, prime number or not) (CO2)
9. Implementation of real-time applications using recursion (factorial, Fibonacci series, count digits of number, length of string, prime or not, GCD, sum of all digits, palindrome) (CO2)
10. Implementation of a pointer in applications (swap two numbers, print string, read array elements, double pointer, find the maximum number, palindrome, reverse array, dynamic memory allocation) (CO3)
11. Implementation of strings handling functions with and without library functions (compare two strings, reverse, concatenate, copy, palindrome, count number of characters, number of words, find, replace) (CO4)
12. Implementation of file-handling operations (read, write, append file, compare two files, read student details and store into files) (CO4)
13. Implementations of Structure in real-time applications (Accept & display employee details, calculate total payment of workers, Library operations, Menu-driven program for employee structure) (CO5)
14. Implementations of Union in programs (Accept & display employee details, calculate total payment of workers, Library operations, Menu-driven program for employee structure) (CO5)
15. Mini Project: Develop an application for any real-world problem

Reference Books:

1. Herbert Schildt, "C – The Complete Reference", Tata McGraw Hill Publishing Company, New Delhi, 2017.
2. Kernighan B. W. and Ritchie D. M., "C Programming Language (ANSI C)", Prentice Hall of India Private Limited, New Delhi, 2010.
3. Deitel and Deitel, "C How to Program", Pearson Education, New Delhi, 2011.
4. Simple Program Design: A Step-by-Step Approach, Fifth Edition by Lesley Anne Robertson

Video References:

1. https://www.youtube.com/watch?v=EjavYOFoJJ0&list=PLdo5W4Nhv31a8UcMN9-35ghv8qyFWD9_S
2. https://www.youtube.com/watch?v=irqbmMNs2Bo

MOOC/NPTEL /SWAYAM Courses:

1. https://www.udemy.com/course/c-programming-2019-master-the-basics
2. https://www.tutorialspoint.com/cprogramming

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19CS111.1	Design solutions for real world problems with programming constructs
R19CS111.2	Solve complex programming problems with arrays and functions
R19CS111.3	Implement dynamic memory addressing techniques with Pointers
R19CS111.4	Implement various error handling techniques for file operations
R19CS111.5	Implement complex data structures such as structures and unions in C to manage and organize data effectively

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202.

R19EM101	Soft Skills	L	T	P	C
		0	0	2	1

1. Course Description:

This course on Soft Skills is designed to enhance the professional development of engineering students by refining essential interpersonal and communication skills. It focuses on cultivating critical attributes such as effective communication, active listening, teamwork, leadership, and time management. The course also emphasizes the importance of professional etiquette, advanced communication techniques, technical writing, and the ability to navigate formal and informal contexts. By integrating these elements, students will develop the competencies necessary for successful collaboration, decision-making, and professional growth in the engineering field.

2. Course Objectives:

1. Develop foundational language skills by reinforcing key communication principles.
2. Instill positive behavioural traits to prepare students for future interactions in the corporate environment.
3. Equip students with the knowledge and skills needed to communicate ideas on social issues, promoting a sense of responsibility and active citizenship.
4. Enhance leadership abilities, teamwork strategies, and the capacity to foster effective connections through impactful communication.
5. Strengthen confidence and public speaking skills by offering experiential learning and techniques to overcome presentation anxiety and communicate effectively in front of an audience.

3. Syllabus

Unit – I: Personality and Professional Development Skills

Interpersonal skills: communication skills, active listening, teamwork, empathy, leadership, motivation, social skills – effective body language – workplace etiquette – types of speeches: memorized speech, manuscript speech, impromptu, and extempore.

Unit – II: Advanced Communication Skills

Word and sentence stress – clear individual sounds – intonation patterns – pronunciation – mother tongue intrusion – tongue twisters - conversation practice: discourse markers, slang, colloquial expressions, collocation - making mini presentations – extending on conservations – collaborative task.

Unit – III: Effective Communication Skills

Verbal and non-verbal communication - formal and informal English – grammatical features: impersonal passives, nominal compounds, third persons, empty verbs, present tense, imperatives, active voice, jargon, cliches – presentation skills - resume preparation - group discussions – mock interviews.

Unit – IV: Team Skills and Interpersonal Communication

Personal skills: time management, motivating others, assessing alternatives and making decisions, accurate written work, organisational skills, attention to detail, negotiation and mediation skills – public speaking - panel discussion – debates.

Unit – V: Engineering Journalism

Technical writing style: accuracy, conciseness, clarity, objectivity – abstract writing – technical documents writing - blogs - editing - copyrights – plagiarism.

References:

Reference Books:

1. Norman Lewis, "Word power made easy".
2. Sylvia Reyes," Team Building: The Ultimate Guide to Build & Manage Winning Teams", MC Grawhill, I
3. Dan Clay, How to write the perfect resume
4. Tyler Hayden, "Communication Activities: A Team Building Activity Book".
5. Ian Tuhovsky, "Communication Skills Training: A Practical Guide to Improving Your Social Intelligence, Presentation, Persuasion and Public Speaking (Positive Psychology Coaching Series Book 9)"

Magazine References:

1. The IUP Journal of Soft Skills - https.//iupindia.in/softskills.asp
2. Soft Skills Personality Development for Life Success
3. https://reader.magzter.com/preview/4lf6by5blmhou4q0k43xgh4388150/438815

Video References:

1. https://youtube.com/playlist?list=PLLy_2iUCG87CQhELCytvXh0E_ybOO1_q&feature=shared
2. https://youtube.com/playlist?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ&feature=shared
3. https://m.youtube.com/watch?feature=shared&v=DUlsNJtg2L8

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EM101.1	Understand and apply interpersonal skills to enhance professional interactions and goal-setting.
R19EM101.2	Demonstrate clear and effective communication in reports and presentations to showcase professional skills.
R19EM101.3	Utilize advanced communication techniques to improve verbal and written effectiveness.
R19EM101.4	Analyze team dynamics and personal skills to enhance individual and group performance.
R19EM101.5	Create accurate and concise technical documents to uphold high standards in engineering journalism

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

SEMESTER II

R19MA102	Advanced Calculus and Complex Variables	L	T	P	C
		3	1	0	4

1. Course Description:

Calculus and Complex Variables is a foundational course that combines two important branches of mathematics which deals with the study of rates of change and accumulation, and complex variables, which extends the concepts of real numbers to the complex plane. This course provides students with a rigorous understanding of calculus principles and techniques including derivatives, integrals and applications as well as an introduction to complex numbers, functions, differentiation, and integration in the complex plane.

2. Course Objectives:

1. Impart an idea of vector calculus and its physical interpretation.
2. Facilitate knowledge in analytical functions and to construct the analytic functions.
3. Introduce complex analysis for addressing problems across diverse fields.
4. Enhance the knowledge of Laplace transform to solve linear mathematical models for a physical system.
5. Inculcate techniques in solving ordinary differential equations.

3. Syllabus

Unit – I: Vector Calculus

Gradient and directional derivative; Divergence and curl; Irrotational and solenoidal vector fields; Integral Theorems: Green's theorem in a plane, Gauss divergence theorem, Stoke's theorem (excluding proofs), Verification of theorem and applications (for cubes and rectangular parallelepipeds).

Unit – II: Complex Differentiation

Analytic functions: Cauchy-Riemann equations (excluding proof), Properties of analytic function, Harmonic conjugate; Construction of analytic function by Milne Thomson method, Bilinear transformation.

Unit – III: Complex Integration

Cauchy's integral theorem, Cauchy's integral formula, Cauchy's integral formula for derivatives, Cauchy residue theorem; Taylor's and Laurent's series; Contour integral in unit circle and semi-circle (Excluding poles on real axis).

Unit – IV: Laplace Transforms

Existence conditions, Properties (excluding proofs), Transform of elementary and special functions, Transforms of derivatives and integrals; Periodic function; Inverse Laplace transform; Applications to solution of linear second order ordinary differential equations with constant coefficients.

Unit – V: Ordinary Differential Equations

Higher order linear differential equations with constant coefficients; Cauchy's and Legendre's linear differential equations; Method of variation of parameters; Application of ordinary differential equations in simple harmonic motion and basic elements of electrical circuits.

Text Books:

1. Grewal B.S, "Higher Engineering Mathematics", Khanna Publications, 44th Edition, 2015.
2. Monty J. Strauss, Gerald J. Bradley and Karl J. Smith," Calculus", 3rd Edition, 2002.

References:

Reference Books:

1. Erwin Kreyszig, "Advanced Modern Engineering Mathematics", John Wiley and Sons (Asia) Ltd, Tenth Edition, 2017.
2. Bali N. P and Manish Goyal," A Textbook of Engineering Mathematics", Laxmi Publication, Eighth Edition, 2011.
3. Jain R.K. and Iyengar S.R.K, "Advanced Engineering Mathematics", Naros Publications, Third Edition, 2007.

Journal References:

1. Handbook of Differential Equations: Ordinary Differential Equations: https://www.sciencedirect.com/handbook/handbook-of-differential-equations-ordinary-differential-equations
2. Abstract and Applied Analysis: https://onlinelibrary.wiley.com/journal/4058

Web Resources:

1. https://www.youtube.com/watch?v=NG9hkGQwT3k
2. https://www.youtube.com/watch?v=CogfMjKUGc0
3. http://videolectures.net/mit1803s06_mattuck_lec19/
4. http://freevideolectures.com/Course/3244/Advanced-Engineering-Mathematics/12
5. https://www.youtube.com/watch?v=OUbMX4eQ5oM

MOOC / NPTEL / SWAYAM Courses:

1. http://nptel.ac.in/courses/111105035/22
2. http://nptel.ac.in/courses/111108081/
3. http://nptel.ac.in/courses/122102004/2

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19MA102.1	Compare the ideas of vector integral theorems for solving given problems and exhibit the relation between them.
R19MA102.2	Make use of Milne Thomson method to construct analytic functions related to complex variable.
R19MA102.3	Apply the concepts of integration for complex functions in certain regions to determine real integrals.
R19MA102.4	Apply Laplace transform and inverse transform of simple functions, properties, various related theorems and application to differential equations with constant coefficients.
R19MA102.5	Apply various techniques in solving differential equations.

R19CY101	Engineering Chemistry	L	T	P	C
		3	0	0	3

1. Course Description:

This course provides the Bachelor of Engineering students a solid foundation in the concepts and applications of chemistry that are pertinent to engineering disciplines. The goal of this course is to provide students with the knowledge and abilities required for a variety of engineering specialties By fusing

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

fundamental chemical principles with engineering applications, this course gives an insight to the engineering students for optimum utilization of resources in scientific, research, technological and industrial application.

2. Course Objectives:

1. To gain the abilities necessary to become an ideal engineer and to be flexible enough to adjust to new advancements in Engineering Chemistry.
2. Including the value of water for industrial use, the basic principles of battery chemistry, and the need to prevent corrosion in order to safeguard structures.
3. To study innovative methods and up-to-date chemical knowledge that inspires pupils to communicate well and express themselves.
4. To gain the necessary understanding of engineering materials, such as glass, refractories, cement, and nanomaterials

3. Syllabus

Unit – I: Electrochemistry and Corrosion

Basics of electrochemistry; Electrochemical cell: Reversible and irreversible cell; EMF measurements; Standard Weston Cadmium cell; Nernst equation and problems; Electrodes: single electrode potential; Types of electrodes: Calomel electrode; Electrochemical series: Significance; Conductometric titration; Potentiometric titration.

Corrosion: Definition, Classification, mechanism; Factors influencing corrosion; Corrosion control: Sacrificial anode and cathodic protection method; Corrosion inhibitors; Electroplating of Nickel and chromium; Paints: Constituents and their function.

Unit – II: Water Technology

Introduction; Hardness of water: Determination of hardness of water by EDTA method; Alkalinity of water: Types of alkalinity, Estimation of alkalinity; Domestic water treatment: Pre-treatment, Removal of suspended impurities, Disinfection methods; Boiler feed water: Requirement of boiler feed water, Boiler troubles: scales and sludges; Treatment of boiler feed water: External treatment: Zeolite process, ion exchange method; Internal treatment method; Desalination: Reverse Osmosis.

Unit – III: Chemical Thermodynamics

Introduction to thermodynamics; Terminologies; Laws of Thermodynamics (only definitions): second law; Entropy as a thermodynamic quantity; Entropy change of an ideal gas: reversible and irreversible process, physical transformations; Clausius inequality theorem; Free energy and work function: Helmholtz and Gibbs free energy function, problems; Gibbs Helmholtz equation, problems; Clausius Clapeyron equation; Maxwell relation; Van't Hoff isotherm and its applications.

Unit – IV: Chemistry of Materials

Refractories; Classification, criteria of good refractory, properties and its application; Manufacture of Alumina, Magnesite and Silicon carbide.

Glass: Manufacture of glass by tank furnace method, Types and properties of glass.

Cement: Portland cement; Comparison and Manufacture by rotary kiln technology; Chemistry of setting and hardening of cement; Role of gypsum.

Nanomaterials; Carbon nano tubes; shape memory alloys; C60 fullerene; Liquid crystals: properties and its application.

Unit – V: Polymer Technology

Introduction; Terminologies; molecular weight of polymers (only definition); Classification of polymers: natural and synthetic, thermoplastics and thermosetting plastics; Types and mechanism of polymerization: addition (free radical), condensation and copolymerization; Properties of polymers; some commercial thermosetting resin: Phenol formaldehyde resin, Amino resins, Silicone resins; some thermoplastics: Polyethylene, PVC, polyvinyl acetate.

Text Books:

1. R. Rathinam., "Engineering Chemistry", Pearson India Pvt.Ltd,2nd edition,2019.
2. S. Vairam and Subha Ramesh., "Engineering Chemistry", Wiley India, Delhi, 2015.
3. S P.C.Jain and M.Jain. "Engineering Chemistry", Dhanpat Rai Publishing Company, 16th Edition, New Delhi, 2017.
4. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.

References:

Reference Books:

1. O.G. Palanna, "Engineering Chemistry" McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.
2. J.C Kuriacase& J Raja ram, Engineering Chemistry, Tata McGraw Hills Co. New Delhi, 2004.
3. S.S. Dara and S.S. Umare., "A Text book of Engineering Chemistry", S. Chand Publishing, 12th Edition, 2014.
4. A.Pahari and B.Chauhan., "Engineering Chemistry", Laxmi Publications, 2nd Edition 2010
5. Devender Singh, Balraj Deshwal, Sathish Kumar.,"Comprehensive Engineering Chemistry",IK International, 2007.
6. H.K.Chopra, A.Parmer., "Chemistry for Engineers", Narosa Publishing House, 2016.

Journals:

1. https://onlinelibrary.wiley.com/journal/15272648
2. https://link.springer.com/journal/10800
3. https://benthamopen.com/TOTHERJ/home/
4 https://www.scimagojr.com/journalsearch.php?q=13540&tip=sid

Video References:

1. https://www.youtube.com/watch?v=l2ENx_Y0dNU
2 https://www.youtube.com/watch?v=hZIMFBuP8zc
3. https://www.youtube.com/watch?v=9GMBpZZtjXM
4. https://www.youtube.com/watch?v=x5OD2KZXd54
5. https://www.youtube.com/watch?v=k_RErdKwaAg

MOOC / NPTEL / SWAYAM Courses:

1. https://nptel.ac.in/courses/113104059/lecture_pdf/Lecture%209.pdf
2. https://nptel.ac.in/courses/Webcourse-contents/IITKANPUR/wasteWater/Domestic%20Water%20TS htm
3. https://onlinecourses.swayam2.ac.in/nou24_es03/preview

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19CY101.1	Apply the principles of electrochemistry and corrosion in engineering.
R19CY101.2	Understand the quality of water, and its treatment methods.
R19CY101.3	Apply the concepts relevant to thermodynamics.
R19CY101.4	Understand the Engineering materials.
R19CY101.5	Understand the science of polymer and polymer reactions.

R19CS201	Data Structures	L	T	P	C
		3	0	0	3

1. Course Description:

This course provides a comprehensive introduction to data structures. Students will delve into the principles behind organizing and manipulating data efficiently, covering a wide array of topics including lists, stacks, queues, sorting algorithms, searching techniques, hashing, trees, and graphs. Through a combination of theoretical lectures, practical coding exercises, and real-world applications, students will gain a solid understanding of how to select and implement the appropriate data structures and algorithms to solve complex computational problems.

2. Course Objectives:

1. To build and work with linear and nonlinear data structures like arrays, linked lists, stacks, queues, trees, and graphs.
2. To discover data structures to solve real-world problems and scenarios, demonstrating understanding of trade-offs and limitations
3. To equip student's skills in designing, implementing, and analyzing tree-based solutions to complex problems
4. To familiarize and working with algorithms, including traversal, shortest paths, and network flow, to solve complex problems
5. To implement and analyze sorting, searching, and hashing techniques to optimize data retrieval and manipulation in various contexts

3. Syllabus

Unit – I: Linked Lists

Arrays vs Linked list; Linked lists: types, singly linked list, doubly linked list, singly circular linked list, doubly circular linked list, operations, insertion, deletion, find, reverse, modifying linked list; Floyd's cycle finding algorithm: slow pointer and fast pointer

Unit – II: Stacks and Queue

Stack: implementation using array and linked list, Operations: push, pop; Applications: infix to postfix conversion, processing function calls; Queue: implementation using array and linked list, enqueue, dequeue, priority queue, circular queue; Applications: call log management

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Unit – III: Trees
Terminologies; Binary Trees: implementation, traversals, expression trees, cousins of a binary tree; Binary Search Trees: construction, insertion, deletion, searching, find-min, find-max; AVL Trees: insertion, deletion; Priority Queues: heaps; Applications: dictionary, text processing
Unit – IV: Graphs
Representation; Types; Traversals: Depth First Search (DFS), Breadth First Search (BFS); Dijkstra's algorithm; Topological sort; Minimum Spanning Tree (MST): Prim's, Kruskal's algorithm; Applications: traffic redirection problem, travelling salesman problem
Unit – V: Sorting, Searching and Hashing
Internal sorting: bubble, insertion, quick; External sorting: merge sort; Searching: linear search, binary search; Hashing: hash table, hash functions, collision resolution techniques; Applications: Telephone Directories, Spell Checker, Design of Game Boards
Text Books:
1. Reema Thareja, "Data Structures Using C", Second Edition, Oxford University Press, 2019 2. Seymour Lipschutz, " Data Structures using C", First Edition, McGraw Hill Education, 2017
References:
Reference Books: 1. Narasimha Karumanchi "Data Structures and Algorithms Made Easy" Fifth Edition, Career Monk publications, 2017 2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 1997. **Web References:** 1. https://www.geeksforgeeks.org/data-structures 2. https://www.javatpoint.com/data-structure-tutorial 3. https://www.udemy.com/course/datastructurescncpp/ **MOOC / NPTEL / SWAYAM Course:** 1. https://in.coursera.org/learn/data-structures?action=enroll

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19CS201.1	Apply the concepts of linked lists by demonstrating and understanding of their implementation and usage to solve given problems
R19CS201.2	Construct stacks and queues using arrays and linked lists and apply these structures to appropriate scenarios
R19CS201.3	Implement tree data structures and their operations to enhance data management and retrieval systems
R19CS201.4	Assess graph-based algorithms to solve complex problems requiring efficient data traversal and manipulation
R19CS201.5	Examine sorting, searching and hashing algorithms to organize and retrieve data effectively

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19CS104	Application Design and Development	L	T	P	C
		2	2	0	4

1. Course Description:

Application Design and Development is a comprehensive integrated course that blends theoretical understanding with practical hands-on experience in creating diverse applications. Students will delve into essential web development concepts using HTML, CSS, and JavaScript, mastering the foundations of building interactive and responsive web interfaces. Additionally, they will learn version control using Git and GitHub, enabling collaborative development and effective management of project iterations. Furthermore, students will explore mobile application development using MIT App Inventor, gaming application development with Construct 2, and image/video editing using Blender tools. Through a combination of theoretical lectures, interactive labs, and project-based learning, students will gain the skills necessary to design, develop, and deploy various types of applications.

2.Course Objectives:

1. To design and build visually appealing and interactive web pages using HTML and CSS, creating a strong foundation for web development
2. To make students to create dynamic and interactive web pages using JavaScript, enhancing user experience and adding functionality to web applications
3. To create and manage Git repositories how to collaborate using GitHub, including forking, cloning, and pull requests
4. To develop mobile applications for Android devices using MIT App Inventor's visual blocks programming
5. To create 2D games using Construct 2 and edit multimedia content using Blender

3.Syllabus

Unit – I: HTML and CSS

Introduction to web- Standards and Terminologies.HTML: Introduction and versions-HTML 5-standards and tags-Head and Body-List-Labels-Tables-Forms-Videos and Audios-Figure, Figure Captions, Images CSS: Introduction-Embedded Types-CSS Selectors-Borders, Margins, Paddings-Colors and Backgrounds-Introduction to Bootstrap-Tailwind CSS

Applications: Static website design for an organization, Report building, Color Palette design

Unit – II: Interactive Web Design using JavaScript

Introduction-Java Script adding Techniques-Variables and Operators- Conditional and Control Statements-Data Types and Functions-Events-Form Validation-Page Redirect-Java Script Exception Handling-Document Object Model (DOM)

Applications: Dynamic website design for an organization, Picture Slideshow, Weather Forecast Report

Unit – III: Git, Git Hub and Shell Scripting

Introduction to Git and GitHub-Terminologies-Local Repository Actions- Remote Repository Actions-Advanced Repository Actions-Branching-Merging-Software Developers Communities: Google Developers Group, Google Student Developers Community, Linux Developer Community, Stack Overflow, Kaggle Shell Scripting: Processing (PS) and Listing (LS)- File Creations and Handling-Users and Groups

Applications: Setting up local repository, Managing multiple branches, CRUD with Shell scripting

Unit – IV: Mobile Application Development with MITAI

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Types of Mobile OS (Android and IOS)-Architecture- Phases of Mobile Application Development -MIT app inventor-Components-Viewer-Properties – Publishing an app

Applications: Talk to me, Ball Bounce, Digital Doodle, Mood Ring, Translation App, To do list, Opinion Pool, Map the movement

Unit – V: Template Driven Applications and Multimedia

Content Management System: Dynamic content-Web flow - Collection fields – Search Engine Optimization, Multimedia: Design with Canva and Blender- Image and Video Editing –Game Development with Construct 2

Applications: Creative blog development, My Portfolio, Simple games (Ball bouncing, Brick ball game, Model Building)

Text Books:

1. Internet & World Wide Web How to Program, 5th edition, by Paul Deitel Harvey Deitel, Abbey Deitel, Pearson Publication, 2018.
2. App Inventor 2: Create Your Own Android Apps 2nd Edition by David Wolber, Hal Abelson, Ellen Spertus, Liz Looney, 2014.

References:

Reference Books:

1. CS50's Web Programming with Python and JavaScript - https://cs50.harvard.edu/web/2020
2. Get Coding! Learn HTML, CSS & JavaScript & Build a Website, App & Game – by Young Rewired State, Walker Books, 2016.
3. Version Control with Git, by Jon Loeliger, Matthew McCullough, 2nd Edition, 2012.

Web References:

1. https://www.w3schools.com/html/html_css.asp
2. https://www.javatpoint.com/javascript-tutorial
3. https://www.freecodecamp.org/news/introduction-to-git-and-github/
4. https://appinventor.mit.edu/explore/ai2/tutorials
5. https://www.construct.net/en/tutorials/beginners-guide-construct-47

MOOC/NPTEL /SWAYAM Courses:

1. https://in.coursera.org/learn/html-css-javascript-for-web-developers
2. https://amigoscode.com/p/git-github

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19CS104.1	Utilize HTML5 and CSS to develop responsive web
R19CS104.2	Create Interactive web applications using JavaScript
R19CS104.3	Analyze and apply GIT and GIT HUB operations and advanced repository actions
R19CS104.4	Create mobile applications using MIT app inventor
R19CS104.5	Create simple game applications using Construct

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE103	Circuit Theory	L	T	P	C
		3	1	0	4

1. Course Description:

This course introduces the theory and fundamental principles of electrical circuits. Covering basic terminologies, circuit elements, and Ohm's law, students delve into series and parallel configurations, applying Kirchhoff's Laws and employing mesh and nodal analysis for DC and AC circuits. Network theorems such as Thevenin's, Norton's, and Superposition are explored alongside voltage and current division. Resonance and coupled circuits are studied, including series and parallel resonance, frequency response, and mutual inductance. The course also delves into transient responses in DC and AC circuits, three-phase systems, and harmonics, offering practical applications throughout to solidify theoretical concepts in real-world scenarios.

2. Course Objectives:

1. To introduce electric circuits and their analysis.
2. To impart knowledge on solving circuit equations using network theorems.
3. To introduce the phenomenon of resonance in coupled circuits.
4. To educate on obtaining the transient response of circuits.
5. To introduce Phasor diagrams and analysis of three-phase circuits.

3. Syllabus

Unit – I: Basic Concepts

Basic circuit terminologies; circuit elements; series and parallel; Ohm's law; Kirchhoff's Laws; mesh and nodal analysis of DC and AC circuits; Fundamentals of alternating current: phase relationship in a pure resistor, inductor, capacitor; complex impedance; power triangle; applications.

Unit – II: Network Theorems

Voltage and current division; source transformation; star/delta conversion; Thevenin's theorem; Norton's theorem; Superposition theorem; Maximum power transfer theorem; applications.

Unit – III: Resonance and Coupled Circuits

Series and parallel resonance; resonant frequency; frequency response; quality facto; bandwidth; Self and mutual inductance; coefficient of coupling; dot convention; series and parallel connection of coupled inductors; applications.

Unit – IV: Transient Response in DC and AC Circuits

Circuit elements in the S-domain; Behaviour of passive elements with AC/DC input; Transient response of RL, RC, RLC Circuits for DC input and AC sinusoidal input; applications.

Unit – V: Three Phase Circuits

Introduction to the three-phase system: voltage, current and power in star and delta connected systems; analysis of three-phase balanced/unbalanced circuits with phasor diagrams; Harmonics: Total Harmonics Distortion; power and power factor measurement; applications.

Text Books:

1. A Sudhakar and Shyammohan S Pali, "Circuits and Networks: Analysis and Synthesis", Tata McGraw Hill, Fifth Edition, 2015.
2. William H Hayt, Jack E Kemmerly and Steven M Durbin, "Engineering Circuit Analysis", Tata McGraw Hill, Ninth Edition, 2018.

References

Reference Books:

1. Charles K Alexander and Mathew N O Sadiku, "Fundamentals of Electric Circuits", Tata McGraw Hill, Third Edition, 2009.
2. Mahadevan. K and Chitra. C, "Electric Circuits Analysis", Prentice Hall India, 2015.
3. Chakrabarti A, "Circuits Theory (Analysis and synthesis)", Dhanpat Rai and Sons, 1999.
4. Nahvi M and Edminister J, "Schaum's Outline of Electric Circuits", Tata McGraw Hill, Fifth Edition, 2011.

Journals:

1. IEEE Transactions on Circuits and Systems
2. International Journal of Circuit Theory and Applications
3. IEEE Transactions on Circuits and Systems II: Express Briefs
4. Analog Integrated Circuits and Signal Processing

Web References:

1. http://www.electrical4u.com/
2. http://www.electrical4u.com/ohms-law-equation-formula-and-limitation-of-ohms-law/
3. http://physics.bu.edu/py106/notes/Circuits.html
4. http://www.electronics-tutorials.ws/accircuits/ac-waveform.html
5. http://www.calvin.edu/~svleest/circuitExamples/NodeVoltageMeshCurrent/
6. http://www.electrical4u.com/norton-theorem-norton-equivalent-current-and-resistance/
7. http://www.allaboutcircuits.com/textbook/direct-current/chpt-6/current-divider- circuits

MOOC / NPTEL / SWAYAM Courses:

1. https://onlinecourses.nptel.ac.in/noc24_ee112/preview
2. https://www.coursera.org/

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE103.1	Apply basic electric concepts to solve electric circuit problems
R19EE103.2	Illustrate the applications of Network Theorems in solving electric circuit problems
R19EE103.3	Demonstrate the concept of resonance in electric circuits
R19EE103.4	Analyse the performance of DC and AC circuits under transient conditions
R19EE103.5	Evaluate the performance of three-phase circuits under balanced and unbalanced load conditions

R19HS551	Business English	L	T	P	C
		2	0	2	3

1. Course Description:

This course is designed to develop a complete view of Communication, its scope and importance to the learners. The Learners will be introduced to a range of situations, which will enhance their understanding of the Communication Process and develop their Practical Skills in Listening, Speaking, Reading and

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Writing. Further, this course will enable the learners to plan for effective presentation by gathering relevant information, determining audience needs, and defining presentation purpose.

2. Course Objectives:

1. Develop strategies and skills to enhance their ability to read and comprehend Engineering and technology texts.
2. Strengthen their listening skills which will help them to comprehend lectures and talks in their areas of specialization.
3. Develop their speaking skills to make technical presentations.
4. Foster their ability to write convincing job applications and effective reports.
5. Build their confidence to participate in group discussions.

3. Syllabus

Unit – I: Types of Conversation

Reading: Reading for Information

Writing: Checklists, Process Description

Grammar: Regular and Irregular Verbs, Discourse Markers, Single Word Substitute

Unit – II: Listening Comprehension

Reading: Reading Longer Texts and Practicing Speed Reading

Writing: Job Application with Resume, Autobiographical Writing

Grammar: If Conditionals, Active and Passive Voice

Unit – III: Presentation Skills

Reading: Reading Business Plans and Reports

Writing: Memorandum, Circular, Notice, Agenda, Minutes of Meeting

Grammar: Degrees of Comparison, Numerical Adjectives.

Unit – IV: Report Writing

Reading: Descriptive and Narrative Passages

Writing: Report Writing, Types of Reports - Feasibility, Accidental and Incident Report

Grammar: Using Idioms in Sentences, Simple, Compound and Complex Sentences.

Unit – V: Interview Skills

Reading: Intensive & Extensive Reading, Note-Making

Writing: Preparing Technical Proposals

Grammar: Extended Definitions - Reported Speech - Embedded Sentences.

List of Experiments:

1. Listening: Listening Comprehension and Answering
2. Speaking: Conversation Building
3. Listening: Listening to Various Technical Talks and Summarizing
4. Speaking: Describing a Process
5. Listening: Listening to Class Room Lectures and Seminars – Preparing Hints

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

6. Speaking: Process Description for a new product
7. Listening: Listening and Note-taking practice
8. Speaking: Techniques to develop effective Presentation – Oral Presentation
9. Listening: Listening to Foreign Speakers and interpreting promptly
10. Speaking: Reviews (Books, Novels & Movies)- Technical Presentation

Text Books:

1. Jack C. Richards, "Interchange Student's Book 1", Cambridge University Press; Fourth Edition, 2015.
2. S. N. Mahalakshmi, "Technical English for Engineers", V. K. Publications; Chennai, Eighth Edition, 2020.

References:

Reference Books:

1. Rizvi M. Ashraf, "Effective Technical Communication", Tata McGraw Hill Publishing Company; New Delhi, 2015.
2. Andrea J.Rutherfoord, "Pearson Education" Inc. and The Darling Kindersley Publishing Inc., 2020.
3. Raman, Meenakshi and Sharma, Sangeetha "Technical Communication Principles and Practice", Oxford University Press; New Delhi, 2019.
4. Richards C. Jack, "Interchange", Fourth edition; Cambridge University Press, 2020.
5. Butterfield, Jeff, "Soft skills for Everyone", Sixth Indian Reprint, 2018.

Video References:

1. https://www.youtube.com/watch?v=tBtc6rpcMz4
2. https://www.youtube.com/watch?v=Ll23cChDSKE
3. https://www.youtube.com/watch?v=fyAtyAdCStM

Web References:

1. https://leo.stcloudstate.edu/grammar/subverag.html
2. http://www.learningdifferences.com/Main%20Page/Topics/Compound%20Word%20Lists/Compound_Word_%20Lists_complete.htm
3. http://examples.yourdictionary.com/examples-of-active-and-passive-voice.html
4. http://www.perfectyourenglish.com/grammar/numeral-adjectives.htm
5. https://en.wikipedia.org/wiki/Commonly_misspelled_English_words
6. https://www.englisch-hilfen.de/en/grammar/if.htm
7. http://www.englishforeveryone.org/Topics/Reading-Comprehension.htm

MOOC / NPTEL / SWAYAM Courses:

1. https://onlinecourses.nptel.ac.in/noc22_hs05/preview
2. https://onlinecourses.nptel.ac.in/noc23_hs72/preview

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19HS551.1	Develop fundamental professional communication skills to effectively navigate and overcome barriers in business conversations.
R19HS551.2	Construct professional emails, memos, and letters, and draft formal business reports and proposals.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19HS551.3	Develop skills in negotiation and persuasion, recognize cultural differences, and use conflict resolution strategies in business.
R19HS551.4	Plan and deliver well-structured business presentations with effective visual aids.
R19HS551.5	Build organized business reports, executive summaries, and documentation with precision and clarity.

R19HS552	Basic Japanese	L	T	P	C
		2	0	2	3

1. Course Description:

The primary objective of this course is to provide a solid foundation in speaking, listening, reading, and writing Japanese. Through interactive lessons and practical exercises, you'll learn essential vocabulary, grammar structures, and pronunciation. Additionally, this course will introduce the various facets of the Japanese culture with cultural insights and real-life scenarios, thereby enhancing their awareness of the cultural subtleties inherent in the language.

2. Course Objectives:

1. Develop proficiency in basic Japanese language skills including speaking, listening and reading and writing to facilitate effective communication in everyday situations.
2. Acquire a solid understanding of the fundamental Japanese grammar structures, vocabularies and pronunciations to construct simple sentences and engage in basic conversations.
3. Enhance language proficiency through interactive activities, role-plays and rea-life scenarios, fostering practical language usage and confidence in communication.
4. Build a foundation for further language study and cultural exploration, enabling the students to pursue advanced language proficiency and deeper cultural understanding.

3. Syllabus

Unit – I: Introduction to Japanese Scripts and Basic Greetings

Japanese Scripts (Hiragana & Katakana) – Daily greetings and expressions – Introduction to grammar particles – N1 wa N2 desu - N1 wa N2 ja arimasen – Phrase/Sentence ka – N1 mo N2 desu - N1 no N2 desu – Honorific suffixes (san, kun, chan) – Demonstrative words (Ko, So, A & Do series) – Soudesu – Soudesuka – Soudesune – Sou ja arimasen/Chigaimasu – S1 ka S2 ka - N1(noun) wa N2(place) desu – Numbers – Days of the week – Days of the month

Unit – II: Introduction to Concept of Time

Ji, fun, pun – Ima wa nan ji desuka – Introduction to verbs (group I, group II, group III verbs) – Verb tense forms – V masu – V mashita – V masen – V masendeshita – N(time) ni V - N1 kara N2 made - N1 to N2 – N to V – S ne – N(place) e ikimasu/kimasu/kaerimasu – Doko(e) mo ikimasen/ikimasendeshita – itsu – S yo - Introduction to de particle – N(place) de V – N(vehicle) de ikimasu/kimasu/kaerimasu – N(tool) de V – N o V(transitive) – N o Shimasu – Usage of nan and nani – V masenka – V mashou, mashouka – Honorific prefixes(o/go) – "word/sentence" wa ~go de nan desuka – N(person) ni agemasu/moraimasu/kuremasu – V mou mashita.

Unit – III: Introduction to Adjectives

I ending adjectives – na ending adjectives – forms of adjectives(negative form, past form) – I ending adjective →ku/Na ending adjective→ni narimasu – degrees of adjectives – S1 ga S2 – N ga adjective – N ga arimasu/wakarimasu – degrees of adverbs – degrees of quantity – S1 kara S2 – Doushite – N1(place) ni

Chairman, Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

N2(noun) ga arimasu – N1(noun) wa N2(place) ni arimasu/imasu – N1(noun) no N2(position) – N1 ya N2 nado.

Unit – IV: Introduction to Counters

Counters for objects – Counters for person – Ikutsu – nan+counter suffix – kurai and gurai – Quantifier(period) ni frequency counter(kai) – Quantifier/Noun+dake - N1 wa N2 yori "adjective" desu - N1 to N2 to Dochira ga "adjective" desuka – N no naka de nani/doko/dare/itsu ga "adjective" desuka – Interrogatives ka/mo/demo.

Unit – V: Verb Conjugations and their Usages

5.1: V masu form and its usages

N ga hoshii desu – V masu form tai desu – V masu form ni ikimasu/kimasu/kaerimasu – V masu form mashouka.

5.2: V te form and its usages

V te form kudasai – V te form imasu – V te form mo iidesu – V te form wa ikimasen – shirimasu,

shirimasen, shitte imasu – te form of adjectives – V1 te form kara V2 – douyatte – V te form agemasu/kuremasu/moraimasu

5.3: V nai form and its usages

V nai form de kudasai – V nai form kereba narimasen – V nai form to – V nai form kutemo iidesu – N(time) madeni V.

5.4: V dictionary form and its usages

V dictionary form koto ga dekimasu – Shumi wa N suru/V dictionary form koto desu – N no/Quantifier(time)/V1 dictionary form maeni V2 – nakanaka – zehi/zettai/mochiron – V dictionary form jikan/youji/yakusoku.

5.5: V ta form and its usages

V ta form koto ga arimasu – V ta ri, V ta ri Shimasu – usage of plain form and polite form – kedo – noun modification using V plain form – V plain form/N no toki ~.

5.6: If clause

V dictionary form to~ - V ta form ra~ - V te form/I adj→kute/Na adj→de/N de mo~ - moshi/ikura~.

Text Books:

1. Minna no Nihongo, Japanese for Everyone: Elementay main textbook 1-1 & 1-2". 1st edition, Goyal Publishers and Distributors Pvt. Ltd., Delhi, 2007.
2. "Basic Kanji 320", published by Meguro Language Centre, Tokyo.

References

Reference Books:

1. "Genki: An Integrated course in elementary Japanese" authored by Eri Banno, Yoko Ikeda, and Yutaka Ohno, latest edition published in 2011 by The Japan Times.
2. "Nihongo So-matome: JLPT N5 grammar" authored and published by Ask Publications, latest edition 2021.

Web Resources:

1. www.japaneselifestyle.com
2. www.learn-japanese.info/
3. www.kanjisite.com/
4. www.learn-hiragana-katakana.com/typing-hiragana-characters/

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19HS552.1	Recognize and write the Japanese alphabet without errors
R19HS552.2	Extend the conversation using basic sounds in the Japanese language
R19HS552.3	Explain the concept of time by learning verbs, tenses and vocabularies.
R19HS552.4	Make use of the appropriate vocabulary required for simple conversations in the Japanese language.
R19HS552.5	Comprehend the conversation and give the correct meaning

R19HS553	Basic German	L	T	P	C
		2	0	2	3

1. Course Description:

This German language course offers a structured approach to learning German, spanning from basic introductions to more complex grammatical concepts and practical applications. Beginning with an introduction to German scripts and daily greetings, participant's progress through units covering essential grammar topics, vocabulary expansion, and pronunciation exercises. Throughout the course, students engage in speaking activities, such as introducing themselves, ordering food, and describing their surroundings, while also focusing on listening comprehension and reading comprehension. By the end of the course, participants will have gained proficiency in basic conversational German, acquired foundational knowledge of German grammar and vocabulary, and developed the skills necessary to navigate everyday situations in a German-speaking environment.

2. Course Objectives:

1. Basic German introduces learners to essential language components such as vocabulary, grammar, pronunciation, and basic conversational phrases.
2. Through interactive lessons and practical exercises, students develop the ability to communicate in basic German for everyday scenarios including greetings, introductions, shopping, dining, and navigating daily life situations.
3. Additionally, learners become familiar with the German alphabet, basic sentence structure, and common expressions, facilitating basic reading and writing skills.

3. Syllabus

Unit – I: Basic Introduction to German Scripts

Theme and Text (Introduction to German - German script, Deutsche Namen, Daily Greetings and Expressions) – Grammar ('wh' questions, das Alphabet)– Speak Action (Buchstabieren, sich und andere vorstellen nach Namen und Herkunft fragen, internationale Wörter auf Deutsch verstehen, jemanden begrüßen)– pronunciation (Buchstabieren J,V,W,Y, - Long vowels A,E,I,O,U - Pronunciation of Ä,Ü,Ö) – To learn (internationale Wörter in Texten finden, Wörter sortieren)

Theme and Text (Gespräche im caf'e, Getränkekarte, Telefon-buch, Namen, Rechnungen) – Grammar (Frägesatze mit wie, woher, wo, was Verben in präsens Singular und Plural, das Verb Sein, Personalpronomen und Verben)– Speak Action (eine Gespräch beginnen sich und andere vorstellen zählen, etwas bestellen und bezhalen Telefonnummern und verstehen)– pronunciation (Wortakzent in Verben und in Zahlen) – To learn (Grammatiktabelle ergänzen, mit einem Redemittelkasten arbeiten)

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Unit – II: Numbers and Nominative Case
Theme and Text (Numbers – 1 to 12 (Eins bis Zwolf) – 20, 30, 40, 90 (zwanzig-Neunzig) – All Numbers (1-10000) – German Currency (Euro) – Basic Mathematics (plus, Minus, Malen, Geteilt durch)) – Grammar (Introduction of verbs –Have Verb – To Come, To Speak, To Read, To Drive, To Fly, To write, To Eat, To sleep, To take etc.,) Theme and Text (Communication in course) – Grammar (Singular and Plural, Artikel: der,das,die/ ein,eine, verneinung: kein, keine, Komposita: das Kursbuch) – Speak Action (Gegenständen fragen/ Gegenstände benennen im kurs:) – pronunciation (word accent Marking, Umlaute ö ä ü hören und sprechen) – To learn (Lernkarten schreiben, Memotipps, eine Regel selbst finden) Theme and Text (City, Town, Language: Nachbar, Sprachen, Sehenswürdigkeiten in Europa) – Grammar (Past tense for Sein, W-Frage, Aussagesatz und Satzfrage) – Speak Action (about city and siteseeing) – pronunciation (Satzakzent in Frage- und Aussagesätzen) – To learn (eine Regel ergänzen, eine Grammatiktabelle erarbeiten, Notizen machen)
Unit – III: Akkusative Case and Prepositions
Theme and Text (Menschen und Hauser, Furniture catalogue, E-Mail, House information) – Grammar (possesivartikel im Nominativ, Artikel im Akkusativ, Adjektive im satz, Graduierung mit zu)– Speak Action (Whonung bescreiben about perons and things)– pronunciation (consonant - ch) – To learn (wortschatz systematisch) Theme and Text (Termine - Appointment and punctuality in Germany) – Grammar (questions with wann?, Preposition (am, um, von... bis), verneinung mit nicht, trennbare verben, präteritum von haben) – Speak Action (Daily plan making, time commitment, excuse for late coming) – pronunciation (consonants-p,b,t,d / k,g) – To learn (Rollenkarten arbeiten) Theme and Text (orientation in working area, go for work, floor plan city plan, office and computer) – Grammar (preposition: in,neben, unter, auf, vor, hinter, an, zwischen, bei und mit + Datic)– Speak Action (work place, work, giving appointments)– pronunciation (consonants: f,w und v) – To learn (Making notice in calender)
Unit – IV: Dativ Case and Prepositions
Theme and Text (Holiday and Party, holiday plan, party plan in Germany) – Grammar (regular and iregular verbs) – Speak Action (holiday speak, accident, Ich-Text schreiben) – pronunciation (lange und kurze vokale markieren) – To learn (Text Order) Theme and Text (organising an Excursion to Berlin through city orientation, Bus plan, City plan, post card, Excursion programme) – Grammar (preposition: in, durch, über + Akkusativ: zu, an... vorbei + Dativ, Modalverb wollen) – Speak Action (Tourism, culture, postcard preparation, travel description) – pronunciation (r and l)– To learn (plaket making) Theme and Text (Beruf und all Tag, Visiten karten, wörterbuch) – Grammar – Speak Action (profession, statistic speaking) – pronunciation (n,ng and nk)– To learn (wörterbuch , text information in tabel)
Unit – V: Adjectives and Pronunciation
Theme and Text (Haushaltstipp, kochrezept, maße und gewichte, Mahlzeiten und Gerichte) – Grammar (jeden Tag, manchmal, nie, Question - welche, Comparison – viel, gut, gern) – Speak Action (about eat, drink question and answers) – pronunciation (e,en,el,er) – To learn (Text auswerten und zusammenfassen) Theme and Text (Clothing, colour, weather) – Grammar (Adjecktive im Akkusativ, unbestimmer Artikel) – Speak Action (weather, dress and colour understanding) – pronunciation (e-o- ö and ie-u- ü) – To learn (wetter and Farben interkulturelle)

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Theme and Text (in super market,purchase, House Maintainence, Emotion, Sports, Body parts) – Grammar (Modal Verb) – Speak Action (Body parts) – To learn (Rollenkarten arbeiten)
Text Books: 1. Funk, Kuhn, Demme, "Studio D A1 Deutsch als Fremdsprache" Goyal Publishers and Distributors; 2016 2. Hueber, "Fit for Goethe- Zertifikat A1 (Start Deutsch 1)" Goyal Publishers and Distributors; 2016
References:
Reference Books: 1. Stefanie Dengler, "Netzwerk Deutsch Als Fremdsprache A1" by Goyal Publishers & Distributors Pvt Ltd 2. Fran Martin, "Grammar Tables for Student of German" by Independently Published, 2017
Web Resources: 1. www.memrise.com/courses/english/german/ 2. www.deutsch-lernen.com/ 3. www.duolingo.com

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19HS553.1	Recognize and write the German alphabet
R19HS553.2	Speak using basic sounds of the German language
R19HS553.3	Apply appropriate vocabulary needed for simple conversation in the German language
R19HS553.4	Apply appropriate grammar to write and speak in the German language
R19HS553.5	Comprehend the conversation and give the correct meaning

R19CY111	Chemistry Laboratory	L	T	P	C
		0	0	2	1

1. Course Description:

Engineering students can gain practical experience and understanding of chemical principles necessary for engineering practice which will help them to get exposed to fundamental laboratory procedures, improve their comprehension of chemical topics to build their critical thinking and problem-solving abilities.

2. Course Objectives:

1. To equip engineering students with precise measurement techniques, safe chemical handling, proper equipment usage, and adherence to experimental protocols.
2. Through hands-on experiments, reinforce theoretical concepts from lectures, providing practical insights into chemical phenomena, reactions, and properties.
3. To develop critical thinking through engaging in experimental design, data analysis, and problem-solving to apply scientific reasoning, identify errors, and address challenges, fostering a stronger grasp of the scientific method.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

4.	To cultivate teamwork by collaborating in group lab activities, enhancing communication, task delegation, and cooperation skills essential for success in engineering and beyond.
5.	To prioritize safety protocols and hazard awareness to instill a safety-oriented mindset, ensuring responsible conduct and risk mitigation during experiments.

3. Syllabus:

List of Experiments:

1. Determination of total, permanent and temporary hardness of water by EDTA method.
2. Estimation of copper in brass by EDTA method.
3. Determination of alkalinity and TDS of water sample.
4. Estimation of chloride content in water by Argentometric method.
5. Determination of strength of acid by Conductometric titration (strong acid Vs strong base & strong base vs mixture of acids).
6. Determination of strength of given hydrochloric acid using pH meter.
7. Estimation of ferrous ion content of the given solution using Potentiometer.
8. Determination of do content of water sample by Winkler's method.

Text Book:

1. R. Rathinam., "Chemistry Lab Manual", Gems Publishers, 2019.

References:

1. Vogel's, "Text book of Quantitative Chemical Analysis", Pearson Publications, 2014.
2. Daniel C Harris, "Quantitative Chemical Analysis", W. H. Freeman and Company, New York, 7th Edition 2007.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19CY111.1	Analyse the role of water quality related parameters
R19CY111.2	Design the engineering materials against corrosion
R19CY111.3	Competent in applying the Argentometric method to precisely determine the chloride content in water, as well as in data analysis, laboratory procedures, and safety protocol observation.
R19CY111.4	Execute conductometric titrations and implement your understanding about the estimation of the substance from the given sample through data interpretation.
R19CY111.5	Implement the electrochemical methods to measure the concentration and amount of unknown chemical substances by validating the data using calibration techniques essential for quantitative analysis.

R19CS211	Data Structures Laboratory	L	T	P	C
		0	0	4	2

1. Course Description:

The Data Structure Laboratory is a hands-on course designed to complement theoretical knowledge with practical implementation skills in data structures. Through a series of lab sessions, students will work on implementing code and projects focusing on lists, stacks, queues, sorting algorithms, searching techniques, hashing, trees and graph data structures. By actively engaging in coding exercises and projects, students will

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

deepen their understanding of the course, enhance their programming skills, and gain valuable experience applicable across various computer science and engineering domains.

2. Course Objectives:

1. To build and work with linear and nonlinear data structures like arrays, linked lists, stacks, queues, trees, and graphs.
2. To discover data structures to solve real-world problems and scenarios, demonstrating an understanding of trade-offs and limitations
3. To equip students' skills in designing, implementing, and analyzing tree-based solutions to complex problems
4. To familiarize and working with algorithms, including traversal, shortest paths, and network flow, to solve complex problems
5. To implement and analyze sorting, searching, and hashing techniques to optimize data retrieval and manipulation in various contexts

3. List of Experiments:

1. Develop a Multimedia Library Management System that organizes and manages various types of multimedia content such as audio, video, and images. Each type of content requires a different approach for efficient management. Choose a suitable linked list operation for each multimedia category's specific needs. (C01)
2. Demonstration of applications of Linked List (Reversal Problems, Segregation of Even and Odd nodes in Linked List, Palindrome checking using Linked List, Loop Detection, Sorting the biotonic using doubly linked list) (CO1)
3. Build a critical software project for a large healthcare organization that processes and manages a high volume of patient data, requiring efficient and reliable data structures for task management, resource allocation, and communication. Select appropriate data structures (stacks and queues) for specific use cases, considering their performance characteristics, flexibility, and memory usage. (C02)
4. Demonstration of applications of Stack and Queue (Evaluating Postfix Expressions, Infix to Postfix conversion, Balancing symbols and Postfix evaluation, Wild card pattern matching (CO2)
5. Develop a movie recommendation system for a popular streaming platform that recommends movies to users based on their past watching history and preferences. Use a binary tree data structure to store and search for movies based on different criteria efficiently. (CO3)
6. Build an online bookstore with a vast collection of books to manage the inventory efficiently and provide a seamless user experience with the help of a Binary Search Tree (BST) data structure. (CO3)
7. Demonstration of applications of Trees (Segment Tree and Range Minimum Query on the Constructed Segment Tree, Maximum depth of Binary tree) (CO3)
8. Design a network for any food delivery partner to understand how people are connected, and how information flows through the network and identify influential users using graph traversal algorithms. (CO4)
9. Construct a travel management system that aims to streamline the planning and organization of travel itineraries for a travel agency. The system utilizes various graph algorithms (Topological Sort, Connected Graph and Ticket Itinerary) to efficiently manage the complexities of travel planning. (CO4)
10. Design a food delivery app for a bustling city. Thousands of orders flow daily, and ensuring fast and efficient delivery is crucial for customer satisfaction. Use Dijkstra's algorithm to find the shortest paths for delivery drivers, optimizing their routes and minimizing delivery times. (CO5)
11. Design an optimized network infrastructure of an organization that connects the various departments within the organization using the minimum amount of cabling to reduce costs and enhance network efficiency. Implement Prim's and Kruskal's algorithms for finding the Minimum Spanning Tree (MST) for the network. (CO5)

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

12. Create a Student Grade Management System for a university that efficiently organizes and displays student grades for various courses. The system should employ different sorting algorithms to cater to diverse requirements and optimize the display of grades. Choose the suitable sorting algorithms (Bubble Sort, Insertion Sort, Quick Sort, Merge Sort) for quick grade overview, mark entry, course ranking and overall grade report. (CO5) 13. Develop a Product Inventory Management System for a retail company that handles a large number of products to implement efficient searching techniques to retrieve information about products in the inventory quickly. Select the appropriate searching technique (Linear Search, Binary Search) for quick product lookup, inventory sorting, and retrieval. (CO5) 14. Demonstration of applications of hashing (Single swap sorted array, Anagram Checking and Range Minimum Query Using Sparse Table, Merge two sorted arrays) (CO5)
References:
Reference Books: 1. Reema Thareja, "Data Structures Using C", Second Edition, Oxford University Press, 2019 2. Narasimha Karumanchi "Data Structures and Algorithms Made Easy" Fifth Edition, Career Monk publications,2017 3. Seymour Lipschutz, "Data Structures using C", First Edition, McGraw Hill Education, 2017 **Web Resources:** 1. https://www.geeksforgeeks.org/data-structures 2. https://www.javatpoint.com/data-structure-tutorial **MOOC/NPTEL /SWAYAM Courses:** 1. https://www.udemy.com/course/datastructurescncpp/ 2. https://in.coursera.org/learn/data-structures?action=enroll

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19CS211.1	Solve Problems by applying the concepts of Linked Lists
R19CS211.2	Implement Stacks and Queues with Array and LinkedList and solve problems with Stacks and Queues
R19CS211.3	Implement tree data structures and demonstrate tree operations such as insertion, deletion, traversal and balancing
R19CS211.4	Implement the graph-based algorithms to solve complex problems requiring efficient data traversal and manipulation
R19CS211.5	Apply sorting, searching and hashing algorithms to organize and retrieve data effectively

R19EE111	Electric Circuits Laboratory	L	T	P	C
		0	0	2	1

1. Course Description:

The Electric Circuits Laboratory course is designed to enhance students' understanding of electric circuits through practical application, fostering skills in measurement, analysis, and troubleshooting. The hands-on experience gained in the laboratory is crucial for students pursuing careers in electrical engineering or related fields.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

2. Course Objectives:

1. Enable students to apply fundamental principles learned in lectures to real-world electrical circuits.
2. Allow students to experimentally verify and validate theoretical concepts, laws, and theorems related to electric circuits, such as Ohm's Law, Kirchhoff's Laws, and network theorems.
3. Provide hands-on experience in solving and analyzing complex circuits.
4. Enhance skills in data analysis and interpretation of experimental results.

3. Syllabus

List of Experiments:

1. Simulation and experimental verification of Ohm's law and Kirchhoff's laws.
2. Simulation and experimental verification of Superposition theorem.
3. Simulation and experimental verification of Thevenin's theorem.
4. Simulation and experimental verification of Norton's theorem.
5. Simulation and experimental verification of the Maximum Power Transfer theorem.
6. Measurement of voltage, frequency and power factor of sinusoidal signals.
7. Design and simulation of series resonant circuits.
8. Design and simulation of a parallel resonant circuit.
9. Simulation and experimental validation of transient response of RC series circuit.
10. Simulation of three-phase balanced and unbalanced star/delta networks.

References:

Reference Books:

1. Charles K Alexander and Mathew N O Sadiku, "Fundamentals of Electric Circuits", Tata McGraw Hill, Third Edition, 2009.
2. Mahadevan. K and Chitra. C, "Electric Circuits Analysis, " Prentice Hall India, 2015.
3. Chakrabarti A, "Circuits Theory (Analysis and synthesis)", Dhanpat Rai and Sons, 1999.
4. Nahvi M and Edminister J, "Schaum's Outline of Electric Circuits", Tata McGraw Hill, Fifth Edition, 2011.

Web References:

1. http://www.electrical4u.com/
2. http://www.electrical4u.com/ohms-law-equation-formula-and-limitation-of-ohms-law/
3. http://physics.bu.edu/py106/notes/Circuits.html
4. http://www.electronics-tutorials.ws/accircuits/ac-waveform.html
5. http://www.calvin.edu/~svleest/circuitExamples/NodeVoltageMeshCurrent/
6. http://www.electrical4u.com/norton-theorem-norton-equivalent-current-and-resistance/
7. http://www.allaboutcircuits.com/textbook/direct-current/chpt-6/current-divider- circuits

MOOC / NPTEL / SWAYAM Courses:

1. https://onlinecourses.nptel.ac.in/noc24_ee112/preview
2. https://www.coursera.org/

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE111.1	Prepare and Conduct experiments in the Electric Circuits laboratory, demonstrate meticulous adherence to proper procedures and attention to detail.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE111.2	Design and implement theoretical concepts using appropriate circuit devices and components, measure relevant electrical parameters during practical experiments and interpret experimental data accurately to conclude circuit behaviour.
R19EE111.3	Analyze experimental data (run-time behaviour of the program) using appropriate analytical techniques, accurately draw inferences, effectively communicate the results and evaluate the accuracy (regarding functionality and performance).
R19EE111.4	Demonstrate the application of presentation tools to present experimental data, analyze findings, draw conclusions, and derive outcomes.
R19EE111.5	Articulate their methodology, discuss findings, and respond to questions, showcasing a comprehensive understanding of the experiment's objectives and outcomes.

R19MC101	தமிழர் மரபு / Heritage of Tamils	L	T	P	C
		1	0	0	1

1. Course Description: / பாடநெறி விளக்கம்

This course is taught to provide insight to the students into the rich culture and heritage of the state. The students should know the valued things such as historic buildings that have been passed down from previous generations and relating to things of Tamil historical and cultural value that are worthy of preservation. This course explains the growth of nationalism, the growth of the Tamil language, various religious reformers, the spread of the Dravidian movement and its possible impact on society, the role of the self-respect movement, educational development in Tamilnadu since independence and the growth of fine arts in Tamilnadu.

மாநிலத்தின் வளமான கலாச்சாரம் மற்றும் பாரம்பரியம் பற்றிய நுண்ணறிவை மாணவர்களுக்கு வழங்க இந்த பாடநெறி கற்பிக்கப்படுகிறது. முந்தைய தலைமுறையினரிடமிருந்து பெறப்பட்ட வரலாற்று கட்டிடங்கள் மற்றும் தமிழ் வரலாற்று மற்றும் கலாச்சார மதிப்புள்ள விஷயங்கள் பாதுகாக்கப்பட வேண்டிய மதிப்புமிக்க விஷயங்களை மாணவர்கள் அறிந்து கொள்ள வேண்டும். தமிழ்நாட்டின் தேசியத்தின் வளர்ச்சி, தமிழ் மொழியின் வளர்ச்சி, பல்வேறு சமய சீர்திருத்தவாதிகள், திராவிட இயக்கத்தின் பரவல் மற்றும் சமுதாயத்தில் அதன் தாக்கம், சுயமரியாதை இயக்கத்தின் பங்கு, சுதந்திரத்திற்குப் பிறகு தமிழகத்தில் கல்வி வளர்ச்சி மற்றும் தமிழகத்தில் நுண்கலைகளின் வளர்ச்சி பற்றி இந்த பாடநெறி விளக்குகிறது.

2. Course Objectives / பாடத்தின் நோக்கங்கள்:

1. To make an inference about language and traditional of the state.
   மாநிலத்தின் மொழி மற்றும் பாரம்பரியம் பற்றி அனுமானிக்க உதவுகிறது.
2. To acquire knowledge in construction of status and various musical instruments
   கட்டிடக்கலை மற்றும் பல்வேறு இசைக்கருவிகளை உருவாக்குவதற்கான அறிவைப் பெறுதல்.
3. To study the detailed information about folklore and paramilitary arts.
   நாட்டுப்புறவியல் மற்றும் ராணுவக் கலைகள் பற்றிய விரிவான தகவல்களைப் படிக்க உதவுகிறது.
4. To gain knowledge of rich culture and success history of ancient kingdoms.
   பண்டைய ராஜ்யங்களின் வளமான கலாச்சாரம் மற்றும் வெற்றி வரலாற்றைப் பற்றிய அறிவைப் பெற உதவுகிறது.
5. To acquaint the student with the knowledge of Siddha medicine and about the Indian freedom struggle.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

சித்த மருத்துவம் மற்றும் இந்திய சுதந்திரப் போராட்டம் பற்றிய அறிவை மாணவருக்கு அறிமுகப்படுத்துதல்.

3. Syllabus / பாடத்திட்டங்கள்:

Unit – I : Language and Literature

அலகு – I : மொழி மற்றும் இலக்கியம்

Language Families in India – Dravidian Languages – Tamil as a Classical Language – Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature – Management Principles in Thirukkural – Tamil Epics and Impact of Buddhism & Jainism in Tamil Land – Bakthi Literature Azhwars and Nayanmars – Forms of minor Poetry – Development of Modern literature in Tamil – Contribution of Bharathiyar and Bharathidhasan.

இந்திய மொழி குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி - தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை - சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துகள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் – சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழிலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

Unit – II: Heritage–Rock Art Paintings to Modern Art Sculpture

அலகு – II: மரபு - பாறை ஓவியங்கள் முதல் ஓவியங்கள் வரை - சிற்பக்கலை

Hero stone to modern sculpture – Bronze icons – Tribes and their handicrafts – Art of temple car making – Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments – Mridhangam, Parai, Veenai, Yazh and Nadhaswaram – Role of Temples in Social and Economic Life of Tamils.

நடுக்கல் முதல் நவீன சிற்பங்கள் வரை - ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினை பொருள்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரி முனையில் திருவள்ளுவர் சிலை – இசைக் கருவிகள் – மிருதங்கம், பறை, யாழ், வீணை, நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு

Unit – III: Folk and Martial Arts

அலகு – III: நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance – Sports and Games of Tamils.

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம் - தமிழர்களின் வீர விளையாட்டுகள்.

Unit – IV: Thinai Concept of Tamils

அலகு – IV தமிழர்களின் திணைக்கோட்பாடுகள்

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature – Aram Concept of Tamils – Education and Literacy during Sangam Age – Ancient Cities and Ports of Sangam Age – Export and Import during Sangam Age – Overseas Conquest of Cholas.

தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு - சங்க காலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்க கால நகரங்களும் துறை

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

முகங்களும் - சங்க காலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி.
Unit – V: Contribution of Tamils to Indian National Movement and Indian Culture **அலகு – V: இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு**
Contribution of Tamils to Indian Freedom Struggle – The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement – Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books. இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிற்பகுதியில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுய மரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.
Text Books:
1. தமிழக வரலாறு - மக்களும் பயன்பாடுகளும் - கே கே பிள்ளை (தமிழக பாட நூல் கழகம் மற்றும் கல்வியல் பணிகள் கழகம்). 2. கணினித் தமிழ் - முனைவர் இல .சுந்தரம் (விகடன் பிரசுரம்). 3. கீழடி - வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (தொல்லியல் துறை வெளீயீடு). 4. பொருநை - ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு). 5. Social Life of Tamils - Dr.K.K.Pillay, A joint publication of TNTB & ESC and RMRL – (in print). 6. Social Life of the Tamils - The Classical Period - Dr.S.Singaravelu (Published by: International Institute of Tamil Studies. 7. Historical Heritage of the Tamils - Dr. S. V. Subatamanian, Dr. K. D. Thirunavukkarasu (Published by: International Institute of Tamil Studies). 8. The Contributions of the Tamils to Indian Culture - Dr.M.Valarmathi (Published by: International Institute of Tamil Studies). 9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation Tamil Nadu). 10. Studies in the History of India with Special Reference to Tamil Nadu - Dr.K.K.Pillay.
References:
1. Journey of Civilization Indus to Vaigai - R. Balakrishnan, Published by RMRL. 2. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

4. Course Outcomes:/ பாடநெறி முடிவுகள்:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome / பாடநெறி முடிவுகள்
R19MC101.1	To know about the language families in India, the impact of the religions, the contribution of Bharathiar and Bharathidhasan. இந்தியாவில் உள்ள மொழி குடும்பங்கள், மதங்களின் தாக்கம், பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு பற்றி தெரிந்து கொள்வது.
R19MC101.2	Observe the growth of sculpture making of musical instruments and the role of temples in socio and economic lives.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

	தமிழர்களின் வாழ்வில் இசைக்கருவிகள், சிற்பங்களை உருவாக்கும் முறைகள், சமூக, பொருளாதார வளர்ச்சி மற்றும் கோவில்களின் பங்களிப்பு பற்றி அறிந்து கொள்வது
R19MC101.3	Understand the significance of folklore and martial arts. நாட்டுப்புறவியல் மற்றும் தற்காப்புக் கலைகளின் முக்கியத்துவத்தைப் புரிந்து கொள்வது.
R19MC101.4	Learn the Sangam literature, Sangam age and overseas conquest of Cholas. சங்க இலக்கியம், சங்க காலம் மற்றும் சோழர்களின் வெற்றிகள் ஆகியவற்றைக் கற்றுக்கொள்வது.
R19MC101.5	Understand the contribution of Tamils to Indian freedom struggle, Role of siddha medicines. இந்திய சுதந்திரப் போராட்டத்தில் தமிழர்களின் பங்களிப்பு, சித்த மருந்துகளின் பங்கு ஆகியவற்றைப் புரிந்து கொள்வது.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

SEMESTER III

R19MA201	Transforms and Partial Differential Equations	L	T	P	C
		3	1	0	4

1. Course Description:

This course explores the theory and applications of transforms and partial differential equations (PDEs) in mathematics. It provides the fundamental knowledge and problem-solving abilities needed to comprehend and analyze a wide range of physical events, making it a vital part of engineering. Gaining expertise in applying transforms to many domains like engineering, physics, and applied mathematics will help us to solve differential equations, evaluate signals and solve problems.

2. Course Objectives:

1. Enhance the basic concepts of PDE for solving standard partial differential equations.
2. Introduce Fourier series that is applied in engineering apart from its use in solving boundary value problems.
3. Familiarize the student with diverse applications of the Fourier series to solve heat flow problems.
4. Acquaint the student with Fourier transform techniques used in a wide variety of situations.
5. Introduce effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete-time systems.

3. Syllabus

Unit – I: Partial Differential Equations

Solutions of standard types of first order partial differential equations; Lagrange's linear equations; Linear homogeneous partial differential equations of second and higher order with constant coefficients.

Unit – II: Fourier Series

Dirichlet's conditions; General Fourier series: Odd and even functions, half range sine series and cosine series, Parseval's identity.

Unit – III: Applications of Partial Differential Equations

Classification of second order linear partial differential equations; Solutions of one-dimensional wave equation; Solutions of one-dimensional heat equation (excluding insulated ends); Steady state solution of two-dimensional equation of heat conduction.

Unit – IV: Fourier Transforms

Fourier Transforms: Fourier sine and cosine transforms, properties, transforms of simple functions, convolution theorem, Parseval's identity (Statement), evaluation of integrals using Parseval's identity.

Unit – V: Z Transforms

Z-transform: Standard functions, properties. initial and final value theorem; Inverse Z- transform: Standard functions, convolution theorem, partial fraction method, residue method; Solution of difference equations using Z-transform techniques.

Text Books:

1. Grewal B.S, "Higher Engineering Mathematics", Khanna Publications, 44th Edition, 2015.
2. Glyn James, "Advanced Modern Engineering Mathematics", Pearson Education, 3rd Edition, 2013.

References:

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Reference Books:

1. Erwin Kreyszig, "Advanced Modern Engineering Mathematics", John Wiley and Sons (Asia) Ltd, 10th Edition, 2017.
2. Bali N. P and Manish Goyal," A Textbook of Engineering Mathematics", Laxmi Publication, 8th Edition, 2011.
3. Ramana B. V, "Advanced Engineering Mathematics", Tata Mc Graw Hill Education, 2016.

Journal References:

1. International Journal of Partial Differential Equations and Applications: https://www.sciepub.com/journal/ijpdea
2. International Journal of differential equations and applications: https://www.ijpam.eu/en/index.php/ijdea

Web Resources:

1. https://www.youtube.com/watch?v=ry9cgNx1QV8
2. https://www.khanacademy.org/...fourier-series/.../ee-fourier-series-i
3. https://www.youtube.com/watch?v=vQLH7qTeJRM /
4. https://www.youtube.com/watch?v=wG6VUnkrO90
5. https://www.youtube.com/watch?v=fH76Wo_Jres

MOOC / NPTEL / SWAYAM Courses:

1. nptel.ac.in/courses/111103021/
2. nptel.ac.in/courses/106106097/pdf/Lecture10_ZTransForm.pdf

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19MA201.1	Apply the mathematical principles to solve partial differential equations.
R19MA201.2	Solve engineering related problems using Fourier series.
R19MA201.3	Utilize the concepts of Fourier series for solving wave and heat flow equations in various situations.
R19MA201.4	Make use of Fourier transform to convert the time function into the sum of sine waves of different frequencies.
R19MA201.5	Apply Z- transform to convert a discrete time signal into a complex domain.

R19CS207	Algorithmic Design Techniques	L	T	P	C
		3	0	0	3

1.Course Description:

This course explores the fundamental principles of algorithmic design and analysis, equipping students with the essential tools to tackle complex computational problems efficiently. Through a comprehensive exploration of various algorithmic techniques, including Brute Force, Divide-and-Conquer, Dynamic Programming, Greedy Approach, Backtracking, and Branch and Bound, students will gain a profound understanding of how to formulate, analyze and optimize algorithms for diverse applications. Through hands-on exercises, projects and theoretical discussions, students will develop the skills necessary to design algorithms, assess their efficiency, and make informed decisions regarding algorithm selection for real-world problems.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

2.Course Objectives:

1. To familiarize the student with analysis of algorithmic efficiency, including time and space complexity, to evaluate and compare algorithm performance.
2. To make students to work on efficient solutions to complex problems using brute force and divide-and-conquer techniques
3. To acquaint students with dynamic programming techniques to solve complex optimization problems.
4. To enable students to understand and apply the greedy approach to solve optimization problems.
5. To Equip students with the problem-solving strategies of backtracking and branch and bound problems.

Syllabus

Unit – I: Algorithm Analysis Techniques

Notion of an algorithm; Importance & role of algorithms in computing ; Important problem types; Analysis of algorithmic efficiency ; Time and Space Complexity; Asymptotic notations and their properties; Analysis framework; Mathematical analysis for recursive and non-recursive algorithms; String Algorithms: Naïve algorithm; Rabin Karp Algorithm-KMP Algorithm; Manachers algorithm.

Unit – II: Brute Force and Divide-And-Conquer

Brute force: Selection sort; String matching; Exhaustive search; Boyer Moore algorithm; Travelling salesman problem; Knapsack problem ; Assignment problem; Huffman codes and data compression; Divide and Conquer: Binary search, Quick sort , Heap sort , Multiplication of large integer.

Unit – III: Dynamic Programming

Ugly numbers; Coin changing problem; Friends pairing problem; Golomb sequence; Warshall's algorithm; Floyd's algorithm; Multi stage graph; Optimal binary search trees; Fractional Knapsack Problem; K Knight's tour on chess board.

Unit – IV: Greedy Approach

Definition; Activity selection problem ; Longest common subsequence; Sieve of Sundaram; Assign mice to holes; Huffman trees; Sparse matrix ; Bloom filter.

Unit – V: Backtracking and Branch and Bound

Backtracking; Rat in maze-Permutation and Combination-N Queen problem; Hamiltonian circuit problem; Knight's tour problem; Subset sum problem; Graph Coloring; Branch and Bound ; Assignment problem; Knapsack problem ; Travelling salesman problem.

Text Books:

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Third Edition, Pearson Education, 2012.

References:

Reference Books:

1. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2008

Web Resources:

1. https://www.javatpoint.com/daa-tutorial
2. https://www.geeksforgeeks.org/design-and-analysis-of-algorithms/

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

3.	https://www.udemy.com/course/design-and-analysis-of-algorithm
MOOC/NPTEL /SWAYAM Course:	
1.	https://onlinecourses.nptel.ac.in/noc24_cs23/preview

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19CS207.1	Understand the importance of designing strategies, time and space complexity
R19CS207.2	Apply brute force and divide and conquer strategies in solving problems
R19CS207.3	Apply dynamic programming in solving complex problems
R19CS207.4	Apply greedy algorithms in solving problems
R19CS207.5	Compare the time and space complexities of different types of algorithms

R19CS203	Object Oriented Programming using Java	L	T	P	C
		3	0	0	3

1.Course Description:

This course provides students with a comprehensive understanding of the principles, mechanisms and advanced features of the Java programming language. Starting with the Foundations of Java, students will build a solid understanding of basic syntax, data types, control structures, and object-oriented concepts. They will explore into Object-Oriented Mechanisms, mastering topics such as classes, objects, inheritance, polymorphism and encapsulation. The course also covers essential Java libraries and features, including Strings, Collections, Java 8 Features, Exception Handling, and Multithreading. Additionally, students will explore JavaFX for graphical user interface (GUI) development and JDBC for database connectivity, enhancing their proficiency in Java application development.

2. Course Objectives:

1. To understand object-oriented programming concepts and the basics of java programming language
2. To know the principles of packages, inheritance and interfaces
3. To understand strings & collections with java 8 features
4. To develop a Java application with exception handling and threads
5. To develop windows-based applications with jdbc

3.Syllabus

Unit – I: Foundations of Java

Overview of OOP – Object oriented programming paradigms – Features of Object-Oriented Programming – Java Buzzwords – Overview of Java – JVM - JDK – Programming Structures in Java – Classes & its types in Java - Data Types, Variables – Operators – Keywords - Control Statements – Wrapper Classes – Constructors - Methods - Access specifiers - Arrays & its types – java.util. Arrays - Java Doc comments - I/O classes

Unit – II: Object Oriented Mechanisms

Association – Aggregation – Composition - Polymorphism – Overloading Vs Overriding – Static and Dynamic Binding - Inheritance - Basics – Types of Inheritance – Super, static & final keywords with inheritance and polymorphism – Abstraction - Abstract Classes and Interfaces - Encapsulation - Packages – Access modifiers

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Unit – III: Strings, Collections & Java 8 Features
Strings, creation, declaration of a string, storage structure of a string and its methods, StringBuilder, String Buffer, regex - Collection Interface – Generics - List, Set, Map interfaces and classes, Comparable - Comparator – Java lambda expressions – Date & time Object in java 1.8 and its functions – Streams
Unit – IV: Exception Handling and Multithreading
Exception handling - Hierarchy, Types of exception, Mechanisms - try, catch, throw, throws and finally, Exception Propagation - Exception in Inheritance - Introduction to Multiprocessing - threads vs process – threads - Creation of thread - Thread states - Thread Lifecycle and its methods, Executor Framework, Concurrency API, Synchronization Blocks
Unit – V: JAVAFX & JDBC
JAVAFX Events and Controls: Event Basics – Handling Key and Mouse Events. Controls: Checkbox, ToggleButton – RadioButtons – ListView – ComboBox – ChoiceBox – Text Controls – ScrollPane. Layouts – Flow Pane – HBox and VBox – Border Pane – Stack Pane – Grid Pane. Menus – Basics – Menu bars – Menu Item - JDBC – drivers, Steps to create a JDBC application- DB Connection Pool
Text Books:
1. Herbert Schildt, "Java: The Complete Reference", 12th Edition, McGraw Hill Education, New Delhi, 2019 2. Cay S.Horstmann., "Core Java Fundamentals", Volume 1, 11th Edition, Prentice Hall, 2018
References:
Reference Books: 1. Deitel P and Deitel H, "Java: How to Program", 11th Edition, Prentice Hall, 2018 2. James Gosling, Bill Joy, Guy Steele, Gilad Bracha, Alex Buckley and Daniel Smith, "The Java Language Specification – Java SE", 13th Edition, Oracle America Inc., USA, 2019 3. Matt Weisfeld, "The Object-Oriented Thought Process", 5th Edition, Addison-Wesley Professional, US, 2019. **Video References:** 1. https://www.youtube.com/@abdul_bari/videos 2. https://www.youtube.com/@JennyslecturesCSIT 3. https://caveofprogramming.teachable.com/p/java-multithreading **MOOC/SWAYAM/NPTEL Courses:** 1. https://www.udemy.com/course/java-se-programming/ 2. https://cse.iitkgp.ac.in/~dsamanta/java/index.htm 3. https://caveofprogramming.teachable.com/p/java-for-complete-beginners

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19CS203.1	Understand the core concepts of Java programming
R19CS203.2	Understand the principles of object-oriented programming
R19CS203.3	Understand the concepts of strings and collections
R19CS203.4	Apply exception-handling & multithreading concepts in applications
R19CS203.5	Apply JavaFX & JDBC in application development

Chairman – Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202.

R19EE201	Field Theory	L	T	P	C
		3	1	0	4

1. Course Description:

This course in Electromagnetic Field Theory comprises five modules covering essential concepts and applications. Beginning with the sources and effects of electromagnetic fields, students explore vector fields, Coulomb's Law, and Gauss's Law in Module I. Module II delves into electrical potential, capacitance, and dielectric polarization. Module III focuses on magnetostatics, including Lorentz force and magnetic flux density. Electrodynamics is addressed in Module IV, covering magnetic circuits, Faraday's law, and Maxwell's equations. The final module, Module V, explores electromagnetic waves, including their generation, parameters, and behavior in different media. This comprehensive course equips students with a solid understanding of electromagnetic principles, enabling them to apply their knowledge in diverse fields such as electrical engineering, telecommunications, and signal processing.

2. Course Objectives:

1. To introduce the basic mathematical concepts related to electromagnetic vector fields.
2. To impart knowledge of electrostatic fields, electrical potential, energy density and their applications.
3. To introduce the magneto static fields, magnetic flux density, vector potential and its applications.
4. To educate on different methods of emf generation and Maxwell's equations.
5. To introduce electromagnetic waves and characterizing parameters.

3. Syllabus

Unit – I: Electrostatics – I

Sources and effects of electromagnetic fields; Coordinate Systems; Vector fields: Gradient, Divergence theorem, Curl and Strokes theorem; Coulomb's Law; Electric field intensity: Field due to discrete and continuous charges, Gauss's law; Applications.

Unit – II: Electrostatics – II

Electrical potential: Electric field and equi potential plots, Uniform and non-uniform field ; Electric field in free space, conductors, dielectric, Dielectric polarization; Electric field in multiple dielectrics: boundary conditions; Capacitance: Energy density; Applications.

Unit – III: Magnetostatics

Lorentz force; magnetic field intensity (H) : Biot - Savart's Law; Ampere's Circuit Law: H due to straight conductors, circular loop, infinite sheet of current; Magnetic flux density (B) : B in free space, conductor, magnetic material, Magnetization; Magnetic field in multiple media: Boundary conditions; Scalar and vector potential; Poisson's Equation.

Unit – IV: Electrodynamic Fields

Magnetic Circuits: Faraday's law, Transformer and motional EMF; Displacement current; Maxwell's equations (differential and integral form); Relation between field theory and circuit theory; Applications.

Unit – V: Electromagnetic Waves

Electromagnetic wave generation and equations; Wave parameters: velocity, Intrinsic impedance and propagation constant; Waves in free space, lossy, lossless dielectrics, conductors and Skin depth; Poynting vector and Poynting theorem.

Text Books:

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

1. Mathew N. O. Sadiku, "Principles of Electromagnetics", Oxford University Press, Sixth Edition, 2015.
2. William H. Hayt and John A. Buck, "Engineering Electromagnetics", Tata McGraw Hill, 2014.

References:

Reference Books:

1. Gangadhar K. A, "Electromagnetic Field Theory", Khanna Publishers, Eighth Reprint, 2015.
2. Kraus and Fleish, "Electromagnetics with Applications", Tata McGraw Hill, Fifth Edition, 2010.
3. Ghosh S. P, Lipika Datta, "Electromagnetic Field Theory", Tata McGraw Hill, First Edition, 2012.

Journals:

1. Journal of Electromagnetic Analysis and Applications
2. PIER (Progress in Electromagnetic Research) journal
3. International Journal of Electromagnetics and Applications

Web Resources:

1. http://scienceblogs.com/dotphysics/2010/03/16/basics-the-electrostatic-inter/
2. http://www.physicsclassroom.com/class/estatics
3 .http://hyperphysics.phy-astr.gsu.edu/hbase/electric/elefie.html
4 .http://www.physicsclassroom.com/class/estatics/Lesson-4/Electric-Field-Lines
5. http://electron9.phys.utk.edu/phys513/Modules/module12/magnetostatics.htm
6. http://www.maxwells-equations.com/

MOOC / NPTEL / SWAYAM Courses:

1. https://onlinecourses.nptel.ac.in/noc21_ee83/preview.
2. Electromagnetic Fields – UDEMY online certification courses

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE201.1	Interpret the basic laws and theorems applicable to Electrostatics and Magneto static fields.
R19EE201.2	Explain the applications of laws and theorems applicable to Electrostatic and Magneto static fields.
R19EE201.3	Apply various laws, theorems and concepts to find the parameters in Electrostatic and Magneto static fields.
R19EE201.4	Solve to find the parameters in Electro dynamic fields and in Electromagnetic waves.
R19EE201.5	Apply the concepts of electromagnetic fields in various practical applications.

R19EE202	Linear Integrated Circuits and Digital Electronics	L	T	P	C
		3	0	0	3

1. Course Description:

The course in Linear Integrated Circuits and Digital Electronics comprises five modules covering the basic concepts and application of Integrated Circuits and digital electronics. In Modul e I students engage in Fabrication of IC, modes of operations of operational Amplifier, applications of operational Amplifier and characteristics of operational amplifier. Module II delves into operation of Special ICs like Timer, Voltage Controlled Oscillator, various voltage regulator and switching regulator. Module III addresses Binary number systems; Binary arithmetic, Binary codes, Boolean algebra, Logical gates, Realization of Boolean functions using Logic gates and study of various digital families. Module IV focuses on Circuits for

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

arithmetic operations, Code conversion; Multiplexers and Demultiplexers, Decoders and encoders, Flip flops, Shift registers, Counters. Module V explores Verilog Programming for logical gates, adders, subtractor, counters, flip flops, Multiplexers & De multiplexers.

2. Course Objectives:

1. To impart knowledge on the basic processes involved in the fabrication of integrated circuits and the characteristics of Op-Amps.
2. To teach the applications of both linear and switching voltage regulation circuits.
3. To discuss the fundamentals of digital logic circuits to design synchronous and asynchronous circuits.
4. To provide knowledge on the design of combinational logic and synchronous sequential circuits.
5. To write Verilog programming for the development of application oriented logic circuits.

3. Syllabus

Unit – I: IC Fabrication and Characteristics of Operational Amplifier

Fundamentals of IC Fabrication; Operational Amplifier: Symbol, Circuit schematic of IC 741,Ideal characteristics, AC and DC Characteristics, Frequency response characteristics and its compensation; Inverting and Non-inverting amplifiers; Differential amplifier; Instrumentation amplifier; Integrator and Differentiator

Unit – II: Special and Application ICs

Functional block:IC 555 Timer, IC-566 voltage-controlled oscillator, IC-565-phase locked loop; Fixed Voltage Regulators: IC LM78XX,IC LM79XX and its application as Linear power supply;Variable Voltage Regulator: LM317, LM723; switching regulator

Unit – III: Boolean Algebra, Logic Gates and Digital Families

Binary number systems: Binary arithmetic, Binary codes; Boolean algebra and theorems; Boolean functions; Simplifications of Boolean functions using Karnaugh map and tabulation methods; Realization of Boolean functions using Logic gates: Resistor Transistor Logic(RTL), Diode Transistor Logic (DTL), Transistor-Transistor Logic (TTL), Emitter Coupled Logic (ECL) and MOS-logic; Comparison of Various Logic Families.

Unit – IV: Combinational and Sequential Logic Circuits

Combinational circuits; Analysis and design procedures; Circuits for arithmetic operations: Code conversion; Multiplexers and Demultiplexers; Decoders and encoders; Flip flops; Shift registers; Counters.

Unit – V Verilog Programming

Introduction to Packages: Subprograms, Test bench(Simulation /Tutorial Examples: logical gates, adders, subtractor, counters, flip flops, Multiplexers & De multiplexers).

Text Books:

1. David J. Comer, "Digital Logic and State Machine Design", Third Indian Edition, Oxford University Press
2. D. Roy Choudhary, Sheil B. Jani, 'Linear Integrated Circuits', II edition, New Age, 2003

References:

Reference Books:

1. David J. Comer, "Digital Logic and State Machine Design", 3rd Indian Edition, Oxford University Press.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

2. Anand Kumar, "Fundamentals of Digital Circuits", 4th Edition, PHI Learning Private Limited, Delhi, 2016.
3. Fiore, "Operational Amplifiers and Linear Integrated Circuits Theory and Applications", Cengage, 2010.
4. Volnei A. Pedroni, "Digital Electronics and Design with VHDL", Elsevier Science, 2008.

Journals:

1. http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)1097-007X
2. IEEE transactions
3. Hindawi publishing corporation
4. IJERT (International Journal of Engineering Research and Technology
5. International Journal of VLSI Design and Embedded Systems (IJVDES)
6. IEEE Transactions on Industrial Electronics and Control Instrumentation

Web Resources:

1. www.southalabama.edu/.../lecture-1-IC%20Fabrication%20Technology-.
2. http://www.siliconfareast.com/epi-deposition.htm
3. http://zebu.uoregon.edu/~rayfrey/431/notes9.pdf
4. http://www.physics.unlv.edu/~bill/PHYS483/op-amps.pdf
5. http://www.electronics-tutorials.ws/opamp/opamp_1.html
6. http://www.555-timer-circuits.com/
7. http://www.technologystudent.com/elec_flsh/timer1a.html
8. http://www.ee.buffalo.edu/courses/elab/LM117.pdf
9. http://www.fairchildsemi.com/ds/LM/LM317.pdf

MOOC / NPTEL / SWAYAM Courses:

1. https://onlinecourses.nptel.ac.in/noc24_ee147/preview
2. https://onlinecourses.nptel.ac.in/noc24_ee140/preview

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE202.1	Illustrate the process of IC fabrication and the various characteristics of Op amp
R19EE202.2	Demonstrate the practical applications of Special and Application IC's
R19EE202.3	Examine the operations of Logic Gates by applying the concepts of Boolean Algebra in the given logical circuits
R19EE202.4	Demonstrate the performance of combinational and sequential logic circuits
R19EE202.5	Select the methodologies of VHDL Programming for practical applications of logic gates

R19CS213	Object Oriented Programming using Java Laboratory	L	T	P	C
		0	0	2	1

1.Course Description:

This laboratory course offers hands-on experience in applying Java concepts and techniques to real-world programming scenarios. Students will engage in practical exercises and projects covering key topics such as Foundations of Java, Object-Oriented Mechanisms, Strings, Collections & Java 8 Features, Exception Handling, Multithreading, JavaFX, and JDBC. Through guided lab sessions, students will develop proficiency in writing Java code, designing object-oriented solutions, implementing error handling strategies, and building graphical user interfaces and database-driven applications using JavaFX and JDBC.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641202.

2.Course Objectives:

1. To understand object-oriented programming concepts and the basics of java programming language
2. To know the principles of packages, inheritance and interfaces
3. To understand strings & collections with java 8 features
4. To develop a Java application with exception handling and threads
5. To build windows-based applications with JDBC

3. List of Laboratory Experiments:

1. Foundations of Java

- Implement class, objects, data types, operators, control statements, wrapper classes and scanner classes using java
- Implement command line arguments with i/o packages using java
- Implement sequential search, binary search and quadratic sorting algorithms using java

2. Object-Oriented Mechanisms

- Implement encapsulation, abstraction, polymorphism and inheritance using java
- Implement interface by accessing super class constructors and methods using java

3. Strings, Collections & Java 8 Features

- Implement string, string functions, string builder, string buffer and regex using java
- Implement lambda expression & for each() method using java
- Implement generics-wildcard expression using java
- Implement stack and queue data structures using java
- Implement list, map, set, date and time using java

4. Exception Handling and Multithreading

- Implement exception handling by creating user-defined exceptions using java
- Implement multithreading and inter-thread communication using java

5. JAVAFX & JDBC

- Develop applications using javafx controls, layouts and menus

6. Project

- Develop an application using jdbc-oops-collections-javafx in eclipse IDE

References:

References Books:

1. Deitel P and Deitel H, "Java: How to Program", 11th Edition, Prentice Hall, 2018.
2. James Gosling, Bill Joy, Guy Steele, Gilad Bracha, Alex Buckley and Daniel Smith, "The Java Language Specification – Java SE", 13th Edition, Oracle America Inc., USA, 2019.
3. Matt Weisfeld, "The Object-Oriented Thought Process", 5th Edition, Addison-Wesley Professional, US, 2019.

Video References:

1. https://www.youtube.com/@abdul_bari/videos
2. https://www.youtube.com/@JennyslecturesCSIT
3. https://caveofprogramming.teachable.com/p/java-multithreading

MOOC/SWAYAM/NPTEL Courses:

1. https://www.udemy.com/course/java-se-programming/
2. https://cse.iitkgp.ac.in/~dsamanta/java/index.htm
3. https://caveofprogramming.teachable.com/p/java-for-complete-beginners

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19CS213.1	Demonstrate the ability to identify, define, and analyze complex problems using appropriate algorithms, data structures, methodologies and
R19CS213.2	Design effective visual representations (UML diagrams/Flowchart) to solve the identified problems
R19CS213.3	Create solutions and implement them using suitable programming platforms
R19CS213.4	Develop effective presentation skills to present and defend the designs and solution
R19CS213.5	Understand issues related to privacy, security and accessibility and adhere to coding standards

R19CS217	Algorithmic Design Techniques Laboratory	L	T	P	C
		0	0	2	1

1. Course Description:

In this practical course students will immerse themselves in the application of foundational algorithmic techniques to real-world problems. Through hands-on exercises, coding assignments and project work, students will gain practical experience in Algorithm Analysis Techniques, including Brute Force, Divide-and-Conquer, Dynamic Programming, Greedy Approach, Backtracking and Branch and Bound. By implementing these algorithms in various programming languages, students will develop a deep understanding of their operation, efficiency and applicability across different problem domains. Through iterative refinement and experimentation, students will hone their algorithmic design skills, learning to optimize solutions for performance and scalability.

2. Course Objectives:

1. To familiarize the students with analysis of algorithmic efficiency, including time and space complexity, to evaluate and compare algorithm performance.
2. To make students to work on efficient solutions to complex problems using brute force and divide-and-conquer techniques
3. To acquaint students with dynamic programming techniques to solve complex optimization problems.
4. To enable students to understand and apply the greedy approach to solve optimization problems.
5. To Equip students with the problem-solving strategies of backtracking and branch and bound problems.

3. List of Experiments:

1. Implementation of string algorithms (CO1)
2. Demonstration of applications of string algorithms (Naïve algorithm, Rabin Karp Algorithm, KMP Algorithm and Manachers algorithm) (CO1)
3. Implementation of brute force and divide-and-conquer techniques(CO1)
4. Demonstration of applications of brute force and divide and conquer techniques (Boyer Moore algorithm, Travelling salesman problem, Knapsack problem, Assignment problem, Jump game, Maximum subarray, Merge Intervals, Tiling problem, Karatsuba algorithm) (CO2)
5. Implementation of dynamic programming(CO3)
6. Demonstration of applications of dynamic programming (Warshall's algorithm, Floyd's algorithm, Knapsack Problem, Longest Common Subsequence, Levenshtein distance (Edit distance) problem, Longest palindrome, Longest common substring, Longest happy string, Palindrome partitioning,

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Minimum coin change, Equal subset sum partition, Wildcard matching, longest repeated subsequence) (CO4)

7. Implementation of Greedy approach (CO4)
8. Demonstration of applications of Greedy approach (Activity Selection Problem, Graph Colouring Problem, Huffman coding compression algorithm, shortest superstring problem, Flip the world, Dials algorithm, Minimum spanning tree, Sieve of sundaram, Remove invalid parenthesis, Maximum ribbon cut) (CO4)
9. Implementation of backtracking and branch & bound(C05)
10. Demonstration of applications of backtracking and branch & bound (Queen problem, Hamiltonian circuit problem, Knight's tour problem, Subset sum problem, Sudoku Solver, Letter combinations of a phone number, Combinatorial optimization problems, Zigzag conversion, Valid Sudoku, People holding hands, Reverse pairs) (CO3, CO4, CO5)

Mini project: Create a simple gaming application.

Text Books:

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms‖, Third Edition, Pearson Education, 2012James
2. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, —Introduction to Algorithms, Third Edition, PHI Learning Private Limited, 2012

References:

Reference Book:

1. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, Computer Algorithms/ C++, Second Edition, Universities Press, 2008

Web Resources:

1. https://www.javatpoint.com/daa-tutorial
2. https://www.geeksforgeeks.org/design-and-analysis-of-algorithms/
3. https://www.udemy.com/course/design-and-analysis-of-algorithm

MOOC/NPTEL /SWAYAM Course:

1. https://onlinecourses.nptel.ac.in/noc24_cs23/preview

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19CS217.1	Demonstrate the ability to identify, define, and analyze complex problems using appropriate algorithms, data structures, methodologies and tools
R19CS217.2	Design effective visual representations (UML diagrams/Flowchart) to solve the identified problems
R19CS217.3	Develop and analyze algorithms and implement them using suitable programming platforms
R19CS217.4	Develop effective presentation skills to present and defend the designs and solutions
R19CS217.5	Understand issues related to privacy, security and accessibility and adhere to coding standards

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE211	Linear Integrated Circuits and Digital Electronics Laboratory	L	T	P	C
		0	0	2	1

1. Course Description:

The course encompasses a comprehensive set of practical modules aimed at providing hands-on experience in computer science, mechanical engineering, electrical engineering, and electronics. In this course, students engage in design and Implementation of Inverting and Non-Inverting Amplifier, design and Implementation of various applications on operational amplifier, design and Implementation of various voltage regulators, Realization of various arithmetic operators, Realization of various Code Converters, design and Implementation of Multiplexers and De-Multiplexers, Design and Implementation of Encoders and Decoders, design and Implementation of Counters using Flip-Flops and Simulation of digital circuits using Verilog programming.

2. Course Objectives:

1. To impart skills required to use operational amplifier and digital integrated circuits.
2. To provide exposure to the students with Special ICs and its operation.
3. To demonstrate the applications of operational amplifiers.
4. To expose the students to understand Verilog programming for basic logic ciruits.
5. To design and develop projects using linear IC's/ Digital Circuits.

3. List of Experiments:

1. Design and Implementation of Inverting and Non-Inverting Amplifier
2. Design and Implementation of Adder, Subtractor, Comparator, Integrator and Differentiator circuit using Op-amp
3. Design and Implementation of Positive and Negative Voltage Regulator
4. Realization of Boolean Expression and Design of Adder and Subtractors
5. Realization of Code Converters
6. Design and Implementation of Multiplexers and De-Multiplexers
7. Design of Encoders and Decoders
8. Design and Implementation of Counters using Flip-Flops
9. Simulation of digital circuits using Verilog programming
10. Design and Development of project using linear IC's/ Digital Circuits

Text Books:

1. M. Morris Mano, "Digital Logic and Computer Design", 4th Edition, Pearson India Education Services Pvt. Ltd., 2016.
2. D. Roy Choudhary, Shail B. Jain, "Linear Integrated Circuits", 6th Edition, New Age International Publishers, 2021.

References:

Reference Books:

1. David J. Comer, "Digital Logic and State Machine Design", 3rd Indian Edition, Oxford University Press.
2. Anand Kumar, "Fundamentals of Digital Circuits", 4th Edition, PHI Learning Private Limited, Delhi, 2016.
3. Fiore, "Operational Amplifiers and Linear Integrated Circuits Theory and Applications", Cengage, 2010.
4. Volnei A. Pedroni, "Digital Electronics and Design with VHDL", Elsevier Science, 2008.

Web Resources:

1. www.southalabama.edu/.../lecture-1-IC%20Fabrication%20Technology-.
2. http://www.siliconfareast.com/epi-deposition.htm
3. http://zebu.uoregon.edu/~rayfrey/431/notes9.pdf
4. http://www.physics.unlv.edu/~bill/PHYS483/op-amps.pdf

MOOC / NPTEL / SWAYAM Courses:

1. https://onlinecourses.nptel.ac.in/noc24_ee147/preview
2. https://onlinecourses.nptel.ac.in/noc24_ee140/preview

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE211.1	Examine the performance and operation of Logical gates, Adder and Subtractor circuits
R19EE211.2	Determine the principle of operation of code converters, Parity generator, Parity Checking and Combinational Circuits.
R19EE211.3	Examine the operations of Logic Gates by applying the concepts of Boolean Algebra in the given logical circuits
R19EE211.4	Demonstrate the performance of combinational and sequential logic circuits
R19EE211.5	Select the methodologies of Verilog Programming for practical applications of logic gates

R19EM201	Logical Thinking	L	T	P	C
		0	0	2	1

1. Course Description:

This course aims to help students build strong skills in logical thinking, reasoning and problem-solving. They will learn to analyze and evaluate arguments, spot logical fallacies and create clear and convincing arguments. Through lectures and practical exercises, students will develop the critical thinking needed to tackle engineering problems methodically and precisely. They will also understand the importance of logical thinking in designing and implementing engineering solutions, making them more effective engineers.

2. Course Objectives:

1. Apply logical algorithms to tackle complex problem-solving scenarios.
2. Develop analytical skills for optimizing costs in logical operations.
3. Master time and resource management through logical approaches.
4. Strengthen quantitative reasoning for data-driven decision-making.
5. Enhance logical and visual reasoning to solve intricate problems effectively.

3. Syllabus

Unit – I: Fundamental Skills for Problem Solving

Application of Problem Solving in real life, Different algorithms in problem solving: Brute force approach, Pattern finding method and Deep Learning Approach. Numbers System: Primes and factors, factors and factorials, divisibility rule, unit digit calculation and power cycle method, remainder concepts, HCF and LCM.

Unit – II: Critical Analysis of Cost Management

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Fundamentals of Finance: Percentages, Fluctuations in percentage, Profit and Loss, Pricing Logics, Retail Pricing Strategy; Interest calculation: Cash Flow and Taxes; Simple and Compound interest calculation, Puzzle related to interest changes and Case Studies.
Unit – III: Time and Work Management
Fundamentals of Human Resources and Operations: Resources allocation, Time and Work, Puzzle involving backtracking, All possible routes, Pipes and Cisterns.
Unit – IV: Quantitative Reasoning and Data Interpretation
Fundamentals of statistics: Mean, Median and Mode, Real life application of statistics, Application of Ratios and Proportions in business problems, Partnerships; Geometry: 2D, 3D Visualizations.
Unit – V: Logical and Visual Reasoning
Paradigm shift and its application: Syllogism, Cube 3D visualization problems, Blood Relation, Coding decoding: Basics and Advanced. Visual reasoning: Patterns, Paper folding, Case Studies and Puzzles.
References:
Reference Books: 1. Dr. R S Aggarwal, "Quantitative Aptitude", Revised Edition, S. Chand Publishing Company Ltd(s), 2022. 2. Arun Sharma, "How to prepare for Quantitative Aptitude for the CAT", 10th Edition, Tata McGraw-Hill Publishing Company Ltd, 2022. **Online References:** 1. https://www.hackerearth.com/ 2. https://www.geeksforgeeks.org/ 3. https://www.indiabix.com

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EM201.1	Understand the imrtance and impact created by aptitude concepts in real life.
R19EM201.2	Understand a lot of learning methods and will be able to apply them in real life problems.
R19EM201.3	Able to apply and solve problems based on application of aptitude concepts in real life
R19EM201.4	Analyze, evaluate, and compare different scenarios given in a problem and find the strategically best solutions.
R19EM201.5	Creating own questions based on parameters and constraints given.
R19EM201.6	Create shortcut formulas by self.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu. Coimbatore - 641 202.

R19MC102	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	L	T	P	J	C
		1	0	0	0	1

1. Course Description: / பாடநெறி விளக்கம்:

The intersection of Tamils and technology refers to the field of agricultural technology, focusing on the use of modern tools and techniques to enhance farming practices and increase agricultural productivity.

சங்க காலத்தில் நெசவு, மட்பாண்டங்கள், வடிவமைப்பு மற்றும் கட்டுமானத்தில் பயன்படுத்தப்பட்ட தொழில்நுட்பங்களைப் பற்றி இந்த பாடநெறி மாணவர்களுக்கு கற்பிக்கிறது. உற்பத்தி, நீர்ப்பாசனம், விவசாயம் போன்ற தொழில்நுட்பங்களின் முக்கியத்துவத்தை மாணவர்கள் புரிந்து கொள்ள வேண்டும். பழங்கால நீர்ப்பாசனம் மற்றும் விவசாய முறைகளைப் படிப்பதன் மூலம் மாணவர்கள் புதிய உபகரணங்களை மேம்படுத்தலாம் நவீன தொழில்நுட்பத்தை அங்கீகரிக்கும் வகையில் தமிழ் கணினி மற்றும் அறிவியல் தமிழர்களின் பரிணாம வளர்ச்சியை மாணவர்கள் புரிந்து கொள்ள வேண்டும். அறிவியல் தமிழ் அறிவின் விரிவாக்கம், தமிழ் கணினி பயன்பாடுகள், தமிழ் புத்தகங்களை டிஜிட்டல் மயமாக்குதல் போன்றவற்றின் மூலம் மாணவர்கள் பெரிதும் பயனடையலாம்.

2. Course Objectives / பாடத்தின் நோக்கங்கள் :

1. To facilitate the students to understand weaving and ceramic technology of sangam age.
   நெசவு மற்றும் மட்பாண்டம் செய்யும் முறைகள் பற்றிய தெளிவான புரிதல்.
2. Observe the design of houses, sculptures and construction of temples.
   சங்ககால கோயில்கள் வடிவமைப்பு மற்றும் கட்டமைப்பின் பல்வேறு பரிமாணங்களைப் பற்றி அறிந்து கொள்வது.
3. Understanding the various manufacturing technology in ship, iron and stone types in Silappathikaram.
   சிலப்பதிகாரத்தில் கப்பல், இரும்பு மற்றும் கல் வகைகளில் பல்வேறு உற்பத்தித் தொழில்நுட்பத்தைப் புரிந்துகொள்வது.
4. Understand the significance of agriculture and irrigation technology in ancient period.
   அணை கட்டுமான வழிமுறைகள், விவசாயம் மற்றும் கடலில் இயந்திரங்களின் பயன்பாடு பற்றி அறிந்து கொள்வது.
5. Explain the growth of scientific Tamil, Tamil computing and digitization of Tamil books.
   அறிவியல் தமிழின் வளர்ச்சி, தமிழ்க் கணினி, தமிழ் நூல்களின் டிஜிட்டல் மயமாக்கல் ஆகியவற்றை அறிந்து கொள்வது.

3. Syllabus / பாடத்திட்டங்கள்: **15 Periods**

அலகு – I: நெசவு மற்றும் பானைத் தொழில்நுட்பம் **(3)**

Unit – I: Weaving and Ceramic Technology

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries

சங்க காலத்தில் நெசவுத் தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள்.

அலகு – II: வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம் **(3)**

Unit – II: Design and Construction Technology

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Designing and Structural construction House & Designs in household materials during the Sangam Age – Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram – Sculptures and Temples of Mamallapuram – Great Temples of Cholas and other worship places – Temples of Nayaka Period – Type study (Madurai Meenakshi Temple) - Thirumalai Nayakar Mahal – Chetti Nadu Houses, Indo – Saracenic architecture at Madras during British Period.

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள், சங்க காலத்தில் வீட்டுப்பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும் கோவில்களும் - சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் - நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டிநாட்டு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ - சாரோசெனிக் கட்டிடக் கலை.

அலகு – III: உற்பத்தி தொழில்நுட்பம் **(3)**

Unit – III: Manufacturing Technology

Art of Ship Building – Metallurgical studies – Iron industry – Iron smelting, steel – Copper and gold Coins as source of history – Minting of Coins – Beads making-industries Stone beads –Glass beads – Terracotta beads – Shell beads – Archeological evidences – Gem stone types described in Silappathikaram.

கப்பல் கட்டும் கலை – உலோகவியல் – இரும்புத்தொழிற்சாலை - இரும்பு உருக்குதல், எஃகு - வரலரற்று சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணிகள் உருவாக்கும் தொழிற்சாலைகள் - கல் மணிகள், கண்ணாடி மணிகள், சுடுமண் மணிகள், சங்கு மணிகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகார மணிகளின் வகைகள்.

அலகு – IV: வேளாண்மை மற்றும் நீர் பாசன தொழில்நுட்பம் **(3)**

Unit – IV: Agriculture and Irrigation Technology

Dam, Tank, ponds, Sluice - Significance of Kumizhi Thoombu of Chola Period - Animal Husbandry – Wells designed for cattle use – Agriculture and Agro Processing – Knowledge of Sea – Fisheries – Pearl – Conche diving – Ancient Knowledge of Ocean – Knowledge Specific Society.

அணை, ஏரி, குளங்கள், மதகு - சோழர் கால குமிழித்தும்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மை சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு – மீன்வளம், முத்து மற்றும் முத்து குளித்தல் பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்.

அலகு – V: அறிவியல் தமிழ் மற்றும் கணித்தமிழ் **(3)**

Unit – V: Scientific Tamil and Tamil Computing

Development of Scientific Tamil – Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

அறிவியல் தமிழின் வளர்ச்சி - கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின் பாதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணைய கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத்திட்டம்.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202.

Text Books:	
1.	தமிழக வரலாறு - மக்களும் பயன்பாடுகளும் - கே கே பிள்ளை (தமிழக பாட நூல் கழகம் மற்றும் கல்வியல் பணிகள் கழகம்).
2.	கணினித் தமிழ் - முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்).
3.	கீழடி - வைகை நதிக்கரையில் சங்க கால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு).
4.	பொருநை - ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு).
5.	Social Life of Tamils - Dr. K. K. Pillay, A joint publication of TNTB & ESC and RMRL.
6.	Social Life of the Tamils - The Classical Period - Dr. S. Singaravelu (Published by: International Institute of Tamil Studies.
7.	Historical Heritage of the Tamils - Dr. S. V. Subatamanian, Dr. K. D. Thirunavukkarasu (Published by: International Institute of Tamil Studies).
8.	The Contributions of the Tamils to Indian Culture - Dr. M. Valarmathi (Published by: International Institute of Tamil Studies).
9.	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation Tamil Nadu).
10.	Studies in the History of India with Special Reference to Tamil Nadu - Dr. K. K. Pillay.
References:	
1.	Journey of Civilization Indus to Vaigai - R. Balakrishnan, Published by RMRL.
2.	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu).

4. Course Outcomes: / பாடநெறி முடிவுகள்

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19MC102.1	Describe about the weaving industry in sangam age and ceramic technology. சங்க காலத்தில் நெசவுத் தொழில் மற்றும் பீங்கான் தொழில்நுட்பம் பற்றி விரிவாக அறிந்து கொள்ளுதல்.
R19MC102.2	Observe the design of houses, sculptures and construction of temples. வீடுகளின் வடிவமைப்பு, சிற்பங்கள் மற்றும் கோவில்களின் கட்டுமானத்தைப் பற்றி தெரிந்து கொள்ளுதல்.
R19MC102.3	Relate the various manufacturing materials and stone types in Silappathikaram. சிலப்பதிகாரத்தில் உள்ள பல்வேறு உற்பத்திப் பொருட்கள் மற்றும் கல் வகைகளைப் பற்றி புரிந்து கொள்ளுதல்.
R19MC102.4	Understand the significance of agriculture and irrigation technology in ancient period. பண்டைய காலத்தில் விவசாயம் மற்றும் நீர்ப்பாசன தொழில்நுட்பத்தின் முக்கியத்துவத்தை புரிந்து கொள்ளுதல்.
R19MC102.5	Explain the growth of scientific Tamil, Tamil computing and the digitization of Tamil books. அறிவியல் தமிழின் வளர்ச்சி, தமிழ்க் கணினி, தமிழ் நூல்களின் டிஜிட்டல் மயமாக்கல் ஆகியவற்றை விரிவாக தெரிந்து கொள்ளுதல்.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

SEMESTER IV

R19MA205	Statistics and Numerical Methods	L	T	P	C
		3	1	0	4

1. Course Description:

This course offers a comprehensive exploration of both statistical methods and numerical techniques, providing students with a versatile skill set applicable to a wide range of scientific, engineering, and business disciplines. The course aims to develop a balanced understanding of statistical analysis and numerical problem solving, emphasizing their synergistic application in tackling real-world challenges.

2. Course Objectives:

1. Acquaint the knowledge of testing the level of hypothesis for small and large samples.
2. Train them to approximate the value of a population parameter on the basis of sample statistics.
3. Impart the basic concepts in solving algebraic and transcendental equations.
4. Introduce the numerical techniques for differentiation, integration and interpolate the data.
5. Familiarize the students in numerical techniques for solving initial value problems.

3. Syllabus

Unit – I: Testing of Hypothesis

Sampling distributions: Mean test for large samples, Small sample test: t-test, F-test, Chi-square test: Goodness of fit, Independence of attributes.

Unit – II: Design of Experiments

Analysis of variance: Completely randomized design, Randomized block design, Latin square design.

Unit – III: Solution of Equations and Eigen Value Problems

Solution of algebraic and transcendental equations: Newton Raphson method; Solution of system of linear equations: Gauss- Jordan method, Gauss-Seidel method; Eigen values of a matrix by power method.

Unit – IV: Interpolation, Numerical Differentiation And Integration

Interpolation: Lagrange's interpolation, Newton's divided difference interpolation, Newton's forward interpolation formula, Newton's backward interpolation formula; Numerical differentiation: Newton's forward and backward interpolation formulae; Numerical integration for a single variable: Trapezoidal rule, Simpson's one third rule.

Unit – V: Initial Value Problems for Ordinary Differential Equations

Single step methods: Taylor series method, Euler's method, Modified Euler's method, Fourth order Runge-Kutta method; Multistep method: Milne's predictor and corrector method.

Text Books:

1. Burden R. L and Douglas Faires J, "Numerical Analysis Theory and Applications", Cengage Learning, 9th Edition, 2016.
2. Richard A. Johnson, Miller & Freund's, "Probability and Statistics for Engineers", Prentice Hall, 9th Edition, New Delhi, 2016.

References:

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Reference Books:

1. Chapra, S. C and Canale, R. P. "Numerical Methods for Engineers", 7th Edition, Tata McGraw-Hill, New Delhi, 2016.
2. Gerald C. F and Wheatley P.O, "Applied Numerical Analysis", 7th Edition, Pearson Education, New Delhi, 2015.
3. Walpole R.E, Myers R.H, Myers R.S.L and Ye K, "Probability and Statistics for Engineers and Scientists", 9th Edition, Pearson's Education, Delhi, 2017.

Journal References:

1. Mathematical Modelling and Numerical Analysis: https://www.scimagojr.com/journalsearch.php?q=25956&tip=sid&clean=0
2. International Journal for Numerical Methods in Engineering: https://www.scimagojr.com/journalsearch.php?q=12336&tip=sid&clean=0
3. International journal of experimental design and process optimisation: https://www.inderscience.com/jhome.php?jcode=ijedpo

Web Resources:

1. https://www.youtube.com/watch?v=14PQawp_rjk
2. https://www.youtube.com/watch?v=sIRI1xWrViY
3. https://www.youtube.com/watch?v=NoVlRAq0Uxs
4. https://www.youtube.com/watch?v=gwQeQWTyp54
5. https://www.youtube.com/watch?v=Bg0m1f-McJM

MOOC/NPTEL/SWAYAM Courses:

1. nptel.ac.in/courses/111105041/
2. nptel.ac.in/courses/122106033/
3. freevideolectures.com › Computer Science › IIT Madras

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19MA205.1	Apply the concept of testing of hypothesis for small and large samples in real life problems.
R19MA205.2	Analyze the variance for the statistical data to acquire a suitable solution.
R19MA205.3	Apply the numerical techniques to obtain approximate solutions for algebraic, transcendental and system of linear equations.
R19MA205.4	Apply the numerical techniques of interpolation in various intervals and the numerical techniques of differentiation and integration for engineering problems.
R19MA205.5	Execute the numerical techniques for solving initial value problems.

R19EE203	Electrical Machines – I	L	T	P	C
		2	1	0	3

1. Course Description:

This course will introduce the basic concepts and operation of rotating electric machines such as DC generator, DC Motor, single phase and three phase Transformers classification, performance characteristics and its applications.

2. Course Objectives:

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

1. Understand the fundamental principles governing the operation of electrical machines, including transformers, DC machines.
2. Analyze the operation, construction, and performance of DC machines, including generators and motors.
3. Understand methods for starting and controlling the speed of DC machines.
4. Comprehend the working principles of transformers, including their construction, equivalent circuit modeling, and performance characteristics.
5. Acquire knowledge of diagnostic techniques used for assessing the condition and performance of DC machines and transformers.

3. Syllabus

Unit – I: Principles of Energy Conversion

Basic magnetic circuit analysis; Faraday's law; Iron loss; Principles of electro mechanical energy conversion; Magnetic field system: Energy – Co-energy; Basic concepts of rotating machines; Dynamic Equation of Electromechanical Systems; Statically and Dynamically Induced EMF.

Unit – II: DC Generators

Construction; principle of operation; EMF equation; Types;magnetization characteristics; process of voltage buildup; critical resistance; critical speed; load characteristics; armature reaction; commutation; Parallel operation; Applications.

Unit – III: DC Motors

Principle of operation; Types; Back EMF; Torque equations; Types of DC Motors; Characteristics; Starting of DC motors; various types of starter; Speed control of DC motors: field control, armature control,Braking: Types; Applications; Case Study: Selection of motor for a given application.

Unit – IV: Transformers

Construction; Principle of Operation; EMF Equation; Transformer on No Load and Load; Phasor Diagram; Equivalent Circuit; Voltage Regulation; Losses; Efficiency: All Day Efficiency; Principle of Operation of auto transformer; Saving of Copper; Three phase transformer connections; Applications.

Unit – V: Testing of DC Machines and Transformers

Losses and efficiency; Testing of DC machines: Brake test, Swinburne's test, Hopkinson's test; Testing of single phase transformer: Open circuit and short circuit test, Sumpner's test; Parallel operation.

Text Books:

1. Kothari D. P and Nagrath I. J, "Electric Machines", Tata McGraw Hill, Fourth Edition, 2014.
2. Gupta J. B, "Theory and Performance of Electrical Machines", S. K. Kataria and Sons, 14th Edition, 2010.

References:

Reference Books:

1. Stephen J. Chapman, "Electric Machinery Fundamentals", Tata McGraw Hill, Fourth Edition, 2010.
2. Bimbhra P. S, "Electrical Machinery", Khanna Publishers, 2011.
3. Fitzgerald A.E, Kingsely C, Umans S. D, "Electric Machinery", Tata McGraw Hill, Sixth Edition, 2003.
4. Rajput R. K, "Electrical Machines", Laxmi Publications (P) Ltd, 2003.

MOOC / NPTEL / SWAYAM Courses:

1. https://nptel.ac.in/courses/108105017
2. https://www.udemy.com/course/electric-machines-complete-guide-on-dc-machines/

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE203.1	Apply the concept of Magnetic Circuit and Electromagnetic Energy Conversion principles in electrical machines to solve magnetic circuit problems.
R19EE203.2	Demonstrate the principle of operation and performance of DC Generators.
R19EE203.3	Illustrate the principle of operation, speed control and braking techniques of DC motors.
R19EE203.4	Investigate the constructional details, performance and three phase connections of Transformers.
R19EE203.5	Examine various testing methods applicable to predict the performance of DC machines and transformers.

R19EE204	Control Systems	L	T	P	C
		3	1	0	4

1. Course Description:

This course shall introduce the fundamentals of modeling and control of linear time invariant systems; primarily from the classical viewpoint of Laplace transforms and a brief emphasis on the state space formulation as well. The course will be useful for students from major streams of engineering to build foundations of time/frequency analysis of systems as well as the feedback control of such systems.

2. Course Objectives:

1. To understand the use of transfer function models for analysis physical systems and introduce the control system components
2. To provide adequate knowledge in the time response of systems and steady state error analysis
3. To accord basic knowledge in obtaining the open loop and closed–loop frequency responses of systems
4. To introduce stability analysis and design of compensators
5. To introduce state variable representation of physical systems

3. Syllabus

Unit – I: Systems Representation

Basic Concept of Control Systems and its components; Transfer function of physical systems: Mechanical systems; Translational and Rotational systems; Electrical network; Transfer function of AC and DC servomotors; Block diagram reduction techniques; Signal flow graphs; Mason's gain formula.

Unit – II: Time Domain Analysis

Various standard test signals and its importance; Time domain specifications; Generalized error series: Steady state error; P, PI, PID modes of feedback control; Tuning and its applications; Definitions; Root locus diagram; Rules to construct root loci.

Unit – III: Frequency Domain Analysis

Introduction; Frequency domain specifications: Bode plot, Polar plot; Correlation between frequency domain and time domain specifications.

Unit – IV: Stability and Compensator Design
Concepts of stability; Compensator: Effect of Lag, lead, lag-lead compensation on frequency response; Compensator Design: Design of Lag, lead, lag- lead compensator using bode plots; Routh-Hurwitz stability criterion; Nyquist criterion.
Unit – V: State Variable Analysis
Concept of state variables; Solution of state and output equation in controllable canonical form; Concepts of controllability and observability.
Text Books:
1. Benjamin C. Kuo, "Automatic Control Systems", Wiley, 2014. 2. Nagarath, I.J. and Gopal, M., "Control Systems Engineering", New Age International Publishers, 2017.
References:
Reference Books: 1. Katsuhiko Ogata, "Modern Control Engineering", Pearson, 2015. 2. Richard C. Dorf and Robert H. Bishop. "Modern Control Systems", Pearson Prentice Hall, 12th Edition, 2010. 3. John J.D., Azzo Constantine, H. and Houpis Stuart, N Sheldon, "Linear Control System Analysis and Design with MATLAB", CRC Taylor and Francis, 2009. 5. Nagoor Kani, "Control Systems Engineering", RBA Publications, 2018. **Journal References:** 1. IEEE Control Systems Magazine 2. IEEE Transactions on Control Systems Technology 3. IET Control Theory and Applications 4. Control Engineering Practice **Web Resources:** 1. http://www.readorrefer.in/article/Tutorial-Problems--Control-Systems---Systems-and-their-Representation_12839/ 2. http://lancet.mit.edu/time response.html 3. http://www.engineeringtoolbox.com/Bode Plot.html 4. http://www.engineeringtoolbox.com/Polar Plot.html **MOOC / NPTEL/ SWAYAM Courses:** 1. Control Engineering - https://onlinecourses.nptel.ac.in/noc23_ee143/announcements?force=true 2. Control Systems - https://swayam.gov.in/explorer

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE204.1	Solve the given physical system using system representation
R19EE204.2	Apply time domain analysis to determine the parameters and characteristics of controllers
R19EE204.3	Predict the performance of physical system under frequency domain and verify its stability
R19EE204.4	Design suitable compensator and determine its stability of the system
R19EE204.5	Analyse various representations of system models using engineering fundamentals

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE205	Measurements and Instrumentation	L	T	P	C
		3	0	0	3

1. Course Description:

This course provides a comprehensive understanding of measurement techniques and instrumentation principles essential for electrical engineering graduates. Emphasis is placed on the theory, design, and application of measurement systems for electrical quantities.

2. Course Objectives:

1. To impart knowledge on the characteristics and standards of measurements.
2. To discuss the construction and operation of various measuring instruments.
3. To equip the students with the knowledge on using various bridge circuits for measuring unknown electrical quantities.
4. To introduce different types of transducers for the measurement of various physical and electrical quantities.
5. To explore the conversion between digital and analog values and data acquisition systems.

3. Syllabus

Unit – I: Concepts of Measurements

Instruments: classification, applications; Elements of a generalized measurement system; Static and dynamic characteristics; Errors in measurement; Statistical evaluation of measurement data.

Unit – II: Measurements of Electrical Quantities

Classification of instruments: moving coil, moving iron, Induction type, dynamometer type; Analog Meters: Voltmeter, Ammeter, Energy meter, Watt meter, Power factor meter, Megger; Digital Meters: Voltmeter, Ammeter; Instrument transformers (CT & PT).

Unit – III: Comparative Methods of Measurements

D.C Bridges: Wheat stone, Kelvin and Kelvin Double bridge; A.C bridges: Maxwell, Hay, Wein, Anderson, Schering bridge; Instrumentation Amplifier.

Unit – IV: Transducers For Measurement of Non – Electrical Parameters

Classification of transducers: Measurement of pressure, temperature, displacement, flow, angular velocity; Digital transducers; Smart Sensors.

Unit – V Digital Instrumentation

A/D converters: Flash type, Dual Slope type, Successive Approximation Type; D/A converters: Binary weighted resistance type, R-2R Ladder type; Digital Storage Oscilloscope; Data acquisition systems; Data Loggers.

Text Books:

1. Sawhney A. K., "A Course in Electrical & Electronic Measurements & Instrumentation", Dhanpat Rai and Co, 2010.
2. Kalsi H. S., "Electronic Instrumentation", Tata McGraw Hill, Third Edition, 2010.

References:

Reference Books:

1. Ernest O. Doeblin, "Measurement Systems: Applications and Design", Tata McGraw Hill, 2001.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

2. Cooper A. D. and Helfrik A. D., "Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, 2001.
3. Alan. S. Morris, "Principles of Measurements and Instrumentation", Prentice Hall of India, Second Edition, 2003.
4. D.V.S. Murthy, "Transducers and Instrumentation", Prentice Hall of India, 2015.
5. Rangan C S, Sharma G R, Mani V S, "Instrumentation Devices and Systems", Tata McGraw Hill, 2004.

Web Resources:

1. www.indiastudychannel.com/resources/139106-Functional-Elements-an-Instrument.aspx
2. https://www.youtube.com/watch?v=xLjk5DrScEU
3. https://www.youtube.com/watch?v=STyKs3bYM0Q

MOOC / NPTEL / SWAYAM Course:

1. https://onlinecourses.nptel.ac.in/noc19_ee44/preview

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE205.1	Perform statistical evaluations of measurement data and explain the characteristics of measurements to ensure accurate and reliable results.
R19EE205.2	Classify various types of measuring instruments and explain their construction and principle of operation.
R19EE205.3	Derive the balanced condition of various bridge circuits to calculate unknown resistance, inductance and capacitance.
R19EE205.4	Classify the different kinds of transducers to measure non-electrical quantities such as pressure, temperature, displacement and strain using various transducers.
R19EE205.5	Build circuits to enable conversion between analog and digital values and explain the storage of such data.

R19EE251	Microprocessors and Microcontrollers	L	T	P	C
		3	0	2	4

1. Course Description:

The goal of this course is to introduce students to the basics of microprocessors and microcontrollers. Students will be able to apply these concepts to their electronic designs in other courses where they will be able to gain control through the implementation of microprocessors/controllers. This course provides a solid basis for microprocessing and applications by connecting the external devices directly to the processor based on the user needs, allowing for the development of new products and solutions to real time issues. Enrich students with Microprocessor knowledge to provide them with the tools needed to analyze electronic equipment in Microprocessor & Embedded systems for industrial, research and commercial field applications.

2. Course Objectives:

1. To impart knowledge on small microprocessor systems with a focus on hardware and software design for embedded systems.
2. To introduce 8051 microcontroller, its architecture and features.
3. To educate on the programming of 8051 microcontroller and its interrupts.
4. To equip the students with the knowledge on interfacing I/O devices with 8051.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

5. To provide a solid foundation for designing real-world applications using microprocessors and microcontrollers.
3. Syllabus
Unit – I: 8085 and 8086 Microprocessors
Introduction to 8085: Architecture, Features, Timing Diagram, Addressing Modes, Instruction Formats, Instruction Set, Assembler Directives, I/O & Memory Interfacing; Introduction to 8086 Architecture: Features, Addressing Modes, Instruction Set; Interrupts; Minimum Mode & Maximum Mode Operation.
Unit – II: 8051 Microcontroller
Introduction to 8051: Hardware features, Architecture, Internal RAM structure, Special Function Registers, Memory Organization, I/O Ports and Circuits, Addressing Modes; Instruction Set, Timers, Interrupts, Serial Communication.
Unit – III: 8051 Programming
Assembly Language Programming and Embedded C Programming: Programming Timer Interrupts, Programming External Hardware Interrupts, Programming the Serial Communication Interrupts, Programming 8051 Timers and Counters.
Unit – IV: I/O Interfacing
I/O and Memory Interface to 8051: LED, LCD, Keyboard, External Memory, ADC & DAC Sensors; Communication Interfaces: RS232, USART.
Unit – V: Microcontroller Applications and Advanced Processor
Temperature Control System; Motor Speed Control System; Traffic light System; Elevator System; Data Acquisitions System; Introduction to Architecture of PIC Microcontroller.
List of Experiments:
1. To write an assembly language program to perform arithmetic and logical operations using 8085 microprocessor. (CO1) 2. To write an assembly language programming with control instructions for the following functions (i) Ascending / Descending order, Maximum / Minimum of numbers (ii) Programs using Rotate instructions (iii) Code conversions. 3. To write an assembly language program to demonstrate the basic instructions with 8051 Micro controller execution, including Conditional jumps, looping and Calling subroutines. (CO1) 4. Experiment for programming practices with simulators/emulators/open source. (CO1) 5. To program 8051 microcontroller and verifying Timer, Interrupts operations. (CO2) 6. To program 8051 microcontroller and verifying UART operations for communication. (CO3) 7. To interface 8051microcontroller with the Keypad and LCD module. (CO4) 8. To programming I/O Port 8051 and study on interface with A/D or D/A sensors. (CO4) 9. To interface and control the Stepper Motor or DC Motor. (CO4) 10. To submit a mini project on microcontroller-based applications. (CO5)
Text Books:

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

1. S. K. Mandal, "Microprocessors and Microcontrollers: Architecture, Programming & Interfacing using 8085, 8086, and 8051", Tata McGraw Hill, First Edition, 2011.
2. Muhammad Ali Mazidi, Janice GillispieMazidi and Rolin D McKinlay, "The 8051 Microcontroller and Embedded Systems using Assembly and C", Pearson Education Asia, Second Edition, 2007.

References:

Reference Books:

1. Ramesh S Gaonkar, "Microprocessor Architecture, Programming and application with 8085", Penram International Publishing, New Delhi, Sixth Edition, 2011.
2. A.K Ray and K.M. Burchandi, "Advanced Microprocessor and peripherals Architectures, Programming and interfacing", Tata McGraw Hill, Third Edition, 2012.
3. Kenneth J Ayala, "The 8051 Microcontroller Architecture Programming and Application", Penram International Publishing, New Delhi, Second Edition, 1996.

Web Resources:

1. https://itp.nyu.edu/physcomp/lessons/microcontrollers-the-basics/
2. https://nptel.ac.in/courses/117104072

MOOC / NPTEL / SWAYAM Courses:

1. https://www.coursera.org/learn/microcontroller-and-industrial-applications
2. https://archive.nptel.ac.in/courses/108/105/108105102/

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE251.1	Identify the functionalities of 8085 and 8086 architectures and experiment with the assembly language programming.
R19EE251.2	Develop advanced programs and utilize timer, counter, communication, and interrupts for the 8051 microcontroller applications.
R19EE251.3	Inspect the architecture, memory and acquire the knowledge about different peripheral interfacing devices, their working and interfacing them with microcontrollers.
R19EE251.4	Design and Interface microcontrollers with other devices & peripherals for real time application.
R19EE251.5	Develop solutions for real time applications using advanced processor.

R19EE212	Electrical Machines Laboratory – I	L	T	P	C
		0	0	3	1.5

1. Course Description:

The Electrical Machines Laboratory course is designed to provide students with practical hands-on experience in working with various electrical machines commonly used in power systems and industrial applications. This laboratory complements theoretical knowledge gained in the Electrical Machines Theory course by offering students the opportunity to apply concepts learned in class to real-world scenarios.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Through a series of experiments and projects, students will gain proficiency in operating, analyzing, and troubleshooting electrical machines.

2. Course Objectives:

1. To impart skills to operate different types of D.C. machines and transformers safely.
2. To provide hands on experience to conduct experiments on DC machines and transformers and to observe data.
3. To educate on the processing of data observed and to plot the performance characteristics.
4. To provide knowledge on understanding the performance of DC machines and transformers from the various plots drawn.
5. To demonstrate the choice of machines for specific application.

3. Syllabus

List of Experiments:

1. Open circuit and load characteristics of DC shunt generator. (CO1 – CO5)
2. Load characteristics of DC compound generator with differential and cumulative connections. (CO1 – CO5)
3. Load test on DC shunt motor. (CO1 – CO5)
4. Load test on DC series motor. (CO1 – CO5)
5. Load test on DC compound motor. (CO1 – CO5)
6. Swinburne's test and speed control of DC shunt motor. (CO1 – CO5)
7. Hopkinson's test on DC motor – Generator set. (CO1 – CO5)
8. Load test on single-phase transformer. (CO1 – CO5)
9. Open circuit and short circuit tests on single phase transformer. (CO1 – CO5)
10. Sumpner's test on single phase transformers. (CO1 – CO5)

References:

Reference Books/ Virual Labs:

1. Kothari D. P and Umre B. S, "Lboratory Manual for Electric Machines", I.K. International Publishing House Pvt. Ltd., Fourth Edition, 2018.
2. https://blogs.mathworks.com/pick/2021/11/02/electric-machines-and-power-virtual-labs/
3. IIT Roorkee – Virtual Lab – https://ems-iitr.vlabs.ac.in/
4. College of Engineering, Pune, Virtual Lab - https://em-coep.vlabs.ac.in/
5. https://www.udemy.com/course/virtual_labs_electrical_machines/

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE212.1	Prepare and Conduct experiments in the Electrical Machines laboratory, demonstrate meticulous adherence to proper procedures and attention to detail.
R19EE212.2	Design and implement theoretical concepts using appropriate equipment and components, measure relevant electrical parameters during practical experiments and interpret experimental data accurately to conclude circuit behaviour.
R19EE212.3	Analyze experimental data (run-time behaviour of the program) using appropriate analytical techniques, accurately draw inferences, effectively communicate the results and evaluate the accuracy (regarding functionality and performance).

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE212.4	Demonstrate the application of presentation tools to present experimental data, analyze findings, draw conclusions, and derive outcomes.
R19EE212.5	Articulate their methodology, discuss findings, and respond to questions, showcasing a comprehensive understanding of the experiment's objectives and outcomes.

R19EE213	Control and Instrumentation Laboratory	L	T	P	C
		0	0	3	1.5

1. Course Description:

The course encompasses a comprehensive set of practical modules aimed at providing hands-on experience in control systems engineering. In Module I, students engage in, study of various controllers and Compensators, Synchros Transmitter – Receiver characteristics, finding the transfer function of DC moor, DC Servomotor and AC Servomotor. Module II focuses on finding the electrical parameters using bridges, characteristics of various transducers, Various converters.

2. Course Objectives:

1. To impart knowledge on various bridges and calibtation.
2. To provide exposure to the students of various transducers and its characteristics.
3. To gain practical experience on types of controllers and Compensators.
4. To expose the students to understand the working of various converters.
5. To impart knowledge to find transfer function of Electrical Machines.

3. Syllabus:

List of Experiments:

1. Bridge Networks – AC and DC Bridges. (CO1)
2. Measurement of pressure using load cell and pressure transducer. (CO2)
3. Calibration of temperature sensors (RTD / thermo couple / thermistor). (CO2)
4. Measurement of linear displacement using LVDT and measurement of strain using strain gauge. (CO2)
5. Analog to digital conversion and digital to analog conversion. (CO5)
6. Study of P, PI, PID Controllers. (CO3)
7. Simulation of Lag, Lead and Lag-Lead compensators using MATLAB/SCILAB. (CO3)
8. Synchro-Transmitter- Receiver and characteristics. (CO3)
9. Transfer function of controlled D.C. motor and servomotor. (CO4)
10. Development of projects using sensors and transducers. (CO5)

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE213.1	Demonstrate the operation of DC machines and transformers to perform various tests on those machines.
R19EE213.2	Conduct various tests on the DC machines and transformers to observe the necessary data by using proper measuring instruments.
R19EE213.3	Utilize the data observed to calculate the necessary parameters of DC machines and transformers and to plot the relevant characteristics.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE213.4	Plot the performance characteritics of the DC machines and transformers to analyse their behaviour under different loading conditions.
R19EE213.5	Assess the performance characteristics of various machines to select a suitable machine for a specific application.

R19EE281	Project with Design Thinking (Product / Software Development Life Cycle)	L	T	P	C
		0	0	2	1

1. Course Description:

This course introduces students to Design Thinking as an innovative, user-centered methodology for problem solving in Electrical and Electronics Engineering (EEE) projects. By integrating technical skills with creative thinking, students will learn how to approach engineering challenges with empathy, ideation, prototyping, and iterative development. Through hands-on projects, the students will develop innovative solutions to real-world problems, applying engineering principles in the fields of power systems, embedded systems, signal processing, control systems, and electronics. Students will work in teams to identify problems, empathize with users, ideate solutions, prototype designs, and test their results. This approach fosters creativity, critical thinking, collaboration, and the practical application of knowledge, resulting in user-centered and innovative electrical and electronics solutions.

2. Course Objectives:

1. Develop the ability to empathize with end-users to identify and define complex problems.
2. Apply empathy tools and techniques to gain a deep understanding of user needs and pain points.
3. Evaluate and prioritize ideas based on criteria such as feasibility, desirability, and viability.
4. Create prototypes to materialize and test design concepts.
5. Validate design solutions through user testing and feedback.

3. Syllabus

Introduction to Design Thinking and SDGs

- Overview of Design Thinking and its application to engineering challenges.
- Deep dive into SDGs such as Goal 7 (Affordable and Clean Energy) and Goal 11 (Sustainable Cities and Communities).

Empathizing and Defining the Problem

- Identifying user needs through research and field studies.
- Defining the problem within the context of engineering and sustainable development.

Ideation and TRL Framework

- Brainstorming innovative solutions that align with specific SDGs.
- Introduction to TRLs and assessing the feasibility of technological solutions.

Prototyping & Testing

- Hands-on sessions on building prototypes using electrical and electronic components.
- Testing solutions for reliability, sustainability, and scalability.

Implementation and Scaling

- Developing a roadmap for taking a project from prototype to real-world application, considering TRLs.
- Collaborating with industry experts, sustainability consultants, and community partners.

Presentation & Reflection

- Final project presentation with a focus on SDG impact, TRL assessment, and design thinking process.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE281.1	Identify the problems in electrical and electronics engineering field by literature survey.
R19EE281.2	Design, analyse and solve the identified problems by using modern engineering tools.
R19EE281.3	Create innovative methodologies to solve the existing problems and developing the working models.
R19EE281.4	Apply the engineering knowledge and suitable fabrication methods for fabrication of the working models.
R19EE281.5	Implement the role of team work in a project to find the solution and estimate the financial requirement of a project.

R19EM202	Advanced Logical Thinking	L	T	P	C
		0	0	2	1

1. Course Description:

This course aims to develop student's logical thinking skills to an advanced level. Students will explore various techniques and strategies to analyse, evaluate, and synthesize information effectively. Analyzing a situation or problem using a logical approach involves gathering all available information, assessing the facts and efficiently deciding the best course of action. Students strive to understand various topics deeply, enhance their memory skills and build greater understanding. They also apply their ideas effectively and thoroughly analyze any arising issues.

2. Course Objectives:

1. Enhance Critical thinking skills by solving programming logic problems involving permutations and combinations.
2. Enhance the Decision making skills using different Possibilities through Probability
3. To develop the skills to analyze complex problems in Simple Solutions through Time Speed Distance Concept
4. Enhance the strategic thinking for Solving Real life problems using Mathematical Concepts
5. Reinforce the Logical skills through Reasoning Puzzles

3. Syllabus:

Unit – I: Inductive Reasoning through Permutations & Combination

Fundamental Principles of Counting: Permutations & Combination, Number Generation Fundamentals; Digit repeater concepts: All possible ways; Recursion and Backtracking: N step Problems, Chess oriented problems and Case Studies.

Unit – II: Decision Making based on Probability

Introduction to Probabilities, Application of Probability; Power of Compounding: Case Studies.

Unit – III: Strategical techniques in Time, Speed and Distance

Definition and Basics of Time, Speed and Distance; Relative speed: Problems based on Trains; Effective Speed: Problems based on Boats and Streams; Problems based on Races, Escalator problems; Case Studies.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Unit – IV: The Logical Approach to Mixture and Allegation
Introduction to Mixtures: Multi variable mixing, Profit and Loss concept based on mixing; Liquid mixing concepts: Replacement problems and Repetitive iteration problems.
Unit – V: Logical Reasoning
Introduction to design of clocks; Formula creation: Speed clock and Slow clock problems; Angle calculation; Calendars design: Concept of odd days, Day of a date and Calendar repetition logic; Data Arrangements; Data Sufficiency; Directions; Number series and Puzzles.
References:
Reference Books: 1. Dr. R S Aggarwal, Quantitative Aptitude, Revised Edition, S. Chand Publishing Company Ltd(s), 2022 2. Arun Sharma, How to prepare for Quantitative Aptitude for the CAT, 10th Edition, Tata McGraw-Hill Publishing Company Ltd, 2022 **Online Resources:** 1. https://www.hackerearth.com/ 2. https://www.geeksforgeeks.org/ 3. https://www.indiabix.com

4. Course Outcomes:

CO. No.	Course Outcome
R19EM202.1	Develop the ability to use inductive reasoning to solve complex problems involving permutations and combinations.
R19EM202.2	Understand probability theory to make informed decisions under uncertainty.
R19EM202.3	Utilize strategic techniques to solve problems related to time, speed, and distance.
R19EM202.4	Apply logical reasoning to solve problems involving mixtures and allegations.
R19EM202.5	Enhance logical reasoning skills to tackle a variety of analytical problems.
R19EM202.6	Develop the ability to use inductive reasoning to solve complex problems involving permutations and combinations.

R19EM203	Summer Internship	L	T	P	C
		-	-	-	NC

1. Course Description:

"Summer Internship" provides students with the opportunity to gain practical work experience in a professional setting during the summer months. Through supervised placements in various industries, students will apply theoretical knowledge acquired in their academic studies to real-world scenarios. The internship aims to enhance students' professional skills, expand their networks, and foster personal and career development. Under the guidance of experienced mentors, interns will engage in hands-on projects, tasks, and responsibilities tailored to their academic background and career interests. Through reflection, feedback, and evaluation, interns will refine their skills, gain valuable insights into industry practices, and make meaningful contributions to their host organizations.

2. Course Objectives:

1. Exposure to an Industrial/professional work environment relevant to the student's field of study.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

2.	Develop the ability to apply practical skills and knowledge learned in academic coursework to real-world projects and tasks.
3	Network with professionals in the industry to explore career opportunities and build professional relationships.
4.	Create awareness of current industrial technological developments relevant to the program domain.
5.	Provide opportunities to understand the social, economic, and administrative considerations in organizations.

3. Guidelines:

The Summer Internship/Industrial Training program offers students valuable opportunities to engage with real-world industrial environments aligned with their academic curriculum. Following completion of the IV Semester, students are required to obtain prior approval from the Head of the Department (HoD) to participate in these immersive learning experiences. The duration of the training spans two weeks during the summer vacation, providing students with focused insights into industry practices and technological advancements relevant to their field of study. Proof of participation, accompanied by a satisfactory completion certificate from the hosting organization, is mandatory to validate the learning experience.

Evaluation Process and Final Assessment

Upon completion of their internship or training, students are required to deliver a seminar based on their training report. This seminar is conducted before an expert committee formed by the concerned department in accordance with institutional norms. The evaluation process focuses on several key criteria to assess the student's performance comprehensively as per AICTE guidelines:

1. Quality of Content Presented
2. Proper Planning for Presentation
3. Effectiveness of Presentation
4. Depth of Knowledge and Skills

Additional Factors such as Attendance records, daily diaries, and departmental reports

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EM203.1	Demonstrate an understanding of industry-specific practices, procedures, and terminology through immersion in a professional work environment
R19EM203.2	Interpret and explain the relevance of theoretical concepts learned in academic coursework to practical tasks and projects encountered during the internship
R19EM203.3	Apply acquired knowledge and skills to solve real-world problems, contribute to projects, and complete assigned tasks effectively within the internship setting
R19EM203.4	Analyze and evaluate their internship experiences, reflecting on challenges faced, solutions implemented, and lessons learned to assess their own growth and development.
R19EM203.5	Synthesize their internship experiences, integrating knowledge gained from various sources, including academic coursework, mentorship, and practical application, to formulate strategies for future career development and success.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19MC201	Environmental Science	L	T	P	C
		1	0	0	NC

1. Course Description:

Environmental science should provide for the engineers to develop sustainable practices and technologies. Also, it ensures engineers can design and implement projects that comply with these regulations, avoiding legal issues and laws and potential fines. By incorporating environmental science, engineers can better assess and mitigate negative health effects related to pollution and environmental degradation. To raise awareness about sustainability all over the world to protect the current resources for future generations.

2. Course Objectives:

1. Analyze how living organisms interact with their environment.
2. To Identify how the environment affects the human world and its importance.
3. Educate on topics such as biodiversity, natural resources, pollution control and waste management.
4. Understand how the environment is protected by the Constitution.

3. Syllabus

Unit – I: Environment and Ecosystem

Key environmental issues: their basic causes and sustainable solutions; concept of an ecosystem; structure and function of an ecosystem: producers, consumers and decomposers; energy flow in the ecosystem: food chains and food webs.

Unit – II: Environmental Pollution

Primary and secondary air pollutants: Air, Water, Marine and soil pollution: causes, effects and control measures.

Unit – III: Risk and Security of Environment

Heavy metals; E-waste and Hazardous waste management; green and blue revolution; GM crops: merits and demerits; ecological impacts of modern agriculture; Bio fertilizer technology; organic farming.

Unit – IV: Energy Resources

Non-renewable energy resources: oil, Natural gas, Coal; Renewable energy resources: Solar energy, Hydroelectric power, Wind, biomass and geothermal energy.

Unit – V: Social Issues and the Environment

Environmental ethics: Issues and possible solutions; water conservation: rain water harvesting, watershed management; Sustainable development: global climatic change, global warming; ozone layer depletion.

Text Book:

1. Babu E. and Tharaneeswaran V., "Environmental Science", V K Publishers, 2019.

References:

Reference Books:

1. Miller T. G. and Spoolman S. E., "Environmental Science", Cengagelearning16th Edition, 2017.
2. Sinha J., "Environmental Science", Galgotia Publications, 2nd Edition, 2011.

Journals

1. Environmental Chemistry Letters (https://link.springer.com/article/10.1007/S10311-020-01100-Y)

Chairman – Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202.

2. Taylor& Francis (https://www.tandfonline.com/doi/pdf/10.1080/00908327709545594)
3. Environmental Research (https://www.sciencedirect.com/science/article/pii/S0013935123016766)
4. Energy Strategy Reviews (https://www.sciencedirect.com/science/article/pii/S2211467X2200133X)
5. Environmental Development (https://www.sciencedirect.com/science/article/pii/S2211464515300099)

Video References:

1. https://www.youtube.com/watch?v=ytxjYhcGNBs
2. https://www.youtube.com/watch?v=oSbUp3XYQX8

MOOC / NPTEL / SWAYAM Courses:

1. https://nptel.ac.in/courses/105104099/
2. https://www.youtube.com/watch?v=CXCT2R1K6Ts
3. https://www.youtube.com/watch?v=89B9IT0TI-Q
4. https://www.youtube.com/watch?v=p-lSPDDdVtc
5. https://www.youtube.com/watch?v=Y5B1nWYle40

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19MC201.1	Understand about eco system and its current impacts by implementing sustainability
R19MC201.2	Acquire the concept of pollution and its types and prevention to overcome the issues.
R19MC201.3	Enhance the vision of waste management system and preservation and making bio fertilizers
R19MC201.4	Obtain the knowledge of energy sources, fossil fuels and current implementation to balance the futuristic needs
R19MC201.5	Know about the Environmental ethics: Issues and water conservation, rain water harvesting, watershed management -Sustainable development

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

SEMESTER V

R19EE301	Electrical Machines – II	L	T	P	C
		2	1	0	3

1. Course Description:

This is an advanced course designed to provide students with an in-depth understanding of the principles, operation and applications of synchronous and induction machines. Building upon the foundational knowledge gained in introductory electrical engineering courses, this course provides the analysis of performance characteristics and applications of synchronous machines, induction machines and other special machines.

2. Course Objectives:

1. To impart knowledge on the principle of operation and voltage regulation of synchronous generators.
2. To illustrate the operating characteristics and applications of synchronous motors.
3. To facilitate the students to analyse the performance parameters of three phase induction motors.
4. To provide knowledge on the starting and speed control of synchronous and induction machines.
5. To equip the students with a comprehensive understanding of the operation and characteristics of single phase induction motors.

3. Syllabus

Unit – I: Synchronous Generator

Principle of operation, Construction, EMF Equation; Predetermination of voltage regulation: EMF and MMF method; Blondel's two reaction theory; Parallel Operation: Synchronizing Power, Synchronizing torque, Change of excitation, frequency and mechanical input; Permanent magnet synchronous generator.

Unit – II: Synchronous Motor

Principle of operation; Starting methods; Torque equation; Characteristics. Operation on infinite bus bars, V and inverted V curves; Power-load angle relations, Current loci for constant power input, constant excitation and constant power developed; losses and efficiency; Hunting; Synchronous condenser; Permanent magnet synchronous motor; Applications.

Unit – III: Three Phase Induction Motor

Construction; Types of rotors; Principle of Operation; Equivalent Circuit; Phasor Diagram; Torque and Power Output; Slip-Torque Characteristics; No load and Blocked Rotor Tests; Circle Diagram; Performance evaluation; Linear induction motor.

Unit – IV: Starting and Speed Control of Three Phase Induction Motor

Starters: Need for starters, Typess: DOL, rotor resistance, autotransformer and star/delta.

Speed control: Changing voltage, frequency, v/f; Slip power recovery scheme: Kramer's system, Scherbius system, Application of slip power recovery scheme.

Unit – V: Single Phase Induction Motors and Special Machines

Constructional details; Two revolving field theory; Starting methods; Equivalent circuit; Performance analysis.

Special machines; Construction and Operation: Stepper motor, Switched reluctance motor, BLDC motor.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Text Books:

1. Kothari D. P and Nagrath I. J, "Electric Machines", Tata McGraw Hill, Fourth Edition, 2014.
2. Gupta J. B, "Theory and Performance of Electrical Machines", S. K. Kataria and Sons, 14th Edition, 2010.

References:

Reference Books:

1. Stephen J. Chapman, "Electric Machinery Fundamentals", Tata McGraw Hill, Fourth Edition, 2010.
2. Bimbhra P. S, "Electrical Machinery", Khanna Publishers, 2011.
3. Fitzgerald A.E, Kingsely C, Umans S. D, "Electric Machinery", Tata McGraw Hill, Sixth Edition, 2003.
4. Rajput R. K, "Electrical Machines", Laxmi Publications (P) Ltd, 2003.
5. Murugesh Kumar, "Electric Machines", Vikas Publishing House Pvt. Ltd, 2002.

Web Resources:

1. https://www.sciencedirect.com/topics/engineering/synchronous-generator
2. https://mechtex.com/blog/introduction-of-synchronous-motor
3. https://www.kebamerica.com/blog/how-a-3-phase-ac-induction-motor-works/

MOOC / NPTEL / SWAYAM Courses:

1. https://nptel.ac.in/courses/108105017
2. https://www.udemy.com/course/electric-machines-complete-guide-on-dc-machines/

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE301.1	Predetermine voltage regulation and load sharing of Synchronous generator.
R19EE301.2	Demonstrate the principle of operation and performance of synchronous motors.
R19EE301.3	Analyse the performance characteristics of induction motors.
R19EE301.4	Study the various starting and speed control techniques of Induction motor.
R19EE301.5	Examine the operating principles of single phase induction motors and other special machines.

R19EE302	Generation, Transmission and Distribution	L	T	P	C
		3	1	0	4

1. Course Description:

Generation, Transmission & Distribution provides a comprehensive overview of the processes involved in supplying electricity from generation sources to end-users. This course covers the fundamentals of power generation technologies and explores their environmental impacts. Transmission and distribution systems are examined, focusing on grid infrastructure, equipment, and operation. The course also addresses emerging trends such as smart grids, microgrids, and distributed energy resources. By the end of the course, students will understand the interplay between generation, transmission, and distribution, and be prepared to contribute to the advancement of efficient, reliable, and sustainable energy networks.

2. Course Objectives:

1. To impart knowledge on the different types of Power generation systems.
2. To equip the students with the concepts of transmission line parameters.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

3.	To facilitate the students to analyse the performance of transmission line.
4.	To provide knowledge on the line supports and insulators and their applications.
5.	To give exposure on the classification of UG cables and distribution systems.

3. Syllabus

Unit – I: Power Generation

Structure of Electric Power System; Generation, Transmission and Distribution Scenario; Types of generating Stations: Thermal Power Plant, Hydro Power Plant, Gas Power Plant, Nuclear Power Plant; Solar power plant, Wind power plant, Biomass power plant.

Unit – II: Transmission System and Line Parameters

Transmission line parameters: R, L & C of Single and 3 Phase lines; Skin effect and Proximity effect; Symmetrical and unsymmetrical spacing; Transposition; Bundled conductors; Selection of conductors.

Unit – III: Modelling and Performance of Transmission Line

Classification of transmission line: Short, medium and long transmission lines; ABCD constants; equivalent circuit; Phasor diagrams; Line regulation; Efficiency; Ferranti effect; Surge impedance; surge impedance loading.

Unit – IV: Line Insulators and Supports

Insulator types; Voltage distribution in insulator string; grading of insulators; Methods of increasing string efficiency; Testing of insulators. Line supports; types; stress and sag calculation; corona; factors affecting corona; selection of insulators and supports.

Unit – V: Underground Cables and Distribution Systems

Construction and classification of UG cables; selection of cables; Grading; Comparison between overhead lines and underground cables; Substations and types; Single line diagram of substation; Feeders, distributors and service mains; Radial, ring main and interconnected systems; Tariff.

Text Books:

1. R.K Rajput, "Power System Engineering", Laxmi Publications (P) Ltd, New Delhi, 7th Edition.
2. S.N.Singh, "Electric Power Generation, Transmission and Distribution ", Prentice Hall of India Pvt. Ltd, New Delhi, Second edition 2011.

References:

1. Soni M L, Gupta P V, Bhatnagar U S and Chakrabarthi A, "A Text Book on Power System Engineering", Dhanpat Rai and Co., New Delhi, 2013
2. Mehta V K Rohit Mehta, "Principles of Power Systems", S.Chand & Co., New Delhi, 2017
3. Duncan Glover J, Mulukutla S. Sarma, Thomas Jeffrey Overbye, Thomas J. Overbye, "Power System Analysis and Design", Thomson Learning, New Delhi, 2016
4. Uppal S L, "Electrical Power Systems ", Khanna Publishers, New Delhi, 2009

Journals:

1. IEEE Transactions on Power Systems
2. International Journal of Electrical Power & Energy Systems
3. Electric Power Systems Research
4. IEEE Power & Energy Magazine
5. IET Generation, Transmission & Distribution

Video References:

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

1. https://www.youtube.com/watch?v=gOR5nCXze6w
2. https://www.youtube.com/watch?v=te0-lURqEU8
3. https://www.youtube.com/watch?v=OXOFZItTI9I&t=16s
4. https://www.youtube.com/watch?v=dNzHCVJB6fo&t=13s
5. https://www.youtube.com/watch?v=QyfVKoaOnBU&t=582s

MOOC / NPTEL / SWAYAM Courses:

1. https://archive.nptel.ac.in/courses/108/102/108102047/
2. https://archive.nptel.ac.in/courses/108/107/108107112/
3. https://archive.nptel.ac.in/noc/courses/noc19/SEM1/noc19-ee24/

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE302.1	Summarize the types of power generating station
R19EE302.2	Explain the concept of transmission line parameters
R19EE302.3	Analyse the performance of different transmission line models
R19EE302.4	Make use of insulators and supports for constructing transmissions line.
R19EE302.5	Explain the types of underground cables and distribution system.

R19EE303	Power Electronics	L	T	P	C
		3	0	0	3

1. Course Description:

This course introduces the field of power electronics, which deals with the control and conversion of electric power. You will gain a solid understanding of the underlying principles, analysis techniques, design considerations, and applications of power electronic circuits.

2. Course Objectives:

1. To impart knowledge on the power semiconductor switches used for the design of various power electronic converters.
2. To equip students with a comprehensive understanding of phase-controlled converters and their applications.
3. To facilitate the students to gain insights on DC-to-DC converters, their types, operation and applications.
4. To provide knowledge on the operation of DC to AC converters and their applications.
5. To give exposure on the different types of AC to AC converters.

3. Syllabus

Unit – I: Power Semiconductor Devices

Introduction; Construction, operation and characteristics: Power Diode, BJT, SCR, MOSFET, IGBT; Triggering and commutation circuit for SCR; Driver and snubber circuits; Introduction to wide-band gap power devices.

Unit – II: Phase Controlled (AC to DC) Converters

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Principle of phase control; two pulse, three pulse and six pulse converters; Performance parameters; Dual Converters; Effect of source inductance; Applications.

Unit – III: DC to DC Converters

Introduction; Principle and operation; Control strategies; Types: step down (buck), Step up (boost) and step down/step up (buck/boost) converters; Four quadrant chopper; Resonant Converters: Zero voltage switching (ZVS), zero current switching (ZCS); SMPS: fly back converter; Applications.

Unit – IV: DC to AC Converters

Introduction; Types: Single phase half and full bridge VSI, Three phase VSI 120 and 180 degree conduction mode; PWM Techniques; Current source inverter; Introduction to multilevel inverters; Applications.

Unit – V: AC to AC Converters

AC Voltage Controllers: Introduction, On-Off control, Phase Control, Single phase Bidirectional Controllers with R and R-L Loads, Three phase full wave controllers.

Cycloconverters: Single Phase and Three phase Cycloconverter and Matrix Converter.

Text Books:

1. Ned Mohan, Tore. M. Undeland, William. P. Robbins, "Power Electronics: Converters, Applications and Design", John Wiley India, Third Edition Reprint, 2009.
2. P.S.Bimbra, "Power Electronics", Khanna Publishers, Seventh Edition, 2012.

References:

Reference Books:

1. Rashid M. H, "Power Electronics: Circuits, Devices & Applications", Pearson, Fourth Edition, 2017.
2. Rama Reddy S, "Fundamentals of Power Electronics", Narosa Publishing House, Second Edition, 2014.
3. Singh M. D. and Khanchandani K. B., "Power Electronics", Tata McGraw Hill, 2013.
4. Philip T. Krein, "Elements of Power Electronics", Oxford University Press, Second Edition, 2015.
5. Joseph Vithayathil, "Power Electronics: Principles and Applications", Tata McGraw Hill, Second Reprint, 2010.

Journal References:

1. IEEE Transactions on Power Electronics
2. IEEE Journal of Emerging and Selected Topics in Power Electronics
3. IET Power Electronics
4. PE Journal of Power Electronics
5. International Journal of Electrical Power & Energy Systems

Web Resources:

1. https://www.coursera.org/courses?query=power%20electronics
2. https://ocw.mit.edu/courses/6-334-power-electronics-spring-2007/resources/chp2/

MOOC / NPTEL / SWAYAM Courses:

1. https://nptel.ac.in/courses/108105066
2. https://onlinecourses.nptel.ac.in/noc21_ee01/preview
3. https://onlinecourses.nptel.ac.in/noc24_ee88/preview

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE303.1	Explain the operation and characteristics of different types of power semi-conductor devices to choose a suitable switch for a specific application.
R19EE303.2	Build various configurations of phase controlled converter circuits to analyse their operation, characteristics and performance parameters.
R19EE303.3	Construct and analyse various topologies of DC to DC converters to to select the most suitable one for a particular application.
R19EE303.4	Develop dc to ac inverter circuits and apply different PWM techniques to reduce harmonics in the inverter output.
R19EE303.5	Understand the methods of AC to AC power conversion to analyze the performance of these converters with various types of loads.

R19EE304	Embedded Systems	L	T	P	C
		3	0	0	3

1. Course Description:

This course provides a comprehensive understanding of embedded systems, covering both theoretical concepts and practical applications. Embedded systems are an integral part of many electronic devices, from simple appliances to complex industrial machines. The aim of the course is to provide students with the necessary knowledge and skills for effective design, development and troubleshooting of embedded systems. Real-time systems are ubiquitous in applications where timely response is essential, such as aerospace, automotive, industrial automation, medical devices, and multimedia systems. The aim of the course is to provide students with the knowledge and skills necessary to understand, develop and implement real-time operating systems

2. Course Objectives:

1. Develop embedded systems projects that integrate hardware and software components to solve real-world problems.
2. Master the development of device drivers, interrupt handling routines, and low-level software components to interface with hardware peripherals.
3. Explain the fundamental concepts of real-time systems, including the distinction between hard and soft real-time requirements.
4. Develop interrupt handling routines and device drivers to minimize interrupt latency and ensure timely response to external events.
5. Analyze the importance of timing constraints and deadlines in real-time applications across various domains.

3. Syllabus

Unit – I: Introduction to Embedded Systems

Definition, Embedded Systems Vs General Computing Systems, History of Embedded Systems, Classification, Major Application Areas, Purpose of Embedded Systems, Characteristics and Quality Attributes of Embedded Systems.

Unit – II: Typical Embedded System

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu. Coimbatore - 641 202.

Core of the Embedded System: General Purpose and Domain Specific Processors, ASICs, PLDs, Commercial Off-The-Shelf Components (COTS), Reset Circuit, Brown-out Protection Circuit, Oscillator Unit, Real Time Clock, Watchdog Timer, Sensors and Actuators, Communication Interface: Onboard and External Communication Interfaces.

Unit – III: Embedded Firmware

Embedded firmware design approaches-super loop-based approach, operating system-based approach; embedded firmware development languages-assembly language-based development, high level language-based development.

Unit – IV: RTOS Based Embedded System Design

Operating System Basics, Types of Operating Systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling.

Unit – V: Task Communication

Shared Memory, Message Passing, Remote Procedure Call and Sockets, Task Synchronization: Task Communication/Synchronization Issues, Task Synchronization Techniques, Device Drivers, How to Choose an RTOS.

Text Books:

1. Shibu K.V, "Introduction to Embedded Systems ", McGraw Hill Education India Private Limited; Second edition (1 July 2017)

References:

Reference Books:

1. Raj Kamal, "Embedded Systems- Architecture, Programming and Design ",McGraw Hill Education; Third edition (1 July 2017)
2. Tony Givargis Frank Vahid, "Embedded System Design: A Unified Hardware / Software Introduction ", Wiley; Student edition (1 January 2006)

Journal References:

1. IEEE Transactions on Computers
2. IEEE Embedded Systems Letters
3. IEEE Transactions on Mobile Computing
4. IEEE Transactions on Signal Processing

Video References:

1. https://www.youtube.com/watch?v=oPn_adlC1Q0
2. https://www.youtube.com/watch?v=JfKFJzvVUVw
3. https://www.youtube.com/watch?v=i2ypCsB93gM
4. https://www.youtube.com/watch?v=bypGn7VFv3c

MOOC / NPTEL / SWAYAM Course:

1. Embedded Systems, IIT Delhi (https://nptel.ac.in/courses/108102045)

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE304.1	Explain the functional blocks and selection procedure of Processors in the Embedded domain.
R19EE304.2	Discover the design and development of typical embedded systems.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE304.3	Assess the design Procedure for Embedded Firmware.
R19EE304.4	Establish the role of Real time Operating Systems in Embedded Systems.
R19EE304.5	Outline the tack communication concepts.

R19EE311	Electrical Machines Laboratory – II	L	T	P	C
		0	0	3	1.5

1. Course Description:

The Electrical Machines Laboratory course is designed to provide students with practical hands-on experience in working with various electrical machines commonly used in power systems and industrial applications. This laboratory complements theoretical knowledge gained in the Electrical Machines Theory course by offering students the opportunity to apply concepts learned in class to real-world scenarios. Through a series of experiments and projects, students will gain proficiency in operating, analyzing, and troubleshooting electrical machines.

2. Course Objectives:

1. To impart skills to operate different types of AC. machines safely.
2. To provide hands on experience to conduct experiments on synchronous and induction machines and to observe data.
3. To educate on the processing of data observed and to plot the performance characteristics.
4. To provide knowledge on understanding the performance of synchronous and induction machines from the various plots drawn.
5. To demonstrate the choice of machines for specific application.

3. Syllabus

List of Laboratory Experiments:

1. Regulation of three phase alternator by EMF and MMF methods.
2. Synchronization of Alternators.
3. V and inverted V curves of three phase synchronous motor.
4. Load test on three phase induction motor.
5. Load test on three phase double winding induction motor.
6. No load and blocked rotor tests on three-phase induction motor.
7. Load test on single phase induction motor.
8. No load and blocked rotor test on single-phase induction motor.
9. Speed control of AC machines.
10. Study of BLDC motor.

References:

Reference Books/ Virtual Labs:

1. Kothari D. P and Umre B. S, "Laboratory Manual for Electric Machines", I.K. International Publishing House Pvt. Ltd., Fourth Edition, 2018.
2. https://blogs.mathworks.com/pick/2021/11/02/electric-machines-and-power-virtual-labs/
3. IIT Roorkee – Virtual Lab – https://ems-iitr.vlabs.ac.in/
4. College of Engineering, Pune, Virtual Lab - https://em-coep.vlabs.ac.in/
5. https://www.udemy.com/course/virtual_labs_electrical_machines/

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE311.1	Prepare and Conduct experiments in the Electrical Machines laboratory, demonstrate meticulous adherence to proper procedures and attention to detail.
R19EE311.2	Design and implement theoretical concepts using appropriate equipment and components, measure relevant electrical parameters during practical experiments and interpret experimental data accurately to conclude circuit behaviour.
R19EE311.3	Analyze experimental data (run-time behaviour of the program) using appropriate analytical techniques, accurately draw inferences, effectively communicate the results and evaluate the accuracy (regarding functionality and performance).
R19EE311.4	Demonstrate the application of presentation tools to present experimental data, analyze findings, draw conclusions, and derive outcomes.
R19EE311.5	Articulate their methodology, discuss findings, and respond to questions, showcasing a comprehensive understanding of the experiment's objectives and outcomes.

R19EE312	Power Electronics Laboratory	L	T	P	C
		0	0	3	1.5

1. Course Description:

The Power Electronics Laboratory course is designed to enhance students' understanding of Power Electronics circuits through practical application, fostering skills in measurement, analysis and troubleshooting. The hands-on experience gained in the laboratory is crucial for students pursuing careers in electrical engineering or related fields.

2. Course Objectives:

1. Enable students to have Hands-on experience with power electronics components
2. To develop practical skills in building and testing circuits
3. To apply control techniques for power converters
4. To gain insights into design considerations
5. To enhance communication and teamwork skill.

3. Syllabus

List of Experiments:

1. Characteristics of SCR and TRIAC
2. Characteristics of MOSFET and IGBT
3. AC to DC half and fully controlled converter
4. Step down and step up MOSFET based choppers
5. IGBT based single phase and three phase PWM inverter
6. AC Voltage controller
7. Switched mode power converter
8. Simulation of PE circuits (1Φ & 3Φ semi converters, 1Φ & 3Φ full converters, DC-DC converters, AC voltage controllers)
9. VFD based Induction Motor Control.

References:

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu. Coimbatore - 641 202.

1. Rashid M. H, "Power Electronics: Circuits, Devices & Applications", Pearson, Third Edition, 2004.
2. Rama Reddy S, "Fundamentals of Power Electronics", Narosa Publishing House, Second Edition, 2014.
3. Singh M. D. and Khanchandani K. B., "Power Electronics", Tata McGraw Hill, 2013.
4. Philip T. Krein, "Elements of Power Electronics", Oxford University Press, Second Edition, 2015.
5. Joseph Vithayathil, "Power Electronics: Principles and Applications", Tata McGraw Hill, Second Reprint, 2010.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE312.1	Prepare and Conduct experiments in the Power Electronics laboratory, demonstrate meticulous adherence to proper procedures and attention to detail.
R19EE312.2	Design and implement theoretical concepts using appropriate circuit devices and components, measure relevant electrical parameters during practical experiments and interpret experimental data accurately to conclude circuit behaviour.
R19EE312.3	Analyze experimental data (run-time behaviour of the program) using appropriate analytical techniques, accurately draw inferences, effectively communicate the results and evaluate the accuracy (regarding functionality and performance).
R19EE312.4	Demonstrate the application of presentation tools to present experimental data, analyze findings, draw conclusions, and derive outcomes.
R19EE312.5	Articulate their methodology, discuss findings, and respond to questions, showcasing a comprehensive understanding of the experiment's objectives and outcomes.

R19MC202	Indian Constitution and Tradition	L	T	P	C
		1	0	0	NC

1. Course Description:

This course provides a comprehensive exploration of the Indian Constitution and Tradition, with a primary focus on understanding its historical evolution, guiding principles, organizational framework, and contemporary relevance. Students will delve into the intricate layers of India's constitutional legacy, examining the multifaceted influences of democratic governance.

2. Course Objectives:

1. Understand the foundational principles and historical context of the Indian Constitution and tradition.
2. Explore the role of tradition in shaping contemporary Indian constitutional law and governance.
3. Assess the interplay between constitutional amendments and traditional values in Indian society.
4. Critically reflect on the relevance and adaptability of Indian constitutional principles in a modern context.
5. Examine the evolution of constitutional rights and duties within the framework of Indian tradition.

3. Syllabus:

Unit – I: History of Indian Constitution

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Meaning of the constitution law and constitutionalism - Historical perspective of the Constitution of India, Salient features and characteristics of the Constitution of India

Unit – II: Fundamental Rights and Duties

Scheme of the fundamental rights - Fundamental Duties and its legal status - Directive Principles of State Policy, Its importance and implementation

Unit – III: Federal Structure and Distribution of Powers

Federal structure and distribution of legislative and financial powers between the Union and the States - Parliamentary Form of Government in India - The constitution powers and status of the President of India - Amendment of the Constitutional Powers and Procedure

Unit – IV: Constitutional Amendments And Emergency Provisions

The historical perspectives of the constitutional amendments in India - Emergency Provisions: National Emergency, President Rule, Financial Emergency - Local Self Government - Constitutional Scheme in India

Unit – V: Right To Equality, Freedom, And Personal Liberty

Scheme of the Fundamental Right to Equality - Scheme of the Fundamental Right to certain Freedom under Article 19 - Scope of the Right to Life and Personal Liberty under Article 21

Text Books:

1. Sunil Khilnani, "The Idea of India", Penguin India Ltd., New Delhi.
2. Madhav Khosla, "The Indian Constitution", Oxford University Press. New Delhi, 2012.

References:

Reference Books:

1. Brij Kishore Sharma, "Introduction to the Indian Constitution", PHI, New Delhi
2. Sumantra Bose, "Transforming India: Challenges to the World's Largest Democracy", Picador India, 2013.
3. Atul Kohli, "Democracy and Discontent: India's Growing Crisis of Governability", Cambridge University Press, Cambridge, U. K., 1991.
4. M. P. Singh and Rekha Saxena, "Indian Politics: Contemporary Issues and Concerns", PHI, New Delhi, 2008, latest edition.
5. Rajni Kothari, "Rethinking Democracy", Orient Longman, New Delhi, 2005.

Video References:

1. https://www.youtube.com/watch?v=JrqpQvRQft0
2. https://www.youtube.com/watch?v=XrKEtEzqZ7g
3. https://www.youtube.com/watch?v=9yaf5TFp-DE

Web References:

1. https://en.wikipedia.org/wiki/Constitution_of_India
2. https://www.india.gov.in/my-government/constitution-india
3. https://byjus.com/free-ias-prep/sources-of-indian-constitution/
4. https://academic.oup.com/past/advance-article/doi/10.1093/pastj/gtad009/7147824
5. https://www.vifindia.org/article/2017/august/03/indian-civilisation-and-the-constitution

MOOC/SWAYAM/NPTEL Courses:

1. https://archive.nptel.ac.in/noc/courses/noc20/SEM2/noc20-lw03/
2. https://archive.nptel.ac.in/courses/129106002/

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

SEMESTER VI

R19EE305	Power System Analysis and Stability	L	T	P	C
		3	1	0	4

1. Course Description:

Power System Analysis provides an in-depth exploration of the principles, methodologies, and tools employed in analyzing electric power systems. This course encompasses foundational topics such as load flow analysis, fault analysis, and transient stability analysis, essential for understanding power system behavior. Advanced concepts including voltage stability, reactive power control, and economic dispatch are thoroughly covered, emphasizing their significance in modern power systems. Practical applications are emphasized through hands-on exercises utilizing simulation software and real-world case studies, facilitating a comprehensive understanding of power system operations.

2. Course Objectives:

1. To understand the modeling and operation of power system.
2. To understand the Concepts of Power Flow analysis.
3. To understand the types of symmetrical Fault analysis.
4. To analyse the performance of types of symmetrical Fault analysis
5. To apply the Power System concept to analyse the stability of Stability.

3. Syllabus

Unit – I: Modeling of Power System

Need for System Analysis in Planning and Operation of Power System; Necessity of Modelling; Types of Modelling: Different Models for Generator, Load, and Transmission Line based on the analysis; Single Line Diagram; Per Phase Representation; Per Unit Representation; Primitive Network And its Matrices; Bus Incidence Matrix; Formation of Bus Admittance by Two Rule Method and Singular Transformation.

Unit – II: Power Flow Analysis

Problem definition; Bus classification; Derivation of power flow equation; Methods of Power flow analysis; Algorithm and flowchart for Gauss Seidel; Newton Raphson method; Computation of slack bus power; transmission loss and line flows; Comparison of power flow methods; Numerical solution of power flow problem by GS method not more than three buses.

Unit – III: Symmetrical Fault Analysis

Types of Faults; Consideration of pre-fault load current; Short circuit analysis of power system components: Synchronous Machine, Transmission Line; Short circuit current calculation using Thevenin's theorem and Bus Impedance Matrix; Short circuit capacity; Selection of circuit breakers.

Unit – IV: Unsymmetrical Fault Analysis

Symmetrical Components; Sequence Impedances; Sequence Network of power system components: Synchronous Machines, Transmission Line, Transformer and Loads; Single Line to Ground Fault; Line to line Fault; Double Line to Ground Fault ; Open Conductor Fault; Unsymmetrical fault analysis using bus impedance matrix; Indian Standards for Short Circuit analysis IS-13234.

Unit – V: Power System Stability Analysis

Steady state and transient stability; Swing equation; Modified Euler's method; Runge Kutta method (Qualitative analysis); Synchronous machine representation by Classical machine model power angle equation; Equal area criterion; Critical clearing angle and time.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Text Books:

1. Nagrath I.J. and Kothari D.P., "Modern Power System Analysis" , Tata McGraw Hill, New Delhi, 4th Edition, 2011.
2. Duncan J. Glover, Mulukutla S. Sarma and Thomas J. Overbye, "Power System Analysis and Desig", Thomas Learning, Fifth Edition, 2011.

References:

Reference Books:

1. Wadhwa C.L., "Electrical Power Systems", New Age International Publishers Pvt. Ltd., Sixth Edition, 2012.
3. John J. Grainger, William D. Stevenson, Gary W. Chang, "Power System Analysis", Tata McGraw Hill, New Delhi, 2016.
4. John J. Grainger and W.D. Stevenson, "Elements of Power System Analysis", Tata McGraw Hill, 2007.
5. Hadi Saadat, "Power System Analysis", Tata McGraw Hill, Third Edition, 2004.

Journals:

1. International Journal of Power System Analysis IJPSA
2. International Journal of Power Systems
3. International Journal of Electrical Power & Energy Systems

Video References:

1. https://www.youtube.com/watch?v=zNl6rToW
2. https://www.youtube.com/watch?v=ouhQPkOorgc
3. https://www.youtube.com/watch?v=PIvfgncUPXQ&t=1596s
4. https://www.youtube.com/watch?v=Z51mNqBOOnA
5. https://www.youtube.com/watch?v=qmCLSYKJ7og

MOOC / NPTEL / SWAYAM Courses:

1. https://archive.nptel.ac.in/courses/108/105/108105067/
2. https://archive.nptel.ac.in/courses/108/107/108107127/

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE305.1	Model electrical network parameters illustrate the power system network under healthy and faulty conditions.
R19EE305.2	Determine the power flow in a transmission network.
R19EE305.3	Devise a Power System model based on symmetrical components and estimate the maximum interrupting current during short circuit
R19EE305.4	Illustrate the transient behaviour of power system network under open circuit and short circuit conditions
R19EE305.5	Analyse the stability of the power system and maintaining a reliable electric power system

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE306	Solid State Drives	L	T	P	C
		3	0	0	3

1. Course Description:

The course aims to impart knowledge on steady state operation and transient dynamics of motor loads, analysis of converter/chopper fed DC drives, operation of AC motor drives, and design of current and speed controllers for closed loop solid state DC motor drives. This course is divided into five units covering drive characteristics, converter/chopper fed DC drives, induction motor drives, synchronous motor drives, and design of controllers for drives. The expected outcomes include the ability to understand solid state drives, select suitable drives for applications, and analyze and design components of closed loop solid state drives.

2. Course Objectives:

1. To understand steady state operation and transient dynamics of a motor load system.
2. To study and analyze the operation of the converter/chopper fed dc drive, both qualitatively and quantitatively.
3. To understand the operation and performance of Induction motor drives.
4. To understand the operation and performance of Synchronous motor drives.
5. To analyze and design the current and speed controllers for a closed loop solid state DC motor drive.

3. Syllabus

Unit – I: Drive Characteristics

Introduction to Electric drive; Equations governing motor load dynamics; Steady state stability of an Electrical drive; Multi quadrant Dynamics: acceleration, deceleration, starting & stopping; Typical load torque characteristics; Selection of motor.

Unit – II: Converter/Chopper fed DC Motor Drive

Steady state analysis of the single and three phase converter fed separately excited DC motor drive: continuous conduction; Time ratio and current limit control; 4 quadrant operation of converter / chopper fed drive; Applications.

Unit – III: Induction Motor Drives

Stator voltage control, V/F control, Rotor Resistance control; Qualitative treatment of slip power recovery drives; Closed loop control, Vector control; Applications.

Unit – IV: Synchronous Motor Drives

V/f control and self control of synchronous motor: Margin angle control and power factor control; Permanent Magnet Synchronous Machine; Three phase voltage/current source fed synchronous motor; Applications.

Unit – V: Design of Controllers for Drives

Transfer function for DC motor / load and converter; Closed loop control with Current and speed feedback; armature voltage control and field weakening mode; Design of controllers: current controller and speed controller; Converter selection and characteristics.

Text Books:

1. Gopal K. Dubey, "Fundamentals of Electrical Drives", Narosa Publishing House, Second Edition, 1992.
2. Krishnan R, "Electric Motor Drives: Modeling, Analysis and Control", Pearson, 2001.

References:

Reference Books:

1. Bimal K. Bose, "Modern Power Electronics and AC Drives", Pearson Education, 2002.
2. Vedam Subramanyam, "Electric Drives Concepts and Applications", McGraw Hill, Second Edition, 2016.
3. Shaahin Felizadeh, "Electric Machines and Drives: Principles, Control, Modeling and Simulation", CRC Press, 2013.
4. John Hindmarsh and Alasdain Renfrew, "Electrical Machines and Drives System", Elsevier 2012.
5. Theodore Wildi, "Electrical Machines, Drives and power systems", Pearson, Sixth Edition, 2015.
6. N.K.De., P.K. Sen, "Electric drives", PHI Pvt. Ltd., Ninth Edition, 2009.

Journals:

1. IEEE Transactions on Consumer Electronics
2. IEEE Transactions on Semiconductor Manufacturing
3. IEEE Transactions on Solid-State Circuits
4. Journal of Solid State Drives

Web Resources:

1. http://electrical4u.com/electrical-drives/
2. http://nptel.ac.in/courses/108102046/mod2/mod/p1.html
3. www.mathworks.in/help/physmod/.../simulating-a-dc-motor-drive.html
4. www.railway-technical.com/drives.shtml

MOOC / NPTEL / SWAYAM Course:

1. https://swayam.gov.in/explorer

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE306.1	Recognize the diverse categories of Electric drives and their distinguishing features.
R19EE306.2	Examine the functionality of converter/chopper-powered DC drives.
R19EE306.3	Illustrate the operation of the Induction motor drive.
R19EE306.4	Illustrate the operation of the synchronous motor drive
R19EE306.5	Demonstrate the current and speed control mechanisms utilized in a closed-loop solid-state DC motor drive.

R19EE307	Internet of Things for Electrical Engineers	L	T	P	C
		3	0	0	3

1. Course Description:

The Introduction to Internet of Things (IoT) course provides students with a comprehensive understanding of IoT concepts, technologies, and applications. Through a combination of theoretical lectures, hands-on experiments, and project-based learning, students will explore the fundamentals of IoT, including hardware, communication protocols, data processing, security, and real-world applications. By the end of the course,

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

students will be equipped with the knowledge and skills to design, develop, and deploy IoT solutions in various domains such as smart homes, healthcare, agriculture, and industrial automation.

2. Course Objectives:

1. To understand the fundamental concepts and principles of Internet of Things (IoT).
2. To familiarize with IoT hardware components, including microcontrollers, sensors, and actuators.
3. To explore different communication protocols used in IoT systems, such as MQTT, HTTP, and CoAP.
4. To learn data processing and analytics techniques for IoT data, including edge computing and cloud computing.
5. To apply IoT concepts and skills to design and implement real-world IoT applications in various domains.

3. Syllabus

Unit – I: Internet of Things an Overview

Definition and Evolution of IoT - Applications of IoT in various sectors (healthcare, agriculture, smart cities)-Key enabling technologies for IoT (sensors, actuators, communication protocols) - IoT ecosystem and its stakeholders (device manufacturers, cloud platforms, data analytics providers) -Security challenges and considerations in IoT

Unit – II: IoT Sensor and Actuators

Introduction to IoT hardware: Microcontrollers, development boards and sensor modules (temperature, humidity, motion, etc.)-Interfacing sensors with microcontrollers: Analog and digital sensors, communication protocols (I2C, SPI, UART), and sensor calibration - Data acquisition and signal conditioning techniques.

Unit – III: IoT Communication Protocols

Introduction to communication protocols for IoT (e.g., MQTT, CoAP, LoRaWAN) - Comparison of different communication protocols based on range, power consumption, and security - Network topologies for IoT applications (star, mesh, cellular) - Cloud connectivity for IoT devices

Unit – IV: IoT Data Management and Analytics

Data collection, storage, and processing techniques for IoT - Introduction to cloud platforms for IoT data management (brief overview) - Data visualization tools for IoT data analysis.

Unit – V: Case Study and IoT Application Development

Home Automation – Smart cities - Environment - Agriculture - Productivity Applications – Healthcare - Automotive/Vehicular IoT- Smart grid

Text Books:

1. ArshdeepBahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2014.
2. Vlasios Tsiatsis, Stamatis Karnouskos, Jan Holler, David Boyle, Catherine Mulligan, "Internet of Things: Technologies and Applications for a New Age of Intelligence", Academic Press, 2019.

References:

Reference Books:

1. Cuno Pfister, "Getting Started with the Internet of Things", O'Reilly Media Press, 2011
2. Jamil Y. Khan, Mehmet R. Yuce, "Internet of Things (IoT): Systems and Applications", Jenny Stanford Publishing, 2019

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Journal References:

1. IEEE Transactions on Power Electronics
2. IEEE Journal of Emerging and Selected Topics in Power Electronics
3. IET Power Electronics
4. PE Journal of Power Electronics
5. Electric Power Systems Research
6. International Journal of Electrical Power & Energy Systems

Web Resources:

1. https://www.researchgate.net/figure/IoT-device-management-with-NETCONF-YANG_fig4_307918031
2. https://www.arm.com/products/processors
3. https://docs.python.org/3/library/json.html
4. https://data-flair.training/blogs/iot-technology/
5. https://users.ece.cmu.edu/~koopman/des_s99/case_studies/index.html

MOOC / NPTEL / SWAYAM Course:

1. https://onlinecourses.nptel.ac.in/noc22_cs53/preview2.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE307.1	Explain the core concepts of IoT and its applications.
R19EE307.2	Identify different types of sensors and actuators used in IoT.
R19EE307.3	Understand the role of communication protocols in IoT.
R19EE307.4	Gain a basic understanding of data management and visualization for IoT.
R19EE307.5	Analyze the various IoT case studies to understand IoT applications.

R19AM303	Artificial Intelligence and Machine Learning	L	T	P	C
		3	0	0	3

1. Course Description:

This course offers a comprehensive exploration of the foundational principles and core concepts in Artificial Intelligence (AI). Beginning with an introduction to the history and applications of AI, the course progressively delves into intelligent agents, problem-solving, search algorithms, and extends to encompass knowledge representation and planning. Machine learning is a branch of artificial intelligence that enables systems to learn from data and improve their performance over time without being explicitly programmed. Students will gain a solid understanding of various machine learning algorithms, their theoretical underpinnings, and how to apply them both artificial intelligence and machine learning to real-world problems.

2. Course Objectives:

1. To study the structure of agents and the nature of environments
2. To learn the search algorithms of AI in different environments
3. To Learn and apply adversarial search techniques to solve problems in dynamic environments.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

4.	To understand the basic concepts of machine learning.
5.	To understand and build supervised and unsupervised learning models.

3. Syllabus:

Unit – I: Intelligent Agents

Introduction to artificial intelligence; Intelligent agents: agents & environment, concept of rationality, nature of environments, structure of agents.

Case Study: Autonomous Delivery Robots which interact with their surroundings and navigate through dynamic environments to deliver packages.

Unit – II: Problem Solving Agents

Uninformed search strategies, Heuristic search strategies, heuristic functions; Local search and optimization problems, local search in continuous space, search with nondeterministic actions, search in partially observable environments, online search agents and unknown environments.

Case Study: Autonomous vehicle Navigation in Unknown Environments

Unit – III: Game Playing and CSP

Adversarial search: Games, optimal decisions in games, alpha - beta pruning, stochastic games, partially observable games; Constraint satisfaction problems; constraint propagation, backtracking search for CSP, local search for CSP, structure of CSP Case Study: Artificial intelligence system plays chess to make optimal moves in a partially observable and dynamic environment.

Unit – IV: Supervised Learning

Machine Learning; Types of Machine Learning: Supervised Learning, Unsupervised Learning; Basic Concepts in Machine Learning ; Machine Learning Process; Weight Space; Testing Machine Learning Algorithms; A Brief Review of Probability Theory : Turning Data into Probabilities , The Bias-Variance Trade off. Linear Models for Regression; Linear Basis Function Models; The Bias-Variance Decomposition; Bayesian Linear Regression; Common Regression Algorithms: Simple Linear Regression, Multiple Linear Regression; Linear Models for Classification: Common Classification Algorithms: k-Nearest Neighbours, Decision Trees, Random Forest model, Support Vector Machines.

Unit – V: Unsupervised Learning

Mixture Models and EM; K-Means Clustering; Dirichlet Process Mixture Models; Spectral Clustering; Hierarchical Clustering; The Curse of Dimensionality; Dimensionality Reduction: Principal Component Analysis; Latent Variable Models(LVM): Latent Dirichlet Allocation (LDA). Reinforcement Learning, Representation Learning – Neural Networks – Active Learning – Ensemble Learning – Bootstrap Aggregation – Boosting – Gradient Boosting Machines.

Text Books:

1. Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", Fourth Edition, Pearson Education, 2020.
2. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.
3. Tom Mitchell, "Machine Learning", McGraw-Hill, 2017.

References:

Reference Books:

1. Deepak Khemani, "A First Course in Artificial Intelligence", McGraw Hill Education, New Delhi, 2017
2. Christopher Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.
3. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.

Video References:

1. https://www.youtube.com/watch?v=JxgmHe2NyeY
2. https://www.youtube.com/watch?v=z18nw4adsx4

Web References:

1. https://alex.smola.org/drafts/thebook.pdf
2. https://www.cin.ufpe.br/~cavmj/Machine%20-%20Learning%20%20Tom%20Mitchell.pdf

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19AM303.1	Implement a study of agents' structures and diverse environments in AI.
R19AM303.2	Apply various AI search algorithms for different environmental scenarios using the knowledge and skills acquired.
R19AM303.3	Implement a comprehensive study of adversarial search techniques and resolving constraint satisfaction problems in AI.
R19AM303.4	Apply logical and probabilistic inference mechanisms to improve decision-making in AI systems.
R19AM303.5	Analyze knowledge representation techniques and planning algorithms vital for Artificial Intelligence

R19EE313	Power Systems Laboratory	L	T	P	C
		0	0	2	1

1. Course Description:

The Power Systems Laboratory course offers students the opportunity to apply theoretical concepts learned in power systems courses to real-world scenarios. Through a series of laboratory experiments, students gain practical experience in the operation, analysis, and troubleshooting of power systems components and networks. The course covers a range of topics, including power generation, transmission, distribution and utilization.

2. Course Objectives:

1. Analyze the effects of parameters such as resistance, inductance, and capacitance on transmission line performance.
2. Develop skills in network modeling and analysis
3. Gain proficiency in power system analysis techniques
4. Apply the method to solve complex power flow problems in practical systems
5. Evaluate methods for enhancing system transient stability and preventing catastrophic failures.

3. Syllabus

List of Experiments:

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

1. Computation of Transmission Line Parameters
2. Formation of Bus Admittance and Impedance Matrices and Solution of Networks
3. Power Flow Analysis using Gauss-Seidel Method
4. Power Flow Analysis using Newton Raphson Method
5. Symmetric and unsymmetrical fault analysis
6. Transient stability analysis of SMIB System
7. Economic Dispatch in Power Systems
8. Load – Frequency Dynamics of Single- Area and Two-Area Power Systems
9. State estimation: Weighted least square estimation
10. Electromagnetic Transients in Power Systems: Transmission Line Energization

References:

1. Nagrath I.J. and Kothari D.P., "Modern Power System Analysis", Tata McGraw Hill, New Delhi, 4th Edition, 2011.
2. Duncan J. Glover, Mulukutla S. Sarma and Thomas J. Overbye, "Power System Analysis and Desig", Thomas Learning, 5th Edition, 2011.

Video References:

1. https://www.youtube.com/watch?v=zNl6rToW
2. https://www.youtube.com/watch?v=ouhQPkOorgc
3. https://www.youtube.com/watch?v=PIvfgncUPXQ&t=1596s
4. https://www.youtube.com/watch?v=Z51mNqBOOnA
5. https://www.youtube.com/watch?v=qmCLSYKJ7og

MOOC / NPTEL / SWAYAM Courses:

1. https://archive.nptel.ac.in/courses/108/105/108105067/
2. https://archive.nptel.ac.in/courses/108/107/108107127/

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE313.1	Prepare and Conduct experiments with collected data to comprehend the current state of the power system, including its strengths, weaknesses, and potential areas for improvement.
R19EE313.2	Understand how impedance matrices represent the network's response to electrical signals and the relationship between voltage and current at different nodes.
R19EE313.3	Analyze the convergence behavior of the Gauss-Seidel method under different conditions, such as varying load levels or network configurations.
R19EE313.4	Apply fault location algorithms to determine the precise location of faults within the power system based on measured currents and voltages.
R19EE313.5	Comprehend the significance of Economic Dispatch in ensuring the economic operation of power systems by optimizing generation schedules.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19AM312	Artificial Intelligence and Machine Learning Laboratory	L	T	P	C
		0	0	2	1

1. Course Description:

This course offers a comprehensive exploration of the foundational principles and core concepts in Artificial Intelligence (AI). Beginning with an introduction to the history and applications of AI, the course progressively delves into intelligent agents, problem-solving, and search algorithms, and extends to encompass knowledge representation and planning. Machine learning is a branch of artificial intelligence that enables systems to learn from data and improve their performance over time without being explicitly programmed. Students will gain a solid understanding of various machine learning algorithms, their theoretical underpinnings, and how to apply them both artificial intelligence and machine learning to real-world problems.

2. Course Objectives:

1. To study the structure of agents and the nature of environments
2. To learn the search algorithms of AI in different environments
3. To Learn and apply adversarial search techniques to solve problems in dynamic environments.
4. To understand the basic concepts of machine learning.
5. To understand and build supervised learning models.

3. List of Experiments:

1. Identify and discuss the distinctive features that set PROLOG apart as a declarative programming language. Break down the essential elements, delving into the role of facts, rules, and queries. Examine how these components work together to facilitate logical reasoning.
2. Imagine you are working on an AI system for an automated chessboard configuration. One of the challenges is placing four queens on a 4x4 chessboard in such a way that no two queens threaten each other. Provide the Prolog code and demonstrate the solution by showing the positions of the queens on the 4x4 grid.
3. Imagine a scenario in a computer game where a character needs to navigate through various cities to complete a quest. The goal is to design a Prolog program that solves the Traveling Salesman Problem for the character, finding the optimal route to visit each city exactly once and return to the starting point while minimizing the total distance traveled. The cities in the game are connected by different types of paths, each with its own associated cost.
4. Assume you are playing the Pac-Man game where the maze is represented as a grid with Pac-Man, ghosts, walls, and empty spaces. Implement Breadth-First Search (BFS) for Pac-Man navigation, considering the presence of ghosts as obstacles in the exploration process.
5. Imagine a Real-Time Strategy game (Age of Empires) where you command a battalion of futuristic units navigating a dynamic battlefield. The terrain is diverse, including open fields, mountains, and urban areas. Your mission is to implement the A* search algorithm for unit path finding, considering the real-time movements of enemy units and dynamically changing obstacles. Describe how you would model the game environment as a grid, incorporating varying traversal costs for different terrains. Discuss the heuristic function you would employ to guide unit movements, considering factors such as the proximity of enemies, defensive structures, and the goal of reaching specific objectives on the map.
6. Implement the Alpha-Beta Pruning algorithm to determine the best move for a player in a Tic-Tac-Toe game tree. The game tree must represent all possible moves and countermoves, creating an extensive search space.
7. Demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
8. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

9.	Implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
10.	Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Libraries can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
11.	Construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set.
12.	Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using K Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering.

References:

Reference Books:

1. Deepak Khemani, "A First Course in Artificial Intelligence", McGraw Hill Education, New Delhi, 2017
2. Christopher Bishop, "Pattern Recognition and Machine Learning", Springer, 2006. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.

Video References:

1. https://www.youtube.com/watch?v=JxgmHe2NyeY
2. https://www.youtube.com/watch?v=z18nw4adsx4

Web References:

1. https://alex.smola.org/drafts/thebook.pdf
2. https://www.cin.ufpe.br/~cavmj/Machine%20-%20Learning%20%20Tom%20Mitchell.pdf

MOOC/SWAYAM/NPTEL Courses:

1. Introduction to Machine learning- MIT OpenCourseWare
2. Essential Mathematics for Artificial Intelligence on edX

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19AM312.1	Implement a study of agents' structures and diverse environments in AI.
R19AM312.2	Apply various AI search algorithms for different environmental scenarios using the knowledge and skills acquired.
R19AM312.3	Implement a comprehensive study of adversarial search techniques and resolving constraint satisfaction problems in AI.
R19AM312.4	Apply logical and probabilistic inference mechanisms to improve decision-making in AI systems.
R19AM312.5	Analyze knowledge representation techniques and planning algorithms vital for Artificial Intelligence.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE381	Innovative / Multi-Disciplinary Project	L	T	P	C
		0	0	2	1

1. Course Description:

This course offers students the opportunity to design, develop, and implement innovative solutions that address real-world challenges through multidisciplinary projects. The projects emphasize creativity, problem-solving, and the integration of knowledge from electrical and electronics engineering with other disciplines such as Computer Science, Mechanical Engineering, Environmental Science, and more. Students will work towards creating sustainable and impactful engineering solutions which will reflect Sustainable Development Goals (SDG) and Technology Readiness Levels (TRL). This course will employ their innovative thinking process to develop projects that not only focus on technical innovation but also consider economic, environmental, and social factors.

2. Course Objectives:

1. To equip students with the skills needed to lead innovative projects that make an impact beyond the traditional boundaries of electrical and electronics engineering.
2. To define and solve complex, real-world problems using electrical and electronics engineering principles in collaboration with other disciplines.
3. To gain experience in managing multi-disciplinary projects from conceptualization to completion, with a focus on achieving SDGs.
4. To assess and improve the technology readiness level of projects, moving ideas from the concept phase to prototypes or market-ready solutions.

3. Guidelines:

The students in a group of 3 to 4 works on a topic approved by the head of the department under the guidance of a faculty member. They develop a project and prepare a comprehensive innovative/ multi-disciplinary project report after completing the work to the satisfaction of the supervisor.

- Evaluation of the progress of the project is based on a minimum of three reviews.
- The Head of the Department will constitute the review committee.
- A project report is required to appear for the semester end examination.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE381.1	Understand and integrate knowledge from various engineering and non-engineering fields to design and develop innovative electrical and electronics engineering projects.
R19EE381.2	Apply the design thinking process to generate creative solutions that address user needs, emphasizing empathy, ideation, prototyping, and testing.
R19EE381.3	Design projects that align with global sustainability goals by incorporating environmental, economic, and societal considerations.
R19EE381.4	Evaluate and increase the readiness level of technology solutions, moving projects from concept to prototype or deployment stages.
R19EE381.5	Construct functional prototypes of designed solutions, conducting rigorous testing and validation to ensure project feasibility and performance.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

VERTICAL 1 – EMBEDDED SYSTEMS AND AUTOMATION

R19EE511	Embedded Controllers and Applications	L	T	P	C
		3	0	0	3

1. Course Description:

Course is centered on crucial points and profound understanding of the AVR and ARM processors, counting its key highlights, instruction set, modes of operation and the fundamental standards of equipment and computer program plan, basic for today's building working environment.

2. Course Objectives:

1. To impart knowledge AVR microcontroller and its programming in C
2. To facilitate learning on programming of AVR microcontroller for interfacing it with other peripherals
3. To enable students to develop a comprehensive understanding of the ARM architecture
4. To provide knowledge on the ARM instruction set, enabling them to develop ALP
5. To explore thumb instruction set to write ALP to develop efficient embedded system applications.

3. Syllabus

Unit – I: AVR Microcontroller

Introduction to AVR Microcontroller - Features - Architectures - Pin configuration - Register and Memory Mapping - various addressing modes - Instruction set - AVR Programming in C

Unit – II: AVR Peripheral Interfacing

Programming AVR for Real world interfacing with LEDs - seven segment display - LCDs - Mechanical switches - keypads - Analog to Digital converter - Digital to Analog converter - DC motor - sensors - Applications

Unit – III: ARM Processor

ARM Embedded Systems Introduction - RISC design philosophy - ARM design philosophy - Embedded system hardware – AMBA bus protocol - ARM bus technology - Memory - Embedded system software – ARM Processor Fundamentals - ARM core dataflow model - registers - current program status register, Pipeline.

Unit – IV: ARM State

Introduction to the ARM Instruction set - Introduction, Data processing instructions - Load - Store instruction - Software interrupt instructions - Program status register instructions - Loading constants - Conditional Execution - ALP programming - Applications

Unit – V: ARM Thumb State

Introduction to the THUMB instruction set Introduction - THUMB register usage - ARM – THUMB interworking - Other branch instructions - Data processing instructions - Stack instructions - Software interrupt instructions - ALP programming - Applications

Text Books:

Chairman – Board of Studies

Chairman – Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202.

1. The AVR Microcontroller and Embedded Systems Using Assembly and C by Muhammed Ali Mazidi, Sarmad Naimi, Prentice Hall Publications, ISBN -13:978-0-13-800331-9.
2. ARM System Developer's guide –Andrew N. SLOSS, ELSEVIER Publications, ISBN 978-81-8147-646-3, 2016.

References:

Reference Books:

1. Jochen Steve Furber, "ARM System-on-Chip Architecture", Addison Wesley Trade Computer Publications, Second Edition, 2000.
2. Jonathan W. Valvano, "Embedded Microcomputer Systems: Real Time Interfacing", Cengage Learning, 2011.
3. ARM System-on-chip Architecture by Steve Furber, Pearson Education, ISBN978-81-317-0840-8, 2E,2012.

Journal Referencess:

1. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=8856
2. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=6287639
3. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=7782634
4. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=23

Web Resources:

1. https://techtrain.microchip.com/mu
2. https://mu.microchip.com/page/all-courses
3. https://www.arm.com/resources/education

MOOC / NPTEL / SWAYAM Courses:

1. https://archive.nptel.ac.in/courses/117/106/117106111/
2. https://onlinecourses.nptel.ac.in/noc22_ee12/preview

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE511.1	Explain the ARM registers, instruction pipeline, interrupts and architectures.
R19EE511.2	Outline the instructions, addressing modes and conditional instructions.
R19EE511.3	Describe the thumb instructions and software interrupt instructions.
R19EE511.4	Experiment with C programming to control ARM processors.
R19EE511.5	Discuss cache architecture, polices, flushing, MMU, page tables, translational, and access permissions.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641202.

R19EE512	Linux Architecture and Device Drivers	L	T	P	C
		3	0	0	3

1. Course Description:

Learn optimization strategies and combine drivers with hardware, making sure green operation and compatibility develop sensible abilities in practical writing and debugging block tool drivers for Linux systems.

2. Course Objectives:

1. To impart knowledge on the basic architecture of Linux OS
2. To provide students with essential knowledge of Linux device management to effectively develop and troubleshoot device drivers and manage system resources.
3. To share the insights on Linux boot process and to understand the interaction between kernel and user space
4. To enlighten the students with the ability to effectively manage and monitor system processes, resources, and user activities in a Unix/Linux environment.
5. To equip students with the foundational knowledge needed to understand and develop Linux device drivers

3. Syllabus

Unit – I: Linux Basic Architecture

Levels and Layers of Abstraction in a Linux System – Hardware – Kernel: Process Management, Memory Management, Device Drivers and Management, System Calls and Support – User Space – Shell Commands

Unit – II: Devices, Disks and File Systems

Device Files – Device Path – Device Name Summary – udev – SCSI and Linux Kernel – Partitioning Disk Devices – Filesystems – Swap Space

Unit – III: Kernel Space and User Space

Linux Kernel Boots: Startup messages – Kernel initialization and Boot options – Kernel Tentative Parameters – Bootloaders – GRUB – UEFI – Chainloading other operating systems – How the User space starts: Introduction to Init – System V Runlevels – system – Upstart – System V init – Shutting down the System – Initial RAM Filesystem – Emergency booting and Single-User modeling

Unit – IV: System Configuration, Process and Resource Utilization

Structure of etc – System Logging – User Management Files – Time – Scheduling Tasks with cron and at – Identification and Authentication – Process and Resource Utilization: Tracking Processes – lsof – Tracing Program Execution and System Calls – Threads – Measuring CPU Time – Adjusting Process Priorities – Load Averages – Memory – I/0 Monitoring

Unit – V: Overview of System Booting, I/O Architecture and Device Drivers in Linux

System startup (Booting) Methods - PC I/O architecture – classification of Linux devices: character and block devices – port I/O – PCI and ISA bus – polling, interrupt, and waiting queue – Device Files - Device driver Registration – Device driver initialization – I/O operation - typical Linux driver – dynamic and static drivers - kernel modules – Linking and unlinking of modules – On Demand modules linking.

Text Books:

1. Brian Ward, How Linux Works – what every superuser should know, Second edition, starch press, 2015.
2. Michael Beck, Harald bohme, Mirko dziadzka, Ulrich Kunitz "Linux Kernel Programming & quot ;, Pearson Education, Reprint 2009.

References:

Reference Books:

1. Robert Love "LINUX System Programming" Shroff publishers & distributors Pvt Ltd,2013.
2. JTim jones M. "GNU/Linux Application Programming", Wiley Dreamtech India Pvt. Ltd, New Delhi, 2008.
3. Raghavan P., Amol Lad, Sriram Neelakandan "Embedded Linux System Design and Development", Tailor & Francis Group, reprint 2019.

Journal References:

1. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=5288519
2. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=23

Web Resources:

1. https://training.linuxfoundation.org/resources/free-courses/
2. https://training.linuxfoundation.org/resources/free-courses/

MOOC / NPTEL / SWAYAM Courses:

1. https://nptel.ac.in/courses/117106113
2. https://archive.nptel.ac.in/courses/117/106/117106113

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE512.1	Interpret an overall view of the structure of Linux and make use of commands to access the different devices.
R19EE512.2	Analyze various memory management techniques, scheduling and used to demonstrate file system, Allocation Methods and Free space management.
R19EE512.3	Work with kernel and user spaces in the Linux environment to automate tasks using scheduling tools.
R19EE512.4	Configure devices and files based on the specific need for Acquire Linux Administration skills to manage resource utilization.
R19EE512.5	Understand cross tooling environments and be exposed to development of device drivers for a target hardware.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore-641 202.

R19EE513	Embedded Networked Systems	L	T	P	C
		3	0	0	3

1. Course Description:

Understand the Embedded Communication Protocols and Gain a solid understanding of networking protocols and architectures specifically tailored for embedded systems. They also develop a network based totally on Embedded structures and Interfaces the hardware and understand how to makes use of the buses.

2. Course Objectives:

1. To educate on the different Communication Protocols available for embedded systems.
2. To impart knowledge on USB and CAN bus protocols to design and troubleshoot embedded systems.
3. To deliver information on Ethernet basics to design and optimize Ethernet networks.
4. To equip students with the knowledge to implement network communication, secure data exchange and web-based interfaces in embedded systems.
5. To explore wireless embedded networking to design, implement, and optimize energy-efficient, robust wireless communication systems for diverse applications

3. Syllabus

Unit – I: Embedded Communication Protocols

Introduction, Serial/Parallel communication: Serial communication protocols - RS232 standard – RS485, – Synchronous Serial Protocols: Serial Peripheral Interface (SPI), Inter Integrated Circuits (I2C), PC Parallel port programming, ISA/PCI Bus protocols, Fire wire.

Unit – II: USB and CAN Bus

USB bus: Introduction – Speed Identification on the bus – USB States, USB bus communication: Packets –Data flow types, A simple application with USB: Inkjet printer, CAN Bus: Introduction - Frames –Bit stuffing –Types of errors –Nominal Bit Timing – CAN Interface –A simple application with CAN: Telephone exchange.

Unit – III: Ethernet Basics

Elements of a network – Inside Ethernet – Building a Network: Hardware options – Cables, Connections and network speed – Design choices: Selecting components –Ethernet Controllers – Using the internet in local and internet communications – Inside the Internet protocol.

Unit – IV: Embedded Ethernet

Exchanging messages using UDP and TCP, serving web pages with Dynamic Data, serving web pages that respond to user Input, Email for Embedded Systems, Using FTP, Keeping Devices and Network secure.

Unit – V: Wireless Embedded Networking

Wireless sensor networks: Introduction – Applications – Network Topology – Localization – Time Synchronization, Energy efficient MAC protocols: SMAC, Energy efficient and robust routing, Data Centric routing.

Text Books:

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

1. Raj Kamal, "Embedded Systems: Architecture, Programming and Design", McGraw Hill, Third Edition, 2017.
2. Jan Axelson, "Embedded Ethernet and Internet Complete: Designing and Programming Small Devices for Networking", Lakeview Research, First Edition, 2003

References:

Reference Books:

1. JRichard Zurawski, "Embedded Systems Handbook: Networked Embedded Systems (Industrial Information Technology)", CRC Press, Second Edition, 2017.
2. Embedded Ethernet and Internet Complete - Jan Axelson, Penram publications, 2003
3. Networking Wireless Sensors - Bhaskar Krishnamachari , Cambridge press 2005.

Journal References:

1. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=8253410
2. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=69

Web Resources:

1. https://www.classcentral.com/course/youtube-fun-and-easy-microcontroller-communication-protocols-94487
2. https://www.theiotacademy.co/blog/communication-protocols-in-embedded-systems/
3. https://developer.arm.com/Architectures/AMBA

MOOC / NPTEL / SWAYAM Courses:

1. https://onlinecourses.nptel.ac.in/noc24_cs33/preview
2. https://archive.nptel.ac.in/courses/108/102/108102045/

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE513.1	Explain the serial and parallel communication protocol related to embedded networking.
R19EE513.2	Explain CAN and USB network protocols
R19EE513.3	Illustrate the concepts of Ethernet communication.
R19EE513.4	Outline different network topologies.
R19EE513.5	Utilize the wireless protocols in Real world interfacing.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE514	Embedded and Real-Time Systems	L	T	P	C
		3	0	0	3

1. Course Description:

Explore embedded real-time systems with an emphasis on hardware and software component design, development, and optimization for applications needing timely responses and deterministic behavior. Through practical projects and simulations, students will become deeply acquainted with the fundamentals of real-time operating systems (RTOS), task scheduling algorithms, hardware interfacing techniques, and realistic implementation strategies.

2. Course Objectives:

1. To develop the ability to distinguish between hard, firm, and soft real-time systems as well as comprehend the effects of each on system design.
2. To discover the principles and operations of RTOS, which involve managing tasks, implementing scheduling algorithms.
3. To understand inter-task communication to efficiently handle real-time constraints.
4. To learn exploring techniques for managing and assessing real-time constraints such as latency, jitter, and throughput to improve the overall performance of the system.
5. To learn designing, implementation, and testing of embedded real-time systems, of diverse components and protocols to address real-world challenges and showcase practical expertise

3. Syllabus

Unit – I: Programming Language and Tools

Fundamentals of Embedded Systems – Embedded Software Development Process: Programming Languages - Embedded C Building Blocks – Mixing of Assembly and C – Preprocessor - Compiler – Assembler - Linker and Loader - Cross Platform Development -Compiler Optimization Techniques – Executable File Formats-Concept of Make Utility - Super Loop based Design Approach.

Unit – II: Real-Time Operating Systems

Basic Terminologies of Real-Time Embedded Systems – Concepts of OS-based Software Development – Real-Time Operating Systems: Definition, Characteristics and Structure – Task Management: Definition, Classification, Structure, States, and Scheduling – Concept of Pseudo Multitasking and True Multitasking.

Unit – III: Inter-Task Synchronization and Communication

Critical Sections – Atomic Operation – Concept of Reentrancy – Semaphores – Event Flag Registers - Inter-task Communication Methods: Shared Memory Technique, Mailbox, Message Queues, and Pipes – Common Design Problems: Premature Task Deletion, CPU Starvation, Deadlocks, and Unbounded Priority Inversion.

Unit – IV: Interrupt Management, I/O Subsystems and Memory Management

Exceptions and Interrupts – Processing of Exceptions and Interrupts – I/O Subsystems – Memory Management – Dynamic Memory Allocation and Fixed-size Memory Allocation in Embedded Systems - Application Modularization for Concurrency: Outside-In Approach – UML Diagrams-Design Examples

Unit – V: Embedded System Application Development

Objective, Need, different Phases & Modelling of the EDLC.choice of Target Architectures for Embedded Application Development-for Control Dominated-Data Dominated Systems-Case studies on Digital Camera, Adaptive Cruise control in a Car, Mobile Phone software for key inputs.
Text Books:
1. Qing Li, "Real-Time Concepts for Embedded Systems", CMP Books, 2003. 2. Insup Lee, Joseph Leung, and Sang Son, "Handbook of Real-Time Systems", Chapman and Hall, 2008.
References:
Reference Books: 1. David E. Simon, "An Embedded Software Primer", Pearson, 2002. 2. Tammy Noergaard, "Embedded System Architecture, A comprehensive Guide for Engineers and Programmers", Elsevier, 2006. 3. Albert Cheng, "Real-Time Systems: Scheduling, Analysis and Verification", Wiley Interscience, 2002. **Journal References:** 1. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=13 2. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=9424 **Web Resources:** 1. https://www.state-machine.com/embedded-programming-video-course-teaches-rtos 2. https://www.doulos.com/training/arm-and-embedded-software/rtos/freertos-real-time-programming/ **MOOC / NPTEL / SWAYAM Courses:** 1. https://onlinecourses.nptel.ac.in/noc20_cs16/preview 2. https://www.arm.com/resources/education/online-courses/real-time-operating-systems

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE514.1	Categorize Embedded Technology and tools to examine real world design constraints
R19EE514.2	Summarize the basics and importance of RTOS and list the use of Databases scheduling, scheduling algorithms in real-time systems.
R19EE514.3	Make use of appropriate protocols for various applications to build embedded applications in real time scenarios.
R19EE514.4	Understand the functionalities of various management technologies. To apply and design small embedded systems using RTOS.
R19EE514.5	Comprehend and ability to use tools and foster ability to understand the role of RTOS in industry.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE515	PLC and SCADA	L	T	P	C
		3	0	0	3

1. Course Description:

The course aims to provide a comprehensive understanding of PLCs in industrial automation, covering their history, architecture, and capabilities. Students will learn PLC programming, including ladder logic and GX Works 2 software. The course includes HMI programming, interfacing PLCs with HMIs, and real-time problem-solving. Additionally, it covers Variable Frequency Drives (VFDs) and their configuration. Finally, the course introduces SCADA systems, focusing on architecture and communication protocols.

2. Course Objectives:

1. To provide the knowledge about the selection of PLC for different applications.
2. To enable the students to develop the ladder logic program for different industrial applications.
3. To provide the knowledge on configuration of GOT and its various functions in industrial automation.
4. To acquire the knowledge about programming of variable frequency drives for induction motor speed control applications.
5. To design and develop the SCADA system for totally integrated automation.

3. Syllabus

Unit – I: Introduction To PLC

History and developments in industrial automation; Control elements in industrial automation; Introduction: Basics of PLC, Advantages, Capabilities of PLC, Architecture of PLC, Scan cycle and Types of PLC; Types of sensors and I/O devices; Types of I/O modules; Configuring a PLC.

Unit – II: Programming Of PLC

Types of Programming: Ladder Programming; Creating programs using GX Works 2: Configuration of modular PLC and different modules in GX Works 2 platform; Process Control Programs using Relay Ladder Logic; PLC arithmetic functions; Timers and counters; Data transfer, Comparison and Manipulation instructions.

Unit – III: HMI Programming and Interfacing

Necessity and Role in Industrial Automation; New project creation using GT Designer: Text display, various screen and object creation; Interfacing PLC to HMI; Developing solutions for real time problems.

Unit – IV: Variable Frequency Drives

Introduction to VFD: Basic v/f concept, Power wiring and Control wiring. Configuration of VFD: Parameter setting; JOG operation; Buffer Memory; Speed Control of Induction Motor.

Unit – V: SCADA

Overview: Developer and runtime packages , Architecture, Tools and Tag; Internal & External graphics; Communication Protocols of SCADA.

Text Books:

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

1.	Bolton W, "Programmable Logic Controllers", Elsevier, 2015.

References:

Reference Books:

1. Frank D Petruzella, "Programmable logic controllers", McGraw Hill, 2016.
2. John R Hackworth and Fredrick D Hackworth Jr., "Programmable Logic Controllers: Programming Methods and Applications", Pearson Education, 2006.
3. Mitsubishi Electric India PLC, SCADA, SERVO, VFD & ROBOTICS Programming Manuals.

Journal References:

1. IEEE Transactions on Industrial Electronics
2. Journal of Manufacturing Systems
3. International Journal of Automation and Control (IJAAC)
4. Control Engineering Practice
5. Journal of Process Control

Web Resources:

1. https://www.plcacademy.com/
2. https://www.automationdirect.com/programmable-logic-controllers/plc-training
3. https://www.mitsubishielectric.com/fa/products/cnt/plc/
4. https://www.youtube.com/@realpars
5. https://www.youtube.com/watch?v=gexOS7imMsE

MOOC / NPTEL / SWAYAM Courses:

1. https://onlinecourses.nptel.ac.in/noc20_me39/preview
2. https://www.eit.edu.au/courses/professional-certificate-of-competency-programmable-logic-controllers-plcs-scada-systems/

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE515.1	Realize the architecture of PLC and different types of I/O devices
R19EE515.2	Design the HMI screens and I/O functions for the project development
R19EE515.3	Configure the Variable Frequency Drives for the speed control of Induction Motor
R19EE515.4	Develop the program for different Pick and Place Applications using Industrial Robot
R19EE515.5	Control the PLC, HMI from remote station using SCADA

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE516	Sensors and Automation	L	T	P	C
		3	0	0	3

1. Course Description:

This course explores the fundamental principles and practical applications of sensors and automation in various engineering fields. It provides students with a comprehensive understanding of sensor technologies, their design, integration with automated systems, and their role in modern industrial processes and everyday life.

2. Course Objectives:

1. To learn techniques for calibrating sensors
2. To study about various motion, Proximity And Ranging Sensors
3. To understand various Force, Magnetic And Heading Sensors
4. To understand PLC controller for automation
5. To study the DCS

3. Syllabus

Unit – I: Functional Descriptions of Measuring Instruments

Functional elements of an instrument – Measurement Errors: Gross errors and systematic errors, Absolute and relative errors - I/O configuration of measuring instruments – Static characteristics: Meaning of static calibration, accuracy, precision and bias, Static sensitivity, linearity, threshold, resolution, hysteresis and dead space, Scale readability, Span, generalized static stiffness and input impedance - Basics of Dynamic characteristics - Inertia Measurement Unit.

Unit – II: Motion, Proximity and Ranging Sensors

Motion Sensors – Potentiometers, Resolver, Encoders – Optical, Magnetic, Inductive, Capacitive, LVDT – RVDT – Synchro – Microsyn, Accelerometer – GPS, Bluetooth, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR)

Unit – III: Force, Magnetic And Heading Sensors

Strain Gage, Load Cell, Magnetic Sensors -types, principle, requirement and advantages: Magneto resistive – Hall Effect – Current sensor Heading Sensors – Compass, Gyroscope, Inclinometers.

Unit – IV: PLC Controller for Automation

Actuators: Pneumatic cylinder, Relay, solenoid (Final Control Element), Converter (I to P). PLC: PLC architecture, PLC operation, Addressing modes of PLC, Languages used in PLC Programming, Instructions used in Ladder programming, Programming examples of different processes

Unit – V: Distributed Control System

Overview of DCS, DCS software configuration, DCS communication, DCS Supervisory Computer Tasks, DCS integration with PLC and Computers, Features of DCS, Advantages of DCS.

Text Books:

1. Sawney A K and Puneet Sawney, A Course in Mechanical Measurements and Instrumentation and Control, 12th edition, Dhanpat Rai and Co, New Delhi, 2013
2. S. Mukhopadhyay, S.Sen and A.K. Deb, Industrial Instrumentation, Control and Automation Jaico Publishing House, 2019.

References:

Reference Books:

1. Hans Kurt Tonshoff (Editor), Ichiro, Sensors in Manufacturing Volume 1, Wiley-VCH April 2001.
2. Patranabis D, Sensors and Transducers, 2nd Edition, PHI, New Delhi, 2011
3. John W Webb and Ronald A Reis , "Programmable logic controllers: Principles and Applications", Prentice Hall India, 2011.
4. S.K. Singh, Industrial Instrumentation and Control,The McGraw Hill Companies, 2013

Journal References:

1. IEEE Transactions on Automation Science and Engineering
2. IEEE Sensors Journal
3. Automation in Construction

Web Resources:

1. https://www.mrosupply.com/blog/sensors-used-in-industrial-automation/
2. https://www.plantautomation-technology.com/articles/types-of-sensors-used-in-industrial-automation
3. https://www.electronicsforu.com/technology-trends/sensors-industrial-automation-choice-make

MOOC / NPTEL / SWAYAM Courses:

1. https://archive.nptel.ac.in/courses/108/105/108105062/

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE516.1	Understand the principle of operation of different sensors and their applications
R19EE516.2	Understand the basic concepts of Intelligent controllers.
R19EE516.3	Evaluate the performance of a Automation system
R19EE516.4	Design an intelligent system for industrial automation
R19EE516.5	Design and develop automatic control system using DCS.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE517	Principles of Robotics	L	T	P	C
		3	0	0	3

1. Course Description:

Students gain an in-depth exploration of the fundamental concepts, theories, and applications in robotics. Topics ranging from robot kinematics and dynamics to perception, control, and ethical considerations in robotic design and deployment

2. Course Objectives:

1. To gain a comprehensive understanding of the core principles of robotics, the different categories and classifications of robots, and to analyze components such as sensors, actuators, and control systems.
2. To understand the basics of kinematics and dynamics in robotic systems.
3. To learn how to find and calculate the position, speed, and acceleration of robotic arms.
4. To understand how to use these algorithms so robots can move around well, steer clear of obstacles, and get to their goals quickly.
5. To learn creating, constructing, and coding robots to carry out tasks, addressing real-world problems.

3. Syllabus

Unit – I: Basic Concepts

Brief history-Types of Robot–Technology-Robot classifications and specifications-Design and control issues- Various manipulators – Sensors - work cell - Programming languages.

Unit – II: Direct and Inverse Kinematics

Mathematical representation of Robots - Position and orientation – Homogeneous transformation-Various joints- Representation using the Denavit Hattenberg parameters -Degrees of freedom-Direct kinematics-Inverse kinematics- SCARA robots- Solvability – Solution methods-Closed form solution.

Unit – III: Manipulator Differential Motion and Statics

Linear and angular velocities-Manipulator Jacobian-Prismatic and rotary joints–Inverse -Wrist and arm singularity - Static analysis - Force and moment Balance.

Unit – IV: Path Planning

Definition-Joint space technique-Use of p-degree polynomial-Cubic polynomial-Cartesian space technique - Parametric descriptions - Straight line and circular paths - Position and orientation planning.

Unit – V: Dynamics and Control

Lagrangian mechanics-2DOF Manipulator-Lagrange Euler formulation-Dynamic model – Manipulator control problem-Linear control schemes-PID control scheme-Force control of robotic manipulator.

Text Books:

1. R.K.Mittal and I.J.Nagrath, Robotics and Control, Tata McGraw Hill, New Delhi,4th Reprint, 2005.

Chairman – Board of Studies

2.	JohnJ.Craig ,Introduction to Robotics Mechanics and Control, Third edition, Pearson Education, 2009.

References:

Reference Books:

1. M.P.Groover, M.Weiss, R.N. Nageland N. G.Odrej, Industrial Robotics, McGraw-Hill Singapore, 1996.
2. Ashitava Ghoshal, Robotics-Fundamental Concepts and Analysis', Oxford University Press, Sixth impression, 2010.
3. R.D.Klafter,T.A.Chimielewski and M.Negin, Robotic Engineering–An Integrated Approach, Prentice Hall of India, New Delhi, 1994.

Journal References:

1. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=13
2. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=9424

Web Resources:

1. https://www.mygreatlearning.com/academy/learn-for-free/courses/robotics-and-ai
2. https://www.futurelearn.com/subjects/it-and-computer-science-courses/ai-and-robotics

MOOC / NPTEL / SWAYAM Courses:

1. https://onlinecourses.nptel.ac.in/noc21_me76/preview
2. https://onlinecourses.nptel.ac.in/noc24_me117/preview

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE517.1	Illustrate the functional elements of robotics and analyze instrumentation systems and their applications to various
R19EE517.2	Summarize knowledge on the direct and inverse kinematics to examine about the differential motion and statics in robotics
R19EE517.3	Construct the manipulator differential motion and control to select various path finding techniques.
R19EE517.4	Outline on various path planning techniques and Inspect on design in robotics and the industrial application.
R19EE517.5	Examine dynamics and control of manipulators examine the need and use of robotic automation.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

VERTICAL 2 – ELECTRIC VEHICLE TECHNOLOGY

R19EE521	Electric Vehicle Architecture and Technology	L	T	P	C
		3	0	0	3

1. Course Description:

This comprehensive course, Electric Vehicle Architecture and Technology explores the core principles and advanced technologies behind EV architecture and systems, empowering you for a deep understanding of this sustainable transportation revolution. It delves into the core principles and cutting-edge technologies of electric vehicle architecture and systems.

2. Course Objectives:

1. To understand the fundamental principles of vehicle mechanics and their application to electric vehicles.
2. To acquire knowledge about the architecture and sizing of electric vehicles.
3. To develop a comprehensive understanding of electric vehicle power components and braking systems
4. To gain proficiency in hybrid vehicle control strategies.
5. To acquire knowledge about plug-in hybrid electric vehicles.

3. Syllabus

Unit – I: Mechanics Of Vehicles

Vehicle mechanics- Roadway fundamentals, Laws of motion, Vehicle Kinetics, Dynamics of vehicle motion, propulsion power, velocity and acceleration, Tire –Road mechanics, Propulsion System Design.

Unit – II: EV Architecture And Sizing

Electric Vehicle History, and Evolution of Electric Vehicles. Series, Parallel and Series parallel Architecture, Micro and Mild architectures. Mountain Bike - Motorcycle- Electric Cars and Heavy Duty EVs. -Details and Specifications.

Unit – III: Power Components and Brakes

Power train Component sizing- Gears, Clutches, Differential, Transmission and Vehicle Brakes. EV power train sizing, HEV Powertrain sizing, Types of Motors, Motor Controllers, Example.

Unit – IV: Hybrid Vehicle Control Strategy

Vehicle supervisory controller, Mode selection strategy, Modal Control strategies, Mode of Power, Software based High Level Supervisory Control, Energy Management System in EV's.

Unit – V: Plug-in Hybrid Electric Vehicle

Introduction-History-Comparison with electrical and hybrid electrical vehicle-Construction and working of PHEV-Block diagram and components-Charging mechanisms-Advantages of PHEVs.

Text Books:

1. MehrdadEhsani, YiminGao, Sebastian E. Gay, Ali Emadi, 'Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design', CRC Press, 2004.

2. Build Your Own Electric Vehicle,SethLeitman , Bob Brant, McGraw Hill, Third Edition 2013.

References:

Reference Books:

1. Advanced Electric Drive Vehicles, Ali Emadi, CRC Press, First edition 2017.
2. The Electric Vehicle Conversion Handbook: How to Convert Cars, Trucks, Motorcycles, and Bicycles -- Includes EV Components, Kits, and Project Vehicles Mark Warner, HP Books, 2011.
3. Heavy-duty Electric Vehicles from Concept to Reality, Shashank Arora,AlirezaTashakoriAbkenar, ShanthaGaminiJayasinghe, Kari Tammi, Elsevier Science, 2021.
4. Electric Vehicles Modern Technologies and Trends, Nil Patel, Akash Kumar Bhoi, SanjeevikumarPadmanaban, Jens Bo Holm-Nielsen Springer, 2020.
5. Hybrid Electric Vehicles: A Review of Existing Configurations and Thermodynamic Cycles, Rogelio León , Christian Montaleza , José Luis Maldonado , MarCOsTostado-Véliz and Francisco Jurado, Thermo, 2021, 1, 134–150. https://doi.org/10.3390/thermo1020010.

Journal References:

1. World Electric Vehicle Journal (WEVJ)
2. SAE International Journal of Electrified Vehicles
3. International Journal of Electric and Hybrid Vehicles (IJEHV)

Web Resources:

1. https://www.sae.org/
2. https://ocw.mit.edu/
3. https://www.fueleconomy.gov/feg/evtech.shtml
4. https://www.nrel.gov/news/program/2023/nrel-research-finds-the-right-tempo-for-national-electric-vehicle-grid-planning.html
5. https://www.eere.energy.gov/education/pdfs/acts_depew_hybridvehicles_314.pdf

MOOC / NPTEL / SWAYAM Courses:

1. https://onlinecourses.swayam2.ac.in/ntr24_ed54/preview
2. https://onlinecourses.swayam2.ac.in/nou24_ec10/preview

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE521.1	Summarize the History and Evolution of EVs, Hybrid and Plug-In Hybrid EVs to understand the basic application.
R19EE521.2	Describe the various EV components for enriching design aspects.
R19EE521.3	Describe the concepts related in the Plug-In Hybrid Electric Vehicles to emulate working operations.
R19EE521.4	Illustrate the details and Specifications of various supervisory hierarchy to understand various control strategies employed in EC's.
R19EE521.5	Summarizing the concept of Electric Vehicles to enhance knowledge on its working.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE522	Design of Motor and Power Converters for Electric Vehicles	L	T	P	C
		3	0	0	3

1. Course Description:

This comprehensive course emerges deep into the design principles of electric motors and power converters, the critical components at the heart of EV propulsion. Through a blend of foundational theory and cutting-edge engineering practices, you'll gain the knowledge to optimize these systems for efficiency, performance, and range, propelling you forward in the electric transportation revolution.

2. Course Objectives:

1. To understand the fundamentals of electric vehicles and their components.
2. To develop a strong foundation in vehicle dynamics for electric vehicles.
3. To acquire knowledge of electric motor design principles.
4. To gain proficiency in electric motor design and control for electric vehicles.
5. To develop expertise in power converter topologies for electric vehicle applications.

3. Syllabus

Unit – I: Introduction to Electric Vehicles

Electric Vehicles-Configuration of an EV-Hybrid EV-Energy Sources- Motors used-Charging Systems-Power Conversion Techniques-Effects of EVs-Barriers to EV adoption-Control Algorithms-Trends and Future development.

Unit – II: Vehicle Dynamics

Longitudinal Vehicle dynamics: Aerodynamic drag force, Rolling resistance, Longitudinal Traction force, Grade-Acceleration performance and Vehicle Power: Final Drive, Speed calculation with Torque Profile- Driving Cycle: Mechanical power Calculation, Electrical Power Calculation, Motor and Inverter loss calculation, Efficiency over driving cycle.

Unit – III: Basics of Motor Design

Winding Methods-MMF with slot openings-Fractional slot machines-Demagnetization analysis-Torque Analysis-Reluctance Motor-Motor types depending on PM arrangements.

Unit – IV: EV Motor Design and Control

Requirements of EV-PMSM design for EV- PMSM design for EV based on FEA-Finite Element Analysis-PMSM Fabrication-PMSM control in practice. .

Unit – V: Converter Topologies for EVApplications

Bidirectional converter topologies for Plug-In-Electric Vehicles: Plug-In charging mode, Propulsion mode- Bidirectional Battery charger for EV- Bidirectional dual active converter for Vehicle to Grid-Direct conversion of an AC-DC converter for Plug-In Hybrid Vehicles.

Text Books:

1. AC Motor Control and Electrical Vehicle Applications- KwangHee Nam- CRC Press- ISBN: 9781351778183, 1351778188- Published: 3 September 2018.
2. Power Converters for Electric Vehicles- L. Ashok Kumar, S. Albert Alexander · 2020, CRC Press, ISBN: 9781000337518, 1000337510.

Chairman – Board of Studies

Chairman – Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

References:
Reference Books: 1. Iqbal Hussain, Electric and Hybrid Vehicles: Design Fundamentals, Second Edition CRC Press, Taylor & Francis Group, Third Edition 2021. 2. Emerging Power Converters for Renewable Energy and Electric Vehicles Modeling, Design, and Control, Md. RabiulIslam,Md.Rakibuzzaman Shah, Mohd. Hasan Ali, CRC Press, 2021, 1st Edition. 3. Power Electronic Converters, TeuvoSuntio, TuomasMesso, JoonasPuukko, First Edition 2017. 4. Handbook of Automotive Power Electronics and Motor Drives, Ali Emadi, Taylor & Francis, 2005,1st Edition. **Journal References:** 1. IEEE Transactions on Transportation Electrification (IT-TE) 2. IEEE Transactions on Industrial Electronics (TIE) 3. Electric Vehicle Technology (EVT) 4. IET Electric Power Applications (EPA) **Web Resources:** 1. https://www.fueleconomy.gov/feg/evtech.shtml 2. https://ieeexplore.ieee.org/Xplore/home.jsp **MOOC / NPTEL / SWAYAM Courses:** 1. https://onlinecourses.swayam2.ac.in/ntr24_ed54/preview 2. https://onlinecourses.swayam2.ac.in/nou24_ec10/preview

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE522.1	To understand Electric Vehicle configuration, charging systems, Conversion techniques, EV barriers and future trends.
R19EE522.2	To use appropriate vehicle dynamics for electric vehicle application.
R19EE522.3	To familiarize Electric Vehicle Motor basics.
R19EE522.4	To design Electric Vehicle Motor using PMSM and learn the control techniques.
R19EE522.5	To compute converter topologies for EV applications.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE523	Power Management for Electric Vehicles	L	T	P	C
		3	0	0	3

1. Course Description:

This course delves into the critical aspects of managing power systems in electric vehicles (EVs). It covers essential topics related to energy storage, conversion, distribution, and optimization within the context of electric mobility. Students will gain insights into the technological advancements, challenges, and strategies associated with power management in EVs.

2. Course Objectives:

1. To make the students to understand the concept of electrical vehicles
2. To understand the architecture of EV's
3. To study the various Electric Propulsion Unit
4. To understand energy storage requirements
5. To study alternative Energy Storage Systems

3. Syllabus

Unit – I: Introduction

Comparisons of EV with internal combustion Engine vehicles- Fundamentals of vehicle mechanics - Basic concept of electric traction: Introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis.

Unit – II: Architecture of EV'S and Power Train Components

Architecture of EV's and HEV's – Power train components and sizing, Gears, Clutches, Transmission and Brakes- Fundamentals of regenerative braking.

Unit – III: Electric Propulsion Unit

Introduction to electric components used in hybrid and electric vehicles - Configuration and control of Induction Motor drives – PMSM drives – BLDC motor drives.

Unit – IV: Battery Based Energy Storage System

Introduction to Energy Storage Requirements in and Electric Vehicles – Battery Basics, Different types, Battery Parameters, Battery modelling, Traction Batteries – Battery management system.

Unit – V: Alternative Energy Storage Systems

Fuel cell based energy storage – Characteristics- Types – hydrogen Storage Systems and Fuel cell EV – Ultra capacitors - Hybridization of different energy storage devices.

Text Books:

1. Iqbal Hussain, "Electric & Hybrid Vehicles – Design Fundamentals", Second Edition, CRC Press, 2011.

References:

Reference Books:

1. James Larminie, "Electric Vehicle Technology Explained", John Wiley & Sons, 2003.
2. Mehrdad Ehsani, Yimin Gao, Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals", CRC Press, 2010.

3. Emadi, A. (Ed.), Miller, J., Ehsani, M., "Vehicular Electric Power Systems" Boca Raton, CRC Press, 2003
4. Sheldon S. Williamson, "Energy Management Strategies for Electric and Plug – in Hybrid Electric Vehicles", Springer, 2013.

Journals:

1. IEEE Transactions on Vehicular Technology
2. IEEE Transactions on Power Electronics
3. IEEE Transactions on Industrial Electronics

Web Resources:

1. https://ietresearch.onlinelibrary.wiley.com/doi/10.1049/iet-est.2018.5026
2. https://www.powerelectronicsnews.com/high-efficiency-power-management-for-electric-vehicles/
3. https://www.cyient.com/blog/battery-management-system-in-electric-vehicles

MOOC / NPTEL / SWAYAM Courses:

1. https://archive.nptel.ac.in/courses/108/106/108106170/

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE523.1	Explain the basic Concepts of Electric vehicles.
R19EE523.2	Outline the concept of Transmission system in Hybrid and Electric vehicle
R19EE523.3	Describe the concepts of electric drives and its controllers
R19EE523.4	Illustrate the basic parameters and the characteristics of batteries.
R19EE523.5	Explain the basic concepts of Energy management system and charging station.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE524	Design of EV Charging Systems	L	T	P	C
		3	0	0	3

1. Course Description:

The course "Design of EV Charging Systems" provides an in-depth exploration into the principles, technologies, and methodologies involved in the design and implementation of electric vehicle (EV) charging infrastructure. With the rapid adoption of electric vehicles globally, there is a pressing need for professionals who can proficiently design, deploy, and manage charging solutions that are efficient, scalable, and sustainable.

2. Course Objectives:

1. To know the charging station and standards
2. To learn the concepts of power converters in charging
3. To find the charging scheme in renewable based EV charging
4. To demonstrate the wireless power transfer technique
5. To design and simulate power factor correction circuits

3. Syllabus

Unit – I: Charging Stations and Standards

Introduction-Charging technologies- Conductive charging, EV charging infrastructure, International standards and regulations - Inductive charging, need for inductive charging of EV, Modes and operating principle, Static and dynamic charging, Bidirectional power flow, International standards and regulations.

Unit – II: Power Electronics for EV Charging

Layouts of EV Battery Charging Systems-AC charging-DC charging systems- Power Electronic Converters for EV Battery Charging- AC–DC converter with boost PFC circuit, with bridge and without bridge circuit - Bidirectional DC–DC Converters- Non-isolated DC–DC bidirectional converter topologies- Half-bridge bidirectional converter.

Unit – III: EV Charging Using Renewable and Storage Systems

Introduction- - EV charger topologies , EV charging/discharging strategies - Integration of EV charging-home solar PV system , Operation modes of EVC-HSP system , Control strategy of EVCHSP system - fast-charging infrastructure with solar PV and energy storage.

Unit – IV: Wireless Power Transfer

Introduction - Inductive, Magnetic Resonance, Capacitive types. Wireless Chargers for Electric Vehicles - Types of Electric Vehicles - Battery Technology in EVs -Charging Modes in EVs - Benefits of WPT. - WPT Operation Modes - Standards for EV Wireless Chargers, SAE J2954, IEC 61980. ISO 19363.

Unit – V: Power Factor Correction in Charging System

Need for power factor correction- Boost Converter for Power Factor Correction, Sizing the Boost Inductor, Average Currents in the Rectifier and calculation of power losses.

Text Books:

1. Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay, Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel cell Vehicles" CRC Press, 2005.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

2. Mobile Electric Vehicles Online Charging and Discharging, Miao Wang Ran Zhang Xuemin (Sherman) Shen, Springer 2016, 1st Edition.

References:

Reference Books:

1. Alicia Trivino-Cabrera, José M. Gonzalez-Gonzalez, Jose A. Aguado, Wireless Power Transferor Electric Vehicles: Foundations and Design Approach, Springer Publisher 1st Edition. 2020.
2. James Larminie Oxford Brookes University, Oxford, UK John Lowry Acenti Designs Ltd., UK, Electric Vehicle Technology Explained
3. Nil Patel, Akash Kumar Bhoi, Sanjeevikumar Padmanaban, Jens Bo Holm-Nielsen, Electric Vehicles Modern Technologies and Trends. Springer Publisher 1st Edition, 2021.
4. Cable Based and Wireless Charging Systems for Electric Vehicles, Technology and control, management and grid integration, Rajiv Singh, Sanjeevikumar Padmanaban, Sanjeet Dwivedi, Marta Molinas and Frede Blaabjerg, IET 2021, 1st Edition.

Journal References:

1. International Journal of Electric and Hybrid Vehicles
2. World Electric Vehicle Journal
3. SAE International Journal of Electrified Vehicles
4. Journal of Asian Electric Vehicles

Web Resources:

1. https://www.ti.com/applications/industrial/energy-infrastructure/ev-charging/overview.html
2. https://www.electrical-installation.org/enwiki/EV_charging_station_design
3. https://www.niti.gov.in/sites/default/files/

MOOC / NPTEL / SWAYAM Courses:

1. https://onlinecourses.swayam2.ac.in/ntr24_ed54/preview
2. https://onlinecourses.swayam2.ac.in/nou24_ec10/preview

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE524.1	Understand the basics of EV charging station and standards according to Indian scenario
R19EE524.2	Understand the concepts of power converters in charging Electric vehicle
R19EE524.3	Find the charging scheme in renewable based EV charging
R19EE524.4	Demonstrate the wireless power transfer technique to modern Electric vehicles
R19EE524.5	Design and simulate power factor correction circuits to reduce power losses

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE525	Electric Vehicle Mechanics and Control	L	T	P	C
		3	0	0	3

1. Course Description:

This intensive course delves into the design principles of electric vehicle architectures, propulsion systems, control strategies, and energy storage solutions. Gain the knowledge to analyze, optimize, and contribute to the development of future generations of clean transportation technologies.

2. Course Objectives:

1. To develop a deep understanding of electric vehicle components and systems to become proficient in the field.
2. To apply their knowledge of vehicle mechanics to design and analyze efficient electric vehicles.
3. To master motor drive control techniques to optimize electric vehicle performance.
4. To explore and evaluate various energy storage options to enhance electric vehicle capabilities.
5. To develop the skills to design and implement effective control strategies for hybrid electric vehicles.

3. Syllabus

Unit – I: Electric Vehicle Architecture

History of evolution of Electric Vehicles - Series parallel architecture of Hybrid Electric Vehicles (HEV) – Plug-in Hybrid Electric Vehicles (PHEV)- Power train components and sizing, Gears, Clutches, Transmission and Brakes.

Unit – II: Mechanics of Electric Vehicles

Fundamentals of vehicle mechanics - tractive force, power and energy requirements for standard drive cycles of EV's - motor torque and power rating and battery capacity.

Unit – III: Control of DC and AC Motor Drives

Speed control for constant torque, constant HP operation of all electric motors - DC/DC chopper based four quadrant operation of DC motor drives, inverter-based V/f Operation (motoring and braking) of induction motor drives, vector control operation of Induction motor and PMSM, Brushless DC motor drives, Switched reluctance motor (SRM) drives.

Unit – IV: Energy Storage Systems

Battery: Principle of operation, types, models, SOC of battery, Traction Batteries and their capacity for standard drive cycles. Alternate sources: Fuel cells, Ultra capacitors, Fly wheels.

Unit – V: Hybrid Vehicle Control Strategy

HEV supervisory control - Selection of modes - power spilt mode - parallel mode - engine brake mode - regeneration mode - series parallel mode.

Text Books:

1. Iqbal Husain, "Electric and Hybrid Electric Vehicles", CRC Press, 2011.

References:

Chairman – Board of Studies

Chairman – Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202.

Reference Books:

1. Wei Liu, "Hybrid Electric Vehicle System Modeling and Control", Second Edition, WILEY, 2017.
2. James Larminie and John Lowry, "Electric Vehicle Technology Explained", Second Edition 2012.
3. Christopher D Rahn, Chao-Yang Wang, "Battery Systems Engineering", Wiley, 2013.

Journal References:

1. IEEE Transactions on Transportation Electrification (IT-TE)
2. SAE International Journal of Electrified Vehicles
3. Electric Power Systems Research

Web Resources:

1. https://www.fueleconomy.gov/feg/evtech.shtml
2. https://www.toyota.ca/toyota/en/connect/4043/hybrid-technology
3. https://www.eere.energy.gov/education/pdfs/acts_depew_hybridvehicles_314.pdf
4. https://batteryuniversity.com/
5. https://ww2.arb.ca.gov/our-work/programs/clean-vehicle-rebate-project

MOOC / NPTEL / SWAYAM Courses:

1. https://onlinecourses.swayam2.ac.in/ntr24_ed54/preview
2. https://onlinecourses.swayam2.ac.in/nou24_ec10/preview

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE525.1	Understand the architecture and dynamics of EVs and HEVs.
R19EE525.2	Design an EV for standard drive cycle.
R19EE525.3	Understand the electrical motors' characteristics and its application for vehicle dynamics.
R19EE525.4	Understand and workout the energy requirements and energy sources for EV application.
R19EE525.5	Understand the mode of operation and control architecture.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Chairman – Board of Studies

R19EE526	Prospects and Challenges for Electric Vehicles	L	T	P	C
		3	0	0	3

1. Course Description:

The course "Prospects and Challenges for Electric Vehicles" offers a comprehensive exploration into the rapidly evolving landscape of electric vehicles (EVs). As society transitions towards sustainable transportation solutions, electric vehicles have emerged as a pivotal technology with immense potential and unique challenges. This course delves into both the opportunities and obstacles facing the widespread adoption of EVs globally.

2. Course Objectives:

1. To evaluate the environmental impact of internal combustion engine vehicles and investigate the potential of renewable energy-driven vehicles as sustainable alternatives.
2. To design and implement charging infrastructure that supports smart charging solutions for electric vehicles, enhancing efficiency and user convenience.
3. To analyze market strategies for electric vehicles to improve their adoption and mobility across diverse geographic and economic landscapes.
4. To assess and select the most suitable energy sources for electric vehicles to enhance their reliability, performance, and overall lifespan.
5. To explore the current challenges and future prospects of electric vehicles in India to develop strategies that promote their widespread adoption and integration.

3. Syllabus

Unit – I: The Automobile

Introduction – Societal Impact – Climate Change – Impact on Human Health – Fossil Fuel Depletion – Impact on other Modes of Transport – Design Aspects – Life Cycle – Re-emergence of EV – Rapid Rise of Renewable Energy.

Unit – II: EV Charging Within Smart Cities

Introduction – Concept of Smart City – Charging Infrastructure – Charging Economics – Smart Charging – Case Studies of worldwide Projects.

Unit – III: Market Introduction of EV to Urban Areas

Introduction – Business Models – Integrated Innovative Business Models for EVs – EV Market Overview – Factors Influencing the adoption of EV in Urban Areas – Case Studies of Business Models for EV in Urban Areas.

Unit – IV: Energy Sources for EV

Requirements of EVs energy sources – Battery – Types of batteries for EVs – Nickel-metal Hydride – Lithium-ion battery – Performance Parameters of Battery – Alternative Energy Storage Devices – Comparison between battery, ultracapacitor and flywheel.

Unit – V: EV: Status and Roadmap For India

Introduction – Characteristics of various models – Past and Current Trends of EV market – EV Market Forecast – EV Programme and Policies – Charging Infrastructure – Challenges and Strategies for Faster Adoption of EVs – Overall Analysis of EV – Recommendations – Steps to Promote EVs.

Text Books:

Chairman – Board of Studies

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

1. Evanthia A. Nanaki, "Electric Vehicles for Smart Cities: Trends, Challenges and opportunities", Elsevier, 2021.
2. Tariq Muneer, Mohan Lal Kolhe, Aisling Doyle , "Electric Vehicles: Prospects And Challenges", Elsevier, 2017.

References:

Reference Books:

1. A. K. Babu, "Electric and Hybrid Vehicles", Khanna Publishing House, New Delhi, First Edition, Reprint, 2019.
2. Chan C. C, Chau K. T, "Modern Electric Vehicle Technology", Oxford University Press, First Edition, 2016.
3. Michael H. Westbrook, "The Electric Car: Development and Future of Battery, Hybrid and Fuel-cell Cars", The Institution of Electrical Engineers, 2019.

Journals:

1. International Journal of Electric and Hybrid Vehicles
2. World Electric Vehicle Journal
3. SAE International Journal of Electrified Vehicles
4. Journal of Asian Electric Vehicles

Web Resources:

1. https://bolt.earth/blog/future-electric-vehicles-india
2. https://www.mdpi.com/2076-3417/13/10/6016
3. https://researchplateau.com/uploads/reasearchpapers/1674748555.pdf

MOOC / NPTEL / SWAYAM Courses:

1. https://onlinecourses.swayam2.ac.in/ntr24_ed54/preview
2. https://onlinecourses.swayam2.ac.in/nou24_ec10/preview

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE526.1	Understand the impact of IC engine vehicles on the environment to search for renewable energy driven vehicles
R19EE526.2	Construct charging infrastructure to facilitate smart charging of EVs
R19EE526.3	Understand market strategies for EVs to improve their mobility in wide range.
R19EE526.4	Choose the best energy source for EVs to improve the reliability and life of EVs
R19EE526.5	Explore the challenges and future of EV in India to promote their adoption

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE527	IoT for EV Applications	L	T	P	C
		3	0	0	3

1. Course Description:

This Course explores the integration of Internet of Things (IoT) technologies in electric vehicle (EV) systems. This course covers sensor networks, data analytics, and communication protocols tailored for EV monitoring and management. Students will gain insights into optimizing EV performance, enhancing efficiency, and ensuring reliability through IoT innovations.

2. Course Objectives:

1. To provide a strong foundation in IoT for societal progress and addressing challenges.
2. To explore SDN's potential for enhancing IoT network flexibility and efficiency.
3. To investigate IoT's role in improving vehicle safety and intelligent transportation.
4. To examine ADAS for enhanced vehicle safety and comfort.
5. To explore IoV and VANET's potential to revolutionize transportation and services.

3. Syllabus

Unit – I: Introduction to IoT

Introduction, Recent Trends in the Adoption of IoT, Societal Benefits of IoT, Wireless sensor networks need for IoT, Edge resource pooling and caching, client side control, and configuration, Basics of Networking, Smart objects as building blocks for IoT, Embedded systems platforms for IoT, IO drivers, Requirement of Operating system for IoT.

Unit – II: Software Defined Networks (SDN)

Software Defined Networks (SDN): From Cloud to Fog and MIST networking for IoT Communications, Principles of Edge/P2P networking, Cloud and Fog Ecosystem for IoT - Review of architecture, Security and privacy in Fog

Unit – III: Vehicle Safety and Intelligent Transport System (ITS)

Vehicle Safety: Introduction to Radar sensor detectors ,Types(Long range, medium, short range and ultra-short, mechanically scanning LIDAR), Working, benefits, Intelligent Transport Systems (ITS): Communication standards in IOT for ITS like, MQTT, DDS, AMQP, BLUETOOTH, ZIGBEE, WIFI, Security and surveillance systems

Unit – IV: Advanced Driver Assistance Systems (ADAS)

ADAS domain controller, Automotive thermal camera, Camera module without processing, Conditionally automated drive controller, Drive assist ECU, Driver monitoring, Driver vital sign monitoring, Front/Rear camera, advance features

Unit – V: Internet of Vehicles(IAV) and Vanet

Introduction to IOV ,Types: V2V (vehicle-to-vehicle), V2R (vehicle-to-road), V2H (vehicle-to-human) and V2S (vehicle-to-sensor) interactions, Benefits of IOV, Introduction to Vehicular Ad-hoc Network (VANET),Difference between IOV and VANET, Connected cars IoT Transportation, Activity Monitoring.

Text Books:

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

1. Sudip Misra, Anandarup Mukherjee, Arijit Roy, "Introduction to IoT", Cambridge University Press 2021.
2. A Bahaga, V. Madisetti, "Internet of Things- Hands on approach", VPT publisher, 2014.

References:

Reference Books:

1. McEwen, H. Cassimally, "Designing the Internet of Things", Wiley, 2013.
2. Cuno Pfister, "Getting started with Internet of Things", Maker Media, 1st edition, 2011.
3. Joe Biron & Jonathan Follett, Foundational Elements of an IoT Solution – The Edge, The Cloud and Application Development, Oreilly,1st Edition, 2016.
4. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013

Journals:

1. IEEE Transactions on Vehicular Technology (TVT)
2. Sustainable Cities and Society

Web Resources:

1. https://hashstudioz.com/blog/iot-for-electric-vehicle-monitoring-management/
2. https://iot.telenor.com/industries/ev-charging/
3. https://www.energetica-india.net/articles/internet-of-things-with-ev-charging-infrastructure

MOOC / NPTEL / SWAYAM Courses:

1. https://onlinecourses.nptel.ac.in/noc22_cs53/preview
2. https://onlinecourses.nptel.ac.in/noc22_ee53/preview

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE527.1	Define the concept of the Internet of Things (IoT) and explain its key components
R19EE527.2	Define the concept of Software Defined Networking (SDN) and its relevance in IoT contexts.
R19EE527.3	Evaluate the key components and sensors used in modern vehicle safety systems and Explain the key components of an Intelligent Transport System (ITS)
R19EE527.4	Define Advanced Driver Assistance Systems (ADAS) and articulate their role in enhancing road safety and vehicle automation.
R19EE527.5	Explain the key components, architecture, and communication protocols that enable the internet of Vehicles (IoV) and VANET ecosystems.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

VERTICAL 3 – GREEN TECHNOLOGY

R19EE531	Renewable Energy Systems	L	T	P	C
		3	0	0	3

1. Course Description:

The course on "Renewable Energy Systems" offers a comprehensive study of renewable energy sources, technologies, integration strategies, and their role in sustainable energy solutions. As the global focus shifts towards reducing greenhouse gas emissions and achieving energy independence, renewable energy systems play a pivotal role in meeting these challenges. This course provides students with a deep understanding of various renewable energy technologies, their applications, and the complex interplay between technical, economic, and environmental factors.

2. Course Objectives:

1. To explain the significance and benefits of renewable energy sources in addressing global energy needs and environmental challenges.
2. To describe the operational principles and components involved in wind energy conversion systems, including the methods of harnessing wind power.
3. To outline the key techniques and technologies used in Solar Photovoltaic (PV) and Solar Thermal conversion systems for efficient energy capture and utilization.
4. To illustrate the processes and technologies involved in converting biomass and hydro resources into usable energy, highlighting their applications and benefits.
5. To summarize the fundamental concepts and methods of energy conversion from renewable energy sources.

3. Syllabus

Unit – I: Renewable Energy Sources

Environmental consequences of fossil fuel use, Importance of renewable sources of energy, Sustainable Design and development, Types of RE sources, Limitations of RE sources, Present Indian and international energy scenario of conventional and RE sources.

Unit – II: Wind Energy

Power in the Wind – Types of Wind Power Plants (WPPs) – Components of WPPs – Working of WPPs – Siting of WPPs – Grid integration issues of WPPs.

Unit – III: Solar PV and Thermal Systems

Solar Radiation, Radiation Measurement, Solar Thermal Power Plant, Central Receiver Power Plants, Solar Ponds – Thermal Energy storage system with PCM – Solar Photovoltaic systems: Basic Principle of SPV conversion – Types of PV Systems – Types of Solar Cells, Photovoltaic cell concepts: Cell, module, array, PV Module I-V Characteristics, Efficiency & Quality of the Cell, series and parallel connections, maximum power point tracking, Applications.

Unit – IV: Biomass Energy and Hydro Energy

Introduction – Bio mass resources – Energy from Bio mass: conversion processes – Biomass Cogeneration – Environmental Benefits. Geothermal Energy: Basics, Direct Use, Geothermal Electricity. Mini/micro hydro power: Classification of hydropower schemes, Classification of water turbine, Turbine theory, Essential components of hydroelectric system.

Unit – V: Other Renewable Energy Sources

Tidal Energy: Energy from the tides, Barrage and Non Barrage Tidal power systems. Wave Energy: Energy from waves, wave power devices. Ocean Thermal Energy Conversion (OTEC)- Hydrogen Production and Storage- Fuel cell: Principle of working – various types – construction and applications. Energy Storage System – Hybrid Energy Systems.

Text Books:

1. Kothari D. P, Singal K. C, Rakesh Ranjan, "Renewable Energy Sources and Emerging Technologies", PHI Learning Pvt. Ltd., Second Edition, 2011.
2. Rai G. D, "Non-Conventional Energy Sources", Khanna Publishers, Fourth Edition, 2009.

References:

Reference Books:

1. Mukerjee A. K. and Nivedita Thakur, "Photovoltaic Systems:Analysis and Design", PHI Learning, 2011.
2. Chetan Singh Solanki, "Solar Photovoltaics: Fundamentals, Technologies and Applications", PHI Learning Pvt. Ltd., Third Edition, 2015.
3. Godfrey Boyle, "Renewable energy", Oxford University Press in association with the Open University, 2004.

Journal References:

1. Progress in Photovoltaics
2. Energy and Environment
3. Renewable and Sustainable Energy
4. Advanced Energy Materials

Web Resources:

1. https://www.solarenergy.org/courses/introduction-to-renewable-energy/
2. https://energsustainsoc.biomedcentral.com/articles/10.1186/s13705-019-0232-1
3. https://online.stanford.edu/programs/energy-innovation-and-emerging-technologies-program

MOOC / NPTEL / SWAYAM Courses:

1. https://onlinecourses.nptel.ac.in/noc24_ph29/preview
2. https://onlinecourses.nptel.ac.in/noc24_ch43/preview

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE531.1	Explain the importance of renewable energy sources
R19EE531.2	Describe the process of wind energy conversion system
R19EE531.3	Outline the techniques of Solar PV and Solar Thermal conversion system
R19EE531.4	Illustrate the process of energy conversion from Bio-Mass and Hydro Systems
R19EE531.5	Summarize the concepts of energy conversion from tide, OTEC, Hydrogen Production, Fuel Cells and Energy storage systems

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Chairman - Board of Studies

R19EE532	Design of Solar Photovoltaic Systems	L	T	P	C
		3	0	0	3

1. Course Description:

The course "Design of Solar Photovoltaic Systems" offers a comprehensive exploration into the principles, technologies, and methodologies involved in designing efficient and cost-effective solar photovoltaic (PV) systems. As solar energy continues to play a crucial role in the transition towards renewable energy, there is a growing demand for professionals who can design, implement, and optimize solar PV systems for various applications.

2. Course Objectives:

1. To explain the fundamental principles and operational mechanisms of Solar Photovoltaic (PV) systems.
2. To outline and describe the key components and their functions within Solar PV systems.
3. To apply theoretical concepts to model and design a stand-alone Solar PV system tailored to specific energy needs and conditions.
4. To utilize design principles and technical knowledge to create and optimize a grid-connected Solar PV system for efficient energy integration.
5. To explain and demonstrate the best practices for the installation, operation, and maintenance of Solar PV systems to ensure optimal performance and longevity.

3. Syllabus

Unit – I: Introduction to Solar PV Systems

Introduction to Solar Radiation: Optimum orientation of Solar PV modules – Solar related measuring devices. Solar PV Electricity – Introduction of Solar PV Modules – Interconnections of PV Modules.

Unit – II: Components of Solar PV Systems

Types of Solar PV systems, Photovoltaic System Components: Introduction to batteries – Charge controller – MPPT – Solar PV inverters – Wires and Cable sizing – Junction Boxes – Combiner Boxes – Fuses.

Unit – III: Stand – Alone PV System

Preparation of Load Chart – Solar Array Sizing – Battery Bank Sizing – Charge Controller Selection – Inverter Selection.

Unit – IV: Grid – Connected PV System

Assessment of Site condition – Estimation of Annual energy usage – average solar radiation of the site – Required demand – Inverter Selection – Solar Array Sizing – Balance of System (BOS) Selection – Net metering.

Unit – V: Installation, Troubleshooting and Safety of PV System

Preparation and General Consideration for Installation – Installation of Array support structure, Modules, Combiner boxes, AC and DC DB's, Inverter – Maintenance and troubleshooting Solar PV system – Electrical safety – Mechanical Safety – Safety Precautions for Batteries.

Text Books:

Chairman – Board of Studies
Department of Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

1. Solanki C.S, "Solar Photovoltaics: Fundamentals, Technologies and Applications", PHI Learning, 2015.
2. Rai. G.D, "Solar energy utilization", Khanna publishes, 1993.
3. Wenham S.R, Green M.A, Watt M.E, Corkish R, "Applied Photovoltaics", Earthscan, Third Edition, 2011.

References:

Reference Books:

1. McNeils, Frenkel, Desai, "Solar & Wind Energy Technologies", Wiley Eastern, 1990
2. Sukhatme S.P, "Solar Energy", Tata McGraw Hill,1987.
3. Eduardo Lorenzo G. Araujo, "Solar Electricity Engineering of Photovoltaic Systems", Progensa,1994

Journal References:

1. Progress in Photovoltaics
2. Energy and Environment
3. Renewable and Sustainable Energy
4. Advanced Energy Materials

Web Resources:

1. https://www.solarenergy.org/courses/introduction-to-renewable-energy/
2. https://energsustainsoc.biomedcentral.com/articles/10.1186/s13705-019-0232-1
3. https://online.stanford.edu/programs/energy-innovation-and-emerging-technologies-program

MOOC / NPTEL / SWAYAM Courses:

1. https://onlinecourses.nptel.ac.in/noc24_ph29/preview
2. https://onlinecourses.nptel.ac.in/noc24_ch43/preview

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE532.1	Explain the fundamentals of Solar PV Systems
R19EE532.2	Outline the Components of Solar PV systems
R19EE532.3	Apply the concepts to model a Stand Alone PV System
R19EE532.4	Utilize the concepts to design a Grid connected PV System
R19EE532.5	Explain the Installation and Maintenance techniques of a Solar PV System

Chairman – Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Chairman – Board of Studies

R19EE533	Grid Integration of Renewable Energy Systems	L	T	P	C
		3	0	0	3

1. Course Description:

Renewable Energy Systems course provides a comprehensive understanding of the principles, challenges, and solutions associated with integrating renewable energy systems into the electrical grid. Students will explore various renewable energy sources, including solar, wind, hydro, and biomass, and learn how these sources can be effectively integrated into the existing grid infrastructure. Students will delve into the regulatory and policy frameworks that govern renewable energy integration and analyze the economic and environmental implications.

2. Course Objectives:

1. To understand the principles of operation of renewable energy technologies.
2. To articulate the technical challenges for each of the renewable sources.
3. To understand about the smart grid and the emerging technologies.
4. To understand the fundamentals of thermal energy storage.
5. To know the recent technologies that underpin for the smart grid development.

3. Syllabus

Unit – I: Dynamics of Distributed Generation Systems

Power system operation: Introduction on electric grid – Supply guarantees- power quality and Stability- Introduction to renewable energy grid integration – concept of mini/micro grids and smart grids; Wind- Solar- Biomass power generation profiles- generation electric features- Load scheduling.

Unit – II: Energy Storage

Mechanical Systems – Electrochemical Systems – Electrical Systems – Thermal Systems – Energy storage for power system applications – Grid Side and Demand side management with Renewables – Other factors.

Unit – III: Grid Integration of Photovoltaic Systems

Requirements for photovoltaic systems - Interconnection requirements - Power Quality – Anti-island - Structure of PV inverters - Detection of island – Structure – Investors and modulation – Control – Island detection and MPPT – Introduction – Passive Methods – Active methods – MPPT.

Unit – IV: Grid Integration of Wind Systems

Requirements for wind systems - Grid Codes for wind turbines - Control of active power - Control of the reactive power - Frequency Control - Operating Range - LVRT - Future trends -Wind Turbines structures - Configuration turbine - Topology converters -Turbine Control.

Unit – V: Advancements in Grid Integration

The electric vehicle in the grid - Load management - HVDC interconnection - STATCOM and filters Assets - FACTS and UPFC.

Text Books:

1. Kersting W. H, "Distribution System Modeling and Analysis", Second Edition, CRC Press, 2017.

Chairman – Board of Studies

Chairman – Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202.

2. Vittal V. and Ayyanar R, "Grid Integration and Dynamic Impact of Wind Energy", Springer, 2013.

References:

Reference Books:

1. Keyhani A, "Design of Smart Power Grid Renewable Energy Systems", Wiley IEEE Press, 2011.
2. Muhannad H. R, "Power Electronics: Circuits, Devices and Applications", Pearson Prentice Hall, 2004.
3. Gellings C. W, "The Smart Grid: Enabling Energy Efficiency and Demand Response", CRC Press, First Edition, 2009.
4. Teodorescu R. Liserre M. Rodriguez P, "Grid Converters for Photovoltaic and Wind Power Systems", Wiley-IEEE Press, First Edition, 2011.

Journal References:

1. IEEE Transactions on Industrial Electronics
2. IEEE Transactions on Power Delivery
3. IEEE Transaction on Power Electronics
4. International Journal of Renewable Energy Research

Web Resources:

1. https://www.nrel.gov/esif/renewable-energy-grid-integration.html
2. https://www.pnnl.gov/grid-integration-renewable-energy
3. https://handbooks.uwa.edu.au/unitdetails?code=ELEC5509
4. https://onlinelibrary.wiley.com/doi/abs/10.1002/9781119751908.ch5

MOOC / NPTEL / SWAYAM Courses:

1. Smart Grid: Basics to Advanced Technologies, IIT Roorkee Prof. N.P. Padhy, Prof. Premalata Jena.
2. Sustainable Power Generation Systems, By Dr. Pankaj Kalita, IIT Guwahati.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE533.1	Illustrate the concepts of power systems, their operation and control focussed on the issues related to the integration of distributed renewable generation into the network and its advancements.
R19EE533.2	Explain the concepts of energy storage for various applications and various factors affecting it.
R19EE533.3	Apply various concepts in integrating various forms of energy to the grid.
R19EE533.4	Choose appropriate power system equipment used for integration.
R19EE533.5	Make use of detailed knowledge about power quality and its management along with approaches for grid stabilization.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE534	Power Electronics for Renewable Energy Systems	L	T	P	C
		3	0	0	3

1. Course Description:

This course Explore into power electronics, the essential technology for harnessing renewable energy sources like solar and wind. Learn how to convert, control, and optimize energy flow, enabling efficient and sustainable power generation for the grid.

2. Course Objectives:

1. To understand renewable energy's environmental impact and explore various resources.
2. To review electrical machine fundamentals and analyze IG, PMSG, SCIG, and DFIG.
3. To understand solar PV system components, inverters, and grid connection issues.
4. To analyze standalone and grid-integrated wind energy systems.
5. To explore hybrid systems,their types,and applications.

3. Syllabus

Unit – I: Introduction

Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment (cost-GHG Emission) - Qualitative study of different renewable energy resources: Solar, wind, ocean, Biomass, Fuel cell, Hydrogen energy systems and hybrid renewable energy systems.

Unit – II: Electrical Machines for Renewable Energy Conversion

Review of reference theory fundamentals – principle of operation and analysis of IG, PMSG, SCIG and DFIG.

Unit – III: Power Converters for Solar Pv Systems

Block diagram of solar photo voltaic system: line commutated converters (inversion-mode) – Boost and buck – boost converters – selection of inverter, battery sizing, array sizing – standalone PV systems – Grid tied and grid interactive inverters – grid connection issues.

Unit – IV: Analysis of Wind Energy Systems

Standalone operation of fixed and variable speed wind energy conversion systems – Grid connection Issues -Grid integrated PMSG, SCIG Based WECS.

Unit – V: Hybrid Renewable Energy Systems

Need for Hybrid Systems – Range and type of Hybrid systems – Case studies of Wind and PV – Maximum Power Point Tracking (MPPT) – Power Electronic System for on-board charging

Text Books:

1. Bhadra S. N, Kastha D, Banerjee S, "Wind Electrical Systems", Oxford University Press, 2005.
2. Khan B.H, "Non-conventional Energy sources", Tata McGraw Hill, 2009.

References:

Reference Books:

1. Rashid. M. H, "Power Electronics Hand book", Academic press, 2001.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

2. Ion Boldea, "Variable speed generators", Taylor & Francis group, 2006.
3. Rai. G.D, "Non-conventional energy sources", Khanna publishes, 1993.
4. Gray, L. Johnson, "Wind energy system", Prentice Hall linc, 1995.
5. Andrzej M. Trzynnadlowski, 'Introduction to Modern Power Electronics', Wiley India, Second Edition, 2012.

Journal References:

1. IEEE Transactions on Power Electronics
2. Sustainable Cities and Society

Web Resources:

1. https://www.monolithicpower.com/en/learning/mpscholar/power-electronics/power-electronic-applications/renewable-energy-systems
2. https://www.transparencymarketresearch.com/power-electronics-for-renewable-energy-market.html
3. https://www.semiconductorreview.com/news/how-do-power-electronics-work-with-renewable-energy-sources-nwid-647.html

MOOC / NPTEL / Online Course:

1. https://onlinecourses.nptel.ac.in/noc21_ee01/preview
2. https://onlinecourses.nptel.ac.in/noc24_ee130/preview

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE534.1	Explain about the stand alone and grid connected renewable energy systems.
R19EE534.2	Describe the fundamental principle and operation of Electrical Machines.
R19EE534.3	Illustrate the basic concept of various power converters.
R19EE534.4	Apply various operating modes of wind electrical generators and solar energy systems.
R19EE534.5	Develop maximum power point tracking algorithm.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641202.

R19EE535	Wind Energy Conversion Systems	L	T	P	C
		3	0	0	3

1. Course Description:

This course explores wind energy conversion systems. Examine wind turbine technology, covering aerodynamics, mechanics, electricity generation, and grid integration. Learn how these systems transform wind power into sustainable electricity.

2. Course Objectives:

1. To understand wind energy history, trends, and modeling.
2. To explore wind turbine aerodynamics, design, and components.
3. To understand wind turbine generator systems and their integration.
4. To explore wind turbine control systems and special considerations.
5. To understand wind turbine implementation, site selection, and financial aspects

3. Syllabus

Unit – I: Introduction to Wind Energy Conversion Systems

History of wind turbine development and trends - Wind regime modelling, measurement instruments, Weibull parameters, height dependency, wind resources worldwide and in India, wind energy forecast.

Unit – II: Wind Turbines

Review on basic aerodynamics, air foils, types and characteristics of wind turbine, turbine design, blade element theory, Betz limit, wake analysis, wind turbine rotor design considerations, number of blades, blade profile, 2/3 blades and teetering, coning, power regulation, wind turbine loads, aerodynamic loads in steady operation, wind turbulence, and tower shadow, wind turbine components, braking, yaw system, tower, others.

Unit – III: Wind Turbine Generator System (WTGS)

Fixed speed and variable speed systems. Electrical machines for wind energy systems, synchronous and asynchronous generators and power electronics. Integration of wind energy systems to electrical networks, converters, inverters, directly connected, wind energy storage solutions.

Unit – IV: Control Systems in Wind Energy Generation System

Requirements, components and strategies. Small wind turbines special considerations and designs, testing, noise issues, Off-shore turbines.

Unit – V: Implementation of Wind Energy System

Site selection and turbine spacing, rotor selection, Annual Energy Output (AEO), optimal placement of wind turbine in a wind park, ICT based monitoring and control of wind farms. Financial considerations: installed costs, payback time, Levelized Energy Cost (LEC).

Text Books:

1. Joshua Earnest and Tore Wizelius, "Wind Power Plants and Project Development", PHI Learning Pvt. Ltd., New Delhi, 2011.
2. J. F. Manwell, J. G. McGowan and A. L. Rogers, "Wind Energy Explained – Theory, Design and Application", Wiley, 2009.

References:

Reference Books:

1. Earnest Joshua, "Wind Power Technology", Second edition, PHI Learning Pvt. Ltd., New Delhi, 2015.
2. Johnson G. L., "Wind Energy Systems", Prentice Hall, 1994 (published by the author online).
3. Spera D. A., "Wind Turbine Technology: Fundamental Concepts of Wind Turbine Engineering", ASME Press, New York, 2009.
4. Voker Quashning, "Understanding Renewable Energy Systems", Earthscan, Second edition, 2016.
5. Tony Burton, David Sharpe, Nick Jenkins, Ervin Bossanyi, "Wind Energy Handbook" JOHN WILEY & SONS, LTD, Second Edition, 2011.

Journal References:

1. IEEE Transactions on Power Electronics
2. Sustainable Cities and Society

Web Resources:

1. https://www.carboncollective.co/sustainable-investing/wind-energy-conversion-system-wecs
2. https://www.coastalwiki.org/wiki/Wave_energy_converters
3. https://openlibrary.org/subjects/wind_energy_conversion_systems

MOOC / NPTEL / Online Course:

1. https://onlinecourses.nptel.ac.in/noc22_ch27/preview

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE535.1	Describe different wind energy conversion systems for choosing its optimum operating region.
R19EE535.2	Compare the performance of different types of wind turbines to summarize its operating characteristics.
R19EE535.3	Compare the performance of different types of generators used in wind turbines for choosing the optimum one to specific application.
R19EE535.4	Classify the different types control system for testing the wind turbine generator system.
R19EE535.5	Analyze the parameters of wind energy system for installing the wind turbine at specific region.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE536	Smart Energy Systems	L	T	P	C
		3	0	0	3

1. Course Description:

The course "Smart Energy Systems" explores the integration of advanced technologies and strategies to enhance the efficiency, reliability, and sustainability of energy systems. As global energy demands rise and climate change concerns grow, there is a critical need for innovative approaches to optimize energy generation, distribution, and consumption. This course examines the concepts, methodologies, and applications of smart energy systems across various sectors.

2. Course Objectives:

1. To understand and evaluate various types of energy sources to select the most suitable option for specific applications based on efficiency, cost, and environmental impact.
2. To describe the operation and application of different types of sensors used for the accurate measurement of physical quantities such as temperature, pressure, and flow.
3. To apply energy audit concepts and methodologies to achieve effective energy management and optimization in industrial settings.
4. To classify and analyze various smart metering systems as alternatives to conventional meters, focusing on their advantages and implementation in industrial environments.
5. To summarize and explore AI techniques utilized in the energy sector, and suggest AI-based solutions for addressing energy-related challenges and improving system performance.

3. Syllabus

Unit – I: Energy Resources

Sources of Chemical Energy – Solar Energy: Solar PV Power plant and Net metering concepts – Wind Energy: Nature of wind – factors influencing wind – Wind data and energy estimation – Wind energy conversion devices – Bio Energy: Biomass resources and classifications – Biomass conversion process – Urban waste to energy conversion – Other energy sources – Selection of energy source based on the applications.

Unit – II: Measurement of Energy Systems

Basic Electrical measurements, Transducers and its types, Signal conditioning and processing - Measurement of temperature, pressure, velocity, flow rate, electrical power, energy, Vibration and noise – different types of smart sensors with IoT features.

Unit – III: Energy Audit and Management

Definition, energy audit, need, types of energy audit. energy management (audit) approach - understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel and energy substitution, energy audit instruments and metering, precautions, smart metering. Roles and responsibilities of energy manager, accountability. energy consumption, production, cumulative sum of differences (CUSUM) – Cost / Energy Share Diagram – Break Even Analysis

Unit – IV: Smart Energy Metering System

Introduction to Smart Metering System (SEM) – Block diagram – SEM technical specification – Display parameters of SEM – Classification of SEM – Area Covered by Smart Meters – Meter Reading Instruments (MRI) – Tele metering – Automated Meter Reading (AMR) and Advanced Metering Infrastructure (AMI)

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Unit – V: Artificial Intelligent (AI) in Energy and Utilities Industries
Role of AI in Energy sector: Data digitalization – Smart Forecasting – Resource Management – Failure Prevention and Predictive analysis for renewable energy systems. Use of AI for energy conservation: Smart Grid – Smart heaters – Digital twins – Renewable energy integration. AI in battery management – AI in voltage, frequency and power flow control in power system - Challenges for implementing the AI technologies in conventional grid system.
Text Books:
1. Bent Sorensen, "Renewable Energy", Elsevier, Academic Press, 2011. 2. Clark W. Gellings, "The Smart Grid: Enabling Energy Efficiency and Demand Response", CRC Press , 2000.
References:
Reference Books: 1. B.H.Khan, "Non-conventional energy sources", Tata McGraw Hill. 2. Bridgurater A.V., "Thermochemical processing of Biomass", Academic Press, 1981. **Journal References:** 1. Smart Energy 2. Energy and Environment 3. Energy Conversion management **Web Resources:** 1. https://www.hs-ansbach.de/en/master/smart-energy-systems/ 2. https://erigrid2.eu/online-training-series-on-the-digitalisation-of-smart-energy-systems/ 3. https://online.stanford.edu/programs/energy-innovation-and-emerging-technologies-program **MOOC / NPTEL / SWAYAM Courses:** 1. https://onlinecourses.swayam2.ac.in/nou24_es10/preview 2. https://onlinecourses.swayam2.ac.in/nou24_es08/preview

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE536.1	Understand the different tupes of energy sources for selecting the optimum energy source for specific application.
R19EE536.2	Describe the operation of different types of sensor for measurement of physical quantities.
R19EE536.3	Apply the energy audit concepts for achieving the energy management in industry.
R19EE536.4	Classify the different types of smart metering system for replacing the conventional meters in industry.
R19EE536.5	Summarize the list of AI techniques used in energy sector for suggesting the AI based solutions to energy related problems.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE537	Advanced Energy Systems Technology	L	T	P	C
		3	0	0	3

1. Course Description:

This course provides a comprehensive understanding of energy conversion, heat transfer, and fluid mechanics fundamentals. It explores renewable energy systems, including solar, wind, hydroelectric, and biomass technologies. Advanced energy storage systems and emerging clean energy technologies such as fuel cells and magneto-hydrodynamic energy conversion are also covered. Additionally, the course examines oxyfuel combustion, carbon capture and storage, and cleaner coal technologies.

2. Course Objectives:

1. To provide the knowledge on energy conversion and heat transfer in energy systems.
2. To impart knowledge on different renewable energy sources and its configurations.
3. To explore the importance of advanced energy storage systems and technology used.
4. To provide the knowledge on production of energy by oxyfuel combustion, coal capture and storage.
5. To summarize the importance of emerging clean energy technologies and efficient energy conversion process.

3. Syllabus

Unit – I: Fundamentals of Energy Conversion, Heat Transfer and Fluid Mechanics

Introduction: Energy, Heat, Work and Power; Energy Forms; Energy of Electromagnetic Radiation; Chemical and Nuclear Energy; Electrical Energy; Mechanical Energy: Heat, Internal Energy, Enthalpy and Entropy; Thermodynamics of Energy Conversion; Basics of Heat Transfer in Energy Systems; Energy Resources and Reserves.

Unit – II: Renewable Energy Systems

Solar Thermal Energy Technology; Non-Concentrating and Concentrating Solar Collectors; Concentrated Photovoltaic Power Generation; Hydroelectric Power Plant: Types; On shore and Offshore Wind Farms; Hybrid Wind Solar Power Installations; Biomass Conversion to Energy and Biofuels; Bio fuel Powered Power Plants.

Unit – III: Advanced Energy Storage Systems

Introduction: Performance Parameters of Energy Storage Systems; Mechanical Energy Storage: Types; Thermal Energy Storage: Types, Hot Water and Steam Energy Storage and Latent Heat Storage. Thermochemical Energy Storage; Electrochemical and Electromagnetic Energy Storage; Advanced Energy Storage Concepts for Solar Power Plants.

Unit – IV: Oxyfuel Combustion, Carbon Capture And Storage And Cleaner Coal Technologies

Introduction: Oxyfuel Combustion, Carbon Capture and Storage, Post and Pre Combustion; Coal Beneficiation; Liquefaction and Gasification; Coal Beneficiation: Pre combustion of coal desulfurization and Coal Liquefaction. Rapid Pyrolysis and Direct Hydrogenation of Coal; Coal Gasification; Hybrid Combined Cycle Power Plants.

Unit – V: Emerging Clean Energy Technologies

Introduction: Fuel Cell, Principle, IV Characteristics, Power Output and Efficiency and Maximum Theoretical Efficiency of a Fuel Cell; Fuel Cell Performance Characteristic; Hydrogen Production

and Utilization; Conventional methods for Hydrogen Production; Hydrogen Use for Power and Heat Production; Magneto hydrodynamic Energy Conversion.

Text Books:

1. Nikolai.V.Kartchenko, Vadym.M. Kartchenko, "Advanced Energy Systems", Second Edition, CRC Press, 2013.
2. Ibrahim Dincer, CalinZamfirescu, "Advanced Power Generation Systems", Elsevier, 2000.

References:

Reference Books:

1. S.C.Bhatia, "Advanced Renewable Energy Systems", Woodhead Publishing India Private Limited, 2014.
2. Fang Lin Luo, Hong Ye, "Renewable Energy Systems: Advanced Conversion Technologies and Applications", CRC Press,2013.
3. Georgios.M.Kopanos, Michael.C.Georgiadis, Pei Liu, "Advances in Energy Systems Engneering", Springer, 2017.

Journal References:

1. Journal of Energy Storage
2. International Journal of Green Energy
3. International Journal of Renewable Energy Research

Web Resources:

1. https://www.renewableenergyworld.com/
2. https://www.nrel.gov/
3. https://www.iea.org/
4. https://www.energy.gov/

MOOC / NPTEL / SWAYAM Courses:

1. Solar Energy Engineering - Instructor: Prof. V.V. Satyamurty, IIT Kharagpur
2. Biomass Conversion Technologies - Instructor: Prof. S.C. Srivastava, IIT Delhi

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE537.1	Summarize the concepts of thermodynamics to understand the operation of power plants.
R19EE537.2	Interpret various renewable energy technologies to understand the functional operations.
R19EE537.3	Compare various forms of storages in energy to employ storage options for various energy sources.
R19EE537.4	Summarizing the methods for power production using fossil fuels for efficient conversion process.
R19EE537.5	Demonstrate various methodologies to enhance knowledge on cleaner power production technologies.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

VERTICAL 4 – POWER SYSTEMS ENGINEERING

R19EE541	Power System Operation and Control	L	T	P	C
		3	0	0	3

1. Course Description:

Power System Operation and Control covers essential principles of managing electrical grids, including generation dispatch, load balancing, and voltage regulation. Emphasis is placed on stability analysis, optimal power flow, and the integration of renewable energy sources. Practical applications and case studies illustrate real-world challenges and solutions in power system operation. This course aims to provide engineering students with a strong understanding of Power system operation and various control methods.

2. Course Objectives:

1. To familiarize the student with the operation of power system
2. To make the students understand various techniques for power system control.
3. To impart knowledge on the reactive power and voltage control in alternators
4. To equip the students with the knowledge on unit commitment and economic load dispatch
5. To enlighten the students with the ability to monitor and control the power system through computers.

3. Syllabus

Unit – I: Introduction

An overview of power system operation and control; System load variation; Load characteristics; Load curves and load; duration curve ; Load factor; Diversity factor; Importance of load forecasting and quadratic and exponential curve fitting techniques of forecasting; Plant level and system level controls.

Unit – II: Real Power – Frequency Control

Load Frequency Control (LFC) of single area system-static and dynamic analysis of uncontrolled and controlled cases; LFC of two area system; tie line modelling; block diagram representation of two area system; static and dynamic analysis; tie line with frequency bias control; state variability model; integration of economic dispatch control with LFC.

Unit – III: Reactive Power – Voltage Control

Generation and absorption of reactive power; basics of reactive power control; excitation systems; modelling; static and dynamic analysis; stability compensation; methods of voltage control: tap changing transformer; SVC (TCR + TSC) and STATCOM; secondary voltage control.

Unit – IV: Unit Commitment and Economic Dispatch

Formulation of economic dispatch problem; I/O cost characterization; incremental cost curve; coordination equations without and with loss (No derivation of loss coefficients); solution by direct method and λ-iteration method; statement of unit commitment problem; priority, list method; forward dynamic programming.

Unit – V: Computer Control of Power Systems

Need of computer control of power systems; concept of energy control centres and functions; PMU; system monitoring, data acquisition and controls; System hardware configurations,

SCADA and EMS functions; state estimation problem; measurements and errors; weighted least square estimation; various operating states; state transition diagram.

Text Books:

1. Olle.I.Elgerd, "Electric Energy Systems theory: An introduction", Tata McGraw Hill, 1983.
2. Allen. J. Wood and Bruce F. Wollen berg, "Power Generation, Operation and Control", John Wiley and Sons, Second Edition, 2005
3. Abhijit Chakrabarti and SunitaHalder, "Power System Analysis Operation and Control", PHI learning Pvt. Ltd., New Delhi, Third Edition, 2010

References:

Reference Books:

1. Kothari D.P. and Nagrath I.J, "Power System Engineering", Tata McGraw Hill, Second Edition, 2008.
2. HadiSaadat, "Power System Analysis", Tata McGraw Hill, Reprint, Third Edition, 2004.
3. Kundur P, "Power System Stability and Control", Tata McGraw Hill, Tenth Reprint, 2010.

Journal References:

1. IEEE Transactions on Power Systems.
2. Electric Power Systems Research.
3. International Journal of Electrical Power & Energy Systems
4. IET Generation, Transmission & Distribution
5. IEEE Power & Energy Magazine

Web Resources:

1. IEEE PES Resource Center
2. EPRI
3. Smart Grid Resource Center

MOOC / NPTEL / SWAYAM Courses:

1. https://archive.nptel.ac.in/courses/108/104/108104052/
2. https://archive.nptel.ac.in/courses/108/101/108101004/
3. https://archive.nptel.ac.in/courses/108/101/108101040/

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE541.1	Understand the day-to-day operation of electric power system.
R19EE541.2	Analyze the control actions to be implemented on the system to meet the minute-to-minute variation of system demand.
R19EE541.3	Acquire knowledge on real power-frequency interaction and the significance of power system operation and control.
R19EE541.4	Understand the reactive power-voltage interaction.
R19EE541.5	Design SCADA and its application for real time operation.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE542	Power Systems Transients	L	T	P	C
		3	0	0	3

1. Course Description:

Power System Transients explores the transient behavior of electrical systems, covering phenomena such as switching surges, lightning strikes, and faults. The course emphasizes modeling, simulation, and mitigation techniques to ensure system reliability and equipment protection. Practical applications and case studies illustrate effective strategies for managing transient events in power networks. This course aims to provide engineering students with a strong understanding of Power system Transients.

2. Course Objectives:

1. To introduce the concept of power system transients and its effects on equipment.
2. To impart knowledge on switching transients and its causes and effects.
3. To explore on lightning transients and its cause and effects.
4. To provide knowledge on computation of transients and its effects on power system
5. To enlighten the students with the knowledge on EMTP for transient analysis.

3. Syllabus

Unit – I: Introduction

Review and importance of the study of transients; causes for transients. RL circuit transient with sine wave excitation; double frequency transients; basic transforms of the RLC circuit transients. Different types of power system transients; effect of transients on power systems; role of the study of transients in system planning.

Unit – II: Switching Transients

Over voltages due to switching transients; resistance switching and the equivalent circuit for interrupting the resistor current; load switching and equivalent circuit; waveforms for transient voltage across the load and the switch; normal and abnormal switching transients. Current suppression; current chopping; effective equivalent circuit. Capacitance switching; effect of source regulation; capacitance switching with a restrike, with multiple restrikes. Illustration for multiple restriking transients; ferro resonance.

Unit – III: Lightning Transients

Review of the theories in the formation of clouds and charge formation; rate of charging of thunder clouds; mechanism of lightning discharges and characteristics of lightning strokes; model for lightning stroke; factors contributing to good line design; protection using ground wires; tower footing resistance; Interaction between lightning and power system.

Unit – IV: Computation of Transients

Computation of transients; transient response of systems with series and shunt lumped parameters and distributed lines. Traveling wave concept; step response; Bewely's lattice diagram; standing waves and natural frequencies; reflection and refraction of travelling waves.

Unit – V: Transients in Integrated Power Systems

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Chairman - Board of Studies

The short line and kilometric fault; distribution of voltages in a power system; Line dropping and load rejection; voltage transients on closing and reclosing lines; over voltage induced by faults; switching surges on integrated system Qualitative application of EMTP for transient computation.

Text Books:

1. Allan Greenwood, "Electrical Transients in Power Systems", Wiley Inter Science, Second Edition, 1991.
2. Indulkar C.S, Kothari D.P, Ramalingam K, "Power System Transients: A statistical approach", PHI Learning Private Limited, Second Edition, 2010

References:

Reference Books:

1. Naidu M.S and Kamaraju V, "High Voltage Engineering", McGraw Hill Education, Fifth Edition, 2013.
2. Begamudre R.D, "Extra High Voltage AC Transmission Engineering", Wiley Eastern Limited, 1986.
3. James L. Kirtley, "Electric Power Principles: Sources, Conversion, Distribution and use", John Wiley, First Edition, 2020.

Journal References:

1. IEEE Transactions on Power Delivery
2. Electric Power Systems Research.
3. IEEE Transactions on Industry Applications

Web Resources:

1. https://www.slideshare.net/slideshow/transient-in-power-system/93451910
2. https://www.slideshare.net/slideshow/pst-chapter-1pptx/252997665
3. https://ece.vt.edu/grad/courses/5334.html
4. https://technav.ieee.org/topic/power-system-transients

MOOC / NPTEL / SWAYAM Courses:

1. https://archive.nptel.ac.in/courses/108/105/108105104/
2. https://archive.nptel.ac.in/courses/108/106/108106026/

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE542.1	Realize the generation of switching transients and analyze its effects.
R19EE542.2	Analyze the switching transient origins and design proper protective techniques
R19EE542.3	Explain the mechanism of lightning strokes and design protection system for transmission line and tower.
R19EE542.4	Identify the propagation, reflection and refraction of travelling waves and design to suitable filters to suppress the surge waves.
R19EE542.5	Analyze the impact of transient in integrated power system.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE543	High Voltage Engineering	L	T	P	C
		3	0	0	3

1. Course Description:

This course covers comprehensive aspects of high voltage phenomena in electrical power systems, including causes and effects of over voltages, dielectric breakdown mechanisms, generation of high voltages and currents, measurement techniques, and standards-compliant testing of electrical apparatus. It emphasizes protection against over voltages using surge protective devices (SPD) and applications of insulating materials in various electrical equipments.

2. Course Objectives:

1. To describe the principles behind generating high DC – AC and impulse voltages.
2. To provide the knowledge on different dielectrics and various breakdown mechanisms.
3. To impart knowledge on various HVAC, HVDC and impulse voltage generation methods.
4. To explain the different circuits for measuring the high voltages and currents.
5. To explore the various HV testing methods conducted on cables, insulators, bushings, transformers and circuits breakers in HV Laboratory.

3. Syllabus

Unit – I: Over Voltages in Electrical Power Systems

Causes of over voltages and its effects on power system; Lightning, switching surges and temporary over voltages; Corona and its effects ; Protection against over voltages; Surge Protective Devices (SPD).

Unit – II: Dielectric Breakdown

Properties of Dielectric materials; Gaseous breakdown in uniform and non-uniform fields; Corona discharges; Vacuum breakdown; Conduction and breakdown in pure and commercial liquids and Maintenance of oil Quality; Breakdown mechanisms in solid and composite dielectrics; Applications of insulating materials in electrical equipments.

Unit – III: Generation of High Voltages and High Currents

Generation of High DC voltage: Rectifiers, voltage multipliers and vande graaff generator; Generation of high impulse voltage: single and multistage Marx circuits; Generation of high AC voltages: cascaded transformers, resonant transformer and tesla coil; Generation of switching surges: Generation of impulse currents, Triggering and control of impulse generators.

Unit – IV: Measurement of High Voltages and High Currents

High Resistance with series ammeter; Dividers: Resistance, Capacitance and Mixed dividers; Peak Voltmeter; Generating Voltmeters; Capacitance Voltage Transformers; Electrostatic Voltmeters; Sphere Gaps; High current shunts; Digital techniques in high voltage measurement.

Unit – V: High Voltage Testing of Electrical Apparatus

High voltage testing of electrical power apparatus as per International and Indian standards; Power frequency, impulse voltage and DC testing of Insulators, circuit breakers, bushing, isolators and transformers.

Chairman – Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Text Books:

1. Naidu S,Kamaraju V, "High Voltage Engineering", Tata McGraw Hill, Fifth Edition, 2013.
2. KuffelE,Zaengl W.S, Kuffel J, "High Voltage Engineering:Fundamentals", Newnes, Second Edition, 2005.
3. Wadhwa C.L, "High voltage Engineering", New Age International Publishers, Third Edition, 2010.

References:

Reference Books:

1. Alston L.L, "High Voltage Technology", Oxford University Press, First Edition, 2011.
2. Mazen Abdel-Salam, Hussein Anis, Ahdab A-Morshedy, RoshdayRadwan, "High Voltage Engineering: Theory &Practice, Marcel Dekker, Second Edition, 2010.
3. Subir Ray, "An Introduction to High Voltage Engineering", PHI Learning, Second Edition, 2013.

Journal References:

1. IEEE Transactions on Dielectrics and Electrical Insulation
2. International Journal of Electrical Power & Energy Systems
3. Electric Power Components and Systems

Web Resources:

1. http://science.howstuffworks.com/nature/natural-disasters/lightning5.htm
2. https://en.wikipedia.org/wiki/Corona_discharge
3. https://www.tu-ilmenau.de/en/department-of-electrical-apparatus-and-switchgear/laboratories-and-equipments/high-voltage-laboratory/
4. http://www.elect.mrt.ac.lk/HV_Chap6.pdf
5. https://www.youtube.com/watch?v=O8s8-tAYny8

MOOC / NPTEL / SWAYAM Courses:

1. High Voltage Engineering - Instructor: Prof. H.N. Singh, IIT Bombay
2. Udemy: High Voltage Engineering
3. FutureLearn: High Voltage Engineering Courses

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE543.1	Realize the causes of over voltage and its protection methods used in Power System
R19EE543.2	Illustrate the Breakdown mechanism in solid, liquid and gaseous dielectrics.
R19EE543.3	Identify the suitable methods for generating High Voltage in Laboratory.
R19EE543.4	Classify the high voltage measurement techniques.
R19EE543.5	Summarize the different High Voltage testing methods applied on Electrical apparatus

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE544	HVDC and FACTS	L	T	P	C
		3	0	0	3

1. Course Description:

This course provides a comprehensive study of advanced technologies in electrical power transmission, focusing on reactive power control, HVDC transmission systems, FACTS (Flexible AC Transmission Systems) controllers including SVC, TCSC, STATCOM, and SSSC, as well as Line Commutated HVDC and Voltage Source Converter (VSC) based HVDC transmission. It covers theoretical foundations, operational principles, control strategies, and practical applications in modern power systems.

2. Course Objectives:

1. To explain the problems and features in AC transmission and DC transmission systems.
2. To explore the SVC and TCSC facts controllers in power system.
3. To provide the knowledge on IGBT based FACTS controllers and their features.
4. To explain the basic operation Line Commutated Converter(LCC) based HVDC links.
5. To impart knowledge on voltage source converter based HVDC link.

3. Syllabus

Unit – I: Introduction

Reactive power control in electrical power transmission lines; Load & system compensation; Uncompensated transmission line; Shunt and series compensation; Need for HVDC Transmission, Comparison between AC & DC Transmission, Types of HVDC transmission System.

Unit – II: Static VAR Compensator (SVC) and Thyristor Controlled Series Compensator (TCSC)

VI characteristics of FC+TSR, TSC+TSR, Voltage control by SVC and advantages of slope in dynamic characteristics; Influence of SVC on system voltage; Design of SVC voltage regulator; Thyristor Controlled Series Compensator (TCSC): Concept of TCSC, Operation of the TCSC, Different modes of operation, Applications.

Unit – III: Voltage Source Converter Based Facts Controllers

Static Synchronous Compensator (STATCOM): Principle of operation, V-I Characteristics and Applications; Steady state power transfer; Enhancement of transient stability; Prevention of voltage instability; SSSC: Operation of SSSC, VI characteristics, Enhancement in Power transfer capability; UPSC: Operation Principle and Applications.

Unit – IV: Line Commutated HVDC Transmission

Operation of Gratz bridge: Effect of delay in Firing Angle, Effect of commutation overlap and Equivalent circuit; Basic concept of HVDC transmission; Model of operations, Control of power flow CC and CIA mode of operation.

Unit – V: VSC Based HVDC Transmission

Basic 2 level IGBT inverter operation: 4 Quadrant operation, Phase angle control and dq control. Control of power flow in VSC based HVDC Transmission; Topologies of MTDC system.

Text Books:

Chairman – Board of Studies.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

1. R. Mohan Mathur, Rajiv K.Varma ,"Thyristor–Based Facts Controllers for Electrical Transmission Systems", IEEE press and John Wiley & Sons, Inc, 2002.
2. Narain G.Hingorani, "Understanding FACTS-Concepts and Technology of Flexible AC Transmission Systems", Standard Publishers Distributors, Delhi-110006, 2011.

References:

Reference Books:

1. K.R. Padiyar, "FACTS Controllers in Power Transmission and Distribution", New Age International (P) Limited, Publishers, New Delhi, 2008
2. T.John, "Flexible A.C. Transmission Systems", Institution of Electrical and Electronic Engineers (IEEE), 1999.
3. V.K. Sood, HVDC and FACTS controllers–Applications of Static Converters in Power System, Kluwer Academic Publishers,2004.
4. R. Mohan Mathur, Rajiv K. Varma, "Thyristor Based Controllers for Electrical Transmission Systems", WileyIndia, 2013.

Journal References:

1. IEEE Transactions on Power Delivery
2. Electric Power Systems Research
3. IET Generation, Transmission & Distribution
4. IEEE Transactions on Power Systems
5. International Journal of Electrical Power & Energy Systems

Web Resources:

1. https://www.epri.com/
2. https://www.cigre.org/
3. https://www.youtube.com/watch?v=vYPW2Kvxco4
4. https://www.youtube.com/watch?v=sJ2Rh1zoR4Q

MOOC / NPTEL / SWAYAM Courses:

1. Flexible AC Transmission Systems (FACTS) - Instructor: Prof. S.K. Bhattacharyya, IIT Kharagpur.
2. HVDC Transmission - Instructor: Prof. S.A. Khaparde, IIT Bombay.
3. Coursera: Electric Power Systems Specialization - Offered by University at Buffalo, SUNY.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE544.1	Understand the problems in AC transmission systems and understand the need for Flexible AC transmission systems and HVDC Transmission.
R19EE544.2	Understand the operation and control of SVC and TCSC and its applications to enhance the stability and damping.
R19EE544.3	Understand the d-q control based operation of VSC based HVDC Transmission
R19EE544.4	Analyze basic operation and control of Line Commutated HVDC Transmission.
R19EE544.5	Analyze basic operation and control of voltage source converter based FACTS controllers

Chairman – Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE545	Power System Planning and Reliability	L	T	P	C
		3	0	0	3

1. Course Description:

Power System Planning and Reliability provides an in-depth understanding of the methodologies and tools used in the planning and ensuring reliability of modern power systems. The curriculum covers both theoretical and practical aspects, focusing on the critical elements required to design and maintain efficient, resilient, and sustainable power systems. This course aims to provide engineering students with a strong understanding of Power system planning and reliability.

2. Course Objectives:

1. Equip students with the skills to efficiently plan and optimize power systems, integrating renewable energy sources and ensuring regulatory compliance.
2. Develop the ability to assess and enhance power system reliability through advanced analytical techniques and risk management strategies.
3. To impart knowledge on the transmission system reliability analysis
4. To provide knowledge on the power system expansion planning and its necessity
5. To give an overview on the distribution system planning.

3. Syllabus

Unit – I: Load Forecasting

Objectives of forecasting; Load growth patterns and their importance in planning; Load forecasting Based on discounted multiple regression technique; Weather sensitive load forecasting Determination of annual forecasting; Use of AI in load forecasting.

Unit – II: Generation System Reliability Analysis

Probabilistic generation and load models; Determination of LOLP and expected value of demand not served; Determination of reliability of ISO and interconnected generation systems; Reliability indices.

Unit – III: Transmission System Reliability Analysis

Deterministic contingency analysis; Probabilistic load flow; Fuzzy load flow probabilistic transmission system reliability analysis; Determination of reliability indices like LOLP and expected value of demand not served.

Unit – IV: Expansion Planning

Basic concepts on expansion planning; Procedure followed for integrate transmission system planning, current practice in India; Capacitor placement problem in transmission system and radial distributions system.

Unit – V: Distribution System Planning Overview

Introduction, Sub transmission lines and distribution substations; Design of primary and secondary systems; distribution system protection and coordination of protective devices.

Text Books:

1.Roy Billinton, Ronald N. Allan, "Reliability Evaluation of Power System", Springer Publication.

Chairman – Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

References:

Reference Books:

1. Sullivan R.L, "Power System Planning", Tata McGraw Hill, 1989.
2. Wang X, McDonald J.R, "Modern Power System Planning", Tata McGraw Hill, 1994.
3. Turan Gonen, "Electrical Power Distribution Engineering", CRC Press, 3rd Edition, 2014.

Journal References:

1. IEEE Transactions on Power Systems
2. Electric Power Systems Research
3. International Journal of Electrical Power & Energy Systems
4. Energy Policy
5. Reliability Engineering & System Safety

Web Resources:

1. https://www.dnv.com/services/power-system-planning-and-reliability-5535/
2. https://zoetalentsolutions.com/course/electric-power-system-planning-and-reliability-calculation
3. https://ekeeda.com/degree-courses/electrical-engineering/power-system-planning-and-reliability
4. https://www.dnv.com/power-renewables/transmission-distribution/power-system-planning/
5. https://www.siemens.com/global/en/products/energy/

MOOC / NPTEL / SWAYAM Courses:

1. https://archive.nptel.ac.in/courses/117/103/117103149/
2. https://nptel.ac.in/courses/108106026
3. http://www.digimat.in/nptel/courses/video/108102047/

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE545.1	Describe the concepts of load forecasting.
R19EE545.2	Discuss reliability analysis of ISO and interconnected systems.
R19EE545.3	Explain the concepts of Contingency analysis and Probabilistic Load flow analysis.
R19EE545.4	Outline the concepts of Expansion planning.
R19EE545.5	Discuss the fundamental concepts of the Distribution system planning.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE546	Artificial Intelligence in Power Systems	L	T	P	C
		3	0	0	3

1. Course Description:

Artificial intelligence (AI) and its uses in contemporary power systems are the focus of this course. In this lesson, students will discover how to improve power systems' efficiency, dependability, and sustainability by utilising AI technologies. Learn the ins and outs of artificial intelligence (AI) with a focus on the power sector. Topics covered include optimisation methods, machine learning, neural networks, and basic AI principles.

2. Course Objectives:

1. To impart knowledge about basic significance of artificial intelligence in the area of decision making, recognition, similarity matching etc.
2. To apply the concept of statistical reasoning on rule based systems and learn application of Baye's theorem on modern AI interface.
3. To introduce the students to the general structure of the network for transferring power from generating stations to the consumers.
4. Analyze the working of expert systems by learning the functioning of different known Expert Systems.
5. Understand the concept of pattern recognition and its methods and applications of those in modern AI interface.

3. Syllabus

Unit – I: Introduction to Artificial Intelligence

Definition – Applications – Components of an AI program – Production system – Problem Characteristics – Overview of searching techniques – Knowledge representation – Knowledge representation issues and overview – Representing knowledge using rules – Procedural versus declarative knowledge – Logic programming – forward versus backward reasoning – Matching – Control knowledge.

Unit – II: Statistical Reasoning

Probability and Daye's theorem – Certainty factor and rule based systems – Baysian Networks – Dampster Shafer theorem – Semantic nets and frames – Script – Examples of knowledge based systems.

Unit – III: Pattern Recognition

Introduction – Automatic pattern recognition scheme – Design Concepts – Methodologies – Concepts of Classifier – Concept of feature selection – Feature selection based on means and covariances. Statistical classifier design algorithms – Increment – Correction and LMSE algorithms – Applications.

Unit – IV: Artificial Neural Networks

Biological Neuron - Neural Net - use of neural nets - applications - Perception - Idea of single layer and multilayer neural nets - back propagation - Hopfield nets - Supervised and unsupervised learning.

Unit – V: Expert Systems

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Introduction – Study of some popular expert systems – Expert System building tools and Shells - Design of Expert Systems.

Text Books:

1. Nagendra Singh and John D. McDonald. Artificial Intelligence Techniques in Power Systems Operations and Analysis. 1st Edition, CRC Press, 2021.
2. Kaushik Das Sharma and Bhavesh Bhalja. Machine Learning and Deep Learning in Real-Time Applications in Power Systems. 1st Edition, Springer, 2021.

References:

Reference Books:

1. Ajith Abraham, Swagatam Das, and Himanshu Soni (Editors). Artificial Intelligence and Machine Learning in Power System Operations and Analysis: A Modern Computational Approach. 1st Edition, CRC Press, 2022.
2. Hongjian Sun, Anastasios Zafeiropoulos, and Nick Jenkins. AI and Machine Learning for Smart Energy Systems. 1st Edition, Institution of Engineering and Technology (IET), 2020.
3. Almotaz Y. Abdelaziz, Shady HossamEldeen Abdel Aleem, Anamika Yadav, "Artificial Intelligence Applications in Electrical Transmission and Distribution Systems Protection", CRC Press, First Edition, 2021.

Journal References:

1. IEEE Transactions on Power Systems
2. IEEE Transactions on Smart Grid
3. Electric Power Systems Research
4. International Journal of Electrical Power & Energy Systems
5. IEEE Access

Web Resources:

1. https://academic.oup.com/ce/article/7/6/1199/7425141
2. https://www.pnnl.gov/publications/artificial-intelligencemachine-learning-technology-power-system-applications-0

MOOC / NPTEL / SWAYAM Courses:

1. https://onlinecourses.nptel.ac.in/noc24_ge47/preview
2. https://onlinecourses.nptel.ac.in/noc24_ee130/preview

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE546.1	Outline the basics of Artificial Intelligence and its necessity.
R19EE546.2	Illustrate the knowledge based systems with examples.
R19EE546.3	Explain the concept of pattern recognition and its applications.
R19EE546.4	Classify the artificial neural networks and explain learning procedure.
R19EE546.5	Build expert systems for certain applications.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641202.

R19EE547	Substation Engineering and Automation	L	T	P	C
		3	0	0	3

1. Course Description:

Substation Engineering and Automation provides comprehensive knowledge on the design, operation, and automation of electrical substations, focusing on modern control systems and smart grid integration. It covers substation components, protection schemes, and advanced automation technologies for enhanced efficiency and reliability. This course aims to provide engineering students with a strong understanding the function of Substation Engineering and Automation

2. Course Objectives:

1. To impart in-depth knowledge of substation design, operation, and automation, emphasizing modern control systems and smart grid technologies.
2. To teach substation components, protection schemes, and advanced automation techniques to enhance system efficiency and reliability.
3. To emphasize on the need for power system protection and its components.
4. To provide basic knowledge on the substation design and layout engineering.
5. To facilitate learning on substation industrial topics.

3. Syllabus

Unit – I: Substation Design Development

Substation Introduction and Classifications; Different bus bar switching schemes for Substation. Standards and Practices, Factors Influencing Substation Design; Altitude, Ambient Temperature, Earthquake and seismic zones, pollution and corrosion etc.; Testing of Electrical Equipment; Concept and development of Single Line Diagram. Requirement of substation calculation.

Unit – II: Substation Equipment

Selection and sizing of main substation equipment: Transformer, Isolator, Circuit Breaker, surge arrestor, Instrument transformers; classification of equipment with a practical overview, and the performance parameters. Classifications of MV Switchgear and Key Design Parameters; MV/LV Switchgear construction and design of control scheme. Station Auxiliary equipment: Diesel Generator System, Basics of AC/DC Auxiliary Power System

Unit – III: Protection

Power System protection; Overcurrent and Earth Fault protection and coordination. Distribution Feeder Protection, Transformer; Unit/Main Protection; Familiarization of NUMERICAL Relays; distance/differential protection for transmission line. Bus and Line Reactor Protection, Capacitor protection.

Unit – IV: Substation Design and Layout Engineering

Layout aspects of Outdoor Air Insulated Substation and GIS: Statutory Clearances, Equipment Layout engineering aspects for Outdoor Substation/GIS and related calculations, and guide lines; Cable routing layout, Erection Key Diagram (EKD); switchyard earthing design as per IEEE80; Importance and Types of Earthing, Earthing Design; Types of Earthing Material; Direct stroke Lightning Protection for switchyard with IS/ IEC 62305. LV Cables; Power & Control, MV Cables,

Unit – V: Substation Industrial Topics

Chairman – Board of Studies

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Remote tap changer control; Auto bus transfer scheme; Capacitor bank concepts; Anitpumping relay; trip circuit supervision; Breaker Failure concepts. Single line diagram; Schematic overview; General Arrangements; bill of Materials ; AC Distribution panel; DC Distribution panel; ANSI Code & IEC codes.

Text Books:

1. Alstom Grid, "Network Protection & Automation Guide", Alstom Grid Worldwide Contact Centre, May 2011.
2. Partap Singh Satnam, P.V. Gupta, "Sub-station Design and Equipment", Dhanpat Rai Publications, 1st Edition, 2013

References:

Reference Books:

1. McDonald John D, "Electric Power Substations Engineering", CRC Press, 3rd Edition, 2012
2. S. Rao. Electrical Substation Engineering & Practice. 3rd Edition, Khanna Publishers, 2015.
3. Manual on Substation by Central Board of irrigation and Power (CBIP) Publication No 342., 2006.
4. Evelio Padilla. Substation Automation System Design and Implementation. 1st Edition, Wiley Publications, November 2015.

Journal References:

1. IEEE Transactions on Power Delivery
2. IEEE Transactions on Smart Grid
3. International Journal of Electrical Power & Energy Systems

Web Resources:

1. ABB Substation Automation
2. Siemens Substation Automation Systems
3. Schneider Electric Substation Automation

MOOC / NPTEL / SWAYAM Courses:

1. https://archive.nptel.ac.in/courses/108/107/108107112/
2. https://archive.nptel.ac.in/courses/108/105/108105062/

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE547.1	Understand the key deciding factors involved in substation design and operation
R19EE547.2	Know about the sizing and selection of equipment which forms part of substation
R19EE547.3	Understand different protection
R19EE547.4	Know about composite layout design aspects of the substation with different services and the challenges including statutory clearances
R19EE547.5	Understand topic on substation Industrial

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Chairman - Board of Studies

VERTICAL 5 – POWER ELECTRONICS AND DRIVES

R19EE551	Advanced Power Semiconductor Devices	L	T	P	C
		3	0	0	3

1. Course Description:

This course provides an in-depth exploration of advanced power semiconductor devices, focusing on their principles, characteristics, applications, and advancements. It covers a range of semiconductor technologies and their integration into modern power electronic systems, emphasizing efficiency, reliability, and performance.

2. Course Objectives:

1. To impart knowledge on power semiconductor fundamentals
2. To teach the characteristics of current controlled devices
3. To provide knowledge on the characteristics of voltage controlled devices
4. To study about protecting circuit
5. To learn about safety standards and practices related to the use of power semiconductor devices

3. Syllabus

Unit – I: Introduction

Power switching devices overview – Attributes of an ideal switch, application requirements, circuit symbols; Power handling capability – (SOA); Device selection strategy – On-state and switching losses – EMI due to switching - Power diodes - Types, forward and reverse characteristics, switching characteristics – rating.

Unit – II: Current Controlled Devices

BJT's – Construction, static characteristics, switching characteristics; Negative temperature coefficient and secondary breakdown; Power darlington - Thyristors – Physical and electrical principle underlying operating mode, Two transistor analogy – concept of latching – Gate and switching characteristics - converter grade and inverter grade and other types – series and parallel operation – comparison of BJT and Thyristor – steady state and dynamic models of BJT & Thyristor.

Unit – III: Voltage Controlled Devices

Power MOSFETs and IGBTs – Principle of voltage controlled devices, construction, types, static and switching characteristics, steady state and dynamic models of MOSFET and IGBTs - Basics of GTO, MCT, FCT, RCT and IGCT.

Unit – IV: Firing and Protecting Circuits

Necessity of isolation, pulse transformer, optocoupler – Gate drives circuit: SCR, MOSFET, IGBTs and base driving for power BJT. - Over voltage, over current and gate protections; Design of snubbers.

Unit – V: Thermal Protection

Heat transfer – conduction, convection and radiation; Cooling – liquid cooling, vapour – phase cooling; Guidance for hear sink selection – Thermal resistance and impedance –Electrical analogy of thermal components, heat sink types and design – Mounting types.

Text Books:

Chairman Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

1.	Muhammad H. Rashid, "Power Electronics Circuits: Devices and Applications", Pearson, Third Edition, 2004

References:

Reference Books:

1. Williams B.W, "Power Electronics: Devices, Drivers and Applications", Macmillan, 1987.
2. Singh M. D. and Khanchandani K. B., "Power Electronics", Tata McGraw Hill, 2013.
3. Ned Mohan, Tore. M. Undeland, William. P. Robbins, "Power Electronics: Converters, Applications and Design", John Wiley India, Third Edition Reprint, 2009.

Journal References:

1. IEEE Transactions on Power Electronics
2. IEEE Journal of Emerging and Selected Topics in Power Electronics
3. Power Electronics, IEEE Transactions
4. Solid-State Electronics

Web Resources:

1. https://www.allaboutcircuits.com/technical-articles/a-review-on-power-semiconductor-devices/
2. https://www.powersemiconductorsweekly.com/
3. https://www.tutorialspoint.com/power_electronics/power_electronics_quick_guide.htm

MOOC / NPTEL / SWAYAM Courses:

1. https://www.tutorialspoint.com/power_electronics/power_electronics_quick_guide.htm

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE551.1	Select power semiconductor device structures for adjustable speed motor control applications..
R19EE551.2	Illustrate the static and dynamic characteristics of current controlled power semiconductor devices
R19EE551.3	Illustrate the static and dynamic characteristics of voltage controlled power semiconductor devices.
R19EE551.4	Select devices for different power electronics applications.
R19EE551.5	Explain the control and firing circuit for different devices.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE552	Modern Power Converters	L	T	P	C
		3	0	0	3

1. Course Description:

Modern Power Converters is a course which provides a comprehensive understanding of power conversion technologies and their applications in modern electrical and electronic systems. This course covers the principles, design, and operation of various types of power converters, including AC-DC, DC-DC, DC-AC, and AC-AC converters.

2. Course Objectives:

1. To familiarize the student with the functions of several variables.
2. To make the students understand various techniques of double integration.
3. To impart knowledge on the modern DC to AC converters.
4. To facilitate learning on the different types of AC to AC converters.
5. To introduce soft switching power converters.

3. Syllabus

Unit – I: Switched Mode Power Supplies (SMPS)

DC Power supplies and Classification; Switched mode dc power supplies - with and without isolation, single and multiple outputs; Closed loop control and regulation; Design examples on converter and closed loop performance.

Unit – II: AC-DC Converters

Switched mode AC-DC converters. synchronous rectification - single and three phase topologies - switching techniques - high input power factor. reduced input current harmonic distortion. improved efficiency. with and without input-output isolation. performance indices design examples.

Unit – III: DC-AC Converters

Multi-level Inversion - concept, classification of multilevel inverters, Principle of operation, main features and analysis of Diode clamped, Flying capacitor and cascaded multilevel inverters; Modulation schemes.

Unit – IV: AC-AC Converters with and without DC Link

Matrix converters. Basic topology of matrix converter; Commutation – current path; Modulation techniques - scalar modulation, indirect modulation; Matrix converter as only AC-DC converter; AC-AC converter with DC link - topologies and operation - with and without resonance link - converter with dc link converter; Performance comparison with matrix converter with DC link converters.

Unit – V: Soft-Switching Power Converters

Soft switching techniques. ZVS, ZCS, quasi resonance operation; Performance comparison hard switched and soft switched converters.AC-DC converter, DC-DC converter, DC-AC converter.; Resonant DC power supplies.

Text Books:

1. Muhammad H. Rashid, "Power Electronics Handbook", Academic press, Second Edition, 2007.
2. Fang Lin Luo and Fang Lin Luo, "Advanced DC/DC Converters", CRC Press, 2004

References:

Reference Books:

1. Issa Batarseh, "Power Electronic Circuits", John Wiley and Sons, 2004.
2. Frede Blaabjerg and Zhe Chen, Morgan, "Power Electronics for Modern Wind Turbines, Claypool Publishers series, 2006.
3. Philip T. Krein, "Elements of Power Electronics", Oxford University Press, Second Edition, 2015.
4. Agarwal, "Power Electronics: Converters, Applications and Design, Prentice Hall, Third Edition, 2000.
5. Umanand L, "Power Electronics: Essentials and Applications", John Wiley and Sons, 2009.

Journal References:

1. Journal of Modern Power Systems and Clean Energy
2. IEEE Transactions on Power Electronics
3. Journal of Power Electronics
4. Protection and Control of Modern Power Systems
5. Energy and Environmental Science

Web Resources:

1. IEEE Xplore Digital Library
2. MIT OpenCourseWare (OCW): Power Electronics
3. Coursera: Power Electronics Specialization
4. TI Training: Power Management
5. edX: Power Electronics

MOOC / NPTEL / SWAYAM Courses:

1. NPTEL Power Electronics Course - https://nptel.ac.in/courses/108105066
2. Fundamental of Power Electronics - https://onlinecourses.nptel.ac.in/noc21_ee01

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE552.1	Realize the working of Switched Mode Power Supplies.
R19EE552.2	Illustrate the perform and working of DC-AC Converters.
R19EE552.3	Identify the suitable methods for choosing the inverter.
R19EE552.4	Classify the different types and application of AC-AC converters.
R19EE552.5	Summarize the different soft switching techniques used in Modern Power converters.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE553	Flexible AC Transmission Systems	L	T	P	C
		3	0	0	3

1. Course Description:

Flexible AC Transmission Systems (FACTS) course explores the principles and applications of FACTS for enhancing the controllability and stability of power systems. It covers the design, operation, and benefits of FACTS devices in improving power flow and voltage regulation. This course aims to provide engineering students with a strong understanding the function of Flexible AC Transmission Systems.

2. Course Objectives:

1. To introduce the concept of FACTS and importance in power systems.
2. To impart knowledge on static VAR compensator and its applications.
3. To facilitate learning on the Thyristor controlled series capacitor and applications.

3. Syllabus

Unit – I: Introduction

Real and reactive power control in electrical power transmission lines; loads & system compensation; Uncompensated transmission line; shunt and series compensation.

Unit – II: Static VAR Compensator

Voltage control by SVC; Advantages of slope in dynamic characteristics; Influence of SVC on system voltage; Design of SVC voltage regulator; TCR, FC, TCR; Modelling of SVC for power flow and fast transient stability; Applications. Enhancement of transient stability; Steady state power transfer; Enhancement of power system damping.

Unit – III: Thyristor Controlled Series Capacitor and Applications

Operation of the TCSC; Different modes of operation; Modelling of TCSC; Variability reactance model; Modelling for Power Flow and stability studies. Applications: Improvement of the system stability limit; Enhancement of system damping.

Unit – IV: Voltage Source Converter Based Facts Controllers

Static Synchronous Compensator Applications: Steady state power transfer; enhancement of transient stability; Prevention of voltage instability. SSSC, Operation of SSSC and the control of power flow; Modelling of SSSC in load flow and transient stability studies; Dynamic voltage restorer.

Unit – V: Advanced Facts Controllers

Interline DVR; Unified Power flow controller (UPFC); Interline power flow controller (IPFC); Unified Power quality conditioner (UPQC).

Text Books:

1. Mohan Mathur R, Rajiv K. Varma, "Thyristor – Based Facts Controllers for Electrical Transmission Systems", IEEE press and John Wiley & Sons, 2002.

References:

Reference Books:

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

1. Narain G. Hingorani, LaszioGyugyi, "Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems", Standard Publishers, 2011.
2. T.J.E Miller, "Reactive Power Control in Electric Systems", Wiley India, 2010.
3. K.R. Padiyar, "FACTS Controllers in Power Transmission and Distribution", New Age International. 2008.

Journal References:

1. IEEE Transactions on Power Electronics
2. IEEE Transactions on Power Systems
3. International Journal of Electrical Power & Energy Systems
4. Electric Power Systems Research
5. IET Generation, Transmission & Distribution

Web Resources:

1. https://www.electrical4u.com/facts-on-facts-theory-and-applications/
2. https://www.siemens-energy.com/global/en/home/products-services/product-offerings/flexible-ac-transmission-systems
3. https://eee.poriyaan.in/topic/flexible-ac-transmission-systems--facts--12194/
4. https://electrical-engineering-portal.com/flexible-ac-transmission-system/
5. https://automationforum.co/what-is-a-flexible-ac-transmission-system-facts/

MOOC / NPTEL / SWAYAM Courses:

1. https://archive.nptel.ac.in/courses/108/107/108107114/
2. https://archive.nptel.ac.in/noc/courses/noc18/SEM2/noc18-ee44/

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE553.1	Explain the various FACTS controller for power system application.
R19EE553.2	Describe the concepts of load compensation techniques.
R19EE553.3	Discuss FACTS devices and the start-of-art of power system.
R19EE553.4	Explain the performance of steady state & transients of FACTS controllers.
R19EE553.5	Explain advanced FACTS controllers.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE554	Power Quality	L	T	P	C
		3	0	0	3

1. Course Description:

This course covers fundamentals such as voltage sags, harmonics, flicker, and their impact on sensitive equipment and networks. Gain insights into measurement techniques, standards compliance, mitigation strategies, and the latest technologies to maintain optimal power reliability and efficiency.

2. Course Objectives:

1. To make the students understand, analyze, and address power quality issues effectively.
2. To make the students understand various strategies and implementation technologies to mitigate and correct power quality issues.
3. To impart knowledge on voltage sag and transients and their effects on power system.
4. To facilitate learning on wiring, grounding and waveform distortion and their effects.
5. To enlighten the students with the Power Quality Monitoring and solutions.

3. Syllabus

Unit – I: Basics of Power Quality

Definitions – Power quality, Voltage quality – Power quality issues: short duration voltage variations, long duration voltage variations – Flicker, Transients, Waveform distortion, Voltage imbalance, Voltage fluctuation, Power frequency variations – Sources and Effects of power quality problems – IEEE and IEC Standards- Computer Business Equipment Manufacturers Associations (CBEMA) curve – ITC curves.

Unit – II: Study on Interruptions

Short Interruptions: Introduction – Origin of short interruptions: Voltage magnitude events due to re-closing, Voltage during the interruption – Monitoring of short interruptions, Adjustable speed drives, electronic equipment's – Single phase tripping: Voltage during fault and post fault period, Current during fault period. Long Interruptions: Definition – Failure, Outage, Interruption – Origin of interruptions – Causes of long interruptions – Principles of regulating the voltage – Voltage regulating devices.

Unit – III: Voltage Sag and Transients

Voltage Sag: Introduction – Definition – Magnitude, Duration – Causes of Voltage Sag – Load influence on voltage sags on Adjustable speed drives, Power electronics loads, Sensitive loads – Unbalance and neutral current issues – Overview of mitigation methods. Transients: Definition and types – Sources and causes of transients – Principles of over voltage protection – Devices for over voltage protection – Capacitor switching transients – Lightning transients – Transients from load switching.

Unit – IV: Wiring, Grounding and Waveform Distortion

Wiring and Grounding: Definitions-wiring and grounding problems-solutions to wiring and grounding problems. Waveform Distortion: Introduction – Definition and terms – Harmonics, Harmonics indices, Inter harmonics, Notching – Voltage Vs Current distortion – Harmonics Vs Transients – Sources and effects of harmonic distortion – System response characteristics.

Unit – V: Power Quality Monitoring and Solutions

Chairman – Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202.

Introduction – Need for power quality monitoring, Evolution of power quality monitoring – Introduction to power quality measurement equipment's – Mitigation and control techniques – Passive and active Filters for Harmonic Reduction.
Text Books:
1. Dugan Roger C., McGranaghan, Mark F. and Beaty, H. Wayne, "Electrical Power Systems Quality", Third Edition, McGraw-Hill, Reprint 2013.
References:
Reference Books: 1. Sankaran C., "Power Quality", CRC Press, First Edition, 2002. 2. Bollen Math II.J., "Understanding Power Quality Problems: Voltage Sags and Interruptions", IEEE Press, First Edition, 2000. 3. Arrillaga J., Watson N.R., and Chen S., "Power System Quality Assessment", John Wiley, First Edition, 2000. **Journal References:** 1. IEEE Transactions on Power Delivery 2. IEEE Transactions on Power Systems 3. Electric Power Systems Research 4. Renewable Energy and Power Quality Journal **Web Resources:** 1. IEEE Xplore Digital Library 2. EPRI Power Quality Online Resource - https://mypq.epri.com/ 3. PQSynergy - https://www.pqsynergy.com/ **MOOC / NPTEL / SWAYAM Courses:** 1. https://onlinecourses.nptel.ac.in/noc21_ee103 2. https://archive.nptel.ac.in/courses/108/107/108107157/ 3. https://www.udemy.com/course/introduction-to-power-quality/

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE554.1	Explain the concept of utility distribution and industrial electric power quality phenomena.
R19EE554.2	Discuss the causes and significances of short and long interruptions and their mitigation techniques.
419EE554.3	Outline the concepts of voltage sag and transient phenomena.
R19EE554.4	Explain the root cause, effects and mitigation of waveform distortion and earthing.
R19EE554.5	Explain the monitoring equipment's of power quality, assessments and data interpretation for industrial application

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Chairman – Board of Studies

R19EE555	Application of Power Electronics to Power Systems	L	T	P	C
		3	0	0	3

1. Course Description:

This course covers the principles, applications, and design considerations of power electronic devices such as converters, inverters, and controllers. This course provides an opportunity to the students to explore the integration of power electronics in modern power systems for efficient energy conversion and control.

2. Course Objectives:

1. To provide knowledge on the basics of different types of power converters.
2. To teach the application of power electronic devices used for maintaining power quality.
3. To explain the modelling and analysis of FACTS controllers.
4. To introduce the concept of harmonics in electrical systems and its effects.
5. To familiarize the methods to mitigate the harmonics.

3. Syllabus

Unit – I: Introduction

Power Converter Circuits: Rectifier, Inverter, Chopper and Cycloconverter and its applications in Power System.

Unit – II: Steady State and Dynamic Problems in AC Systems

Flexible AC transmission systems (FACTS), Principles of series and shunt compensation, Description of static var compensators (SVC), Thyristor Controlled series compensators (TCSC), Static phase shifters (SPS), Static condenser (STATCON), Static synchronous series compensator (SSSC) and Unified power flow controller (UPFC).

Unit – III: Modelling and Analysis of FACTS Controllers

Control strategies to improve system stability, Power Quality problems in distribution systems

Unit – IV: Harmonics

Harmonics creating loads, modelling, harmonic propagation, Series and parallel resonances, harmonic power flow

Unit – V: Mitigation of Harmonics

Mitigation of harmonics, filters, passive filters, Active filters, shunt, series hybrid filters, voltage sags & swells, voltage flicker, Mitigation of power quality problems using power electronic conditioners, IEEE standards, HVDC Converters and their characteristics, Control of the converters (CC and CEA), Parallel and series operation of converters.

Text Books:

1. N.G. Hingorani, Laszlo Gyugyi, "Understanding FACTS", IEEE Press, 2000.

References:

Reference Books:

1. K.R. Padiyar, "FACTS controllers in Power Transmission and Distribution", New Age International publishers, New Delhi, 2007.

2. K.R. Padiyar, "HVDC Power Transmission Systems", New Age International Publishers, New Delhi, 1999.
3. E. F. Fuchs, Mohammad A.S. Masoum, "Power Quality in Power Systems and Electrical Machines", Elsevier Academic Press 2008.

Journal References:

1. IEEE Transactions on Power Electronics
2. IEEE Transactions on Power Systems
3. Electric Power Systems Research
4. IET Power Electronics

Web Resources:

1. IEEE Xplore Digital Library
2. European Power Electronics and Drives Association (EPE)

MOOC / NPTEL / SWAYAM Courses:

1. https://onlinecourses.nptel.ac.in/noc24_ee130/preview

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE555.1	Understand the basic converter circuits used in day electric power system.
R19EE555.2	Analyze the control actions to be implemented on the system to meet the system demand.
419EE555.3	Acquire knowledge on modelling and analysis of FACTS controllers.
R19EE555.4	Realize the harmonics created due to various load and its impact.
R19EE555.5	Apply the different harmonic mitigation techniques to improve power quality of the power system.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE556	SMPS and UPS	L	T	P	C
		3	0	0	3

1. Course Description:

This course offers a thorough comprehension of Switch Mode Power Supply (SMPS) and Uninterruptible Power Supply (UPS) systems, with a specific emphasis on their design, functioning, and practical use. Students will examine the ideas and technologies that underlie these power supply systems, acquiring knowledge of their functions in guaranteeing dependable and effective power distribution in many applications.

2. Course Objectives:

1. To provide a comprehensive understanding of the basic principles, design, and operation of Switch Mode Power Supply (SMPS) and Uninterruptible Power Supply (UPS) systems.
2. To explore the practical applications of SMPS and UPS in different industries and scenarios, including critical systems that require reliable power delivery.
3. To demonstrate the working of buck boost and buck- boost converters in continuous and discontinuous conduction mode.
4. To analyze the behaviors of isolated DC-DC converters and to design SMPS for battery operated vehicle.
5. To compare the different topologies of UPS and also simulate them.

3. Syllabus

Unit – I: DC-DC Converters

Principles of step down and step up converters – Analysis and state space modelling of Buck, Boost, Buck- Boost and Cuk converters.

Unit – II: Switching Mode Power Converters

Analysis and state space modelling of fly back, Forward, Luo, Half bridge and full bridgeconverters- control circuits and PWM techniques.

Unit – III: Resonant Converters

Introduction- classification- basic concepts- Resonant switch- Load Resonant converters- ZVS , Clamped voltage topologies- DC link inverters with Zero Voltage Switching- Series and parallel Resonant inverters- Voltage control .

Unit – IV: DC-AC Converters

Single phase and three phase inverters, control using various (sine PWM, SVPWM and advanced modulation) techniques, various harmonic elimination techniques- Multilevel inverters- Concepts - Types: Diode clamped- Flying capacitor- Cascaded types- Applications.

Unit – V: Power Conditioners, UPS and Filters

Introduction- Power line disturbances- Power conditioners – UPS: offline UPS, Online UPS, Applications –Filters: Voltage filters, Series-parallel resonant filters, filter without series capacitors, filter for PWM VSI, current filter, DC filters – Design of inductor and transformer for PE applications – Selection of capacitors.

Text Books:

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

1. Ned Mohan, Tore M. Undeland, and William P. Robbins, "Power Electronics: Converters, Applications, and Design", 3rd Edition, Wiley, 2002.
2. Christophe Basso, "Switch-Mode Power Supplies: SPICE Simulations and Practical Designs", McGraw-Hill, 2008.

References:

Reference Books:

1. Ali Emadi, "Uninterruptible Power Supplies and Active Filters", CRC Press, 2015.
2. Marty Brown, "Power Supply Cookbook", 2nd Edition, Newnes, 2001.
3. Abraham I. Pressman, Keith Billings, and Taylor Morey, "Switching Power Supply Design", 3rd Edition, McGraw-Hill, 2009.

Journal References:

1. IEEE Transactions on Power Electronics
2. IEEE Transactions on Industrial Electronics
3. IEEE Transactions on Energy Conversion
4. International Journal of Electrical Power & Energy Systems
5. IEEJ Transactions on Electrical and Electronic Engineering
6. International Journal of Power Electronics

Web Resources:

1. https://www.geeksforgeeks.org/difference-between-smps-and-ups/
2. https://www.smps.us/
3. https://ieeexplore.ieee.org/
4. https://www.powerelectronicsnews.com/
5. https://www.edn.com/

MOOC / NPTEL / SWAYAM Courses:

1. NPTEL Power Electronics Course
2. NPTEL Introduction to Power Electronics Course
3. NPTEL Advanced Power Electronics Course
4. NPTEL Renewable Energy and Distributed Generation Course

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE556.1	Analyze the state space model for DC – DC converters.
R19EE556.2	Acquire knowledge on switched mode power converters.
R19EE556.3	Understand the importance of Resonant Converters.
R19EE556.4	Acquire knowledge on modern power electronic converters and its applications in electric power utility.
R19EE556.5	Acquire knowledge on filters and UPS.

Chairman – Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kondampatti, Coimbatore – 641 202.

R19EE557	Digital Controller in Power Electronics	L	T	P	C
		3	0	0	3

1. Course Description:

This course offers a comprehensive examination of digital control systems as they are applied to power electronics. Students will acquire knowledge of the fundamental principles and practical implementations of digital control techniques utilised in contemporary power electronic converters and systems. This course encompasses both the theoretical underpinnings and practical applications, providing students with the necessary expertise to create, evaluate, and execute digital controllers for diverse power electronic uses.

2. Course Objectives:

1. To teach the fundamentals of control theory, focusing on digital control techniques.
2. To provide knowledge about the hardware platforms used in digital control, such as microcontrollers and Digital Signal Processors (DSPs).
3. To learn design controllers for Power Electronic Systems.
4. To gain knowledge about Special Machines with Controllers incorporated.
5. To acquire knowledge on the design of power converters and implement using hardware.

3. Syllabus

Unit – I: TMS C2XX DSP

Introduction to the C2xx DSP core and code generation. The components of the C2xx DSP core, Peripherals and Peripheral Interface, System configuration registers, Memory, Types of Physical Memory, memory Addressing Modes, Code Composer Studio for C2xx DSP.

Unit – II: I/O and Interrupts

Pin Multiplexing (MUX) and General Purpose I/O Overview, Multiplexing and General Purpose I/O Control Registers, Programming I/O. Introduction to Interrupts, Interrupt Hierarchy, Interrupt Control Registers, Initializing and Servicing Interrupts in Software, Programming Interrupts.

Unit – III: ADC and Event Managers

ADC Overview , Operation of the ADC in the DSP , Overview of the Event manager (EV), Event Manager Interrupts , General Purpose (GP) Timers , Compare Units, Capture Units And Quadrature Enclosed Pulse (QEP) Circuitry, General Event Manager Information, Programming of ADC and Event Managers.

Unit – IV: Design of Controllers for Power Electronic Converters

DSP-based implementation of DC-DC buck-boost converter- DSP-Based implementation of SPWM, SVPWM inverter pulse generation.

Unit – V: Design of Controllers for Special Machines

DSP-based control of permanent magnet brushless DC machines- DSP-based Implementation of clarkes's and park's transformations.

Text Books:

1. Luca Corradini, Dragan Maksimović, Paolo Mattavelli, and Regan Zane. Digital Control of High-Frequency Switched-Mode Power Converters. Wiley-IEEE Press, 2015.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

2. M. Sami Fadali and Antonio Visioli. Digital Control Engineering: Analysis and Design. 2nd Edition, Academic Press, 2012.

References:

Reference Books:

1. Euzeli dos Santos and Edison da Silva, "Advanced Power Electronics Converters: PWM Converters Processing AC Voltages", Springer, 2014.
2. Ned Mohan, Tore M. Undeland, and William P. Robbins, "Power Electronics: Converters, Applications and Design", 3rd Edition, Wiley, 2002.
3. Simone Buso and Paolo Mattavelli, "Digital Control in Power Electronics", IEEE Press, 2006.

Journal References:

1. IEEE Transactions on Power Electronics
2. IEEE Transactions on Industrial Electronics
3. IEEE Journal of Emerging and Selected Topics in Power Electronics
4. International Journal of Electronics and Communications (AEÜ)

Web Resources:

1. http://cce.iisc.ac.in/cdc-2.pdf
2. https://cusp.umn.edu/power-electronics/digital-control-power-electronics
3. https://www.monolithicpower.com/jp/learning/mpscholar/power-electronics/control-of-power-electronic-systems/digital-control-of-power-electronic-systems

MOOC / NPTEL / SWAYAM Courses:

1. https://onlinecourses.nptel.ac.in/noc22_ee124/preview
2. https://nptel.ac.in/courses/108105066

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE557.1	Understand the architecture of DSP processor to write the necessary assembly level language.
R19EE557.2	Explain the various I/Os and interrupts to configure them for a particular application.
R19EE557.3	Program the ADC in DSP to generate necessary firing pulses for various converter circuits.
R19EE557.4	Design the controllers for various power electronic converters
R19EE557.5	Design the controllers for special machines

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

VERTICAL 6 – ELECTRICAL ENERGY ENGINEERING

R19EE561	Utilisation of Electrical Energy	L	T	P	C
		3	0	0	3

1. Course Description:

This course insights on the principles of energy conversion, distribution, utilization technologies, and energy management strategies to enhance efficiency, sustainability, and reliability in electrical energy systems.

2. Course Objectives:

1. To provide a comprehensive understanding of lighting systems, covering the principles of illumination.
2. To impart knowledge on the different types electric heating and welding.
3. To facilitate learning on requirements of electric traction system and recent trends.
4. To equip students with a comprehensive understanding of domestic electrical energy utilization.
5. To educate students about the fundamental components of energy conservation and management.

3. Syllabus

Unit – I: Illumination

Importance of lighting – properties of good lighting scheme – laws of illumination – photometry – types of lamps – lighting calculations – basic design of illumination schemes for residential, commercial, street lighting, factory lighting and flood lighting – LED lighting and energy efficient lamps.

Unit – II: Heating and Welding

Introduction – advantages of electric heating – modes of heat transfer - methods of electric heating - resistance heating – arc furnaces - induction heating – dielectric heating – electric welding – types – resistance welding – arc welding – power supply for arc welding – radiation welding.

Unit – III: Traction

Merits of electric traction – Requirements of electric traction system – Supply systems – Mechanics of train movement – Traction motors and control – Braking – Recent trends in electric traction.

Unit – IV: Domestic Utilization of Electrical Energy

Domestic utilization of electrical energy – Induction based appliances, Online and OFF-line UPS, Batteries - Power quality aspects – Nonlinear and domestic loads – Domestic Earthing.

Unit – V: Elements of Energy Conservation and Management

General energy problem – Sector wise energy consumption – Demand supply gap – Energy conservation method – Scope for energy conservation and its benefits – Energy conservation Principle – Maximum energy efficiency – Maximum cost effectiveness – Energy conservation building codes (ECBC), Energy management concept and objectives – Initializing Planning, Leading, Controlling, Promoting, Monitoring and Reporting.

Text Books:

Chairman – Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

1. Wadhwa, C.L. "Generation, Distribution and Utilization of Electrical Energy", New Age International Pvt. Ltd, 2003.

References:

Reference Books:

1. Uppal S.L, Rao S, "Electrical Power Systems", Khanna Publishers, New Delhi, Fifteenth Edition, 2014.
2. Partab H, "Art and Science of Utilisation of Electrical Energy", Dhanpat Rai and Co, New Delhi, 2004.
3. Gupta J. B., "Utilization of Electric Power and Electric Traction", S. K. Kataria and Sons, 2002.
4. Openshaw Taylor E, "Utilization of Electrical Energy in SI Units", Orient Longman Pvt. Ltd, 2003.

Journal References:

1. IEEE Transactions on Energy Conversion
2. Energy
3. International Journal of Electrical Power & Energy Systems

Web Resources:

1. IEEE Xplore Digital Library
2. Energy.gov - Energy Efficiency & Renewable Energy - https://www.energy.gov/eere/office-energy-efficiency-renewable-energy

MOOC / NPTEL / Online Course:

1. https://nptel.ac.in/courses/108105060

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE561.1	Explain the laws of Illumination and different lighting systems.
R19EE561.2	Describe the process of utilization of electric energy in heating and welding.
419EE561.3	Illustrate the concepts applicable for Electric traction.
R19EE561.4	Discuss the domestic utilization of Electric energy.
R19EE561.5	Describe the concepts of energy conservation and management techniques.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE562	Energy Auditing and Management	L	T	P	C
		3	0	0	3

1. Course Description:

This comprehensive course equips professionals with the expertise to conduct energy audits across various sectors. Through in-depth exploration of energy principles, regulations, and auditing methodologies, participants gain the ability to identify and implement energy-saving measures in electrical utilities, HVAC systems, and thermal processes. Financial analysis techniques are also covered, enabling participants to evaluate the economic viability of energy-saving projects.

2. Course Objectives:

1. To analyze energy consumption patterns and evaluate potential energy savings through comprehensive energy audits.
2. To evaluate the effectiveness of energy management strategies for electrical systems
3. To apply engineering principles to optimize the performance of fluid handling systems.
4. To evaluate the energy efficiency of thermal systems and develop strategies for improvement.
5. To create and implement cost-effective energy efficiency projects.

3. Syllabus

Unit – I: Introduction to Energy Auditing

Classification of Energy - Energy Scenario - Energy Needs of Growing Economy - Energy Pricing in India – Energy and Environment - Energy Conservation Act - Role of energy managers and auditors- Energy Auditing Types, objectives and Methodology -Audit instruments.

Unit – II: Energy Audit in Electrical Utilities

Electric Power Supply Systems - Electricity Billing – Electrical Load Management and Maximum Demand Control- Power factor improvement and its benefit - Factors involved in determination of motor efficiency- Energy efficient motors- Lightning-Energy efficient light sources-Energy Conservation in Lighting schemes.

Unit – III: Fans, Blowers and Pumps

Fan Types - Blower Types- Fan Performance evaluation- Fan Laws- Flow control strategies- Pumps- Types – Factors affecting pump performance- System characteristics- Efficient Pumping system operation- Flow Control Strategies- Energy conservation opportunities in pumping systems

Unit – IV: Energy Audit in Thermal Utilities

Steam – Introduction, Properties of steam, Steam distribution systems - Boilers- Types and Classification- Performance Evaluation of Boilers – Boiler Efficiency- Direct and Indirect methods – Energy Conservation opportunities in boilers- Principle of cogeneration – Technical options for cogeneration- Waste heat recovery - Classification and benefits.

Unit – V: Project and Financial Management

Financial analysis techniques-Simple payback period, Return on investment, Net present value, Internal rate of return, Cash flows, Risk and sensitivity analysis; Financing options, Energy performance contracting and role of ESCOs.

Chairman – Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Text Books:

1. Bureau & Energy Efficiency, "Energy Efficiency in Electrical Utilities", Guide Book for National Certification Examination for Energy Managers and Energy Auditors, 2013. (www.bee - india.nic.in)

References:

Reference Books:

1. Hamies, "Energy Auditing and Conservation; Methods, Measurements, Management & Case Study", Hemisphere, Washington, 1980.
2. Larry C Witte et. al, "Industrial Energy Management & Utilization". Springer Publication, First Edition, 1990.
3. Eastop T.D and Croft D.R, "Energy Efficiency for Engineers and Technologists", Logman Scientific & Technical publications,1990.
4. Reay D.A, "Industrial Energy Conservation", Pergamon Press, First Edition, 1977.

Journal References:

1. Energy and Buildings
2. Applied Energy
3. Energy
4. Journal of Energy Management

Web Resources:

1. https://www.energystar.gov/buildings
2. https://www.ashrae.org/
3. https://www.pumps.org/
4. https://www.chpa.org/
5. https://corporatefinanceinstitute.com/

MOOC / NPTEL / SWAYAM Courses:

1. https://onlinecourses.swayam2.ac.in/nou23_es05/preview
2. https://www.edx.org/learn/energy/hec-montreal-introduction-to-energy-management-powered-by-retscreen
3. https://sustainabilityeducationacademy.com/courses/online-energy-audit-course/

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE562.1	Explain the basic of industrial energy audits, objectives, methodology and outcomes.
R19EE562.2	Identify energy consumption pattern of various electrical utilities.
R19EE562.3	Explain possible auditing methods in electric fans, motors and blower along with energy conservation measures.
R19EE562.4	Identify energy consumption pattern of various thermal utility system.
R19EE562.5	Analyse practice calculation methods to prepare viable energy conservation proposals using project and financial management.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202.

R19EE563	Energy Conservation Practices	L	T	P	C
		3	0	0	3

1. Course Description:

This intensive course equips professionals with comprehensive strategies for electrical energy conservation. Through in-depth exploration of energy-efficient technologies, power factor improvement, and best practices across various applications – motors, lighting, and electric traction – participants gain the knowledge to optimize energy consumption and reduce operational costs. Additionally, the course delves into electrolytic processes and battery storage, providing insights into emerging energy storage solutions.

2. Course Objectives:

1. To understand the principles of energy conservation and its significance.
2. To develop skills in identifying and implementing energy-saving measures in electrical systems.
3. To acquire knowledge of lighting systems and energy-efficient lighting practices.
4. To understand the fundamentals of electric traction and its energy efficiency.
5. To gain knowledge of energy storage technologies and their applications.

3. Syllabus

Unit – I: Introduction to Energy Conservation

Need for electrical energy conservation - methods – energy efficient equipment – energy management – energy auditing - Features of Energy Conservation Act – Economics of power factor improvement – design for improvement of power factor using power capacitors – DSM techniques.

Unit – II: Energy Conservation in Electrical System

Energy Conservation potential in motors – Pumps – Fans and Compressors – Refrigeration and HVAC system, operation and maintenance practices for electrical energy conservation – Case studies.

Unit – III: Energy Conservation in Lighting System

Laws of illumination – Calculation of illumination – Street lighting and Flood lighting – MSCP – Choice of Lighting – Different types of illumination sources and Energy efficiency – Control of Lighting – Lighting standards for industry and Commercial – Energy conservation measures for lighting.

Unit – IV: Electric Traction

Characteristics of traction motors – Choice of an Electric Motor – Control of traction motors – Systems of railway electrification – Power and Energy output from driving axles – Specific Energy output and consumption – Braking methods – Current collection systems – Recent trends in electric traction – Introduction to Aircraft electrical system.

Unit – V: Electrolytic Process and Storage of Electricity

Electrolysis – simple problems involving Faraday's laws of electrolysis - Electroplating – Nickel iron batteries – Lead acid Batteries – components and materials - capacity rating of batteries – battery chargers – Method of charging and maintenance – Case studies.

Text Books:

Chairman – Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202.

1.	Gupta J.B., "Utilization of Electric Power and Electric Traction", S.K. Kataria& Sons, 2-12.

References:

Reference Books:

1. Chakrabarti A., Soni M.L., Gupta P.V. and Bhatnagar U.S., "A Textbook on Power System Engineering", Dhanpat Rai & Co., 2-1-.
2. Taylor E. Openshaw, "Utilization of Electrical Energy", Orient Longman, 2--6.
3. AmlanChakrabarti, "Energy Engineering and Management", PHI, Second Edition, 2-18.
4. Suryanarayana N.V, "Utilisation of Electric power", New Age International Limited, Reprint, 2--5.
5. CB Smith, "Energy Management Principles", Elsevier, Second Edition, 2-16.

Journal References:

1. Energy
2. Applied Energy
3. Energy Efficiency
4. IEEE Transactions on Industrial Electronics (TIE)
5. Electric Traction

Web Resources:

1. https://www.energystar.gov/
2. https://www.energy.gov/eere
3. https://www.ashrae.org/
4. https://www.ies.org/
5. https://uitp.org/

MOOC / NPTEL / SWAYAM Courses:

1. https://onlinecourses.swayam2.ac.in/nou23_es05/preview
2. https://www.coursera.org/learn/energy-and-environment

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE563.1	Summarize the concept of energy conservation and industrial energy management.
R19EE563.2	Identify various energy conservation methods in electrical utilities and best operating practices.
R19EE563.3	Develop the concept of lighting system for all applications aong with various energy conservation measures.
R19EE563.4	Select traction motor, discuss their energy performance and basic applications in railways and aircraft electrical system.
R19EE563.5	Explain the process, technology and application of electrolytic process.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE564	Distributed Generation and Microgrid	L	T	P	C
		3	0	0	3

1. Course Description:

This course provides a comprehensive understanding of various distributed generation technologies, their integration with the grid, the economic and regulatory considerations surrounding them, and the design and control strategies of microgrids.

2. Course Objectives:

1. To introduce the concept of distributed generation and microgrid.
2. To provide students with a comprehensive understanding of distributed generation systems, including their design, operation, and integration into the electrical grid.
3. To equip students with the knowledge necessary to understand and address the challenges and opportunities associated with integrating non-conventional energy (NCE) sources into existing power systems.
4. To facilitate the learning on basics of a microgrid and power electronics interfaces in DC and AC microgrids.
5. To impart knowledge on the control and operation of microgrid.

3. Syllabus

Unit – I: Introduction

Conventional power generation: advantages and disadvantages, Energy crises, Non-conventional energy (NCE) resources: review of Solar PV, Wind Energy systems, Fuel Cells, micro-turbines, biomass, and tidal sources.

Unit – II: Distributed Generations

Concept of distributed generations, topologies, selection of sources, regulatory standards / framework, Standards for interconnecting Distributed resources to electric power systems: IEEE 1547. DG installation classes, security issues in DG implementations. Energy storage elements: Batteries, ultra-capacitors, flywheels. Captive power plants.

Unit – III: Impact of Grid Integration

Requirements for grid interconnection, limits on operational parameters: voltage, frequency, THD, response to grid abnormal operating conditions, islanding issues. Impact of grid integration with NCE sources on existing power system: reliability, stability and power quality issues.

Unit – IV: Basics of a Microgrid

Concept and definition of microgrid, microgrid drivers and benefits, review of sources of microgrids, typical structure and configuration of a microgrid, AC and DC microgrids, Power Electronics interfaces in DC and AC microgrids.

Unit – V: Control and Operation of Microgrid

Modes of operation and control of microgrid: grid connected and islanded mode, Active and reactive power control, protection issues, anti-islanding schemes: passive, active and communication based techniques, microgrid communication infrastructure, Power quality issues in microgrids, regulatory standards, Microgrid economics, Introduction to smart microgrids.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Text Books:

1. Gharephpetian G.B, Mohammad Mousavi Agah S, "Distributed Generation Systems: Design, Operation and Grid Integration", Butterworth Heinemann, 2017.
2. Chauhan R.K, Chauhan K, "Distributed Energy Resources in Microgrids: Integration, Challenges, Optimization", Academic Press, 2019.

References:

Reference Books:

1. Dorin Neacsu, "Power Switching Converters: Medium and High Power", CRC Press, Taylor & Francis, 2006.
2. Chetan Singh Solanki, "Solar Photovoltaics", PHI learning Pvt. Ltd., New Delhi,2009.
3. Manwell J.F, McGowan J.G, "Wind Energy Explained, Theory Design and Applications", Wiley publication 2010.
4. Amirnaser Yezdani, Reza Iravani, "Voltage Source Converters in Power Systems: Modeling, Control and Applications", IEEE John Wiley Publications, 2010.

Journal References:

1. IEEE Transactions on Power Electronics
2. Sustainable Cities and Society

Web Resources:

1. https://www.smart-energy.com/industry-sectors/distributed-generation/distributed-energy-resources-and-microgrids/
2. https://new.abb.com/low-voltage/solutions/smart-power-solutions-for-microgrids/distributed-energy-resources-(der)-microgrids-and-virtual-power-plants
3. https://www.epa.gov/energy/distributed-generation-electricity-and-its-environmental-impact

MOOC / NPTEL / SWAYAM Courses:

1. https://onlinecourses.nptel.ac.in/noc20_ee84/preview

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE564.1	Explain the various schemes of conventional and nonconventional power generation.
R19EE564.2	Illustrate the topologies and energy sources of distributed generation.
R19EE564.3	Outline the requirements for grid interconnection and its impact with NCE sources.
R19EE564.4	Explain the concepts of power quality management in Smart Grids.
R19EE564.5	Summarize the fundamental concepts of Microgrid.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE565	Smart Grid	L	T	P	C
		3	0	0	3

1. Course Description:

This course explores the fundamentals and advanced concepts of smart grid technology, which integrates traditional power systems with modern communication and information technologies. This course covers smart grid architecture, renewable energy integration, grid automation, and cyber security.

2. Course Objectives:

1. To impart knowledge on the core principles and architecture of smart grid systems.
2. To provide a comprehensive understanding on various smart grid technologies.
3. To teach the use of smart meters and advanced metering infrastructure.
4. To facilitate learning on power quality management in smart grid.
5. To develop a comprehensive understanding of High Performance Computing (HPC) techniques and their application in the context of smart grid

3. Syllabus

Unit – I: Introduction to Smart Grid

Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional and Smart Grid, National and International Initiatives in Smart Grid.

Unit – II: Smart Grid Technologies

Smart energy resources, Smart substations, Substation Automation, Feeder Automation, Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/Var control, Fault Detection, Isolation and service restoration, Outage management.

Unit – III: Smart Meters and Advanced Metering Infrastructure

Introduction to Smart Meters, Advanced Metering infrastructure AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit, Intelligent Electronic Devices (IED).

Unit – IV: Power Quality Management in Smart Grid

Power Quality & EMC issues in Smart Grid, Power Quality issues in smart grid systems, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

Unit – V: High Performance Computing for Smart Grid Applications

Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broadband over Power line (BPL), IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.

Text Books:

1. Stuart Borlase, "Smart Grid: Infrastructure, Technology and Solutions", CRC Press 2012.

References:

Reference Books:

1. Janaka Ekanayake, Nick Jenkins, Kithsiri Liyanage, Jianzhong Wu, Akihiko Yokoyama, "Smart Grid: Technology and Applications", John Wiley, 2012.
2. Vehbi C. Gungor, Dilan Sahin, Taskin Kocak, Salih Ergut, Concettina Buccella, Carlo Cecati, and Gerhard P. Hancke, "Smart Grid Technologies: Communication Technologies and Standards" IEEE Transactions on Industrial Informatics, Vol. 7, No. 4, November 2011.
3. Xi Fang, Satyajayant Misra, Guoliang Xue, and Dejun Yang "Smart Grid – The New and Improved Power Grid: A Survey", IEEE Transaction on Smart Grids, vol. 14, 2012.

Journal References:

1. IEEE Transactions on Smart Grid
2. IEEE Transactions on Power Systems
3. Renewable and Sustainable Energy Reviews

Web Resources:

1. IEEE Xplore Digital Library
2. National Institute of Standards and Technology (NIST) - Smart Grid - https://www.nist.gov/ctl/smart-connected-systems-division/smart-grid-group/smart-grid-framework.

MOOC / NPTEL / SWAYAM Courses:

1. https://onlinecourses.nptel.ac.in/noc23_ee60
2. https://onlinecourses.nptel.ac.in/noc21_ee68/preview

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE565.1	Explain the concepts of Smart Grid and its present developments
R19EE565.2	Discuss the concepts of different Smart Grid technologies
419EE565.3	Explain about smart meters and advanced metering infrastructure.
R19EE565.4	Describe power quality management in Smart Grids.
R19EE565.5	Outline the concepts of LAN, WAN and Cloud Computing for Smart Grid applications.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE566	Fuel Cells and Battery Management Systems	L	T	P	C
		3	0	0	3

1. Course Description:

This course explore the core principles and performance of fuel cells. The course explains the difference between primary (non-rechargeable) and secondary (rechargeable) batteries. The course equips students with the ability to evaluate thermal management in fuel cells and compare these technologies with battery systems for various applications.

2. Course Objectives:

1. To impart knowledge on the principles and performance characteristics of fuel cells, including efficiency and power output.
2. To teach the design and performance of fuel cells.
3. To provide a comprehensive understanding on batteries and types.
4. To discuss some case studies on battery thermal management.

3. Syllabus

Unit – I: Fuel Cells: Introduction

Description, working principle, anodic, cathodic and cell reactions, fabrication of electrodes and other components, applications, advantages, disadvantages and environmental aspects of the following types of fuel cells: Proton Exchange Membrane Fuel Cells, alkaline fuel cells, phosphoric acid, solid oxide, molten carbonate, direct methanol fuel cells. Membranes for fuel cells: Nafion – Polymer blends and composite membranes

Unit – II: Fuel Cell Design and Performance

Stoichiometric coefficients and utilization percentages of fuels and oxygen, mass flow rate calculation for fuel and oxygen in single cell and fuel cell stack, total voltage and current for fuel cells in parallel and serial connection, over-potential and polarizations, DMFC operation scheme, general issues-water flooding and water management, polarization in PEMFC.

Unit – III: Batteries: Primary Batteries

The chemistry, fabrication and performance aspects, packing classification and rating of the following batteries: (The materials taken their function and significance, reactions with equations, their performance in terms of discharge, capacity, and energy density to be dealt with). Zinc-carbon (Leclanche type), zinc alkaline (Duracell), zinc/air batteries; Lithium primary cells – liquid cathode, solid cathode and lithium-ferrous sulphide cells (comparative account).

Unit – IV: Batteries: Secondary Batteries

Lead acid and VRLA (valve regulated (sealed) lead acid), nickel-cadmium, nickel-zinc, nickel-metal hydride batteries, lithium ion batteries, ultrathin lithium polymer cells (comparative account). Advanced Batteries for electric vehicles, requirements of the battery – sodium-beta and redox batteries.

Unit – V: Battery Thermal Management Case Studies

EV Battery Cooling- challenges and solutions. Heat Exchanger Design and Optimization Model for EV Batteries using PCMs- system set up, selection of PCMs. Chevrolet Volt Model Battery Thermal

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Management System- Case study. Modelling Liquid Cooling of a Li-Ion Battery Pack with COMSOL Multiphysics- simulation concepts.
Text Books:
1. Ibrahim Dinner, Halil S. Hamut, and Nader Javani, Thermal Management of Electric Vehicle Battery Systems, Wiley, 2017 2. Jiuchun Jiang and Caiping Zhang, Fundamentals and applications of Lithium-Ion batteries in Electric Drive Vehicles, Wiley, 2015. 3. Mehrdad Ehsani, Yimin Gao, Sebastien E. Gay and Ali Emadi, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles-Fundamentals, Theory, and Design, CRC Press, 2005.
References:
Reference Books: 1. Younes Shabany, Heat Transfer: Thermal Management of Electronics Hardcover 2010, CRC Press. 2. T. Yomi Obidi, Thermal Management in Automotive applications, 2015, SAE International. **Journal References:** 1. IEEE Transactions on Power Electronics 2. Sustainable Cities and Society 3. Applied Energy **Web Resources:** 1. https://www.energy.gov/eere/fuelcells/fuel-cells 2. https://www.umicore.com/en/newsroom/news/fuel-cells-battery-difference/ 3. https://www.cummins.com/news/2020/05/14/batteries-and-fuel-cells-understanding-differences-and-opportunities **MOOC / NPTEL / Online Course:** 1. https://archive.nptel.ac.in/courses/103/102/103102015/

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE566.1	Explain the fundamental principles of fuel cell operation and their components
R19EE566.2	Analyze the performance characteristics of fuel cells, including efficiency and power output.
R19EE566.3	Classify different primart battery types based on their functionality.
R19EE566.4	Categorize various Secondary battery types according to their discharge characteristics
R19EE566.5	Evaluate thermal management strategies employed in fuel cell systems..

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE567	Special Electrical Machines	L	T	P	C
		3	0	0	3

1. Course Description:

This course provides a comprehensive study of advanced electric motors, covering stepper motors, switched reluctance motors (SRM), permanent magnet brushless DC motors (PMBLDC), permanent magnet synchronous motors (PMSM), and other special machines. It includes principles of operation, construction, control methods, performance characteristics, comparisons between motor types, and practical applications across various industries.

2. Course Objectives:

1. To make the learner to be aware of latest special machines which are in vogue.
2. To impart knowledge on Construction, principle of operation and performance of synchronous reluctance motors.
3. To impart knowledge on the Construction, principle of operation, control and performance of stepping motors & switched reluctance motors.
4. To impart knowledge on the Construction, principle of operation, control and performance of permanent magnet brushless D.C. motors &permanent magnet synchronous motors.
5. To be familiar with design features of special electrical machines.

3. Syllabus

Unit – I: Stepper Motor

Construction, Principle of operation of Variable Reluctance Stepper Motor; PMSM; HSM: Torque Equation, Characteristics, Open loop, Closed loop and Microprocessor based Control. Comparison of Permanent Magnet, VR and Hybrid Stepper Motor; Applications.

Unit – II: Switched Reluctance Motor

Construction, Principle of operation; Basics of SRM Analysis: Torque Equation and Characteristics; Power Converter Circuits: Control of SRM, RPS, Microprocessor Based and Sensorless Control of SRM and Applications.

Unit – III: Permanent Magnet Brushless DC Motor

Construction, Principle of Operation, Classification and Electronic Commutation; BLDC Square Wave Motor; Microprocessor Based and Sensorless Control of PMBLDC Motor; Comparison of Conventional DC and BLDC Motor; Applications.

Unit – IV: Permanent Magnet Synchronous Motor

Construction, Principle of Operation, EMF Equation, Torque Equation and Phasor Diagram; Comparison of Conventional Motor and PMSM; Control of PMSM and Applications.

Unit – V: Other Special Machines

Construction, Principle of Operation and Applications: Synchronous Reluctance Motor, AC Series Motor, Repulsion Motor, Hysteresis Motor, Universal Motor, Servo Motors and Linear Induction Motors.

Text Books:

1. Janardanan E.G, "Special Electrical Machines", PHI Learning Private Limited, Delhi, 2014.

References:

Reference Books:

1. Acarnley P, "Stepping Motors: A Guide to Motor Theory and Practice", The Institution of Electrical Engineers, Fourth Edition, 2002.
2. Takashi Kenjo, "Stepping Motors and their Microprocessor Controls", Clarendon Press London, 1994.
3. Kenjo T and Nagamori S, "Permanent Magnet and Brushless DC Motors", Clarendon Press, London, 1988.
4. Miller T.J.E, "Brushless Permanent Magnet and Reluctance Motor Drives", Oxford University Press, 1989.
5. Venkataratnam K, "Special Electrical Machines", Universities Press (India) Private Limited, 2009.

Journal References:

1. International Journal of Electrical Machines and Drives
2. Electric Machines and Power Systems
3. IEEE Transactions on Industry Applications
4. IET Electric Power Applications

Web Resources:

1. https://www.iec.ch/homepage
2. https://www.epe-association.org/
3. https://www.youtube.com/watch?v=mbpVvP8fCkM
4. https://www.youtube.com/watch?v=WIIcmfKfwYY
5. https://www.youtube.com/watch?v=DD0nZPdVmKE

MOOC / NPTEL / SWAYAM Courses:

1. Coursera: Electric Motor Systems Technician
2. edX: Electric Machines, Transformers, and Power Electronics
3. LinkedIn Learning: Electric Machines and Drives Courses
4. Electric Machines - Offered by IIT Madras

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE567.1	Explain the Construction, Principle of Operation of Stepper Motors and its applications.
R19EE567.2	Illustrate the Construction, Principle of Operation of Switched Reluctance Motor.
R19EE567.3	Describe the concept behind the construction, principle of operation of PMBLDC Motor.
R19EE567.4	Outline the construction, principle of operation and control techniques of Permanent Magnet Synchronous Motor.
R19EE567.5	Summarize the construction, principle of operation and applications of Special Machines.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Vertical 7 – ARTIFICIAL INTELLIGENCE AND DATA SCIENCE FOR ELECTRICAL ENGINEERS

R19EE571	Artificial Intelligence in Electrical Engineering	L	T	P	C
		3	0	0	3

1. Course Description:

This course explores the integration of artificial intelligence (AI) techniques in electrical engineering applications. Students will learn about machine learning, neural networks, and optimization methods to solve complex engineering problems.

2. Course Objectives:

1. To impart knowledge on artificial intelligence principles, techniques and its history
2. To facilitate understanding on knowledge representation, problem solving, and learning methods in engineering problems
3. To develop problem-solving skills for tasks that involve finding solutions that satisfy given constraints.
4. To develop and apply techniques for representing and reasoning with knowledge.
5. To equip students with a strong understanding on the applications of AI in the field of electrical and electronic engineering.

3. Syllabus

Unit – I: Agent and Environment

Introduction to artificial intelligence; Intelligent agents: agents and environment, concept of rationality, nature of environments, structure of agents.

Case study: autonomous delivery reports which interact with surroundings and navigate through dynamic environments to deliver packages.

Unit – II: Problem Solving Techniques

Uniformed search strategies, Heuristic search strategies, heuristic functions; local search and optimization problems, local search in continuous space, search with non-deterministic actions, search in partially observable environments, online search agents and unknown environments;

Case study: autonomous vehicle navigation in unknown environments.

Unit – III: Constraint Satisfaction Problems

Constraint propagation; Backtracking search for CSP; Local search for CSP; Adversarial search and games: Optimal decisions and strategies, Monte-Carlo tree search; Minimax search procedure; Alpha-Beta pruning; Additional refinements; Iterative deepening.

Unit – IV: Knowledge Engineering

Knowledge base: Representations, mapping of domain knowledge, if-then rules, semantic networks, frames; Predicate logic: Representing instance, computable functions and predicates, resolution, natural deduction; Procedural and declarative knowledge; Logic programming; Forward and backward reasoning; Matching; Representing knowledge in uncertain domain.

Unit – V: Applications of AI in Electrical and Electronic Engineering

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

AI in Power Systems: Smart grids, Load flow studies, Predictive maintenance of electrical equipment; AI in Control Systems: Adaptive and intelligent control, Reinforcement learning for control; AI in Machines: Speed control of DC and AC motors.

Text Books:

1. Stuart Russel ad Peter Norwig, "Artificial Intelligence: A Modern Approach", 4th Edition, Pearson Education, 2022.
2. Elaine Rich, and Kevin Knight, "Artificial Intelligence", tat McGraw Hill, New Delhi, 2014.

References:

Reference Books:

1. I. Bratko, "Prolog: Programming for Artificial Intelligence", 4th Edition, Addison-Wesley Education Publishers Inc., 2015.
2. Deepak Khemani, "A First Course in Artificial Intelligence", Tata McGraw Hill, New Delhi, 2017.
3. Luger, G.F., "Artificial Intelligence -Structures and Strategies for Complex Problem Solving", 7th edition, Pearson, 2011.
4. Poole. D and Mackworth. A, "Artificial Intelligence: Foundations of Computational Agents", Cambridge University Press, 2nd Edition, 2017.

Journal References:

1. https://iaeme.com/Home/journal/IJAIEE
2. https://journal.esrgroups.org/jes/article/view/1463
3. https://sanad.iau.ir/journal/jaiee

Web Resources:

1. Introduction to Generative AI - https://youtu.be/cZaNf2rA30k
2. Application of Generative AI in Electrical - https://youtu.be/-nUAQq_evxc
3. AI in Renewable Energy - https://youtu.be/pghjLyAmc5g

MOOC / NPTEL / SWAYAM Courses:

1. https://onlinecourses.nptel.ac.in/noc22_cs56/preview
2. https://onlinecourses.nptel.ac.in/noc24_ge47/preview

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE571.1	Implement a study of agent structures and diverse environments in artificial intelligence.
R19EE571.2	Demonstrate the knowledge of reasoning and representation for solving real world problems
R19EE571.3	Analyze and illustrate search and planning algorithms in problem solving
R19EE571.4	Apply various knowledge representation techniques to model domain knowledge effectively
R19EE571.5	Implement the AI models for electrical engineering applications

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE572	Generative AI for Electrical Engineering	L	T	P	C
		3	0	0	3

1. Course Description:

This course provides an in-depth exploration of Generative Artificial Intelligence (AI) techniques and their applications in Electrical Engineering. Students will learn the theoretical foundations and practical implementations of generative models, such as Generative Adversarial Networks (GANs), Variational Autoencoders (VAEs), and other state-of-the-art AI architectures.

2. Course Objectives:

1. To familiarize the student with the application of Generative AI and its application in Electrical and Electronics engineering.
2. To make the students understand various techniques of deep learning algorithms and Optimization techniques.
3. To make the students acquire sound knowledge of techniques in solving signal processing engineering problems.
4. To make the students gain knowledge in the application of Generative AI in circuit design and optimization.
5. To make the students acquire strong knowledge in application of Generative AI in Power system.

3. Syllabus

Unit – I: Introduction to Generative AI

Fundamentals of Artificial Intelligence (AI) and Machine Learning (ML); Introduction to Generative AI models: Generative Adversarial Networks (GANs), Variational Autoencoders (VAEs) and Autoregressive models; Application of Generative AI in Electrical Engineering.

Unit – II: Fundamentals of Deep Learning

Neural Network Architectures: CNNs, RNNs, and their variants; Training Deep Learning Models: Optimization techniques, regularization, and hyper parameter tuning; Deep Learning Frameworks: Tensor Flow and PyTorch.

Unit – III: Generative AI for Signal Processing

Generative models for synthetic data generation: Images, waveforms and time series; Applications in noise reduction, signal enhancement, and data augmentation for electrical engineering problems; Deep learning techniques for signal processing: Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs).

Unit – IV: Generative AI for Circuit Design and Optimization

Generative models for designing novel circuits and components with desired properties; Applications in electronic design automation (EDA), device optimization, and material discovery; Evolutionary algorithms and neuro evolution for circuit design.

Unit – V: Generative AI for Power Systems

Applications of Generative AI for power system analysis: Load forecasting, anomaly detection and state estimation; Generative models for simulating power system dynamics and stability; Reinforcement learning for optimal control of power systems.

Text Books:

Chairman – Board of Studies

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

1. David Foster, "Generative Deep Learning: Teaching Machines to Dream", Grey Scale Indian Edition, India, 2019.
2. Wei Bao and KeigoNitadori "Deep Learning for Signal Processing: A Unified Framework Incorporating CNNs, RNNs, Attention Mechanisms, and Generative Models", India, 2020.

References:

Reference Books:

1. Dr. Suresh Namboothiri, "Generative AI for Electrical Engineering: Unleashing the Power of Prompt Engineering in Electrical Engineering & AI Integration", kindle edition, India, 2020.
2. Alger Fraley, "The Artificial Intelligence and Generative AI Bible: [5 in 1] The Most Updated and Complete Guide", India, 2024.
3. Jacob Emerson, "Ripples of Generative AI: How Generative AI Impacts, Informs and Transforms Our Lives", India, 2024.

Journal References:

1. Journal of Machine Learning Research (JMLR
2. Neural Computation
3. IEEE Transactions on Pattern Analysis and Machine Intelligence (TPAMI)
4. ACM Transactions on Intelligent Systems and Technology (TIST)

Web Resources:

1. Introduction to Generative AI - https://youtu.be/cZaNf2rA30k
2. Application of Generative AI in Electrical - https://youtu.be/-nUAQq_evxc
3. GenerativeAI-https://youtu.be/4Y-9Cg_ii3Y?list=PL6K4zYD8coBRhUrfQmLAZd812Nc0 xwwt
4. AI in Renewable Energy - https://youtu.be/pghjLyAmc5g

MOOC / NPTEL / SWAYAM Courses:

1. https://youtu.be/pKeVMlkFpRc?list =PLwdnzlV3 ogoXaceHrrFVZCJKbm_laSHcH
2. Generative AI Unleashed: Exploring Possibilities and Future, Udemy.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE571.1	Identity the suitable AI modal to solve the electrical engineering problems.
R19EE571.2	Apply the deep learning concepts to tune the different AI modals for optimizing the output.
R19EE571.3	Compare the AI modal responses for the different digital and analog input signals to assess its performance.
R19EE571.4	Choose the circuit parameters with various AI modal to get the optimized output.
R19EE571.5	Apply the various Generative AI concepts for efficient and secure operation of the power system.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE573	Electrical Data Warehousing and Mining	L	T	P	C
		3	0	0	3

1. Course Description:

The course electrical data warehousing and mining introduces engineering students to the principles of data warehousing and mining, emphasizing their application in electrical engineering. Key learning aspects include data modelling, advanced data analysis, and the use of industry-standard tools. By the end of the course, students will be equipped to solve complex engineering problems through data-driven insights, enhancing their analytical and technical skills in the electrical engineering domain.

2. Course Objectives:

1. To introduce the concept of data warehousing and mining in electrical engineering.
2. To equip students with the essential knowledge to prepare raw data for analysis by identifying, correcting, and transforming data into a suitable format for machine learning.
3. To facilitate students with the knowledge on data warehousing and architecture.
4. To impart knowledge on the applications of data warehousing and mining in electrical engineering.

3. Syllabus

Unit – I: Introduction to Data Warehousing and Mining in Electrical Engineering

Overview of data warehousing and mining concepts; Importance and applications of data mining in electrical engineering; Overview of electrical data types and their significance in power systems, control systems, and machine operation; Challenges and opportunities in electrical data warehousing and mining.

Unit – II: Data Pre-processing and Cleaning

Data preprocessing techniques: Cleaning, integration, transformation, and reduction; Handling missing data and outliers in electrical datasets; Data quality assessment and improvement techniques.

Unit – III: Data Warehousing and Architecture

Fundamentals of Data Warehousing; Conceptual design and architecture of electrical data warehouses; Implementation of data warehousing technologies and tools; Data modelling techniques: Star schema, snowflake schema.

Unit – IV: Data Mining Techniques for Electrical Engineering

Supervised learning methods: Regression, classification, and ensemble methods; Unsupervised learning techniques: Clustering, association rule mining, and dimensionality reduction; Advanced data mining algorithms and their applications in electrical engineering.

Unit – V: Applications in Electrical Engineering

Predictive maintenance and fault detection in electrical systems; Energy consumption forecasting and optimization; Power System Monitoring and Analysis; Case studies and real-world applications of data warehousing and mining in electrical engineering

Text Books:

1. Jiawei Han, Micheline Kamber, and Jian Pei, "Data Mining: Concepts and Techniques," 3rd Edition, Morgan Kaufmann, 2011.

Chairman – Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

2. Paulraj Ponniah, "Data Warehousing Fundamentals: A Comprehensive Guide for IT Professionals," Wiley-Interscience, 2001.
3. James A. Momoh, "Electric Power System Applications of Optimization," 2nd Edition, CRC Press, 2009.

References:

Reference Books:

1. Ralph Kimball, "Data Warehousing in the Real World: Building Modern Data Warehouses," 1st Edition, Addison-Wesley Professional, 1998.
2. J. Duncan Glover, Mulukutla S. Sarma, Thomas Overbye, "Power System Analysis and Design," 6th Edition, Cengage Learning, 2016.
3. Herbst, Nicole, "Introduction to Data Mining for Engineers," Springer, 2006.

Journal References:

1. Chen, Zhe, Liu, Wenxin, and Li, Xin, "Data Preprocessing for Power System Analysis," Journal of Power Systems Engineering, vol. 28, no. 4, pp. 555-567, 2023.
3. Selvi, V., Venkatesan, M., and Baskar, S., "Applications of Data Mining Techniques in Power Systems," IEEE Transactions on Industrial Informatics, vol. 14, no. 4, pp. 1372-1380, 2018. doi:10.1109/TII.2018.8254331.

Web Resources:

1. https://www.youtube.com/watch?v=nt_Ouf5Cw-c&list=PLmAmHQ-_5ySxGcWD6xHihs-DXV-VnV_pN
2. https://www.youtube.com/watch?v=j0tqUBhs-Nc
3. https://www.youtube.com/watch?v=CHYPF7jxlik&t=693s

MOOC / NPTEL / SWAYAM Courses:

1. https://onlinecourses.nptel.ac.in/noc21_cs06/preview
2. https://onlinecourses.swayam2.ac.in/cec19_cs01/preview

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE572.1	To demonstrate a comprehensive understanding of data warehousing and mining concepts involved in managing and extracting valuable insights from large datasets.
R19EE572.2	To apply advanced data preprocessing techniques to effectively prepare electrical datasets for analysis, ensuring data quality, consistency, and usability.
R19EE572.3	To implement advanced techniques for designing and architecting electrical data warehouses, schema abstraction strategies, and indexing mechanisms to optimize performance and scalability.
R19EE572.4	To implement unsupervised learning algorithms effectively to uncover hidden relationships, reduction techniques to extract essential features.
R19EE572.5	To understand practical challenges and opportunities in electrical engineering through the application of data warehousing and mining techniques.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE574	Foundation of Machine Learning and Deep Learning for Electrical Engineers	L	T	P	C
		3	0	0	3

1. Course Description:

The course "Foundations of Machine Learning and Deep Learning for Electrical Engineers" is designed to equip electrical engineering students with the fundamental concepts, techniques, and applications of machine learning (ML) and deep learning (DL) relevant to their field.

2. Course Objectives:

1. To familiarize the student to Machine Learning techniques
2. To make the students understand the mathematical foundations to machine learning
3. To make the students acquire sound knowledge of supervised learning algorithms
4. To make the students acquire comprehensive knowledge of unsupervised learning algorithms and deep learning
5. To understand advance topics in deep learning for electrical engineers

3. Syllabus

Unit – I: Introduction to Machine Learning

Overview of machine learning; Types of Machine Learning Systems – Supervised/Unsupervised Learning, Batch and Online Learning; Main Challenges of machine Learning; Testing and validating data.

Unit – II: Mathematical Foundations for Machine Learning

Linear algebra: Scalars, Vectors, Matrices, Tensors, Eigen decomposition, Trace Operator and Moore-Penrose Pseudoinverse; Probability theory and statistics: Probability distributions, random variables, and statistical inference; Numerical Computation: Overflow and underflow, Poor Conditioning, Gradient based optimization and constrained optimization.

Unit – III: Supervised Learning Algorithms

Support vector machines (SVMs) and kernel methods; Decision trees, random forests, and ensemble learning techniques.

Unit – IV: Unsupervised Learning Algorithm and Deep Learning

Clustering algorithms: K-means clustering, limits of K-means, and DBSCAN, other Clustering algorithms and Gaussian Mixtures.

Introduction to Artificial Neural Networks with keras – Biological Neurons, Logical Computations with Neurons, Perceptron, Regression MLPs, Classification of MLPs and Implementing MLPs with keras.

Unit – V: Advanced Topics in Deep Learning for Electrical Engineers

Artificial Neural Network (ANN); Convolutional Neural Networks (CNNs) for image processing and computer vision applications; Recurrent Neural Networks (RNNs); Generative models: Generative Adversarial Networks (GANs).

Text Books:

1. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.

2. Ian Goodfellow, Yoshua Bengio, and Aaron Courville, "Deep Learning", The MIT Press, Cambridge, 2016.
3. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", The MIT Press, England, 2012.

References:

Reference Books:

1. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", O'Reilly Media, Inc.,2019
2. Charu C. Aggarwal, "Neural Networks and Deep Learning: A Textbook", Springer, 2018.

Journal References:

1. Industrial Artificial Intelligence by Springer
2. Journal of Artificial Intelligence Research
3. International Journal of Artificial Intelligence

Web Resources:

1. https://developers.google.com/machine-learning/crash-course
2. https://ieeexplore.ieee.org/document/9262226
3. https://www.tensorflow.org/tutorials

MOOC / NPTEL / SWAYAM Courses:

1. https://onlinecourses.nptel.ac.in/noc24_cs74/preview
2. https://onlinecourses.nptel.ac.in/noc24_ee146/preview
3. https://onlinecourses.nptel.ac.in/noc24_ma61/preview
4. https://onlinecourses.swayam2.ac.in/imb24_mg126/preview

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE573.1	Analyze various machine learning algorithms and methodologies in order to select the most appropriate approach for a given problem domain.
R19EE573.2	Demonstrate the application of advanced mathematical concepts, such as linear algebra, calculus, and probability theory, to analyze and interpret the underlying principles of machine learning algorithms and models.
R19EE573.3	Compare and justify the selection of appropriate supervised learning algorithms for specific tasks by critically evaluating their underlying principles, performance metrics, and implementation considerations.
R19EE573.4	Demonstrate understanding of the basic principles and applications of unsupervised learning algorithms and deep learning techniques in various domains
R19EE573.5	Synthesize and critically evaluate cutting-edge research in deep learning, applying advanced concepts to solve complex problems in electrical engineering, and demonstrate proficiency in designing and implementing novel deep learning architectures tailored to specific applications within the field

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE575	IoT Data Processing and Analysis	L	T	P	C
		3	0	0	3

1. Course Description:

Calculus for Engineers is typically a challenging but essential course for engineering students, as it provides them with the mathematical foundation necessary for more advanced coursework in their respective engineering disciplines. This course aims to provide engineering students with a strong understanding of calculus concepts and their practical applications in engineering fields. Calculus teaches critical problem-solving skills that are invaluable in engineering. Through solving calculus problems, students learn to analyze complex systems, break them down into smaller, manageable parts, and develop strategies to solve them effectively. These problem-solving skills are transferrable to various engineering disciplines and real-world scenarios. Employers often value candidates with strong mathematical skills, including proficiency in calculus. For internships, co-op positions, or full-time engineering roles, demonstrating competence in calculus can enhance your resume and make you more competitive in the job market.

2. Course Objectives:

1. To critically evaluate the impact of IoT across different industries by analyzing real-world use cases.
2. To design a scalable cloud-based architecture for processing and storing large volumes of IoT data.
3. To develop and implement data cleaning pipelines using appropriate techniques to ensure the quality and integrity of IoT data for further analysis.
4. To extract actionable insights from real-time and historical IoT data streams.
5. To design and implement data governance and security protocols to ensure the protection and responsible management of sensitive IoT data.

3. Syllabus

Unit – I: Introduction

IOT devices - Networking basics-IOT networking connectivity protocols-IOT networking data messaging protocols - Analyzing data to infer protocol - device characteristics.

Unit – II: IOT Analytics for the Cloud:

Introduction to elastic analytics-Decouple key components-Cloud security and analytics - Designing data processing for analytics - Applying big data technology to storage.

Unit – III: IOT Data Processing

Exploring and visualizing data -Techniques to understand data quality-Basic time series analysis-Statistical analysis - Data Cleaning and Preprocessing Techniques - Data Storage and Management Solutions

Unit – IV: Data Science for IOT Analytics

Introduction to Machine Learning, Feature engineering with IOT data, Validation methods, Understanding the bias - variance tradeoff, Use cases for deep learning with IOT data.

Unit – V: Strategies to Organize Data for Analytics

Chairman - Board of Studies
Department of Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Chairman - Board of Studies

Data Modeling for IoT - Introduction to data modeling concepts (entity-relationship diagrams, dimensional modeling)-Designing data models for sensor data (considerations for time-series data)-Choosing appropriate data models for different IoT applications (e.g., relational vs. NoSQL)-Managing data lakes-data retention strategy.
Text Books:
1. Arshdeep Bahga and Vijay Madisetti, "Internet of Things - A Hands on Approach, Universities Press, 2015. 2. Kevin, Townsend, Carles, Cufí, Akiba and Robert Davidson, "Getting Started with Bluetooth Low Energy" O'Reilly.
References:
Reference Books: 1. Madhur Bhargava, "IoT Projects with Bluetooth Low Energy", Packt Publishing, August 2017. 2. Robin Heydon, "Bluetooth Low Energy: The Developer's Handbook", Pearson, October 2012. 3. Kumar Saurabh, "Cloud Computing", Wiley India, 1st Edition, 2016. **Web Resources:** 1. https://www.youtube.com/watch?v=7PshJ9CHYgo 2. https://www.youtube.com/watch?v=mE-8By8hqO0 3. https://www.youtube.com/watch?v=kOVKHovPTV4 4. https://www.youtube.com/watch?v=QWtKykvoDvQ 5. https://www.youtube.com/watch?v=tHuqUZGpf04 **MOOC / NPTEL / Online Course:** 1. https://nptel.ac.in/courses/106105195

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE575.1	Explain the fundamental concepts of the Internet of Things (IoT) and its applications across various domains.
R19EE575.2	Analyze and understand the challenges associated with processing and analyzing large volumes of IoT data.
R19EE575.3	Apply data preprocessing techniques to clean and prepare IoT data for analysis.
R19EE575.4	Utilize data science methods to extract meaningful insights from IoT data.
R19EE575.5	Design and implement strategies for organizing and managing IoT data for effective analytics.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE576	Computer Vision in Electrical Engineering	L	T	P	C
		3	0	0	3

1. Course Description:

This course provides an in-depth exploration of how computer vision technologies can be applied to the field of electrical inspection and maintenance. Students will learn the fundamentals of computer vision and its practical applications in detecting, diagnosing, and predicting issues in electrical systems. Through a combination of theoretical knowledge and hands-on projects, participants will gain the skills necessary to implement computer vision solutions in real-world electrical maintenance scenarios.

2. Course Objectives:

1. To understand the principles and techniques of computer vision.
2. To utilize image processing techniques to detect faults in electrical systems.
3. To develop and deploy machine learning models for predictive maintenance.
4. To Integrate computer vision solutions with existing electrical inspection workflows.
5. To Evaluate the performance and reliability of computer vision systems in maintenance tasks.

3. Syllabus

Unit – I: Introduction to image processing and computer vision

Model of image and image digitization- digital image elements-digital image processing systems- Image Acquisition-Image representation and convolution theory -Fourier transform, Statistical operations, basic image processing operations- Spatial transformation and operations, image enhancement and image restoration- Edge detection- Contour Representation.

Unit – II: Computer Vision for Electrical Inspection and Maintenance

Computer vision for automated visual inspection of electrical equipment- Focus on tasks like :Defect detection in transformers, power lines, and other electrical components- Anomaly identification within electrical infrastructure using image analysis- Image-based classification of electrical components for maintenance purposes.

Unit – III: Object Detection and Recognition for Electrical Systems

Convolutional Neural Networks (CNNs) for object detection and classification in electrical images- Real-world applications like automatic meter reading, object recognition in substations, and foreign object detection on power lines- Techniques for training and deploying object detection models for specific electrical engineering tasks.

Unit – IV: Advanced Techniques for Electrical Image Analysis

Image segmentation for isolating specific regions of interest in electrical images for further in-depth analysis- Anomaly detection using advanced deep learning models for identifying unusual patterns in electrical equipment imagery, enabling proactive maintenance strategies- Applications in power system monitoring and fault diagnosis through advanced image analysis, contributing to improved grid reliability and efficiency.

Unit – V: Project and Future Trends

Design and implement a computer vision system for automated detection of cracks and defects in power line insulators, enhancing infrastructure safety and inspection efficiency- Develop a deep

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

learning model for classifying electrical components in substations based on image data, streamlining asset management and maintenance workflows- Implement an anomaly detection.
Text Books:
1. Computer Vision: Algorithms and Applications; by Richard Szeliski 2. Practical Computer Vision Applications Using Deep Learning with CNNs; by Ahmed Fawzy Gad 3. Deep Learning for Computer Vision with Python; by Adrian Rosebrock.
References:
Reference Books: 1. Forsyth and Ponce, "Computer vision: a modern approach," 2nd Ed., Pearson, 2012. 2. Sonka, Hlavac and Boyle, "Digital image processing and computer vision," Cengage learning, 2008. 3. D. A. Forsyth and J. Ponce, Computer Vision, A Modern Approach, Pearson Education, 2003. **Journal References:** 1. Research Paper: "A Survey of Deep Learning Techniques for Electrical Equipment Inspection; by Wei Zhang et al. 2. Case Studies: Applications of Computer Vision in Power Line Inspection (Industry Reports) 3. Research Paper:A Deep Learning Framework for Foreign Object Detection in Power Line Inspection Images ; by Yanan Qin et al. **MOOC / NPTEL / SWAYAM Courses:** 1. https://archive.nptel.ac.in/courses/108/103/108103174/ 2. https://www.coursera.org/learn/image-processing 3. https://www.youtube.com/watch?v=dJYGatp4SvA

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE576.1	Apply basic image processing techniques to enhance images, remove noise, and extract useful information for further analysis.
R19EE576.2	Apply machine learning models to predict potential failures or maintenance needs based on historical inspection data and sensor readings.
R19EE576.3	Analyze the performance of different object detection models in terms of accuracy, precision, recall, and computational efficiency for detecting objects in electrical imagery.
R19EE576.4	Assess the reliability and reproducibility of analysis results and interpret findings in the context of safety, regulatory compliance, and asset management in electrical infrastructure.
R19EE576.5	Assess the ethical and societal implications of deploying computer vision systems in the electrical engineering domain, including issues related to privacy, security, and bias.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EE577	Data Visualization and Data Exploration for Electrical Engineering	L	T	P	C
		3	0	0	3

1. Course Description:

Data visualization and exploration are critical skills for electrical engineers to analyze and interpret complex datasets, extract insights, and make informed decisions in various domains such as power systems, signal processing, and control engineering. This course provides an introduction to the principles, techniques, and tools for visualizing and exploring data relevant to electrical engineering applications.

2. Course Objectives:

1. To recognize the significance of data visualization in gaining insights from electrical engineering data and communicating findings effectively.
2. To explore principles of effective data visualization, including visual perception, data encoding, and design principles for creating clear and informative visualizations.
3. To gain proficiency in using data visualization tools and libraries such as Matplotlib, Seaborn, and Plotly in Python to create a wide range of static and interactive visualizations.
4. To learn techniques for exploratory data analysis, including data cleaning, summarization, and visualization methods to understand the underlying patterns and relationships in datasets.
5. To apply data visualization techniques to analyze and explore real-world electrical engineering datasets, including sensor data, time series data, and spatial data.

3. Syllabus

Unit – I: Introduction to Data Visualization

Importance and principles of data visualization in electrical engineering-Overview of visualization tools and libraries-Types of visualizations: Charts, graphs, maps, and dashboards.

Unit – II: Data Exploration Techniques

Exploratory data analysis (EDA) methods -Summary statistics and data profiling -Data distribution analysis and feature engineering.

Unit – III: Visualization Techniques for Time-Series Data

Visualization of temporal data: Line charts, bar charts, and heatmaps-Time-series decomposition and trend analysis-Seasonality detection and visualization.

Unit – IV: Spatial Data Visualization in Electrical Engineering

Geographic Information Systems (GIS) for spatial data analysis -Visualization of geographic data: Maps, choropleths, and scatter plots -Applications of spatial data visualization in electrical engineering.

Unit – V: Basics of R Programming

Introduction to R and RStudio - The Basics of Data Exploration - Loading Data into R - Transforming Data - Creating Tidy Data - Case Study.

Text Books:

1. Storytelling with Data: A Data Visualization Guide for Business Professionals; by Cole Nussbaumer Knaflic.
2. Data Visualization: A Practical Introduction; by Kieran Healy.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

3. Interactive Data Visualization for the Web; by Scott Murray
References:
Reference Books: 1. Python Data Visualization Cookbook; by Igor Milovanović and Dimitry Foures. 2. Fundamentals of Data Visualization; by Claus O. Wilke. 3. Data Visualization: Principles and Practice; by Alexandru C. Telea. **Journal References:** 1. Research paper (reference to be updated): "A Survey on Data Visualization Techniques for Power Systems" by Y. Wang et al. 2. Industry Reports and Case Studies: Data Visualization in Electrical Engineering (IEEE, EPRI). **Web Resources:** 1. The Data Visualization Society: https://datavizsociety.org 2. Online Resource: Seaborn Visualization Gallery 3. Online Resource: Python for Electrical Engineers & Scientists 4. Online Resource: Python for Electrical Engineers & amp; Scientists: https://realpython.com/python-introduction/ **MOOC / NPTEL / Online Course:** 1. https://elearn.nptel.ac.in/shop/iit-workshops/completed/data-visualization-with-r/?v=c86ee0d9d7ed.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EE577.1	Analyze and interpret basic visualizations to extract insights and trends from data.
R19EE577.2	Apply basic data exploration techniques to analyze and understand datasets, including calculating summary statistics, visualizing distributions, and identifying outliers.
R19EE577.3	Apply basic time-series visualization techniques to analyze and interpret time-series datasets, including plotting time series, trend lines, and seasonality components.
R19EE577.4	Assess the limitations and potential biases of spatial data visualizations and consider alternative representations or analytical approaches.
R19EE577.5	Evaluate the effectiveness of interactive data visualization techniques in engaging users and facilitating data exploration and discovery.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19AD651	Data Science Essentials	L	T	P	C
		2	0	2	3

1. Course Description:

The course aims to provide students with a comprehensive understanding of data science, covering key concepts, methodologies, and tools essential for data analysis, interpretation, and decision-making. Students will learn to collect, preprocess, and analyze data from various sources using statistical techniques and machine learning algorithms. Students will gain practical experience in applying data science methods to real-world problems. By the end of the course, students will be equipped with the knowledge and proficiency needed to extract valuable insights from data, make informed decisions, and contribute effectively to the rapidly evolving field of data science.

2. Course Objectives:

1. Gain a foundational understanding of data science concepts and methods.
2. Develop the ability to collect, clean, and manage data.
3. Learn how to analyse data using statistical and machine learning techniques.
4. Develop the ability to solve real-world problems using data science.
5. Develop an understanding of the ethical implications of data science

3. Syllabus:

Unit – I: Introduction to Data Science and Data Acquisition

Data science: definition, scope, importance of data-driven decision making, interdisciplinary nature of data science, stages of data science life cycle; overview of data science tools and techniques, applications of data science; Data acquisition: Sources of data, data collection and API, web scraping: extracting data from websites, accessing different sources of data.

Unit – II: Data Exploration and Feature Engineering

Data analytics: descriptive analysis, diagnostic analytics, predictive analytics, predictive analytics; Data pre-processing: handling missing values – imputation techniques, dealing with outliers; Exploratory Data Analysis(EDA); Feature Engineering: One-hot encoding, label encoding, creating new features, dimensionality reduction techniques.

Unit – III: Data Visualization

Tableau: Introduction, Overview of Tableau interface and workspace; Features and advantages, connecting to data sources, importing data from local files and cloud storage services, creating basic visualizations in Tableau: Bar charts, line charts, scatter plots, pie charts, histograms, heatmaps, advanced visualization techniques in Tableau:Treemaps, bubble charts, box plots, dual-axis charts, combination charts, adding filters and parameters, building interactive dashboards in Tableau.

Power BI: Overview, connecting to data Sources in Power BI, Importing data from local files, databases, and web sources; creating basic visualizations in Power BI: Bar charts, line charts, scatter plots, pie charts, histograms, heatmaps; advanced visualization techniques in Power BI: Treemaps, bubble charts, box plots, dual-axis charts, combination charts, building interactive dashboards in Power BI.

Unit – IV: Statistical Concepts for Data Science

Role of Statistics in Data Science; Population vs. Sample; Descriptive vs. Inferential statistics; Probability distributions: Poisson, Normal, Binomial, Uniform; Bayes' theorem and conditional probability; Descriptive statistics: Measures of central tendency: Mean, median, mode; Measures of dispersion: Variance, standard deviation; Inferential statistics: Hypothesis testing: Null and alternative hypotheses, p-values; Confidence intervals, ANOVA, Chi-square test, T-test; Correlation and Covariance.

Unit – V: Tools for Data Science

Microsoft Excel for data analysis: Introduction to Excel for basic data manipulation and analysis, data cleaning and formatting techniques in Excel, creating charts and graphs, pivot tables and pivot charts for summarizing and analyzing data, advanced Excel features for statistical analysis; Python

Chairman - Board of Studies
Department of Electronics and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

packages for data science: NumPy for statistical analysis, data manipulation with Pandas data frames, data visualization using Matplotlib and Seaborn library.

List of Experiments:

1. Web Scrapping
   Use Case: Perform Web-Scrapping, create DataFrame by collecting the data from the website.
2. Exploratory Data Analysis: Perform Data Preprocessing & Data Wrangling on Netflix International Dataset
3. Exploratory Data Analysis: Perform EDA on Netflix International Dataset.
4. Fraud Detection in Financial Transactions
   Use Case: A banking institution aims to detect fraudulent transactions by analyzing historical transaction data.
   Experiment: Explore the dataset to identify patterns and anomalies indicative of fraudulent behavior. Develop new features such as transaction frequency, transaction amount, and geographical location. Apply anomaly detection techniques to flag suspicious transactions for further investigation.
5. Predictive Maintenance for Industrial Equipment
   Use Case: A manufacturing plant wants to implement predictive maintenance strategies to minimize downtime and optimize equipment performance.
   Experiment: Explore sensor data collected from industrial equipment to identify patterns associated with equipment failures. Engineer features such as equipment usage, temperature, and vibration levels. Train machine learning models to predict equipment failures before they occur based on historical sensor data.
6. Market Segmentation Analysis- Tableau
   Use Case: A beverage company is planning to launch a new health drink targeted towards health-conscious consumers. However, they recognize that the health-conscious market is diverse, with varying preferences and needs. To ensure the success of their product, they decide to conduct a market segmentation analysis..
7. Covid-19 Trends- Power BI
   Use Case: During the COVID-19 pandemic, public health authorities and policymakers need accurate and timely information to respond effectively to the evolving situation. Market segmentation analysis can be a valuable tool to understand how different population segments are affected by the virus, which can inform targeted interventions and resource allocation.
8. Exploring COVID-19 Data Trends
   Use Case: Health authorities want to visualize and analyze trends in COVID-19 cases to inform public health policies.
   Experiment: Collect COVID-19 data from reliable sources such as government health departments. Use data visualization tools to create interactive dashboards displaying trends in case counts, testing rates, and vaccination coverage. Analyze the data to identify hotspots and patterns over time.
9. Visualizing Stock Market Volatility
   Use Case: Financial analysts want to visualize and analyze stock market volatility to make informed investment decisions.
   Experiment: Gather historical stock market data from financial databases. Use data visualization techniques to create candlestick charts and volatility plots showing price fluctuations and trading volumes. Apply technical analysis indicators such as moving averages and Bollinger Bands to identify potential trading opportunities.
10. Sales Performance Analysis
    Use Case: Analyze sales data to identify top-performing products and regions for strategic decision-making.
    Experiment: Analyze sales data using Microsoft Excel to uncover insights into sales performance and trends. Utilize Excel's data manipulation, visualization, and analysis tools to

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

examine total sales revenue, product performance, regional sales distribution, and sales trends over time.

Text Books:

1. Avrim Blum, John Hop croft, and Ravindran Kannan," Foundations of Data Science", Springer-2018
2. Suresh Kumar Mukhiya, Usman Ahmed, "Hands-On Exploratory Data Analysis with Python", O'Reilly, 2013.
3. Cathy O' Neil, Rachel Schutt, "Doing Data Science, Straight Talk from The Frontline", O'Reilly, 2013.
4. Chandraish Sinha, "Tableau 10 for Beginners: Step by Step Guide to Developing Visualizations in Tableau 10", Create space Independent Pub, 2017.

References:

Reference Books:

1. Dean J, "Big Data, Data Mining and Machine learning", Wiley Publications, 2014.
2. Provost F and Fawcett T, "Data Science for Business" ,O'Reilly Media Inc, 2013.

Journals References:

1. https://jds-online.org/journal/JDS
2. https://link.springer.com/journal/41060
3. https://epjdatascience.springeropen.com/

Video References:

1. https://www.youtube.com/watch?v=-ETQ97mXXF0
2. https://www.youtube.com/watch?v=dcXqhMqhZUo&t=2s

MOOC/NPTEL/SWAYAM Courses:

1. https://onlinecourses.nptel.ac.in/noc21_cs69/preview
2. https://onlinecourses.nptel.ac.in/noc22_cs32/preview

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19AD651.1	Apply the fundamentals of data science for effective contribution to real-world.
R19AD651.2	Apply the various data collection and exploration techniques to analyze the data
R19AD651.3	Design interactive dashboards using suitable data science tools to reveal the insights of data.
R19AD651.4	Analyze the distribution of data using various statistical techniques.
R19AD651.5	Analyze datasets using Python packages and Microsoft Excel to derive actionable.

R19AD652	Exploratory Data Analysis and Visualization	L	T	P	C
		2	0	2	3

1. Course Description:

This course covers principles and tools for creating impactful visualizations, using software like Tableau, Power BI, and Python libraries. Students learn to analyze and communicate data effectively, developing interactive dashboards and compelling visual narratives for decision-making across industries.

2. Course Objectives:

1. To learn the essential exploratory techniques for analyzing and visualizing data.
2. To gain hands-on experience of using software tools for data preparation, analytics, and visualization.
3. To utilize visualization for exploratory data analysis, identifying patterns and trends.

Chairman - Board of Studies
Department of Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kondampatti, Coimbatore - 641 202.

4. To apply visualization techniques to practical, real-world datasets.
5. To develop compelling visual narratives to communicate insights effectively.

3. Syllabus:

Unit – I: Data Exploration

Data: Aesthetics, Types of Data, Coordinate systems and axes, Colour Scales; Data Cleanup Basics: Normalizing and standardizing the data; Exploring the data: Importing the data, exploring table functions, identifying correlation and outliers; Introduction to Single variable: Distribution Variables, Numerical Summaries of Level and Spread, Scaling and Standardizing, Inequality, Smoothing Time Series.

Unit – II: Data Analysis

Data collection and management: Introduction, Sources of data, Data collection, APIs; Data Pre-processing Techniques; Data Analysis and Data Analytics: Descriptive Analysis, Diagnostic Analytics, Predictive Analytics, Prescriptive Analytics, Exploratory Analysis, Mechanistic Analysis; Analysis Method: Quantitative Methods, Qualitative Methods; Evaluation: Comparing Models, Cross Validation; Data storage and management, using multiple data sources.

Unit – III: Data Visualization

The Seven Stages of Visualizing Data, Univariate Plots: Histogram, Single and multiple distributions, Probability Distribution plots, Run Sequence Plots; Bivariate Plots: Bar graphs, Heat maps; Density Plots, Pair plots, Contour plots; Empirical cumulative distribution functions and q-q plots; Time series Data: Individual time series, Multiple time series and dose–response curves; Geo-spatial Data: Cartograms.

Unit – IV: Introduction to Tableau

Overview of Tableau and its applications, Installation and setup, connecting to data sources (Excel, CSV, databases), Understanding Tableau's interface; Data Preparation in Tableau, Maps and geographical data visualization, Intermediate Visualization Techniques, Storytelling with Tableau, Real-time data connections and live dashboards.

Unit – V: Power BI for Data Visualization and Analysis

Data Preparation and Transformation, Basic Visualization Techniques, Advanced DAX functions and calculations, Power BI Data Modelling; Case Study: Wildfire Activity in the Western United States, Single Family Residential Home and Rental Values.

List of Experiments:

1.	You are a data analyst working for an insurance company and you have been tasked with generating a comprehensive data quality report for the company's customer data. The data is intended to be used for risk assessment and policy pricing. The dataset contains information about policyholders, their coverage details, and claim history. Your goal is to identify and report on missing values, irregular cardinality, and outliers in the dataset.
2.	You are a data analyst working for a winery, and your team has provided you with a dataset containing information about various attributes related to wine quality. The dataset includes features such as acidity levels, residual sugar, alcohol content, and the quality rating assigned by experts. Your task is to perform Exploratory Data Analysis (EDA) to gain insights into the characteristics of the wines and understand the factors influencing wine quality.
3.	You are a data scientist working for an e-commerce company, and your team has provided you with a dataset containing information about customer purchases. The dataset includes features such as purchase amount, product category, customer age, and the time of purchase. Your goal is to prepare the data for exploratory analysis, employing normalization, binning, and sampling methods.
4.	You are a data scientist working for a telecommunications company, and your team is interested in predicting customer churn. The dataset includes various features such as customer tenure, monthly charges, usage patterns, and customer satisfaction scores. Your task is to identify a descriptive feature that shows a clear relationship with the target feature, which

	is whether a customer churns or not. You will use visualization techniques to explore these relationships effectively.
5.	You are a data scientist working for a retail company, and your team has provided you with a time series dataset containing daily sales data for various products over the past few years. Your task is to perform time series analysis to understand sales patterns, trends, and seasonality. Additionally, you need to forecast future sales using appropriate visualization techniques.
6.	You work for a travel and tourism company, and your team has tasked you with analyzing and visualizing data related to popular tourist destinations. The dataset includes information such as location coordinates, tourist attractions, and ratings. Your goal is to perform data analysis and represent the information on a map with interactive features, including mouse rollover effects and user interaction.
7.	You work for a global non-profit organization that focuses on socio-economic development, and your team has tasked you with creating cartographic visualizations for multiple datasets involving various countries worldwide and specific states and districts within India. The datasets cover diverse indicators such as education, health, and economic factors. Your goal is to create insightful visualizations that allow stakeholders to compare socio-economic conditions across different regions.
8.	Assume you have a sample COVID-19 dataset named covid_data with variables like Date, Country, Confirmed_Cases, Deaths, and Recovered. How can you filter rows and variables in Tableau? Use the ggplot2 package for data visualization to understand the trend of confirmed cases, deaths, and recoveries over time. Consider a real- time problem: "Visualizing the spike in confirmed cases for a specific country, e.g., USA."
9.	**Case Study 1: Retail Sales Analysis** Objective: You are a data analyst for a retail company, and the management wants you to analyze the sales data to identify trends, customer preferences, and potential areas for improvement. Dataset: The dataset includes the following columns: Order_ID: Unique identifier for each order. Order_Date: Date of the order placement. Product_ID: Unique identifier for each product. Product_Name: Name of the product. Category: Product category (e.g., Electronics, Clothing, Home Appliances). Unit_Price: Price of one unit of the product. Quantity: Number of units ordered. Total_Sales: Total sales amount for the order. Insights and Recommendations: a. Monthly Sales Trend: Sales have been consistently increasing, with a noticeable spike in [specific month]. Management could investigate the factors contributing to this increase for potential replication in other months. b. Product Category Analysis: [Category A] is the highest-selling category, indicating a strong demand. The company might consider expanding or promoting products within this category. c. Top Selling Products: [Top Product 1] and [Top Product 2] are the highest-selling products. Marketing efforts can be focused on these products to capitalize on their popularity. d. Customer Segmentation: Further analysis is needed to understand customer segments based on demographics. Targeted marketing strategies can be developed for each segment. e. Correlation Analysis: Positive correlations between [Variable X] and [Variable Y] suggest that changes in [Variable X] may impact [Variable Y]. Further investigation is recommended.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

	Case Study 2: Ridesharing Platform Analysis Objective: You are a data analyst for a ridesharing company, and the management wants you to analyze the rides data to gain insights into user behavior, trip patterns, and areas for service improvement. Dataset: The dataset includes the following columns: Ride_ID: Unique identifier for each ride. User_ID: Unique identifier for each user. Timestamp: Date and time of the ride. Pickup_Location: Pickup location of the ride. Dropoff_Location: Dropoff location of the ride. Distance: Distance of the ride in miles. Duration: Duration of the ride in minutes. Fare: Fare amount for the ride. Rider_Rating: Rating given by the rider to the driver (out of 5). Insights and Recommendations: a. User Activity Over Time: There is a noticeable increase in rides during peak hours, suggesting high demand during specific times. Consider adjusting service capacity or introducing dynamic pricing during peak hours. b. Trip Duration Distribution: Most trips have a duration of between 10-30 minutes. Investigate and optimize routes for shorter trips to enhance efficiency. c. User Ratings Analysis: The median rider rating is high, indicating overall satisfaction. Identify factors contributing to low ratings and address them to maintain service quality. d. Geographical Analysis: Analyze popular pickup and dropoff locations to optimize driver allocation and potentially identify areas for promotional campaigns. Further Analysis: a. User Segmentation: Explore user segments based on frequency, distance traveled, and rider ratings. Tailor marketing strategies for each segment. b. Price Sensitivity Analysis: Investigate the relationship between fare amounts and rider ratings. Understand if there is a correlation and adjust pricing strategies accordingly. c. Weather Impact: If available, incorporate weather data to analyze how weather conditions influence ride demand and duration.
10.	**Mini project:** **Scenario 1: E-commerce Sales Analysis** Objective: You are working for an e-commerce company, and the management wants to understand the sales performance of their products over the past year. They have provided you with a dataset containing information about the sales transactions. Dataset: The dataset includes the following columns: Transaction_ID: Unique identifier for each transaction. Product_ID: Unique identifier for each product. Product_Name: Name of the product. Transaction_Date: Date of the transaction. Transaction_Amount: The amount of money spent on the transaction. Perform the following tasks and subtasks: 1. Data Exploration a. Load the data b. Explore the data c. Check for missing values 2. Data Visualization a. Time series analysis b. Product sales distribution c. Transaction amount distribution

Chairman – Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

	d. Monthly sales trend **Scenario 2: Fitness App User Engagement Analysis** Objective: You are working for a fitness app company, and the management wants to understand the user engagement patterns and activity levels of their users. They have provided you with a dataset containing information about user activities. Dataset: The dataset includes the following columns: User_ID: Unique identifier for each user. Date: Date of the activity. Steps: Number of steps taken by the user on that day. Calories Burned: Calories burned by the user on that day. Active Minutes: The total number of active minutes (e.g., exercise, workout) by the user. Perform the following tasks and subtasks: 1. Data Exploration a. Load the data b. Explore the data c. Check for missing values 2. Data Visualization a. Daily Steps Trend b. Calories Burned vs. Active Minutes c. Weekly Aggregation of Steps d. Histogram of Active Minutes e. User Engagement by Day of the Week

Text Books:

1. Claus O Wilke, "Fundamentals of Data Visualization A Primer on Making Informative and Compelling Figures", O'Reilly Media, Inc., First Edition, 2019.
2. David Baldwin," Mastering Tableau: Smart Business Intelligence techniques to get maximum insights from your data", Packt, First Edition, 2016.

References:

Reference Books:

1. Catherine Marsh, Jane Elliott, Exploring Data: An Introduction to Data Analysis for Social Scientists, Wiley Publications, 2nd Edition, 2008.
2. Alberto Cairo, "The Functional Art: An Introduction to Information Graphics and Visualization", New Riders, 2012.
3. Nathan Yau, "Visualize This: The Flowing Data Guide to Design, Visualization and Statistics", John Wiley & Sons, 3rd Edition, 2011.
4. Ben Fry, "Visualizing Data", O" Reilly Media, Inc., 2007.

Journals References:

1. Deepmala Srivastava, "An Introduction to Data Visualization Tools and Techniques in Various Domains," International Journal of Computer Trends and Technology, vol. 71, no. 4, pp. 125-130, 2023. Crossref, https://doi.org/10.14445/22312803/IJCTT-V71I4P116
2. Diamond, Michael and Angela Mattia. "Data Visualization: An Exploratory Study into the Software Tools Used by Businesses." Journal of Instructional Pedagogies 17 (2015).

Video References:

1. https://www.youtube.com/watch?v=TPMlZxRRaBQ
2. https://youtu.be/64-eK-tdTPc

MOOC/NPTEL/SWAYAM Courses:

1. https://www.udemy.com/course/data-exploration-data-analysis-data-visualization/
2. https://www.coursera.org/courses?query=data%20visualization

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19AD652.1	Apply the key techniques and theory behind Data Exploration.
R19AD652.2	Apply the statistical techniques and methods for Data visualization
R19AD652.3	Apply various data visualization techniques for a variety of tasks
R19AD652.4	Implement data visualization techniques using Tableau and Power BI
R19AD652.5	Create story telling Dashboards using Tableau and Power BI

R19AD653	Machine Learning Techniques	L	T	P	C
		3	0	0	3

1. Course Description:

This course provides an in-depth introduction to the fundamental concepts and techniques of machine learning, a field at the intersection of computer science and statistics that focuses on the development of algorithms capable of learning from data. Students will gain a comprehensive understanding of the principles and applications of machine learning, along with hands-on experience in implementing and evaluating machine learning models.

2. Course Objectives:

1. To explain the different types of Machine learning techniques and mathematical concepts
2. To use natural language processing techniques using large language models
3. To apply the different machine learning tools to solve the real-time problems
4. To make decisions using reinforcement learning and Markov Decision process.

3. Syllabus:

Unit – I: Introduction

Review of Linear Algebra for Machine Learning. Introduction and motivation for machine learning; Types of Machine Learning: Supervised Learning, Unsupervised Learning and Reinforcement learning.Statistical Decision theory: Classification and Regression, Bias and Variance.

Case Study: Stock Price Prediction

Unit – II: Classification and Regression

Linear Regression, Multivariate Regression, Subset Selection, Shrinkage methods, Principal Components Regression, Partial Least Squares. Ridge and LASSO Regression. Logistic Regression. Linear Discriminant Analysis. Decision Tree, K Nearest Neighbor, Separating hyperplane – Perceptron learning Support Vector Machines and kernels. Artificial Neural Networks: Backpropagation Algorithm, Maximum Likelihood estimate.

Case Study: House Price Prediction using Linear Regression and spam email classification using support vector machine algorithm.

Unit – III: Evaluation Measures and Ensemble Techniques

Evaluation Measures: Bootstrapping and cross validation ROC Curve, Minimum Description length and exploratory analysis. Ensemble Methods: Bagging, Committee machines, Stacking, Boosting, Gradient Boosting, Random Forest

Case Study: Random Forest for Credit Scoring and Stacking for Image Classification

Unit – IV: Bayesian Networks and Clustering

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Naïve Bayes, Bayesian Networks, Undirected Graphical models, Hidden Markov models, Variable Elimination, Belief Propagation; Partitional Clustering, Hierarchical Clustering, BIRCH and CURE algorithms, Density based Clustering, Spectral Clustering.

Case Study: Analyze customer reviews to determine the sentiment (positive, negative, or neutral) associated with a product or service.

Unit – V: Reinforcement Learning

Introduction to Reinforcement Learning, Framework, Elements of Reinforcement learning, Markov Decision Process, Q – Learning in Python, Deep Q- learning.

Case Study: Game Playing

Text Books:

Ethem Alpaydin, "Introduction to Machine Learning", Third Edition, Prentice Hall of India, 2015.

Tom Mitchell, "Machine Learning", McGraw-Hill, 2017.

Christopher Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.

Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.

Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Second Edition, CRC Press, 2014.

References:

Reference Books:

1. Fabio Nelli, "Python Data Analytics with Pandas, Numpy, and Matplotlib", Second Edition, Apress,2018. Educational Publishers Inc., 2015.
2. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", FirstEdition, Cambridge University Press, 2012.

Video References:

https://www.youtube.com/c/3blue1brown

https://www.youtube.com/channel/UCfzlCWGWYyIQ0aLC5w48gBQ

Web Resources:

https://www.youtube.com/channel/UCWN3xxRkmTPmbKwht9FuE5A

Machine Learning by Andrew Ng on Coursera

MOOC/SWAYAM/NPTEL Courses:

1. Introduction to Deep Learning - MIT Open Courseware
2. Essential Mathematics for Artificial Intelligence on edX

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19AD653.1	Apply the mathematical concepts of Machine learning to solve real-time problems.
R19AD653.2	Apply the different types of Machine learningand graphical modelling for data analysis andvisualization.
R19AD653.3	Implement boosting algorithms using appropriate libraries and tune hyperparametersfor optimal performance.
R19AD653.4	Interpret and communicate the results obtained from Bayesian network analysis and clusteringalgorithms in the context of specific applications.
R19AD653.5	Examine the Markov Decision Process and Reinforcement learning algorithms in a simulated environment.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202

R19AD654	Foundations of Artificial Intelligence	L	T	P	C
		3	0	0	3

1. Course Description:

This course offers a comprehensive exploration of the foundational principles and core concepts in Artificial Intelligence (AI). Beginning with an introduction to the history and applications of AI, the course progressively delves into intelligent agents, problem-solving, search algorithms, and extends to encompass knowledge representation and planning. Through a structured journey, students will delve into the origin of Artificial Intelligence (AI), covering a spectrum of topics crucial for understanding and equipping them with the problem-solving skills essential for the broader field of AI.

2. Course Objectives:

1. To study about structure of agents and the nature of environments
2. To learn the search algorithms of AI in different environments
3. To Learn and apply adversarial search techniques to solve problems in dynamic environments.
4. To study and infer the logical and probabilistic inference mechanisms.
5. To study the knowledge representation and planning algorithms.

3. Syllabus:

Unit – I: Intelligent Agents

Introduction to artificial intelligence; Intelligent agents: agents & environment, concept of rationality, nature of environments, structure of agents.

Case Study: Autonomous Delivery Robots which interact with their surroundings and navigate through dynamic environments to deliver packages.

Unit – II: Problem Solving Agents

Uninformed search strategies, Heuristic search strategies, heuristic functions; Local search and optimization problems, local search in continuous space, search with nondeterministic actions, search in partially observable environments, online search agents and unknown environments.

Case Study: Autonomous vehicle Navigation in Unknown Environments

Unit – III: Game Playing and CSP

Adversarial search: Games, optimal decisions in games, alpha - beta pruning, stochastic games, partially observable games; Constraint satisfaction problems; constraint propagation, backtracking search for CSP, local search for CSP, structure of CSP

Case Study: Artificial intelligence system plays chess to make optimal moves in a partially observable and dynamic environment.

Unit – IV: Logical Agents

Knowledge-based agents, propositional logic, propositional theorem proving, propositional model checking, agents based on propositional logic; First-order logic: syntax and semantics, knowledge representation and engineering; Inferences in first-order logic: forward chaining, backward chaining, resolution

Case Study: Automated personal assistant to assist users in managing their daily tasks, scheduling, and information retrieval.

Unit – V: Knowledge Representation and Planning

Ontological engineering, categories and objects, events, mental objects and modal logic, reasoning systems for categories, reasoning with default information; Classical planning, algorithms for classical planning; time, schedule, and resources analysis, hierarchical planning, planning and acting in non-deterministic domains

Case Study: Autonomous Warehouse Management System (WMS) for efficient planning, scheduling, and resource allocation within a warehouse environment.

Text Books:

1. Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", Fourth Edition, Pearson Education, 2020.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

2. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill Publishing Company, New Delhi, 2014.

References:

Reference Books:

1. I. Bratko, "Prolog: Programming for Artificial Intelligence", Fourth edition, Addison-Wesley Educational Publishers Inc., 2015.
2. Deepak Khemani, "A First Course in Artificial Intelligence", McGraw Hill Education, New Delhi, 2017

Video References:

1. https://www.youtube.com/watch?v=R3nqhDIEyMg&list=PLaatXkJEXKyJjYYOrWrmVPNbWvs_sRgm
2. https://www.youtube.com/watch?v=WfdwKUuiLNo&list=PLbhdEzRraaeGjIhuP96wB3L2BTBhaOeWe

Web References:

1. https://www.geeksforgeeks.org/optimal-decision-making-in-games/
2. https://www.javatpoint.com/ai-informed-search-algorithms

MOOC/SWAYAM/NPTEL Courses:

1. https://onlinecourses.nptel.ac.in/noc20_cs81/preview
2. https://www.udemy.com/course/searching-algorithms-in-ai/

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19AD654.1	Implement a study of agents' structures and diverse environments in AI.
R19AD654.2	Apply various AI search algorithms for different environmental scenarios using the knowledge and skills acquired.
R19AD654.3	Implement a comprehensive study of adversarial search techniques and resolving constraint satisfaction problems in AI.
R19AD654.4	Apply logical and probabilistic inference mechanisms to improve decision-making in AI systems.
R19AD654.5	Analyse knowledge representation techniques and planning algorithms vital for Artificial Intelligence

R19CC651	Network Protocols	L	T	P	C
		2	0	2	3

1. Course Description:

This course is designed to equip students with a solid understanding of network protocols, addressing, and their functions in computer networks. Topics covered include the various types of IP addressing, the functionalities of Internet Protocol (IP), and the basics of TCP protocol design and operations. Additionally, students will learn to identify different types of TCP/IP family network protocols crucial for effective network management and communication.

2. Course Objectives:

1. To examine network protocols, addressing, and functions for foundational comprehension.
2. To make students understand diverse IP addressing types for efficient network management.
3. To summarize Internet Protocol functionalities for communication understanding.

Chairman – Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

4. To gain knowledge of TCP protocol basics for reliable data transmission comprehension.
5. To identify TCP/IP family protocols for specific network functionality comprehension.

3. Syllabus:

Unit – I: Protocols and Standards

Protocols and Standards- Internet Standards-Protocol Layers-OSI Reference Model-TCP/IP Protocol Suite-Addressing: Physical, Logical, Application and Port Addressing.

Unit – II: IP Addressing

Address Space- Notation- Range of Addresses-Classful Addressing: Classes And Blocks- Two-Level Addressing- Subnetting and Supernetting-Classless Addressing: Variable-Length Blocks- Two-Level Addressing- Block Allocation.

Unit – III: Internet Protocol

TCP/IP Protocol Suite -Datagram-Fragmentation-Options- Checksum-Security: Packet Sniffing, Packet Modification, IP Spoofing-IP Packaging-Internet Control Message Protocol: Messages and Formats- Error Reporting-Query- Checksum- Internet Control Message Protocol Design

Unit – IV: Transmission Control Protocol

Process To Process Communication -TCP Services –Segment -Options- Checksum-Flow Control-Error Control- TCP Timers-Connection-State Transition Diagram-Congestion Control-TCP Operation- TCP Design

Unit – V: TCP/IP Family Protocols

User Datagram Protocol: UDP Services-UDP Applications-File Transfer Protocol: Connections Communication-Command Processing-File Transfer-Anonymous FTP-Security For FTP- Hypertext Transfer Protocol: HTTP Overview-Message Formats- HTTP Connections-Security

List of Experiments:

1. Simulate and compare the OSI and TCP/IP protocol layers using a network simulator
2. Configure a small network using Classful and Classless (CIDR) IP addressing schemes. Perform subnetting and supernetting to manage IP addresses efficiently in Cisco Packet Tracer.
3. Analyze IP packets, focusing on packet fragmentation, reassembly, and identifying spoofed packets.
4. Simulate a TCP connection establishment and analyse its flow control mechanism
5. Set up an FTP server and client, transfer files between them, and monitor the communication

Text Books:

1. Behrouz A. Forouzan, —TCP/IP Protocol Suite‖, Tata McGraw Hill Publishing Company, New Delhi, 2010.
2. DOUGLAS E. COMER, —Internetworking With TCPI/IP Principles, Protocols, and Architecture‖, Pearson, 2015.

References:

1. Achyut S. Godbole, Atul Kahate —Data Communications and Networks, Tata McGraw Hill Publishing Company, New Delhi, 2011.
2. William Stallings —Data and Computer Communications‖, Pearson Prentice-Hall, New Delhi, 2011.
3. W. Richard Stevens, —TCP/IP Illustrated: The Protocols‖, Addison-Wesley Professional, 2011.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19CC651.1	Implement the basics of protocols, addressing, and their functions in computer networks.
R19CC651.2	Classify the different types of IP addressing and their functions in networks.

Chairman – Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19CC651.3	Demonstrate the functionalities of Internet Protocol and its elements.
R19CC651.4	Analyze the basics of TCP protocol design and operations.
R19CC651.5	Differentiate the types of TCP/IP family of network protocols within the network.

R19CC601	High Speed Networks	L	T	P	C
		3	0	0	3

1. Course Description:

This course is designed to provide a comprehensive understanding of high-speed networks, focusing on the architecture of ATM and high-speed LANs. Students will analyze congestion control within packet-switching networks, describe various traffic management techniques in ATM, and explore the basic taxonomy and architecture implementation of high-speed wireless LANs. Additionally, they will learn to compare and select appropriate modes in wireless ATM networks, preparing them for effective network design and management in high-speed environments.

2. Course Objectives:

1. To examine ATM and high-speed LAN architectures for foundational comprehension.
2. To make students understand congestion control in packet-switching networks for effective management.
3. To impart knowledge on traffic management techniques in ATM to optimize performance.
4. To examine high-speed wireless LAN taxonomy and architecture for comprehension.
5. To compare and select modes in wireless ATM networks for efficient transmission.

3. Syllabus:

Unit – I: High Speed Networks

Asynchronous Transfer Mode – ATM Protocol Architecture, ATM Logical Connection – ATM Cell – ATM Service Categories – AAL. High Speed LANs – Fast Ethernet – Gigabit Ethernet – Fibre Channel – Wireless LAN's Applications, Requirements – Architecture of IEEE 802.11.

Unit – II: Queuing Analysis and Congestion Control

Single Server Queues – Multiserver Queues – Queues with Priorities – Networks of Queues –Effects of Congestion – Congestion Control – Traffic Management – Congestion Control in Packet Switching Networks – Frame Relay Congestion Control

Unit – III: ATM Congestion Control

Traffic and Congestion Control in ATM – Requirements – Attributes – Traffic Management Frame Work – Traffic Control – ABR Traffic Management – ABR Rate Control – RM Cell Formats – ABR Capacity Allocations – GFR Traffic Management.

Unit – IV: High Speed Wireless Lan

Classification Of Wireless LANs: Radio LANs-Direct Sequence Spread Spectrum-Frequency Hopping Spread Spectrum-Comparison-Infrared LANs-Wireless LAN Implementation-Components-Protocol Architecture-LAN Topologies-Deployment- Performance of Wireless LANs.

Unit – V: Wireless ATM Networks

ATM Technology: Comparison of Transfer Modes, ATM vs IP- Need for Wireless ATM-Wireless Communication using ATM-Multimedia Communications using Wireless ATM.

Text Books:

1. William Stallings, —High-speed Networks and Internet, Pearson Education, 2nd Edition, 2002.
2. Benny Bing, —High-Speed Wireless ATM and LANs, Artech House Publishers, 2000

Chairman - Board of Studies
Department of Electronics & Communication Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

References:
1. Jean Warland, Pravin Varaiya—High-performance Communication Networksǁ, Jean Harcourt Asia Private Limited, 2nd Edition, 2000. 2. Abhijit S. Pandya, ErcanSen —ATM Technology for Broadband Telecommunications Networks, CRC Press, 2004. 3. William Stallings —High-speed Networks: TCP/IP and ATM Design Principlesǁ, PHI, 2nd Edition, 2008

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19CC601.1	Implement the basics of architecture of ATM and high-speed LANs.
R19CC601.2	Analyze and manage congestion control in various scenarios within packet switching networks.
R19CC601.3	Demonstrate a range of traffic management strategies in ATM.
R19CC601.4	Evaluate the basic taxonomy in high-speed wireless LANs and their architectural implementation.
R19CC601.5	Select and apply appropriate modes in wireless ATM networks.

R19CC602	Introduction to Industrial Networking	L	T	P	C
		3	0	0	3

1. Course Description:

This course is designed to provide an introduction to industrial networking, covering fundamental concepts such as data networks and internetworking. Students will familiarize themselves with serial communications, delve into specifics like HART and Field buses, and understand communication protocols like MODBUS and PROFIBUS. Additionally, the course explores industrial Ethernet and wireless communication, equipping students with essential knowledge for navigating the complexities of industrial networking.

2. Course Objectives:

1. To examine data network basics to establish foundational understanding.
2. To understand internetworking and serial communications fundamentals for application.
3. To explore HART and Field buses to grasp their industrial significance.
4. To make students understand MODBUS, PROFIBUS, and other protocols for effective communication.
5. To impart knowledge on industrial Ethernet and wireless communication for modern networking.

3. Syllabus:

Unit – I: Data Network Fundamentals

Networks hierarchy and switching – Open System Interconnection model of ISO - Data link control protocol - Media access protocol - Command/response - Token passing - CSMA/CD, TCP/IP

Unit – II: Internet Working and RS 232, RS 485

Bridges - Routers - Gateways - Standard ETHERNET and ARCNET configuration special requirement for networks used for control - RS 232, RS 485 configuration Actuator Sensor (AS) – interface, Device net.

Unit – III: HART and Fieldbus

Chairman – Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202.

Introduction - Evolution of signal standard - HART communication protocol - HART networks – HART commands - HART applications - Field bus - Introduction - General Field bus architecture – Basic requirements of Field bus standard - Field bus topology - Interoperability - Interchangeability - Introduction to OLE for process control (OPC).
Unit – IV: Modbus and Profibus PA/DP/FMS and FF
MODBUS protocol structure - function codes – troubleshooting Profibus, Introduction, Profibus protocol stack, Profibus communication model - communication objects - system operation - troubleshooting - review of foundation field bus - Data Highway
Unit – V: Industrial Ethernet and Wireless Communication
Industrial Ethernet, Introduction, 10 Mbps Ethernet, 100 Mbps Ethernet - Radio and wireless communication, Introduction, components of radio link - radio spectrum and frequency allocation – radio MODEMs-Introduction to wireless HART and ISA100.
Text Books:
1. Steve Mackay, Edwin Wrijut, Deon Reynders, John Park, Practical Industrial Data Networks 2. 'Design, Installation and Troubleshooting' Newnes Publication, Elsevier First Edition, 2004 3. A. Behrouz Forouzan, Data Communications & Networking,3RD edition, Tata Mc Graw hill, 2006.
References:
1. Andrew S. Tanenbaum, David J. Wetherall, Computer Networks, Prentice Hall of India Pvt. Ltd., 5th Edition. 2011. 2. Theodore S Rappaport, Wireless Communication: Principles and Practice, Prentice Hall of India 2nd Edition, 2001. 3. William Stallings, Wireless Communication & Networks, Prentice Hall of India, 2nd Edition, 2005.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19CC602.1	Apply the basic concepts of data networks.
R19CC602.2	Implement the basics of internetworking and serial communications.
R19CC602.3	Utilize the details of HART and Field buses.
R19CC602.4	Implement MODBUS, PROFIBUS, and other communication protocols.
R19CC602.5	Apply industrial Ethernet and wireless communication concepts.

R19CC603	Basics of Mobile Communication	L	T	P	C
		3	0	0	3

1. Course Description:

This course is designed to provide a comprehensive understanding of the basics of mobile communication. Students will explore wireless communication mediums used in cellular systems, understand the architecture and fundamentals of mobile telecommunication systems, and delve into the architecture of Wireless LAN technologies. Additionally, they will determine the functionalities of network and transport layers, illustrate the generations of wireless networks, and acquire knowledge of application layer functionalities and associated languages and operating systems in mobile communication.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641202.

2. Course Objectives:

1. To impart knowledge on wireless communication mediums for cellular systems, establishing a foundational understanding.
2. To equip students with a practical understanding of mobile telecommunication system architecture.
3. To provide comprehensive insights into the architecture of Wireless LAN technologies.
4. To enhance the understanding of network and transport layer functionalities, along with the evolution of wireless network generations.
5. To develop expertise in application layer functionalities, associated programming languages, and operating systems relevant to mobile communications.

3. Syllabus:

Unit – I: Wireless Transmission and Channel

Introduction: Applications, History of wireless communication. Wireless Transmission: Frequencies for radio transmission, Signal Propagation, Cellular Systems. Medium Access Control: Motivation for a specialized MAC, SDMA, FDMA, TDMA and CDMA.

Unit – II: Mobile Communication Systems

Mobile Communication systems: GSM Mobile services, System Architecture, Radio Interface, Protocols, Localization and calling, Handover, Security, New Data services. Satellite systems: Overview and applications. Broadcast systems: Overview, DAB and DVB, Convergence of Broadcasting and Mobile communication

Unit – III: Wireless LAN

Wireless LAN: Infra-red vs. radio transmission, Infrastructure and ad-hoc network, IEEE 802.11, HIPERLAN, Bluetooth

Unit – IV: Mobile Network Layer and Transport Layer

Mobile Network Layer and Transport Layer: Mobile IP, Dynamic Host Configuration Protocol, Mobile adhoc networks, Traditional and classical TCP and TCP over 2.5/3G wireless networks.

Unit – V: Application Layer

Application Layer: Wireless Application Protocol, Architecture, Wireless datagram protocol, wireless transport layer security, wireless transaction protocol, wireless session protocol, wireless application environment, wireless mark-up language, WMLScript, I-mode, SuncML, WAP2.0, Mobile Application Languages: Mobile application Development, XML, JAVA, Java 2 Micro Edition, Java card, Mobile Operating system: Window Mobile and CE, Android.

Text Books:

1. Jochen Schiller, —Mobile communications‖ Pearson, 2nd edition 2009
2. Clint Smith, Daniel Collins, —Wireless Networks, Third Edition, McGraw Hill Publications, 2014.

References:

1. Raj Kamal, —Mobile Computing Oxford University Press 2nd Edition
2. Prasanth Kumar Patnaik, Rajib Mall, — Fundamentals of Mobile Computing‖, PHI Learning Pvt. Ltd., New Delhi, 2012

4. Course Outcomes:

After successful completion of the course, the student should be able to:

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

CO. No.	Course Outcome
R19CC603.1	Apply the concepts of wireless communication and mediums used for cellular systems.
R19CC603.2	Implement the basics of mobile telecommunication systems and their architectures.
R19CC603.3	Utilize the architecture of Wireless LAN technologies.
R19CC603.4	Determine the functionality of the network layer and transport layer, and illustrate the generations of wireless networks.
R19CC603.5	Apply the functionalities of application layer and associated languages and operating systems in mobile communications.

R19CC604	Introduction to Wireless Communication Networks	L	T	P	C
		3	0	0	3

1. Course Description:

This course is designed to provide an introduction to wireless communication networks, covering fundamental concepts and technologies. Students will understand the basics of wireless communication systems, explore cellular system concepts based on resource availability, and analyze the performance of various modulation schemes. Additionally, they will delve into the concepts of multiple input multiple output (MIMO) systems and grasp basic wireless networking concepts, preparing them for navigating the complexities of wireless communication networks.

2. Course Objectives:

1. To impart knowledge on wireless communication systems for foundational understanding.
2. To develop an understanding of cellular system concepts with a focus on resource availability.
3. To explore and analyze the performance of various modulation schemes.
4. To provide insights into the concepts of different MIMO systems for deeper comprehension.
5. To foster a comprehensive understanding of basic wireless networking concepts.

3. Syllabus:

Unit – I: Services and Technical Challenges

Types of Services, Requirements for the services and Technical Challenges of wireless communication-Multipath propagation, Spectrum Limitations, Noise and Interference limited systems.

Unit – II: Cellular Communication Concepts

Introduction - frequency reuse - channel assignment - handoff - coverage and capacity improvement, Multiple Access techniques – TDMA, FDMA, CDMA, SDMA.

Unit – III: Wireless Transceivers

Structure of a wireless communication link, Modulation and demodulation – Quadrature Phase Shift Keying, pi/4-Differential Quadrature Phase Shift Keying, Offset-Quadrature Phase Shift Keying, Binary Frequency Shift Keying, Minimum Shift Keying, Gaussian Minimum Shift Keying, OFDM Principles.

Unit – IV: Multipath Mitigation and MIMO Systems

Equalization – Adaptive equalization, Linear and Non-Linear equalization. Diversity – Micro and Macro diversity, Diversity combining techniques, Error probability in fading channels with diversity reception, Rake receiver. MIMO systems – spatial multiplexing -System model -Pre-coding – Beamforming.

Unit – V: Wireless Networks
Introduction-IEEE 802.11 project – Bluetooth – WiMAX- IEEE project 802.16 – Cellular Telephony – Generations, satellite communication Networks- GEO satellite, MEO Satellites, LEO Satellites.
Text Book:
1. Andreas.F. Molisch, —Wireless Communications‖, John Wiley – India, 2nd Edition.
Reference Books:
1. Rappaport,T.S., —Wireless communications‖, Second Edition, Pearson Education, 2010. 2. Behrouz A. Forouzan —Data communication and Networking‖, Fourth Edition, Tata McGraw Hill, 2011. 3. Simon Haykin & Michael Moher—Modern Wireless Communications‖, Pearson Education, 2007. 4. Andrea Goldsmith, Wireless Communications, Cambridge University Press, 2007.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19CC604.1	Demonstrate an understanding of the basics of wireless communication systems.
R19CC604.2	Analyze cellular system concepts based on resource availability.
R19CC604.3	Evaluate the performance of various modulation schemes.
R19CC604.4	Apply the concepts of various MIMO systems.
R19CC604.5	Apply basic wireless networking concepts.

R19CB601	Algorithmic Trading Strategies	L	T	P	C
		3	0	0	3

1. Course Description:

The aim of the Algorithmic Trading Strategies course is to investigate various methods implemented in trading strategies with emphasis on automated trading. The course also provides a broad view of the algorithmic trading strategies, system architecture, and its risk management. The course content includes methods implemented in multiple quantitative trading strategies on quantitative finance-based approaches to enhance the trade decision making mechanism. Students will learn to quantify liquidity risk, market risk, operational and real economy risks; as well as how to manage those risks.

2. Course Objectives:

1. To understand some basic theories of quantitative trading.
2. To implement spectrum of modelling skills to investigate and summarize stylized features of the market data.
3. To acquire skills in designing and implementing systematic investment trading strategies.
4. To learn regulations and risk management aspects of the business of quantitative trading.
5. Gain a comprehensive understanding of the importance of audit and compliance processes.

3. Syllabus:

Unit – I: Introduction to Algorithmic Trading

Overview: Evolution of Algorithmic Trading, Meaning of Algorithmic Trading, Different Trading Methodologies; Trends in Algorithmic Trading: Global and India, Benefits of Algorithmic Trading.

Unit – II: Trading Strategies

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Order Types: Different Order Types, Execution of Trading Strategies; Trading Strategies: Calendar Spread, Cash Future Arbitrage Strategy, Index Arbitrage, Pair Trading, News Based Trading Strategies, Conversion, Reversal.
Unit – III: Algorithmic Trading: System Architecture
Market Data: CEP Engine, Order Routing / Order Manager, Colocation, Smart Order Routing (SOR), Connectivity Options.
Unit – IV: Risk management in Algorithmic Trading
Different Stages involved in Risk Management, Risk Management Specific to High Frequency & Algorithmic Trading.
Unit – V: Audit and Compliance Process
International Organization of Securities Commissions, Auditing Process and Requirements (As defined by NSE for member-broker); SEBI Recommendations on Algorithmic Trading: Software Testing and Empanelment, Exchange Audits, Technology and System Audit, Compliance Requirements.
Text Books:
1. Raja Velu, Maxence Hardy and Daniel Nehren, "Algorithmic Trading and Quantitative Strategies", CRC Press Taylor and Francis Group, Florid, 2020. 2. Sebastien Donadio, Sourav Ghosh, "Learn Algorithmic Trading: Build and Deploy Algorithmic Trading Systems and Strategies Using Python and Advanced Data Analysis", United Kingdom: Packet Publishing 2019.
References:
Reference Books: 1. Conlan C, "Algorithmic Trading with Python: Quantitative Methods and Strategy Development" United States: Independently Published, 2020. 2. Satya R. Chakravarthy and Palash Sarkar, "An Introduction to Algorithmic Finance, Algorithmic Trading and Blockchain", Emerald Publishing, Bingley, 2020. **Journals:** 1. Journal of Financial Markets 2. Journal of Financial and Quantitative Analysis (JFQA) 3. Journal of Portfolio Management 4. Journal of Computational Finance **Video References:** 1. https://www.youtube.com/watch?v=f911dDCELX4 2. https://www.youtube.com/watch?v=5iuF42s6zNo 3. https://www.youtube.com/watch?v=kFnUxQ2OQgk 4. https://www.youtube.com/watch?v=u3aJCJSunWA 5. https://www.youtube.com/watch?v=9Y3yaoi9rUQ **MOOC/SWAYAM/NPTEL Courses:** 1. https://nptel.ac.in/courses/110104169 2. https://nptel.ac.in/courses/110107144

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19CB601.1	Recognize the trends and benefits of algorithmic trading

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19CB601.2	Analyze various order types and trading strategies
R19CB601.3	Appraise the system architecture for algorithmic trading
R19CB601.4	Obtain knowledge related to risk management in algorithmic trading
R19CB601.5	Understand the importance of audit and compliance process

R19CB602	Business Simulation	L	T	P	C
		3	0	0	3

1. Course Description:

Business Simulation is built around a computer-based business simulation of a technology company start-up. Students on the course are formed into company teams of six or so members who will self-allocate themselves into the different board of director roles (Strategy, Finance, Marketing, Operations, HR/Organisation and Innovation) to manage their simulated company through a series of five simulation rounds that represent two years in the life of the company.

2. Course Objectives:

1. Gain an understanding of integrating business management principles and practice the theory in an interdisciplinary environment
2. Develop skills that are necessary to solidify a business situation using what-if scenarios
3. Obtain the knowledge and skill to analyze a business process – not just at high-level.
4. Work as a member of a team in completing everyday business tasks and making decisions relating to the overall operation of the business and growth of the business.
5. Apply critical thinking and problem-solving skills in a rapidly evolving environment

3. Syllabus:

Unit – I: Basic Simulation Modeling

The Nature of Simulation Systems: Models and Simulation with ExtendSim, Simulation of a Single Server Queuing System Simulation of an Inventory System Simulation with ExtendSim, Parallel/ Distributed Simulation, Steps in a Simulation Study Other types of Simulation

Unit – II: – Simulation Software

Introduction, Classification, Desirable Software Features, Simulation Software Demonstration, Simulation Software Demonstration

Unit – III: Probability and Statistics

Random Variables, Simulation Output Data and Stochastic Process, Simulation Output Data and Stochastic Process, Case studies, MODELNG COMPLEX SYSTEMS, List Processing in Simulation

Unit – IV: Simulator

Introduction to discrete event simulation and ExtendSim, ExtendSim Simulation, A panorama of ExtendSim models, Stochastic Optimization, Combining Solver and @Risk

Unit – V: System Design

Process Analysis and Variability, Staffing Small Service Systems, Staffing Large Service Systems, Network models, Comparison of Alternative Systems, Routing in Service Systems

Text Books:

1. Business simulation A Complete Guide-2020 Edition by Gerardus Blokdyk 2020.
2. Business Process Modeling, Simulation and Design Hardcover – 26 December 2018
3. Simulation Modelling Comcepts,Tools and Practical Business Applications by Andrew Greasley 2023

References:

Reference Books:

1. Contributions on Applied Business Research and Simulation Studies Mariya Gubareva (Editor) , Orlando Gomes (Editor),2020

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)

2. The Big Book of Simulation Modeling:Multimethod Modeling with AnyLogic 8, Dr. Andrei Borshchev, Ilya Grigoryev,2019
3. Modeling and Simulation in Complex Project Management, Sergey Suslov, Dmitry Katalevsky2002.

Journals:

1. Journal of Marketing Research
2. Journal of International Marketing
3. Journal of Vacation Marketing
4. Journal of Academy of Marketing Science

Video References:

1. https://www.youtube.com/watch?v=FO_nOu1nhcs
2. https://www.youtube.com/watch?v=IP0cUBWTgpY
3. https://www.youtube.com/watch?v=kMfXH2vuPX0
4. https://www.youtube.com/watch?v=wYMh0nHCKKk
5. https://www.youtube.com/watch?v=oxN6FYjBDso

MOOC/SWAYAM/NPTEL Course:

1. https://onlinecourses.nptel.ac.in/noc20_mg05/preview/

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19CB602.1	Develop a managerial approach to analyzing business problems.
R19CB602.2	Apply the skills necessary to develop corporate, business level and functional level strategies that will create competitive advantages and be able to defend their selection for a particular business situation
R19CB602.3	Demonstrate an ability to apply general management know-how as a member of a team in a simulated business setting.
R19CB602.4	Apply critical thinking and problem-solving skills in a rapidly evolving environment
R19CB602.5	Apply problem solving processes within a business context

R19CB603	Principles of Taxation	L	T	P	C
		3	0	0	3

1. Course Description:

This course provides an in-depth understanding of the principles and practices of taxation. It covers various types of taxes, the legal and regulatory framework governing taxation, and the impact of taxes on business decisions.

2. Course Objectives:

1. Understand the fundamental principles of taxation.
2. Analyze different types of taxes and their implications for businesses.
3. Apply tax laws and regulations in practical scenarios.
4. Evaluate the impact of tax policies on business strategy and operations.
5. Develop skills to engage with tax professionals and authorities effectively.

3. Syllabus:

Unit – I: Introduction to Taxation

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Definition and purpose of taxation, History and evolution of taxation, Key concepts in taxation; Types of Taxes: Income tax, Corporate tax, Sales and use tax, Property tax, Value-added tax (VAT) and Goods and Services Tax (GST)
Unit – II: Taxation of Individuals
Income Tax for Individuals: Taxable income, Deductions and exemptions, Tax credits, Filing status and requirements, Tax rates and brackets; Tax Planning for Individuals: Retirement accounts and tax implications, Estate and gift taxes, Tax-efficient investment strategies, Health savings accounts (HSAs), Education-related tax benefits
Unit – III: Corporate Taxation
Corporate Income Tax: Taxable income for corporations, Deductions for businesses, Tax credits and incentives, Depreciation and amortization, corporate tax rates and compliance; International Taxation: Taxation of multinational companies, Transfer pricing, Tax treaties and agreements, Foreign tax credits, Base erosion and profit shifting (BEPS)
Unit – IV:Tax Administration and Compliance
Tax Filing and Reporting: Tax forms and filing requirements, electronic filing and recordkeeping, Deadlines and penalties, Role of tax authorities, Common filing errors and how to avoid them; Tax Audits and Dispute Resolution, Process of tax audits, Handling tax disputes, Legal recourse and appeals, Documentation and evidence, Working with tax professionals
Unit – V: Tax Policy and Economic Impact
Tax Policy Analysis: Principles of tax policy, Impact of taxation on economic behavior, Tax reform and policy changes, Comparative tax systems, Political and social considerations in tax policy; Fiscal Policy and Taxation: Relationship between taxation and government spending, Taxation and economic growth, Equity and efficiency in taxation; Case Studies in Taxation: Analysis of real-world tax issues, Lessons from notable tax cases, Group presentations on tax scenarios
Text Books:
1. "Federal Income Taxation" by Joseph Bankman, Thomas D. Griffith, and Katherine Pratt 2. "Principles of Taxation for Business and Investment Planning" by Sally Jones and Shelley Rhoades-Catanach 3. Taxation: Finance Act 2023" by Alan Melville
References:
Reference Books: 1. "International Taxation in a Nutshell" by Mindy Herzfeld and Richard L. Doernberg 2. "Taxation for Decision Makers" by Shirley Dennis-Escoffier and Karen A. Fortin 3. "South-Western Federal Taxation: Comprehensive Volume" by William H Hoffman, Jr., James C. Young, William A. Raabe, and David M. Maloney **Journals:** 1. The Journal of Taxation 2. Tax Law Review 3. The National Tax Journal 4. Tax Notes **Video References:** 1. https://www.youtube.com/watch?v=cXX8pBPU8tU

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

2. https://www.youtube.com/watch?v=LX9L0Rxa7ww
3. https://www.youtube.com/watch?v=d5YhN8o4j9A
4. https://www.youtube.com/watch?v=pmAcG9GxnwY
5. https://www.youtube.com/playlist?list=PLerzWq9nGRYciYtps9nWhdHiJG2bUignt
6. https://www.youtube.com/watch?v=wZ8A81tI3XQ

MOOC/SWAYAM/NPTEL Course:

1. https://nptel.ac.in/courses/112107209

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19CB603.1	Demonstrate a solid grasp of taxation fundamentals, encompassing the essential purpose and historical evolution of taxation
R19CB603.2	calculate taxable income for individuals, apply deductions, exemptions, and tax credits, and strategize tax planning techniques tailored to individual circumstances,
R19CB603.3	Analyze corporate taxation principles, including taxable income determination, deductions, and incentives, as well as navigate international tax issues
R19CB603.4	Develop practical skills in tax filing, reporting, and compliance, including understanding tax forms, electronic filing, and audit procedures,
R19CB603.5	Analyzation of Tax Policy and Economic Impact

R19CB604	Strategic Business Leader	L	T	P	C
		3	0	0	3

1. Course Description:

Explore the multifaceted landscape of modern business through this comprehensive course. Delve into the realms of Leadership and Governance, analyzing leadership qualities, organizational culture, and ethical standards. Understand the intricacies of Strategy and Risk, navigating environmental challenges, competitive forces, and risk management strategies. Embrace the transformative power of Technology and Data Analytics, exploring cloud computing, big data, and IT security. Gain insights into Organizational Control, Audit, and Finance, mastering management systems, compliance, financial analysis, and decision-making techniques.

2. Course Objectives:

1. Understand leadership qualities and ethical codes for effective organizational governance.
2. Analyze strategic choices and manage risks for sustainable competitive advantage.
3. Utilize technology and analytics for enhancing organizational performance and innovation.
4. Implement control mechanisms and financial analysis for informed decision-making and compliance.
5. Foster innovation, manage change, and develop professional skills for organizational excellence.

3. Syllabus:

Unit – I: Leadership and Governance

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Leadership: Qualities of leadership, Leadership and organizational culture, Professionalism, ethical codes and the public interest; Governance: Agency, Stakeholder analysis and organisational social responsibility; Governance, scope and approaches; Reporting to stakeholders; The board of directors; Public sector governance.

Unit – II: Strategy and Risk

Strategy: Concepts of strategy, Environmental issues, Competitive forces, The internal resources, capabilities and competences of an organisation, Strategic choices; Risk: Identification, assessment and measurement of risk, Managing, monitoring and mitigating risk.

Unit – III: Technology and Data Analytics

Technology: Cloud and mobile technology, Big data and data analytics, E- business value chain, IT systems security and control.

Unit – IV: Organisational control and audit, Finance in planning and decision-making

Organisational control: Management and internal control systems, Audit and compliance, Internal control and management reporting; Finance: Function, Financial analysis and decision-making techniques, Cost and management accounting.

Unit – V: Innovation, Performance Excellence and Change Management

Enabling success: Organising, disruptive technologies, talent management, performance excellence; Managing strategic change; Innovation and change management; Leading and managing projects; Professional skills: Communication, Commercial acumen, Analysis, Scepticism and Evaluation.

List of Laboratory Experiments:

1. Written Case Study Analysis - Analyze a case study on leadership and ethics, proposing solutions.
2. Stakeholder Engagement Exercise - Develop a stakeholder engagement plan for a given scenario.
3. Strategic Decision Analysis - Analyze a case study, develop a strategic plan with risk mitigation.
4. Risk Assessment Report - Conduct a risk assessment, and propose mitigation strategies in a report.
5. Data Analytics Project Proposal - Propose a data analytics project with objectives and methodology.
6. Internal Control Assessment - Assess internal controls, propose improvements in an audit report.

Text Books:

1. Organizational Culture and Leadership, 5th Edition by Edgar H. Schein with Peter Schein, Wiley Publishers.
2. "Strategic Management: Concepts and Cases" by Fred R. David and Forest R. David, Pearson, 2015
3. Innovation and Entrepreneurship" by Peter F. Drucker, Harper & Row, 1985

References:

Reference Books:

1. Financial Management by I.M. Pandey, Vikas Publishing House PVT Ltd.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

2. Big-Data Analytics for Cloud, IoT and Cognitive Computing by Kai Hwang, Min Chen, Wiley
3. Publishers
4. Managing Innovation and Change by David Mayle, Sage publishing

Journals:

1. Journal of Leadership & Organizational Studies
2. Strategic Management Journal
3. Financial Analysts Journal

Video References:

1. https://www.youtube.com/watch?v=lmyZMtPVodo
2. https://www.youtube.com/watch?v=u6XAPnuFjJc
3. https://www.youtube.com/watch?v=4y_kGc1GdhQ

MOOC/SWAYAM/NPTEL Course:

1. https://onlinecourses.nptel.ac.in/noc19_mg34/preview

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19CB604.1	Apply leadership qualities and ethical codes to foster effective governance within organizational contexts.
R19CB604.2	Apply strategic thinking to assess competitive forces and manage risks for organizational sustainability and growth.
R19CB604.3	Analyze the impact of technology and data analytics on organizational performance and innovation across the e-business value chain.
R19CB604.4	Analyze organizational control mechanisms and financial data to inform decision-making processes and ensure compliance with regulatory standards.
R19CB604.5	Analyze strategies for fostering innovation, managing change, and developing professional skills to enhance organizational performance and adaptability.

R19CB605	Information Systems Audit and Control	L	T	P	C
		3	0	0	3

1. Course Description:

This subject allows students to acquire, in pedagogic terms, the basic core knowledge of the field of Information Systems Audit and Control, the audit process and the protection of information, consistent with the ISACA Model Curriculum (Note 1), and to develop, in pragmatic terms, the necessary background and skills needed to enter the Information Systems Audit and Control profession.

2.Course Objectives:

1. Introduce students to the fundamental concepts, procedures and standards of IS audit and controls;
2. Describe the qualifications needed to enter and become successful in this field

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

3. Develop students' practical skills in handling various types of IS audits and examining the IS controls 4. Prepare students to develop generic skills in communication, individual and team works 5. Study the case analysis and reporting, and creative problem solving
3.Syllabus:
Unit – I: Introduction
Introduction: Information systems and auditing, Conducting an information system audit
Unit – II: The Management Control Framework
The Management Control Framework: Top Management Controls, Systems Development Management controls, Programming Management Controls, Data Resource Management Controls, Security Management Controls, Operations Management Controls, Quality Assurance Management Controls
Unit – III: Application Control Framework
The Application Control Framework Boundary Controls, Input Controls, Communication Controls, Processing Controls, Database Controls, Output Controls
Unit – IV: Evidence Collection and Evaluation
Evidence Collection and Evaluation - Audit Software - Code Review, Test Data, and Code Comparison - Concurrent Auditing Techniques 9 17 - Interviews, Questionnaires, and Control Flowcharts - Performance Measurement Tools - Evaluating Asset Safeguarding and Data Integrity - Evaluating System Efficiency and Effectiveness
Unit – V: Information System Audit and Management
Information System Audit and Management Managing the Information systems audit function, Practical: Carry out the audit of an IS.
Text Books:
1. Ron Weber- Information Systems Control and Audit 2. Wendy Robson -Strategic Management & Information Systems 3. Mohan Bhatia- Auditing in a Computerized Environment 4. 4. Chris Davis -IT Auditing: Using Controls to Protect Information Assets
References:
Reference Books: 1. Hunton, J.E., Bryant, S.M., and Bagranoff, N.A., Core Concepts of Information Technology Auditing, John Wiley & Sons, 2004 2. Champlain, J.J., Auditing Information Systems, John Wiley, 2003 3. CISA Review Manual, ISACA **Web Resource:** 1. ISACA publications including IS Audit & Control Journal

4.Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19CB605.1	Understand the role of the IS auditor and the IS audit function
R19CB605.2	Understand the purpose of controls in an information systems environment
R19CB605.3	Learn how access to systems, resources, and data can be controlled
R19CB605.4	Understand some of the basic theory underlying computer security policies, models, and problems
R19CB605.5	Understand the basic issues in auditing computer security policies and mechanisms

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19CS651	Application Development using Java	L	T	P	C
		2	0	2	3

1. Course Description:

This course provides students with a comprehensive understanding of the principles, mechanisms and advanced features of the Java programming language. Starting with the Foundations of Java, students will build a solid understanding of basic syntax, data types, control structures, and object-oriented concepts. They will explore into Object-Oriented Mechanisms, mastering topics such as classes, objects, inheritance, polymorphism and encapsulation. The course also covers essential Java libraries and features, including Strings, Collections, Java 8 Features, Exception Handling, and Multithreading. Additionally, students will explore JavaFX for graphical user interface (GUI) development and JDBC for database connectivity, enhancing their proficiency in Java application development.

2.Course Objectives:

1. To understand object-oriented programming concepts and the basics of java programming language
2. To know the principles of packages, inheritance and interfaces
3. To understand strings & collections with java 8 features
4. To develop a Java application with exception handling and threads
5. To develop windows-based applications with jdbc

3.Syllabus:

Unit – I: Foundations of Java

Overview of OOP , Object oriented programming paradigms , Features of Object Oriented Programming; Java Buzzwords ; Overview of Java , JVM , JDK ; Programming Structures in Java , Objects & Classes in Java , Data Types, Variables , Operators , Keywords , Control Statements; Wrapper Classes ; Constructors , Methods , Access specifiers , Garbage Collection ; Arrays & its types ; java.util.Arrays ; Java Doc comments ; I/O classes

Unit – II: Object Oriented Mechanisms

Association, Aggregation, Composition, Polymorphism; Inheritance, Basics, Types of Inheritance, Super, static & final keywords with inheritance and polymorphism; Overloading Vs Overriding , Static and Dynamic Binding ; Abstraction , Abstract Classes and Interfaces , Encapsulation , Packages , Access modifiers

Unit – III: Strings, Collections & Java 8 Features

Types of Classes in Java, Strings, creation, declaration of a string , Mutable & Immutable Strings , Storage structure of a string and its methods, StringBuilder , String Buffer, regex ; Collection Interface ; Generics - List, Set, Map interfaces and classes, Comparable , Comparator ; Java lambda expressions , Date & time Object in java 1.8 and its functions, Streams

Unit – IV: Exception Handling and Multithreading

Exception handling, Hierarchy, Types of exceptions, Mechanisms - try, catch, throw, throws and finally, Exception Propagation, Exception in Inheritance; Introduction to Multiprocessing, threads vs process, threads, Creation of thread , Thread states , Thread Lifecycle and its methods, Executor Framework, Concurrency API, Synchronization Blocks

Unit – V: JAVAFX & JDBC

JAVAFX Events and Controls: Event Basics, Handling Key and Mouse Events; Controls: Checkbox, Toggle Button, Radio Buttons, List View, Combo Box, Choice Box, Text Controls, Scroll Pane. Layouts, Flow Pane, HBox and VBox, Border Pane, Stack Pane , Grid Pane; Menus , Basics , Menu bars , Menu Item ; JDBC – drivers, Steps to create a JDBC application , DB Connection Pool

Text Books:

1. Herbert Schildt, "Java: The Complete Reference", 12th Edition, McGraw Hill Education, New

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641202.

Delhi, 2019

2.Cay S.Horstmann, "Core Java Fundamentals", Volume 1, 11th Edition, Prentice Hall, 2018

References:

References Books:

1. Deitel P and Deitel H, "Java: How to Program", 11th Edition, Prentice Hall, 2018
2. James Gosling, Bill Joy, Guy Steele, Gilad Bracha, Alex Buckley and Daniel Smith, "The Java Language Specification – Java SE", 13th Edition, Oracle America Inc., USA, 2019
3. Matt Weisfeld, "The Object-Oriented Thought Process", 5th Edition, Addison-Wesley Professional, US, 2019

Video References:

1. https://www.youtube.com/@abdul_bari/videos
2. https://www.youtube.com/@JennyslecturesCSIT
3. https://caveofprogramming.teachable.com/p/java-multithreading

MOOC/ NPTEL/ SWAYAM Courses:

1. https://www.udemy.com/course/java-se-programming/
2. https://cse.iitkgp.ac.in/~dsamanta/java/index.htm
3. https://caveofprogramming.teachable.com/p/java-for-complete-beginners

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19CS651.1	Understand the core concepts of Java programming
R19CS651.2	Understand the principles of object-oriented programming
R19CS651.3	Understand the concepts of strings and collections
R19CS651.4	Apply exception-handling & multithreading concepts in applications
R19CS651.5	Apply JavaFX & JDBC in application development

R19CS652	Database Technologies	L	T	P	C
		2	0	2	3

1.Course Description:

This course offers a comprehensive exploration of Database Management Systems (DBMS) theory, focusing on essential concepts and principles underlying the design, implementation and optimization of databases. Students will explore into various topics, including an Introduction to Databases, Structured Query Language (SQL) & Procedural Language/SQL (PL/SQL), Transaction and Concurrency Control, Storage & Indexing, and NoSQL databases. The students will gain a deep understanding of database architectures, data modelling techniques, query languages, transaction management strategies, storage mechanisms, indexing methods and the role of NoSQL databases in modern data management.

2.Course Objectives:

1. To enable students to understand the fundamental concepts and principles of database management.
2. To teach students to master the database querying and programming using SQL and PL/SQL
3. To foster students to learn the principles and mechanisms of transaction processing and concurrency control
4. To familiarize students to design and implement efficient database storage and indexing solutions
5. To acquaint students to effectively use NoSQL databases to build scalable, high-performance applications

3.Syllabus:

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Unit – I: Introduction to Databases

Purpose of Database – Types and examples of Databases (RDBMS, NOSQL, In-memory Databases & Distributed SQL databases)– Relational Database System Architecture - Views of Data– Schema architecture – Data Independence – Schema and instance- Data Models–Benefits and Phases of Data Model - ER Diagram - Symbols, Components, Relationships, Weak entities, Attributes, Cardinality - Extended ER Diagram – Examples- Relational Data Model – Keys - Relational Algebra- Normalization - 1NF, 2NF, 3NF, BCNF,4NF,5NF

Case Study: ER Diagram on Online Streaming, Movie Ticket Recommendation, Bike Tracking

Unit – II: SQL & PL/SQL

SQL Fundamentals – DDL Commands - Create, Drop, Alter, Truncate, Rename, Keys - Primary Key, Candidate Key, Super Key, Foreign Key – DML Commands – DQL Commands - Select, Insert, Update, Delete, Any, All, In, Exists, Non-Exists, Union, Intersection, Advanced SQL Features – Aggregate Functions - SUM, COUNT, AVG, MIN, MAX, EXPLAIN, COALESCE - Clauses – Order By - Group By, Having, CASE, LIMIT,WITH Clause, Date Functions, String Functions -Subqueries - Nested, Correlated, Joins- Inner, Outer, and Equi-Joins - Order of Execution, Embedded SQL- Dynamic SQL. Creation and Dropping of Views, Types of Views - Creation and Execution of Stored Procedures - Cursors - Opening, Fetching, and Closing - Triggers - Creation, Insertion, Deletion, and Updating Database - Exception Handling - MySQL JDBC Connectivity

Case Study: Online Streaming, Movie Ticket Recommendation, Bike Tracking, Import/Export Random records from CSV file to MYSQL

Unit – III: Transaction and Concurrency Control

Transaction processing - ACID Properties - Failure and Recovery – Schedules – Serializability - Concurrency Control –Lock-based protocol - Isolation levels - SQL Facilities for concurrency and recovery- Database Integrity, Security and Authorization

Case Study: ACID Properties in Online Streaming Database

Unit – IV: Storage & Indexing

Overview of Storage Techniques – File organization - RAID –Indexing - Types of ordered indices - B & B+ tree – Hashing - Static & Dynamic Hashing - Query Processing & Optimization – SQL Performance Tuning

Case Study: Indexing in Online Streaming Database to optimize the retrieval of data

Unit – V: NOSQL

Need for NO SQL – Characteristics of NOSQL - Key-value database - Columnar Databases - Apache Cassandra – Click House– Document Databases - MongoDB – CRUD operations with MongoDB - MongoDB JDBC Connectivity –MongoDB Testing - Graph Databases – Metabase

Case study: Conversion of Online Streaming Database (RDBMS) to MongoDB

4.List of Laboratory Experiments / Exercises:

Design a project for the following application using JDBC Connectivity

- Online Food Ordering System
- Online Movie Ticket Booking System
- Online Parking System
- Online Hotel Room Booking System

1 ER Diagrams

Create an Entity Relationship model for the above applications

2 SQL Queries

Develop the SQL Queries using the following commands for the database

a. DDL commands - Create, alter (Add, Modify, Rename), Truncate, Drop commands

b. DML commands - Insert, Update, and Delete commands

c. DQL commands - Select and its basic operations

Chairman – Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202.

d. DCL commands - Commit, Rollback, and Savepoint operations

e. TCL commands - Grant and Revoke operations for the different users

3 Implementation of Key constraints

a. Build the Integrity Constraints - Unique, NOT NULL, Auto Increment, Primary Key, Foreign Key, Check, Default constraints for the given databases

4 Advanced SQL Queries

Implementation of Aggregate Functions

a. Find the total count of all the records in the table

b. Find the average value of a specific column in the table

c. Find the maximum/min/sum value of a specific column in the table

d. Find the count of all distinct values in a specific column in the table

5 Implementation of Group By Clause

a. Find the average/max/min/sum of all values of a specific column for each group records in the table

b. Find the count/average/max/min of all records in the table grouped by multiple columns

6 Implementation of OrderBy Clause

a. Sort the list of all records in the table by multiple columns/specific columns in ascending or descending order

b. Find the top/ bottom 10 records in the table sorted by a specific column/multiple columns

c. Find the list of all records in the table sorted by a specific column/multiple columns and limited to a certain range

7 Implementation of String Functions

a. Find the length of characters in a specific string

b. Find the leftmost/rightmost portion of a specific string up to a certain character or length

c. Find the specific portion of a string extracted using a regular expression pattern

d. Find the specific string with all occurrences of a certain character or pattern replaced with another character or string

e. Find the specific string converted to uppercase or lowercase

f. Find the specific string with leading or trailing whitespace characters removed

g. Find the specific string with a certain character or substring removed or replaced

h. Find the specific string with a certain character or substring added at a certain position

i. Find the specific string with all occurrences of a certain substring concatenated with another substring

8 Implementation of Date function

a. Find the current date and time in MySQL

b. Find the day of the week for a specific date in MySQL

c. Find the month/year for a specific date in MySQL

d. Find the difference between two specific dates in MySQL

e. Find the date in MySQL after adding/subtracting a specific number of days

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

to a specific date.

f. Find the number of days/average time between two specific dates in MySQL

g. Find the earliest or latest date in a specific column of the table in MySQL

9 Implementation of Nested queries

a. Find the maximum/min/count/sum/average/distinct count value of a specific column in the table for a specific subset of records selected using a nested query

b. Find the average/max/sum/count/min value of a specific column in the table where the value of another column is equal to a specific value selected using a nested query

c. Find the maximum value of a specific column in the table for a specific subset of records selected using a nested query within another nested query

10 Implementation of Joins

a. Find the result of an inner/left/right/full outer/cross joins between two/multiple tables on a specific column in MySQL

11 Construction of Index

a. Create an index for the database and show the comparative analysis of Query execution time with and without using an index for the given scenario

12 Implementation of views

a. Perform the DDL, DML, and DQL operations on the views and check the consistency of the relations

b. Create different types of views and their categories of the REFRESH command.

c. Implement the materialized views with Aggregate and Join queries

13 PLSQL

Develop a program in PLSQL using Before/After trigger, row, and statement trigger and instead of trigger

a. Develop a program in PLSQL using Before/After trigger, row, and statement trigger and instead of trigger.

b. Create a trigger and check for the before/after insertion, update, and deletion operations in the table.

14 NOSQL

Implementation of MongoDB application and run through CRUD operations

a. Command to create a collection and a document in MongoDB

b. Command to insert/update/delete a document in a MongoDB collection

c. Command to query a MongoDB collection to retrieve documents that meet certain criteria

d. Command to use aggregation pipelines to perform more complex queries in MongoDB

e. Command to create an index in MongoDB to improve query performance

15 Create tables and execute the queries using Click House

a. Command to create a table, view, and functions

b. Command to insert the data in a table from compressed files, Infiles, and multiple files

c. Command to query the data using the SELECT, WHERE, JOIN, GROUPBY, HAVING clauses command to query the data using the Regular, Aggregate, and Table functions

Text Books:

Chairman – Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan —" Database System Concepts", Sixth Edition, Tata McGraw Hill, 2013 2. Ramez Elmasri, Shamkant B. Navathe —" Fundamentals of Database Systems", Sixth Edition, Pearson Education, 2014
References:
References Books: 1. C.J.Date, A.Kannan, S. Swamynathan, —" An Introduction to Database Systems", Eighth Edition, Pearson Education, 2013 2. Krisitna Chodorow, "MongoDB – The Definitive Guide", O' Reilly, 2013 **Video References:** 1. https://www.youtube.com/playlist?list=PLsjUcU8CQXGFFAhJI6qTA8owv3z9jBbpd 2. https://www.youtube.com/watch?v=c5HAwKX-suM 3. https://youtu.be/FNYdBLwZ6cE 4. https://youtu.be/qEhNHOEa5sE **MOOC/ NPTEL/ SWAYAM Courses:** 1. https://onlinecourses.NPTEL.ac.in/noc23_cs41/preview 2. https://codewithmosh.com/p/complete-sql-mastery 3. https://www.udemy.com/course/nosql-databases-for-beginners/

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19CS652.1	Use data models and depict a database system
R19CS652.2	Design relations for various business requirements
R19CS652.3	Understand the properties of the database and recovery process
R19CS652.4	Understand the optimization techniques in database storage
R19CS652.5	Design non-structured database systems in application development

R19CS653	Full Stack Technologies	L	T	P	C
		2	0	2	3

1. Course Description:

This is a comprehensive course designed to equip students with the knowledge and skills required to become proficient full-stack developers. The course covers essential front-end and back-end technologies, including HTML5, CSS3, JavaScript, React.js, Node.js with Express.js, Spring Boot backend framework, and fundamentals of MongoDB. Through a combination of theoretical lectures, hands-on coding exercises, and real-world examples, students will gain a deep understanding of each technology's role in the development process and how they work together to build modern web applications

2. Course Objectives:

1. To empower students to design, develop, and deploy dynamic web applications using HTML5, CSS3, and JavaScript
2. To introduce students to build fast, scalable, and maintainable front-end applications using ReactJS
3. To familiarize students with the skills to effectively use MongoDB to build robust, scalable, and data-driven applications

4. To acquaint students to build scalable and efficient web applications using Node.js and Express.js
5. To equip students with the skills to master Spring Boot's core features

3.Syllabus

Unit – I: HTML5, CSS3 and JavaScript

Full Stack Application: component; HTML5: tags, attributes, properties, importance of semantic HTML, classes; CSS3: CSS3 syntax, properties, borders, text, image, grid layout, media queries, animations; Types of CSS frameworks; Overview of JavaScript: advanced working with functions; JavaScript namespaces; Prototypes; Error handling; Modules in JavaScript

Case Study: Website design for an automobile industry

Unit – II: ReactJS

ReactJS: library, directory; React components: types of Components, component composition, component styling, adding styles, component intercommunication, data sharing, routing; Hooks: states, hooks vs states, types of Hooks; React bootstrap: props, router

Case Study: Portfolio development with authentication

Unit – III: MongoDB

MongoDB: features, environment; Data modelling: Schema creation using Mongoose (ODM), create database, data types, drop database; Collection: insert, query, update and delete; Projection: limiting records, sorting records, indexing and aggregation

Case Study: Design of a simple search engine

Unit – IV: Node JS and Express JS

NodeJS: node module system, Node Package Manager (NPM); ExpressJs: building RESTful API's; Advanced topics: asynchronous JavaScript, CRUD operations using Mongoose, mongo data validation, mongoose modeling relationships between connected data

Case Study: QR Code Generator application

Unit – V: Spring Boot

Spring Boot: configuration, spring data JPA, create spring data repositories for JPA, web application with Spring Boot, RESTful controllers, message converters, WAR / JAR deployment, creating a RESTful application, HTTP GET, PUT, POST, DELETE

Case Study: Real time message transfer application

List of Laboratory Experiments / Exercises:

1. Develop a music streaming web application to provide users with a seamless and interactive music listening experience. Users should be able to discover, play, and share their favourite music in real-time. The application should support multiple features such as user authentication, personalized playlists, real-time updates on trending tracks, and social sharing capabilities
2. Build a video conferencing web application that facilitates seamless communication between individuals or groups through high-quality video and audio interactions and supports real-time features, user authentication, screen sharing to enhance the overall video conferencing experience
3. Develop a dynamic and engaging social media platform web application that connects users globally. The platform aims to provide a seamless and real-time social experience, allowing

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

users to connect, share content, and interact with each other and should incorporate features such as user profiles, real-time feed updates, multimedia content sharing, instant messaging, and community building

4. Create a web application that constitutes a dynamic Content Management System (CMS) tailored for blogging that allows users to effortlessly create, manage, and share blog content and provides an intuitive interface, support multimedia content, and facilitate collaboration among multiple authors
5. Build a web application designed to serve as a real-time Project Management Dashboard to streamline project management processes, enhance collaboration, and provide stakeholders with a dynamic and comprehensive view of project progress. The application should offer real-time updates, intuitive navigation, and advanced project tracking features.
6. Design a web application to perform real-time analytics for data-driven decision-making. This web application aims to empower users to analyze, visualize, and derive insights from streaming data that will be suitable for industries requiring instantaneous data processing, such as finance, e-commerce environments
7. Develop a web application designed to revolutionize the job search process to provide job seekers with real-time access to a diverse range of job opportunities, personalized recommendations, and interactive tools to streamline the entire job searching experience
8. To develop an online crowdfunding web application to facilitate real-time creative financing for innovative projects. which acts as a catalyst for novel ideas by providing a dynamic platform where creators can present their visions, attract support, and turn aspirations into tangible achievements
9. Build a To-Do List web application elevates the task management experience through real-time collaboration and user authentication. This application provides users with an intuitive platform for creating, organizing, and collaborating on to-do lists in real-time, ensuring secure access and personalized task management
10. Develop a chat web application to facilitate real-time communication and collaboration. The web application aims to provide users with a seamless and interactive platform for one-on-one and group chats, ensuring instant messaging, multimedia sharing, and a user-friendly experience
11. Develop a comprehensive web application to empower users with a real-time expense tracking system for efficient money management that constitutes users with a user-friendly interface, real-time financial insights, and personalized budgeting features to help them make informed financial decisions and achieve their financial goals
12. Design a gaming web application that offers a real-time multiplayer gaming experience to provide users with a diverse range of games, interactive features, and a social gaming environment, allowing players to connect, compete, and collaborate in real-time

Project:

Develop a project for any of the above use cases using the MERN stack

Text Books:

1. Vasan Subramanian, 'Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node', Second Edition, Apress, 2019

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

2. Brad Dayley, Brendan Dayley, Caleb Dayley, 'Node.js, MongoDB and Angular Web Development', Addison-Wesley, Second Edition, 2018
References:
1. Chris Northwood, 'The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer', Apress; 1st edition, 2018. 2. Kirupa Chinnathambi, 'Learning React: A Hands-On Guide to Building Web Applications Using React and Redux', Addison-Wesley Professional, 2nd edition, 2018.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19CS653.1	Build dynamically enriched web pages with HTML5, CSS3, and JavaScript
R19CS653.2	Implement data handling and fetching in React applications using state management libraries
R19CS653.3	Develop a web application with MongoDB as the backend
R19CS653.4	Develop ExpressJS applications that define routes and handle HTTP requests and responses
R19CS653.5	Develop RESTful APIs with Spring Boot for resource representation, HTTP methods and error handling

R19CS654	Fundamentals of Python Programming	L	T	P	C
		2	0	2	3

1.Course Description:

This course covers the fundamental concepts and practical applications of Python programming. Students will explore topics ranging from basic data types and expressions to advanced data manipulation and visualization techniques. The course will delve into programming paradigms, emphasizing Python's versatility in supporting imperative, functional, and object-oriented programming styles. Through hands-on exercises, projects, and real-world examples, students will develop a strong foundation in Python programming, enabling them to write efficient, readable, and maintainable code for various applications.

2.Course Objectives:

1. To learn to solve simple problems with Python programs
2. To choose and use data structures such as lists, tuples, dictionaries and sets in Python programs
3. To understand file operations in Python
4. To implement object-oriented programming constructs in Python
5. To learn to use libraries for data analysis in Python and use Django framework for web application development

3.Syllabus

Unit – I: Python Constructs

Introduction: Python Interpreter and interactive mode, Comments, Identifiers and Keywords; Data Types; Variables and Expressions; Operators; Conditional Statements; Looping Statements; Fruitful Functions; Lambda Function

Illustrative Programs: Financial application, sandwich vowel, and Chocolate Distribution Algorithm

Chairman – Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202.

Unit – II: Lists, Tuples, Dictionaries and Set

Lists: operations - Processing Array elements, slices, methods, loop, mutability, aliasing, cloning, parameters, lists as arrays; Tuples: assignment, tuple as return value; Dictionaries: operations and methods; Sets: operations;

Illustrative Programs: Dutch National Flag Algorithm, Count and Say Problem and Kadanne's Algorithm

Unit – III: Files, Modules and Packages

Files: text files, reading and writing files; Format Operator; Command Line Arguments; Error and Exception Handling; Modules; Packages; Locating path of modules – Python Date – Python Regex.

Illustrative Programs: Bank Management application using File concept

Unit – IV: OOP and Databases

Object, class, constructor, inheritance, abstraction, polymorphism, encapsulation; MongoDB: Environmental Setup, creating new Database, CRUD Operations, Python DB connectivity

Application: Event management using MongoDB, Real Estate management using MongoDB.

Unit – V: Data Analysis and Web Frameworks

NumPy: Basics of NumPy Arrays; Computations: Universal Functions; Aggregations: Min-Max and Everything in Between; Pandas: Objects, Data Indexing and Selection, Data Operations, Handling Missing Data; Matplotlib: Types of plots, Simple Line Plots, Boxplots, Simple Scatter Plots; Django: Overview, Introduction to MVC and MVT architecture in Web development, Django folder structure, generic views, HTML templates

Illustrative Programs: Graph Plotting for performance Analysis, form design, webpage design

4.List of Laboratory Experiments / Exercises:

1. Create a Python application that uses expressions and control flow statements to automate a common task. Ensure that your application is user-friendly and robust to different inputs.
   Suggested Problems: Swap two numbers without a temporary variable, Quadratic Equation, Valid Palindrome

2. Implement a Python program that simulates a real-world system or process using conditions and iterative loops.
   Suggested Problems: check whether an alphabet is a vowel or consonant, sum of all even numbers from 0 to n, factorial of a number

3. Implementation of Strings in the program.
   Suggested Problems: Determine if string halves are alike, palindrome, character count, replacing characters

4. Implementation of real-time/technical applications using Lists and Tuples.
   Suggested Problems: Minimum Index Sum of Two Lists, concatenate two lists index-wise, Tuple with the same product, Copy specific elements from one Tuple to a new tuple)

5. Implementation of real-time applications using Set and Dictionaries.
   Suggested Problems: Magic Dictionary, Longest Word in Dictionary, Set Mismatch and Smallest Number in Finite Set

6. Implementation of Functions in the program.

Chairman – Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202.

Chairman – Board of Studies

Suggested Problems: Factorial, largest number in a list, area of shape

7. Implementation of file-handling operations.
   Suggested Problems: copy from one file to another, wordcount, longest word

8. Implementation of applications of standard libraries.
   Suggested Problems: Handle scalars to work on the NumPy array, Insert values at random positions in an array, Convert the index of a series into a column of a data frame, Combine many series to form a data frame, Get frequency counts of unique items of a series, Union of two arrays, Convert a NumPy array to a data frame of a given shape, Plotting datasets.
9. Implementation of OOP concepts in Python.

References:

References Books:

1. Al Sweigart, "Automate the Boring Stuff with Python: Practical Programming for Total Beginners," 2nd Edition, No Starch Press, 2019
2. Liang Y. Daniel, "Introduction to Programming Using Python," Pearson Education, 2017
3. Jake Vander Pla, "Python Data Science Handbook," O'Reilly (https://jakevdp.github.io/PythonDataScienceHandbook)
4. William S Vincent, "Django for Beginners: Build Websites with Python and Django," Welcome to Code Publishers, 2020

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19CS654.1	Apply syntax and semantics of Python programming language for developing real-world applications
R19CS654.2	Analyse Python solutions by implementing lists, tuples and dictionaries
R19CS654.3	Create file system applications with built in functions
R19CS654.4	Apply principles of OOP and MongoDB
R19CS654.5	Analyse data manipulation techniques and develop web pages with Django Framework

R19CS655	Competitive Coding Techniques	L	T	P	C
		2	0	2	3

1.Course Description:

This course is designed to enhance problem-solving and programming skills required for competitive programming and coding interviews. Students will explore advanced algorithms and data structures, and develop strategies for tackling complex coding challenges under time constraints.

2.Course Objectives

1. To understand the fundamentals of competitive programming`
2. To apply the advanced concepts data structures techniques
3. To apply the advanced algorithmic techniques in data structures
4. To apply the advanced searching and graph data structures techniques

3.Syllabus

Unit I: Introduction to Competitive Programming

Overview of Competitive Programming - Common Online Judges (Codeforces, AtCoder, CodeChef,

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

etc.) - Input/Output techniques - Time and Space Complexity Analysis - Big O Notation - Common Complexity Classes - Basic Math and Number Theory for CP - Prime numbers, GCD, LCM, Factorization - Modular arithmetic - Introduction to Data Structures in CP (Arrays, Lists, Sets)
Unit – II: Advanced Data Structures
Stacks and Queues - Priority Queues and Heaps - Applications in CP - Trees and Graphs - Traversals (DFS, BFS) - Shortest Paths (Dijkstra's and Floyd-Warshall algorithms) - Advanced Data Structures (Segment Trees, Fenwick Trees) - Applications in CP - Disjoint Set Union (Union-Find)
Unit – III: Algorithmic Techniques
Greedy Algorithms - Applications in CP - Fractional Knapsack (Greedy) - Huffman Coding (Greedy) - Dynamic Programming (DP) - Bottom-up and Top-down DP - Knapsack Problems - Recursion and Memoization - Common DP Patterns - Examples of DP in CP - Divide and Conquer - Binary Search
Unit – IV: Advanced Searching and Graph Techniques
Advanced Searching Algorithms (Ternary Search, Binary Indexed Tree) - Bit Manipulation - Number Theory Algorithms (Sieve of Eratosthenes, Modular Inverse) - Combinatorial in CP - Graph Algorithms (Strongly Connected Components, Topological Sort) - Advanced Topics in Trees (LCA, Diameter)
Unit – V: Dynamic Programming Techniques
Advanced Dynamic Programming Techniques - Bitmask DP - State Compression - Convex Hull DP - Advanced Graph Algorithms - Network Flows (Ford-Fulkerson, Edmonds-Karp) - Minimum Spanning Trees (Kruskal, Prim) - Articulation Points and Bridges - Advanced Data Structures - Persistent Data Structures - Trie and Suffix Trees - Treap and Cartesian Tree - Applications in Competitive Programming - Computational Geometry - Line Sweep Algorithms - Closest Pair of Points - Convex Hull (Graham Scan, Jarvis March)
Text Books:
1. "Competitive Programming" (3rd Edition) by Steven Halim, Felix Halim, 2018 (3rd Edition)
2. "Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, 2009 (3rd Edition)

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19CS655.1	Understand the fundamentals of competitive programming
R19CS655.2	Apply the advanced concepts in stack, queue and tree data structures techniques
R19CS655.3	Apply the advanced algorithmic techniques in data structures
R19CS655.4	Apply the advanced searching and graph data structures techniques
R19CS655.5	Apply the advanced dynamic programming techniques in data structures

R19AM601	Deep Learning Models	L	T	P	C
		3	0	0	3

1. Course Description:

This course covers fundamental machine learning and deep learning concepts, algorithms, and architectures. Topics include learning algorithms, overfitting, hyperparameters, neural networks, CNNs, RNNs, and autoencoders.

2. Course Objectives:

1. Understand the theoretical foundations- algorithms and methodologies of Neural Networks.
2. Apply the concept to design an application using specific deep learning models.
3. To provide the knowledge for analysing real-world applications.

3. Syllabus

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

UNIT – I: Machine Learning Fundamentals
Learning algorithms, Capacity, Overfitting and Under fitting, Hyper parameters and Validation sets, Maximum likelihood estimation, Bayesian Statistics, Building machine learning algorithm, Feed Forward Neural Networks- Back propagation, Optimizers: Gradient Descent (GD), Stochastic gradient decent.
UNIT – II: Deep Learning Architectures
Introduction- Perceptron Algorithm, Multilayer Perceptron. Activation Functions: RELU, LRELU, ERELU. Unsupervised Training of Neural Networks, Restricted Boltzmann Machines, Auto Encoders: Deep Unsupervised Learning, Deep Reinforcement learning, Deep Learning Applications.
UNIT – III: Convolutional Neural Networks
Architectural Overview: Motivation, Pooling, Layers, Filters, Parameter sharing, Regularization, Popular CNN Architectures: ResNet, AlexNet, VGG-16, Modern CNN Architecture: Stacked and Hierachical CNN, Dilated CNN, Inception Networks.
UNIT – IV: Sequence Modelling
Recurrent Neural Networks, Bidirectional RNNs, Encoder-decoder sequence to sequence architectures, BPTT for training RNN, Deep Recurrent Networks, and Recursive Neural Networks.
UNIT – V: Autoencoders and Deep Generative Models
Under complete Auto encoder, Regularized Auto encoder, stochastic Encoders and Decoders, Contractive Encoders, Monte Carlo Methods, Boltzmann Machines, Deep Belief networks, Deep Boltzmann Machine, Generative Adverbial Networks.
Text Books: 1. Kamath, Uday, John Liu, and James Whitaker, "Deep learning for NLP and speech recognition". Vol. 84. Cham: Springer, 2019. 2. Ian Goodfellow, Yoshua Bengio and Aaron Courville, "Deep Learning", MIT Press, 2017. 3. Christopher Bishop, "Pattern Recognition and Machine Learning", Springer, 2006. 4. Charu C. Aggarwal, "Neural Networks and Deep Learning", Springer, 2018.
References:
Reference Books: 1. Kevin P. Murphy "Machine Learning: A Probabilistic Perspective", The MIT Press, 2012. 2. Giancarlo Zaccone, Md. RezaulKarim, Ahmed Menshawy "Deep Learning with TensorFlow: Explore neural networks with Python", Packt Publisher, 2017. 3. Francois Chollet "Deep Learning with Python", Manning Publications, 2017
MOOC/NPTEL/SWAYAM Course: 1. Deep Learning -https://archive.nptel.ac.in/courses/106/106/106106184/

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19AM601.1	Design Multi-Layer neural network to solve Supervised Learning problems
R19AM601.2	Apply Regularization methods Early stopping, data augmentation, dropout etc. for optimization results
R19AM601.3	Apply Classical Supervised methods CNN'S, FCN, RCNN etc. for Image Denoising, Segmentation and Object detection problems
R19AM601.4	Use Long Short-Term Memory (LSTM) Networks, GRU for time series analysis classification problems
R19AM601.5	Apply Generative Adversarial Networks, GAN, VAE to solve Supervised and Unsupervised Learning Problems

Chairman – Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19AM602	Video and Speech Analytics	L	T	P	C
		3	0	0	3

1. Course Description:

The course broadly covers the various speech and video processing methodologies. The course enables the students to understand the fundamental concepts of speech analysis and facilitates feature extraction. The course also further teaches the student to track an object in a visual along a boundary for analysis.

2. Course Objectives:

1. To understand the basics of speech signals.
2. To apply the various methodologies for recognizing audio signals.
3. To effectively understand the basics of processing a video.
4. To precisely extract the features through advanced motion detection algorithms.
5. To perform effective detection of boundaries for object tracking.

3. Syllabus

UNIT – I: Speech Processing Concepts

The speech production mechanism, Discrete-time speech signals, Pole-Zero modeling of speech, relevant properties of the fast Fourier transform for speech recognition, convolution, linear and nonlinear filter banks, spectral estimation of speech using DFT. Linear Prediction analysis of speech.

UNIT – II: Speech Recognition

Real and Complex Cepstrum, application of cepstral analysis to speech signal, feature extraction for speech, static and dynamic feature for speech recognition, robustness issues, discrimination in the feature space, feature selection, MFCC, LPCC, Distance measures, vector quantization models. Gaussian Mixture model, HMM

UNIT – III: Basics of Video Processing

Video formation, perception and representation: Principle of color video, video cameras, video display, pinhole model, CAHV model, Camera motion, Shape model, motion model, Scene model, two-dimensional motion models. Three-Dimensional Rigid Motion, Approximation of projective mapping.

UNIT – IV: Motion Estimation Techniques

Optical flow, motion representation, motion estimation criteria, optimization methods, pixel-based motion estimation, Block matching algorithm, gradient Based, Intensity matching, feature matching, frequency domain motion estimation, Depth from motion. Motion analysis applications: Video Summarization, video surveillance.

UNIT – V: Object Tracking and Segmentation

2D and 3D video tracking, blob tracking, kernel based counter tracking, feature matching, filtering Mosaicking, video segmentation, mean shift based, active shape model, video shot boundary detection. Interframe compression, Motion compensation.

Text Books:

1. Fundamentals of Speech recognition – L. Rabiner and B. Juang, Prentice Hall signal processing series.
2. Digital Video processing, A Murat Tekalp, Prentice Hall.
3. Discrete-time speech signal processing: principles and practice, Thomas F. Quatieri, Coth.
4. Video Processing and Communications, Yao Wang, J. Osternann and Qin Zhang, Pearson Education.

References:

Reference Books:

1. "Speech and Audio Signal Processing", B.Gold and N. Morgan, Wiley.
2. "Digital image sequence processing, Compression, and analysis", Todd R. Reed, CRC Press.
3. "Handbook of Image and Video Processing", Al Bovik, Academic press, Second Edition.

Journals (Reference):

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

1. Middle East Journal of Scientific Research 23:370-376 - Analysis on Video Retrieval Using Speech and Text for Content-Based Information. 2. Applied Sciences - https://www.mdpi.com/2076-3417/14/7/2766.
MOOC/NPTEL/SWAYAM Course: 1. https://archive.nptel.ac.in/courses/117/105/117105145/

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19AM602.1	(Understand) Understand the mechanisms of the human speech production system.
R19AM602.2	(Understand) Understand and learn the various speech recognition methodologies.
R19AM602.3	(Understand) Understand and learn the various video processing mechanisms.
R19AM602.4	(Understand) Explore the various motion estimation techniques.
R19AM602.5	(Apply) Analyze the various methods available for object tracking and boundary detection.

R19AM603	Industrial Machine Learning	L	T	P	C
		3	0	0	3

1. Course Description:

The course helps the students to understand and apply various machine learning algorithms in industrial applications.

2. Course Objectives:

1. Students will be able to describe the fundamental principles of the Fourth Industrial Revolution and summarize its impact on different industry sectors such as Energy, Healthcare, Telecommunications, and Financial Services.
2. Students will evaluate the challenges faced by smart industries in adopting machine learning techniques and identify opportunities for improving industry operations through data-driven solutions.
3. Students will design and construct a Hidden Markov Model-based Remaining Useful Life (RUL) estimation system using feature extraction from vibration signals and interpret the results of the degradation model.

3. Syllabus

Unit – I: Introduction

The Fourth Industrial Revolution: Introduction, Industry Summarization, Machine Learning Challenges and Opportunities within Smart Industries; Applications: Energy Sector, Basic Materials Sector, Industrials Sector, Customer Services Sector, Healthcare Sector, Customer Goods Sector, Telecommunications Sector, Utilities Sector, Financial Services Sector, Information Technology Sector.

Unit – II: Component-Level Case Study

Introduction: Ball Bearing Prognostics: Data, Driven Techniques, PRONOSTIA Testbed, Feature Extraction from Vibration Signals; Hidden Markov Model-Based RUL Estimation: Hidden Markov Model Construction, RUL Results, Interpretation of the Degradation model.

Unit – III: Machine-Level Case Study

Introduction: Performance of Industrial Motors as a Fingerprint, Improving Reliability Models with Fingerprints, Industrial Internet Consortium Testbed, Testbed Dataset Description. Clustering Algorithms for Fingerprint Development: Agglomerative Hierarchical Clustering, K-means Clustering, Spectral Clustering, Affinity Propagation, Gaussian Mixture Model Clustering, and Implementation Details.

Unit – IV: Production-Level Case Study

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Introduction: Laser Surface Heat Treatment: Image Acquisition, Response Time Requirement, Anomaly Detection-Based AVI System: Anomaly Detection Algorithms in Image Processing, Proposed Methodology, Performance of the AVI System, Interpretation of the Normality Model.
Unit – V: Distribution-Level Case Study
Introduction: Air Freight Process, Data Preprocessing, Supervised Classification Algorithms for Forecasting: k-Nearest Neighbors, Classification Trees, Rule Induction, Artificial Neural Networks, Support Vector Machines, Logistic Regression, Bayesian Network Classifiers, Meta classifiers, Implementation.
Text Book:
1. Pedro Larranaga, David Atienza,Javier Diaz-Rozo, Alberto Ogbechie, Carlos Esteban Puerto-Santana, Concha Bielza, "Industrial Applications of Machine Learning", 1st Edition, CRC Press, 2019 .
References:
Reference Book: 1. Andreas François Vermeulen," Industrial Machine Learning: Using Artificial Intelligence as a Transformational Disruptor", 1 st Edition, Apress, 2020.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19AM603.1	Understand the concepts and implications of the Fourth Industrial Revolution across various industrial sectors.
R19AM603.2	Analyze machine learning challenges and opportunities within smart industries
R19AM603.3	Develop and implement component-level prognostics for industrial applications using data-driven techniques.
R19AM603.4	Evaluate the performance of industrial motors using clustering algorithms to develop reliability models.
R19AM603.5	Implement supervised classification algorithms for forecasting in air freight processes.

R19AM604	Machine Learning for Smart Cities	L	T	P	C
		3	0	0	3

1. Course Description:
This course provides working principles of Sensors, UAVs, Geriatric Design and IoT Enabled Homes and applying machine learning for Smart Cities
2. Course Objectives:
1. To understand the role of machine learning in creating sustainable and resilient buildings. 2. To explore the use of sensors and UAVs in monitoring and managing smart environments. 3. To analyze data fusion approaches for enhancing smart city infrastructure.
3. Syllabus
Unit – I: Machine Learning for Sustainable and Resilient Buildings
Introduction, Sustainability and Resiliency Conditions, Paradigm and challenges of Sustainability and Resilience, Sustainability and Resilience of Engineered System, Structure Engineering Dilemmas and Resilient Epcot, Smart Building Appliances Intelligent Tools (SRB), Component of Smart Buildings, Machine Learning Tasks, ML Tools and Services, Big Data Application in SB.
Unit – II: Sensors and UAVs

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Introduction, Sensors, Unmanned Aerial Vehicle, Bluetooth, Problem Description, Univariate Time series, Multivariate Time Series, Hidden Markov Model, Fuzzy Logic.
Unit – III: Data Fusion Approaches
Introduction to Data Fusion, Types of Data Fusion Architecture, Centralized Architecture, Decentralized Architecture, Distributed Architecture, Hierarchical Architecture, Case Study: Smart City Infrastructure, IoT Deployments, Smart City Control and Management Centers, Theory of Unified City Modeling, Smart City Operational Model. Theories and Models: Case Study: Web Browsing History Analysis, Data Model for Group Construction in Student's Industrial Placement.
Unit – IV: Geriatric Design and IoT Enabled Smart Homes
Introduction to Geriatric Design: Background, Development of Smart Homes, Development of Smart Homes for Elderly, Indian Scenario, Geriatric Smart Home Requirements, Design, Framework for Smart homes, Architectural Interventions. Case Study: Schematic Design for a Nesting Home, IoT Based Real Time Automation, Technical Components of Smart Home.
Unit – V: Impact of IoT Enabled Smart Cities
Recent Developments in IoT Applications for Modern City, Classification of IoT based Smart Cities, Impact of 5G Technology, IoT Five Layer Architecture, IoT Computing Paradigm, Research Advancement and Drawbacks, Integration of Cloud Computing, integration of Applications, System Security, Research Challenges and Guidelines.
Text Book: 1. Adarsh Kumar, Anand Nayyar, Arun Solanki, "Digital Cities Road map IoT-Based Architecture and Sustainable Buildings", 1st Edition, Wiley, 2021.
References:
Reference Book: 1. J. Joshua Thomas, Vasiliki Geropanta, Anna Karagianni, Vladimir Panchenko, "Smart Cities and Machine Learning in Urban Health", 1st Edition, IGI Global, US, 2021.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19AM604.1	Interpret the machine learning concepts for sustainable and resilient buildings
R19AM604.2	Demonstrate the concept of sensors and time series data
R19AM604.3	Explore Data fusion approach vectors and trends
R19AM604.4	Develop Geriatric design on IoT enabled homes
R19AM604.5	Study the impact of IoT enabled smart cities

R19EC601	Discrete Time Signal Processing	L	T	P	C
		3	0	0	3

1. Course Description:

This course explores the fundamentals of discrete-time signal processing, focusing on the analysis and manipulation of digital signals. Students will learn techniques for sampling, filtering, and transforming signals using various algorithms. Practical applications and tools will be emphasized, equipping learners with skills for real-world signal processing challenges.

2. Course Objectives:

1. To learn discrete fourier transform, properties of DFT and its application to linear filtering
2. To understand the characteristics of digital filters, design digital IIR and FIR filters and apply these filters to filter undesirable signals in various frequency bands
3. To understand the effects of finite precision representation on digital filters
4. To understand the fundamental concepts of multi rate signal processing and its applications
5. To introduce the concepts of adaptive filters and its application to communication engineering

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

3. Syllabus:

Unit – I: Discrete Fourier Transform

Review of signals and systems, concept of frequency in discrete-time signals, summary of analysis & synthesis equations for FT & DTFT, frequency domain sampling, Discrete Fourier transform (DFT) - deriving DFT from DTFT, properties of DFT - periodicity, symmetry, circular convolution. Linear filtering using DFT. Filtering long data sequences - overlap save and overlap add method. Fast computation of DFT - Radix-2 Decimation-in-time (DIT) Fast Fourier transform (FFT), Decimation-in-frequency (DIF) Fast Fourier transform (FFT). Linear filtering using FFT.

Unit – II: Infinite Impulse Response Filters

Characteristics of practical frequency selective filters. characteristics of commonly used analog filters - Butterworth filters, Chebyshev filters. Design of IIR filters from analog filters (LPF, HPF, BPF, BRF) - Approximation of derivatives, Impulse invariance method, Bilinear transformation. Frequency transformation in the analog domain. Structure of IIR filter - direct form I, direct form II, Cascade, parallel realizations.

Unit – III: Finite Impulse Response Filters

Design of FIR filters - symmetric and Anti-symmetric FIR filters - design of linear phase FIR filters using Fourier series method - FIR filter design using windows (Rectangular, Hamming and Hanning window), Frequency sampling method. FIR filter structures - linear phase structure, direct form realizations.

Unit – IV: Finite Word Length Effects

Fixed point and floating point number representation - ADC - quantization - truncation and rounding - quantization noise - input / output quantization - coefficient quantization error - product quantization error - overflow error - limit cycle oscillations due to product quantization and summation - scaling to prevent overflow.

Unit – V: Introduction to Digital Signal Processors

DSP functionalities - circular buffering – DSP architecture – Fixed and Floating point architecture principles – Programming – Application examples.

Text Book:

1. John G. Proakis & Dimitris G.Manolakis, —Digital Signal Processing – Principles, Algorithms & Applications‖, Fourth Edition, Pearson Education / Prentice Hall, 2007.

Reference Books:

1. Emmanuel C. Ifeachor & Barrie. W. Jervis, —Digital Signal Processing‖, Second Edition, Pearson Education / Prentice Hall, 2002.
2. A. V. Oppenheim, R.W. Schafer and J.R. Buck, —Discrete-Time Signal Processing‖, 8th Indian Reprint, Pearson, 2004.
3. Sanjit K. Mitra, —Digital Signal Processing – A Computer Based Approach‖, Tata Mc Graw Hill, 2007.
4. Andreas Antoniou, —Digital Signal Processing‖, Tata Mc Graw Hill, 2006..

Journals:

1. https://www.sciencedirect.com/journal/signalprocessing-journal
2. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=92

Video References:

1. https://www.youtube.com/watch?v=oZSv68esbgI
2. https://www.youtube.com/watch?v=4cPkr1VHu7Q

MOOC/NPTEL/SWAYAM Course:

1. https://www.udemy.com/course/digital-signal-processing

Chairman – Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EC601.1	Illustrate the concepts of Discrete Fourier Transform and its properties
R19EC601.2	Learn the design and characteristics of infinite impulse response (IIR) filters for filtering undesired signals
R19EC601.3	Learn the design and characteristics of finite impulse response (FIR) filters for filtering undesired signals
R19EC601.4	Explain the concepts of finite word length effects
R19EC601.5	Assess various applications in Multi-rate signal processing using various DSP processors

R19EC602	Principles of Analog and Digital Communication	L	T	P	C
		3	0	0	3

1. Course Description:

This course aims at designing Analog and Digital Communication Systems that are used for transmission of information from the source to the destination. A detailed framework for analog and digital communication techniques are addressed. The purpose of this course is to give hands on training to the students in understanding the theory of communication and practicing sessions used in analog and digital communication systems. This will enhance the understanding capability of the students.

2. Course Objectives:

1. To analyze the principles and characteristics of various analog communication techniques.
2. To describe the operation and components of data communication systems, including pulse modulation techniques.
3. To apply knowledge of digital communication techniques.
4. To design and implement error control coding schemes.
5. To understand and utilize techniques for multi-user radio communication.

3. Syllabus:

Unit – I: Analog Communication

Introduction to Communication Systems – Modulation – Types – Need for Modulation. Theory of Amplitude Modulation – Evolution and Description of SSB Techniques – Theory of Frequency and Phase Modulation – Comparison of Analog Communication Systems.

Unit – II: Data and Pulse Communication

Pulse Communication: Pulse Amplitude Modulation (PAM) – Pulse Time Modulation (PTM) – Pulse code Modulation (PCM) – Comparison of various Pulse Communication System, Data Communication: History of Data Communication – Standards, Organizations for Data Communication- Data Communication Circuits.

Unit – III: Digital Modulation

Amplitude Shift Keying (ASK) – Frequency Shift Keying (FSK)–Phase Shift Keying (PSK) – BPSK – QPSK – Quadrature Amplitude Modulation (QAM) – 8 QAM - Bandwidth Efficiency– Comparison of various Digital Communication System

Unit – IV: Source and Error Control Coding

Entropy, Source Encoding Theorem, Shannon Fano Coding, Huffman Coding, Mutual Information, Channel Capacity, Error Control Coding, Linear Block Codes, Cyclic Codes – ARQ Techniques.

Unit – V: Multi-user Radio Communication

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Global System for Mobile Communications (GSM) – Code Division Multiple Access (CDMA) – Cellular Concept and Frequency Reuse – Channel Assignment and Handover Techniques – Overview of Multiple Access Schemes – Satellite Communication – Bluetooth.

Text Books:

1. Wayne Tomasi, "Advanced Electronic Communication Systems", 6th Edition, Pearson Education, 2019.
2. B.P.Lathi, "Modern Analog and Digital Communication Systems", 3rd Edition, Oxford University Press, 2007.

Reference Books:

1. Simon Haykin, "Communication Systems", 4th Edition, John Wiley & Sons, 2004
2. Rappaport T.S, "Wireless Communications: Principles and Practice", 2nd Edition, Pearson Education,2007
3. H.Taub, D L Schilling and G Saha, "Principles of Communication", 3rd Edition, Pearson Education, 2007.
4. Blake, "Electronic Communication Systems", Thomson Delmar Publications, 2002.

Journals:

1. https://www.sciencedirect.com/journal/microelectronics-journal
2. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=92

Video References:

1. https://www.youtube.com/watch?v=oZSv68esbgI
2. https://www.youtube.com/watch?v=4cPkr1VHu7Q

MOOC/NPTEL/SWAYAM Courses:

1. https://www.udemy.com/course/asic-bootcamp-sta-basic-concepts
2. https://www.coursera.org/learn/vlsi-cad-layout

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EC602.1	Analyze the principles and characteristics of various analog communication techniques, such as AM and FM.
R19EC602.2	Describe the operation and components of data communication systems like PWM and PPM.
R19EC602.3	Understand digital communication techniques, such as ASK, PSK, and FSK.
R19EC602.4	Design and implement error control coding schemes to ensure reliable communication in digital systems.
R19EC602.5	Understand and utilize techniques for multi-user radio communication including TDMA and CDMA.

R19EC603	Digital Systems and VLSI Design	L	T	P	C
		3	0	0	3

1. Course Description:

This course introduces digital systems and integrated circuit design concepts and techniques, focusing on CMOS logic for digital design. Students learn to analyze circuit performance and verify functionality and timing constraints.

2. Course Objectives:

1. To understand the basics of the number system and minimization techniques
2. To understand the design of combinational and sequential logic circuits
3. To introduce the basic concepts and techniques of modern integrated circuit design.
4. Describe the fundamental principles underlying digital design using CMOS logic
5. Analyze the performance characteristics of these digital circuits

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

3. Syllabus:

Unit – I: Introduction of Basics concepts of Digital System

Review of Number systems - Logic gates - Boolean algebra: Boolean postulates and laws - De-Morgan's Theorem - Principle of Duality - Simplification using Boolean algebra - Canonical forms - Sum of product and Product of sum -Minimization using Karnaugh map - NAND and NOR implementation.

Unit – II: Combinational Logic Circuits

Combinational Logic: Design Procedure – Adders – Subtractors - Magnitude Comparator -Code converters– decoder - encoder – Multiplexer and Demultiplexer - parity generator – parity checker.

Unit – III: Sequential Logic Circuits

Flip flops – SR, D, JK, T – Realization of one flip flop using other flip flops, Analysis and design of clocked sequential circuits - Design of Counters, shift registers, Shift register counters - Moore/Mealy models, state minimization, state assignment.

Unit – IV: MOS Transistor Theory

MOS transistors; Long Channel I-V Characteristics; C-V Characteristics; Non-ideal I-V effects; Fabrication process; Layout Design Rules: MOSIS scalable CMOS design rules, Micron design rules; Stick diagrams.

Unit – V: CMOS Performance Analysis

CMOS logic: The Inverter, NAND gate, NOR gate, Pass transistors, Transmission gates; CMOS Inverter - DC transfer characteristics, Transistor sizing, Noise Margin; Transient response; RC delay model; Linear delay model; Logical effort of paths; Timing analysis of delay models,

Text Books:

1. M. Morris Mano and Michael D. Ciletti, "Digital Design", 5th Edition, Pearson, 2014.
2. Neil H.Weste, Harris, A. Banerjee, CMOS VLSI Design, A circuits and System Perspective, 2015, 4th Edition, Pearson Education.
3. Wayne Wolf, "FPGA-Based System Design", First Edition, Prentice Hall India Private Limited, 2004.

Reference Books:

1. Thomas L.Floyd, "Digital Fundamentals", Prentice Hall, 11th Edition, 2015.
2. Jan M. Rabaey, Anantha Chadrakasan, Borivoje Nikolic, Digital Integrated Circuits: A Design Perspective Paperback, 2016, 2rd Edition, Pearson Education, India.
3. John P. Uyemura, "Introduction to VLSI Circuits and Systems", John Wiley & Sons, Reprint 2009.
4. Douglas A. Pucknell, "Basic VLSI Systems and Circuits", Prentice Hall of India, 3rd Edition, reprint2008.

Journals:

1. https://www.sciencedirect.com/journal/microelectronics-journal
2. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=92

Video References:

1. https://www.youtube.com/watch?v=oZSv68esbgI
2. https://www.youtube.com/watch?v=4cPkr1VHu7Q

MOOC/NPTEL/SWAYAM Courses:

1. https://www.udemy.com/course/asic-bootcamp-sta-basic-concepts
2. https://www.coursera.org/learn/vlsi-cad-layout

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EC603.1	Apply Boolean algebra, Karnaugh map to design combinational logic circuits
R19EC603.2	Apply different minimization techniques for designing various combinational logic circuits
R19EC603.3	Outline and design the synchronous sequential digital circuits for real time applications
R19EC603.4	Understand MOS transistor fundamentals, CMOS logic and layout design principles.
R19EC603.5	Analyze the characteristics of CMOS inverter and various delay models

R19EC604	Introduction to IoT	L	T	P	C
		3	0	0	3

1. Course Description:

Comprehensive Internet of Things (IoT) coursework will allow you to investigate this revolutionary field. Learn about embedded systems, communication protocols, cloud computing, privacy protection, and new IoT applications. Get hands-on experience and insights into the technologies transforming the digital landscape of interconnected gadgets and intelligent systems.

2. Course Objectives:

1. To understand the core components of embedded systems and their role in IoT devices.
2. To explore cloud-based services and tools for data visualization, analytics, and other applications in IoT.
3. To analyze various communication protocols used in IoT networks (e.g., Wi-Fi, Bluetooth, cellular) and their suitability for different applications.
4. To analyze the security vulnerabilities and privacy risks associated with data collection, transmission, and storage in IoT deployments.
5. To analyze the privacy risks associated with data collection, transmission, and storage in IoT deployments.

3. Syllabus

Unit – I: Overview of IoT

Introduction to IoT: hardware architecture, software architecture, Characteristics of IoT, Challenges, applications; Impact of IoT on business and society; IoT product development life cycle; Network Layers

Unit – II: Communication Protocols and Hardware's for IoT

Communication modules: BLE, WiFi, IoT Protocols: IPv6, CoAP, MQTT; Wired Communication, Launch Pads Overview: Arduino/ESP 32, AT Tiny; Hardware for IoT:Sensors, Actuators, RFID technology; Power Sources.

Unit – III: Cloud Computing for IoT

Cloud Enabling Technologies, Characteristics and benefits of Cloud Computing, Cloud Service Models, Cloud computing Infrastructure, Cloud Challenges, Server Types within IaaS solutions, Cloud-based data storage, Cloud-based backup devices.

Unit – IV: Privacy Protection and Trust Models for IoT

One-Time Mask Scheme, Mobile Wireless Body Sensor Network, Trust Model Concepts, Public Key Infrastructures Architecture Components, Public Key Certificate Formats, Design Considerations for Digital Certificates, Authentication in IoT, and Computational Security for IoT.

Unit – V: IoT Applications for Value Creations

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Introduction, IoT applications for industry: Brownfield IoT, IoT for Retailing Industry, IoT for Oil and Gas Industry, Opinions on IoT Applications and Value for Industry, Home Management, eHealth.
Text Books:
1. Arshdeep Bahga and Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2015. 2. Hu, Fei. Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations, 2016, 1st edition, CRC Press, USA.
Reference Books: 1. Bahga, Arshdeep, and Vijay Madisetti, Cloud computing: A hands-on approach, 2014,2nd edition, CreateSpace Independent Publishing Platform, USA. 2. Anthony T. Velte Toby J. Velte, "Cloud Computing: A Practical Approach" MGH, 2010. 3. Rajkumar Buyya,Amir Vahid " Internet of Things Principles and Paradigms", Elsevier, 2016. 4. Neil Cameron, "Arduino Applied: Comprehensive Projects for Everyday Electronics", A Press, 2019 **Journals:** 1. Kumar, S., Tiwari, P. &Zymbler, M. Internet of Things is a revolutionary approach for future technology enhancement: a review. J Big Data 6, 111 (2019). https://doi.org/10.1186/s40537-019-0268-2 2. V. -V. Vo, D. -T. Le, S. M. Raza, M. Kim and H. Choo, "Active Neighbor Exploitation for Fast Data Aggregation in IoT Sensor Networks," in IEEE Internet of Things Journal, vol. 11, no. 8, pp. 13199-13216, 15 April15, 2024, doi: 10.1109/JIOT.2024.3354730. **Video Reference:** 1.https://www.youtube.com/playlist?list=PLEiEAq2VkUUImmTXP_YC2j5qIGOV9NPLy **MOOC/NPTEL /SWAYAM Course:** 1. Introduction To Internet of Things, By Prof. Sudip Misra, IITKharagpurhttps://onlinecourses.nptel.ac.in/noc24_cs35/preview

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EC604.1	Explain the fundamentals of an embedded system, networking, and its applications.
R19EC604.2	Apply the appropriate communication protocol based on the requirements of an IoT application.
R19EC604.3	Analyze the cloud computing models and apply them based on the applications.
R19EC604.4	Analyze the importance of privacy protection in IoT ecosystems, considering legal, ethical, and societal implications.
R19EC604.5	Develop IoT solutions that address specific challenges in various real-time applications

R19EC605	Basics of Biomedical Instrumentation	L	T	P	C
		3	0	0	3

1. Course Description:

This course provides an in-depth exploration of Medical Electronics, focusing on essential topics crucial to understanding healthcare technology. Students will delve into the principles of bio-potential signals generated by the human body and learn techniques for their recording and analysis. The design, operation, and application of transducers converting biological signals into electrical signals suitable for processing and measurement. Students will study the integration of transducers with

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

recording systems, including signal conditioning, amplification, and digitization techniques. The course explores various types of biomedical recorders used in clinical settings, emphasizing their functionalities, data storage, and retrieval mechanisms. Students will analyze safety considerations in medical electronics, focusing on equipment design, regulatory standards, and risk management.

2. Course Objectives:

1. Grasp the fundamental concepts related to bio-electric potential, including its generation and measurement techniques.
2. Gain knowledge about various types of physiological transducers, their principles of operation, and their applications in healthcare and research.
3. Learn the engineering principles behind recording systems used to capture bio-electric signals and other physical parameters.
4. Apply their understanding of basic sciences to effectively record bio-electric potentials from living organisms.
5. Recognize different shock hazards associated with electrical equipment in clinical environments and take preventive measures to ensure safety.

3. Syllabus:

Unit – I: Electro-Physiology and Bio-Potential Recording

Sources of bioelectric potential – Resting and Action potential – Propagation of action potential, Bioelectric Potentials- ECG, EEG and EMG, Electrode theory, Bio-potential electrodes and Biochemical transducers

Unit – II: Physiological Transducers

Classification of Transducers- Static and Dynamic Characteristics of Transducers – Potentiometric Transducer- LVDT- Strain Gauge Pressure Transducer, Thermistors, Photoelectric Transducer- Barrier layer cells, Photo emissive Cells, Fibre Optic Sensors –Physical Sensors - Chemical Sensors.

Unit – III: Recording System

Basic Recording System, Basic of Preamplifiers, Bio-potential Amplifier, Instrumentation amplifier, Chopper amplifier, Isolation amplifier, Direct writing galvanometric recorder, Thermal Array Recorders.

Unit – IV: Biomedical Recorders

Electrocardiograph (ECG), Phonocardiograph (PCG), Electroencephalograph (EEG), Electromyography (EMG)

Unit – V: Patient Safety Equipment

Electric shock hazards – Leakage current – Safety Codes for Electromedical Equipment – Electrical Safety Analyser – Testing of Biomedical Equipment

Text Books:

1. Khandpur. R.S., "Handbook of Biomedical Instrumentation", TATA McGraw Hill, NewDelhi,3rd Edition, 2014.
2. Leslie Cromwell, Fred J. Weibell and Erich A. Pfeiffer, "Biomedical instrumentation and measurement", 2nd Edition, Pearson Education, New Delhi, 2001

Reference Books:

1. John G.Webster, "Medical Instrumentation Application and Design", Fourth Edition, John Wiley &Sons,Singapore, 2010.
2. Joseph J. Carrand John M. Brown, "Introduction to Biomedical equipment Technology", Pearson Education, New Delhi, Fourth Edition Indian Reprint, 2004.
3. Arther C Guyton, John E. Hall, "Textbook of Medical Physiology", 12th Edition, Elsevier Publication, 2016.

Journals:

1. Mendes, P.M., Figueiredo, C.P., Fernandes, M., Gama, Ó.S. (2011). Electronics in Medicine. In: Kramme, R., Hoffmann, KP., Pozos, R.S. (eds) Springer Handbook of

Medical Technology. Springer Handbooks. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-540-74658-4_74.

Video References:

1. https://www.youtube.com/watch?v=uSKv-b0Fe_A
2. https://www.youtube.com/watch?v=iK6q4nnmtA&list=PLVsrfTSIZ_42OoOyhzWoDgZrL9iineZxQ
3. https://www.youtube.com/watch?v=FaHK9oO8ink
4. https://www.youtube.com/watch?v=QzZh243-Ac8
5. https://www.youtube.com/watch?v=Ir5Y1g55WBw

MOOC/NPTEL/ SWAYAM Course:

1. https://onlinecourses.swayam2.ac.in/nou23_bt05/preview

4. Course Outcomes

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EC605.1	Understand the concepts of bio-electric potential and bio potential measurements
R19EC605.2	Understand the working of different types of Physiological Transducers
R19EC605.3	Understand the basic engineering concept of recording system on physical parameters
R19EC605.4	Apply the knowledge of basic sciences to record bio-electric potential
R19EC605.5	Identify the different shock hazards to prevent electrical accidents in clinical environment

R19EC606	Introduction to Image Processing	L	T	P	C
		3	0	0	3

1. Course Description:

This course introduces the steps and components of image processing, how digital images are acquired, sampled, quantized and the relationship between pixels. In image enhancement and restoration both spatial and frequency domain techniques are utilized. Segmentation techniques explained with edge detection and morphological processing. This course addresses the compression techniques and standards for efficient storage. It also deals with the techniques to extract features for image representation and recognition

2. Course Objectives:

1. To introduce the Basic concepts and analytical methods of analysis of digital images.
2. To study fundamental concepts of Digital Image Processing and basic relations among pixels
3. To study different spatial and frequency domain concepts.
4. To understand restoration process of degraded image and Multi resolution processing.
5. To understand image compression and Segmentation Techniques.

3. Syllabus:

Unit – I: Image Fundamentals

Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some basic Relationships between Pixels. Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System.

Unit – II: Image Enhancement

Some Basic Gray Level Transformation, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, smoothing spatial Filters, Sharpening spatial Filters. Introduction to the Fourier Transform and the Frequency Domain, smoothing frequency-domain Filters, Sharpening Frequency-domain Filters, Homomorphic Filtering, Implementation

Unit – III: Image Restoration

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

A Model of the Image Degradation/Restoration Process, Linear, Position Invariant Degradations, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering. Wavelets and Multi resolution Processing
Unit – IV: Image Segmentation and Compression
Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation. Image Compression Models, Error-free Compression, Lossy Compression, Image Compression Standards.
Unit – V: Representation and Description
Boundary representation, Chain Code, Polygonal approximation, signature, boundary Segments, Boundary description, Shape number, Fourier Descriptor, moments, Regional Descriptors, Topological feature, Texture, Patterns and Pattern classes, Recognition based on matching.
Text Books: 1. Rafael C. Gonzales, Richard E. Woods, "Digital Image Processing", Third Edition, Pearson Education, 2010. 2. Anil Jain K. "Fundamentals of Digital Image Processing", PHI Learning Pvt. Ltd., 2011.
Reference Books: 1. Jayaraman, S., Esakkirajan, S., &Veerakumar, T. (2009). Digital image processing (Vol. 7014) New Delhi: Tata McGraw Hill Education. 2. Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", Third Edition Tata Mc Graw Hill Pvt. Ltd., 2011. 3. Willliam K Pratt, "Digital Image Processing", John Willey, 2002. **Journals:** 1. Journal of Real-Time Image Processing 2. Computer Vision, Graphics, and Image Processing 3. IET Image Processing **Video Reference:** 1. https://www.youtube.com/watch?v=CVV0TvNK6pk **MOOC/NPTEL/SWAYAM Course:** 1. https://archive.nptel.ac.in/courses/117/105/117105135/

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EC606.1	Discuss digital image fundamentals
R19EC606.2	Articulate image enhancement and restoration techniques
R19EC606.3	Examining image compression Techniques
R19EC606.4	Implementing image segmentation Techniques
R19EC606.5	Representation and recognition of images

R19EC607	Microcontroller and Embedded Systems	L	T	P	C
		3	0	0	3

1. Course Description:

This course introduces the steps and components of image processing, how digital images are acquired, sampled, quantized and the relationship between pixels. In image enhancement and restoration both spatial and frequency domain techniques are utilized. Segmentation techniques explained with edge detection and morphological processing. This course addresses the compression techniques and standards for efficient storage. It also deals with the techniques to extract features for image representation and recognition

2. Course Objectives:

1. To study about the architecture and programming of 8051 microcontroller
2. To study the design techniques of peripheral ICs with microcontroller

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

3. To study the basic functions and programming of 8051 microcontroller 4. To study about the fundamentals of embedded system design 5. To learn about embedded system architecture
3. Syllabus:
Unit – I: Introduction to Microcontroller
Introduction to 8-bit microcontroller: 8051 architecture, memory organization, special function registers – port operation – timer/counters – serial interface – interrupts – operand addressing – instruction set – programming.
Unit – II: Interfacing 8051Microcontroller
Programming 8051 Timers; Serial Port Programming; Interrupts Programming; Interfacing: LCD, Keyboard, ADC, DAC, Sensor, External Memory, Stepper Motor; Waveform generation.
Unit – III: Embedded System Architecture
Introduction to Embedded system – application areas – categories – overview – specialties – recent trends – hardware architecture – software architecture – application software – communication software – process of generating executable image – developing and testing tools.
Unit – IV: Embedded System Development
Development process – requirements engineering – design – implementation – integration and testing – Architecture of Kernel - Tasks and task scheduler – Interrupt service routines – semaphores – mailboxes – timers – memory management – priority inversion problem.
Unit – V: Embedded Hardware Platforms
RISC Vs CISC Architecture; Introduction to Arduino Uno; Switches: Tactile switch; Sensors: Temperature, LDR, PIR; LCD Display; Bluetooth Communication: BT terminal HC-05 app; Wi-Fi Communication: NodeMCU ESP8266; Introduction to Raspberry pi.
Text Books:
1. Krishna Kant, "Microprocessors and Microcontrollers: Architecture, Programming and System Design 8085, 8086, 8051, 8096", PHI, 2013. 2. Dr.K.V.K.K. Prasad, "Embedded/Real-time Systems: Concepts, Design and Programming", Dreamtech Press, 2012.
Reference Books: 1. A.K. Ray and K.M. Bhurchandi, "Advanced Microprocessor and Peripherals", MGH, 3/e, 2017 2. Mohammed Ali Mazidi, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Pearson, 2/e, 2012 3. Wayne wolf, "Computers as Components: Principles of Embedded Computing System design", 4/e, M.K. Publishers, 2013 **Journals:** 1. Journal of Real-Time Embedded Systems 2. Microprocessors and Microcontrollers Video Reference: 1. https://www.youtube.com/watch?v=CVV0TvNK6pk **MOOC/NPTEL/SWAYAM Course:** 1. https://archive.nptel.ac.in/courses/microcontrollers/

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EC607.1	Analyze the architecture of the 8051-microcontroller .

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19EC607.2	Demonstrate comprehension of the 8051-microcontroller architecture by developing an assembly program using 8051 instructions
R19EC607.3	Outline the programming model and interfacing peripheral devices with 8051 microcontroller
R19EC607.4	Applying the knowledge of tasks and task scheduling of embedded system architecture and design process
R19EC607.5	Evaluate microcontrollers-based systems using Sensor and Communication devices

R19EC608	Wireless Sensor Networks	L	T	P	C
		3	0	0	3

1. Course Description:

This course provides an in-depth exploration of Wireless Sensor Networks (WSNs), focusing on their architecture, protocols, and applications. Students will gain insights into medium access control, routing strategies, and embedded operating systems tailored for WSNs. Practical applications across various fields, including industrial and environmental monitoring, will be highlighted.

2. Course Objectives:

1. Understand the characteristics and challenges specific to wireless sensor networks.
2. Explore and analyze various medium access control protocols used in WSNs.
3. Investigate routing protocols and data gathering techniques in sensor networks.
4. Examine embedded operating systems designed for sensor nodes and their programming.
5. Identify and evaluate real-world applications of WSNs across diverse sectors.

3. Syllabus:

Unit – I: Characteristics of WSN

Characteristic requirements for WSN - Challenges for WSNs – WSN vs Adhoc Networks - Sensor node architecture – Commercially available sensor nodes –Imote, IRIS, Mica Mote, EYES nodes, BTnodes, TelosB, Sunspot -Physical layer and transceiver design considerations in WSNs, Energy usage profile, Choice of modulation scheme, Dynamic modulation scaling, Antenna considerations.

Unit – II: Medium Access Control Protocols

Fundamentals of MAC protocols - Low duty cycle protocols and wakeup concepts – Contention based protocols - Schedule-based protocols - SMAC - BMAC - Traffic-adaptive medium access protocol (TRAMA) - The IEEE 802.15.4 MAC protocol.

Unit – III: Routing and Data Gathering Protocols

Routing Challenges and Design Issues in Wireless Sensor Networks, Flooding and gossiping – Data centric Routing – SPIN – Directed Diffusion – Energy aware routing - Gradient-based routing - Rumor Routing – COUGAR – ACQUIRE – Hierarchical Routing - LEACH, PEGASIS – Location Based Routing – GF, GAF, GEAR, GPSR – Real Time routing Protocols – TEEN, APTEEN, SPEED, RAP - Data aggregation - data aggregation operations - Aggregate Queries in Sensor Networks - Aggregation Techniques – TAG, Tiny DB.

Unit – IV: Embedded Operating Systems

Operating Systems for Wireless Sensor Networks – Introduction - Operating System Design Issues - Examples of Operating Systems – TinyOS – Mate – MagnetOS – MANTIS - OSPM - EYES OS – SenOS – EMERALDS – PicOS – Introduction to Tiny OS – NesC – Interfaces and Modules- Configurations and Wiring - Generic Components -Programming in Tiny OS using NesC, Emulator TOSSIM.

Unit – V: Applications of WSN

WSN Applications - Home Control – Building Automation - Industrial Automation - Medical Applications - Reconfigurable Sensor Networks - Highway Monitoring - Military Applications - Civil and Environmental Engineering Applications - Wildfire Instrumentation - Habitat Monitoring - Nanoscopic Sensor Applications – Case Study: IEEE 802.15.4 LR-WPANs Standard - Target detection and tracking - Contour/edge detection - Field sampling

Text Books:

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

1.Kazem Sohraby, Daniel Minoli and Taieb Znati, "Wireless Sensor Networks Technology, Protocols, and Applications ", John Wiley & Sons, 2007. 2.Holger Karl and Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, Ltd, 2005.
Reference Books: 1. K. Akkaya and M. Younis, "A survey of routing protocols in wireless sensor networks", Elsevier Ad Hoc Network Journal, Vol. 3, no. 3, pp. 325--349 2. Philip Levis, " TinyOS Programming" 3. Anna Ha´c, "Wireless Sensor Network Designs", John Wiley & Sons Ltd, **Journals:** 1. Journal of Sensor and Actuator Networks 2. IEEE Transactions on Wireless Communications **Video References:** 1. https://www.youtube.com/watch?v=2b7wU0U9tW4 2. https://www.youtube.com/watch?v=xq2EDWJYyOQ **MOOC/NPTEL/SWAYAM Course:** 1. NPTEL Wireless Sensor Networks Course

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EC608.1	Analyze the fundamental characteristics and requirements of wireless sensor networks.
R19EC608.2	Design and implement medium access control protocols suitable for WSNs.
R19EC608.3	Evaluate routing strategies and data aggregation techniques for effective communication.
R19EC608.4	Develop applications using embedded operating systems and programming languages specific to WSNs.
R19EC608.5	Assess the impact and potential of WSNs in various practical applications and industries.

R19EC609	Introduction to Robotics and Automation	L	T	P	C
		3	0	0	3

1. Course Description:

This course offers a comprehensive overview of robotics, covering the history, types, and drive systems of robots. Students will explore sensing and control methods, as well as computer interfaces and maintenance practices. The curriculum emphasizes practical applications of robots in various industries and their future impact on society.

2. Course Objectives:

1. Understand the fundamental concepts and history of robotics and their evolution.
2. Explore various drive systems and end effectors used in robotic applications.
3. Analyze sensing technologies and control methods for effective robot programming.
4. Learn about robot-computer interfaces and the importance of maintenance practices.
5. Evaluate the diverse applications of robots in manufacturing and their societal implications.

3. Syllabus:

Unit – I: Robot - Introduction

Robot history - Computer programs – Microprocessors - Positive aspects of robots - Robots versus humans - Types of robots – Manipulator - Degrees of freedom – Coordinates - Moving the manipulator.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Unit – II: Drive Systems
Hydraulics, Pneumatics, Electric – End effectors – Positioning – Repeatability and accuracy – Drives, Harmonic drives – Belts – Chains.
Unit – III: Sensing and Control Methods
Sensing: Classes of sensors – Sensor: Proximity, range, tactile - Control methods: Electric power, Servo controlled, Non-servo controlled – Actuators - Controllers – Programming a robot.
Unit – IV: Computer Interface and Maintenance
Robot-computer interface – Languages - Interfacing - Interfacing robot and computer - Program control - Vision for the robot – Maintenance: Preventive maintenance - Maintenance of small electric motors - Using meters to check for problems.
Unit – V: Uses for Robots
Loading and Unloading - Materials Handling - Fabricating - Assembling - Painting - Welding - Inspecting and Testing - The Future of Flexible Automation - The Future of Robots - Social Impact of Robots.
Text Book:
1. Mark R. Miller and Rex Miller, "Robots and Robotics: Principles, Systems, and Industrial Applications", 1/e, 2017
Reference Books: 1. Mordechai Ben-Ari and Francesco Mondada, "Elements of Robotics", Springer, 2017 2. Mikell P Groover, Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, "Industrial Robotics, Technology programming and Applications", McGraw Hill, 2012. **Journals:** 1. IEEE Transactions on Robotics and Automation 2. Robotics and Autonomous Systems **Video References:** 1. https://www.youtube.com/watch?v=6A9TAX2BZ_U 2. https://www.youtube.com/watch?v=7Vg2fW7Tz1M **MOOC/NPTEL/SWAYAM Course:** 1. Introduction to Robotics: NPTEL Robotics Course

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EC609.1	Describe the historical development and types of robots used in various applications.
R19EC609.2	Analyze different drive systems and their role in robotic functionality.
R19EC609.3	Identify and apply various sensors and control methods in robot programming.
R19EC609.4	Implement effective robot-computer interfaces and understand maintenance techniques.
R19EC609.5	Assess the applications of robots in industries and their broader social impact.

R19EC610	Medical Electronics	L	T	P	C
		3	0	0	3

1. Course Description:

This course provides an in-depth exploration of Medical Electronics, focusing on essential topics crucial to understanding healthcare technology. Students will delve into the principles of bio-potential signals generated by the human body and learn techniques for their recording and analysis. The design, operation, and application of transducers converting biological signals into electrical signals suitable for processing and measurement. Students will study the integration of transducers with

Chairman - Board of Studies
Department of Electronics and Communication Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202

recording systems, including signal conditioning, amplification, and digitization techniques. The course explores various types of biomedical recorders used in clinical settings, emphasizing their functionalities, data storage, and retrieval mechanisms. Students will analyze safety considerations in medical electronics, focusing on equipment design, regulatory standards, and risk management.

2. Course Objectives:

1. Understand the concepts of bio-electric potential and bio potential measurements
2. Understand the working of different types of Physiological Transducers
3. Understand the basic engineering concept of recording system on physical parameters
4. Apply the knowledge of basic sciences to record bio-electric potential
5. Identify the different shock hazards to prevent electrical accidents in clinical environment

3. Syllabus:

Unit – I: Electro-Physiology and Bio-Potential Recording

Sources of bioelectric potential – Resting and Action potential – Propagation of action potential, Bioelectric Potentials- ECG, EEG and EMG, Electrode theory, Bio-potential electrodes and Biochemical transducers

Unit – II: Physiological Transducers

Classification of Transducers- Static and Dynamic Characteristics of Transducers – Potentiometric Transducer- LVDT- Strain Gauge Pressure Transducer, Thermistors, Photoelectric Transducer- Barrier layer cells, Photoemissive Cells, Fibre Optic Sensors –Physical Sensors - Chemical Sensors.

Unit – III: Recording System

Basic Recording System, Basic of Preamplifiers, Bio-potential Amplifier, Instrumentation amplifier, Chopper amplifier, Isolation amplifier, Direct writing galvanometric recorder, Thermal Array Recorders.

Unit – IV: Biomedical Recorders

Electrocardiograph (ECG), Phonocardiograph (PCG), Electroencephalograph (EEG), Electromyography (EMG)

Unit – V: Patient Safety Equipment

Electric shock hazards – Leakage current – Safety Codes for Electromedical Equipment – Electrical Safety Analyser – Testing of Biomedical Equipment

Text Books:

1. Khandpur. R.S., "Handbook of Biomedical Instrumentation", TATA McGraw Hill, New Delhi,3rd Edition, 2014.
2. Leslie Cromwell, Fred J. Weibell and Erich A. Pfeiffer, "Biomedical instrumentation and measurement", 2nd Edition, Pearson Education, New Delhi, 2001

Reference Books:

1. John G.Webster, "Medical Instrumentation Application and Design", Fourth Edition, John Wiley &Sons,Singapore, 2010.
2. Joseph J. Carrand John M. Brown, "Introduction to Biomedical Equipment Technology", Pearson Education, New Delhi, Fourth Edition Indian Reprint, 2004.
3. Arther C Guyton, John E. Hall, "Textbook of Medical Physiology", 12th Edition, Elsevier Publication, 2016.

Journal:

1. Mendes, P.M., Figueiredo, C.P., Fernandes, M., Gama, Ó.S. (2011). Electronics in Medicine. In: Kramme, R., Hoffmann, KP., Pozos, R.S. (eds) Springer Handbook of Medical Technology. Springer Handbooks. Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-540-74658-4_74.

Video References:

1. https://www.youtube.com/watch?v=uSKv-b0Fe_A

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

2. https://www.youtube.com/watch?v=iK6q4nnmtA&list=PLVsrfTSlZ_42OoOyhzWoDgZrL9iineZxQ
3. https://www.youtube.com/watch?v=FaHK9oO8ink
4. https://www.youtube.com/watch?v=QzZh243-Ac8
5. https://www.youtube.com/watch?v=Ir5Y1g55WBw

MOOC/NPTEL/UDEMY Course:

1. https://onlinecourses.swayam2.ac.in/nou23_bt05/preview

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19EC610.1	Understand the concepts of bio-electric potential and bio potential measurements
R19EC610.2	Understand the working of different types of Physiological Transducers
R19EC610.3	Understand the basic engineering concept of recording system on physical parameters
R19EC610.4	Apply the knowledge of basic sciences to record bio-electric potential
R19EC610.5	Identify the different shock hazards to prevent electrical accidents in clinical environment

R19IT601	Introduction to Software Engineering	L	T	P	C
		3	0	0	3

1. Course Description:

This course is designed to equip students with essential skills in software engineering, focusing on applying the right development models for various scenarios. Students will learn to effectively gather, analyze, and document project requirements through requirement engineering techniques. The course emphasizes evaluating and selecting suitable design models tailored to specific application needs. Additionally, students will apply testing principles to ensure the quality of software projects and utilize estimation techniques to manage resources, timelines, and costs for successful project management.

2. Course Objectives:

1. To select and apply appropriate software development models for specific scenarios
2. To gain skills in gathering, analysing, and documenting project requirements effectively.
3. To develop the ability to compare and choose suitable design models for various applications.
4. To apply software testing techniques to ensure project quality during development.
5. To apply estimation techniques to manage resources and project timelines effectively.

3. Syllabus:

Unit – I: Software Product and Process

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models – System Engineering – Computer Based System – Business Process Engineering Overview – Product Engineering Overview.

Unit – II: Requirements Analysis

Software Requirements: Functional and Non-Functional, User requirements, System requirements – Software Requirements Document - IEEE Standards for SRS – Requirement Engineering Process: Feasibility Studies, Requirements elicitation – Requirements analysis

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

modeling techniques – requirements validation.
Unit – III: Software Design
Design process: Design Concepts, Quality-Design Model, Heuristics - Architectural Design: Architectural styles-Architectural Mapping using Data Flow - Performing User interface design: Interface analysis and design models-Component level Design.
Unit – IV: Testing and Maintenance
Software testing fundamentals – Testing Strategies: White box testing – control structure testing, black box testing – Unit Testing, Integration Testing, Acceptance Testing –Regression Testing, Validation Testing, System Testing and Debugging – Software Implementation Techniques: Coding practices – Refactoring – Reverse and Forward Engineering.
Unit – V: Project Management
Software Project Management: Estimation – LOC, FP Based Estimation, Make/Buy Decision COCOMO Model – Project Scheduling – Scheduling, Earned Value Analysis Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection - Risk Management-Risk Identification-RMMMPlan-CASE TOOLS
Text Books:
1. R.S. Pressman, "Software Engineering – A Practitioner's Approach", Eighth Edition, McGraw HillInternational Edition, 2015. 2. Ian Sommerville — "Software Engineering", 10th Edition, Pearson Education, 2016.
References:
1. Ronald J. Leach, "Introduction to Software Engineering", CRC Press, 2016. 2. Rod Stephens "Beginning Software Engineering", John Wiley & Sons, 2015.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19IT601.1	Apply appropriate software engineering model for a given development scenario.
R19IT601.2	Apply appropriate requirement engineering techniques for realtime projects.
R19IT601.3	Compare and choose the suitable design models for the givenapplication scenario.
R19IT601.4	Apply the testing principles to software project development.
R19IT601.5	Apply the estimation techniques for software projectmanagement.

R19IT602	Web Programming	L	T	P	C
		3	0	0	3
1. Course Description:					
This course focuses on equipping students with practical skills in modern web development. Students will understand and apply object-oriented programming concepts using Java, along with mastering client-side programming for creating dynamic user interfaces. The course also covers server-side programming techniques, enabling students to build robust backend systems.					

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Additionally, learners will explore PHP frameworks and the MVC architecture to structure projects efficiently. Finally, students will utilize relevant web frameworks and web services to build, deploy, and manage scalable and interactive web applications.
2. Course Objectives:
1. To implement object-oriented programming principles and Java semantics in real-world applications. 2. To Master the use of client-side technologies such as HTML, CSS, and JavaScript for interactive web development. 3. To develop skills to implement server-side functionality using technologies like Java, Node.js, or PHP for dynamic web applications. 4. To build web applications using PHP frameworks and apply the MVC architecture for organized project development. 5. To apply web frameworks and integrate web services to build, deploy, and manage scalable web applications.
3. Syllabus:
Unit – I: Web Fundamentals
Web Essentials: Clients, Servers and Communication – The Internet – Basic Internet protocols – World wide web – HTTP Request Message – HTTP Response Message – Web Clients – Web Servers – HTML5 – Tables – Lists – Image – HTML5 control elements – Semantic elements – Drag and Drop – Audio –Video controls - CSS3 – Inline, embedded and external style sheets – Rule cascading – Inheritance – Backgrounds – Border Images – Colors – Shadows – Text – Transformations – Transitions – Animations
Unit – II: Client Side Scripting Language
Java Script: An introduction to JavaScript–JavaScript DOM Model-Date and Objects,- Regular Expressions- Exception Handling-Validation-Built-in objects-Event Handling DHTML with JavaScript
Unit – III: Server Side Programming
Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions Session Handling- Understanding Cookies- Installing and Configuring Apache Tomcat Web Server- Database Connectivity: JDBC perspectives, JDBC program example - JSP: Understanding Java Server Pages- JSP Standard Tag Library (JSTL)-Creating HTML forms by embedding JSP code.
Unit – IV: PHP and XML
Functions: Built-in Functions, User defined functions – Function Prototypes –Recursion – Command Line Argument -Arrays and Functions – Strings and Functions. Pointers: Declaration – Pointer operators – Pointer arithmetic -Passing Pointers to a Function – Pointers and one-dimensional arrays – Dynamic Memory Allocation
Unit – V: Introduction to Ajax and Web Services
AJAX: Ajax Client Server Architecture-XML Http Request Object-Call Back Methods; Web Services: Introduction- Java web services Basics – Creating, Publishing, Testing and Describing a Web services (WSDL)-Consuming a web service, Database Driven web service from an application –SOAP.
Text Books:

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

1. Deitel and Deitel and Nieto, —Internet and World Wide Web - How to Program, Prentice Hall, 5th Edition, 2011.
References:
1. Stephen Wynkoop and John Burke —Running a Perfect Website‖, QUE, 2nd Edition,1999. 2. Chris Bates, Web Programming – Building Intranet Applications, 3rd Edition, Wiley Publications, 2009 3. Jeffrey C and Jackson, —Web Technologies A Computer Science Perspective‖, Pearson Education, 2011. 4. Gopalan N.P. and Akilandeswari J., —Web Technology‖, Prentice Hall of India, 2011. 5. UttamK.Roy, —Web Technologies‖, Oxford University Press, 2011.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19IT602.1	Understand and apply the features of object-oriented programming paradigm and Java Semantics
R19IT602.2	Understand and apply the concepts of Client-side programming
R19IT602.3	Understand and apply the concepts of Server-Side Programming
R19IT602.4	Understand and apply the features of PHP frameworks and project development using MVC Architecture
R19IT602.5	Use relevant Web Frameworks along with web services for application building and deployment

R19IT603	Basic of Software Testing	L	T	P	C
		3	0	0	3

1. Course Description:

This course focuses on equipping students with the knowledge and skills to design and execute effective software testing strategies across various domains. Students will learn to define appropriate test cases and understand fundamental concepts in software testing, including strategies and methods tailored to specific development scenarios. The course covers selecting suitable tests for different applications, designing detailed test cases, and preparing comprehensive test plans. Additionally, students will gain hands-on experience with automated testing tools to enhance efficiency and accuracy in the software testing process.

2. Course Objectives:

1. To identify and define suitable test cases for various software development domains.
2. To gain knowledge of fundamental testing concepts, strategies, and methods for different software domains.
3. To develop the ability to select the most appropriate tests to ensure software quality in different scenarios.
4. To learn to design effective test cases and prepare comprehensive test plan documents for software projects.
5. To understand and apply automated testing tools to streamline the software testing process.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

3. Syllabus:
Unit – I: Fundamentals of Testing
Testing as an Engineering Activity – Testing as a Process – Basic definitions – Software Testing Principles – The Tester's Role in a Software Development Organization – Origins of Defects – Cost of defects – Defect Classes – The Defect Repository and Test Design – Defect Examples – Developer/Tester Support of Developing a Defect Repository.
Unit – II: Test Case Design Strategies
Test case Design Strategies – Using Black Box Approach to Test Case Design – Random Testing – Requirements based testing – Boundary Value Analysis – Equivalence Class Partitioning – State-based testing – Cause-effect graphing – Compatibility testing – user documentation testing – domain testing – Using White Box Approach to Test design – static testing vs. structural testing – code functional testing – Coverage and Control Flow Graphs – Covering Code Logic – Paths – code complexity testing – Evaluating Test Adequacy Criteria
Unit – III: Levels of Testing
The need for Levers of Testing – Unit Test – Unit Test Planning – Designing the Unit Tests – The Test Harness – Running the Unit tests and Recording results – Integration tests – Designing Integration Tests –System Testing – Acceptance testing – Performance testing – Regression Testing – Internationalization testing – Ad-hoc testing – Alpha, Beta Tests – Usability and Accessibility testing – Configuration testing – Compatibility testing – Website testing.
Unit – IV: Test Management
People and organizational issues in testing – Organization structures for testing teams – testing services – Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items – test management – test process – Reporting Test Results – The role of three groups in Test Planning and Policy Development – Introducing the test specialist – Skills needed by a test specialist – Building a Testing Group.
Unit – V: Test Automation
Software test automation – skill needed for automation – scope of automation – design and architecture for automation – requirements for a test tool – challenges in automation – Test metrics and measurements – project, progress and productivity metrics.
Text Books:
1. Paul C. Jorgensen, "Software Testing: A Craftsman's Approach", Fourth Edition, CRC Press, 2013. 2. Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing – Principles and Practices", Pearson Education, 2006. 3. Ilene Burnstein, "Practical Software Testing", Springer International Edition, 2003.
References:
1. Ali Mili, Fairouz Chier, "Software Testing: Concepts and Operations", Wiley, 2015. 2. Dorothy Graham, Mark Fewster, "Experiences of Test Automation: Case Studies of Software TestAutomation", Pearson Education, 2012. 3. Aditya P. Mathur, "Foundations of Software Testing _ Fundamental Algorithms and Techniques", Dorling Kindersley (India) Pvt. Ltd., Pearson Education, 2008.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

CO. No.	Course Outcome
R19IT603.1	Define the test cases which are suitable for a software development for different domain
R19IT603.2	Explain fundamental concepts in software testing, strategies and methods for a software development for different domains.
R19IT603.3	Determine the suitable tests to be carried out.
R19IT603.4	Design test cases and prepare a test plan document.
R19IT603.5	Describe the usage of the automatic testing tools.

R19IT604	Introduction to Blockchain Technology	L	T	P	C
		3	0	0	3

1. Course Description:

This course provides a comprehensive understanding of blockchain technology, equipping students with the ability to describe its foundational concepts and emerging models. Students will explore the process of cryptocurrency issuance, proof-of-work, and alternative consensus mechanisms, while also gaining familiarity with the operational aspects of the cryptocurrency ecosystem. The course emphasizes practical implementation, enabling students to integrate blockchain technology in various domains, applying it to real-world scenarios and multiple perspectives.

2. Course Objectives:

1. To describe the foundational concepts and explain the workings of blockchain technology.
2. To explore and comprehend emerging abstract models in blockchain technology.
3. To gain insight into cryptocurrency issuance, proof-of-work, and alternative consensus mechanisms.
4. To understand the functional and operational aspects of the cryptocurrency ecosystem.
5. To apply and implement blockchain technology across various domains and perspectives.

3. Syllabus:

Unit – I: Basics of Blockchain

Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof.

Unit – II: Blockchain

Introduction, Advantage over conventional distributed database, Blockchain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Blockchain application, Soft & Hard Fork, Private and Public blockchain.

Unit – III: Distributed Consensus

Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate.

Unit – IV: Cryptocurrency

Chairman – Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin
Unit – V: Cryptocurrency Regulation
Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy. **Applications:** Internet of Things, Medical Record Management System, Domain Name Service and future of Blockchain.
Text Books:
1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016). 2. Imran Bashir, "Mastering Blockchain - Distributed ledgers, decentralization and smart contracts explained", Packt Publishing Ltd., Second Edition, 2017.
References:
1. Andreas M. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies, O'Reilly Media, Inc., December 2014 2. Bikramaditya Singhal, Gautama, Panda, "Beginning Blockchain: A Beginner's Guide to Building Blockchain Solutions", Apress. 3. DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger", Yellow paper 2014.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19IT604.1	Describe and explain blockchain technology
R19IT604.2	Understand emerging abstract models for Blockchain Technology.
R19IT604.3	Understand the process of Cryptocurrencies issuance, proof-of-work and alternative consensus mechanisms and transaction
R19IT604.4	Familiarize the functional /operational aspects of Cryptocurrency ecosystem
R19IT604.5	Integrate ideas from various domains and implement them using block chain technology in different perspectives.

R19IT605	Soft Computing Technologies	L	T	P	C
		3	0	0	3

1. Course Description:

This course provides a deep dive into the fundamentals of artificial intelligence, beginning with an understanding of human intelligence and its connection to AI. Students will explore the basics of fuzzy logic and neural networks, delving into concepts like fuzzy sets and heuristic approaches inspired by human reasoning. The course also examines genetic algorithms and random search procedures, emphasizing their role in self-learning and optimization tasks. In addition, students will gain exposure to current research problems and methods in soft computing, fostering an understanding of cutting-edge developments in this field.

2. Course Objectives:

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

1. To learn the fundamental concepts of human intelligence and how they relate to artificial intelligence.
2. To gain a foundational understanding of fuzzy logic and neural networks.
3. To explore the concepts of fuzzy sets, fuzzy logic, and the use of heuristics derived from human experience.
4. To investigate the use of genetic algorithms and random search methods for finding global optima in self-learning scenarios.
5. To develop familiarity with current research challenges and methods in soft computing techniques.

3. Syllabus:

Unit – I: Introduction to Soft Computing

Introduction of soft computing, soft computing vs. hard computing, various types of soft computingtechniques, Fuzzy Computing, Neural Computing, Genetic Algorithms, Associative Memory, Adaptive Resonance Theory, Classification, Clustering, Bayesian Networks

Unit – II: Artificial Neural Networks

Neural Network: Biological and Artificial Neuron, Neural Networks, Supervised and Unsupervised Learning. Single Layer Perceptron - Multilayer Perceptron – Back propagation Learning.

Unit – III: Fuzzy Systems

Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets – Classical Relations and Fuzzy Relations - Membership Functions -Defuzzification – Fuzzy Arithmetic and Fuzzy Measures - Fuzzy Rule Base and Approximate Reasoning

Unit – IV: Genetic Algorithms

Basic Concepts- Working Principles -Encoding- Fitness Function – Reproduction -Inheritance Operators – Cross Over – Inversion and Deletion -Mutation Operator

Unit – V: Hybrid Systems

Hybrid Systems -Neural Networks, Fuzzy Logic and Genetic -GA Based Weight Determination – LR- Type Fuzzy Numbers – Fuzzy Neuron – Fuzzy BP Architecture – Learning in Fuzzy BP

Text Books:

1. Herbert Schildt, "C – The Complete Reference", Tata McGraw Hill Publishing Company, New Delhi, 2017.
2. N.P.Padhy, S.P.Simon, "Soft Computing with MATLAB Programming", Oxford University Press, 2015
3. J.S.R.Jang, C.T.Sun and E.Mizutani, "Neuro-Fuzzy and Soft Computing", PHI, 2004, Pearson Education 2004

References:

1. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, —Neuro-Fuzzy and Soft Computing, Prentice-Hall of India, 2002.
2. KwangH.Lee, —First course on Fuzzy Theory and Applications, Springer, 2005.
3. George J. Klir and Bo Yuan, —Fuzzy Sets and Fuzzy Logic-Theory and Applications, Prentice Hall,1996.
4. S.N.Sivanandam , S.N.Deepa, "Principles of Soft Computing", Wiley India Pvt. Ltd., 2nd Edition, 2011.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19IT605.1	Understand human intelligence and AI
R19IT605.2	Generalize basics of Fuzzy logic and neural networks
R19IT605.3	Discuss the ideas of fuzzy sets, fuzzy logic and use of heuristics based on human experience
R19IT605.4	Examine with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations
R19IT605.5	Experiment some familiarity with current research problems and research methods in Soft Computing Techniques.

R19IT606	Fundamentals of IT Infrastructure Management	L	T	P	C
		3	0	0	3

1. Course Description:

This course provides a comprehensive understanding of IT infrastructure design, starting with the basics of ITIL and its role in improving IT services. Students will explore various IT infrastructure management operations and learn to distinguish their key components. The course also covers strategic methods for managing storage in IT environments and introduces the essentials of security management in Information Technology. Additionally, students will stay up to date with the latest global trends in IT, gaining insight into current innovations and how they impact the industry worldwide.

2. Course Objectives:

1. To learn the fundamental principles of IT infrastructure design and the ITIL framework.
2. To develop the ability to differentiate between different IT infrastructure management operations.
3. To gain knowledge of strategic methods for managing storage in IT systems.
4. To learn the principles and practices of security management in Information Technology.
5. To gain detailed knowledge of recent trends and innovations in IT on a global scale.

3. Syllabus:

Unit – I: IT Infrastructure: Overview

Introduction - Challenges in IT Infrastructure Management, Design Issues - Determining Customer's Requirements, IT Systems and Service Management Process, IT Infrastructure Library.

Unit – II: IT Infrastructure Management

Service Delivery Process: Service Level Agreements, Financial Management, IT Service Continuity Management, Capacity Management, Availability Management.

Unit – III: Storage Management

Introduction, Backup and Storage, Archive and Retrieve, Disaster Recovery, Space Management, Database and Application Protection, BMR, and Data Retention.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Unit – IV: Security Management
Security Management: Introduction, Computer Security, Internet Security, Physical Security, Identity Management, Access Control, Intrusion Detection.
Unit – V: Emerging Trends in IT
E-Commerce, Electronic Data Interchange, Global System for Mobile Communication (GSM), Bluetooth, Infrared Technology.
Text Books:
1. Phalguni Gupta, "IT Infrastructure and Its Management", Tata McGraw Hill Publishing Company, New Delhi, 2010. 2. Rich Schiesser, "IT Systems Management: Designing, Implementing, and Managing World-Class Infrastructures", Pearson, 2001.
References:
1. S.C.Mourya," IT Infrastructure and Its Management- A conceptual Approach", Technical Publications, 2014. 2. Anita Sengar "IT Infrastructure Management", S K Kataria publications, 2012. 3. Mani Subrahmanian, "Network Management, Principles and Practice", Pearson Education,2010.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19IT606.1	Understand the basics of IT infrastructure design and ITIL.
R19IT606.2	Distinguish between various IT Infrastructure Management Operations.
R19IT606.3	Understand the strategic methods of storage management in Information Technology.
R19IT606.4	Able to know the Security Management in Information Technology.
R19IT606.5	Able to Know about the Detailed Knowledge of IT Recent Trends in Globally.

R19IT607	Mobile Application Development	L	T	P	C
		3	0	0	3

1. Course Description:

This course focuses on the intricacies of mobile application design and development, starting with an exploration of the challenges developers face in creating user-friendly and efficient applications. Students will learn to apply practical knowledge to design mobile applications that meet specific requirements, and they will implement these designs using the Android SDK. The course covers the development of applications utilizing various components of the Android framework, equipping students with the skills to build robust mobile solutions. Additionally, learners will gain hands-on experience in integrating file handling and database management into their Android applications, ensuring they can create fully functional and data-driven mobile experiences.

2. Course Objectives:

1. To understand and articulate the common challenges faced in the design and development of mobile applications.
2. To utilize practical knowledge to create designs for mobile applications tailored to specific user needs.
3. To learn to implement mobile application designs using the Android Software Development Kit (SDK).
4. To gain experience in developing mobile applications utilizing various components of the Android framework.
5. To develop Android applications that effectively integrate file handling and database management functionalities.

3. Syllabus:

Unit – I: Fundamentals of Android

Introduction to Android, Android versions and its feature,Android Development Environment - System Requirements, Android SDK, Installing Java, and ADT bundle - Eclipse Integrated Development Environment (IDE), Creating Android Virtual Devices (AVDs)- Market and business drivers for mobile applications – Requirements gathering and validation for mobile applications.

Unit – II: Design Aspects

Introduction – Basics of embedded systems design – Embedded OS - Design constraints for mobile applications, both hardware and software related – Architecting mobile applications – Android Libraries, Application Framework, Creating a New Android Project , Defining the Project Name and SDK Settings, Project Configuration Settings, Configuring the Launcher Icon, Creating an Activity, Running the Application in the AVD, Stopping a Running Application, Modifying the Example Application,
Reviewing the Layout and Resource Files

Unit – III: Android Development Platform

Understanding Java SE and Virtual Machine, The Directory Structure of an Android Project, CommonDefault Resources Folders, The Values Folder, Leveraging Android XML, Screen Sizes , Launching Your Application: The AndroidManifest.xml File,Creating Your First Android Application

Unit – IV: Android Framework Overview

Android Application Components, Android Activities: Defining the UI, Android Services: Processing inthe Background, Broadcast Receivers: Announcements and Notifications Content Providers: Data Management, Android Intent Objects: Messaging for Components, Android Manifest XML: Declaring Your Components, Views and View Groups, Android Layout Managers, The View Hierarchy, Designing an Android User Interface using the Graphical Layout Tool

Unit – V: Files, Content Providers, and Databases

Saving and Loading Files, SQLite Databases, Android Database Design, Exposing Access to a Data Source through a Content Provider, Content Provider Registration, Native Content Providers, Packaging and deployment – Interaction with server side applications – Using Google Maps, GPS and Wifi – Integration with social media applications

Text Books:

1. Code Complete: A Practical Handbook of Software Construction, 2016, 2nd Edition by Steve McConnell.

Chairman - Board of Studies
Dept. of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

2. Mobile Apps Made Simple: The Ultimate Guide to Quickly Creating, Designing and Utilizing MobileApps for Your Business, 2016,2nd Edition by Jonathan McCallister 3. Android Application Development Cookbook- 2016, Second Edition by Rick Boyer and Kyle Mew
References:
1. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development", Wrox, 2012 2. Charlie Collins, Michael Galpin and Matthias Kappler, "Android in Practice", DreamTech, 2012 3. James Dovey and Ash Furrow, "Beginning Objective C", Apress, 2012. 4. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, "Beginning iOS 6 Development: Exploring the iOS SDK", Apress, 2013.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19IT607.1	Describe the challenges in mobile application design and development
R19IT607.2	Use Practical Knowledge of the design for mobile applications for specific requirements
R19IT607.3	Implement the design using Android SDK
R19IT607.4	Develop applications using components of android framework
R19IT607.5	Develop android applications including files and databases

R19IT651	Basics of Cloud Technology	L	T	P	C
		2	0	2	3

1. Course Description:

Delve into Cloud Computing fundamentals, virtualization, and deployment models, alongside software security objectives, design principles, and development practices. Assess risks, challenges, and threats to infrastructure, data, and access control, while addressing security architecture issues, identity management, and autonomic security for comprehensive cloud protection and management

2. Course Objectives:

To make students familiar with:

1. Fundamentals of Cloud Computing
2. The Concepts of Virtualization and the Cloud delivery and Deployment Models
3. Cloud computing software security objectives, design principles and development practices
4. Cloud computing risks, challenges and threats to infrastructure, data and access control
5. Cloud computing security architectural issues, Identity management and Autonomic security

3. Syllabus:

Unit – I: Cloud Computing fundamentals

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu. Coimbatore - 641202.

Essential characteristics, Architectural Influences, Technological Influences, and Operational Influences.
Unit – II: Cloud Computing Architecture
Cloud Delivery models, The SPI Framework, Cloud Software as a Service (SaaS) , Cloud Platform as a Service(PaaS), Cloud Infrastructure as a Service(IaaS), Cloud deployment models, Public Clouds, Community Clouds, Hybrid Clouds, Alternative Deployment models, Expected benefits.
Unit – III: Cloud Computing Software Security fundamentals
Cloud Information Security Objectives, Confidentiality, Integrity, Availability, Cloud Security Services, Relevant Cloud Security Design Principles, Secure Cloud Software Requirements, Secure Development practices, Approaches to Cloud Software Requirement Engineering, Cloud Security Policy Implementation.
Unit – IV: Cloud Computing Risk Issues & challenges
Cloud Computing Risk Issues: The CIA Traid, Privacy and Compliance Risks, Threats to Infrastructure, Data and Access Control, Cloud Access Control Issues, Cloud Service Provider Risks.
Unit – V: Cloud Computing Security Architecture
Architectural Considerations, General Issues, Trusted Cloud Computing, Secure Execution environments and Communications, Micro architectures, Identity Management and Access Control, Autonomic Security
List of Experiments:
1. Install Virtual box and create a windows/linux virtual image and analyze the virtual configuration 2. Register with Amazon AWS and create a windows/linux instance and connect with RDP and create S3 buckets. 3. A case study on Amazon Elastic Cloud Services 4. A case study on Azure 5. Installation and Configuration of Just cloud.
Text Books:
1. Ronald L. Krutz, Russell Dean Vines, "Cloud Security A Comprehensive Guide to secure Cloud Computing" Wiley.
References:
1. John W. itinghouse james F. Ransome, "Cloud Computing Implementation, Management and Security", CRC Press 2. Borko Furht. Armando Escalante, "Handbook of Cloud Computing", Springer 3. Charles Badcock, "Cloud Revolution" , TMH

4. Course Outcomes:

After successful completion of the course, the student should be able to:

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

CO. No.	Course Outcome
R19IT651.1	Articulate the main concepts, key technologies, strengths, limitations of cloud computing and the possible applications for state-of-the-art cloud computing.
R19IT651.2	Identify the architecture and infrastructure of cloud computing, including cloud delivery and deployment models.
R19IT651.3	Analyze the core issues of cloud computing such as security, privacy, and interoperability
R19IT651.4	Identify problems and analyze the various cloud computing solutions.
R19IT651.5	Analyze appropriate cloud computing solutions and recommendations according to the applications used.

R19IT652	Introduction to Computer Networks	L	T	P	C
		2	0	2	3

1. Course Description:

This course provides a comprehensive understanding of computer networks, beginning with the division of network functionalities into layers and the role of transmission media. Students will study data link layer protocols and be introduced to IEEE standards that define how networks operate. The course also covers the tracing of data flow between nodes in a network, providing insights into how information is transmitted efficiently. Learners will gain a solid understanding of different routing protocols used to manage data traffic across networks. Additionally, students will familiarize themselves with various network applications and their functionalities, preparing them for practical applications in the field of networking.

2. Course Objectives:

1. To learn the concept of dividing network functionalities into layers and understand the role of transmission media.
2. To study various data link layer protocols and get introduced to IEEE networking standards.
3. To understand how data flows from one node to another in a network.
4. To gain knowledge of various routing protocols used for directing data in networks.
5. To explore common network applications and understand their functionalities in network environments.

3. Syllabus:

Unit – I: Networking Fundamentals

Computer Networks Applications-Network Types: PAN, LAN, MAN and WAN Network-Internet-Reference Models: OSI Reference Model-TCP/IP Reference Model-Comparison of OSI and TCP/IP-Critique of Reference Models.

Unit – II: Datalink Layer

Framing; Error control including Bit-parity, CRC and Hamming Codes; Reliable transmission and Automatic Repeat Request (ARQ) protocols including Stop-and-Wait, Go-back-N, Selective Repeat. Performance analysis of ARQ protocols. Example protocols such as HDLC and PPP.

Unit – III: Transport Layer

Elements of Transport Layer Protocols, The Internet Transport Protocols: Details of TCP header and operation, Performance problems in Computer Networks, UDP Header.

Unit – IV: Network Layer

Network Design issues, Routing protocols including distance-vector and link-state approaches Routing Algorithms including Dijkstra's algorithm and distributed Bellman-Ford algorithm; Example protocols: OSPF, RIP, BGP. Approaches to Congestion Control, Packet scheduling, Ipv4 and Ipv6 addressing and headers. Gateway protocol concepts.

Unit – V: Application Layer

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

DNS–The Domain Name System, Electronic mail, The World wide web: Architectural overview, FTP, HTTP and Mobile web.

List of Experiments:

1. Setting up LAN connections using Ethernet cables, configure IP addresses and subnet masks manually and using DHCP.
2. Installing and configuring a simple HTTP server (e.g., Apache, Nginx), Creating and hosting a basic website, and accessing the website from different computers within the network.
3. Setting up an FTP server, Uploading and downloading files using FTP clients & explore FTP commands and permissions.
4. Configuring a DNS server (e.g., BIND) for domain name resolution, Creating and managing DNS records (A, CNAME, MX records), Testing name resolution using nslookup and dig commands.
5. Configuring a firewall (e.g., iptables) to allow/block specific traffic, implementing access control lists (ACLs) to restrict network access, Testing firewall rules and monitoring network traffic.
6. Setting up a wireless access point (WAP) and configuring SSIDs and security settings, connecting devices to the wireless network and test connectivity & Analyze wireless network performance and signal strength.
7. Using network monitoring tools (e.g., Wireshark) to capture and analyze network packets, identify network protocols, traffic patterns, and anomalies, troubleshoot network issues based on packet analysis.
8. Designing and simulate network topology with routers, switches, PCs using network simulation software (e.g., Cisco Packet Tracer, GNS3) & Configuring routers with RIP to connect different network.
9. Simulate OSPF protocol in Packet Tracer / GNS3 to optimize network selection among routers.
10. Test network behavior after configuring exterior protocol EIGRP.

Text Books:

1. JamesF. Kurose, KeithW. Ross, "Computer Networking: A Top-Down Approach", Seventh Edition, Pearson Education, 2017.
2. S.Tanenbaum,David J,Wetherall, "Computer Networks Andrew S". Pearson Education India 5th Edition, 2013

References:

1 LarryL.Peterson,BruceS.Davie,"ComputerNetworks:ASystemsApproach",FifthEdition,Morgan Kaufmann Publishers, 2011.

2 BehrouzA.Forouzan,"DatacommunicationandNetworking",FourthEdition,TataMcGraw –Hill, 2011

4. Course Outcomes:

CO. No.	Course Outcome
R19IT652.1	Understanding of networking concepts, including protocols, topologies, addressing schemes, and OSI/TCP/IP models.
R19IT652.2	Articulate the functions and operations of data link layer protocols such as HDLC, PPP, Ethernet, and IEEE 802.11.
R19IT652.3	Describe and differentiate between various transport layer protocols such as TCP (Transmission Control Protocol) and UDP (User Datagram Protocol)
R19IT652.4	Comprehend the role and functions of the network layer in the OSI and TCP/IP models, including routing, addressing, and packet forwarding.
R19IT652.5	Describe and differentiate between various application layer protocols such as HTTP, FTP, SMTP, DNS, and their functionalities.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19IT653	Game Programming Fundamentals	L	T	P	C
		2	0	2	3

1. Course Description:

This course helps the students to gain foundational knowledge in the video game development process. In this course, The students can able to learn about the Game Design, Game play Development, Understand the inner workings of an engaging game such as game play mechanics, artificial intelligence, and user experience, Game Assets.

2. Course Objectives:

1. To learn Game Essentials, Types of Games, Stages of Design process
2. To understand requirements of designing a game
3. To learn how a concept turns into a game, and game world
4. To create a expressive play, characters in the game
5. To learn general principles of level design and design issues of online gaming

3. Syllabus:

Unit – I:Design and Development of Games

Games and Video Games: Game, Conventional Games Versus Video Games, Games for Entertainment, Serious Games; **Designing and Developing Games:** An Approach to the Task, Key Components of Video Games, The Structure of a Video Game, Stages of the Design Process, Game Design Team Roles, Game Design Documents, The Anatomy of a Game Designer.

Unit – II: Understanding the Game Genres

The Major Genres: Genre, The Classic Game Genres; **Understanding Your Player**: VandenBerghe's Five Domains of Play, Demographic Categories, Gamer Dedication, The Dangers of Binary Thinking**; Understanding Your Machine:** Home Game Consoles, Personal Computers, Portable Devices Other Devices.

Unit – III: GAME World

Game Concepts: Getting an Idea, From Idea to Game; **Concept Game Worlds**: Game World, The Purposes of a Game World, The Dimensions of a Game World, Realism

Unit – IV: Characteristics of GAME & Story Telling

Creative and Expressive Play: Self-Defining Play, Creative Play, Other Forms of Expression, Game Modifications; **Character Development:** The Goals of Character Design, The Relationship Between Player and Avatar, Visual Appearances, Character Depth, Audio Design; **Storytelling:** Put Stories in Games, Key Concepts, The Storytelling Engine, Linear Stories, Nonlinear Stories, Granularity, Mechanisms for Advancing the Plot, Emotional Limits of Interactive Stories, Scripted Conversations and Dialogue Trees, When to Write the Story, Other Considerations

Unit – V:Creating the User Experience

General Principles of Level Design: Level Design, Key Design Principles, Layouts, Expanding on the Principles of Level Design, The Level Design Process, Pitfalls of Level Design; **Design Issues for Online Gaming**: Online Games, Advantages of Online Games, Disadvantages of Online Games, Design Issues, Technical Security, Persistent Worlds, Social Problems

Text Books:

1. Ernest Adams," Fundamentals of Game Design", Third Edition, by, New Riders, 2022,ISBN: 9780133435726

References:

1. Tynan Sylvester, "Designing Games: A Guide to Engineering Experiences", OREILLY Publication, 2013.
2. Briar Lee Mitchell, "Game Design Essentials", Sybex Publications, 2013.

List of Experiments:

1. OpenGL. OpenGL graphics library: basic concepts and usage
2. Data types and multi-platform issues.
3. 3D graphics. 3D objects and conventions. Coordinate systems and transformations. Coding / drawing. Drawing and managing 3D objects.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

4. Input and sounds. Handling buttons and other input devices. The XBox 360 controller. Multi-channel sound. Managing game sounds 5. Simple game physics. Moving objects. Concepts in collision detection 6. Cameras and images. Cameras: Othographic, bitmap and perspective views. Loading, drawing and managing images. 7. Texture mapping. Basic concepts of texture application. UV coordinates, texels and rendering operations 8. Mini Project

5. Course Outcomes:

CO. No.	Course Outcome
R19IT653.1	Examine the Game Essentials, Types of Games, Stages of Design process
R19IT653.2	Identify the requirements of designing a game
R19IT653.3	Create a expressive play and characters in the game
R19IT653.4	Experiment with the various components of storytelling
R19IT653.5	Apply the general principles of level design and design issues of online gaming

R19ME601	Product Design and Innovation	L	T	P	C
		3	0	0	3

1.Course Description:

This course explores the principles, methodologies, and practices involved in the creation and innovation of products. Students will learn about the complete product design process, from initial research and concept development to prototyping and final production. The course integrates design thinking, user-centered design, and lean methodologies to foster a deep understanding of how to create innovative and marketable products. Through a combination of theoretical knowledge and practical exercises, students will develop the skills necessary to generate creative ideas, solve complex design problems, and bring their concepts to life.

2. Course Objectives:

1. Understand the Fundamentals of Product Design and Innovation
2. Apply Design Thinking Principles
3. Conduct Effective Research and Analysis
4. Develop Prototypes and Iterate Designs
5. Manage the Product Development Process
6. Present and Communicate Design Ideas

3.Syllabus

Unit – I: Introduction

Need for design creativity – creative thinking for quality – essential theory about directed creativity

Unit – II: Mechanism of Thinking and Visualization

Definitions and theory of mechanisms of mind heuristics and models: attitudes, Approaches and Actions that support creative thinking - Advanced study of visual elements and principles- line, plane, shape, form, pattern, texture gradation, colour symmetry. Spatial relationships and compositions in 2 and 3 dimensional space - procedure for genuine graphical computer animation – Animation aerodynamics – virtual environments in scientific Visualization – Unifying principle of data

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

management for scientific visualization – Unifying principle of data management for scientific visualization - Visualization benchmarking
Unit – III: Creativity
Methods and tools for Directed Creativity – Basic Principles – Tools of Directed Creativity – Tools that prepare the mind for creative thought – stimulation of new ideas – Development and Actions: - Processes in creativity ICEDIP – Inspiration, Clarification, Distillation, Perspiration, Evaluation and Incubation – Creativity and Motivation the Bridge between man creativity and the rewards of innovativeness – Applying Directed Creativity to the challenge of quality management
Unit – IV: Design
Process Design, Emotional Design – Three levels of Design – Visceral, Behavioural and Reflective-Recycling and availability-Creativity and customer needs analysis – Innovative product and service designs, future directions in this application of creativity thinking in quality management
Unit – V: Innovation
Achieving Creativity – Introduction to TRIZ methodology of Inventive Problem Solving - the essential factors – Innovator's solution – creating and sustaining successful growth – Disruptive Innovation model – Segmented Models – New market disruption - Commoditation and DE-commoditation – Managing the Strategy Development Process – The Role of Senior Executive in Leading New Growth – Passing the Baton
Text Books:
1. Donald A. Norman," Emotional Design", Perseus Books Group New York, 2004 2. Geoffrey Petty," how to be better at Creativity", The Industrial Society 1999
Reference Books:
1. Clayton M. Christensen Michael E. Raynor," The Innovator's Solution", Harvard Business School Press Boston, USA, 2003 2. Semyon D. Savransky," Engineering of Creativity – TRIZ", CRC Press New York USA," 2000 3. Rousing Creativity: Think New Now, Floyd Hurr, ISBN 1560525479, Crisp Publications Inc. 1999

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19ME601.1	(Understand) Understand the various techniques adopted for stimulating creativity and innovation
R19ME601.2	(Apply) Apply the techniques to the design and development of new products
R19ME601.3	(Analyze) Identify and analyse the product design and development processes in the manufacturing industry.
R19ME601.4	(Apply) Apply creative process techniques in synthesizing information, problem-solving and critical thinking.
R19ME601.5	(Apply) Use the Product Design and Development Process, as a means to manage the development of an idea from concept through to production.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19ME602	3D Printing and Tooling	L	T	P	C
		3	0	0	3

1. Course Description:

This course provides an in-depth exploration of 3D printing technologies and their applications in modern tooling and manufacturing processes. Students will gain a comprehensive understanding of additive manufacturing techniques, materials used in 3D printing, and the design considerations necessary for creating functional and efficient tools. The course combines theoretical knowledge with hands-on experience, enabling students to design, print, and evaluate 3D-printed components. Key topics include CAD modelling, the operation of 3D printers, post-processing techniques, and the integration of 3D printing into traditional manufacturing workflows.

2. Course Objectives:

1. Understand the Fundamentals of 3D Printing
2. Apply design principles that take into account the limitations and advantages of 3D printing, such as support structures, layer orientation, and material properties.
3. Understand the properties of various 3D printing materials, including plastics, metals, and composites.
4. Apply post-processing methods such as sanding, painting, and annealing to improve the quality and functionality of 3D-printed parts.
5. Analyze the benefits and challenges of integrating 3D printing into existing manufacturing workflows.

3.Syllabus

Unit – I: Introduction

Need - Development of AM systems – AM process chain - Impact of AM on Product Development - Virtual Prototyping- Rapid Tooling – RP to AM -Classification of AM processes- Applications.

Unit – II: Reverse Engineering and CAD Modelling

Basic concept- Digitization techniques – Model reconstruction – Data Processing for Rapid Prototyping: CAD model preparation, Data requirements – Geometric modelling techniques: Wireframe, surface and solid modelling – data formats - Data interfacing, Part orientation and support generation, Support structure design, Model Slicing, Tool path generation Software for AM- Case studies.

Unit – III: Liquid Based and Solid Based Additive Manufacturing Systems

Stereo lithography Apparatus (SLA): Principle, pre-build process, part-building and post-build processes, photo polymerization of SL resins, part quality and process planning, recoating issues, materials, advantages, limitations and applications. Solid Ground Curing (SGC): working principle, process, strengths, weaknesses and applications. Fused deposition Modeling (FDM): Principle, details of processes, process variables, types, products, materials and applications. Laminated Object Manufacturing (LOM): Working Principles, details of processes, products, materials, advantages, limitations and applications - Case studies

Unit – IV: Powder Based Additive Manufacturing Systems

Selective Laser Sintering (SLS): Principle, process, Indirect and direct SLS- powder structures, materials, post processing, surface deviation and accuracy, Applications. Laser Engineered Net Shaping (LENS): Processes, materials, products, advantages, limitations and applications– Case Studies.

Unit – V: Tooling

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Classification, Soft tooling, Production tooling, Bridge tooling, direct and indirect tooling, Fabrication processes, Applications Case studies automotive, aerospace and electronics industries.
Text Books:
1. Chua, C.K., Leong K.F. and Lim C.S., "Rapid prototyping: Principles and applications", second edition, World Scientific Publishers, 2010. 2. Gibson, I., Rosen, D.W. and Stucker, B., "Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010.
Reference Books:
1. Gebhardt, A., "Rapid prototyping", Hanser Gardener Publications, 2003 2. Kamrani, A.K. and Nasr, E.A., "Rapid Prototyping: Theory and practice", Springer, 2006. 3. Hilton, P.D. and Jacobs, P.F., Rapid Tooling: Technologies and Industrial Applications, CRC press, 2005. 4. Liou, L.W. and Liou, F.W., "Rapid Prototyping and Engineering applications: A toolbox for prototype development", CRC Press, 2011.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19ME602.1	(Understand) Understand the history, concepts and terminology of additive manufacturing
R19ME602.2	(Apply) Apply the reverse engineering concepts for design development
R19ME602.3	(Understand) Understand the variety of additive manufacturing techniques
R19ME602.4	(Apply) Design and develop newer tooling models
R19ME602.5	(Analyze) Analyse the cases relevant to mass customization and some of the important research challenges associated with AM and its data processing tools

R19ME603	Quality Management	L	T	P	C
		3	0	0	3

1.Course Description:

This course provides a comprehensive overview of quality management principles, practices, and methodologies. Students will explore the concepts and tools necessary to ensure quality in products and services, focusing on both theoretical foundations and practical applications. Topics covered include the history and evolution of quality management, key quality frameworks and standards (such as ISO 9001), statistical quality control, Six Sigma, and Total Quality Management (TQM). Through case studies, real-world examples, and hands-on projects, students will learn how to implement quality management systems and continuous improvement initiatives to enhance organizational performance.

2. Course Objectives:

1. Trace the historical development of quality management and its key contributors.
2. Develop and implement quality management systems (QMS) in organizational settings.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

3. Utilize various tools such as Pareto charts, cause-and-effect diagrams, and flowcharts to identify and solve quality issues.
4. Implement process improvement strategies to enhance efficiency and effectiveness.
5. Develop strategies to improve customer satisfaction and loyalty.
6. Implement best practices from different quality standards to improve organizational performance.

3.Syllabus

Unit – I: Introduction

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, and Customer retention.

Unit – II: TQM Principles

Leadership - Quality Statements, Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

Unit – III: TQM Tools And Techniques I

The seven traditional tools of quality - New management tools - Six Sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Benchmarking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

Unit – IV: TQM Tools And Techniques II

Quality Circles - Cost of Quality - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

Unit – V: Quality Management System

Introduction—Benefits of ISO Registration—ISO 9000 Series of Standards—Sector-Specific Standards—AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements—Implementation—Documentation—Internal Audits—Registration- Environmental Management System: Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001—Benefits of EMS.

Text Books:

1. Dale H.Besterfiled, Carol B.Michna,Glen H. Besterfield,Mary B.Sacre,Hemant Urdhwareshe and Rashmi Urdhwareshe, "Total Quality Management", Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2013.
2. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.

Reference Books:

1. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.
2. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
3. ISO 9001-2015 standards

4. Course Outcomes:

After successful completion of the course, the student should be able to:

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

CO. No.	Course Outcome
R19ME603.1	(Understand) Acquire the basic concepts of total quality management and contributions by Deming, juran and Crossby.
R19ME603.2	(Understand) Acquire the knowledge of total quality management principles and apply the same in manufacturing and service organizations
R19ME603.3	(Apply) Explain the various tools and techniques of total quality management and solve various quality-related problems.
R19ME603.4	(Apply) Explain the various tools and techniques and apply the concepts of Six Sigma in the manufacturing &service sectors.
R19ME603.5	(Apply) Apply ISO 9000-2000 & ISO 14000 quality systems in a product and service organization.

R19ME604	Enterprise Resource Planning	L	T	P	C
		3	0	0	3

1.Course Description:

This course offers a comprehensive understanding of Enterprise Resource Planning (ERP) systems and their role in integrating various business processes across an organization. Students will learn about the core components of ERP systems, including modules for finance, human resources, supply chain management, and customer relationship management. The course covers the selection, implementation, and management of ERP systems, as well as the challenges and best practices associated with ERP projects. Through case studies, practical exercises, and real-world examples, students will gain the skills necessary to effectively utilize ERP systems to improve organizational efficiency and decision-making.

2. Course Objectives:

1. Define ERP and explain its purpose and importance in modern organizations.
2. Understand the technological advancements that have shaped ERP systems.
3. Map out key business processes and identify how they are integrated within an ERP system.
4. Develop criteria for selecting the appropriate ERP system for an organization.
5. Learn best practices for project management, including risk management and change management.
6. Understand the future direction of ERP systems and their potential impact on businesses.

3.Syllabus

Unit – I: Enterprise Resource Planning

Principle – ERP framework – Business Blue Print – Business Engineering vs Business process Re-Engineering – Tools – Languages – Value chain – Supply and Demand chain – Extended supply chain management – Dynamic Models –Process Models.

Unit – II: Technology and Architecture

Client/Server architecture – Technology choices – Internet direction – Evaluation framework – CRM – CRM pricing – chain safety – Evaluation framework.

Unit – III: ERP System Packages

SAP, People soft, Baan and Oracle – Comparison – Integration of different ERP applications – ERP as sales force automation – Integration of ERP and Internet – ERP Implementation strategies – Organisational and social issues.

Unit – IV: ERP Architecture

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Overview – Architecture – AIM – applications – Oracle SCM.SAP: Overview – Architecture – applications -Before and after Y2k – critical issues – Training on various modules of IBCS ERP Package-Oracle ERP and MAXIMO, including ERP on the NET
Unit – V: ERP Procurement Issues
Market Trends – Outsourcing ERP – Economics – Hidden Cost Issues – ROI – Analysis of cases from five Indian Companies.
Text Books:
1. ERPWARE, ERP Implementation Framework, Garg & Venkitakrishnan, Prentice Hall, 1999 2. Sadagopan.S , ERP-A Managerial Perspective, Tata Mcgraw Hill, 1999.
Reference Books: 1. Jose Antonio Fernandez, The SAP R/3 Handbook, Tata Mcgraw Hill, 1998. 2. Thomas E Vollmann and BeryWhybark, Manufacturing and Control Systems, Galgothia Publications, 1998. 3. Vinod Kumar Crag and N.K.Venkitakrishnan, Enterprise Resource Planning –Concepts and Practice, Prentice Hall of India, 1998.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19ME604.1	(Understand) Provide an integrated view of the various facets of business, including planning, manufacturing, sales, finance and marketing.
R19ME604.2	(Understand) Understand the development of software to integrate business activities such as inventory management and control, order tracking, customer service, finance and human resources.
R19ME604.3	(Apply) Become aware of the software applications and tools that are available to business to use to drive out costs and improve efficiency.
R19ME604.4	(Apply) Identify the important business functions provided by typical business software such as enterprise resource planning and customer relationship management
R19ME604.5	(Analyze) Develop skills necessary for building and managing relationships with customers, and stakeholders.

R19ME605	Micro Electro Mechanical Systems	L	T	P	C
		3	0	0	3

1.Course Description:

This course explores MEMS and Microsystems, covering materials, working principles, mechanics, scaling laws, design considerations, fabrication processes (including photolithography and micromachining), packaging technologies, and micrometrology techniques. Emphasis is on integrating theory with practical applications across various industries.

2. Course Objectives:

1. Understand MEMS materials and fabrication techniques to design microsystems for diverse applications.
2. Learn scaling laws and engineering principles to optimize the design and performance of MEMS devices.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

3. Implement advanced micromachining processes for precise fabrication of microstructures.
4. Understand packaging technologies to ensure reliability and functionality of microsystems.
5. Utilize micro metrology tools for accurate characterization and analysis of MEMS components.

3.Syllabus

Unit – I: Introduction

Overview of MEMS and Microsystems: MEMS and Microsystems, Evolution of Microfabrication, Microsystems and Microelectronics, Microsystems and miniaturization-Materials for MEMS and Microsystems: substrates and wafers, active substrate materials, Silicon, Gallium Arsenide, Piezoelectric Crystals, Polymers, Packaging materials-Working principles of Microsystems: micro sensors, micro actuation, MEMS with microactuators, Micro accelerometers, micro fluidics-Applications of Microsystems in various industries.

Unit – II: Mechanics, Scaling and Design

Engineering Mechanics for Microsystems design: Introduction, Static bending of Thin Plates, Mechanical Vibration, Thermomechanics, Thermofluid, Engineering and microsystem design, Laminar fluid flow, Incompressible fluid Flow, Heat conduction in solids-scaling Laws in Miniaturization, Introduction to scaling, Scaling in (Electrostatic forces electromagnetic forces, Electricity, fluid mechanics, heat transfer)-Microsystems Design: Design Consideration, Process design, Mechanical Design, Design of Micro fluidic Network systems

Unit – III: Micro System Fabrication Processes

Introduction: Photolithography, Ion implantation; Chemical Vapour Deposition, Physical Vapour Deposition; Bulk micromachining : etching, isotropic and anisotropic etching, wet and dry etching-Surface micro machining :process, mechanical problems associated with surface micro machining; LIGA process: General description, materials for substrates and photo resists-SLIGA process-Abrasive jet micro machining-Laser beam micro machining- Micro Electrical Discharge Micro Machining –Ultrasonic Micro Machining- Electro chemical spark micro machining- Electron beam micro machining-Focused Ion Beam machining

Unit – IV: Microsystems Packaging

Introduction: Microsystems Packaging, Interfaces in Microsystems Packaging, Essential Packaging Technologies; Die preparation, surface bonding, wire bonding, sealing; Three-dimensional Packaging, Assembly of Microsystems, Signal Mapping and Transduction

Unit – V: Micro metrology And Characterization

Microscopy and visualization, Lateral and vertical dimension, optical microscopy, Scanning white light interferometry; Confocal Laser scanning microscopy, Molecular measuring machine; Micro coordinate measuring machine: Electrical measurements, Physical and chemical analysis – XRD, SEM; Secondary Ion mass spectrometry: Auger Electron Spectroscopy, SPM

Text Books:

3. Franssila, S., "Introduction to Micro Fabrication" John Wiley & sons Ltd, 2004.ISBN:470-85106-6
4. Hsu, T.R., "MEMS & Microsystems Design and Manufacture", Tata McGraw Hill, 2002, ISBN: 9780070487093
5. Hak M.G., "MEMS Handbook", CRC Press, ISBN: 8493-9138-5, 2006.
6. Jackson, M.J., "Microfabrication and Nanomanufacturing" Taylor and Francis 2006.

Reference Books:

1. Jain, V.K., "Introduction to Micromachining" Narosa Publishing House, 2010.
2. McGeough, J.A., "Micromachining of Engineering Materials", CRC Press, ISBN: 0824706447, 2001.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19ME605.1	Use mechanics principles to analyze the mechanical performance of microsystems.
R19ME605.2	Be familiar with the tools and processes used in micromachining of microelectromechanical systems (MEMS).
R19ME605.3	Explain MEMS technology, present, future and challenges.
R19ME605.4	Explain micro sensors, micro-actuators, their types and applications.
R19ME605.5	Explain about fabrication processes for producing micro-sensors and actuators.

R19ME606	Quality Control Tools and Techniques	L	T	P	C
		3	0	0	3

1.Course Description:

This course covers fundamental concepts of quality management, including quality dimensions, control charts for variables and attributes, statistical process control techniques, acceptance sampling methods, and their applications in ensuring product and process quality in various industrial contexts.

2. Course Objectives:

1. Understand the evolution and importance of quality concepts in industrial practices.
2. Implement control charts for variables to monitor and improve process performance.
3. Learn statistical process control methods to enhance process stability and capability.
4. Apply control charts for attributes to minimize defects and non-conformities in production.
5. Learn the acceptance sampling techniques for efficient quality assurance and compliance with standards.

3.Syllabus

Unit – I: Quality Fundamentals

Importance of quality; evolution of quality; definitions of quality; dimensions of quality; quality control: quality assurance, areas of quality, quality planning; quality objectives and policies; quality costs, economics of quality; Quality loss function: Quality Vs Productivity, Quality Vs reliability

Unit – II: Control Charts For Variables

Process variation preliminary decisions, control limits and their computation; construction and application of X bar, R and S charts; Warning and modified control limits; process adjustment for trend; Comparison of process variation with specification limits; O.C. curve for X bar chart.

Unit – III: Statistical Process Control

Process stability: process capability study using control charts, capability indices; Cp, Cpk and Cpm; capability analysis using histogram and normal probability plot; machine capability study: gauge capability study, setting statistical tolerances for components and assemblies- individual measurement charts: X-chart, moving average and moving range chart, multi-variable chart.

Unit – IV: Control Charts for Attributes

Limitations of variable control charts, Control charts for fraction non-conforming; p and np charts; variable sample size; operating characteristic function, run length; Control chart for nonconformities (defects) c, u, ku charts, demerits control chart, applications.

Unit – V: Acceptance Sampling

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Need, Economics of sampling, sampling procedure, single and double sampling, O.C. curves; Average outgoing quality, Average sample number, Average total inspection, Multiple and sequential sampling, Standard sampling plans; MIL Standards, Dodge, Roming; IS 2500.
Text Books:
1. Douglus C. Montgomery, "Introduction to Statistical Quality Control", Wiley-India, Seventh Edition, 2013. 2. Krishnaiah K.," Applied Statistical Quality Control and Improvement", PHI, 2014. 3. AmitavaMitra, "Fundamentals of Quality Control and Improvement", Wiley, Third Edition, 2008.
Reference Books:
1. Dale H. Besterfield, Quality Control, Pearson Education Asia, Eighth Edition, 2008. 2. Eugene L. Grant and Richard S. Leaven Worth, "Statistical Quality Control", McGraw-Hill Education, Seventh Edition, 2000.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19ME606.1	Familiar with details of quality costs, economies and planning
R19ME606.2	Control the quality of processes using control charts for variables in manufacturing/service industries.
R19ME606.3	Good understanding and in depth knowledge have been imparted in the process capability study.
R19ME606.4	Control the occurrence of defects in product or service industries
R19ME606.5	Determine the acceptance sampling procedures that are practised.

R19ME607	World Class Manufacturing	L	T	P	C
		3	0	0	3
1.Course Description:					
This course examines industrial trends from decline to resurgence, emphasizing manufacturing excellence across regions. It explores customer-focused principles, value assessment, strategic linkages, and identifies impediments in operational effectiveness, providing insights into achieving stability and competitiveness in global markets.					
2. Course Objectives:					
1. Understand and evaluate the historical and global trends in industrial decline and ascendancy, focusing on manufacturing excellence across different regions and decades. 2. Develop and apply customer-focused principles in design, operations, human resources, quality, and marketing to enhance organizational effectiveness. 3. Understand and assess the importance of product costing, enterprise quality, and organizational stability, including the roles of individual and team contributions to overall project cohesiveness.					
3.Syllabus					
Unit – I: Industrial Decline and Ascendancy					
Manufacturing excellence: US Manufacturers, French Manufacturers; Japan decade; American decade; Global decade.					

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Unit – II: Building Strength through Customer – Focused Principles
Customer; Focused principles; General principles: Design, Operations, Human resources; Quality and Process improvement; Promotion and Marketing.
Unit – III: Value and Valuation
Product Costing: Motivation to improve, Value of the enterprises QUALITY; The Organization: Bulwark of stability and effectiveness; Employee stability; Quality Individuals Vs. Teams; Team stability and cohesiveness; Project cohesiveness and stability
Unit – IV: Strategic Linkages
Product decisions and customer service; Multi-company planning; Internal manufacturing planning; Soothing the demand turbulence.
Unit – V: Impediments
Bad plant design; Mismanagement of capacity, Production Lines, Assembly Lines; Whole Plant Associates: Facilitators, Teams Manship; Motivation and reward in the age of continuous Improvement.
Text Books:
1. By Richard B. Chase, Nicholas J. Aquilano, F. Robert Jacobs – "Operations Management for Competitive Advantage", McGraw-Hill Irwin, ISBN 0072323159 2. Moore Ran, "Making Common Sense Common Practice: Models for Manufacturing Excellence", Elsevier Multiworth
Reference Books: 1. Narayanan V. K., "Managing Technology & Innovation for Competitive Advantage", Pearson Education Inc 2. Korgaonkar M. G., "Just In Time Manufacturing", MacMillan Publishers India Ltd., 3. Sahay B. S., Saxena K. B. C., Ashish Kumar, "World Class Manufacturing", MacMillan Publishers

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19ME607.1	Understand the concept and the importance of manufacturing strategy for industrial enterprise competitiveness.
R19ME607.2	Apply appropriate techniques in the analysis an devaluation of company's opportunities for enhancing competitiveness in the local regional and global context.
R19ME607.3	Identify formulation and implement strategies for manufacturing and therefore enterprise competitiveness.
R19ME607.4	Analyzing how World Class Manufacturing technique can create value generation for organization.
R19ME607.5	Apply smart techniques to bring competitive business culture for improving organization performance

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19ME608	Industrial Safety Engineering	L	T	P	C
		3	0	0	3

1.Course Description:

This course covers industrial safety, maintenance engineering, wear and corrosion prevention, fault tracing, and periodic/preventive maintenance. It includes accident causes and control, safety regulations, maintenance strategies, lubrication methods, fault detection, and preventive maintenance procedures, ensuring comprehensive understanding of maintaining and improving industrial equipment and workplace safety.

2. Course Objectives:

1. Identify and control industrial hazards to ensure workplace safety and compliance with safety regulations.
2. Implement maintenance strategies for efficient operation and longevity of industrial equipment.
3. Apply fault tracing techniques to diagnose and resolve issues in various industrial systems

3.Syllabus

Unit – I: Industrial Safety

Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Unit – II: Maintenance Engineering

Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Unit – III: Wear and Corrosion and their prevention

Wear: types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications: i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication; Definition, principle and factors affecting the corrosion; Types of corrosion; corrosion prevention methods.

Unit – IV: Fault Tracing

Fault tracing: concept and importance, decision tree concept, need and applications, sequence of fault-finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like: i. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors; Types of faults in machine tools and their general causes.

Unit – V: Periodic and Preventive Maintenance

Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: i. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, Advantages of preventive maintenance. Repair cycle concept and importance.

Text Books:

1. L M Deshmukh, Industrial Safety Management, Tata McGraw-Hill Education, 2005

Chairman – Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

2. Charles D. Reese, Occupational Health and Safety Management: A Practical Approach, CRC Press, 2003.
3. Edward Ghali, V. S. Sastri, M. Elboujdaini, Corrosion Prevention and Protection: Practical Solutions, John Wiley & Sons, 2007.
4. Garg, HP, Maintenance Engineering, S. Chand Publishing.

Reference Book:

1. J Maiti, Pradip Kumar Ray, Industrial Safety Management: 21st Century Perspectives of Asia, Springer, 2017.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19ME608.1	(Apply)Explain the fundamental concept and principles of industrial safety
R19ME608.2	(Apply)Apply the principles of maintenance engineering.
R19ME608.3	(Analyze)Analyze the wear and its reduction.
R19ME608.4	(Evaluate)Evaluate faults in various tools, equipment and machines.
R19ME608.5	(Apply)Apply periodic maintenance procedures in preventive maintenance

R19ME609	Introduction to Industry 4.0	L	T	P	C
		3	0	0	3

1.Course Description:

Introduction to Industry 4.0 covers the fundamentals of road to Industry 4.0, related Disciplines, System, Technologies, role Of Data, Information, Knowledge and Collaboration in Future Organizations and Business Issues in Industry 4.0.

2. Course Objectives:

1. To study the basics of Industrial Revolution
2. To study the basic concepts of Industry 4.0
3. To study the Concepts of related disciplines, system, technologies for enabling industry 4.0
4. To study the role of data, information, knowledge and collaboration in future organizations
5. To analyse the Business issues in Industry 4.0

3.Syllabus

Unit – I: Introduction to Industry 4.0

The Various Industrial Revolutions, Digitalization and the Networked Economy: Drivers, Enablers, Compelling Forces and Challenges for Industry 4.0; The Journey so far: Developments in USA, Europe, China and other countries; Comparison of Industry 4.0 Factory and Today's Factory, Trends of Industrial Big Data and Predictive Analytics for Smart Business Transformation.

Unit – II: Road to Industry 4.0

Internet of Things (IoT), Industrial Internet of Things (IIoT) and Internet of Services; Smart Manufacturing, Smart Devices and Products, Smart Logistics, Smart Cities and Predictive Analytics.

Unit – III: Related Disciplines, System, Technologies for Enabling Industry 4.0

Big data, Physical Systems, Robotic Automation and Collaborative Robots; Support System for Industry 4.0: Mobile Computing, Artificial intelligence and Machine learning, Cyber Security, Digital twin, Digital thread, PLM, Augmented reality and Virtual Reality.

Unit – IV: Role of Data, Information, Knowledge and Collaboration In Future Organizations

Resource: based view of a firm, Data as a new resource for organizations; Harnessing and sharing knowledge in organizations: Cloud Computing Basics, Cloud Computing and Industry 4.0.

Unit – V: Business Issues in Industry 4.0

Opportunities and Challenges, Future of Works and Skills for Workers in the Industry 4.0 Era; Strategies for competing in an Industry 4.0 world: legacy, social issues and their solutions.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Text Book:
1. Alasdair Gilchrist, "Industry 4.0: The Industrial Internet of Things", A press, 2016.
Reference Books:
1. "The Fourth Industrial Revolution" by Klaus Schwab, World Economic Forum 2. "Internet of Things: A Hands-On Approach" by Arsheep Bahga and Vijay Madisetti, University Press 3. NOC: Introduction to Industry 4.0 and Industrial Internet of Things

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19ME609.1	(Understand) Understand the basics of Industrial Revolution
R19ME609.2	(Understand) Understand the basic concepts of Industry 4.0
R19ME609.3	(Understand) Understand the Concepts of related disciplines, system, and technologies for enabling Industry 4.0
R19ME609.4	(Understand) Understand the role of data, information, knowledge and collaboration in future organizations
R19ME609.5	(Analyze) Analyze the Business issues in Industry 4.0

R19ME610	Lean Six Sigma and Supply Chain Management	L	T	P	C
		3	0	0	3

1.Course Description:

This course integrates Lean Six Sigma principles into supply chain management, focusing on waste reduction, process optimization, quality improvement, and achieving operational excellence through practical tools and project-based learning.

2. Course Objectives:

1. To integrate Lean principles (waste reduction) and Six Sigma methodologies (defect reduction) to optimize supply chain processes.
2. To apply tools like Value Stream Mapping and DMAIC (Define, Measure, Analyze, Improve, Control) to streamline supply chain operations.
3. To implement Six Sigma practices to enhance product and service quality, reduce defects, and improve overall efficiency.
4. To create a culture of continuous improvement and operational excellence throughout the supply chain.
5. To engage in practical projects to apply Lean Six Sigma concepts in real-world supply chain scenarios, emphasizing measurable outcomes and sustainable improvements.

3.Syllabus

Unit – I: Introduction to Lean And Six-Sigma

Introduction to Lean: Definition, Purpose, features of Lean; top seven wastes, Need for Lean, Elements of Lean Manufacturing, Lean principles, the lean metric, Hidden time traps. Introduction to quality, Definition of six-sigma, origin of six-sigma, six-sigma concept, and Critical success factors for six-sigma. Evolution of lean six-sigma, the synergy of Lean and six sigma, Definition of lean six-sigma, the principles of lean six-sigma, Scope for lean six sigma, Features of lean six sigma, the laws of lean six-sigma, Benefits of lean six-sigma.

Unit – II: Tools for Lean Six- Sigma

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Define tools, Project Definition Form(PDF) and SIPOC; Measure tools: Process mapping, Parato chart, cause and effect matrix, FMEA, Brain-storming, NGT, Multi-voting, Cause & Effect diagram, Check sheets, Gauge R&R, Run charts, Control charts and process capability analysis; Analyze tools: scatter plots, ANOVA, Regression analysis and time trap analysis; Improve tools: Mistake proofing, KAIZEN, Reducing congestions and delays, SMED, TPM, Design of Experiments and the pull system; Control tools: SPC.
Unit – III: Design for Lean Six-Sigma
Predicting and improving team performance, nine team roles, Team leadership, Team building & Team exercise. DMAIC process and toll gate reviews, Need for institutionalizing Lean Six- Sigma, Comply, commit, embed and encode; Steps in institutionalizing the Lean Six- Sigma; Objectives of Design for Lean Six-Sigma, Improving design velocity, Reducing product line complexity, Design for Lean Six-Sigma-QFD,TRIZ, Robust design.
Unit – IV: Concepts of Supply Chain
Service and manufacturing supply chain dynamics, Evolution of supply chain management, Multiple views and flows, Service supply chains, Manufacturing supply chains, Measures of supply chain performance, Differentiation, Bullwhip effect.
Unit – V: Supply Chain Processes and Strategies
Integrated supply chains design, Customer relationship process, Order fulfilment process, Supplier relationship process, Supply chain strategies, Strategic focus, Mass customization, Lean supply chains, Outsourcing and offshoring, Virtual supply chains.
Text Books:
1. Michael L. George, Lean Six Sigma, McGraw-Hill, 2002. 2. Sunil Chopra Peter Meindl, D.V.Kalra," Supply chain management", Pearson Education, Prentice Hall of India, 2010.
Reference Books: 1. Forrest W. Breyfogle III, Implementing Six Sigma: Smarter Solutions Using Statistical Methods, 1999. 2. James P. Womack, Daniel T. Jones, Lean Thinking, Free press business, 2003.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19ME610.1	(Understand) Understand issues & challenges in implementing & developing lean manufacturing techniques from TPS & its contribution.
R19ME610.2	(Apply) Apply lean techniques to bring competitive business culture for improving organization performance.
R19ME610.3	(Analyze) Analyze how lean techniques can be applied to the manufacturing & service industry.
R19ME610.4	(Apply) Developing lean management strategy for Supply chain management.
R19ME610.5	(Analyze) Analysing how lean technique can create value generation for organization.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19ME611	Business Organization and Development	L	T	P	C
		3	0	0	3

1.Course Description:

This course focus on understanding structures, strategic planning, organizational effectiveness, entrepreneurship, legal compliance, financial management, market analysis, growth strategies, risk management, and global business dynamics.

2. Course Objectives:

1. To understand various business structures and their implications for operations and governance.
2. To develop skills in formulating and implementing business strategies aligned with organizational goals.
3. To explore methods to enhance leadership, team dynamics, and adaptability within organizations.
4. To study the principles of entrepreneurship, fostering innovation, and seizing business opportunities.
5. To understand legal requirements and ethical considerations in business operations, emphasizing compliance and responsible corporate conduct.

3.Syllabus

Unit – I: Business Environment

Nature and purpose of business, classification of business activities: industry, commerce and trade, objective of business and essential of successful business, economic environment: basic problems of scarcity and choice, allocation of resources, opportunity cost; Business growth and measurement of size ,International Environment-balance of trade ,the trade gap ,and balance of payments, role and methods of trade protectionism, Business Ethics.

Unit – II: Business Structure and Organization

Historical view of business development forms of business organization: sole proprietorship, partnership, join stock companies, co-operative societies, public enterprise; Definition, Meaning, characteristics, Advantages and Disadvantages; Role of Government in business activity, organization charts.

Unit – III: Elements of Business Activity

Purchasing: choosing suppliers, overview of stock control, production-scale of production, main features of job, mass and batch production systems; Marketing: concept and role of marketing, marketing mix, channels of distribution; Finance: sources of finance, assessing business performance.

Unit – IV: Human Resources

Demographic trends and their impact on business concerns; Unemployment: effects and types of unemployment; Local trends in employment in various sectors, selection, recruitment, training of workers, motivation, basic knowledge of working age, contract of work, minimum wage, statutory hours of work, statutory benefits.

Unit – V: Foreign Trade and Banking

Foreign trade: meaning, nature, importance, procedure of export and import, globalization, MNC, MNE; Introductory idea about commercial banks: functions and services; Insurance: meaning, types, principles, benefits.

Text Books:

1. Joel Dean - Managerial Economics, Prentice Hall/Pearson, 2007.
2. Rangarajan - Principles of Macro Economics, Tata McGraw Hill

Reference Books:

1. Marketing Management - Philip Kotler - Pearson Education- Millennium Edition
2. Gary Dessler, "Human Resource Management", Seventh edition, Prentice-Hall of India P.Ltd., Pearson

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19ME611.1	(Understand) Explain the basic fundamentals of the business environment, organisational theory and marketing, including capacity to recognise and use relevant terminology
R19ME611.2	(Understand) Read, understand and critically evaluate the information contained in relevant academic texts.
R19ME611.3	(Understand) Organise and present information to a satisfactory standard in oral presentations, essays and reports.
R19ME611.4	(Understand) Give an idea about organisation structure and different types of organisations
R19ME611.5	(Understand) Provide idea about motivation, importance of foreign trade and Principles of coordinating the import and export

R19ME612	Product Distribution and Promotion Management	L	T	P	C
		3	0	0	3

1.Course Description:

This course focuses on developing strategies for efficient product distribution through effective channel management and logistics. It also covers promotional techniques like advertising and digital marketing to maximize product visibility and sales effectiveness.

2. Course Objectives:

1. To develop effective distribution channels and logistics plans to optimize product flow and reach target markets.
2. To study the various methods including advertising, sales promotions, and digital marketing to enhance product visibility and consumer engagement.
3. To identify and target specific customer segments to tailor distribution and promotional strategies accordingly.
4. To understand how to manage relationships with distributors and retailers to ensure efficient product placement and availability.
5. To provide sales teams with the necessary tools and strategies to effectively promote and sell products in diverse market environments.

3.Syllabus

Unit – I: Introduction

Marketing: Definitions, Conceptual frame work; Marketing environment: Internal and External; Marketing interface with other functional areas: Production, Finance, Human Relations Management, Information System; Marketing in global environment: Prospects and Challenges.

Unit – II: Product Distribution Strategy

Marketing strategy formulations, Key Drivers of Marketing Strategies; Strategies for Industrial Marketing: Consumer Marketing, Services marketing; Competitor analysis: Analysis of consumer and industrial markets; Strategic Marketing Mix components.

Unit – III: Marketing Mix Decisions

Product planning and development, Product life cycle; New product Development and Management: Market Segmentation, Targeting and Positioning, Channel Management; Advertising and sales promotions: Pricing Objectives, Policies and methods.

Unit – IV: Buyer Behaviour

Understanding industrial and individual buyer behaviour, influencing factors; Buyer Behaviour Models: Online buyer behaviour; Building and measuring customer satisfaction: Customer relationships management, Customer acquisition, Retaining, Defection.

Unit – V: Marketing Research & Trends in Marketing

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Marketing Information System; Research Process, Concepts and applications: Product, Advertising, Promotion, Consumer Behaviour; Retail research, Customer driven organizations, Cause related marketing, Ethics in marketing, Online marketing trends.
Text Books:
1. Philip Kotler and Kevin Lane Keller, Marketing Management, PHI 14th Edition, 2012 2. KS Chandrasekar, "Marketing management-Text and Cases", Tata McGraw Hill, First edition,2010
Reference Books:
1. Lamb, hair, Sharma, Mc Daniel– Marketing – An Innovative approach to learning and teaching-A South Asian perspective, Cengage Learning — 2012 2. Paul Baines, Chris Fill and Kelly Page, Marketing, Oxford University Press, 2nd Edition,2011.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19ME612.1	(Understand) Understand the concepts of marketing management
R19ME612.2	(Understand) Learn about marketing process for different types of products and services
R19ME612.3	(Understand) Understand the tools used by marketing managers in decision situations
R19ME612.4	(Understand) Understand the marketing environment
R19ME612.5	(Understand) Demonstrate effective understanding of relevant functional areas of marketing management and its application.

R19ME613	Business Ethics, Corporate Social Responsibilities and Governance	L	T	P	C
		3	0	0	3

1.Course Description:

The course aims to enhance understanding of ethical decision-making, integrate corporate social responsibility into business practices, explore governance principles, engage stakeholders effectively, and ensure legal compliance in organizational operations.

2. Course Objectives:

1. To develop awareness of ethical issues and dilemmas in business contexts, and learn frameworks for ethical decision-making.
2. To understand the importance of CSR, and learn strategies to integrate ethical practices into business operations.
3. To explore corporate governance structures, roles, and responsibilities of boards, and practices for transparency and accountability.
4. To study the methods to effectively engage and manage relationships with stakeholders, considering their interests and expectations.
5. To understand legal frameworks related to ethics, CSR, and governance, ensuring adherence to regulations and ethical standards in business practices.

3.Syllabus

Unit – I: Introduction

Definition & nature Business ethics, Characteristics, Ethical theories; Causes of unethical behavior; Ethical abuses; Work ethics; Code of conduct; Public good.

Unit – II: Ethics Theory and Beyond

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Management of Ethics - Ethics analysis [Hosmer model]; Ethical dilemma; Ethics in practice-ethics for managers; Role and function of ethical managers- Comparative ethical behaviour of managers; Code of ethics; Competitiveness, organizational size, profitability and ethics; Cost of ethics in Corporate ethics evaluation. Business and ecological / environmental issues in the Indian context and case studies.
Unit – III: Legal Aspects of Ethics
Political – legal environment; Provisions of the Indian constitution pertaining to Business; Political setup – major characteristics and their implications for business; Prominent features of MRTP & FERA. Social – cultural environment and their impact on business operations, Salient features of Indian culture and values
Unit – IV: Environmental Ethics
Economic Environment; Philosophy of economic grow and its implications for business, Main features of Economic Planning with respect to business; Industrial policy and framework of government contract over Business; Role of chamber of commerce and confederation of Indian Industries.
Unit – V: Corporate Social Responsibility and Governance
Definition- Evolution- Need for CSR; Theoretical perspectives; Corporate citizenship; Business practices; Strategies for CSR; Challenges and implementation; Evolution of corporate governance; Governance practices and regulation; Structure and development of boards; Role of capital market and government; Governance ratings; Future of governance- innovative practices; Case studies with lessons learnt.
Text Books:
1. Robert A.G. Monks and Nell Minow, Corporate governance, John Wiley and Sons, 2011. 2. William B. Werther and David B. Chandler, Strategic corporate social responsibility, Sage Publications Inc., 2011
Reference Books:
1. S.A. Sherlekar, Ethics in Management, Himalaya Publishing House, 2009. 2. Beeslory, Michel and Evens, Corporate Social Responsibility, Taylor and Francis, 1978.

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19ME613.1	(Understand) Students will be able to explain the concept of business ethics, its necessity, and its role in contemporary business.
R19ME613.2	(Understand) Students will understand and apply ethical theories like utilitarianism, deontology, and virtue ethics to real-world business dilemmas.
R19ME613.3	(Analyze) Learners will analyse examples of ethical abuses and their impact on business and society, providing insights into avoiding such practices.
R19ME613.4	(Understand) Students will understand the significance of maintaining strong work ethics and adhering to a company's code of conduct.
R19ME613.5	(Apply) Learners will explore different theoretical perspectives on CSR and how they apply to business practices.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19PH601	Laser Technology	L	T	P	C
		3	0	0	3

1. Course Description:

Laser technology course is designed to offer engineering students with a sturdy base in the field of laser incorporating its basic principles and its potential applications in various fields.

2. Course Objectives:

1. Facilitating the students to restate the basics of lasers, characteristics and their types.
2. To build knowledge on basics of holography and its applications.
3. Encouraging the students to gain a comprehensive understanding on the applications of laser in industries.
4. Assisting the learners in gaining exposure on the medicinal applications of laser.
5. Helping students acquaint themselves with atmospheric applications.

3. Syllabus

Unit – I: Foundation to Laser and its Types

Introduction to laser - Requirements for obtaining population inversion - 2,3 and 4 level systems: Pumping schemes - Threshold gain coefficient - Ruby laser - Nd:YAG laser - He-Cd laser - X-ray laser - Carbon dioxide laser - Semiconductor laser: Homojunction and Hetrojunction lasers - Liquid lasers - Dye laser - Quantum well laser - Free electron Lasers - Fiber Lasers.

Unit – II: Holography

Holography: Basic Principle - Holography vs. photography - Principle of Hologram Recording - Condition For Recording - A hologram - Holographic components - Construction and Reconstruction of a hologram - Viewing the holographic image - Holography for non-destructive testing (HNDT) - Speckle Non Destructive Testing (SNDT) - Optical disk storage.

Unit – III: Industrial Applications

Laser parameters for welding, drilling, cutting: Dependence of wavelength, pulse width, repetition rate, modulation and gas shielding factors influencing the parameters - Recent developments - Hybrid welding - Cooling parameters for welding processes - Advantages of laser processing versus conventional methods.

Unit – IV: Medical Applications

Laser and tissue interaction - Medical applications of lasers: Dermatology - Plastic surgery - Wound healings - Nerve stimulation - Dentistry - Ophthalmology - Laser instruments for surgery - Removal of tumours of vocal cards - Brain surgery - Gynaecology Oncology - Cancer diagnosis and therapy - Laser safety fundamentals - Basic laser tweezers.

Unit – V: Metrological Applications

Interferometric techniques - Calibration Methods - LIDARS - Theory and different experimental arrangements - Pollution monitoring by remote sensing - Applications - Laser gyroscope.

Text Books:

1. Nambiar, K.R., "Laser Principles, Types & Applications", New Age International, 2004.

2. Duley,W.W., "Laser Processing and Analysis of Materials", Plenum Press, New York,1983.

3. Ghatak, A.K., Thyagarajan, K., "Lasers: Theory and Applications", McMillan, 2003.

References:

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Reference Books:

1. Thyagarajan, K., Ghatak,A., "Lasers: Fundamentals and Applications", Springer, 2012.

2. Nityanand Choudhary, RichaVerma, "Laser Systems and Applications", PHI Learning Private Ltd, 2011.

3. Nagabhushana, S., Sathyanarayana B., "Lasers and Optical Instrumentation", I.K. International Publishing House Pvt. Ltd, 2010.

4. KoechnerW., "Solid State Laser Engineering", Springer Series in Optical Sciences, Vo.1, Springer Verlag

Journals:

1. https://www.sciencedirect.com/journal/optics-and-laser-technology
2. https://www.hilarispublisher.com/lasers-optics-photonics.html

Video References:

1. https://www.youtube.com/watch?v=XkU9jWg49rg
2. https://archive.nptel.ac.in/courses/104/104/104104085/
3. https://ocw.mit.edu/courses/res-6-005-understanding-lasers-and-fiberoptics-spring-2008/resources/laser-fundamentals-i/

MOOC/NPTEL/SWAYAM Courses:

1. https://archive.nptel.ac.in/courses/115/102/115102124/
2. https://onlinecourses.nptel.ac.in/noc22_me92/preview
3. https://onlinecourses.nptel.ac.in/noc20_cy17/preview

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19PH601.1	Realize the fundamentals of lasers, laser systems, their characteristics and types.
R19PH601.2	Acquire knowledge on principles of holography and its applications in various fields.
R19PH601.3	Identify and explore the various industrial applications of laser.
R19PH601.4	Gain capabilities to explore the applications of laser in medical field in addition to their safety guidelines.
R19PH601.5	Interpret the knowledge on investigating applications of laser in the atmosphere and its phenomena, including both weather and climate.

R19PH602	Nanomaterials and Applications	L	T	P	C
		3	0	0	3

1. Course Description:

Nanomaterials are materials with nanoscale dimensions where the surface or interface properties dominate over the bulk properties. The very large surface area of these nanomaterials can result in novel physical and chemical properties, such as increased catalytic activity, improved solubility, or different optical behavior. Nanomaterials are already found in a wide variety of consumer products, such as textiles, paints, sunscreens, and other healthcare products. Intensive research is being done in the use of nanomaterials for energy storage and energy conversion, pharmaceuticals, life science applications, solar cells, catalysis, and composite materials, to name just a few.

2. Course Objectives:

1. To enable the students to learn the properties of nanomaterials.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

2. To prepare the students to understand the concept of different characterization techniques used for analysing the various samples.
3. To enable the students to understand the impact of nanotechnology in the environment.
4. To enable the students to learn the applications of nanomaterials in different sectors.

3. Syllabus

Unit – I: Nanomaterials: Properties and Synthesis

Introduction, quantum confinement: 0D, 1D, 2D & 3D structures; Unique properties of materials, Difference between bulk and nano materials, Synthesis andpreparation of nanomaterials: Sol Gel processing, Micro emulsion, Hydrothermal, Solvo thermal, Microwave assisted synthesis, Organic-Inorganic hybrid nano composites – Quantumdot (QDs) synthesis.

Unit – II: Nanosensors and Nanotubes

Introduction: Nano sensors, Characteristic and terminology; Nano wire based sensors, Properties and fabrication of nano wires, Nano wires sensors for Gas sensing application, Electron Skin, Field effect transistors, Gold nano particles, Carbon nano tubes: Structure, Properties, Synthesis and applications of CNT – Fullerenes.

Unit – III: Nanomaterials Characterization Techniques

Diffraction analysis: X-ray diffraction, Powder diffraction, Lattice parameters, Structure Analyses, Strain analyses, Phase identification, Particle size analyses using Scherer's formula, X-ray Photoelectron spectroscopy (XPS); Infra-Red spectroscopy (IR); Rotational & Vibrational ;UV-Visible , Raman Spectroscopy; Photo Luminescence (PL), Cathode Luminescence (CL).

Unit – IV: Nanotechnology in Environment

Environmental pollutants in air, water, soil, hazardous and toxic wastes: Water treatment, Drinking water and Air/Gas purifications; The challenge to occupational health and hygiene; Toxicity of nano particles, Effects of inhaled Nano sized particles, Skin exposure to nano particlesHazards and risks of exposure to nano particles, Monitoring nano particles in work place and sensors.

Unit – V: Applications of Nanotechnology

Nanoelectronics, Nanotechnology in Diagnostics, Environmental, Agricultural and food processing, Nanotechnology for energy systems.

Text Books:

1. Sanjay Mathur and Mrityunjay Singh," Nanostructured Materials and Nanotechnology", II Eds., Willey, 2008.
2. S. Vijaya, G.Rangarajan, "Materials Science", M, Tata McGraw Hill publishing company Ltd., NewDelhi, 2003.
3. Geoffrey A. Ozin, Andre C. Arsenault and Ludovico Cademartiri, "Nanochemistry: A Chemical Approach to Nanomaterials", Second New edition, Royal Society of Chemistry, Cambridge UK, 2008.

References:

Reference Books:

1. Schmidt.G ,"Nanoparticles: From theory to applications", Wiley –VCH, 2006.
2. Zhong Lin Wang, Yi Liu and Ze Zhang," Hand Book of Nanophase& Nanostructured materials", Volumes I-IV, Springer,2002.
3. Chaudhery Mustansar Hussain, Ajay Kumar Mishra," Nanotechnology in Environmental Science", Wiley-VCH, 2018.
4. Zishan Husain Khan, "Nanomaterials and Their Applications", Springer, 2018.
5. Kevin C. Honeychurch," Nano sensors for Chemical and Biological Applications"

Sensing with Nanotubes, Nanowires and Nanoparticles", Woodhead publishing Ltd., 2014.

Journals:

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

1. http://www.aspbs.com/jnn/
2. https://iopscience.iop.org/journal/0957-4484
3. https://onlinelibrary.wiley.com/journal/8384
4. https://www.nature.com/nnano/
5. https://www.sciencedirect.com/journal/nanomedicine-nanotechnology-biology-and-medicine
6. https://www.sciencedirect.com/journal/environmental-nanotechnology-monitoring-and-management

Video References:

1. https://youtu.be/ebO38bbq0_4?list=PLbMVogVj5nJTdeiLvuGSB_AE8hloTAHWJ
2. https://youtu.be/EABqmh2aDPU
3. https://youtu.be/lFYs3XDu4fQ
4. https://youtu.be/Y32Csnt-1Pw

https://youtu.be/0EWCqCIsFOA?list=PLyqSpQzTE6M8682dGkNTN8936vSY4CbqZ

MOOC/NPTEL/SWAYAM Courses:

1. https://nptel.ac.in/courses/118102003
2. https://onlinecourses.nptel.ac.in/noc19_mm21/preview
3. https://archive.nptel.ac.in/courses/118/107/118107015/
4. https://archive.nptel.ac.in/courses/118/102/118102003/
5. https://archive.nptel.ac.in/courses/118/104/118104008/

4. Course Outcomes

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19PH602.1	Explain the effects of quantum confinement on the electronic structure and corresponding physical and chemical properties of materials at nanoscale.
R19PH602.2	Explore the properties of nanotubes and sensors for different applications.
R19PH602.3	Identify the suitable technique for characterization of nanomaterials and devices for various applications.
R19PH602.4	Identify impacts of nano pollutants on environment and E-waste management techniques.
R19PH602.5	Examine the different applications of nanomaterials.

R19PH603	Physics for Solar PV System	L	T	P	J	C
		3	0	0	0	3

1. Course Description:

This course offers cutting-edge knowledge within the field of photovoltaic system technology. This course is unique and provides the spotlight on the solar resources and how photovoltaic energy conversion can be applied to produce electric power. It incorporates the design and operation of different solar cell, the various photovoltaic system components for various applications.

2. Course Objectives:

1. To impart knowledge on photovoltaic fundamentals and to build solar cells of better efficiency.
2. To offer a blend of technical expertise required for design and operation of a solar photovoltaic systems.
3. To review on the classification of photovoltaics and the components used to apply in various advanced photovoltaic devices.

3. Syllabus

Unit – I: Photovoltaic Fundamentals

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202

Chairman - Board of Studies

Solar radiation, its measurements and analysis - Solar angles- day length, angle of incidence on tilted surface, Sun path diagrams- Shadow determination- P-N junction- homo and hetro junctions, Metal-semiconductor interface, Dark and illumination characteristics - Figure of merits of Solar Cell - Efficiency limits - Variation of efficiency with band-gap.

Unit – II: PV Module Performance

Photovoltaic modules - Solar PV modules from solar cells - Series and parallel connection of cells, mismatch in series connection - Hot spots in module, bypass diode, mismatching in parallel connection. Solar PV Systems - Components: PV array, inverter, energy storage, Performance analysis of solar photovoltaic (PV) Cell - Efficiency of solar cell - Limitation of Solar Cell, Solar module & Solar Array - Solar power plant battery, Inverter, system charge control, load, balance of systems (BOS) components. Maintenance of solar lighting system, types and advantages of solar outdoor lighting.

Unit – III: Design of Photovoltaic System

Principles of designing high - Quality PV systems: load, suitability, site adequacy, weather, system balance, additional considerations. Classification of PV system - Classification - Stand-alone PV system, Grid-Interactive PV System, Small system for consumer applications, Hybrid solar PV system. Commercial solar cells - Production process of single crystalline silicon cells, multi crystalline silicon cells, amorphous silicon, cadmium telluride, copper indium gallium di selenide cells. Design of solar PV systems and cost estimation.

Unit – IV: Photovoltaic Classification and Components

Classification - Central Power Station System, Distributed PV System, Stand-alone PV system, Grid Interactive PV System, small system for consumer applications - System Components - PV arrays, inverters, batteries, charge controls, net power meters - PV Array Installation, Operation, Costs, Reliability.

Unit – V: Solar Photovoltaic System Applications

Building - integrated photovoltaic units - grid-interacting central power stations - standalone devices for distributed power supply in remote and rural areas - solar cars, aircraft, space solar power satellites -Socio-economic and environmental merits of photovoltaic systems.

Text Books:

1. Sukhatme, S.P and Nayak, J.K, "Solar Energy", Tata McGraw Hill Private Ltd, 2010.
2. Chetansingh Solanki, "Solar Photovoltaic", PHI Learning Private Ltd., 2018.
3. Partain, L.D and Fraas, L.M., "Solar Cells and their Applications", 2nd ed., Wiley, 2010.

References:

Reference Books:

1. Dr. H. Naganagouda, "Solar Power Hand Book", 2014.
2. G.N. Tiwari, "Solar Energy, Fundamentals Design, Modelling and Application", 2015.
3. Michale Boxwell, "Solar Electricity Handbook", 2017.
4. D.P. Kothari and K.C. Signal, "Renewable Energy Sources and Emerging Technologies", PHI Publications, 2nd Edition, 2011.

Journals:

1. https://www.sciencedirect.com/journal/solar-energy-materials-and-solar-cells
2. https://onlinelibrary.wiley.com/journal/1099159x
3. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=5503869
4. https://link.springer.com/journal/11949
5. https://www.ises.org/what-we-do/publications/solar-energy-journal

Video References:

1. https://www.youtube.com/watch?v=LOVZE9WalRE
2. https://www.youtube.com/watch?v=r5A_N29ZchE
3. https://www.youtube.com/watch?v=pH03Y5KwpjU

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

4. https://www.youtube.com/watch?v=r5qbf5hNYUU
5. https://www.youtube.com/watch?v=yuThr48A2cY

MOOC/SWAYAM/NPTEL Courses:

1. https://archive.nptel.ac.in/courses/115/107/115107116/
2. https://archive.nptel.ac.in/courses/117/108/117108141/
3. https://archive.nptel.ac.in/courses/115/103/115103123/

4. Course Outcomes:

After the completion of syllabus, the student should be able to:

CO. No.	Course Outcome
R19PH603.1	Apply the basic principle of direct solar energy conversion to power using PV technology of radiation, the energy balance of earth.
R19PH603.2	Acquire knowledge on performance analysis of solar photovoltaic cell and limitations of solar cell.
R19PH603.3	Build the concept to design PV systems for various applications.
R19PH603.4	Learn the socio-economic and environmental merits of photovoltaic systems for a variety of applications.
R19PH603.5	Summarize the prospects of photovoltaic technology for sustainable power generation.

R19PH604	Medical Physics	L	T	P	C
		3	0	0	3

1. Course Description:

This course will provide a solid background in the radiation physics, interaction of radiation with matter and the basic dosimetry concepts and radiation detectors. It enables to make use of the methods and technologies employed in modern medical physics. It is concerned with the use of various imaging modalities to aid in the diagnosis of disease, radiation therapy and radiation protection.

2. Course Objectives:

1. To teach the different electromagnetic spectrum and radiation aspects to categorize the interaction of radiation with matter.
2. To impart knowledge on the basics of how radiological imaging is computed to experiment with various imaging Equipment.
3. To review the radiation principles and to utilize the working and applications of various advanced analytical devices.

3. Syllabus

Unit – I: Introduction to X-Rays

Electromagnetic Spectrum - Production of X-rays - X-ray Spectra - Bremsstrahlung - Characteristic X-ray - X-ray Tubes - Coolidge Tube - X-ray Tube Design - Tube Cooling - Stationary Mode - Rotating Anode X-ray Tubes - Tube Rating - Quality and Intensity of X-ray, X-ray Generator Circuits - HT Cables.

Unit – II: Radiation Physics

Radiation Units - Exposure - Absorbed Dose - Rad Gray - Relative Biological Effectiveness - Effective Dose - Sievert - Inverse Square Law - Interaction of Radiation with Matter - Linear Attenuation Coefficient. Radiation Detectors -Thisble Chamber - Condenser Chambers - Geiger Counter - Scintillation Counter - Ionization Chamber - Dosimeters.

Unit – III: Medical Imaging Physics

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Radiological Imaging - Radiography - Filters - Grids - Cassette - X-ray Film - Film Processing - Fluoroscopy - Computed Tomography Scanner - Principal Function - Display - Generations - Mammography. Ultrasound Imaging, Magnetic Resonance Imaging - Thyroid Uptake System - Gamma Camera (Only Principle, Function and Display)

Unit – IV: Radiation Therapy Physics

Radiotherapy - Kilo Voltage Machines - Deep Therapy Machines - Tele-cobalt Machines - Medical Linear Accelerator. Basics of Teletherapy Units - Deep X-ray, Telecobalt Units, Medical Linear Accelerator - Radiation Protection - External Beam Characteristics - Phantom - Dose Maximum and Build Up - Bolus - Percentage Depth Dose - Tissue - Air Ratio - Back Scatter Factor.

Unit – V: Radiation Protection

Principles of Radiation Protection - Protective Materials - Radiation Effects - Somatic, Genetic Stochastic and Deterministic Effect, Personal Monitoring Devices - TLD Film Badge - Pocket Dosimeter.

Text Books:

1. Thayalan, K. "Basic Radiological Physics", Jayapee Brothers Medical Publishing Pvt Ltd, New Delhi, 2003.
2. Khan, F.M. "Physics of Radiation Therapy", Williams and Wilkins [3rd Edition] 2003.

References:

Reference Books:

1. Williams and Wilkins, "Christensen's Physics of Diagnostic Radiology", Cutry Dowdey and Murry - Lippincot, 1990.
2. Bushberg, Seibeft, Leidholdt, Boone Lippincot Williams and Wilkins, "The Essential physics of Medical Imaging [2nd Edition], 2002.

Journals:

1. https://www.sciencedirect.com/journal/physica-medica
2. https://aapm.onlinelibrary.wiley.com/journal/15269914
3. https://iopscience.iop.org/page/medical-physics-and-biophysics
4. https://journals.lww.com/jomp/pages/default.aspx
5. https://medicalphysics.imedpub.com/

Video References:

1. https://www.youtube.com/watch?v=7LBkmoOuMXY
2. https://www.youtube.com/watch?v=cLMVb6NvRq4
3. https://www.youtube.com/watch?v=0q9wTyGhqFs
4. https://www.youtube.com/watch?v=gEwo4mHhzS0
5. https://www.youtube.com/watch?v=NyEqt-yF7J4

MOOC/SWAYAM/NPTEL Courses:

1. https://archive.nptel.ac.in/courses/113/106/113106069/
2. https://archive.nptel.ac.in/courses/108/105/108105091/
3. https://archive.nptel.ac.in/content/storage2/courses/104103068/module1/lec1/2.html

4. Course Outcomes:

After the completion of syllabus, students should be able to:

CO. No.	Course Outcome
R19PH604.1	Recall on the Characteristics and Production of X-rays.
R19PH604.2	Summarize Theory of Radiation and Various Radiation Chambers.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19PH604.3	Explain Principle and the Function of Various Imaging System.
R19PH604.4	Discuss Basic Teletherapy Techniques.
R19PH604.5	Analyze Various Measures and Radiation Protection Devices.

R19CY601	Chemical Sensors and Bio Sensors	L	T	P	C
		3	0	0	3

1. Course Description:

This course provides the understanding of how to measure and analyze chemical and biological processes but also contributes to advancements in various fields that directly impact daily life and global challenges. These types of sensors are critical in scientific research and help in research development, chemical analysis and environmental studies, healthcare, pharmaceuticals, and biological research and medical diagnostics for biological contaminants or pathogens. The aim of this course is to offer students with an insight into the engineering students for optimal utilization of resources in scientific, research, technological, and industrial applications.

2. Course Objectives:

1. To obtain the knowledge about basic principles of biological, chemical and optical sensors and its characteristics applications
2. To acquire industrial and medical applications in sensors and key its role in medicinal and industrial real time benefits.
3. To study innovative methods and up-to-date chemical knowledge that inspires pupils to Communicate well and express them.
4. To gain the knowledge of sensors and its types in various industrial and research development field.

3. Syllabus

Unit – I: Introduction to Sensors

Definitions, Basic principles, theoretical background-components of interactions (covalent and non-covalent), Fundamental sensing, Molecular sensors.

Unit – II: Chemical Sensing Elements

Ionic recognition: molecular recognition-chemical recognition agent-spectroscopic recognition-biological Recognition agents; Immobilization of biological components: performance reactors of Urea Biosensors, Amino Acid Biosensors, Glucose Biosensors and Uric Acid, factors affecting the performance of sensors.

Unit – III: Biosensors

Bio sensors: Catalytic biosensors; mono enzyme electrodes; bi-enzyme electrodes: enzyme sequence electrodes and enzyme competition electrodes; Affinity-based biosensors; Inhibition based biosensors; cell-based biosensors; Biochips and biosensor arrays; problems and limitations.

Unit – IV: Chemical Sensors

Introduction to chemical sensing; Potentiometry: fundamental principles, membrane potentials, Applications of potentiometry; ion-selective electrodes; Amperometry: fundamental principles, diffusion limited currents, Applications of Amperometry; the Clark oxygen electrode; glucose sensors in diabetes: enzyme electrodes, immunosensors.

Unit – V: Application of Sensors

Automotive Sensors: Environmental Sensors-Sensors for Medical Diagnosis and patient monitoring, Aerospace sensors.

Text Books:

1. Brain R Eggins -Biosensors an Introduction, First edition, John Wiley & Sons Publishers, 1996
2. T.E. Edmonds, Chapman and Hall: Principles of Chemical Sensors, J Janata, Plenum Press

References:

Chairman – Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore 641 202.

Reference Books:

1. Chemical Sensors and Biosensors; Brian, R Eggins; Wiley; New York, Chichester, 2002.
2. Biosensor: A Practical Approach, J. Cooper & C. Tass, Oxford University Press, 2004.
3. Donald G. Buerk - Biosensors Theory and Applications, First Edition Technomic Publishing, Co,Inc, 1993.
4. Sensors- A Comprehensive study-W.Gopal, J Hesse, J N Zemel

Journals:

1. https://onlinelibrary.wiley.com/doi/book/10.1002/9781118354162
2. https://www.springer.com/series/5346
3. https://pubs.rsc.org/en/content/articlelanding/2015/ra/c4ra13080d
4 https://www.sciencedirect.com/science/article/abs/pii/S0166526X03801149

Video References:

1. https://www.youtube.com/watch?v=8-Gtr6eWSTY
2 .https://www.youtube.com/watch?v=z4hgRj5QsZQ
3. https://www.youtube.com/watch?v=9IVmGDgVFdQ.
4. https://www.youtube.com/watch?v=kQ6CY1qpGjY
5. https://www.youtube.com/watch?v=nfxhJxmuUYE

MOOC/SWAYAM/NPTEL Courses:

1. https://nptel.ac.in/courses/102104062
2. https://onlinecourses.nptel.ac.in/noc24_ee45/preview
3. https://nptel.ac.in/courses/115107122

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19CY601.1	To understand the basic principles of biosensing in terms of biological, chemical and optical responses.
R19CY601.2	To realize the chemical sensing methods and material characteristics to be applied in biosensors.
R19CY601.3	Demonstrate knowledge of the industrial and socioeconomic context of biosensor development and market.
R19CY601.4	Understand the operation principle of potentiometric, aerometric sensors their applications.
R19CY601.5	Apply the sensor measurements for various applications.

R19CY602	Energy Storage Devices	L	T	P	C
		3	0	0	3

1. Course Description:

This course provides the understanding of how to measure and analyze chemical and biological processes but also contributes to advancements in various fields that directly impact daily life and global challenges. These types of sensors are critical in scientific research and help in research development, chemical analysis and environmental studies, healthcare, pharmaceuticals, and biological research and medical diagnostics for biological contaminants or pathogens. The aim of this

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

course is to offer students with an insight into the engineering students for optimal utilization of resources in scientific, research, technological, and industrial applications.

2. Course Objectives:

1. understanding about conventional energy resources and its applications
2. Acquire industrial compressed air, bio-chemical energy storage systems and various types of applications.
3. Obtain idea about various existing batteries to the currently available batteries to Communicate well and express them.
4. To gain knowledge of fuel cells and their basic principle, comparative performance of supercapacitors which corresponds with futuristic materials

3. Syllabus

Unit – I: Energy Demands and Energy Sources

Energy Scenario: Indian and Global Perspectives: Need, consumption and demand. Non-conventional renewable energy Sources-Potential of renewable energy sources- Solar energy types. Wind energy. Wave, tidal and OTEC.

Unit – II: Energy Storage: Different Approaches

Potential energy: Pumped hydro storage, KE and Compressed gas system: Flywheel storage, compressed air energy storage, Electrical and magnetic energy storage: Capacitors, electromagnets. Chemical Energy storage: Thermo-chemical, photo-chemical, bio-chemical, electro-chemical, fossil fuels and synthetic fuels: Hydrogen for energy storage and Solar Ponds for energy storage

Unit – III: Batteries

Primary, Secondary batteries; the difference between primary and secondary batteries, chemistries of primary batteries such as Zinc-Carbon, Alkaline and secondary batteries such as Lead acid, Nickel Cadmium, Metal hydrides, lithium-ion, high-temperature batteries- sodium-sulphur.

Unit – IV: Fuel Cells

Fuel Cell Technology: type of fuel cells, Operating principles of Fuel Cell, Fuel and Oxidant Consumption, Fuel Cell System Characteristics, application and limits.

Unit – V: Supercapacitors

Super/ultracapacitors; Basics of Electrochemical Supercapacitors, Types and electrolyte interfaces and their capacitances, Charge-Discharge density, RuOz as a material for electrochemical capacitors, various metal Coupling with batteries and fuel cells- Applications.

Text Books:

1. C. Daniel and Jurgen O. Besenhard, Handbook of Battery Materials, Wiley-VCH Verlag, 2011
2. Battery Technology Handbook by H. A. Kiehne, Marcel Dekker, Inc. , New York, Basel

References:

Reference Books:

1. Doughty Liaw, Narayan and Srinivasan, "Batteries for Renewable Energy Storage", The 1' Electrochemical Society, New Jersy,2010.
2. "Jim Eyer, Garth Corey", Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide, Report, Sandia National Laboratories, Feb 2010.
3. Electrochemical Supercapacitors, Scientific Fundamentals and Technological Applications By B. E. Conway, Kluwer Academic/ Plenum Publishers, New York, Boston, Dordj€ncht, London, Moscow, 1999.

Journals:

1. https://www.sciencedirect.com/topics/engineering/energy-storage-application
2. https://www.mdpi.com/1996-1073/16/16/5930
3. https://www.sciencedirect.com/science/article/pii/S259000722300059X
4. https://www.intechopen.com/chapters/83927

Video References:

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

1. https://www.youtube.com/watch?v=qMlOgDzPEKU
2 .https://www.youtube.com/watch?v=f_DTiHSZqqw
3. https://www.youtube.com/watch?v=5_lDGna9MBM
4 .https://www.youtube.com/watch?v=LKw5KjOr8hw
5. https://www.youtube.com/watch?v=E-m7Psbuup0

MOOC/SWAYAM/NPTEL Courses:

1. https://www.youtube.com/watch?v=yar51GJVqgg
2. https://archive.nptel.ac.in/courses/113/105/113105102/
3. https://onlinecourses.nptel.ac.in/noc22_ch66/preview

4. Course Outcomes:

After the successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19CY602.1	Understand the characteristics of energy from various sources and need for storage
R19CY602.2	Classify various types of energy storage and various devices used for the purpose
R19CY602.3	To address the underlying concepts, methods and application of batteries
R19CY602.4	Illustrate the various types and working principle of R fuel cells
R19CY602.5	Understand the utilization of next generation super-capacitors and its applications.

R19CY603	Chemistry in Forensic Science	L	T	P	C
		3	0	0	3

1. Course Description:

This course provides the understanding of how to measure and analyze chemical and biological processes but also contributes to advancements in various fields that directly impact daily life and global challenges. These types of sensors are critical in scientific research and help in research development, chemical analysis and environmental studies, healthcare, pharmaceuticals, biological research and medical diagnostics for biological contaminants or pathogens. This course aims to offer students with an insight into the engineering students for optimal utilization of resources in scientific, research, technological, and industrial applications.

2. Course Objectives:

1. Understanding conventional energy resources and their applications.
2. Acquire industrial compressed air, bio-chemical energy storage systems and various types of applications.
3. Obtain ideas about various existing batteries to the currently available batteries to communicate well and express them.
4. To gain knowledge of fuel cells and their basic principle, comparative performance of supercapacitors which corresponds with futuristic materials

3. Syllabus

Unit – I: Preamble to Forensic Science

Forensic Science: History and development - Scope and need of forensic science in criminal justice system- Role of the Forensic Laboratory: Organization setup of Forensic Science Laboratory: Structure and function of State, Regional and Central Forensic Science Laboratories.

Unit – II: Forensic Tools and Techniques

Principles of Chromatography, Classification of Chromatographic Methods, Adsorption and Partition Chromatography. Thin Layer Chromatography: Basic Principle, Setup, visualization and Forensic applications.

Unit – III: Chemistry and Analysis of Drugs

Drug Chemistry, Origin, Pharmacology, Methods of preparation, Storage, Diluents and Adulterants, Sample Handling, Optimization of Experimental Conditions, Screening- and Confirmatory Methods: Colour/spot test, Microcrystalline tests, NMR, UV Spectrophotometry, IR Spectrophotometry.
Unit – IV: Explosives and Arson
Explosives: Chemistry of explosives, Characteristics of high and low explosives. Analysis of Explosive: Pre-blast and Post blast residue collection, Systematic examination of explosives and explosion residues in the laboratory using chemical and instrumental techniques and Interpretation of results. **Arson**: Arson motives, Degrees of Arson, Scheme of analysis: Extraction of samples from debris (Direct and solvent extraction methods, SPME, Distillation), Analysis (GC-MS, SEM), Interpretation of GC-MS spectra.
Unit – V: Analytical Forensic Toxicology
Samples required in Toxicological analysis - Alternative specimens: Drugs in oral fluid, Detection of drugs in sweat etc. - Alcohol Intoxication & analysis, Chemical tests for alcohol in blood and urine. Breath Alcohol Screening devices- Method of analysis of beverages in biological materials by chemical methods (Kozelka- Hine) and instrumental Methods (GC).
Text Books:
1. James, S.H and Nordby, J.J. "Forensic Science: An introduction to scientific and investigative techniques CRC Press", 2003.
References:
Reference Books: 1. Nanda B.B and Tewari R.K, "Forensic Science in India- A vision for the twenty-first century", Select Publisher, New Delhi, 2001. 2. Houck M M, "Mute witness: trace evidence analysis", Academic Press, 2001. 3. Yinon Litrin, "Modern Methods & Application in Analysis of Explosives," John Wiley Sons, England, 1993. **Journals:** 1. https://www.sciencedirect.com/journal/forensic-chemistry 2. https://www.frontiersin.org/journals/analytical-science/sections/forensic-chemistry 3. https://link.springer.com/chapter/10.1385/1-59259-946-X:91 4. https://link.springer.com/journal/11419 **Video References:** 1. https://www.youtube.com/watch?v=wl9prpOuHD8 2. https://www.youtube.com/playlist?list=PLCP8L39atqUrkDliAkEMdIMA_idd_v0AU 3. https://www.youtube.com/watch?v=TPV6T3KpAmo 4. https://www.youtube.com/watch?v=QevbUnyEgzs 5. https://www.youtube.com/watch?v=iNW37r_snHY **MOOC/SWAYAM/NPTEL Courses:** 1. https://archive.nptel.ac.in/noc/courses/noc21/SEM2/noc21-cy28/ 2. https://www.youtube.com/user/nptelhrd 3. https://www.youtube.com/c/NPTELSpecialLectureSeries

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19CY603.1	Understand various branches of Forensic science and their functions.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19CY603.2	Describe how different tools and assays can be used in Investigations.
R19CY603.3	Understand the composition of drugs.
R19CY603.4	Apply summarize the chemistry behind arson and explosives.
R19CY603.5	Identify and assess the value of various techniques for forensic applications.

R19CY604	Industrial and Material Chemistry	L	T	P	C
		3	0	0	3

1. Course Description:

This course delves into the intersection of chemistry with industrial processes: exploration of large-scale chemical production methods, including reactions, separation techniques, and process optimization. This topic describes the principles and environmental impact, sustainability improvement, and industrial progression. Its main focus is on material properties, synthesis methods, and applications in technology and manufacturing.

2. Course Objectives:

1. Understand the requirements of food and packaging
2. Apply the concepts relevant to petroleum products
3. Summarize the manufacturing processes of various fertilizers.
4. Understand, identify the ingredients and types of soaps and detergents.
5. Understand the controlling methods of environmental problems in metallurgical processes.

3. Syllabus

Unit – I: Food and Packaging Industry

Chemical Composition of common foodstuffs, methods of food preservation and processing by heat, chill storage, deep freezing, drying, concentration, fermentation and radiation. Packaging-Concepts & Significances. Primary packaging media - Paper boards, metals, plastics, glass, flexible materials Labels, caps and adhesives. Testing & evaluation of packaging media. Environmental, ecological & Economic issues, recycling and waste disposal.

Unit – II: Petrochemical Industries

Crude oil - constitution and distillation - composition of different distillates -ignition point, flash point octane number - cracking - catalysts used in petroleum industries - structure, selectivity and applications, Manufacture of synthetic petrol - Fischer Tropsh process- Manufacture of petrochemicals and petrochemical polymers.

Unit – III: Fertilizers and Speciality Chemicals

Fertilizers -Raw materials, manufacture (flow chart - chemical process with equations) of ammonium nitrate, ammonium sulphate, urea, calcium ammonium nitrate, sodium nitrate, ammonium chloride, ammonium phosphate, superphosphate of lime, NPK fertilizers.
Manufacture - Properties and industrial uses of solvents - DMF, DMSO and THF.

Unit – IV: Oils, Soaps and Detergents

Oils - the difference between oils and fats - manufacture of cotton seed oil and soya bean oil - manufacture of soaps - toilet and transparent soaps - Detergents - synthetic detergents - . surface active agents and their classification - manufacture of anionic, cationic and non-ionic detergents and shampoo.

Unit – V: Metallurgy

General methods of metallurgy - ores - types - methods of concentrations of ores - hydrometallurgy, pyrometallurgy, refining of metals extraction of Cr, Mfl, Pt, U and Th.
Environmental problems of chemical industries -waste management. methods of control - sewage treatment and waste management.

Text Books:

1. Sharma 8.K., Industrial Chemistry, Goel Publishing House, Meerut, 2003,

References:

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Reference Books:

1. Alan Cottrel, An Introduction to Metallurgy, Orient Longman, 2000.
2. James A. Kent, Riegel's Handbook of Industrial Chemistry. Springer Science & ustness Media, 2003.

Journals:

1. https://www.sciencedirect.com/journal/materials-chemistry
2. https://asianpubs.org/index.php/ajmc
3. https://www.rsc.org/journals-books-databases/about-journals/industrial-chemistry-materials/
4 https://www.sciencedirect.com/journal/journal-of-industrial-and-engineering-chemistry

Video References:

1. https://www.youtube.com/playlist?list=PLLnAFJxOjzZs8uuljB_7T4otrip_evaVz
2. https://www.youtube.com/watch?v=inz_n9veiXY
3. https://www.youtube.com/user/wwwrscorg
4. https://www.youtube.com/channel/UCBNvvmhKeuZZhWCA7Yddkig

MOOC/SWAYAM/NPTEL Courses:

1. https://archive.nptel.ac.in/courses/104/105/104105103/
2. https://nptel.ac.in/courses/104104011
3. https://nptel.ac.in/courses/104103019

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19CY604.1	Understand the requirements of food and packaging Industries.
R19CY604.2	Apply the concepts relevant to petroleum products
R19CY604.3	Summarize the manufacturing processes of various fertilizers.
R19CY604.4	Identify the ingredients and types of soaps and detergents.
R19CY604.5	Understand the controlling methods of environmental problems in metallurgical processes.

R19HS601	English for Competitive Examinations	L	T	P	C
		3	0	0	3

1. Course Description:

This open elective course is designed to equip engineering students with the essential English language skills needed to excel in competitive examinations. Emphasizing technical proficiency and general communication, the course covers key areas such as comprehension, vocabulary building, grammar, and writing skills, all tailored to the context of engineering

2. Course Objectives:

1. Develop a strong command of technical and general English vocabulary relevant to engineering disciplines.
2. Enhance reading comprehension skills through the analysis of academic texts, articles, and examination papers.
3. Improve writing skills for technical reports, essays, and application letters.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

4. Strengthen listening and speaking skills through interactive discussions, presentations, and mock interviews.
5. Familiarize students with the format and types of questions commonly found in competitive exams.

3. Syllabus

Unit I: Vocabulary Enrichment

Spelling Rules: Root words, Prefix, Suffix – Synonyms & Antonyms – Practice – Punctuations – Question Mark (?), Exclamation Mark(!), Full stop (.), Comma (,), Quotation Mark (“”), Colon (:), Semi-Colon (;), Apostrophe (‘) – Commonly Misspelled Words – Practice.

Unit II: Essential of Tenses

Tenses – Present, Past, Future Tenses Essential – Practice – Active and Passive Voice – Direct & Indirect Speech – Fill in Blans – Sentence Correction/Error Spotting – Rearrangement of Sentences – Paragraph Completion.

Unit III : Essential Parts of Speech

Noun – Traditional and Modern Nouns – Gerund, Gender, Number, Case – Practice – Pronoun – Types of Pronouns and its Essentials – Verbs – Types of Verbs and its Essentials – Adverb – Types of Adverbs and its Essentials – Adjective – Types of Adjectives and its Essentials.

Unit IV :Parts of Speech

Prepositions – Types of Prepositions and its Essentials – Conjunctions – Types of Conjunctions and its Essentials – Interjections – Types of Interjection and its Essentials – Fill in the Blanks – Conjunctions, Preposition etc – Concord; Subject Verb agreement – Degrees of Comparison – Articles – Conditional Sentences.

Unit V : Principles of Writing

Reading Comprehension – Hints Development – Paragraph Writing – Essay Writing (Expository Essays, Persuasive Essays, Narrative Essays, Descriptive Essays) – Letter Writing/ Precise Writing – Email Etiquette/ Email Writing.

Text Books:

1. APAART: Speak Well 1 (English language and communication)
2. APPART: Speak Well 2 (Soft Skills)
3. 2. S. N. Mahalakshmi, “Communicative for Engineers”, V. K. Publications; Chennai, Ninth Edition, 2019.

References:

Reference Books:

1. Rizvi M.Ashraf, “Effective Technical Communication”, Tata McGraw Hill Publishing Company; New Delhi, 2007.
2. Alan Mccarthy and O’dell – English Vocabulary in Use – Third Edition – Cambridge University Press 2017.
3. Dr. Saroj Hiermath – Business Communication – Nirali Prakashan.
4. Richards C. Jack, “Interchange”, Fourth edition; Cambridge University Press, 2012.
5. Butterfield, Jeff, “Soft skills for Everyone”, Sixth Indian Reprint, 2015.

Journals:

1. The Journal of English Language Teaching
2. English Language Teaching Journal
3. TESOL Quarterly

Video References:

1. www.youtube.com/watch?v=Hzj6Lbp3z0Y
2. www.youtube.com/watch?v=53V09Wuv0m0

Web References:

1. https://leo.stcloudstate.edu/grammar/subverag.html
2. http://www.learningdifferences.com/Main%20Page/Topics/Compound%20Word%20Lists/Compound_Word_%20Lists_complete.htm

Chairman – Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore – 641 202.

3. http://examples.yourdictionary.com/examples-of-active-and-passive-voice.html
4. http://www.perfectyourenglish.com/grammar/numeral-adjectives.htm
5. https://en.wikipedia.org/wiki/Commonly_misspelled_English_words
6. https://www.englisch-hilfen.de/en/grammar/if.htm
7. http://www.englishforeveryone.org/Topics/Reading-Comprehension.htm

MOOC/SWAYAM/NPTEL Courses:

1. https://archive.nptel.ac.in/courses/109/106/109106116/
2. https://onlinecourses.nptel.ac.in/noc24_hs73/preview

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19HS601.1	Remember the Vocabulary and Punctuation rules.
R19HS601.2	Understand the concept, process and importance of communication.
R19HS601.3	Apply Essentials of the different parts of speech in English.
R19HS601.4	Organize and write grammatically correct sentences.
R19HS601.5	Make them to write and appreciate different types of prose.

R19HS602	Personality Development and Interpersonal Skills	L	T	P	C
		3	0	0	3

1. Course Description:

This open elective course is designed for engineering students to enhance their personal and professional growth through the development of essential interpersonal skills and personality traits. In today's competitive environment, technical proficiency alone is not sufficient; effective communication, teamwork, and emotional intelligence are critical for success in the engineering field.

2. Course Objectives:

1. To understand the components of personality and how they influence personal and professional interactions.
2. To develop effective communication skills, including verbal, non-verbal, and written communication.
3. To cultivate emotional intelligence and self-awareness for better relationship management.
4. To enhance teamwork and collaboration skills through group activities and discussions.
5. To build confidence in public speaking and presentation skills.

3. Syllabus:

Unit – I: Personality Development

Personality: Concept, Significance, Determinants, Dimensions, Personal Grooming, Personal Hygiene, Social Etiquette.

Unit – II: Aspects of Personality Development

Character building, Leadership and qualities, Teamwork, Decision, Problem-solving, Time management, Conflict & Stress Management, Work ethics.

Unit – III:Traits Required for Personality Development

Importance of self-motivation, Attitude, Factors affecting attitude, Positive attitude, Advantages, Negative attitude, Disadvantages, Ways to develop positive attitude, Difference between Personalities having Positive and Negative Attitude, Significance, Internal & external motives

Unit – IV:Essentials of Body Language

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Body Language: Verbal & Non-Verbal Communication, Significance, Types and functions of Body Language, Mock Sessions, 7'Cs of Effective Communication.
Unit – V: Interpersonal Relationships
Interpersonal Relationship, Self-Analysis (Strength & Weakness), Teaming, Types of Reams, Team Roles and Behaviour (Developing positive personality), Analysis of strengths and weakness, Group Discussion, Concept, Etiquettes, Mock GD.
Text Books:
1. APAART: Speak Well 1 (English language and communication) 2. APAART: Speak Well 2 (Soft Skills) 3. S Bhatnagar, Nitin and Mamta Bhatnagar. Communicative English for Engineers and Professionals. Pearson: New Delhi, 2010. 4. Hughes, Glyn and Josephine Moate. Practical English Classroom. Oxford University Press: Oxford, 2014.
References:
Reference Books: 1. Rizvi M. Ashraf, "Effective Technical Communication", Tata McGraw Hill Publishing Company; New Delhi, 2007. 2. Ladousse, Gillian Porter. Roll. Play. Oxford University Press: Oxford, 2014. 3. Richards C. Jack. Person to Person (Starter). Oxford University Press: Oxford, 2006. **Journals:** 1. Journal of Personality and Social Psychology 2. International Journal of Interpersonal Relationships 3. Journal of Applied Psychology **Video References:** 1. www.youtube.com/watch?v=J8N6R_Lq6I4 2. www.youtube.com/watch?v=9pTg7ZmAiH4 **Web References:** 1. https://leo.stcloudstate.edu/grammar/subverag.html 2. http://www.learningdifferences.com/Main%20Page/Topics/Compound%20Word%20Lists/Compound_Word_%20Lists_complete.htm 3. http://examples.yourdictionary.com/examples-of-active-and-passive-voice.html 4. http://www.perfectyourenglish.com/grammar/numeral-adjectives.htm 5. https://en.wikipedia.org/wiki/Commonly_misspelled_English_words 6. https://www.englisch-hilfen.de/en/grammar/if.htm 7. http://www.englishforeveryone.org/Topics/Reading-Comprehension.htm **MOOC/SWAYAM/NPTEL Courses:** 1. nptel.ac.in/courses/109/103/109103131/ 2. nptel.ac.in/courses/109/104/109104149/

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19HS602.1	Understand the concepts, process and importance of Personality Development.
R19HS602.2	Understand the essentials of Body language.
R19HS602.3	Recognize the ethical dimensions of interpersonal relation.
R19HS602.4	Understand the concept of personality and personality development and its significance.
R19HS602.5	Understand and develop various traits required for personality development.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

R19HS603	Communication Techniques for Employability	L	T	P	C
		3	0	0	3

1. Course Description:

This open elective course equips engineering students with essential communication skills to enhance employability in competitive job markets. Recognizing that effective communication is vital in professional settings, this course focuses on developing verbal, non-verbal, and written communication techniques tailored to the engineering field.

2. Course Objectives:

1. To understand the role of communication in professional success.
2. To improve verbal and non-verbal communication skills for interviews and presentations.
3. To develop strong written communication skills, including resume writing and email etiquette.
4. To practice effective listening and feedback techniques.
5. To enhance networking skills and professional relationship-building.

3. Syllabus:

Unit -I: Communication Skills

Methods of communication – Verbal – Non-Verbal – Principles of Effective Communication – Barriers to effective communication – Measures to overcome barriers in effective communication.

Unit -II: Self-Management Skills

Self-regulation – Self Motivation – Significance and its uses – self-awareness – Types of self-awareness – ability to work independently – Types of Meaning and importance of stress management – Stress management techniques – physical exercise, yoga, meditation – Vacations with family and friends – Taking nature Walks.

Unit -III: Information and Communication Technology Skills

Classes of operating systems – Menu, icons and taskbar on the desktop – File concept, file operations, file organization, directory structures, and file – system structures – Creating and managing files and folders Importance and need of care and maintenance of computer – Cleaning computer components – Preparing maintenance schedule – Protecting computer against viruses – Scanning and cleaning viruses and removing SPAM files, temporary – files and folders.

Unit -IV: Entrepreneurial Skills

Entrepreneurship and society – Qualities and functions of an entrepreneur – Role and importance of an entrepreneur – Entrepreneurship as a career options.

Unit – V: Employability Quotient

Resume building – The art of participating in group discussion – Acing the Personal (HR & Technical) Interview – Frequently Asked Questions - Psychometric Analysis – Mock Interview Sessions.

Text Books:

1. APAART : Speak Well 1(English language and communication).
2. Ahmad, K. (2012). Relationship between employability and graduates' skill. International Business Management,6,440-445.
3. S Bhatnagar, Nitin and Mamta Bhatnagar. Communicative English for Engineers and Professionals Pearson: New Delhi,2020.
4. Hughes,Glyn and Josephine Moate. Practical English Classroom, Oxford University Press: Oxford,2014.

References:

Reference Books:

1. Rizvi M.Ashraf, "Effective Technical Communication", Tata McGraw Hill Publishing Company; New Delhi, 2007.
2. Kalam, A.P.J. A (2006).Capacity building for entrepreneurship, University News (An AIU Newsletter), 44,189-190.

Journals:

Chairman – Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

Chairman – Board of Studies

1. Journal of Communication
2. Business Communication Quarterly
3. International Journal of Business Communication
4. Communication Education
5. Journal of Applied Communication Research
6. Journal of Workplace Learning

Video References:

1. www.youtube.com/watch?v=kaWw9FJSy6E
2. www.youtube.com/watch?v=OT1-Z9IoUO4

NPTEL/MOOC/SWAYAM Courses:

1. nptel.ac.in/courses/109/104/109104149/
2. nptel.ac.in/courses/109/105/109105136/

4. Course Outcomes:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19HS603.1	Demonstrate the knowledge and various methods of communication.
R19HS603.2	Identify the stress management techniques.
R19HS603.3	Apply basic skills for care and maintenance of the operating system.
R19HS603.4	Understand the concept of Entrepreneurial skills.
R19HS603.5	Develop and maintain a Good Resume.

R19HS604	Mass Communication	L	T	P	C
		3	0	0	3

Course Description:

This open elective course explores the fundamental concepts and practices of mass communication, tailored specifically for engineering students. In an age where technology and communication converge, understanding mass media is crucial for effective information dissemination and public engagement. Students will examine various media forms, the role of communication in society, and the skills necessary to communicate effectively within and beyond their technical fields.

Course Objectives:

1. Analyse the evolution and functions of various media channels, including print, broadcast, and digital platforms, and their impact on society and technology.
2. Learn to create engaging and informative content suitable for diverse audiences, focusing on clarity, coherence, and effective storytelling techniques.
3. Improve verbal and written communication skills to effectively convey technical information to non-specialist audiences, facilitating better understanding and collaboration.
4. Foster critical thinking skills to assess media content, identify biases, and understand the role of media in shaping public perception and opinion.
5. Examine ethical issues in mass communication, including the responsibilities of communicators, the impact of misinformation, and the importance of responsible media practices.

Syllabus:

Unit I Communication

Elements, Functions and Dimensions – Theories of Communication (Cross Cultural Communication,
Cultural Identity Theory, Face Negotiation Theory – Accommodation Theory (CTA), - Barriers of Communication: Semantic, Physical, Environmental, Attitudinal and Cultural.

Unit II Principles of Mass Communication

Nature and Process of Human Communication – Communication Models – Nature and Process of Mass Communication – Media Systems and Theories – Ownership – Patterns of mass media – media and Social Responsibility.

Unit III Development of Media

Print: Language and Society – Early Communications Systems in India – Newspapers and Magazines in the 19th century in India – Birth of the Indian Languages Press – The Indian Press and Freedom Movement – Journalism in Indian Languages – The press in India after Independence – Social Issues –
Radio: Development of Media as a medium of Mass Communication - Emergence of AIR – Commercial broadcasting – FM: Television – Development of Television as a Medium of Mass Communication – Historical Perspective of Television in India – Satellite and Cable Television in India – Films – Early efforts – Film as a Mass Medium – Historical Developments of Indian Films – Silent era – Indian Cinema after Independence – Parallel Cinema/Commercial cinema – Documentaries –Issues and Problems of Indian Cinema – Folk Media: Traditional Media in India – Regional Diversity – Content, Form, Utility, Evaluation, Future – New Media: Development of New Media – Convergence – Internet.

Unit IV Print Media

Reporting: News – Interviewing- Interpretative Reporting – Investigative Reporting – political Reporting – Legislative Reporting – Diplomatic Reporting – Scoops and Specialized Reporting – Editing: meaning and Purpose – Proof Reading – News Desk, editorial department set-up, news flow, copy management and organization – Headlines – Magazine Editing, Layouts, Graphics.

Unit V Advertising

Evolution and Growth of Advertising - Advertising tools and practices - Mass Media Laws concerning advertising - Ad Agency Management - Activity based on advertising - Client-related issues and process - Process of Motivation and theories of motivation - Advertising research.

Text Books:

1. Bever S.H., et.al., The Sociology of Mass Media Communications, The Social Review, The University of Keele, Staffordshire, 1969.
2. David K. Berlo, The Process of communication, Holt Rhinehart and Winston, 1960.
3. Keval J. Kumar, Mass Communication in India, Vikas Publications New Delhi, 1994.
4. Hughes, Glyn and Josephine Moate. Practical English Classroom. Oxford University Press: Oxford, 2014.

References

References Books:

1. Krishna Moorthy, V.S., Modern Trends in Printing Technology
2. Clement J. Jones, Mass Media, Code of Ethics and Councils.

Journals:

1. Journalism & Mass Communication Quarterly
2. Mass Communication and Society
3. Communication Research
4. Journal of Communication
5. New Media & Society
6. Television & New Media

Video References:

1. https://www.youtube.com/shorts/K6rUorovQ2E
2. https://www.youtube.com/shorts/fIOyB36seYg
3. https://www.youtube.com/shorts/uxM2esd93II

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.

NPTEL/SWAYAM/MOOC Courses:
1. https://ugcmoocs.inflibnet.ac.in/index.php/courses/view_ug/125
2. https://ugcmoocs.inflibnet.ac.in/index.php/courses/view_ug/79

4. COURSE OUTCOMES:

After successful completion of the course, the student should be able to:

CO. No.	Course Outcome
R19HS604.1	Understand basic concepts of communication and its role in society
R19HS604.2	Understands the basics of journalism and its role in society.
R19HS604.3	Introduce different types of media and their characteristics, merits and demerits.
R19HS604.4	Make students understand the historical underpinnings of media theories with relevant models.
R19HS604.5	Understand the importance of advertising and the role of journalism in framing it.

Chairman - Board of Studies
Department of Electrical and Electronics Engineering
Sri Eshwar College of Engineering (Autonomous)
Kinathukadavu, Coimbatore - 641 202.