B.E. (Electronics and Communication Engineering)

CURRICULUM AND SYLLABUS HANDBOOK
Regulation 2023

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. Problem Solving Mindset
3. Spirit of Collaboration
4. Culture of Innovation
5. Responsibility to Society

2.0 Vision and Mission of the Department of Electronics and Communication and Engineering

Vision

"To groom students into futuristic and globally competent Electronics and Communication engineering professionals."

Mission

M1: To impart quality education with moral and ethical values to develop competent engineers, leaders and successful entrepreneurs.

M2: To establish state-of-art infrastructure and provide opportunities to update on emerging tools and technologies.

M3: To empower the faculty towards excellence in teaching – learning, consultancy, research and development activities.

M4: To foster socially relevant and industry oriented innovation among students.

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

PEO1: Pursue career in multinational organizations, research organizations and core industries, higher studies at premier institutions and establish start-ups.

PEO2: Acquire core competencies in Electronics and Communication Engineering and exposure to latest Electronic Design Automation (EDA) tools.

PEO3: Exhibit professional skills and collaborative work experience.

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.

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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.

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

PO1: **Engineering Knowledge**: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization 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).

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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. (ECE) Program Specific Outcomes (PSOs)

PSO1: Interpret and Design Electronic systems using the Internet of Things, VLSI Technology and Efficient signal processing algorithms.

PSO2: Apply knowledge to solve problems in Communication Systems and Networks.

7.0 B.E (ECE) Program Curriculum

7.1. Curriculum Structure

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 specialization or branch.

Professional Electives (PE): Elective courses within the chosen Specialisation (Verticals).

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.

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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.

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7.2. B.E. (ECE) - Curriculum

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

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Semester I

Sl. No.	Course Code	Course Name	Category	Periods/wk				TC	C
				L	T	P	J		
Theory Courses									
-	-	Induction Program	-	-	-	-	-	-	-
1	U23MA201	Calculus for Engineers	BS	3	1	0	0	4	4
2	U23CS301	Problem Solving using C	ES	3	0	0	0	3	3
Theory cum Practical Courses									
3	U23HS181	Technical English	HS	2	0	2	0	4	3
4	U23CY281	Engineering Chemistry	BS	2	0	2	0	4	3
5	U23CS381	Application Design and Development	ES	2	0	2	0	4	3
Practical Courses									
6	U23GE351	Engineering Practices Laboratory	ES	0	0	2	0	2	1
7	U23CS351	Problem Solving using C Laboratory	ES	0	0	4	0	4	2
Professional Development Course									
8	U23EM751	Soft Skills	EM	0	0	2	0	2	1
Mandatory Course									
9	U23MC901	தமிழர்மரபு/ Heritage of Tamils	HSMC	1	0	0	0	1	1
Total				**13**	**1**	**14**	**0**	**28**	**21**

Semester II

Sl. No.	Course Code	Course Name	Category	Periods/wk				TC	C
				L	T	P	J		
Theory Courses									
1	U23MA205	Complex Variables and Transforms	BS	3	1	0	0	4	4
2	U23EC301	Circuit Analysis	ES	3	1	0	0	4	4
3	U23CS401	Data Structures	ES	3	0	0	0	3	3
	U23NCC01	NCC Credit Course Level I#	OC	2	0	0	0	2	2
Theory cum Practical Courses									
4	U23HS5XX	Language Elective*	HS	2	0	2	0	4	3
				3	0	0	0	3	3
5	U23PH285	Semiconductor Devices	BS	3	0	2	0	5	4
Theory cum Practical with Project Course									
6	U23CS382	Python Programming	ES	2	0	2	2	6	4
Practical Courses									
7	U23CS451	Data Structures Laboratory	PC	0	0	4	0	4	2
8	U23EC351	Electric Circuits and Devices Laboratory	ES	0	0	2	0	2	1
Professional Development Course									
9	U23EM752	Logical Thinking	EM	0	0	2	0	2	1
Mandatory Course									

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Sl. No.	Course Code	Course Name	Category	Periods/wk				TC	C
				L	T	P	J		
10	U23MC902	தமிழரும் தொழில்நுட்பமும் /Tamils and Technology	HSMC	1	0	0	0	1	1
Total				**16**	**1**	**14**	**2**	**35**	**27**

*-U23HS581: Business English (2-0-2-0-3); U23HS501: Basic Japanese (3-0-0-0-3); U23HS502: Basic German (3-0-0-0-3)

Semester III

Sl. No.	Course Code	Course Name	Category	Periods/wk				TC	C
				L	T	P	J		
Theory Courses									
1	U23MA207	Linear Algebra and Partial Differential Equations	BS	3	1	0	0	4	4
2	U23EC401	Analog Electronic Circuits	PC	3	0	0	0	3	3
3	U23EC402	Digital System Design	PC	3	0	0	0	3	3
4	U23EC403	Electromagnetic Fields and Waveguides	PC	3	0	0	0	3	3
5	U23OXXXX	Open Elective I*	OE	3	0	0	0	3	3
Theory with Practical and Project Course									
6	U23CS491	Java Programming	PC	2	0	2	2	6	4
Practical Courses									
7	U23EC451	Analog Electronic Circuits Laboratory	PC	0	0	4	0	4	2
8	U23EC452	Digital System Design Laboratory	PC	0	0	2	0	2	1
Professional Development Course									
9	U23EM753	Advanced Logical Thinking	EM	0	0	2	0	2	1
Mandatory Course									
10	U23MC903	Environmental Science	MC	1	0	0	0	1	NC
Total				**18**	**1**	**10**	**2**	**31**	**24**

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

Semester IV

Sl. No.	Course Code	Course Name	Category	Periods/wk				TC	C
				L	T	P	J		
Theory Courses									
1	U23MA209	Probability and Statistics	BS	3	1	0	0	4	4
2	U23CS303	Algorithm Design Techniques	ES	3	0	0	0	3	3
3	U23EC404	Analog and Digital Communication	PC	3	0	0	0	3	3
4	U23EC405	Microprocessor and Embedded Systems	PC	3	0	0	0	3	3
5	U23OXXXX	Open Elective II*	OC	3	0	0	0	3	3
Theory cum Practical Courses									
6	U23EC481	Signals and Systems	PC	3	0	2	0	5	4
	U23NCC02	NCC Credit Course Level II#	OC	2	0	2	0	4	3#
Practical Courses									
7	U23EC453	Communication Systems Laboratory	PC	0	0	2	0	2	1
8	U23EC454	Microprocessor and Embedded Systems Laboratory	PC	0	0	2	0	2	1
9	U23CS353	Algorithm Design Techniques Laboratory	ES	0	0	2	0	2	1
Project Work									

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Sl. No.	Course Code	Course Name	Category	Periods/wk				TC	C
				L	T	P	J		
10	U23EC651	Project with Design Thinking (Product / Software Development Life Cycle)	PW	0	0	0	2	2	1
Mandatory Course									
11	U23MC904	Universal Human Values	MC	1	0	0	0	1	NC
Total				**19**	**1**	**8**	**2**	**30**	**24**

*- Electives Structure: 3 0 0 0 3 / 2 0 2 0 3; #-Offered only for NCC students

Semester V

Sl. No.	Course Code	Course Name	Category	Periods/wk				TC	C
				L	T	P	J		
Theory Courses									
1	U23EC407	VLSI Design	PC	3	0	0	0	3	3
2	U23EC408	Control Systems Engineering	PC	3	1	0	0	4	4
3	U23EC5XX	Professional Elective I*	PE	3	0	0	0	3	3
Theory cum Practical Course									
4	U23EC482	Digital Signal Processing	PC	3	0	2	0	5	4
Theory with Practical and Project Course									
5	U23EC491	Internet of Things	PC	2	0	2	2	6	4
Practical Course									
6	U23EC457	VLSI Design Laboratory	PC	0	0	4	0	4	2
Professional Development Courses									
7	U23EM754	Summer Internship	EM	-	-	-	-	-	1
8	U23IECXX	Industry Oriented Course$	EM	0	0	2	0	2	1
Total				**14**	**1**	**10**	**2**	**27**	**22**

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

$ - Electives are offered as 1 0 0 0 1 or 0 0 2 0 1.

Semester VI

Sl. No.	Course Code	Course Name	Category	Periods/wk				TC	C
				L	T	P	J		
Theory Courses									
1	U23EC409	Antenna and Wave Propagation	PC	3	0	0	0	3	3
2	U23EC410	Networks and Security	PC	3	0	0	0	3	3
3	U23EC5XX	Professional Elective II*	PE	3	0	0	0	3	3
4	U23EC5XX	Professional Elective III*	PE	3	0	0	0	3	3
Theory cum Practical Course									
	U23NCC03	NCC Credit Course Level III#	OC	2	0	2	0	4	3#
Theory with Practical and Project Course									
5	U23AM496	Artificial Intelligence and Machine Learning for Electronic Engineers	PC	2	0	2	2	6	4
Practical Course									
6	U23EC458	Networks and Security Laboratory	PC	0	0	2	0	2	1
Project Work									
7	U23EC652	Innovative / Multi-Disciplinary Project	PW	0	0	0	2	2	1
Total				**14**	**0**	**4**	**4**	**22**	**18**

*- Electives Structure: 3 0 0 0 3 / 2 0 2 0 3, #-Offered only for NCC students

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Semester VII

Sl. No.	Course Code	Course Name	Category	Periods/wk				TC	C
				L	T	P	J		
Theory Courses									
1	U23CB103	Principles of Management	HS	3	0	0	0	3	3
2	U23CB104	Project Management and Finance	HS	1	0	0	0	1	1
3	U23EC411	Wireless Communication	PC	3	0	0	0	3	3
4	U23EC5XX	Professional Elective IV *	PE	3	0	0	0	3	3
5	U23OXXXX	Open Elective III*	OE	3	0	0	0	3	3
Theory cum Practical Course									
6	U23EC483	Microwave and Optical Communication	PC	3	0	2	0	5	4
Project Work									
7	U23EC653	Project work – Phase I	PW	0	0	0	6	6	3
Total				**16**	**0**	**2**	**6**	**24**	**20**

Semester VIII

Sl. No	Course Code	Course Name	Category	Periods/wk				TC	C
				L	T	P	J		
Project Work									
1	U23EC654	Project Work – Phase II	PW	0	0	0	16	16	8
Total				**0**	**0**	**0**	**16**	**16**	**8**

L→Lecture; T→Tutorial; P→Practical; J→Project; 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	-	-	-	-	4	-	10	6.1
2	BS	7	8	4	4	-	-	-	-	23	14.0
3	ES	9	14	4	4	-	-	-	-	31	18.9
4	PC	-	-	12	12	17	10	7	-	58	35.4
5	PE	-	-	-	-	3	6	3	-	12	7.3
6	OE	-	-	3	3	-	-	3	-	9	5.5
7	PW	-	-	-	1	-	1	3	8	13	7.9
8	EM	1	1	1	-	2	1	-	-	6	3.7
9	MC	-	-	NC	NC	-	-	-	-	-	-
10	HSMC	1	1	-	-	-	-	-	-	2	1.2
	OC	-	√	-	√	-	√	√	√	-	-
Total		**21**	**27**	**24**	**24**	**22**	**18**	**20**	**8**	**164**	**100**

* Excluding NCC and Honours Courses **Total Number of Credits: 164**

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7.3 Professional Elective Courses:

Sl. No.	Course Code	Course Name	Category	Periods/ Week				TC	C
				L	T	P	J		
Vertical 1—Semiconductor Chip Design and Testing									
1	U23EC511	Advanced Digital System Design	PE	3	0	0	0	3	3
2	U23EC512	ASIC Physical Design	PE	3	0	0	0	3	3
3	U23EC513	Low-Power IC Design	PE	3	0	0	0	3	3
4	U23EC514	Analog IC Design	PE	3	0	0	0	3	3
5	U23EC515	Mixed Signal IC Design Testing	PE	3	0	0	0	3	3
6	U23EC581	RTL Design and Verification	PE	2	0	2	0	4	3
7	U23EC582	VLSI Testing and Design ForTestability	PE	2	0	2	0	4	3
Vertical 2— Sensor Technologies and IoT									
1	U23EC521	IoT Processors	PE	3	0	0	0	3	3
2	U23EC522	Industrial IoT Industry 4.0	PE	3	0	0	0	3	3
3	U23EC523	Sensors Technology	PE	3	0	0	0	3	3
4	U23EC583	IoT Based System Design	PE	2	0	2	0	4	3
5	U23EC584	Cloud Computing for IoT	PE	2	0	2	0	4	3
6	U23EC585	Embedded C and RTOS	PE	2	0	2	0	4	3
7	U23EC586	Linux and Device Drivers	PE	2	0	2	0	4	3
Vertical 3—Signal Processing									
1	U23EC531	Speech Processing	PE	3	0	0	0	3	3
2	U23EC532	DSP Architecture and Programming	PE	3	0	0	0	3	3
3	U23EC533	Computer Vision for Electronics Engineers	PE	3	0	0	0	3	3
4	U23EC534	Video Analytics for Electronics Engineers	PE	3	0	0	0	3	3
5	U23EC535	Software Defined Radio	PE	3	0	0	0	3	3
6	U23EC587	Image Processing	PE	2	0	2	0	4	3
7	U23EC588	Advanced Digital Signal Processing	PE	2	0	2	0	4	3
Vertical 4—Advanced Communication Systems									
1	U23EC541	Optical Communication Networks	PE	3	0	0	0	3	3
2	U23EC542	Wireless Networks	PE	3	0	0	0	3	3
3	U23EC543	Enterprise Devices & Networking	PE	3	0	0	0	3	3
4	U23EC544	Telecom Network Management	PE	3	0	0	0	3	3
5	U23EC545	Advanced Wireless Communication Techniques	PE	3	0	0	0	3	3
6	U23EC546	Massive MIMO Networks	PE	3	0	0	0	3	3
7	U23EC589	High-Speed Communication Networks	PE	2	0	2	0	4	3
Vertical 5—Biomedical Technologies									
1	U23EC551	Medical Electronics	PE	3	0	0	0	3	3
2	U23EC552	Wearable Devices	PE	3	0	0	0	3	3
3	U23EC553	Human Assist Devices	PE	3	0	0	0	3	3
4	U23EC554	TherapeuticEquipment	PE	3	0	0	0	3	3
5	U23EC555	Medical Imaging Systems	PE	3	0	0	0	3	3
6	U23EC556	Brain-Computer Interface and Applications	PE	3	0	0	0	3	3
7	U23EC557	Body Area Networks	PE	3	0	0	0	3	3
Vertical 6—Space Technologies									

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Sl. No.	Course Code	Course Name	Category	Periods/ Week				TC	C
				L	T	P	J		
1	U23EC561	SatelliteCommunication	PE	3	0	0	0	3	3
2	U23EC562	Drone Technology	PE	3	0	0	0	3	3
3	U23EC563	RadarEngineering	PE	3	0	0	0	3	3
4	U23EC564	Avionics Systems	PE	3	0	0	0	3	3
5	U23EC565	Positioning andNavigationSystems	PE	3	0	0	0	3	3
6	U23EC566	Remote Sensing	PE	3	0	0	0	3	3
7	U23EC567	RFTransceivers	PE	3	0	0	0	3	3

7.4 Open Elective Courses:

Sl. No.	Course Code	Course Name	Category	Periods/ Week				TC	C
				L	T	P	J		
1	U23OAD81	Data Science Essentials	OE	2	0	2	0	4	3
2	U23OAD82	Machine Learning Techniques	OE	2	0	2	0	4	3
3	U23OAD83	Exploratory Data Analysis and Visualization	OE	2	0	2	0	4	3
4	U23OAD84	Foundations of Artificial Intelligence	OE	2	0	2	0	4	3
5	U23OCC81	Network Protocols	OE	2	0	2	0	4	3
6	U23OCC01	High Speed Networks	OE	3	0	0	0	3	3
7	U23OCC02	Introduction to Industrial Networking	OE	3	0	0	0	3	3
8	U23OCC03	Basics of Mobile Communication	OE	3	0	0	0	3	3
9	U23OCC04	Introduction to Wireless Communication Networks	OE	3	0	0	0	3	3
10	U23OCB81	Algorithmic Trading Strategies	OE	2	0	2	0	4	3
11	U23OCB82	Business Simulation	OE	2	0	2	0	4	3
12	U23OCB01	Principles of Taxation	OE	3	0	0	0	3	3
13	U23OCB83	Strategic Business Leader	OE	2	0	2	0	4	3
14	U23OCB02	Information Systems Control and Audit	OE	3	0	0	0	3	3
15	U23OCS81	Object Oriented Programming using Java	OE	2	0	2	0	4	3
16	U23OCS82	Database Technologies	OE	2	0	2	0	4	3
17	U23OCS83	Full Stack Technologies	OE	2	0	2	0	4	3
18	U23OCS84	Agile Software Practices	OE	2	0	2	0	4	3
19	U23OCS85	Fundamentals of Python Programming	OE	2	0	2	0	4	3
20	U23OAM01	DeepLearningModels	OE	3	0	0	3	3	3
21	U23OAM02	VideoandSpeechAnalytics	OE	3	0	0	3	3	3
22	U23OAM03	IndustrialMachineLearning	OE	3	0	0	3	3	3
23	U23OAM04	MachineLearningforSmartCities	OE	3	0	0	3	3	3
24	U23OSY01	Foundations of Ethical Hacking	OE	3	0	0	0	3	3
25	U23OSY02	Cyber Security Auditing and Assurance	OE	3	0	0	0	3	3
26	U23OSY03	Application Security	OE	3	0	0	0	3	3
27	U23OEE81	Solid State Electronics	OE	2	0	2	0	4	3
28	U23OEE82	Non-Conventional Energy Resources	OE	2	0	2	0	4	3

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Sl. No.	Course Code	Course Name	Category	Periods/ Week				TC	C
				L	T	P	J		
29	U23OEE01	Energy Conservation Practices	OE	3	0	0	0	3	3
30	U23OEE83	Energy Auditing and Management	OE	2	0	2	0	4	3
31	U23OEE02	Introduction to Hybrid and Electric Vehicles	OE	3	0	0	0	3	3
32	U23OEE03	Design of Solar Photovoltaic Systems	OE	3	0	0	0	3	3
33	U23OEE84	PLC and SCADA	OE	2	0	2	0	4	3
34	U23OIT01	Introduction to Blockchain Technology	OE	3	0	0	0	3	3
35	U23OIT02	Fundamentals of IT Infrastructure Management	OE	3	0	0	0	3	3
36	U23OIT81	Basics of Cloud Technology	OE	2	0	2	0	4	3
37	U23OIT82	Introduction to Computer Networks	OE	2	0	2	0	4	3
38	U23OIT83	Game Programming Fundamentals	OE	2	0	2	0	4	3
39	U23OME01	Quality Management	OE	3	0	0	0	3	3
40	U23OME02	Industrial Safety Engineering	OE	3	0	0	0	3	3
41	U23OME03	Industry 4.0	OE	3	0	0	0	3	3
42	U23OME04	Machine Vision	OE	3	0	0	0	3	3
43	U23OME05	Product Distribution and Promotion Management	OE	3	0	0	0	3	3
44	U23OME06	Business Ethics, Corporate Social Responsibilities and Governance	OE	3	0	0	0	3	3
45	U23OME81	Product Design and Development	OE	2	0	2	0	4	3
46	U23OME82	Additive Manufacturing and Tooling	OE	2	0	2	0	4	3
47	U23OME83	Product Lifecycle Management	OE	2	0	2	0	4	3
48	U23OME84	Robotics and Expert Systems	OE	2	0	2	0	4	3

7.5 Industry Oriented Courses:

Sl. No.	Course Code	Course Name	Category	Periods/ Week				TC	C
				L	T	P	J		
1	U23IEC01	Functional Electronics and PCB Prototyping	EM	0	0	2	0	2	1
2	U23IEC02	Mastering Advanced Microcontrollers	EM	0	0	2	0	2	1
3	U23IEC03	CISCO Routing and Switching Certification (CCNA)	EM	0	0	2	0	2	1
4	U23IEC04	RTL Design using Verilog	EM	0	0	2	0	2	1
5	U23IEC05	Machine Learning using Python	EM	0	0	2	0	2	1
6	U23IEC06	Exploring Generative AI	EM	0	0	2	0	2	1

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8.0. B.E. (ECE) SYLLABUS

SEMESTER I

U23MA201	Calculus for Engineers	L	T	P	J	C
		3	1	0	0	4

1. Course Description:

This course is designed to provide solid foundations in differential and integral calculus, emphasizing practical applications in science and engineering disciplines. Differential equations are essential for understanding dynamic systems, physical phenomena, mathematical modelling, and simulating real-world problems. Vector calculus explores the mathematical framework necessary for understanding and analyzing vector fields in three-dimensional space.

2. Course Objectives:

1. Familiarize the students with the functions of several variables.
2. Acquaint them with methods of evaluating multiple integrals.
3. Facilitate them with techniques in solving ordinary differential equations.
4. Impart an idea of vector calculus and its physical interpretation.
5. Elucidate various techniques of vector integration.

3. Syllabus **45 + 15= 60 Periods**

Unit-I: Differential Calculus **(9+3)**

Limits and Continuity; Partial derivatives: Total derivative, differentiation of implicit functions; Jacobian, properties; Taylor's series; Maxima and minima of functions of two variables.

Unit-II: Integral Calculus **(9+3)**

Double integrals: Integrals in cartesian and polar coordinates; Area enclosed by plane curves; Change of order of integration; Change of variables between cartesian and polar co-ordinates.

Unit-III: Ordinary Differential Equations **(9+3)**

Higher order linear differential equations with constant coefficients; Method of variation of parameters; Cauchy's and Legendre's linear differential equations; Application of ordinary differential equations in spring-mass system.

Unit-IV: Vector Differentiation **(9+3)**

Vector and scalar functions; Derivatives: Curves, tangents, arc length, curves in mechanics, velocity and acceleration; Gradient of a scalar field; Directional derivative; Divergence of a vector field; Curl of a vector field; Scalar potential function.

Unit-V: Vector Integration **(9+3)**

Line Integral; Green's theorem in a plane; Triple integral; Gauss divergence theorem; Stoke's theorem (statement only).

List of Tutorials:

1. The working procedure, Basic commands and symbolic computation. (CO 1)
2. Drawing the curve for the given function f(x) and the surface for the given function. (CO 1)
3. To find the Partial derivative of a given function f (x, y). (CO 1)
4. Evaluating Extreme values of a single variable function. (CO 1)
5. Evaluating the Maxima and minima of functions of two variables. (CO 1)
6. Differentiation of various functions. (CO 1)
7. Integration - Definite and indefinite integrals - Constant and variable limits. (CO 2)
8. Understanding integration as an Area under the curve. (CO 2)

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9. Evaluating triple integrals. (CO 2)
10. Visualizing different surfaces. (CO 2)
11. Evaluating gradient, curl and divergence. (CO 4)
12. Directional derivative of a given function. (CO 4)
13. Evaluating line integrals. (CO 5)

Text Books:

1. Erwin Kreyszig, "Advanced Modern Engineering Mathematics", 10th Edition, John Wiley and Sons (Asia) Ltd, Singapore, 2017.
2. Dennis G Zill, "Advanced Engineering Mathematics", 6th Edition, Jones & Bartlett India P Ltd., New Delhi, 2017.
3. B. S, "Higher Engineering Mathematics", 44th Edition, Khanna Publications, New Delhi, 2015.
4. Maurice D. Weir, Joel Hass, Christopher Heil "Thomas' Calculus",14th Edition, Pearson Education, New Delhi, 2018.

References:

Reference Books:

1. John Bird, "Higher Engineering Mathematics", An imprint of Elsevier, Burlington, Reprint 2010.
2. Bali. N. P and Manish Goyal," A Textbook of Engineering Mathematics", 8th Edition, Laxmi Publications Ltd, 2011.
3. Srimanta Pal and Subodh C Bhunia, "Engineering Mathematics", 3rd Edition, Oxford University Press, New Delhi, 2016.

Journal References:

1. Journal of Differential Equations:
   - https://www.sciencedirect.com/journal/journal-of-differential-equations
2. Journal of the Australian Mathematical Society:
   https://www.cambridge.org/core/journals/journal-of-the-australian-mathematical-society

Web Resources:

1. https://www.youtube.com/watch?v=riXcZT2ICjA
2. https://www.youtube.com/watch?v=1CBOwkS7nII
3. https://www.youtube.com/watch?v=rfG8ce4nNh0
4. https://www.youtube.com/playlist?list=PL5Dqs90qDljXm4Q6htsu9C88_gSebN33z

MOOC/NPTEL/SWAYAM Courses:

1. https://archive.nptel.ac.in/courses/111/104/111104092/
2. https://archive.nptel.ac.in/courses/111/105/111105122/

4. Course Outcomes:

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

CO. No.	Course Outcome
U23MA201.1	Classify the extreme values of functions of two variables.
U23MA201.2	Apply integration concepts to compute the area of the given surfaces, integrals in cartesian and polar coordinates.
U23MA201.3	Assess various techniques in solving differential equations.
U23MA201.4	Compare the ideas of vector differentiation and exhibit the relation between them.

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U23MA201.5	Apply Green's theorem, Stoke's theorem and Divergence theorem to evaluate integrals.

U23CS301	Problem Solving using C	L	T	P	J	C
		3	0	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.

2. 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 students in effectively working with strings, user-defined data types, and file operations.

3. Syllabus **45 periods**

Unit-I: C Fundamentals **(9)**

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 **(9)**

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 **(9)**

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 **(9)**

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 **(9)**

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:

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

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
U23CS301.1	Understand problem-solving techniques and typical programming constructs C
U23CS301.2	Apply looping and conditional constructs to solve real-world problems
U23CS301.3	Apply arrays and functions effectively to address complex programming challenges
U23CS301.4	Understand and apply best practices in pointers, memory allocation and error handling for modular programming efficiency
U23CS301.5	Choose and implement complex data structures using structures and Unions, applying advanced file operations in C for effective problem-solving

U23HS181	Technical English	L	T	P	J	C
		2	0	2	0	3

1. Course Description:

This course provides foundational education in technical communication for first-year BE/B.Tech. students, focusing on vocabulary development for diverse academic and professional contexts. It emphasizes the enhancement of LSRW (Listening, Speaking, Reading, and Writing) skills to improve overall communication proficiency. Additionally, the course covers critical areas such as Grammar, Word Formation, Summarizing, and Report Writing, which are essential for success in the Engineering and Technology fields.

2. Course Objectives:

1. Help students learn different reading techniques like skimming and scanning, so they can better understand and analyze various texts.
2. Improve students' skills in writing clear and organized sentences and paragraphs, and teach them how to write informal letters for different purposes.
3. Strengthen students' understanding of basic grammar rules, such as parts of speech, articles, and tenses, to make their writing and speaking more accurate.

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4. Train students to listen carefully to audio materials and participate in speaking activities like introductions and role-plays to improve their communication skills.
5. Encourage students to use their language skills in everyday situations, like writing informal letters and doing role-plays, to build confidence and fluency in English.

3. Syllabus **30 + 30 = 60 Periods**

Unit-I: Fundamentals of Language Skills **(6)**

Types of Reading: Intensive and Extensive - Skimming and Scanning Techniques - Reading Comprehension Strategies; Word Formation Techniques - Sequence Words in Writing - Hints Development for Writing - Informal Letters: Congratulating, Apologizing, etc.; Grammar: Parts of Speech - Articles (Definite and Indefinite) – Tense; Listening Types - Listening to Audio files and answering; Speaking - Introducing oneself & Family - Role Play

Unit-II: Advanced Reading and Writing Strategies **(6)**

Reading articles from Newspapers & Magazines - Cloze Exercises; Writing Instructions and Recommendations - Paragraph Writing Techniques; Grammar: Homonyms, Homophones, and Homographs - Subject – Verb Agreement - Modal Verbs - Question Types: Wh-type, Yes/No, and Tag Questions; Listening for Specific Information: Announcements and Radio Broadcasts Speaking: Extempore - Just A Minute (JAM) Sessions

Unit-III: Advanced Communication Skills **(6)**

Reading for Specific Information & Identifying Lexical and Contextual Meaning; Writing Formal Letters: Seeking Permission for Industrial Visit - Letter of Invitation (Acceptance/Declination) - Arranging Jumbled Sentences; Grammar: Cause and Effect Expressions - Purpose and Function - Phrases - Compound Nouns; Listening to TED Talks & News Reading from English News Channels (CNN, NDTV, India Today, etc.) Speaking: Group Discussion

Unit-IV: Effective Written Communication **(6)**

Summarizing Techniques: Paraphrasing Skills - Note Making Strategies; Preparing Job Application - Email Etiquette and Writing Emails - Free Writing on Any Given Topic; Grammar: Phrasal Verbs - Types of Sentences (Simple, Compound, Complex) - Single Sentence Definitions; Listening and summarizing; Speaking: Narrating a Story

Unit-V: Technical Presentation Skills **(6)**

Reading practice based on Competitive Examinations; Writing: Preparing Transcripts for Speeches - Pictorial Representations: Flowcharts, Pie Charts, Bar Charts, Tabular Columns; Grammar: Single Word Substitutes - Spotting Errors; Listening to Eminent Personality Interviews & Other Forms of Interviews; Speaking - Compering, Welcome Address & Vote of Thanks

List of Exercises: **(30)**

1. Listening to Audio files and answering the questions. (CO 1)
2. Listening for specific information like announcements and Radio Broadcasts (CO 1)
3. Practice developing hints into full sentences or paragraphs. (CO 1)
4. Practice delivering short, impromptu speeches on various topics. (CO 2)
5. Listening to TED Talks & News Reading from English News Channels (CNN, NDTV, India Today etc.) (CO 1)
6. Listening to interviews of eminent personalities and analysing the content. (CO 4)
7. Practising self-introduction in role-play scenarios. (CO 3)
8. Participating in group discussions on various topics with emphasis on communication strategies and effective participation. (CO 3)
9. Exercises on narrating stories, focusing on structure and engagement. (CO 4)

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10. Compering events, delivering Welcome Addresses, and practising Vote of Thanks. (CO 5)

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 Resources:

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. https://www.englishforeveryone.org/Topics/Reading-Comprehension.html

MOOC/ SWAYAM /NPTEL 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
U23HS181.1	Apply basic reading techniques, construct clear sentences for informal correspondence, and enhance grammar and listening skills for effective communication.
U23HS181.2	Analyze complex texts, formulate precise instructions and recommendations, and utilize advanced grammar in spoken communication.
U23HS181.3	Simplify specific and contextual information, compose formal letters, and actively engage in group discussions.
U23HS181.4	Interpret and take notes proficiently, compose professional documents and emails, and demonstrate strong listening skills.

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U23HS181.5	Analyze and create detailed technical documents and visual aids, deliver formal presentations and conduct interviews with confidence.

U23CY281	Engineering Chemistry	L	T	P	J	C
		2	0	2	0	3

1. Course Description:

Engineering Chemistry is a fundamental course designed to provide Bachelor of Engineering students with a strong foundation in the principles and applications of chemistry relevant to engineering disciplines. This course integrates essential concepts of chemistry with engineering applications, aiming to equip students with the knowledge and skills necessary for various branches of engineering.

2. Course Objectives:

1. To study chemistry concepts and acquire engineering skills to become a perfect engineer.
2. To acquire knowledge of electrochemistry, polymer technology and water treatment which are essential for the Engineers and industry
3. To study new techniques and current information in chemistry that motivates students to express themselves and work effectively.
4. To learn about supercapacitors, energy production, electric field-based concepts of material behaviour, and environmental application in engineering and technology.
5. To explore the current technological development in chemistry in the engineering stream.

3. Syllabus **30+30=60 Periods**

Unit-I: Water Technology **(6)**

Introduction-Sources of natural water, Impurities; Hardness of water and its determination; Alkalinity of water: Types and Estimation-External treatment: Zeolite process-ion exchange method; Internal treatment method: Desalination – Reverse Osmosis.

Unit-II: Electrochemistry **(6)**

Electrochemical cells: EMF measurements-Nernst equation; Reference electrodes: Ion selective electrode; Electrochemical series-significance; Conductometric titration; Potentiometric titration.

Unit-III: Polymer Technology **(6)**

Polymers; definition-polymerization and its types-Free radical mechanism; Plastics-Classification- preparation, properties and uses of PVC, Teflon, Nylon-6,6, PET; Application and Limitations of polymers.

Unit-IV: Super Capacitors **(6)**

Basics of electrochemical supercapacitors; Types of supercapacitors; Electrode and electrolyte interfaces and their capacitances-charge-discharge characteristics-Energy/power density; Coupling with batteries and fuel cells; Applications.

Unit-V: Energy Sources and Storage Devices **(6)**

Introduction-Nuclear reaction-Nuclear reactor; Sustainable energy; Batteries-Classification; Superconducting magnetic energy storage(SMES); Application of storage devices in smart grid and Electric vehicles (EV).

List of Experiments: **(30)**

1. Determination of total hardness of given water sample by rapid EDTA method. (CO 1)
2. Determination of alkalinity in a given water sample. (CO 1)
3. Estimation of chloride content in water by Argentometric method. (CO 1)
4. Conductometric titration between strong acid Vs strong base. (CO 2)

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5. Conductometric titration between Mixture of acid Vs strong base. (CO 2)
6. Conductometric precipitation titration using Barium chloride and sodium sulphate. (CO 2)
7. Determination of strength of given hydrochloric acid using a pH meter. (CO 2)
8. Estimation of ferrous ion content of the given solution using a Potentiometer. (CO 2)

Text Books:

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

References:

Reference Books:

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

Journals:

1. https://pubs.rsc.org/en/content/articlehtml/2012/ra/c2ra20340e
2. https://www.sciencedirect.com/science/article/abs/pii/S0360319916309478
3. https://www.sciencedirect.com/science/article/abs/pii/S2211285518305755
4. http://www.electrochemsci.org/papers/vol11/111210628.pdf

Video References:

1. https://www.youtube.com/watch?v=ZLucc8DIVPs
2. https://www.youtube.com/watch?v=CWOJW4357Bg
3. https://www.youtube.com/watch?v=1U6Nzcv9Vws
4. https://www.youtube.com/watch?v=WUZqgAtKMJg
5. https://www.youtube.com/watch?v=NVC9TwW11wg

MOOC/NPTEL/ SWAYAM Courses:

1. https://onlinecourses.nptel.ac.in/noc21_cy49/preview
2. https://onlinecourses.nptel.ac.in/noc24_cy10/preview
3. https://onlinecourses.swayam2.ac.in/nou24_es03/preview

4. Course Outcomes:

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

CO. No.	Course Outcome
U23CY281.1	Use the principles of water characterization and treatment for portable and industrial purposes.
U23CY281.2	Utilize the laws of electrochemistry to explore its applications in vehicles and storage devices.

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U23CY281.3	Show the understanding of polymer degradation during the processing and use of polymers.
U23CY281.4	Assess the components and performance of battery management systems and fuel cells coupled with supercapacitors.
U23CY281.5	Appraise and compare various energy sources and their applications towards sustainable development.

U23CS381	Application Design and Development	L	T	P	J	C
		2	0	2	0	3

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 create dynamic and interactive web pages using JavaScript, enhancing user experience and adding functionality to web applications
3. To create and manage Git repositories and 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 **(30+30 = 60 Periods)**

Unit-I: HTML and CSS **(6)**

Software Development: SDLC (Waterfall Model)- Phases - Methods and Practices-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

Unit-II: Interactive Web Design using JavaScript **(6)**

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)

Unit-III: Git, Git Hub and Shell Scripting **(6)**

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

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Community, Linux Developer Community, Stack Overflow, Kaggle Shell Scripting: Processing (PS) and Listing (LS)- File Creations and Handling-Users and Groups

Unit-IV: Mobile Application Development with MITAI **(6)**

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

Unit-V: Template-Driven Applications and Multimedia **(6)**

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

List of Experiments **(30)**

1. Develop a visually appealing static website with an intuitive user interface with multimedia content such as text, images and videos using HTML, CSS and JavaScript (CO1)
2. Create a simple form to collect the name, address, email ID and phone number from the user and use JavaScript to validate each field before submitting the form (CO1)
3. Create an interactive quiz that allows the user to select answers to multiple-choice questions. Use JavaScript to calculate the user's score and provide feedback based on their performance (CO1)
4. Create a simple animation using CSS and JavaScript. Use CSS to define the animation's properties, such as duration and timing and use JavaScript to trigger the animation in response to user input or other events (CO2)
5. Create a local repository using Git and perform basic operations such as initializing the repository, adding files, committing changes, and creating and managing multiple branches to organize and track changes (CO3)
6. Create a shell script that can automate file management tasks such as processing, listing, creation and handling of files and user and group management tasks (CO3)
7. Develop mobile applications using MITAI (Simple calculator, Step counter, a Weather app that retrieves current weather information from an API, Talk to Me, Translation App) (CO4)
   a) Design a poster for an event using Canva templates (CO4)
   b) Create a visual infographic using Canva tools to present data and information (CO4)
8. Develop a simple 2D game using a Construct visual interface and event system (CO4)
9. Model a 3D object using Blender modelling tools and techniques. Animate a short scene or character using Blender animation tools and a timeline (CO5)

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.

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:

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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
6. https://www.blender.org/support/tutorials/

MOOC/NPTEL /SWAYAM Courses:

1. https://in.coursera.org/learn/html-css-javascript-for-web-developers
2. https://amigoscode.com/p/git-github
3. Ultimate-web-design-course-https://university.webflow.com/courses/ultimate-web-design- course

4. Course Outcomes:

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

CO. No.	Course Outcome
U23CS381.1	Utilize HTML5 and CSS to develop responsive web
U23CS381.2	Create Interactive web applications using JavaScript
U23CS381.3	Analyze and apply GIT and GIT HUB operations and advanced repository actions
U23CS381.4	Create mobile applications using the MIT app inventor
U23CS381.5	Create simple game applications using Construct

U23CS351	Problem Solving using C Laboratory	L	T	P	J	C
		0	0	4	0	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 **60 Periods**

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)

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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)
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 a 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

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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
U23CS351.1	Design solutions for real-world problems with programming constructs
U23CS351.2	Solve complex programming problems with arrays and functions
U23CS351.3	Implement dynamic memory addressing techniques with Pointers
U23CS351.4	Implement various error-handling techniques for file operations
U23CS351.5	Implement complex data structures such as structures and unions in C to manage and organize data effectively

U23GE351	Engineering Practices Laboratory	L	T	P	J	C
		0	0	2	0	1

1. Course Description:

The course encompasses a comprehensive set of practical units aimed at providing hands-on experience in Computer Science, Mechanical, Electrical and Electronics Engineering fields.

Computer Science and Engineering Practices:

The students will be engaged in Computer assembly and disassembly, honing troubleshooting skills for both hardware and software issues.

Mechanical Engineering Practices:

The students will be delving into Mechanical Engineering practices which include plumbing, basic machining operations and rapid prototyping with 3D printing. The exploration extends to the assembly of a centrifugal pump, hands-on exercises involving pump/motor, submersible pump sets and refrigeration & air-conditioning systems.

Electrical Engineering Practices:

The students will be focusing on Electrical Engineering practices which involve UPS connections, domestic wiring, safety precautions and the design of solar PV systems.

Electronics Engineering Practices:

The students will be focusing on Electronics Engineering practices which include soldering techniques, a study of smartphone components and practical projects in home automation.

Through this multifaceted course, students gain a well-rounded understanding of essential skills in Computer Science, Mechanical, Electrical & Electronics preparing them for diverse applications in those fields.

2. Course Objectives:

1. To impart knowledge on computer assembling, disassembling and troubleshooting.
2. To provide exposure to the students with rapid prototyping with 3D printing and plumbing operations.

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3. To gain practical experience in UPS connections, domestic house wiring and solar PV systems. 4. To expose the students to understanding home automation, smartphone operation and soldering and desoldering techniques.
3. Syllabus **30 Periods**
Unit-I: Computer Science and Engineering Practices **(7)**
1. Troubleshooting Desktops and PCs 2. Disassembly and Assembly of Desktops and PCs 3. Setting up Basic Computer Networks 4. Demonstration of AR/VR Technologies and Their Applications in Engineering Design, Simulation, and Training
Unit-II: Mechanical Engineering Practices **(8)**
1. Hands-on exercise on plumbing connection of a residential building involving minor troubleshooting 2. 3D Printing of simple engineering objects without a support structure 3. 3D Printing of simple engineering objects with support structure 4. Hands-on exercise on basic connections and maintenance with minor troubleshooting of Refrigeration System (Study)
Unit-III: Electrical Engineering Practices **(7)**
1. UPS Connection - Hands-on exercise on basic electrical connections with UPS Connection 2. Domestic Wiring - Hands-on exercise on basic domestic wiring 3. Safety Precautions - Hands-on exercise on electrical earthing and safety precautions 4. Renewable Energy - Design of Solar PV System for Residence (Study)
Unit-IV: Electronics Engineering Practices **(8)**
1. Manual soldering of electronic components onto PCB 2. Analyse Smartphone component integration, design choices and their effects on performance. 3. Design and Building of Simple Home Automation System

4. Course Outcomes:

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

CO. No.	Course Outcome
U23GE351.1	Perform the basic troubleshooting of the PC including assembly and disassembly.
U23GE351.2	Carry out minor plumbing troubleshooting in a residential building & print 3D components with or without support materials.
U23GE351.3	Carry out minor troubleshooting and maintenance tasks in a Refrigeration System.
U23GE351.4	Perform basic domestic wiring of a residential building with provision of inverter and safety measures and Design solar PV System for residence.
U23GE351.5	Execute basic home automation projects.

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U23EM751	Soft Skills	L	T	P	J	C
		0	0	2	0	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: **30 Periods**

Unit-I: Personality and Professional Development Skills **(6)**

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 **(6)**

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 **(6)**

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 **(6)**

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 **(6)**

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".2020.

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2. Sylvia Reyes," Team Building: The Ultimate Guide to Build & Manage Winning Teams", MC Graw Hill, 2014.
3. Dan Clay, how to write the perfect resume 2018.
4. Tyler Hayden," Communication Activities: A Team Building Activity Book", 2019.
5. Ian Tuhovsky, "Communication Skills Training: A Practical Guide to Improving Your Social Intelligence, 2019.
6. Presentation, Persuasion and Public Speaking (Positive Psychology Coaching Series Book, 2015.

Magazine References:

1. The IUP Journal of Soft Skills
2. https.//iupindia.in/softskills.asp
3. Soft Skills Personality Development for Life Success
4. 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
U23EM751.1	Understand and apply interpersonal skills to enhance professional interactions and goal-setting.
U23EM751.2	Demonstrate clear and effective communication in reports and presentations to showcase professional skills.
U23EM751.3	Utilize advanced communication techniques to improve verbal and written effectiveness.
U23EM751.4	Analyze team dynamics and personal skills to enhance individual and group performance.
U23EM751.5	Create accurate and concise technical documents to uphold high standards in engineering journalism

U23MC901	தமிழர் மரபு / Heritage of Tamils	L	T	P	J	C
		1	0	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.

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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.
   சித்த மருத்துவம் மற்றும் இந்திய சுதந்திரப் போராட்டம் பற்றிய அறிவை மாணவருக்கு அறிமுகப்படுத்துதல்.

3. Syllabus / பாடத்திட்டங்கள்: 15 Periods

Unit-I / அலகு-I: Language And Literature / மொழி மற்றும் இலக்கியம் (3)

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

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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 / அலகு - II: Heritage–Rock Art Paintings to Modern Art –Sculpture / மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக்கலை **(3)**

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 / அலகு-III: Folk and Martial Arts / நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள் **(3)**

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

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

Unit-IV / அலகு-IV: Thinai Concept of Tamils / தமிழர்களின் திணைக்கோட்பாடுகள் **(3)**

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 முகங்களும் - சங்க காலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி - கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி.

Unit-V/ அலகு-V: Contribution Of Tamils To Indian National Movement and Indian Culture / இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு **(3)**

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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
U23MC901.1	To know about the language families in India, the impact of the religions, and the contribution of Bharathiar and Bharathidhasan. இந்தியாவில் உள்ள மொழி குடும்பங்கள், மதங்களின் தாக்கம், பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு பற்றி தெரிந்து கொள்வது.
U23MC901.2	Observe the growth of sculpture making of musical instruments and the role of temples in socio and economic lives.

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	தமிழர்களின் வாழ்வில் இசைக்கருவிகள், சிற்பங்களை உருவாக்கும் முறைகள், சமூக, பொருளாதார வளர்ச்சி மற்றும் கோவில்களின் பங்களிப்பு பற்றி அறிந்து கொள்வது
U23MC901.3	Understand the significance of folklore and martial arts. நாட்டுப்புறவியல் மற்றும் தற்காப்புக் கலைகளின் முக்கியத்துவத்தைப் புரிந்து கொள்வது.
U23MC901.4	Learn the Sangam literature, Sangam age and overseas conquest of Cholas. சங்க இலக்கியம், சங்க காலம் மற்றும் சோழர்களின் வெற்றிகள் ஆகியவற்றைக் கற்றுக்கொள்வது.
U23MC901.5	Understand the contribution of Tamils to the Indian freedom struggle and the role of Siddha medicines. இந்திய சுதந்திரப் போராட்டத்தில் தமிழர்களின் பங்களிப்பு, சித்த மருந்துகளின் பங்கு ஆகியவற்றைப் புரிந்து கொள்வது.

SEMESTER II

U23MA205	Complex Variables and Transforms	L	T	P	J	C
		3	1	0	0	4

1. Course Description:

This course provides students with a rigorous understanding of complex variables, which extends the concepts of real numbers to the complex plane. 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 and evaluate signals.

2. Course Objectives:

1. Introduce complex analysis for addressing problems across diverse fields.
2. Enhance their understanding of complex functions along curves in the complex plane.
3. Impart the knowledge of Laplace transform to solve linear mathematical models for a physical system.
4. Acquaint the student with Fourier series and Fourier transform techniques used in real-time situations.
5. Familiarize the students with Z- transform techniques for discrete-time systems.

3. Syllabus **45+15 = 60 Periods**

Unit-I: Complex Differentiation **(9+3)**

Analytic functions: Cauchy-Riemann equations excluding proof, properties of analytic function, construction of analytic function by Milne Thomson method; Conformal mapping: w= z+c, cz, 1/z; Bilinear transformation.

Unit-II: Complex Integration **(9+3)**

Integral theorems: Cauchy's integral theorem, Cauchy's integral formula, Cauchy's integral formula for derivatives, Cauchy residue theorem; Taylor series, Laurent's series; Singularities, zeros.

Unit-III: Laplace Transform **(9+3)**

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Existence conditions, linearity, shifting, transforms of derivatives and integrals; Periodic function; Inverse Laplace transform: Partial fraction method, convolution theorem; Application: Method of solving second order ordinary differential equations.
Unit-IV: Fourier Series and Fourier Transform **(9+3)**
Fourier series: Odd and even functions, half range sine series, half range cosine series; Fourier transform pair.
Unit-V: Z Transform **(9+3)**
Z-transform of standard functions, properties excluding proof; Inverse Z – transform: Standard functions, Partial fraction technique, Convolution theorem; Application: Solutions of difference equation using Z-transform.
Text Books:
1. Dennis G Zill, "Advanced Engineering Mathematics", 6th Edition, Jones & Bartlett India P. Ltd., New Delhi, 2017. 2. Erwin Kreyszig, "Advanced Modern Engineering Mathematics", 10th Edition, John Wiley and Sons (Asia) Ltd, Singapore, 2017. 3. Grewal B. S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, Delhi, 2015.
References:
Reference Books: 1. Mathews J. H. and Howell R. W "Complex Analysis for Mathematics and Engineering", Narosa Publishing House, New Delhi, 2012. 2. Wylie C. R. and Barrett L. C "Advanced Engineering Mathematics", Tata McGraw-Hill., New Delhi, 2019. 3. Dean G Duffy "Advanced Engineering Mathematics with MATLAB", CRC., USA, 2017.
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://youtu.be/Nw7QTMj5Sfc?si=d_IF68RcMrJs4ZUG 2. https://www.youtube.com/watch?v=vQLH7qTeJRM / 3. https://www.youtube.com/watch?v=wG6VUnkrO90 4. https://www.youtube.com/watch?v=KqokoYr_h1A 5. https://www.youtube.com/watch?v=fH76Wo_Jres
MOOC/NPTEL/SWAYAM/ Courses: 1. https://archive.nptel.ac.in/courses/111/103/111103070/ 2. https://archive.nptel.ac.in/courses/111/106/111106046/

4. Course Outcomes:

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

CO. No.	Course Outcome
U23MA205.1	Construct analytic functions and bilinear transformations to determine the image under the given conformal mapping.
U23MA205.2	Utilize the concepts of integration for complex functions in the specified regions.

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U23MA205.3	Apply Laplace transform and inverse transform to various functions and to solve differential equations.
U23MA205.4	Determine functions expressed in trigonometric terms to represent periodic physical phenomena.
U23MA205.5	Utilize Z- transform to convert a discrete-time signal into a complex domain.

U23EC301	Circuit Analysis	L	T	P	J	C
		3	1	0	0	4

1.Course Description:

This course provides an exploration of basic principles and methods used in the analysis of electrical circuits. Students will understand the fundamental concepts of voltage, current, resistance, and power within the circuit. It provides how to evaluate and predict the behaviour of electrical circuits through laws and theorems. The course covers both direct current (DC) and alternating current (AC) circuits, including the analysis of series and parallel circuits, transient response in RLC circuits, and steady-state sinusoidal analysis, which helps engineers and designers to ensure proper functionality, efficiency, and safety of electrical systems.

2. Course Objectives:

1. To facilitate understanding of the basic principles of electrical circuits, including voltage, current, resistance and power factor.
2. To instruct the procedure of network theorems to simplify and solve complex circuit problems.
3. To impart the way to analyse the steady-state and transient behaviour of AC circuits, including resonance.
4. To explain various parameters in two-port networks and sinusoidal response.
5. To explore the use of circuit simulation software to model and analyse electrical circuits.

3.Syllabus **45 + 15 = 60 Periods**

Unit-I: Basics of Circuit Analysis **(12)**

Ohm's law; Kirchhoff's laws; Network reduction; Voltage and current division; Source transformation; Wye-delta transformation; Sinusoidal steady state analysis: phase or, complex power; Mesh and nodal analysis for DC and AC circuits.

Unit-II: Network Theorems **(12)**

Theorems: Superposition, thevenin's, Norton's, reciprocity, maximum power transfer for DC and AC circuits; Applications of network theorems.

Unit-III: Resonance and Coupled Circuits **(12)**

Resonance: Series, parallel; Parameters: Frequency response, bandwidth, quality factor, selectivity; Applications; Self-inductance; Mutual inductance; Coupling coefficient; Coupled circuits: Series, parallel, Single tuned.

Unit-IV: Transients **(12)**

Natural response; Forced response; Transient response: RL, RC, RLC circuits for DC and AC (sinusoidal) excitations using Laplace transformation technique; Singularity functions; Introduction to waveform synthesis.

Unit-V: Two Port Networks and Complex Frequency **(12)**

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Network: One port, two port; Parameters: Z, Y, T, h; Interconnection of two-port networks; Concept of complex frequency: Poles and zeros of admittance function, properties, sinusoidal response from pole-zero integral solutions.

Text Books:

1. William H. Hayt, Jr. Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuit Analysis", McGraw-Hill Science Engineering, Eighth Edition, 11th Reprint 2016.
2. Joseph Edminister and Mahmood Nahvi, "Electric Circuit", Schaum's Outline Series, Tata McGraw Hill Publishing Company, New Delhi, Fifth Edition Reprint 2016.

References:

Reference Books:

1. M.E. Van Valkenburg, "Network Analysis", Prentice Hall of India Pvt. Ltd., 3rd Edition, 2006.
2. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuit", Fifth Edition, McGraw Hill, 9th Reprint 2015.
3. Sudhakar A. and Shyammohan S. Pillai, "Circuits and Networks Analysis and Synthesis", McGraw Hill, New Delhi, 2015.

Journals:

1. IEEE Transactions on Circuits and Systems
2. WSEAS Transactions on Circuits and Systems

Magazines:

1. IEEE Circuits and Systems Magazine
2. https://www.allaboutcircuits.com//

Web Resources:

1. http://iitkgp.vlab.co.in/index.php
2. https://www.circuitbasics.com/circuit-analysis/
3. https://www.circuitbread.com/study-guides/dc-circuits/circuit-analysis-methods
4. https://www.jakelectronics.com/blog/understanding-basic-circuit-analysis-for-beginners
5. https://www.electronics-tutorials.ws/
6. https://dcaclab.com/
7. https://easyeda.com/
8. http://www.docircuits.com/
9. http://falstad.com/circuit/

MOOC / NPTEL / SWAYAM Courses:

1. https://onlinecourses.nptel.ac.in/noc23_ee34/preview
2. https://www.udemy.com/course/full-course-circuit-analysis/
3. https://www.coursera.org/courses?query=circuit%20analysis

4. Course Outcomes:

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

CO. No.	Course Outcome
U23EC301.1	Utilize the principles of electric circuit laws to determine branch currents and node voltages.
U23EC301.2	Compute electrical parameters using network theorems.

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U23EC301.3	Evaluate the operation of resonance and coupled circuits concerning frequency response.
U23EC301.4	Examine the transient response of RL, RC and RLC Circuits.
U23EC301.5	Analyze mathematically to evaluate a system using two-port networks and pole-zero concepts.

U23CS401	Data Structures	L	T	P	J	C
		3	0	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 an understanding of trade-offs and limitations
3. To equip students with skills in designing, implementing, and analyzing tree-based solutions to complex problems
4. To familiarize and work 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 **45 periods**

Unit-I: Linked Lists **(9)**

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 **(9)**

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

Unit-III: Trees **(9)**

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 **(9)**

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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 (9)
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,2023. 2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2020. **Video 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
U23CS401.1	Apply the concepts of linked lists by demonstrating an understanding of their implementation and usage to solve given problems
U23CS401.2	Construct stacks and queues using arrays and linked lists and apply these structures to appropriate scenarios
U23CS401.3	Implement tree data structures and their operations to enhance data management and retrieval systems
U23CS401.4	Assess graph-based algorithms to solve complex problems requiring efficient data traversal and manipulation
U23CS401.5	Examine sorting, searching and hashing algorithms to organize and retrieve data effectively

U23NCC01	NCC Credit Course Level I	L	T	P	J	C
		2	0	0	0	2

1. Course Description:

The NCC Course is designed to instil discipline, leadership, and a sense of social responsibility in participants. Through a blend of theory and practical activities, students learn to respect cultural diversity, manage time effectively, and handle stress efficiently. They

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develop teamwork skills and engage in social service initiatives, fostering a well-rounded approach to personal and community development.
2. Course Objectives:
1. Provide a comprehensive understanding of the NCC's structure and objectives. 2. Foster national integration and the NCC's role in nation-building. 3. Develop leadership and personality development skills. 4. Encourage active participation in social service and community development. 5. Enhance awareness of safety protocols and key government initiatives.
3. Syllabus: **30 Periods**
Unit-I: NCC General **(5)**
Aims, Objectives & Organization of NCC - Incentives - Duties of NCC Cadet - NCC Camps: Types & Conduct
Unit-II: National Integration and Awareness **(5)**
National Integration: Importance & Necessity - Factors Affecting National Integration - Unity in Diversity & Role of NCC in Nation Building - Threats to National Security
Unit-III: Personality Development **(6)**
Self-awareness, Empathy, Critical & Creative Thinking, Decision-making and Problem-Solving - Communication Skills - Group Discussion: Stress & Emotions, Time Management, Team Work – Career Counseling, SSB Procedure & Interview Skills – Public Speaking
Unit-IV: Leadership **(7)**
Traits, Indicators, Motivation, Moral Values, Honour code - Case Studies: Shivaji, Jhansi Ki Rani, APJ Abdul Kalam, Tippu Sultan, Rabindranath Tagore, Ratan Tata
Unit-V: Social Service and Community Development **(7)**
Basics - Rural Development Programmes, NGOs, Contribution of Youth – Swachh Bharat Abhiyan – Drug Abuse, Tree Plantation Traffic Awareness, Digital Awareness, Beti Padhao Beti Bachao, Women Health & Sanitation - Protection of Children and Women Safety - Road / Rail Travel Safety - New Initiatives - Cyber and Mobile Security Awareness
Text Book:
1. National Cadet Corps "Cadets Hand Book – Army(Common Subjects)"
Web reference:
1. https://indiancc.nic.in/

4. Course Outcomes:

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

CO. No.	Course Outcome
U23NCC01.1	Demonstrate the conduct of NCC cadets, exhibiting discipline and leadership qualities, respect and appreciate the diversity of Indian culture, and fostering a sense of unity amidst differences.
U23NCC01.2	Conduct a comprehensive SWOT analysis to identify personal strengths and weaknesses, and implement strategies to overcome weaknesses, enhancing overall performance.
U23NCC01.3	Utilize various strategies for stress management, ensuring mental well-being and resilience in challenging situations
U23NCC01.4	Collaborate effectively within a team, demonstrating teamwork skills to achieve common objectives.

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U23NCC01.5	Engage in social service activities on different occasions, contributing positively to the community and fostering a sense of social responsibility

U23HS581	Business English	L	T	P	J	C
		2	0	2	0	3

1. Course Description:

This course is designed to make the learners understand the importance and scope of Business Communication. The Learners will be introduced to a range of various situations, which will enable them to utilize the business terms profusely. It also enhances their competency to emerge successfully in the corporate world. Further, this course will enable them to do effective presentations 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 business communication.
2. Strengthen their listening skills which will help them to perform effectively in the business world.
3. Develop their speaking skills to analyze and respond appropriately.
4. Foster their ability to excel in written business communication.
5. Build their confidence to participate in business meetings and interviews.

3. Syllabus **30+30=60 Periods**

Unit-I: Introduction to Business Communication **(6)**

Basics of Business Communication - Types of Business Communication: Internal and External - The Communication Process and Barriers - Business Vocabulary: Common Terms and Phrases; Grammar: Sentence Structure and Types of Sentences - Punctuation in Business Writing; Listening: Listening to business conversations and identifying key information; Speaking: Role-play exercises simulating business meetings and phone calls; Reading: Analyzing business emails and memos; Writing: Drafting professional emails and business letters.

Unit-II: Business **(6)**

Writing Business Emails, Memos, and Letters - Writing Reports and Proposals - Creating Agendas and Minutes of Meetings; Grammar: Active and Passive Voice - Modal Verbs for Politeness and Formality; Listening: Listening to sample business discussions and note-taking; Speaking: Presenting ideas and reports in meetings; Reading: Reading and analyzing business proposals; Writing: Composing various forms of business correspondence.

Unit-III: Negotiation and Persuasion **(6)**

Techniques of Persuasion in Business - Negotiation Strategies and Tactics - Understanding Cultural Differences in Negotiation - Conflict Resolution and Handling Objections; Grammar: Conditional Sentences in Business Scenarios - Use of Conjunctions and Linking Words; Listening: Listening to negotiation dialogues and identifying key tactics; Speaking: Role-playing negotiation scenarios; Reading: Analyzing case studies on successful negotiations; Writing: Drafting negotiation emails and proposals.

Unit-IV: Presentations and Public Speaking **(6)**

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Planning and Structuring Business Presentations - Using Visual Aids Effectively - Public Speaking Techniques - Handling Q&A Sessions; Grammar: Use of Cohesive Devices and Transitions - Clauses of Reason, Purpose, and Result; Listening: Listening to business presentations and taking notes; Speaking: Delivering business presentations; Reading: Reviewing presentation slides and materials; Writing: Preparing presentation scripts and speaker notes.

Unit-V: Business Reports and Documentation **(6)**

Writing and Structuring Business Reports - Writing Executive Summaries - Creating Business Plans - Documenting Processes and Procedures; Grammar: Complex Sentence Structures - Use of Passive Voice in Reports - Reported Speech in Business Contexts; Listening: Listening to report summaries and identifying main points; Speaking: Presenting a summary of a business report; Reading: Analyzing business reports and identifying key sections; Writing: Drafting business reports and executive summaries.

List of Exercises: **(30)**

1. Listening to business conversations and identifying key information. (CO 1)
2. Role-play exercises simulating business meetings and phone calls. (CO 2)
3. Listening to sample business discussions and note-taking. (CO 2)
4. Presenting ideas and reports in meetings. (CO 4)
5. Listening to negotiation dialogues and identifying key tactics. (CO 3)
6. Role-playing negotiation scenarios. (CO 3)
7. Listening to business presentations and taking notes. (CO 4)
8. Delivering business presentations. (CO 4)
9. Listening to report summaries and identifying main points. (CO 5)
10. Presenting a summary of a business report. (CO 5)

Text Books:

1. Business Communication: Building Critical Skills" by Kitty O. Locker and Stephen Kyo Kaczmarek, McGraw-Hill Education.
2. Business Communication Today" by Courtland L. Bovee and John V. Thill, Pearson.

References:

Reference Books:

1. Essentials of Business Communication" by Mary Ellen Guffey and Dana Loewy, Cengage Learning.
2. The Business Communication Handbook" by Judith Dwyer, Pearson Australia.
3. Technical Communication: A Reader-Centered Approach" by Paul V. Anderson, Cengage Learning.
4. Guide to Managerial Communication: Effective Business Writing and Speaking" by Mary Munter and Lynn Hamilton, Pearson.
5. Effective Business Writing: Strategies, Suggestions and Examples" by Maryann V. Piotrowski, HarperCollins Publishers.

Video References:

1. https://www.youtube.com/watch?v=V8uF1EoIneE
2. https://www.youtube.com/watch?v=moIucWGgvMc
3. https://www.youtube.com/watch?v=o9aVjBHEEbU

Web Resources:

1. https://learnenglish.britishcouncil.org/business-english
2. https://research.com/education/useful-links-for-learning-and-teaching-english-and-teaching

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3. https://www.talaera.com/learn/
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://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
U23HS581.1	Develop fundamental professional communication skills to effectively navigate and overcome barriers in business conversations.
U23HS581.2	Construct professional emails, memos, and letters, and draft formal business reports and proposals.
U23HS581.3	Develop skills in negotiation and persuasion, recognize cultural differences, and use conflict resolution strategies in business.
U23HS581.4	Plan and deliver well-structured business presentations with effective visual aids.
U23HS581.5	Build organized business reports, executive summaries, and documentation with precision and clarity.

U23HS501	Basic Japanese	L	T	P	J	C
		3	0	0	0	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, 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 real-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 **45 Periods**

Unit-I: Introduction to Japanese Scripts and Basic Greetings **(9)**

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Japanese Scripts (Hiragana & Katakana) – Daily greetings and expressions – Introduction to grammar particles – N1 wa N2desu - N1 wa N2ja arimasen – Phrase/Sentence ka – N1 mo N2desu - N1 no N2desu – 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 **(9)**
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 N2made - 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 **(9)**
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 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 **(9)**
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 N2to 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 **(9)**
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**

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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: Elementary 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, Eri Banno, Yoko Ikeda, and Yutaka Ohno, , The Japan Times, 2011.
2. Nihongo So-matome: JLPT N5 grammar" authored and published by Ask Publications, 2021 edition.

Web Resources:

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

4. Course Outcomes:

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

CO. No.	Course Outcome
U23HS501.1	Recognize and write the Japanese alphabet without errors
U23HS501.2	Extend the conversation using basic sounds in the Japanese language
U23HS501.3	Explain the concept of time by learning verbs, tenses and vocabularies.
U23HS501.4	Make use of the appropriate vocabulary required for simple conversations in the Japanese language.
U23HS501.5	Comprehend the conversation and give the correct meaning

U23HS502	Basic German	L	T	P	J	C
		3	0	0	0	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, participants 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.

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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 **45 Periods**

Unit-I: Basic Introduction to German Scripts **(9)**

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)

Unit-II: Numbers and Nominative Case (9)

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 **(9)**

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 the working area, go for work, floor plan city plan, office and computer) – Grammar (preposition: in, neben, unter, auf, vor, hinter, an, zwischen, bei und

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mit + Datic)– Speak Action (workplace, work, giving appointments)– pronunciation (consonants: f,w und v) – To learn (Making notice in the calendar)
Unit-IV:Dativ Case and Prepositions **(9)**
Theme and Text (Holiday and Party, holiday plan, party plan in Germany) – Grammar (regular and irregular 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, postcard, 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 **(9)**
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) Theme and Text (in supermarket,purchase, House Maintenance, Emotions, 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

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4. Course Outcomes:

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

CO. No.	Course Outcome
U23HS502.1	Recognize and write the German alphabet
U23HS502.2	Speak using basic sounds of the German language
U23HS502.3	Apply appropriate vocabulary needed for simple conversation in the German language
U23HS502.4	Apply appropriate grammar to write and speak in the German language
U23HS502.5	Comprehend the conversation and give the correct meaning

U23PH285	Semiconductor Devices	L	T	P	J	C
		3	0	2	0	4

1. Course Description:

In order to perform essential operations including amplification, switching, signal processing, and data storage, semiconductor devices is essential to electronic devices, which are fundamental building blocks of electronic systems. Semiconductor devices is essential to many electronic products, including computers, televisions, smart phones, automobile systems, and medical equipment. Modern life is shaped by improvements brought about by advancements in semiconductor technology, which have also led to the miniaturisation, improved functionality, and higher performance of electronic gadgets.

2. Course Objectives:

1. To teach the electronic properties of semiconductor materials and to apply in various semiconducting devices.
2. To review the fundamental concepts of PN diode and to create an understanding the concepts of diodes in half-wave and full-wave rectifiers.
3. To impart knowledge and to solve problems based on circuits with BJT in different configurations along with load line analysis and Biasing.
4. To study the fundamentals of JFET and MOSFET and to understand their Drain and Transfer characteristics.
5. To educate the working principle of special semiconductor devices and to utilize in modern semiconductor based devices.

3. Syllabus **45+30=75 Periods**

Unit-I: Introduction to Semiconductors **(9)**

Classification of Materials based on Energy Gap: Metals, Semiconductors and Insulators; Semiconductors: Properties, Classification; Intrinsic and Extrinsic Semiconductors (Qualitative); Extrinsic Conduction: Majority and Minority carriers; Fermi-Dirac Distribution Function, Fermi Energy, Effects of Temperature on Fermi level.

Hall Effect: Hall Coefficient Derivation, Experimental Setup, Applications.

Unit-II: PN Junction and Zener Diode **(9)**

P-N Junction diode: Properties, Forward and Reverse Bias Operation, V-I characteristics, Breakdown Voltage, Knee Voltage, Diode equation (qualitative); Limitations in the Operating Conditions of P-N Junction; Applications, Static and dynamic Resistance, Peak Inverse Voltage (PIV), Equivalent Circuit.**Zener Diode:** V-I Characteristics, Zener breakdown, Zener Diode as Voltage Regulator.

Rectifier: Half-Wave Rectifier and its Efficiency, Full-Wave Bridge Rectifier and its

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Efficiency; Nature of Rectifier Output; Ripple Factor.

Unit-III: Bipolar Junction Transistor **(9)**

Transistors: Symbols, Biasing, Working of NPN Transistor; Transistor Connections: CB, CE and CC Configurations, Current Amplification Factor, Expression for Collector Current, Input and Output Characteristics of Common Emitter (CE) Connections; Transistor as an Amplifier in CE Arrangement.

Biasing of BJT: Operating Point; D.C. Load Line: Cut off Point, Saturation Point, Active Region; Methods of Transistor Biasing: Voltage-Divider Bias Method; Power Rating of Transistor; Frequency Response of CE amplifier.

Unit-IV: Field Effect Transistors **(9)**

Field Effect Transistors: Introduction, Types.

Junction Field Effect Transistor (JFET): Symbol, Principle and Working, Drain Characteristics, Transconductance Curve, Shorted-Gate Drain Current, Pinch Off Voltage, Gate-Source Cut Off Voltage; Expression for Drain Current (ID); Variation of Transconductance (g_m or g_{fs}) of JFET; Advantages of JFET; Comparison of JFET and BJT; Biasing of JFET: Voltage-Divider Bias, D.C. Load Line Analysis.

Metal Oxide Semiconductor FET (MOSFET): Symbol, construction; Types: D-MOSFET and E-MOSFET: Circuit Operation, Drain and Transfer Characteristics.

Unit-V: Special Semiconductor Devices **(9)**

Special-Purpose Diodes: Light-Emitting Diode (LED), Photo-diode, Opto-isolator.

Silicon Controlled Rectifier (SCR): Working, V-I Characteristics.

Power Electronics: DIAC: Construction, Operation, Characteristics, Applications; TRIAC: Construction, Operation, Characteristics, Applications.

List of Experiments: **30 Periods**

1. Construct and calculate the energy band gap of a given semiconductor diode by measuring the current at different temperatures. (CO1)
2. Analyze the V-I characteristics of the PN Junction Diode and determine the knee voltage by varying the forward bias voltage and current in reverse biased conditions due to minority carriers. (CO2)
3. Analyze the breakdown mechanism of the Zener diode for voltage regulation in a circuit with the help of its VI characteristics.(CO2)
4. Construct the circuit of BJT in Common Emitter Configuration and plot its input and output characteristic curves. (CO3)
5. Construct a BJT amplifier using a Voltage Divider Biasing configuration and plot the frequency response of the CE amplifier.(CO3)
6. Design a JFET amplifier using a Voltage Divider Biasing configuration and plot the amplified output. (SIMULATION) (CO4)
7. Analyze the drain and transfer characteristics of MOSFET and plot the drain current by varying the VGS voltage and VDS voltages. (SIMULATION)(CO4)
8. Analyze the I-V characteristics of Light Emitting Diode (LED) in forward bias. (SIMULATION) (CO5)

Text Books:

1. Mehta V.K and Rohit Mehta, "Principles of Electrical Engineering and Electronics", S. Chand & Company, 2016.

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2. Sze S.M and Lee. M.K, "Semiconductor Devices: Physics and Technology", John Wiley & Sons, 2016.

References:

Reference Books:

1. Bhattacharya P, "Semiconductor Optoelectronic Devices", Pearson Education, 2017.
2. Charles Kittel, "Introduction to Solid State Physics", 8th Edition, John Wiley & Sons, 2012.
3. Mehta V K &Rohit Mehta, "Principles of Electronics", S. Chand & Company, 2016.
4. Rajput R.K, "Basic Electrical and Electronics Engineering", University Science Press, 2017.
5. Streetman B.G and Banerjee S.K, "Solid State Electronic Devices", Pearson Education, 2016.

Journals:

1. https://iopscience.iop.org/journal/1674-4926
2. https://engineeringjournals.stmjournals.in/index.php/JoSDC/index
3. https://www.sciencedirect.com/journal/materials-science-in-semiconductor-processing/about/aims-and-scope
4. https://iopscience.iop.org/journal/0268-1242
5. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=16

Video References:

1. https://youtu.be/JA3sCmrv11M
2. https://youtu.be/wj7DUNTzu6g
3. https://youtu.be/0C4uxtS-tlQ
4. https://youtu.be/SjeK1nkiFvI
5. https://youtu.be/7G1sR-3_5uA

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1. https://onlinecourses.nptel.ac.in/noc22_ee97/preview
2. https://onlinecourses.nptel.ac.in/noc22_ee13/preview
3. https://archive.nptel.ac.in/courses/108/108/108108122/
4. https://nptel.ac.in/courses/108108122
5. https://onlinecourses.nptel.ac.in/noc21_ee80/preview

4. Course Outcomes:

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

CO. No.	Course Outcome
U23PH285.1	Analyze the Classification, Properties and Applications of Semiconducting Materials.
U23PH285.2	Explore the operation of Diodes and Rectifiers in Electronic Circuits.
U23PH285.3	Construct the various biasing techniques of Bipolar Junction Transistor and their role in Amplifiers.
U23PH285.4	Analyze the different configurations of Field Effect Transistor, MOSFET and their Characteristics.
U23PH285.5	Analyze the Working of Special Semiconductor Devices and assess their operation.

U23CS382	Python Programming	L	T	P	J	C
		2	0	2	2	4

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 make students to write efficient, readable, and well-structured code
2. To choose and use data structures such as lists, tuples, dictionaries and sets in Python programs
3. To make students effectively organize, structure, and manage Python code using files, modules, and packages
4. To implement object-oriented programming constructs in Python
5. To use libraries for data analysis in Python and use Django framework for web application development

3. Syllabus **30+30+30=90 periods**

Unit-I: Python Constructs **(6)**

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

Unit-II: Lists, Tuples, Dictionaries and Set **(6)**

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 **(6)**

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 **(6)**

Object, class, constructor, inheritance, abstraction, polymorphism, encapsulation; MongoDB: Environmental Setup, creating new Database, CRUD Operations, Python DB connectivity

Illustrative Programs: Event management using MongoDB, Real Estate management using MongoDB

Unit-V: Data Analysis and Web Frameworks **(6)**

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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

List of Experiments **(30)**

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. (CO1)
2. Suggested Problems: Swap two numbers without a temporary variable, Quadratic Equation, Valid Palindrome
3. Implement a Python program that simulates a real-world system or process using conditions and iterative loops. (CO1)
4. Suggested Problems: check whether an alphabet is a vowel or consonant, the sum of all even numbers from 0 to n, factorial of a number (CO1)
5. Implementation of Strings in the program.
6. Suggested Problems: Determine if string halves are alike, palindrome, character count, replacing characters
7. Implementation of real-time/technical applications using Lists and Tuples.(CO2)
8. 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)
9. Implementation of real-time applications using Sets and Dictionaries. (CO2,CO3)
10. Suggested Problems: Magic Dictionary, Longest Word in Dictionary, Set Mismatch and Smallest Number in Finite Set
11. Implementation of Functions in the program. (CO3)
12. Suggested Problems: Factorial, largest number in a list, area of shape
13. Implementation of file-handling operations. (CO4)
14. Suggested Problems: copy from one file to another, wordcount, longest word
15. Implementation of applications of standard libraries. (CO4)
16. 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.
17. Implementation of OOP concepts in Python (CO5)

Project **(30)**

Develop a web application for any real-world problem

Text 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.

References:

Reference Books:

1. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-Disciplinary Approach," Pearson India Education Services Pvt. Ltd., 2016
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist,"2nd Edition, Updated for Python 3, Shroff O'Reilly Publishers, 2016
3. Timothy A. Budd, "Exploring Python," Mc-Graw Hill Education (India) Private Ltd., 2015

Video References:

1. https://www.codecademy.com/catalog/language/python
2. https://www.geeksforgeeks.org/python-programming-language-tutorial/

MOOC/NPTEL /SWAYAM Courses:

1. https://nptel.ac.in/courses/106106145
2. https://onlinecourses.nptel.ac.in/noc24_cs45/preview

4. Course Outcomes:

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

CO. No.	Course Outcome
U23CS382.1	Apply syntax and semantics of Python programming language for developing real-world applications
U23CS382.2	Analyse Python solutions by implementing lists, tuples and dictionaries
U23CS382.3	Create file system applications with built-in functions
U23CS382.4	Apply principles of OOP and MongoDB
U23CS382.5	Analyse data manipulation techniques and develop web pages with the Django Framework

U23CS451	Data Structures Laboratory	L	T	P	J	C
		0	0	4	0	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 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 work 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 **(60)**

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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 bitonic 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)
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)

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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 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
U23CS451.1	Solve Problems by applying the concepts of Linked Lists
U23CS451.2	Implement Stacks and Queues with Array and LinkedList and solve problems with Stacks and Queues
U23CS451.3	Implement tree data structures and demonstrate tree operations such as insertion, deletion, traversal and balancing
U23CS451.4	Implement the graph-based algorithms to solve complex problems requiring efficient data traversal and manipulation
U23CS451.5	Apply sorting, searching and hashing algorithms to organize and retrieve data effectively

U23EC351	Electric Circuits and Devices Laboratory	L	T	P	J	C
		0	0	2	0	1

1. Course Description:

This course is designed to provide hands-on experience with the concepts and techniques covered in electric circuits and electronic device concepts. Through a series of structured experiments, students will explore the behaviour and characteristics of basic electrical components, circuits, and electronic devices. The course emphasizes the practical application of circuit analysis methods, the use of laboratory instruments, and the interpretation of experimental data.

2. Course Objectives:

1. To strengthen the connection between theoretical concepts and practical implementation, demonstrating the ability to apply classroom knowledge to hands-on experiments effectively. And to develop proficiency in operating essential laboratory instruments for accurate measurement and analysis of electrical circuits.
2. To impart hands-on experience in building and testing various DC and AC circuits by applying laws and network theorems techniques in practical scenarios to solve real-world circuit problems.

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3. To teach the experimental method to observe and analyse the transient responses in RC, RL, and RLC circuits, as well as the steady-state behaviour of AC circuits, to understand the dynamic nature of electrical circuits.
4. To instruct the procedure to investigate the operational characteristics of key electronic components and explore their applications in amplification and switching circuits.
5. To integrate circuit simulation software into the laboratory experience to model and predict circuit behaviour before physical construction, enhancing analytical and problem-solving skills.

3. Syllabus	**30 Periods**
List of Experiments	**(30)**

1. Design a complex electrical circuit with multiple resistors, voltage sources, and junctions and analyze it using Ohm's and Kirchhoff's laws. (CO1)
2. Investigate and analyze the applicability of the Superposition Theorem in complex electrical circuits, exploring the impact of multiple independent sources on circuit behaviour and understanding the limits of the theorem in practical scenarios. (CO2)
3. Experiment on Thevenin's and Norton's theorems, examining their utility and limitations in complex electrical circuits analyze their application under various conditions and evaluating their relevance in real-world scenarios. (CO2)
4. Confirm the Maximum Power Transfer conditions by adjusting the load resistance for different source resistances. (CO2)
5. Examine the circuit parameters and external influences on the determination of the resonant frequency in series RLC circuits. (CO3)
6. Experiment with the resonant behaviour of parallel RLC circuits to identify the influence of circuit parameters. (CO3)
7. Experiment with transient behaviour in RL and RC circuits to justify the time and frequency response. (CO4)
8. Analyze how SCRs respond to dynamic changes in voltage and current inputs, focusing on the circuit's adaptability and stability. (CO5)
9. Explore the impact of dynamic changes in light conditions on the photodiode's response. (CO5)
10. Mini Project (Applications of Semiconductor devices)

References:

Reference Books:

1. Laboratory Manual Prepared by ECE Department.
2. Salivahanan, N. Suresh Kumar and A. Vallavaraj, "Electronic Devices and Circuits",2nd Edition, Tata McGraw Hill, Ninth reprint, 2010.
3. Sudhakar A and Shyammohan S Palli, "Circuits and Networks: Analysis & Synthesis", 4th Edition, Tata McGraw Hill, 2010.
4. James M. Fiore, "DC Electrical Circuit Analysis - A Practical Approach", 2020.

Journals:

1. IEEE Transactions on Circuits and Systems
2. WSEAS Transactions on Circuits and Systems
3. IEEE Transactions on Electronics Devices
4. Microelectronics Journal

Magazines:

1. IEEE Circuits and Systems Magazine
2. https://www.allaboutcircuits.com//
3. https://www.electronicdesign.com/
4. https://spectrum.ieee.org/

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Web Resources:

1. http://iitkgp.vlab.co.in/index.php
2. https://www.circuitbasics.com/circuit-analysis/
3. https://www.circuitbread.com/study-guides/dc-circuits/circuit-analysis-methods
4. https://www.jakelectronics.com/blog/understanding-basic-circuit-analysis-for-beginners
5. https://www.electronics-tutorials.ws/
6. https://dcaclab.com/
7. https://easyeda.com/
8. http://www.docircuits.com/
9. http://falstad.com/circuit/

MOOC / NPTEL / SWAYAM Courses:

1. https://onlinecourses.nptel.ac.in/noc23_ee34/preview
2. https://www.udemy.com/course/full-course-circuit-analysis/
3. https://www.coursera.org/courses?query=circuit%20analysis

4. Course Outcomes:

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

CO. No.	Course Outcome
U23EC351.1	Design electrical circuits and verify them using Ohm's law and Kirchhoff's laws.
U23EC351.2	Assess the appropriateness of selected network theorems for different circuit scenarios.
U23EC351.3	Break down the response of passive circuit elements and analyze the behaviour of each component.
U23EC351.4	Examine the behaviour of electronic components based on their characteristic curves.
U23EC351.5	Design circuits for real-time application with suitable electronic devices.

U23EM752	Logical Thinking	L	T	P	J	C
		0	0	2	0	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 **30 Periods**

Unit-I: Fundamental Skills for Problem Solving **(6)**

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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 (6)
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 (6)
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 (6)
Fundamentals of statistics: Mean, Median and Mode, Real-life life application of statistics, Application of Ratios and Proportions in business problems, Partnerships; Geometry: 2D, 3D Visualization.
Unit-V: Logical and Visual Reasoning (6)
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
U23EM752.1	Apply logical algorithms and mathematical methods to solve real-world problems.
U23EM752.2	Analyze and evaluate cost management strategies in various contexts.
U23EM752.3	Apply principles of time management and work efficiency in practical situations.
U23EM752.4	Use quantitative methods and interpret data to make informed decisions.
U23EM752.5	Create solutions to complex logical and visual reasoning problems by applying advanced reasoning techniques

U23MC902	Tamils and Technology / தமிழரும் தொழில்நுட்பமும்	L	T	P	J	C
		1	0	0	0	1

1. Course Description:

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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.

2. Course Objectives:

1. To increase agricultural productivity and profitability by implementing innovative solutions that optimize resource usage, minimize losses, and enhance crop yields.
2. To automate the irrigation systems to adjust water usage based on real-time data on soil moisture levels, weather forecasts, and crop water requirements.

3. Syllabus: **15 Periods**

Unit-I: Weaving and Ceramic Technology / நெசவு மற்றும் பானைத் தொழில்நுட்பம் **(3)**

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.

Unit-II: Design and Construction Technology / வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம் **(3)**

Designing and Structural construction of Houses & 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 வீட்டுப் பொருட்களில் 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

Unit-III: Manufacturing Technology / உற்பத்தித் தொழில் நுட்பம் (3)

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/ bone beats - Archeological evidence - Gem stone types described in Silappathikaram.

கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல்மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத்துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

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Unit-IV: Agriculture and Irrigation Technology / வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம் (3)

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu 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 - சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு- மீன்வளம் முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்.

Unit-V: Scientific Tamil and Tamil Computing /அறிவியல் தமிழ் மற்றும் கணித்தமிழ் (3)

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 மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம்- தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.

Text Books:

1. தமிழக வரலாறு மக்களும் பண்பாடும் கே.கே.பிள்ளை (வெளியீடு - தமிழ்நாடு பாடநூல் மற்றும்கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).
3. கீழடி - வைகை நதிக்கரையில் சங்ககால 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 – (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) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

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12. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) – Reference Book.
References:
Reference Books: 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
U23MC902.1	Describe about the weaving industry in sangam age and ceramic technology. சங்க காலத்தில் நெசவுத் தொழில் மற்றும் பீங்கான் தொழில்நுட்பம் பற்றி விரிவாக அறிந்து கொள்ளுதல்.
U23MC902.2	Observe the design of houses, sculptures and construction of temples. வீடுகளின் வடிவமைப்பு, சிற்பங்கள் மற்றும் கோவில்களின் கட்டுமானத்தைப் பற்றி தெரிந்து கொள்ளுதல்.
U23MC902.3	Relate the various manufacturing materials and stone types in Silappathikaram. சிலப்பதிகாரத்தில் உள்ள பல்வேறு உற்பத்திப் பொருட்கள் மற்றும் கல் வகைகளைப் பற்றி புரிந்து கொள்ளுதல்.
U23MC902.4	Understand the significance of agriculture and irrigation technology in the ancient period. பண்டைய காலத்தில் விவசாயம் மற்றும் நீர்ப்பாசன தொழில்நுட்பத்தின் முக்கியத்துவத்தை புரிந்து கொள்ளுதல்.
U23MC902.5	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.

SEMESTER III

U23MA207	Linear Algebra and Partial Differential Equations	L	T	P	J	C
		3	1	0	0	4

1. Course Description:

Linear algebra is a branch of mathematics that studies systems of linear equations and the properties of matrices. This course covers the theory of vector spaces and linear transformations as well as practical methods like diagonalization and row-reduction of matrices. It gives the ability to solve problems using mathematical and logical methods that are applicable to many fields of science. Partial differential equations develop student's skills in the formulation, solution, understanding and interpretation of models as well as developing

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analytic solutions in modern science and engineering. They are effectively employed to simulate a wide range of phenomena such as resolving wave and heat equations.

2. Course Objectives:

1. Initiate the basic concepts in the vector space and its attributes.
2. Cultivate the knowledge in inner product spaces and its applications.
3. Enhance their knowledge in linear transformations.
4. Explore their knowledge in solving partial differential equations.
5. Acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.

3. Syllabus **45 +15 = 60 Periods**

Unit-I: Vector Spaces **(9+3)**

Vector spaces: Subspaces, linear combinations, linear independence and linear dependence, basis and dimensions.

Unit-II: Inner Product Spaces **(9+3)**

Inner product: Norms, Gram-Schmidt orthogonalization process; QR decomposition; Least square approximation.

Unit-III: Linear Transformation and Diagonalization **(9+3)**

Linear transformation: Null spaces and ranges; Dimension theorem; Matrix representation of a linear transformations; Eigen values and eigen vectors; Diagonalizability.

Unit-IV: Partial Differential Equations **(9+3)**

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-V: Applications of Partial Differential Equations **(9+3)**

Classification of second order linear partial differential equations; Solutions of one - dimensional wave equation; Solution of one-dimensional equation of heat conduction; Steady state solution of one-dimensional heat equation using Fourier series.

List of Tutorials:

1. Working procedure, basic commands and symbolic computation. (CO 1)
2. Solving several types of systems of linear equations. (CO 1)
3. Matrix operations. (CO 1)
4. Shifting and scaling of vectors. (CO 1)
5. Matrix decomposition- QR decomposition. (CO 2)
6. Least square method (case study). (CO 2)
7. Eigen values and eigen vector computation. (CO 3)
8. Solving Lagrange's linear equations. (CO 4)
9. Solving one dimensional wave and heat equation in Fourier series. (CO 5)

Text Books:

1. Howard Anton and Chris Rorres, "Elementary Linear Algebra", 11th Edition, Wiley India, New Delhi, 2018.
2. Grewal B.S., "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, New Delhi, 2015.

References:

Reference Books:

1. Kolman, B. Hill, D.R., "Introductory Linear Algebra", Pearson Education, New Delhi, 1st Reprint, 2009.
2. Lay, D.C., "Linear Algebra and its Applications", 5th Edition, Pearson Education, 2015.
3. Erwin Kreyszig, "Advanced Modern Engineering Mathematics", 10th Edition, John Wiley and Sons (Asia) Limited, Singapore, 2017.

Journal References:

1. Electronic Journal of Linear Algebra: https://journals.uwyo.edu/index.php/ela
2. Journal of Numerical Linear Algebra with Applications: https://onlinelibrary.wiley.com/journal/10991506
3. Numerical Linear Algebra with Applications (NLAA) http://www.drps.ed.ac.uk/16-17/dpt/cxmath10059.htm
4. An international journal Communications in Partial Differential Equations: https://www.tandfonline.com/toc/lpde20/current

Web Resources:

1. https://www.youtube.com/watch?v=YrHlHbtiSM0
2. https://www.khanacademy.org/math/linear-algebra/vectors-and spaces/vectors/v/adding-vectors
3. https://www.khanacademy.org/math/linear-algebra/matrix-transformations/linear-transformations/v/linear-transformations
4. https://www.khanacademy.org/science/electrical-engineering/ee-signals/ee-fourier-series/v/ee-fourier-series-intro

MOOC/NPTEL/SWAYAM Courses:

1. https://archive.nptel.ac.in/courses/111/106/111106135/
2. https://archive.nptel.ac.in/courses/111/106/111106100/

4. Course Outcomes

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

CO. No.	Course Outcome
U23MA207.1	Implement the principles of vector space and its characteristics to address real time problems.
U23MA207.2	Examine orthonormal basis within inner product spaces.
U23MA207.3	Articulate the eigen values and eigen vectors of matrix representation of a linear transformation within a finite dimensional space.
U23MA207.4	Apply the mathematical principles to solve partial differential equations.
U23MA207.5	Evaluate one-dimensional wave and heat flow equations in various situations.

U23EC401	Analog Electronic Circuits	L	T	P	J	C
		3	0	0	0	3

1. Course Description:

This course offers a comprehensive introduction to the principles and applications of analog electronic circuits. It covers fundamental concepts of analog electronics, including the analysis, design, and operation of basic circuits such as amplifiers, oscillators, and filters. Students will explore the behavior of electronic components like diodes, transistors, and operational amplifiers in analog systems. The course emphasizes hands-on learning through practical laboratory sessions, enabling students to apply theoretical knowledge in real-world scenarios. By the end of the course, students will have the skills to design, analyze, and troubleshoot analog electronic circuits, preparing them for advanced studies or careers in electronics and related fields.

2. Course Objectives:

1. To guide students through the principles of large signal amplification and feedback, enabling them to design and analyze amplifier circuits for various practical applications.

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2. To instruct on the Design and Application of Tuned Amplifiers and Oscillators.
3. To provide comprehensive instruction on the characteristics and functions of operational amplifiers
4. To assist students in understanding and constructing waveform generators and multivibrators.
5. To introduce students to the use of special function integrated circuits (ICs), demonstrating how to incorporate these components into analog circuit designs to meet complex design requirements.

2. Syllabus **45 Periods**

Unit-I: Large Signal and Feedback Amplifiers **(9)**

Single stage amplifier - Multistage Amplifiers: coupling schemes, Cascade and Cascode amplifiers, Darlington amplifier (Qualitative Analysis) – Introduction to Power amplifiers - Class A,B,C,AB (Qualitative Analysis) - Feedback: Concept of feedback – Characteristics of negative feedback amplifier - Method of identifying feedback topology and feedback factor - Voltage series, Voltage shunt, Current series and current shunt amplifiers.

Unit-II: Tuned Amplifiers **(9)**

Q factor - unloaded and loaded Q of tank circuits, small signal tuned amplifiers – Analysis of capacitor coupled single tuned amplifier - effect of cascading single tuned and double tuned amplifiers on bandwidth – Stagger tuned amplifiers - Stability of tuned amplifiers – Neutralization: Hazeltine neutralization method.

Unit-III: Oscillators and Multivibrators **(9)**

Barkhausen criterion- General form of an LC oscillator - Hartley, Colpitts, and Clapp Oscillators - Wien Bridge Oscillator - RC phase shift oscillator - Multivibrators: Astable, Monostable and Bistable multivibrators.

Unit-IV: Op-Amp Characteristics and Its Applications **(9)**

Basics of Op-Amp - Characteristics of an ideal Op-Amp, Op-Amp Schematic Internal Circuit- DC and AC characteristics - V-to-I and I-to-V converters, Applications: adder, subtractor, Instrumentation amplifier - Wave shaping circuits: Peak detector, Clipper and Clamper, Differentiator, Integrator, Comparators, Schmitt trigger.

Unit-V: Waveform Generators and Special Function ICs **(9)**

Square wave generator - Triangular wave generator – Special Function ICs: Series Op-Amp and IC Voltage Regulator - 555 Timer: Functional Diagram – 565 PLL: Basic Principles – 566 VCO - D/A Converter: Basic DAC Technique, R/2R ladder DAC, SAR ADC.

Text Books:

1. S.Salivahanan, N. Suresh Kumar, "Electronic Devices and Circuits", McGraw Hill, 4/e. (Unit I, II & III)
2. D.Roy Choudhury, Shail B Jain, "Linear Integrated Circuits", New Age International Publishers, IV edition (Unit IV & V)

References:

Reference Books:

1. Adel S.Sedra, Kenneth C. Smith, "Microelectronic Circuits", Oxford International student edition, 6/e.
2. David.A.Bell, "Electronic Devices and Circuits", Prentice Hall of India IV edition.
3. Milman Jacob, "Integrated Electronics", Tata McGraw-Hill, I edition.

Journals:

1. Analog Integrated Circuits and Signal Processing-An International Journal
2. AEU - International Journal of Electronics and Communications

Magazines:

5. https://www.electronicdesign.com/
6. https://spectrum.ieee.org/

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Web Resources:

1. https://www.allaboutcircuits.com/
2. https://www.electronics-tutorials.ws/

MOOC/NPTEL/SWAYAM Courses:

1. https://onlinecourses.nptel.ac.in/noc23_ee77/preview
2. https://onlinecourses.nptel.ac.in/noc21_ee07/preview

4. Course Outcomes

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

CO. No.	Course Outcome
U23EC401.1	Classify and analyze the performance of various amplifiers.
U23EC401.2	Apply the principle of tuned amplifiers in real time applications.
U23EC401.3	Apply the concepts of oscillations to design waveform generating circuits using transistors.
U23EC401.4	Apply the characteristics of Op-amp in application specific circuits.
U23EC401.5	Interpret the characteristics of waveform generators and special function IC's

U23EC402	Digital System Design	L	T	P	J	C
		3	0	0	0	3

1. Course Description:

This course covers the fundamentals of digital design, including number systems, minimization techniques, modeling digital circuits using Verilog HDL, and designing combinational and sequential logic circuits. Additionally. it explores memory devices and logic families

2. Course Objectives:

1. To guide students in grasping the fundamentals of number systems and minimization techniques.
2. To instruct and support students in modeling digital circuits using Verilog HDL.
3. To facilitate students' understanding of the design principles behind combinational logic circuits.
4. To enable students to apply theoretical concepts in the practical design and analysis of sequential digital circuits.
5. To educate students on memory devices and different logic families.

3.Syllabus **45 Periods**

Unit-I: Introduction of Basics concepts of Digital System **(9)**

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: Verilog HDL **(9)**

Lexical conventions – Ports and modules – Gate level modeling – Operators – Dataflow modeling – Behavioural level modeling – Test bench.

Unit-III: Combinational Logic Circuits **(9)**

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Combinational Logic: Design Procedure – Adders – Subtractors - Magnitude Comparator - Code converters– decoder - encoder – Multiplexer and Demultiplexer - parity generator – parity checker – Modeling of combinational logic circuits using Verilog HDL.

Unit-IV: Sequential Logic Circuits **(9)**

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, logic implementation - Modeling of sequential logic circuits using Verilog HDL – Overview of Asynchronous logic circuits.

Unit-V: Memory Devices and Logic Families **(9)**

Memory Devices: Classifications of memory – ROM - PROM – EPROM – EEPROM – RAM – Static and dynamic RAM – Programmable Logic Devices – Implementation of combinational logic circuits using PLA, PAL and PROM. Logic Families: TTL and CMOS Logic and their characteristics.

Text Books:

1. M. Morris Mano and Michael D. Ciletti, "Digital Design", 5th Edition, Pearson, 2014.
2. S. Palnitkar, "Verilog HDL – A Guide to Digital Design and Synthesis", Pearson

References:

Reference Books:

1. Donald P Leach, Albert Paul Malvino, GowtamSaha, "Digital Principles and Applications", MGH, 8th Edition, 2018
2. Thomas L.Floyd, "Digital Fundamentals", Prentice Hall, 11th Edition, 2015.
3. A.Anand Kumar, "Fundamentals of Digital Circuits", 4th Edition, PHI Learning, 2016

Journals:

1. Journal of VLSI circuits and systems - https://www.vlsijournal.com/index.php/vlsi
2. International Journal of VLSI design & Communication Systems - https://airccse.org/journal/vlsi/vlsics.html

Web Resources:

1. https://www.chipverify.com/verilog/verilog-coding-style-effect/
2. https://www.electronics-tutorials.ws/combination/comb_1.html
3. https://www.electronics-tutorials.ws/sequential/seq_1.html
4. https://www.electronics-tutorial.net/digital-logic-families/

MOOC / NPTEL / SWAYAM Courses:

1. https://onlinecourses.nptel.ac.in/noc23_ee88/unit?unit=16&lesson=17
2. https://nptel.ac.in/courses/117/106/117106086/

4. Course Outcomes:

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

CO. No.	Course Outcome
U23EC402.1	Apply Boolean algebra, Karnaugh map to design combinational logic circuits.
U23EC402.2	Outline the concepts of Verilog HDL coding for modeling combinational and sequential logic circuits.
U23EC402.3	Apply different minimization techniques for designing various combinational logic circuits.
U23EC402.4	Analyze the synchronous sequential digital circuits for real time applications.

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U23EC402.5	Utilize the PLDs for combinational circuit design.

U23EC403	Electromagnetic Fields and Waveguides	L	T	P	J	C
		3	0	0	0	3

1. Course Description:

This course delves into the fundamentals of electromagnetism starting from the basics of vector calculus striving towards various laws and theorems. It offers topics such as Electrostatics and Magnetostatics in electromagnetic fields. It explores time-varying fields, Maxwell's equations, and introduces concepts related to waves and waveguides with an introduction of electromagnetic interference (EMI) and electromagnetic compatibility (EMC).

2.Course Objectives:

1. To facilitate understanding the basics of electromagnetism
2. To explain electrostatics in Electromagnetic fields
3. To explain magnetostatics in Electromagnetic fields
4. To facilitate understanding the Time-varying field and derive Maxwell's equations
5. To teach the concepts of waveguides and EMI/EMC

3.Syllabus **45 Periods**

Unit-I: Introduction to Electromagnetic Fields **(9)**

Electromagnetic model, SI Units and constants, Review of vector algebra, Rectangular, cylindrical and spherical coordinate systems, Integrals Containing Vector Functions, Gradient of a scalar field, Divergence of a vector field, Divergence theorem, Curl of a vector field, Stoke's theorem, Null identities, Helmholtz's theorem.

Unit-II: Electrostatics **(10)**

Electric field, Coulomb's law, Gauss's law and applications, Electric potential, Conductors in static electric field, Dielectrics in static electric field, Electric flux density and dielectric constant, Boundary conditions, Capacitance, Electrostatic energy, Poisson's and Laplace's equations.

Unit-III: Magnetostatics **(10)**

Lorentz force equation, Ampere's law, Vector magnetic potential, Biot-Savart law and applications, Magnetic field intensity and idea of relative permeability, Boundary conditions for Magnetostatic fields, Inductance, Magnetic energy, Magnetic forces and torques.

Unit-IV: Time-varying Fields and Maxwell's Equations **(9)**

Faraday's law, Equation of continuity, Conduction and Displacement currents, Current density and Ohm's law, Maxwell's equations, Electromagnetic boundary conditions, Time-harmonic fields.

Unit-V: Waveguides and EMI/EMC **(7)**

Waves: Wave equations and solutions, Wave parameters -Velocity, Intrinsic impedance, Propagation constant - Skin depth – General Wave behaviors along uniform Guiding structures – Transverse Electric, Magnetic and Electromagnetic Waves – EMIC: Introduction to EMI and EMC, Sources and Victims of EMI, Radiation hazards to humans.

Text Books:

1. David K. Cheng, "Field and Wave Electromagnetics", 2nd ed., Pearson Education India, 2014
2. Clayton R. Paul, "Introduction to Electromagnetic Compatibility", Wiley - Interscience, 2006

References:

1. W.H. Hayt Jr., J.A. Buck and M.Jaleel Akhtar, "Engineering Electromagnetics", 9th ed., McGraw-Hill (India), 2020

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2. Dr.P.Dananjayan, "Electromagnetic Fields", 6th ed., Lakshmi Publications, 2023.
3. M.N.O. Sadiku and S.V. Kulkarni, "Principles of Electromagnetics", 6th ed., Oxford (Asian Edition), 2015
4. David J. Griffiths, "Introduction to Electrodynamics", 4th ed., South Asia Edition, Cambridge
5. University Press, 2020
6. Branislav M. Notaros, "Electromagnetics", 1st ed.Pearson, 2011
7. S.Ramo, Whinnery J R, "Fields and Waves in Communication Electronics", John Wiley, 2011

Journals:

1. Journal of Electromagnetic Analysis and Applications
2. Journal of Progress in Electromagnetics Research
3. International Journal of Electromagnetic and Applications

Magazines:

1. https://www.electronicdesign.com/
2. https://spectrum.ieee.org/search/?q=electromagnetics

Web Resources:

1. https://www.uni-muenster.de/imperia/md/content/physik_tp/lectures/ws2016- 2017/ num_methods_i/wave.pdf
2. https://physicscatalyst.com/magnetism/mag_current_0.php
3. www.ece.mcmaster.ca/faculty/nikolova/EM_2FH3.../lectures/L13_BCdiel_post.pdf

MOOC / NPTEL / SWAYAM Courses:

1. https://onlinecourses.nptel.ac.in/noc24_ee137/preview
2. https://onlinecourses.nptel.ac.in/noc24_ee120/preview

4. Course Outcomes:

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

CO. No.	Course Outcome
U23EC403.1	Understand the fundamental electromagnetic laws and concepts
U23EC403.2	Analyze field potentials due to static charges and static electric fields
U23EC403.3	Analyze field potentials due to static charges and static magnetic fields
U23EC403.4	Apply Maxwell Equations and Classify the fields under time varying situations
U23EC403.5	Develop the electromagnetic wave equations and understand the basic concepts of waveguides and electromagnetic interference and compatibility

U23CS491	Java Programming	L	T	P	J	C
		2	0	2	2	4

1. Course Description:

This course provides a comprehensive understanding of Java programming language and its application development capabilities. Through theoretical discussions and hands-on lab exercises, students will learn the foundational concepts of Java, object-oriented programming principles, advanced features of Java 8, exception handling, multithreading, JavaFX for GUI development, and JDBC for database connectivity. By the end of the course, students will have the knowledge and skills to develop robust Java applications and graphical user interfaces.

2. Course Objectives:

1. To establish a foundation in Java programming concepts.

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2.	To empower students to master object-oriented mechanisms in java programming
3.	To teach students to expertly handle strings, collections, and Java 8 features
4.	To familiarize the students to build reliable and concurrent Java programs using exception handling and multithreading
5.	To acquaint students to build dynamic, data-driven desktop applications using JavaFX and JDBC

3. Syllabus	**30+30+30=90 Periods**
Unit-I: Foundations of Java	**(6)**
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	**(6)**
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	
Unit-III: Strings, Collections & Java 8 Features	**(6)**
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	**(6)**
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	**(6)**
JAVAFX Events and Controls: Event Basics , Handling Key and Mouse Events ; Controls: Checkbox, ToggleButton , RadioButtons , ListView , ComboBox , ChoiceBox , Text Controls , ScrollPane , Layouts , FlowPane , HBox and VBox , BorderPane , StackPane , GridPane; Menus: Basics , Menu bars , MenuItem , JDBC , drivers, Steps to create a JDBC application , DB Connection Pool	

	List of Experiments	**(30)**
1.	Implement class, objects, data types, operators, control statements, wrapper classes and scanner classes using java (CO 1)	
2.	Implement command line arguments with i/o packages using java (CO 1)	
3.	Implement sequential search, binary search and quadratic sorting algorithms using java (CO 1)	
4.	Implement encapsulation, abstraction, polymorphism and inheritance using java (CO 2)	
5.	Implement interface by accessing super class constructors and methods using java (CO 2)	
6.	Implement string, string functions, string builder, string buffer and regex using java (CO 3)	
7.	Implement lambda expression & for each() method using java (CO 3)	
8.	Implement generics-wildcard expression using java (CO 3)	
9.	Implement stack and queue data structures using java (CO 3)	
10.	Implement list, map, set, date and time using java (CO 3)	

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11. Implement exception handling by creating user-defined exceptions using java (CO 4) 12. Implement multithreading and inter-thread communication using java (CO 4) 13. Develop applications using javafx controls, layouts and menus (CO5)	
Project:	**(30)**
Develop a Java application for any real-world problem	
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. 4. Daniel Liang L, "Introduction to Java Programming", 10th Edition, Pearson Education, New Delhi, 2015.	
Web Resources: 1. https://www.javatpoint.com/java-tutorial 2. https://docs.oracle.com/javase/tutorial/ 3. https://www.geeksforgeeks.org/java/ **MOOC/NPTEL /SWAYAM Courses:** 1. https://www.coursera.org/specializations/object-oriented-programming 2. https://intellipaat.com/academy/course/java-training/ 3. https://www.udemy.com/course/java-tutorial/	

4. Course Outcomes:

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

CO. No.	Course Outcome
U23CS491.1	Understand the core concepts of Java programming
U23CS491.2	Explain the principles of object-oriented programming (OOP) and apply them to develop Java applications.
U23CS491.3	Analyze and apply the concepts of strings, collections, and Java 8 features to solve programming problems
U23CS491.4	Develop Java applications with effective exception handling mechanisms and implement multithreading concepts
U23CS491.5	Design and develop windows-based applications using JavaFX, incorporating various GUI components and event handling mechanisms.

U23EC451	Analog Electronic Circuits Laboratory	L	T	P	J	C
		0	0	4	0	2

1.Course Description:

The Analog Electronic Circuits Lab is designed to provide hands-on experience with the fundamental and advanced concepts covered in the Analog Electronic Circuits course. This laboratory complements the theoretical knowledge by allowing students to design, construct,

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and test various analog circuits, including amplifiers, oscillators, waveform generators, and applications of operational amplifiers. Through a series of structured experiments, students will develop practical skills in circuit analysis, troubleshooting, and the use of electronic measurement instruments.

2. Course Objectives:

1. To facilitate students' understanding and practical application of feedback principles and power amplifier design.
2. To provide instruction on oscillator design, guiding students in constructing RC and LC oscillators
3. To assist students in designing multivibrator circuits.
4. To provide comprehensive instruction on the design of operational amplifier circuits.
5. To help in designing voltage regulators and also in simulation process.

3. List of Laboratory Experiments / Exercises: **60 Periods**

1. Design a voltage series feedback amplifier to meet specific gain, stability, and bandwidth requirements, considering trade-offs and optimization techniques.
2. Design a direct coupled Class A power amplifier to achieve a balance between efficiency, output power, and distortion within specified constraints.
3. Design an RC and LC oscillator using a BJT based on frequency requirements and stability considerations.
4. Design a multivibrator circuit using BJT to meet desired pulse width, frequency, and stability requirements.
5. Design a Class C single tuned amplifier for a specific frequency band, optimizing output power and efficiency.
6. Design of Inverting and Non-Inverting using Op-Amp.
7. Design of Integrator, Differentiator, Instrumentation Amplifier, Schmitt Trigger using Op-Amp.
8. Design an LM78XX-based voltage regulator to meet specific voltage and current requirements.
9. Simulation of experiment no.3,4,6,7 using SPICE tool.
10. **Mini project:** Design of Analog circuits for real time applications using discrete Analog components.

References:

1. S.Salivahanan, N. Suresh Kumar, "Electronic Devices and Circuits", McGraw Hill, 4/e.
2. D.Roy Choudhury, Shail B Jain, "Linear Integrated Circuits", New Age International Publishers, IV edition.
3. Adel S.Sedra, Kenneth C. Smith, "Microelectronic Circuits", Oxford International student edition, 6/e.
4. David.A.Bell, "Electronic Devices and Circuits", Prentice Hall of India IV edition.

4. Course Outcomes:

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

CO. No.	Course Outcome
U23EC451.1	Design and analyze the various types of amplifiers
U23EC451.2	Construct and simulate waveform generating circuits.
U23EC451.3	Analyze wave shaping circuits using active devices.
U23EC451.4	Design and simulate the basic amplifier circuits using Op-Amp.
U23EC451.5	Design simple electronic application using active devices.

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U23EC452	Digital System Design Laboratory	L	T	P	J	C
		0	0	2	0	1

1.Course Description:

This practical course introduces Verilog as a hardware description language (HDL) for digital logic design. Students learn Verilog constructs and modeling techniques, coding and simulating digital circuits, and implementing designs on FPGAs. By the end, the students will be equipped to create real-world digital systems

2.Course Objectives:

1. To instruct students on analyzing the characteristics of digital ICs, enhancing their understanding of digital electronics.
2. To guide students in the design and implementation of arithmetic circuits like half adders and full adders using multiplexers.
3. To facilitate hands-on learning in modeling and simulating various flip-flops, counters, and shift registers, reinforcing concepts in sequential logic design.
4. To mentor students in implementing and simulating combinational circuits using both logic gates and FPGA technology.
5. To support students in designing and synthesizing complex digital systems, such as simple ALUs and state machines, to solve real-life problems.

3.List of Experiments: **30 Periods**

1. Analyze the Characteristics of digital ICs.
2. Design and Implementation of half adder and full adder using Multiplexer.
3. Design and implementation of Encoder and Decoder using logic gates.
4. Simulation of JK, D and T Flip-flops.
5. Model and simulate of 4-bit ripple counter and Mod-10 counter.
6. Model and simulate of SISO and PIPO shift registers using Flip- flops.
7. Simulation of combinational circuits (Expt.No.2 and 3).
8. Implementation of combinational circuits using FPGA (Expt.No.2 and 3).
9. Simple ALU design (Simulation and Synthesis).
10. Complex state machine design (Simulation and Synthesis for a real-life problem).

References:

1. M. Morris Mano and Michael D. Ciletti, "Digital Design", 5th Edition, Pearson, 2014.
2. S. Palnitkar, "Verilog HDL – A Guide to Digital Design and Synthesis", Pearson, 2003.
3. Donald P Leach, Albert Paul Malvino, GowtamSaha, "Digital Principles and Applications", MGH, 8th Edition, 2018
4. Thomas L.Floyd, "Digital Fundamentals", Prentice Hall, 11th Edition, 2015.

4. Course Outcomes:

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

CO. No.	Course Outcome
U23EC452.1	Identify, configure and use off-the-shelf digital ICs.
U23EC452.2	Design of combinational circuits using various logic gates.
U23EC452.3	Design of sequential circuits using various logic gates and flip flops.
U23EC452.4	Design and implement combinational and Sequential circuits using Verilog.
U23EC452.5	Design and implement simple digital system for a real-life problem

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U23EM753	Advanced Logical Thinking	L	T	P	J	C
		0	0	2	0	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: **30 Periods**

Unit-I: Inductive Reasoning through Permutations & Combination **(6)**

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 **(6)**

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

Unit-III: Strategical techniques in Time, Speed and Distance **(6)**

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.

Unit-IV: The Logical Approach to Mixture and Allegation **(6)**

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 **(6)**

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 References:

1. https://www.hackerearth.com/
2. https://www.geeksforgeeks.org/
3. https://www.indiabix.com/

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4. Course Outcomes:

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

CO. No.	Course Outcome
U23EM753.1	Develop the ability to use inductive reasoning to solve complex problems involving permutations and combinations.
U23EM753.2	Understand probability theory to make informed decisions under uncertainty.
U23EM753.3	Utilize strategic techniques to solve problems related to time, speed, and distance.
U23EM753.4	Apply logical reasoning to solve problems involving mixtures and allegations.
U23EM753.5	Enhance logical reasoning skills to tackle a variety of analytical problems.

U23MC903	Environmental Science	L	T	P	J	C
		1	0	0	0	NC

1. Course Description:

Environmental Science for Engineering Students offers a focused exploration of key environmental concepts tailored to the needs and interests of engineering students. This course provides a comprehensive understanding of environmental issues relevant to engineering practice, emphasizing the application of scientific principles and engineering solutions to address environmental challenges. Students will develop the knowledge, skills, and perspectives necessary to integrate environmental considerations into engineering design, planning, and decision-making processes.

2. Course Objectives:

1. To impart knowledge on the principle of environmental science and engineering.
2. To make students understand the ecosystems and natural resources.
3. To enable students understand the various causes for environmental degradation.
4. To create awareness on pollution, value education, population growth and social issues.
5. To enhance the current opportunities in sustainability and its solution in environmental aspects.

3. Syllabus **15 Periods**

Unit-I: Environment and Ecosystem **(3)**

Scope and importance; concept of sustainability and sustainable development: 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 and Analysis **(3)**

Environmental pollution: types, causes, effects and controls, Air, Water, soil and noise Pollution, Role of individual in control of pollution; Nuclear hazards and human health risks.

Unit-III: Natural Resources **(3)**

Land resources and land use change: Land degradation, soil erosion and desertification; Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations; Water: Use and over-exploitation of surface and ground water.

Unit-IV: Social Issues and Environmental Polices **(3)**

Environmental Issues; Environmental ethics; Climate change: global warming, ozone layer depletion and acid rain; Environment Laws: Environment Protection Act, Air (Prevention & Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act.

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Unit-V: Human Population and the Environment (3)
Population growth: variation among nations, Population explosion, Family Welfare Programmes; Environment and human health: Human Rights, Value Education; Women and Child Welfare; Role of Information Technology in Environment and Human Health.

Text Books:

1. Gilbert M. Masters, Introduction to Environmental Engineering and Science, 2nd Edition, Pearson Education, 2004.
2. Dr. A. Ravikrishnan, Environmental Science and Engineering, Sri Krishna Hi-Tech Publishing Company Pvt. Ltd., 10th Edition, 2014.
3. M. Davis, S. Masten, Principles of Environmental Engineering and Science, Mcgraw hill publisher, 3rd Edition, 2013.
4. G.M. Masters, W. Ela, Introduction to Environment Engineering and Science, Prentice Hall Publisher, 2008.

References:

Reference Books:

1. R. K. Trivedy and P. K. Goel, An Introduction to Air Pollution, BS Publications, 2003.
2. G. Tyler Miller and Scott E. Spoolman, Environmental Science, 15th Edition, Cengagelearning, 2016.
3. Miller T. G. and Spoolman S. E., "Environmental Science". Cengagelearning16th Edition, 2017.
4. Sinha J., "Environmental Science". Galgotia Publications. 2nd Edition. 2011.
5. P. J. Vesilind. J. J. Peirce. R.F. Weiner. Environmental Pollution and Control. Butterworth-Heinemann, USA, 1990.
6. S. Divan, A. Rosencranz, Environmental Law and Policy in India: Cases, Materials and Statues (2nd edition). Oxford University Press, 2002.

Journals:

1. RSC Advances (https://pubs.rsc.org/en/content/articlehtml/2012/ra/c2ra20340e)
2. International journal of Hydrogen Energy (https://www.sciencedirect.com/science/article/abs/pii/S0360319916309478)
3. Nano Energy journal (https://www.sciencedirect.com/science/article/abs/pii/S2211285518305755)
4. International Journal of Electrochemical Science. (http://www.electrochemsci.org/papers/vol11/111210628.pdf)

Video References:

1. https://www.youtube.com/watch?v=Y5B1nWYle40
2. https://study.com/academy/lesson/what-is-environmental-science-definition-and-scope-of-the-field.html
3. https://www.youtube.com/watch?v=CXCT2R1K6Ts
4. https://www.youtube.com/watch?v=89B9IT0Tl-Q
5. https://www.youtube.com/watch?v=p-lSPDDdVtc

MOOC/SWAYAM/NPTEL Courses:

1. https://onlinecourses.nptel.ac.in/noc23_hs155/preview
2. https://onlinecourses.nptel.ac.in/noc19_ge22/preview
3. https://onlinecourses.nptel.ac.in/noc20_ge16/preview

4. Course Outcomes:

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

CO. No.	Course Outcome
U23MC903.1	Outline the structure and functions of an eco system

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U23MC903.2	Categorize the different types of pollution and its preventive measures
U23MC903.3	Interpret the importance of natural resources in environment
U23MC903.4	Identify the social issues and to utilize the environmental policies
U23MC903.5	Apply role of IT in human population and environment

SEMESTER IV

U23MA209	Probability and Statistics	L	T	P	J	C
		3	1	0	0	4

1. Course Description:

This course provides a foundational understanding of probability theory and statistical methods, essential for making informed decisions in diverse fields such as science, engineering, business and social sciences. The curriculum encompasses both theoretical principles and practical applications, enabling students to analyze data, draw meaningful inferences, and make informed decisions in uncertain situations.

2. Course Objectives:

1. Familiarize the students on outcomes of random occurrences.
2. Enhance them in various distributions and its applications.
3. Impart the knowledge of correlation and regression and interpret the linear regression equation.
4. Inculcate inference about the population on the basis of a random sample.
5. Train them to approximate the value of a population parameter on the basis of sample statistics.

3. Syllabus **45 +15 = 60 Periods**

Unit-I: Random Variables **(9+3)**

Probability axioms; Conditional probability; Baye's theorem statement only; Discrete and continuous random variables; Moments, moment generating functions.

Unit-II: Standard Probability Distributions **(9+3)**

Discrete distributions: Binomial distribution, poisson distribution; Continuous distributions: Uniform distribution, exponential distribution, normal distribution.

Unit-III: Two Dimensinal Random Variables **(9+3)**

Joint probability distributions; marginal and conditional distributions; covariance; correlation and regression for discrete case.

Unit-IV: Testing of Hypothesis **(9+3)**

Introduction, Critical region and level of significance; Types of Errors; Large sample tests: Z-test for single mean and difference of means; Small sample tests: Student's t-test for testing significance of single mean and difference of means; F-test for comparison of variances; Chi-square test: Test of goodness of fit, Test of independence of attributes.

Unit-V: Design of Experiments **(9+3)**

Analysis of variance, One way classification: Completely randomized design; Two way classification: Randomized block design; Three way classification: Latin square design.

List of Tutorials :

1. Using statistical software R data numerically to perform data analysis. (CO 1)
2. Introduction: Understanding Data types; importing/exporting data. (CO 1)
3. Generation of poisson and uniform random variables. (CO 1)
4. Generation of gaussian and exponential random variables. (CO 2)
5. Computation of the probability distributions. (CO 2)
6. Fitting of Normal distribution. (CO 2)
7. Estimation of mean and variance. (CO 2)

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8. Implementation of various statistical measures like mean, median, mode. (CO 2)
9. Applying correlation and simple linear regression model to real dataset. (CO 3)
10. Testing of hypothesis for large sample tests. (CO 4)
11. Applying the t-test for independent and dependent samples. (CO 4)
12. Testing of hypothesis for Small Sample tests for F-test. (CO4)
13. Applying Chi-square test Contingency test to real dataset. CO 4)
14. Performing ANOVA for real dataset for one way, two way and three way classifications. (CO 5)

Text Books:

1. Douglas C. Montgomery and George C. Runger, "Applied Statistics and Probability for Engineers", 3rd Edition, John Wiley and Sons Inc, 2005.
2. Walpole R. E., Myers S.L. and Keying Ye, "Probability and Statistics for Engineers and Scientists", 9th Edition, Pearson Education Inc, 2012.

References:

Reference Books:

1. Johnson R. A., Miller and Freund's, "Probability and Statistics for Engineers", 8th Edition, Pearson Education, Delhi, 2015.
2. Devore. J. L., "Probability and Statistics for Engineering and the Sciences", 8th Edition, Cengage Learning, New Delhi, 2014.

Journal References:

1. International journal of probability and statistics: http://www.sapub.org/Journal/articles.aspx?journalid=1119
2. 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=KzfWUEJjG18
2. https://www.youtube.com/watch?v=bpKarwfDRIk
3. https://www.youtube.com/watch?v=32CuxWdOlow
4. https://www.youtube.com/watch?v=zJ8e_wAWUzE
5. https://www.youtube.com/watch?v=iYiOVISWXS4
6. https://www.youtube.com/watch?v=I_dhPETvll8

MOOC/NPTEL/SWAYAM Courses:

1. https://archive.nptel.ac.in/courses/117/105/117105085/
2. https://nptel.ac.in/noc/courses/noc22/SEM1/noc22-ma30/
3. https://onlinecourses.nptel.ac.in/noc22_mg31/

4. Course Outcomes

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

CO. No.	Course Outcome
U23MA209.1	Formulate and solve problems involving random variables.
U23MA209.2	Analyze the basic concepts of random variables and find an appropriate distribution for an experiment.
U23MA209.3	Apply statistical methods like correlation, regression analysis in analyzing, interpreting experimental data.
U23MA209.4	Analyze the concept of various test statistics used in hypothesis testing for mean and variances of large and small samples.
U23MA209.5	Evaluate the factors controlling the value of a parameter through conducting, planning, analysing and interpreting the data.

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U23CS303	Algorithm Design Techniques	L	T	P	J	C
		3	0	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.

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.

3.Syllabus **45 Periods**

Unit-I: Algorithm Analysis Techniques **(9)**

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 **(9)**

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 **(9)**

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 **(9)**

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 **(9)**

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 Book:

1. Anany Levitin — Introduction to the Design and Analysis of Algorithms, Third Edition, Pearson Education, 2017

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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/
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
U23CS303.1	Understand the importance of designing strategies, time and space complexity
U23CS303.2	Apply brute force and divide and conquer strategies in solving problems
U23CS303.3	Apply dynamic programming in solving complex problems
U23CS303.4	Apply greedy algorithms in solving problems
U23CS303.5	Compare the time and space complexities of different types of algorithms

U23EC404	Analog And Digital Communication	L	T	P	J	C
		3	0	0	0	3

1. Course Description:

This course delves into the fascinating world of communication, exploring the fundamental principles and techniques behind both analog and digital systems. Students will learn how continuous signals carry information and discover modulation techniques like AM and FM. Dive into the binary world of digital data and understand how it's transformed for transmission.

2. Course Objectives:

1. To describe the basic components of a communication system.
2. To understand the concept of modulation, demodulation, signal-to-noise ratio (SNR), and bandwidth.
3. To understand the differences between Analog and Digital communication.
4. Identify and characterize different types of Analog modulation (AM, FM, PM).
5. Explore the principles of various Digital modulation techniques

3. Syllabus **45 Periods**

Unit-I: Amplitude Modulation **(9)**

Amplitude Modulation: Modulation Techniques, Need for modulation, Types of Modulation (AM, FM, PM, PAM, PWM, PPM), Amplitude modulation in Time domain and frequency domain, Single tone modulation; Generation of Amplitude Modulation: Square law, Switching modulators; Detection of amplitude modulation: Square law, Envelope detectors; Super Heterodyne Receiver.

Unit-II: Frequency Modulation **(9)**

Introduction: Single tone Frequency Modulation, Narrow Band Frequency Modulation, Wide Band Frequency Modulation; FM generation: Direct Method: Varactor Diode; Indirect Method: Armstrong Method; FM detection: Balanced Slope Detector, Foster Seeley Method; Comparison of FM & AM.

Unit-III: Waveform coding and Encoding Techniques **(9)**

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Pulse code modulation; Differential pulse code modulation; Delta modulation; Adaptive Delta Modulation; Encoding: Nyquist criterion for distortion less base-band binary transmission, duo-binary coding, Eye pattern.

Unit-IV: Digital Modulation Techniques (9)

Digital modulation formats; Coherent Binary Modulation Techniques: BFSK and BPSK, QPSK, MSK, M-ary QAM; Power spectra of BFSK, BPSK, QPSK and MSK.

Unit-V: Information Theory and Coding (9)

Introduction to Channel coding: Need for channel coding, Shannon's coding theorem; Linear Block codes: Hamming Code and Cyclic Code, Code rate, encoding procedure; Error detecting and correcting capability: Syndrome calculation for error detection; Error Correction: Convolutional encoder representation, transform domain representation, tree, trellis and state representation.

Text Books:

1. Simon Haykin, "Communication Systems", Wiley India, 4th edition, 2006 (Module I and II)
2. Simon Haykin, "Digital Communication", Wiley India, 4th edition, 2006 (Module III, IV and V)

References:

Reference Books:

1. H.Taub, D L Schilling and G Saha, "Principles of Communication", 4th Edition, Pearson Education.2017
2. B. P.Lathi, Zhi Ding, Hari Mohan Gupta "Modern Analog and Digital Communication Systems". 4th Edition, Oxford University Press, 2017
3. Wayne Tomasi, "Advanced Electronic Communication Systems", 6th Edition, Pearson Education, 2018.
4. Kennedy, G., "Electronic Communication systems", Tata McGraw Hill, New Delhi, 2015.

Journals:

1. https://ieeexplore.ieee.org/document/1456366
2. https://www.sciltp.com/journals/jadc/2024/1/359
3. https://www.sciencedirect.com/journal/digital-communications-and-networks

Web Resources:

1. https://gctjaipur.wordpress.com/wp-content/uploads/2015/08/an-introduction-to-analog-and-digital-communications-2nd-edition.pdf
2. https://www.javatpoint.com/digital-communication
3. https://www.monolithicpower.com/en/learning/resources/analog-vs-digital-signal?srsltid=AfmBOoqodLhvsYyJzlQ4Cecjj_JOF90HNKHewDJzBjv5nXRPu1ZihyGi

MOOC / NPTEL / SWAYAM Course:

1. https://nptel.ac.in/courses/117101106

4. Course Outcomes:

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

CO. No.	Course Outcome
U23EC404.1	Evaluate the performance of different amplitude modulation and demodulation techniques to determine their suitability for different communication needs
U23EC404.2	Analyze the bandwidth utilization and power consumption characteristics of different FM and demodulation techniques.

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U23EC404.3	Apply adaptive modulation strategies that dynamically adjust channel noise levels to optimize performance.
U23EC404.4	Evaluate the efficacy of different methods for encoding digital data onto carrier signals for transmission.
U23EC404.5	Analyze the strengths and weaknesses of different coding techniques applied in real-world scenarios.

U23EC405	Microprocessor and Embedded Systems	L	T	P	J	C
		3	0	0	0	3

1. Course Description:

This course introduces students to the fundamental concepts of microprocessors and embedded systems, emphasizing their architecture, programming, and interfacing. Students will explore the design and operation of microprocessor-based systems, with a focus on embedded applications. The course covers essential topics such as assembly language programming, interfacing techniques, and peripheral devices. Key concepts include the architecture of microprocessors, instruction sets, addressing modes, and timing analysis. Students will gain hands-on experience through laboratory exercises, where they will design, program, and debug embedded systems using modern microcontrollers. The course will also address real-time operating systems (RTOS) and the integration of hardware and software components to solve real-world problems.

2. Course Objectives:

1. To teach the instruction set of the 8085, including addressing modes and instruction categories.
2. To instruct the architecture and key features of the Intel 8051 microcontroller.
3. To educate the on-chip peripherals of the 8051, such as timers, counters, and serial communication units.
4. To define the key components of an embedded system, including hardware and software.
5. To illustrate the various embedded hardware platforms with real time project examples.

3. Syllabus **45 Periods**

Unit-I: Intel Microprocessor 8085 **(9)**

Introduction to Microprocessor and Buses: 8085 Hardware Architecture, 8085 Pin out, register organization, instruction format, addressing modes, instruction set, programming 8085.

Unit-II: Intel Microcontroller 8051 **(9)**

Introduction to 8-bit microcontroller: 8051 architecture, memory organization, Special function registers, Port operation, operand addressing, instruction set, programming 8051.

Unit-III: Interfacing 8051Microcontroller **(9)**

Programming 8051 Timers; Serial Port Programming; Interrupts Programming; Interfacing: LCD, Keyboard, ADC, DAC, Sensor, External Memory, Stepper Motor; Waveform generation.

Unit-IV: Embedded System Architecture and Design **(9)**

Introduction to Embedded system: application areas, categories, overview, specialties, recent trends, hardware architecture, software architecture; Architecture of Kernel: Tasks and task scheduler; Development process: requirements engineering, design, implementation, integration and testing.

Unit-V: Embedded Hardware Platforms **(9)**

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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 (Unit I, II & III)
2. Dr.K.V.K.K. Prasad, "Embedded/Real-time Systems: Concepts, Design and Programming", Dreamtech Press, 2012. (Unit IV)
3. Niel Cameron, "Arduino Applied Comprehensive Projects for Everyday Electronics", APress, 2018 (Unit V)

References:

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. IEEE Transactions on Electronics Devices
2. Microelectronics Journal

Magazines:

1. https://www.electronicdesign.com/
2. https://spectrum.ieee.org/

Web Resources:

1. https://www.allaboutcircuits.com/
2. https://www.electronics-tutorials.ws/

MOOC / NPTEL / SWAYAM Courses:

1. https://onlinecourses.nptel.ac.in/noc22_ee12/preview
2. https://archive.nptel.ac.in/courses/117/103/117103063/

4. Course Outcomes:

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

CO. No.	Course Outcome
U23EC405.1	Analyze the architecture of the 8085 microprocessor and demonstrate the application of its principles by crafting an assembly program using instruction sets.
U23EC405.2	Demonstrate comprehension of the 8051-microcontroller architecture by developing an assembly program using 8051 instructions
U23EC405.3	Outline the programming model and interfacing peripheral devices with 8051 microcontroller
U23EC405.4	Applying the knowledge of tasks and task scheduling of embedded system architecture and design process
U23EC405.5	Evaluate microcontrollers-based systems using Sensor and Communication devices

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U23EC481	Signals and Systems	L	T	P	J	C
		3	0	2	0	4

1. Course Description:

This course offers a captivating journey into the fundamental principles that govern how information is represented, processed, and transmitted. Dive into different types of signals and unravel the hidden meaning within signals using powerful mathematical techniques like Fourier, Laplace and Z Transforms. Understand how systems process and manipulate continuous and discrete signals.

2. Course Objectives:

1. To define and classify the basic elementary signals and systems.
2. To teach how a continuous time signal is analysed using Fourier and Laplace Transforms.
3. To facilitate understanding the properties of linear time-invariant (LTI) systems and their response to different types of continuous time signal inputs.
4. To clarify how a discrete time signal is analysed using Z transform and impact of sampling process.
5. To elucidate the use of Z transform to analyse discrete time system and solving for stability and frequency response.

3. Syllabus **45 + 30 = 75 Periods**

Unit-I: Continuous and Discrete Time Signals and Systems (9)

Standard signals: Step, Ramp, Pulse, Impulse, Real and complex exponentials, and Sinusoids; Representation of Signals; basic operations on signals; Classification of signals: Continuous time (CT) and Discrete Time (DT) signals. Periodic & Aperiodic signals. Deterministic & Random signals. Energy & Power signals; CT systems and DT systems; Classification of systems.

Unit-II: Fourier and Laplace Analysis of Continuous Time Signals (9)

Introduction to Continuous Time Fourier Series (CTFS); Representation of CT aperiodic signals by Continuous Time Fourier Transform (CTFT); CTFT of CT periodic signals; Convergence of CTFT; Laplace transforms (LT) in Signal Analysis; properties of LT.

Unit-III: Linear Time Invariant Continuous Time Systems (9)

Differential Equation; Block diagram representation: direct form I and II; convolution integrals: graphical method; step response and impulse response of LTI systems; Fourier and Laplace transforms in Analysis of LTI systems.

Unit-IV: Z Transform Analysis of Discrete Time Signals (9)

Baseband Sampling of CT signals; sampling theorem; Introduction to Discrete Time Fourier Series (DTFS) and Discrete-Time Fourier Transform (DTFT); Z transform: ROC, Inverse Transform using Residue method, Partial Fraction methods, Properties of Z transform.

Unit-V: Linear Time Invariant Discrete Time Systems (9)

Difference Equations; Block diagram representation: direct form I and II, Cascade and Parallel; Linear and Circular Convolutions; Pole-zero plot; Analysis and characterization of LTI system using Z transform: step response and impulse response of LTI systems, frequency response of DT systems, Stability and Causality.

List of Experiments: **(30)**

1. Generate the mathematical representation of a CT and DT signal using software tools. (CO1)
2. Analyze the combined effect of performing multiple basic operations on signals and sequences. (CO1)
3. Compare and contrast the behaviour of linear and circular convolution (CO3 & CO5)

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4. Reconstruct the square wave by summing the calculated sinusoidal components based on their frequencies and amplitudes. (CO2)
5. Analyze practical scenarios where aliasing might occur and propose strategies to mitigate it. (CO4)
6. Apply basic signal processing techniques (e.g., scaling, filtering) to enhance specific features of the sensor data. (CO5)

Text Books:

1. Alan V Oppenheim, Alan S Willsky and S Hamid Nawab "Signals and Systems", Second edition, PHI Learning Private Limited, New Delhi, 2010.
2. Haykin. S and Barry Van Veen, "Signals and Systems", John Wiley and Sons, Second Edition, 2012

Reference Books:

1. Krishnaveni.V, Rajeswari.A, "Signals and Systems", First Edition, Wiley India Pvt. Ltd, 2012.
2. R.E.Zeimer, W.H.Tranter and R.D. Fannin, "Signals & Systems - Continuous and Discrete", Pearson, 2007
3. P.Ramesh Babu and R.Anandnatarajan. "Signals and Systems". Scitech Publications. 2016

Journals:

1. Circuits, Systems, and Signal Processing ISSN: 1531-5878 http://www.springer.com/engineering/electronics/journal/34

Web Resources:

1. https://ocw.mit.edu/courses/res-6-007-signals-and-systems-spring-2011/pages/lecture-notes/
2. https://ocw.mit.edu/courses/res-6-007-signals-and-systems-spring-2011/video_galleries/video-lectures

MOOC / NPTEL / SWAYAM Courses:

1. Signals and Systems By Prof. Hitesh Shrimali, Prof. Kushal K. Shah ,IIT Mandi, IISER Bhopal Principles of Signals and Systems By Prof. Aditya K. Jagannatham, IIT Kanpur

4. Course Outcomes:

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

CO. No.	Course Outcome
U23EC481.1	Apply basic operations to signals and systems in their respective representations.
U23EC481.2	Calculate the Fourier series and transforms to analyse the continuous time signals.
U23EC481.3	Identify the key features of an LTI system's frequency response that determine its behaviour for different input signals.
U23EC481.4	Compare and contrast different methods for analysing discrete-time signal using the Z-transform.
U23EC481.5	Analyze the stability of a discrete-time LTI system using Z-transform and pole locations.

U23NCC02	NCC Credit Course Level II	L	T	P	J	C
		2	0	2	0	3

1. Course Description:

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NCC Course Level II designed by UGC as a general elective course, equips students with essential skills for emergency response, fieldwork, and military activities. Students acquire expertise in disaster management, including coordinating relief efforts and managing various disaster scenarios. They also enhance their communication and navigation skills, mastering map reading and compass usage. This course provides a foundational understanding of the Armed Forces while advancing the field and battle skills of students. Overall, cadets enhance their physical fitness, agility, and discipline through rigorous training, culminating in a remarkable improvement in their overall agility and readiness.

2. Course Objectives:

1. Equip students with the necessary skills to maintain health and safety standards, respond effectively to medical emergencies, and manage patient care during crises
2. Instruct students in the principles of disaster management, enabling them to respond effectively to emergencies, collaborate with relevant authorities, and support relief efforts.
3. Develop students' proficiency in communication and map reading, including interpreting various map features, using navigation tools, and understanding geographic orientation.
4. Educate students on the structure and roles of the armed forces, pathways for entry, and the significance of military honors and awards.
5. Train students in essential field and battle craft skills, focusing on distance estimation, terrain analysis, camouflage, and effective communication

3. Syllabus **30 + 30 = 60 Periods**

Unit-I: Health & Hygiene **(6)**

Hygiene & Sanitation, Cleanliness, Water supply and its purification, Physical and Mental Health, First Aid: Common Medical Emergencies, Dressing of Wounds, Fracture & Treatment, Evacuation of Casualties, Methods of Carrying a Patient.

Unit-II: Disaster Management **(6)**

Civil Defence Organizations, Natural Disaster Management Authority (NDMA), National Disaster Responsive Force (NDRF), Types of Disaster, Fire Fighting, Traffic Control, Methods of NCC Assistance, Relief Camp, Collection & Distribution of Aid Material

Unit-III: Communication & Map Reading **(6)**

Communication, Introduction to types of maps & conventional signs, Scales & Grid System, Relief, Contours & Gradients, Cardinal points & Types of North, Types of Bearing, Service Protractor, Prismatic Compass.

Unit-IV: Armed Forces **(6)**

Basic organization of Armed forces & Army, Modes of Entry to Army, Honours & Awards, Concept of Integrated Defence staff.

Unit-V: Field Craft & Battle Craft **(6)**

Introduction to FC&BC, Judging Distance, Description of ground, Observation camouflage & concealment, Field Signal, Section Formation, Fire Control Orders, Fire & Movement.

List of Experiments: **(30)**

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1.Evaluate basic drill exercises to enhance discipline, coordination, and teamwork among cadets 2. Provide cadets with basic weapon handling skills, safety procedures, and marksmanship fundamentals. 3.Analyse the basics of map reading, including understanding map symbols, using a compass, and determining coordinates, to enhance their navigation skills. 4. Demonstrate the fundamentals of firing, including safety procedures, weapon handling, and marksmanship, to enhance their shooting skills and discipline. 5.Enhance physical fitness, agility, and confidence among cadets by training them to overcome various obstacles training
Text Books:
1. National Cadet Corps "Cadets Hand Book – Army (Common Subjects)".
Web Reference: 1. https://indiancc.nic.in/

4. Course Outcomes:

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

CO. No.	Course Outcome
U23NCC02.1	Evaluate various health and hygiene practices, including first aid techniques, to optimize community health and emergency response efforts and develop effective disaster management plans.
U23NCC02.2	Analyze the organizational structure and operational strategies of Civil Defence Organizations and the strategic plans for career entry into the Armed Forces
U23NCC02.3	Understand the advanced map reading and communication skills to accurately interpret navigational tools
U23NCC02.4	Demonstrate teamwork strategies and physical training through advanced drills and obstacle courses, enhancing coordination and discipline.
U23NCC02.5	Analyse and implement advanced techniques in weapon handling, safety, and navigation,

U23EC453	Communication Systems Laboratory	L	T	P	J	C
		0	0	2	0	1

1. Course Description:

This Communication Systems Laboratory course will transform your theoretical understanding of communication systems into practical skills through exciting hands-on experiments and simulations, you'll delve into the real-world working of various communication technologies, from analog modulation to digital signal processing and digital communication.

2.Course Objectives:

1. To enable students to understand the fundamental principles of analog and digital communication systems, including signal generation, transmission, and reception.

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2. To familiarize students with the use of laboratory equipment such as signal generators, oscilloscopes, spectrum analyzers, and communication kits, allowing them to measure and analyze communication signals.
3. To provide hands-on experience in implementing various modulation (AM, FM, PM) and demodulation techniques, as well as digital modulation schemes (ASK, PSK, FSK, QAM).
4. To teach students how to use software tools like MATLAB, or specialized communication software to simulate communication systems and analyze their performance.
5. To enhance critical thinking by designing and troubleshooting communication system experiments for optimal performance.

3. List of Laboratory Experiments: **30 Periods**

1. Design and develop the AM and FM (Modulation and Demodulation) systems and evaluate their performance characteristics with varying modulating and carrier frequencies.
2. Build the pulse modulation schemes (PAM, PPM and PWM) and analyze how the amplitude, position and duration are varied with varying input signals.
3. Develop a system which performs the signal sampling at different sampling intervals and reproduce the same, evaluate the system outcomes with noise characteristics.
4. Construct a system to explore strategies to reduce bandwidth requirements in PCM and DM. Evaluate their performance limits, noise characteristics, and trade-offs.
5. Perform the simulation of digital modulation schemes (ASK, FSK, and PSK generation and detection) and identify its limitations over different inputs.
6. Develop a MATLAB code to generate the QAM to attain higher spectral efficiency and robustness to noise for satellite applications.
7. Develop a MATLAB code to simulate Linear block and Cyclic error control coding schemes to explore their performance trade-offs for real-world communication scenarios.
8. Develop a MATLAB code to generate the Convolutional coding scheme for digital broadcasting.

References:

1. Lab manual prepared by Department of ECE.
2. John G. Proakis, Masoud Salehi, "Contemporary Communication Systems Using MATLAB", Cengage Learning; 1st Edition (2007)
3. Simon Haykin, "Communication Systems", Wiley India, 4th edition, 2006

4. Course Outcomes:

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

CO. No.	Course Outcome
U23EC453.1	Build different analog modulation and demodulation circuits and evaluate its performance against theoretical models.
U23EC453.2	Design, construct, and analyze pulse-based communication systems to uncover their strengths and limitations.
U23EC453.3	Implement and evaluate the signal sampling, PCM, and DM techniques to explore their performance limits, noise characteristics, and trade-offs.
U23EC453.4	Simulate and interpret the fundamental digital modulation schemes to analyze their strengths and limitations.
U23EC453.5	Experiment with diverse coding techniques in a virtual laboratory, analysing their impact on data integrity through interactive simulations

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U23EC454	Microprocessor and Embedded Systems Laboratory	L	T	P	J	C
		0	0	2	0	1

1. Course Description:

This laboratory course provides you a practical experience in programming, interfacing, and designing real-world applications using Microprocessor and Microcontrollers.

2. Course Objectives:

1. To develop proficiency in Assembly Language Programming
2. To facilitate Hands-on Learning in Peripheral Interfacing
3. To promote Critical Analysis of Embedded Systems.
4. To encourage Creative Problem-Solving through Project-Based Learning.
5. To teach students to assess the impact of fluctuating environmental conditions on embedded systems

3. List of Laboratory Experiments / Exercises:

1. Develop an assembly language program using 8085 microprocessor for fundamental Arithmetic and logical operations and execute the results with different test inputs.
2. Develop an assembly language program using 8051 microcontroller for fundamental Arithmetic and logical operations and execute the results with different test inputs.
3. Develop an assembly language program for interfacing an Analog-to-Digital Converter (ADC) with an 8051 microcontroller. Analyze the performance by comparing the obtained digital data with the corresponding analog inputs.
4. Execute a comprehensive program and circuitry to enable precise control over the stepper motor's rotation using 8051. Implement features such as variable speed, direction control, and step resolution adjustments.
   (Pre-requisite: Study of Arduino/NodeMCU)
5. Develop an ALP program for LCD interface with Arduino/NodeMCU and analyze the efficiency of your program in managing complex data displays and dynamic content on the LCD.
6. Develop an ALP program for digital sensors interface with either Arduino or NodeMCU. Analyze executed results concerning the environmental conditions.
7. Develop an ALP program for analog sensors interface with either Arduino or NodeMCU. Investigate the impact of fluctuating environmental conditions on the precision of sensor readings, and propose strategic measures to address potential challenges.
8. Analyze the intricacies of the communication protocol between the Arduino/NodeMCU and the RTC module.
9. Assess the precision and effectiveness of the PWM signal generation in regulating LED brightness. Evaluate the system's responsiveness to dynamic intensity adjustments.
10. Devise and execute a mini-project that requires integrating multiple concepts or sensor-based monitoring system using Arduino/NodeMCU, that incorporates data acquisition, processing, and wireless communication.

References:

1. Lab manual prepared by ECE Department
2. Dr.K.V.K.K. Prasad, "Embedded/Real-time Systems: Concepts, Design and Programming", Dreamtech Press, 2012.
3. Niel Cameron, "Arduino Applied Comprehensive Projects for Everyday Electronics", APress, 2018.

4. Course Outcomes:

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

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CO. No.	Course Outcome
U23EC454.1	Demonstrate the Arithmetic and logical operations using an 8085-instruction set
U23EC454.2	Execute the Arithmetic and logical operations using an 8051-instruction set
U23EC454.3	Examine the concept of interfacing in analog/digital sensors with processing device
U23EC454.4	Analyze the intricacies of the communication protocol with the Arduino/NodeMCU
U23EC454.5	Develop and assess a simple project applying all concepts of embedded system

U23CS353	Algorithm Design Techniques Laboratory	L	T	P	J	C
		0	0	4	0	2

1. Course Description:

In this practical course students will immerse themselves in the application of foundational algorithm 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: **60 Periods**

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

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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, 2012
2. Thomas H.Cormen, Charles E.Leiserson, Ronald L. Rivest and Clifford Stein, —Introduction to Algorithms. Third Edition. PHI Learning Private Limited. 2022

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/
3. https://www.udemy.com/course/design-and-analysis-of-algorithm

MOOC/NPTEL /SWAYAM Courses:

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
U23CS353.1	Implement various algorithm design strategies in a programming environment and analyze their time and space complexities
U23CS353.2	Apply brute force, divide and conquer strategies for sorting and searching tasks
U23CS353.3	Implement dynamic programming solutions for complex optimization and pathfinding problems
U23CS353.4	Apply greedy algorithms to solve optimization problems
U23CS353.5	Analyze the time and space complexities of different algorithms

U23EC651	Project with Design Thinking (Product / Software Development Life Cycle)	L	T	P	J	C
		0	0	0	2	1

1. Course Description:

Students will leverage design thinking to develop electronic and communication systems with a focus on sustainability. Projects will progress from technology formulation (TRL 2) to scalable prototypes (TRL 5), aiming to create solutions that improve energy efficiency and connectivity. The course will align with SDGs such as Affordable and Clean Energy (SDG 7) and Sustainable Cities and Communities (SDG 11), emphasizing the development of technologies that contribute to environmental sustainability and enhanced urban

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infrastructure.
2. Course Objectives:
1. Facilitate the application of design thinking methodologies to uncover user needs and challenges in electronic and communication systems for sustainable solutions. 2. Mentor students in progressing their projects from TRL 2 to TRL 5, ensuring a solid understanding of technology development stages. 3. Support the creation of prototypes aimed at enhancing energy efficiency in alignment with SDG 7 (Affordable and Clean Energy). 4. Guide the design and prototyping of technologies that improve connectivity and infrastructure in urban settings, contributing to SDG 11 (Sustainable Cities and Communities). 5. Encourage the evaluation of project environmental impacts using sustainability metrics to promote reduced carbon footprints and sustainable technology practices.
3. Syllabus: **30 Periods**
This course on Sustainable Electronic and Communication Systems Design aims to equip students with essential skills to identify user needs and develop innovative, sustainable solutions. It begins with an introduction to design thinking, emphasizing user research techniques to understand challenges in electronic systems. Students will explore the technology development lifecycle, focusing on transitioning projects from TRL 2 to TRL 5, while applying agile methodologies. The syllabus includes modules on energy efficiency, where students will create prototypes aligned with SDG 7. and urban connectivity. addressing infrastructure challenges in urban settings linked to SDG 11. Additionally, students will learn to evaluate environmental impacts using sustainability metrics and strategies for reducing carbon footprints. The course culminates in a capstone project, allowing students to apply their knowledge in developing and presenting a prototype that meets user needs and sustainability criteria. Assessments will include participation, assignments, and a comprehensive project evaluation. Recommended readings will support their understanding and application of these concepts.

4. Course Outcomes:

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

CO. No.	Course Outcome
U23EC651.1	Apply design thinking methodologies to identify user needs and challenges in electronic and communication, leading to innovative solutions that prioritize sustainability.
U23EC651.2	Successfully progress their projects from TRL 2 (technology formulation) to TRL 5 (scalable prototypes), demonstrating an understanding of the stages of technology development and evaluation.
U23EC651.3	Create prototypes that effectively improve energy efficiency in electronic and communication systems, aligning their designs with the principles of SDG 7 (Affordable and Clean Energy).
U23EC651.4	Design and prototype technologies that enhance connectivity and infrastructure in urban settings, contributing to the goals of SDG 11 (Sustainable Cities and Communities).
U23EC651.5	Evaluate the environmental impact of their projects, using sustainability metrics to assess how their designs contribute to reducing carbon footprints and promoting sustainable practices in technology.

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U23MC904	Universal Human Values	L	T	P	J	C
		1	0	0	0	NC

1. Course Description:

Universal Human Values explores fundamental ethical principles and humanistic values across cultures. The course encourages critical reflection on compassion, integrity, respect, and empathy, fostering personal growth and societal responsibility. Through interdisciplinary readings and discussions, students gain insights into the universal aspects of human dignity and moral conduct.

2. Course Objectives:

1. Understand what value education is and explore how personal reflection can help achieve happiness and prosperity in life.
2. Learn how to distinguish between the needs of the mind and body, and develop practices for maintaining balance and health.
3. Recognize the importance of trust and respect in relationships, and understand how to foster harmony within families and communities.
4. Understand the interconnectedness of all living things and how to promote mutual fulfillment within nature.
5. Learn the principles of professional ethics, including human values and the role they play in fostering a just and harmonious society.

3. Syllabus: **15 Periods**

Unit-I: Introduction to Value Education **(3)**

Understanding Value Education, Self – exploration as the process for Value Education, Continuous Happiness and Prosperity - the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, method to fulfil the Basic Human Aspirations

Unit-II: Harmony in the Human Being **(3)**

Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health

Unit-III: Harmony in the Family and Society **(3)**

Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order

Unit-IV: Harmony in the Nature/Existence **(3)**

Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence

Unit-V: Implications of the Holistic Understanding – A Look at Professional Ethics **(3)**

Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition

Text Books:

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1. R R Gaur, R Asthana, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034- 47-1
2. R R Gaur, R Asthana, G , The Teacher"s Manual for A Foundation Course in Human Values and Professional Ethics, 2019.

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4. Course Outcomes:

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

CO. No.	Course Outcome
U23MC904.1	Compare values and skills, review value education guidelines and content, and evaluate the societal context of happiness and prosperity today.
U23MC904.2	Distinguish between the Self and the Body; comprehend the meaning of Harmony within the Self and the Co-existence of Self and Body.
U23MC904.3	Identify the importance of trust, respect, and positive emotions in relationships and their role in fostering a harmonious society.
U23MC904.4	Demonstrate the harmony in nature and existence, and develop ways to ensure mutually fulfilling participation within nature.
U23MC904.5	Distinguish between ethical and unethical practices, and begin developing a strategy to create a harmonious environment in any workplace.

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