Regulations 2024

Bachelor of Engineering

Electronics Engineering

(VLSI Design and Technology)

R.M.K. COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution)

R.S.M Nagar, Puduvoyal, Gummidipoondi Taluk, Thiruvallur District, Tamil Nadu-601206
Affiliated to Anna University, Chennai/Approved by AICTE, New Delhi /
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PROGRAMME EDUCATIONAL OBJECTIVES

PEO 1: Foundational Knowledge and Technical Skills: Graduates will be able to develop a strong theoretical foundation and gain hands-on experience in designing and testing both analog and digital VLSI circuits.

PEO 2: Advanced Design and Testing Proficiency: Graduates will be able to utilize advanced tools to design and test VLSI systems, and create high-performance solutions that meet industry standards.

PEO 3: Problem-Solving and Critical Thinking: Graduates will be able to apply innovative problem-solving skills and critical thinking to address design challenges and stay updated with the latest VLSI technology trends.

PEO 4: Professionalism and Collaboration: Graduates will be able to demonstrate ethical awareness and social responsibility as a VLSI professional, enhancing skills and knowledge through collaborative projects and professional development.

PROGRAMME OUTCOMES

Engineering Graduates will be able to:

a) **Engineering Knowledge**: Apply the fundamentals of mathematics, science, and core electronics engineering to analyze and solve complex problems in VLSI design and semiconductor systems.

b) **Problem analysis**: Identify, formulate, and analyze complex VLSI and electronic system problems using principles of electronics, device physics, and circuit theory.

c) **Design / development of solutions**: Design analog, digital, and mixed-signal VLSI systems and components that meet specified requirements considering functionality, power, area, cost, speed and reliability.

d) **Conduct investigations of complex problems**: Conduct experiments and apply modern research methods in circuit simulation, layout design, signal integrity analysis, and verification to derive valid outcomes.

e) **Modern tool usage**: Use industry-standard EDA tools (like Cadence, Synopsys, Mentor Graphics) and computing platforms for design entry, synthesis, simulation, verification, layout, and testing of VLSI systems.

f) **The Engineer and Society**: Apply contextual knowledge to assess the societal, legal, and ethical implications of VLSI products and technologies, especially in the context of safety-critical systems.

g) **Environment and sustainability**: Understand the environmental impact of semiconductor manufacturing and electronics waste, promoting energy-efficient and sustainable VLSI design solutions.

h) **Ethics**: Commit to ethical practices and professional responsibilities in the VLSI and electronics engineering domains, including IP rights, data confidentiality, and responsible innovation.

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i) **Individual and team work**: Work effectively as an individual and in interdisciplinary teams to deliver complex VLSI and embedded system solutions.

j) **Communication**: Communicate technical concepts effectively through verbal, visual, and written means to both engineering and non-engineering stakeholders.

k) **Project Management and finance**: Demonstrate project planning, budgeting, and resource management skills in the execution of VLSI and embedded system projects in industrial or research settings.

l) **Life-long learning:** Engage in independent and lifelong learning in areas of emerging semiconductor technologies, verification methodologies, hardware-software co-design, and AI-driven hardware design.

PROGRAM SPECIFIC OBJECTIVES (PSOs)

1. **VLSI Design Proficiency**: Apply fundamental and advanced concepts to design, simulate, and implement digital and analog VLSI circuits using industry-standard tools.
2. **Embedded and System Integration Skills**: Develop integrated hardware-software solutions involving microcontrollers, FPGAs, and ASICs for real-world electronic applications.
3. **Industry-Readiness and Innovation**: Demonstrate the ability to solve semiconductor industry challenges through project-based learning, research aptitude, and collaboration with industry partners like Tech Mahindra.
4. **Ethical Engineering and Lifelong Learning:** Demonstrate commitment to ethical engineering practices, professional responsibility, and continuous learning by engaging in interdisciplinary projects, industry collaborations, and adapting to emerging trends in semiconductor and VLSI domains.

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MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the Programme Educational Objectives and the Programme Outcomes is given in the following table

PROGRAMME EDUCATIONAL OBJECTIVES	PROGRAMME OUTCOMES											
	a	b	c	d	e	f	g	h	i	j	k	l
1	3	3	3	2	3	1	1	2	2	2	1	2
2	2	2	3	3	3	1	1	2	2	2	2	2
3	3	3	3	3	2	2	2	2	2	2	1	3
4	1	1	2	1	2	2	3	3	3	3	3	3

MAPPING OF PROGRAM SPECIFIC OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the Program Specific Objectives and the Programme outcomes is given in the following table

PROGRAM SPECIFIC OBJECTIVES	PROGRAMME OUTCOMES											
	a	b	c	d	e	f	g	h	i	j	k	l
1	3	3	3	3	3	1	1	2	2	2	2	2
2	2	2	3	2	3	1	1	1	3	2	3	2
3	2	3	3	2	2	2	2	2	3	3	3	3
4	2	2	2	2	2	3	3	3	3	3	2	3

Contribution 1: Reasonable   2: Significant   3: Strong

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B.E. ELECTRONICS ENGINEERING
VLSI DESIGN AND TECHNOLOGY
REGULATIONS-2024
CHOICE BASED CREDIT SYSTEM

MAPPING OF COURSE OUTCOMES WITH PROGRAMME OUTCOMES:
A broad relation between the Course Outcomes and Programme Outcomes is given in the table

FIRST YEAR

SEM	COURSE NAME	a	b	c	d	e	f	g	h	i	J	k	l
I	Matrices and Calculus	✓	✓	✓	✓	✓	✓	✓					✓
	Physics for Electrical and Electronics Engineering (Lab Integrated)	✓	✓	✓	✓							✓	✓
	Programming in C++ (Lab Integrated)	✓	✓	✓					✓	✓	✓		✓
	Software Development Practices (Lab Integrated)	✓	✓	✓		✓	✓		✓	✓	✓		✓
	Electron Devices and Circuit Theory (Lab Integrated)	✓	✓	✓					✓	✓	✓		✓
	Interpersonal skills, Psychometric Analysis and Career Development	✓								✓	✓		✓
	Heritage of Tamils								✓	✓	✓	✓	✓
	Idea Lab–1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Environmental Science and Sustainability (Non Credit)	✓	✓	✓	✓	✓						✓	✓
	Programming in C (Non Credit)	✓	✓	✓					✓	✓	✓		✓
	Induction Program (Non Credit)							✓	✓	✓	✓		
II	Transforms and Numerical Methods (Lab Integrated)	✓	✓	✓	✓	✓	✓						✓
	Introduction to Artificial Intelligence (Lab Integrated)	✓	✓	✓	✓	✓	✓					✓	✓
	Chemistry for Electrical & Electronics Engineering (Lab Integrated)	✓	✓				✓	✓					✓
	Data Structures and Algorithms (Lab Integrated)	✓	✓	✓	✓	✓	✓					✓	✓
	Java Programming (Lab Integrated)	✓	✓	✓		✓			✓	✓	✓		✓
	Tamils and Technology							✓	✓	✓	✓	✓	✓
	Innovation and Creativity Skills Development	✓		✓		✓					✓		
	Idea Lab-2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Yoga for Stress Management							✓	✓	✓	✓	✓	✓

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SECOND YEAR

	COURSE OUTCOMES					PROGRAMME OUTCOMES						
Sem	COURSE NAME	a	b	c	d	e	f	g	h	i	j	k	l
III	Probability and Random Processes	✓	✓	✓	✓	✓							✓
	Digital Electronics (Lab Integrated)	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓
	Advanced Java Programming (Lab Integrated)	✓	✓	✓		✓			✓	✓	✓		✓
	Database Management Systems (Lab Integrated)	✓	✓	✓	✓	✓		✓					✓
	Signals and Systems	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Universal Human Values II: Understanding Harmony	✓	✓	✓	✓								✓
	Aptitude and Coding Skills I	✓	✓							✓	✓		
	Product Development Lab-1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Internship/ Seminar-1 week	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Indian Institution (Non Credit)	✓	✓							✓	✓		
IV	Statistics and Linear Algebra (Lab Integrated)	✓	✓	✓	✓	✓							✓
	Digital circuit design with CMOS	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓
	Control systems Engineering	✓	✓	✓	✓	✓							✓
	Analog circuits-I (Lab Integrated)	✓	✓	✓	✓	✓				✓	✓	✓	✓
	Web development Frameworks (Lab Integrated)	✓	✓	✓	✓	✓	✓					✓	✓
	RTL Design and Synthesis using Verilog HDL (Lab Integrated)	✓	✓	✓	✓	✓				✓	✓	✓	✓
	Aptitude and Coding Skills II	✓	✓							✓	✓		
	Product Development Lab-2	✓	✓	✓	✓	✓	✓	✓	✓				✓
	Value Education (Non-credit)							✓	✓	✓	✓	✓	✓

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THIRD YEAR

	COURSE OUTCOMES	PROGRAMME OUTCOMES											
Sem	COURSE NAME	a	b	c	d	e	f	g	h	i	j	k	l
V	Professional Elective I												
	Professional Elective II												
	Computer Architecture and Organisation	✓	✓	✓	✓	✓	✓					✓	✓
	Microprocessors and Microcontrollers	✓	✓	✓	✓	✓	✓					✓	✓
	Analog Circuits-II	✓	✓	✓	✓	✓	✓					✓	✓
	Professional Communication I-TOEFL						✓	✓	✓	✓	✓	✓	✓
	Product Development Lab-3	✓	✓	✓	✓	✓	✓	✓	✓				✓
	Advanced Aptitude and Coding Skills I	✓	✓							✓	✓		
	Internship /Seminar-2 Weeks	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	Indian Traditional Knowledge (Non-Credit)	✓	✓	✓						✓	✓		
VI	Professional Elective III												
	Open Elective I												
	Analog System Design with Linear ICs	✓	✓	✓	✓	✓	✓					✓	✓
	Design Thinking						✓	✓	✓	✓	✓	✓	✓
	Discrete Time Signal Processing	✓	✓	✓	✓	✓	✓					✓	✓
	Advanced Aptitude and Coding Skills II	✓	✓	✓	✓	✓	✓					✓	✓
	Professional Communication II-TOEFL						✓	✓	✓	✓	✓	✓	✓
	Electromagnetic Fields Interference and Compatibility	✓	✓	✓	✓	✓	✓					✓	✓
	Advanced Aptitude and Coding Skills II	✓	✓	✓	✓	✓	✓					✓	✓
	Personality Development (Non Credit)	✓	✓	✓		✓	✓			✓	✓	✓	✓

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FINAL YEAR

	COURSE COUTCOMES	PROGRAMME OUTCOMES											
Sem	COURSE NAME	a	b	c	d	e	f	g	h	i	j	k	l
VII	Professional Elective IV												
	Professional Elective V												
	Open Elective II/ (MOOC / SWAYAM)												
	ASIC Design and Implementation	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓
	VLSI Testing and Testability	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓
	Internship /Seminar-4 Weeks	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
VIII	Project Work	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

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		SEMESTER–I						
Sl.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY COURSES WITH LABORATORY COMPONENT								
1	24CS101	Programming in C++ (Lab Integrated)	ESC	6	3	0	3	4.5
2	24CS102	Software Development Practices (Lab Integrated)	ESC	6	3	0	3	4.5
3	24PH101	Physics for Electrical and Electronics Engineering (Lab Integrated)	BSC	5	3	0	2	4
4	24EC101	Electron Devices and Circuit theory (Lab Integrated)	PCC	5	3	0	2	4
THEORY COURSE								
5	24GE101	Heritage of Tamils	HSMC	1	1	0	0	1
6	24MA101	Matrices and Calculus	BSC	4	3	1	0	4
LABORATORY COURSE								
7	24EE111	Interpersonal skills, Psychometric Analysis and Career Development	EEC	2	0	0	2	1
MANDATORY COURSE								
8	24CH102	Environmental Science & Sustainability (Non Credit)	MC	2	2	0	0	0
9	24EC111	Idea Lab I (Non Credit)	EEC	1	0	0	1	0
10	24MC101	Students Induction Programme (Non Credit)	MC	3 Weeks				
11	24MC102	Programming in C (Non Credit)	MC	40 Periods				
TOTAL				32	18	1	13	23

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SEMESTER–II								
Sl.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY COURSES WITH LABORATORY COMPONENT								
1	24MA202	Transforms and Complex Analysis (Lab Integrated)	BSC	5	3	0	2	4
2	24CS203	Data Structures and Algorithms (Lab Integrated)	ESC	6	3	0	3	4.5
3	24CS202	Java Programming (Lab Integrated)	ESC	6	3	0	3	4.5
4	24CH201	Chemistry for Electrical & Electronics Engineering (Lab Integrated)	BSC	5	3	0	2	4
5	24AI201	Introduction to Artificial Intelligence (Lab Integrated)	ESC	4	2	0	2	3
THEORY COURSE								
6	24GE201	Tamils and Technology	HSMC	1	1	0	0	1
EMPLOYABILITY ENHANCEMENT COURSES								
7	24EE201	Innovation and Creativity Skills Development	EEC	1	1	0	0	1
8	24ME211	Idea Lab II	EEC	2	0	0	2	1
MANDATORY COURSE								
9	24MC201	Yoga for Stress Management (Non Credit)	MC	1	0	0	1	0
TOTAL				**31**	**16**	**0**	**15**	**23**

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SEMESTER–III								
Sl.No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES WITH LABORATORY COMPONENT								
1	24EV301	Digital Electronics (Lab Integrated)	PCC	4	2	0	2	3
2	24CS303	Database Management Systems (Lab Integrated)	ESC	6	3	0	3	4.5
3	24CS302	Advanced Java Programming (Lab Integrated)	ESC	6	3	0	3	4.5
THEORY COURSES								
4	24EV302	Signals and Systems	PCC	3	3	0	0	3
5	24MA302	Probability and Random Processes	BSC	4	3	1	0	4
6	24GE301	Universal Human Values 2: Understanding Harmony	HSMC	3	2	1	0	3
EMPLOYABILITY ENHANCEMENT COURSES								
7	24EV311	Product Development Lab – I	EEC	2	0	0	2	1
8	24CS311	Aptitude and Coding Skills I	EEC	3	0	0	3	1.5
9	24EV312	Internship and Seminar (1 Week)	EEC	1	0	0	1	0.5
MANDATORY COURSE								
10	24MC301	Indian Constitution (Non Credit)	MC	1	1	0	0	0
TOTAL				33	17	2	14	25

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Sl.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
SEMESTER–IV								
THEORY COURSES WITH LABORATORY COMPONENT								
1	24EV401	RTL Design and Synthesis using Verilog HDL (Lab Integrated)	PCC	5	3	0	2	4
2	24EV402	Analog Circuits-I (Lab Integrated)	PCC	4	2	0	2	3
3	24MA402	Statistics and Linear Algebra (Lab Integrated)	BSC	5	3	0	2	4
4	24CS403	Web Development Frameworks (Lab Integrated)	ESC	6	3	0	3	4.5
THEORY COURSES								
5	24EV403	Digital Circuit Design with CMOS	PCC	3	3	0	0	3
6	24EV404	Control Systems Engineering	PCC	3	3	0	0	3
EMPLOYABILITY ENHANCEMENT COURSES								
7	24EV411	Product Development Lab – II	EEC	2	0	0	2	1
8	24CS411	Aptitude and Coding Skills II	EEC	3	0	0	3	1.5
AUDIT COURSE								
9	24AC401	Value Education (Non Credit)	AC	1	1	0	0	0
TOTAL				**32**	**18**	**0**	**14**	**24**

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		SEMESTER–V						
Sl.No.	**Course Code**	**Course Title**	**Category**	**Contact Periods**	**L**	**T**	**P**	**C**
THEORY COURSES WITH LABORATORY COMPONENT								
1	24EC502	Microprocessors and Microcontrollers (Lab Integrated)	PCC	5	3	0	2	4
2	24EV501	Analog Circuits -II (Lab Integrated)	PCC	4	2	0	2	3
THEORY COURSES								
3	24EV502	Computer Architecture and Organization	PCC	3	3	0	0	3
4		Professional Elective I	PEC	3	3	0	0	3
5		Professional Elective II	PEC	3	3	0	0	3
LABORATORY COURSE								
6		Professional Communication-I (TOEFL)	HSMC	4	0	0	4	2
EMPLOYABILITY ENHANCEMENT COURSES								
7	24CS511	Advanced Aptitude and Coding Skills I	EEC	3	0	0	3	1.5
8	24EV512	Internship and Seminar (2 Weeks)	EEC	2	0	0	2	1
9	24EV511	Product Development Lab - III	EEC	2	0	0	2	1
MANDATORY COURSE								
10	24MC501	Essence of Indian Traditional Knowledge (Non Credit)	MC	1	1	0	0	0
TOTAL				30	15	0	15	21.5

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SEMESTER–VI								
Sl.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY COURSES WITH LABORATORY COMPONENT								
1	24EV601	Analog System Design with Linear ICs (Lab Integrated)	PCC	4	2	0	2	3
2	24EC601	Discrete Time Signal Processing (Lab Integrated)	PCC	5	3	0	2	4
3		Design Thinking	HSMC	3	1	0	2	2
THEORY COURSES								
4	24EV602	Electromagnetic Fields Interference and Compatibility	PCC	3	3	0	0	3
5		Professional Elective III	PEC	3	3	0	0	3
6		Open Elective I	OEC	3	3	0	0	3
LABORATORY COURSE								
7		Professional communication-II (TOEFL)	HSMC	2	0	0	2	1
EMPLOYABILITY ENHANCEMENT COURSES								
8	24CS611	Advanced Aptitude and Coding Skills II	EEC	3	0	0	3	1.5
9	24EV611	Product Development Lab - IV	EEC	2	0	0	2	1
AUDIT COURSE								
10	24AC601	Personality Development (Non Credit)	AC	2	2	0	0	0
TOTAL				**30**	**17**	**0**	**13**	**21.5**

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SEMESTER–VII								
Sl.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
THEORY COURSES WITH LABORATORY COMPONENT								
1	24EV701	ASIC Design and Implementation (Lab Integrated)	PCC	5	3	0	2	4
THEORY COURSES								
2	24EV702	VLSI Testing and Testability	PCC	3	3	0	0	3
3		Professional Elective IV	PEC	3	3	0	0	3
4		Professional Elective V	PEC	3	3	0	0	3
5		Open Elective II	OEC	3	3	0	0	3
EMPLOYABILITY ENHANCEMENT COURSE								
6	24EV711	Internship and Seminar (4 weeks)	EEC	4	0	0	4	2
TOTAL				21	15	0	6	18

SEMESTER–VIII								
Sl.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
LABORATORY COURSE								
1	24EV811	Project Work	EEC	16	0	0	16	8
TOTAL				16	0	0	16	8

CREDIT DISTRIBUTION

S.No	Category	CREDITS AS PER SEMESTER								Total Credits	% of Distribution	As per AICTE
		I	II	III	IV	V	VI	VII	VIII			
1	HSMC	1	1	3	-	2	3	-	-	10	6.1	15
2	BSC	8	8	4	4	-	-	-	-	24	14.6	23
3	ESC	9	12	9	4.5	-	-	-	-	34.5	21	17
4	PCC	4	-	6	13	10	10	7	-	50	30.5	62
5	PEC	-	-	-	-	6	3	6	-	15	9.2	08
6	OEC	-	-	-	-	-	3	3	-	06	3.7	08
7	EEC	1	2	3	2.5	3.5	2.5	2	8	24.5	14.9	29
8	MC/AC	-	-	-	-	-	-	-	-	-		
TOTAL		23	23	25	24	21.5	21.5	18	8	161+3		164

R.M.K. COLLEGE OF ENGINEERING AND TECHNOLOGY

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PROFESSIONAL ELECTIVES COURSES - VERTICALS

Advanced Digital and Semiconductor Design	Communication Technologies	CAD and Computational Intelligence	Hardware Design and Automation	Hardware-Software Co-Design	RF and Mixed Signal ICs
Reconfigurable Computing Architecture	Analog and Digital Communication Engineering	Design and Analysis of Algorithms	VHDL for Digital Design	Embedded System Design	Microwave Engineering
Low Power IC Design	Wireless Communication Systems	Computational Intelligence Techniques	Formal Methods and Logic Synthesis	Internet of Things (IoT) Systems Design	RF Integrated Circuit Design
Advanced CMOS and FinFET Technologies	Optical Communication	RTL Design Flow Automation	System Verilog for Verification	Real-Time Systems and Co-Design	High Speed Analog Design
Introduction to Quantum computing	High Speed Communication	EDA Tool Development and Scripting	Bluespec System Verilog (BSV)	Hardware Security trusted Computing	Analog and mixed signal IC Design
Machine Learning based Hardware Design	Error Control and Coding Techniques	Machine Learning for EDA	High-Level Synthesis and Code Generation	RISC-V	Signal Integrity & RF IC layout techniques
Semiconductor Devices and Fabrication Processes	Satellite Communication	CAD for Digital VLSI	Advanced Embedded Systems	FPGA based System Prototyping	PLL and Data Converter Design

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PROFESSIONAL ELECTIVE I								
Sl.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	24EV901	Reconfigurable computing Architecture	PEC	3	3	0	0	3
2	24EV902	Analog and Digital Communication Engineering	PEC	3	3	0	0	3
3	24EV903	Design and Analysis of Algorithms	PEC	3	3	0	0	3
4	24EV904	VHDL for Digital Design	PEC	3	3	0	0	3
5	24EV905	Embedded System Design	PEC	3	3	0	0	3
6	24EV906	Microwave Engineering	PEC	3	3	0	0	3

PROFESSIONAL ELECTIVE II								
Sl.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	24EV907	Low Power IC Design	PEC	3	3	0	0	3
2	24EV908	Wireless Communication Systems	PEC	3	3	0	0	3
3	24EV909	Computational Intelligence Techniques	PEC	3	3	0	0	3
4	24EV910	Formal Methods and Logic Synthesis	PEC	3	3	0	0	3
5	24EV911	Internet of Things (IoT) Systems Design	PEC	3	3	0	0	3
6	24EV912	RF Integrated Circuit Design	PEC	3	3	0	0	3

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PROFESSIONAL ELECTIVE III								
Sl.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	24EV913	Advanced CMOS and FinFET Technologies	PEC	3	3	0	0	3
2	24EV914	Optical Communication	PEC	3	3	0	0	3
3	24EV915	RTL Design Flow Automation	PEC	3	3	0	0	3
4	24EV916	System Verilog for Verification	PEC	3	3	0	0	3
5	24EV917	Real-Time Systems and Co-Design	PEC	3	3	0	0	3
6	24EV918	High Speed Analog Design	PEC	3	3	0	0	3

PROFESSIONAL ELECTIVE IV								
Sl.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	24EV919	Introduction to Quantum computing	PEC	3	3	0	0	3
2	24EV920	High Speed Communication	PEC	3	3	0	0	3
3	24EV921	EDA Tool Development and Scripting	PEC	3	3	0	0	3
4	24EV922	Bluespec System Verilog (BSV)	PEC	3	3	0	0	3
5	24EV923	Hardware Security trusted Computing	PEC	3	3	0	0	3
6	24EV924	Analog and mixed signal IC Design	PEC	3	3	0	0	3

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PROFESSIONAL ELECTIVE V								
Sl.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	24EV925	Machine Learning based Hardware Design	PEC	3	3	0	0	3
2	24EV926	Error Control and Coding Techniques	PEC	3	3	0	0	3
3	24EV927	Machine Learning for EDA	PEC	3	3	0	0	3
4	24EV928	High-Level Synthesis and Code Generation	PEC	3	3	0	0	3
5	24EV929	RISC-V	PEC	3	3	0	0	3
6	24EV930	Signal Integrity & RF IC layout techniques	PEC	3	3	0	0	3

PROFESSIONAL ELECTIVE VI								
Sl.No.	Course Code	Course Title	Category	Contact Periods	L	T	P	C
1	24EV931	CAD For Digital VLSI	PEC	3	3	0	0	3
2	24EV932	Advanced Embedded Systems	PEC	3	3	0	0	3
3	24EV933	FPGA based system Prototyping	PEC	3	3	3	0	3
4	24EV934	PLL and Data Converter Design	PEC	3	3	3	0	3
5	24EC947	Semiconductor Devices and Fabrication Processes	PEC	3	3	0	0	3
6	24EC923	Satellite Communication	PEC	3	3	0	0	3

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CURRICULUM OF B.E (HONOURS) IN ELECTRONICS ENGINEERING (VLSI DESIGN AND TECHNOLOGY) WITH SPECIALIZATION IN

Internet of Things / High Speed Communication / Signal & Image Processing / Robotics &Automation

(Additional 18 credits to be completed from the courses offered in the specific Verticals)

INTERNET OF THINGS

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	24EC941	Industrial and Medical IoT	PEC	3	3	0	0	3
2	24EC942	Programming and Web Technologies for IoT	PEC	3	3	0	0	3
3	24EC943	Robotic Operating Systems	PEC	3	3	0	0	3
4	24EC944	Design of Smart Cities	PEC	3	3	0	0	3
5	24EV999	Capstone Project	EEC	12	0	0	12	6

HIGH SPEED COMMUNICATION

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	24EC953	Advanced Wireless Communication	PEC	3	3	0	0	3
2	24EC954	Advanced Wireless Networks	PEC	3	3	0	0	3
3	24EC955	Software-defined Networks	PEC	3	3	0	0	3
4	24EC956	Satellite Communication & Navigation Systems	PEC	3	3	0	0	3
5	24EV999	Capstone Project	EEC	12	0	0	12	6

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SIGNAL & IMAGE PROCESSING

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	24EC965	Computer Vision	PEC	3	3	0	0	3
2	24EC966	Big Data Analytics	PEC	3	3	0	0	3
3	24EC967	Image Processing with Python	PEC	3	3	0	0	3
4	24EC970	Pattern Recognition	PEC	3	3	0	0	3
5	24EV999	Capstone Project	EEC	12	0	0	12	6

ROBOTICS & AUTOMATION

S.NO	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1	24EC971	Concepts in Mobile Robotics	PEC	3	3	0	0	3
2	24EC972	Sensors and Actuators for Robotics	PEC	3	3	0	0	3
3	24EC973	Microcontrollers for Robotics	PEC	3	3	0	0	3
4	24EC974	Process Control Automation	PEC	3	3	0	0	3
5	24EV999	Capstone Project	EEC	12	0	0	12	6

24CS101	PROGRAMMING IN C++	L	T	P	C
	(Common to All Branches)	3	0	3	4.5

OBJECTIVES:

The Course will enable learners to:
- To learn problem solving and programming fundamentals.
- To gain knowledge on pointers and functions.
- To apply the principles of object orientated programming.
- To understand operator overloading, inheritance and polymorphism.
- To use the functionalities of I/O operations, files build C++ programs using exceptions.

UNIT I	PROGRAMMING FUNDAMENTALS	9+9

Procedural Languages vs Object Oriented Languages - Types of computer programming languages - Genesis of C++ - Program Life Cycle -Structure of C++ program - Identifiers - Variables - Keywords - Number System -Binary Number System -Octal Number System- Decimal Number System -Hexadecimal Number System - Data types - Constants - Errors – Operators- Expressions - Type Conversions - Control-Flow Statements - Conditional Statements - Iterative Statements - Unconditional Control Statements - Arrays - One-Dimensional Arrays - Two-Dimensional Arrays - Multi -Dimensional Arrays - Strings - String Manipulation Functions - Array of Strings.

List of Exercise/Experiments:
1. Write C++ programs for the following:
    a. Find the sum of individual digits of a positive integer.
    b. Compute the GCD of two numbers.
    c. Find the roots of a number (Newton 's method)
2. Write C++ programs using arrays:
    a. Find the maximum of an array of numbers.
    b. Remove duplicates from an array of numbers.
    c. Print the numbers in an array after removing even numbers.
3. Write C++ programs using strings:
    a. Checking for palindrome.
    b. Count the occurrences of each character in a given word.

UNIT II	POINTERS AND FUNCTIONS	9+9

Pointers - Pointer Variables - Pointer Operators & Expressions -Pointers with Arrays - Functions - Scope Rules -Function Arguments -return Statement - Function Variables - Storage Classes - Types of storage classes - Create Header Files - User-Defined Functions - Inline Functions - Function Overloading -Recursion - Namespaces.

List of Exercise/Experiments:
1. Generate salary slip of employees using structures and pointers. Create a structure Employee with the following members:EID, Ename, Designation, DOB, DOJ, Basic pay
    Note that DOB and DOJ should be implemented using structure within structure.
2. Compute internal marks of students for five different subjects using structures and functions.

UNIT III	CLASSES AND OBJECTS	9+9

Concepts of Object Oriented Programming – Benefits of OOP – Simple C++ program -

Classes and Objects - Member functions - Nesting of member functions - Private member functions - Memory Allocation for Objects - Static Data Members - Static Member functions - Array of Objects - Objects as function arguments - Returning objects - friend functions – Const Member functions - Constructors – Destructors.

List of Exercise/Experiments:
1. Write a program Illustrating Class Declarations, Definition, and Accessing Class Members.
2. Program to illustrate default constructor, parameterized constructor and copy constructors.

Practice Questions & Scenario Based Questions:

1. Imagine you are working as a software engineer at a tech company. Your team is developing a mathematical software library that will be used in various applications across the company. One of the features that your team lead has asked you to implement is a function that calculates the number of trailing zeros in the factorial of a number.
   The team lead has emphasized the importance of encapsulation in your implementation.
2. Create a C++ class Calculator representing a simple calculator. The class should have the following attributes and methods:

   Attributes: Two operands and an operation (+, -, *, /)
   Methods: Perform the operation and return the result
   Implement constructors to initialize the calculator with default values (0,0) and with specified values. Also, implement a destructor to perform any necessary cleanup.

UNIT IV	OPERATOR OVERLOADING, INHERITANCE AND POLYMORPHISM	9+9

Operator Overloading - Overloading Using Friend functions – Inheritance – Types of inheritance – Virtual Base Class - Abstract Class – Constructors in Derived Classes - member class: nesting of classes.
Pointer to objects – this pointer- Pointer to derived Class - Virtual functions – Pure Virtual Functions – Polymorphism.

List of Exercise/Experiments:
1. Write a Program to Demonstrate the i) Operator Overloading. ii) Function Overloading.
2. Write a Program to Demonstrate Friend Function and Friend Class.
3. Program to demonstrate inline functions.
4. Program for Overriding of member functions.
5. Write C++ programs that illustrate how the following forms of inheritance are supported:
   a) Single inheritance b) Multiple inheritance c) Multi level inheritance d) Hierarchical inheritance.

Practice Questions & Scenario Based Questions:
1. Joy is a software developer at a 3D modeling company. The company is developing a new software tool that will be used by architects and engineers to design and analyze 3D models of various structures. One of the features that her project manager has asked is to implement a function that calculates the volume of basic 3D shapes like cylinders and cuboids. The project manager has emphasized the importance of using function overloading in her implementation..
2. Imagine you are a software developer tasked with creating a utility program for a school that handles student scores. The school wants a simple program where teachers can enter the scores of students for a particular test, and the program will then provide the highest and lowest scores among them. This will help the teachers quickly identify the top performer and the student who might need extra help.
   Your task is to write program that satisfies the above scenario using **inline function**
3. Develop a software system to manage part-time worker students at a university. These students have unique attributes such as their name, student ID, hourly wage, and hours worked per week. Your goal is to create a C++ program that models this system.
3. Ramu is a software developer at a company specializing in developing software solutions for geometric shapes. Recently, a client approached with a request to create a program to calculate the areas of rectangles and triangles.

UNIT V	I/O, FILES AND EXCEPTIONS	9+9

C++ Streams – Unformatted I/O - Formatted Console I/O – Opening and Closing File – File modes - File pointers and their manipulations – Templates – Class Templates – Function Templates - Exception handling.

List of Exercise/Experiments:
1. Program to demonstrate pure virtual function implementation.
2. Count the number of account holders whose balance is less than the minimum balance using sequential access file.
3. Write a Program to Demonstrate the Catching of all Exceptions.

Practice Questions & Scenario Based Questions:
1. Develop a simple library management system. Create a base class Book representing a book in the library. The class should have attributes such as title, author, and ISBN (International Standard Book Number). Implement a virtual function displayDetails() to display information about the book.
2. A software developer working on a banking application. One of the requirements is to analyze account holders' balances based on a minimum balance threshold. The application should read account information from a sequential access file, where each line represents an account record in the format: account_holder_name, balance.
3. The financial company is developing a new software tool that will be used by financial analysts to perform various calculations. One of the features of that project is to implement is a function that performs division of two numbers.
   Write a program that takes two integer inputs, numerator and denominator, from the user. Implement error handling to check if the denominator is zero. If the denominator is zero, display the message "Division by zero is not allowed!" using an exception. If the denominator is not zero, calculate the result of the division and display it.
4. Mini project.

TOTAL: 45 (L) + 45 (P) = 90 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Solve problems using basic constructs in C++.
CO2: Implement C++ programs using pointers and functions.
CO3: Apply object-oriented concepts and solve real world problems.
CO4: Develop C++ programs using operator overloading and polymorphism.
CO5: Implement C++ programs using Files and exceptions.
CO6: Develop applications using C++ concepts

TEXT BOOKS:

1. Herbert Schildt, "The Complete Reference C++", 4th edition, MH, 2015.
2. E Balagurusamy," Object Oriented Programming with C++", 4th Edition, Tata McGraw-Hill Education, 2008.

REFERENCES:

1. Karl Beecher," Computational Thinking: A beginner's guide to problem-solving and programming", BCS Learning & Development Ltd, 2017. (Unit 1)
2. Nell Dale, Chip Weems, "Programming and Problem Solving with C++", 5th Edition, Jones and Barklett Publishers, 2010.
3. John Hubbard, "Schaum's Outline of Programming with C++", MH, 2016.
4. Yashavant P. Kanetkar, "Let us C++", BPB Publications, 2020
5. ISRD Group, "Introduction to Object-oriented Programming and C++", Tata McGraw-Hill Publishing Company Ltd., 2007.
6. D. S. Malik, "C++ Programming: From Problem Analysis to Program Design", Third Edition, Thomson Course Technology, 2007.
7. Paul Deitel, Harvey Deitel, "C++ How to Program", 10th Edition, Pearson Education Inc. 2017.
8. https://infyspringboard.onwingspan.com/web/en/app/toc/ lex_auth_01297200240671948837_shared/overview

LIST OF EQUIPMENTS:

1. Standalone desktops with C/C++ compiler (or) Server with C/C++ compiler.

24CS102	SOFTWARE DEVELOPMENT PRACTICES	L	T	P	C
	(Common to All Branches)	3	0	3	4.5

OBJECTIVES:

The Course will enable learners to:
- To discuss the essence of agile development methods.
- To set up and create a GitHub repository.
- To create interactive websites using HTML
- To design interactive websites using CSS.
- To develop dynamic web page using Java script.

UNIT I	AGILE SOFTWARE DEVELOPMENT AND Git and GitHub	9+9

Software Engineering Practices – Waterfall Model - Agility – Agile Process – Extreme Programming - Agile Process Models – Adaptive Software Development – Scrum – Dynamic Systems Development Method – Crystal – Feature Driven Development – Lean Software Development – Agile Modeling – Agile Unified Process – Tool set for Agile Process.

Introduction to Git –Setting up a Git Repository - Recording Changes to the Repository - Viewing the Commit History - Undoing Things - Working with Remotes -Tagging - Git Aliases - Git Branching - Branches in a Nutshell - Basic Branching and Merging - Branch Management - Branching Workflows - Remote Branches - Rebasing.

Introduction to GitHub – Set up and Configuration - Contribution to Projects, Maintaining a Project – Scripting GitHub.

List of Exercise/Experiments:
1. Form a Team, Decide on a project:
   a) Create a repository in GitHub for the team.
   b) Choose and follow a Git workflow
      - Each team member can create a StudentName.txt file with contents about themselves and the team project
      - Each team member can create a branch, commit the file with a proper commit message and push the branch to remote GitHub repository.
      - Team members can now create a Pull request to merge the branch to master branch or main development branch.
      - The Pull request can have two reviewers, one peer team member and one faculty. Reviewers can give at least one comment for Pull Request updating.
      - Once pull request is reviewed and merged, the master or main development branch will have files created by all team members.
2. Create a web page with at least three links to different web pages. Each of the web pages is to be designed by a team member. Follow Git workflow, pull request and peer reviews.
3. Form a Team, Decide on a project:
   c) Create a repository in GitHub for the team.
   d) Choose and follow a Git workflow
      - Each team member can create a StudentName.txt file with contents about themselves and the team project

- Each team member can create a branch, commit the file with a proper commit message and push the branch to remote GitHub repository.
- Team members can now create a Pull request to merge the branch to master branch or main development branch.
- The Pull request can have two reviewers, one peer team member and one faculty. Reviewers can give at least one comment for Pull Request updation.
- Once pull request is reviewed and merged, the master or main development branch will have files created by all team members.

4. Create a web page with at least three links to different web pages. Each of the web pages is to be designed by a team member. Follow Git workflow, pull request and peer reviews.

UNIT II	HTML	9+9

Introduction – Web Basics – Multitier Application Architecture – Cline-Side Scripting versus Server-side Scripting – HTML5 – Headings – Linking – Images – Special Characters and Horizontal Rules – Lists – Tables – Forms – Internal Linking – meta Elements – Form input Types – input and datalist Elements – Page-Structure Elements.

List of Exercise/Experiments:
1. Create web pages using the following:
   - Tables and Lists
   - Image map
   - Forms and Form elements
   - Frames

UNIT III	CSS	15

Inline Styles – Embedded Style Sheets – Conflicting Styles – Linking External Style Sheets – Positioning Elements – Backgrounds – Element Dimensions – Box Model and Text Flow – Media Types and Media Queries – Drop-Down Menus – Text Shadows – Rounded Corners – Colour – Box Shadows – Linear Gradients – Radial Gradients – Multiple Background Images – Image Borders – Animations – Transitions and Transformations – Flexible Box Layout Module – Multicolumn Layout.

List of Exercise/Experiments:
1. Apply Cascading style sheets for the web pages created.

UNIT IV	JAVASCRIPT BASICS	9+9

Introduction to Scripting – Obtaining user input – Memory Concepts – Arithmetic – Decision Making: Equality and Relational Operators – JavaScript Control Statements – Functions – Program Modules – Programmer-defined functions – Scope rules – functions – Recursion – Arrays – Declaring and Allocating Arrays – References and Reference Parameters – Passing Arrays to Functions – Multidimensional arrays.

List of Exercise/Experiments:
1. Form Validation (Date, Email, User name, Password and Number validation) using JavaScript.

UNIT V	JAVASCRIPT OBJECTS	9+9

Objects – Math, String, and Date, Boolean and Number, document Object – Using JSON to Represent objects – DOM: Objects and Collections – Event Handling.

List of Exercise/Experiments:
Implement Event Handling in the web pages.

Mini Projects-Develop any one of the following web applications (not limited to one) using above technologies.
  a. Online assessment system
  b. Ticket reservation system
  c. Online shopping
  d. Student management system
  e. Student result management system
  f. Library management
  g. Hospital management
  h. Attendance management system
  i. Examination automation system
  j. Web based chat application

TOTAL: 45 (L) + 45 (P) = 90 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Understand basic software engineering practices effectively.

CO2: Apply version control using Git and GitHub, and manage code repositories proficiently.

CO3: Design web applications using HTML, CSS, and JavaScript.

CO4: Analyze problems and create solutions using CSS for better web page presentation and usability.

CO5: Develop interactive web pages using JavaScript with an event-handling mechanism.

CO6: Apply the technological changes and improve skills continuously.

TEXT BOOKS:

1. Roger S. Pressman, "Software Engineering: A Practitioner's Approach", McGraw Hill International Edition, Nineth Edition, 2020.
2. Scott Chacon, Ben Straub, "Pro GIT", Apress Publisher, 3rd Edition, 2014.
3. Deitel and Deitel and Nieto, "Internet and World Wide Web - How to Program", Pearson, 5th Edition, 2018.

REFERENCES:

1. Roman Pichler, "Agile Product Management with Scrum Creating Products that Customers Love", Pearson Education, 1 st Edition, 2010.
2. Jeffrey C and Jackson, "Web Technologies A Computer Science Perspective", Pearson Education, 2011.
3. Stephen Wynkoop and John Burke, "Running a Perfect Website", QUE, 2nd Edition, 1999.
4. Chris Bates, "Web Programming – Building Intranet Applications", 3rd Edition, Wiley Publications, 2009.

5. Gopalan N.P. and Akilandeswari J., "Web Technology", Second Edition, Prentice Hall of India, 2014.
6. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013382690411003904735_shared/overview
7. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013094421427470 3362099_shared/overview

LIST OF EQUIPMENTS:
1. Systems with either Netbeans or Eclipse
2. Java/JSP/ISP Webserver/Apache
3. Tomcat / MySQL / Dreamweaver or
4. Equivalent/ Eclipse, WAMP/XAMP

Course Code	PHYSICS FOR ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
24PH101	Theory Course with Laboratory Component (Common to I Semester B.E.-ECE AND EE(VLSI)	3	0	2	4

OBJECTIVES

The course will enable the learners to:
- Understand the classical free electron theory and Fermi distribution function
- Differentiate the types of semiconductors and derive their carrier concentration
- Relate the theory of laser with its applications in optical devices.
- Solve the Schrodinger's wave equation in one dimensional and three dimensional box
- Comprehend the behavior of semiconductor diodes in various electron devices and nano electronic devices.

UNIT I CONDUCTING MATERIALS   12

Drude and Lorentz classical free electron theory - Expressions for electrical conductivity and thermal conductivity -Wiedemann-Franz law - Success and failures of classical free electron theory - thermal conductivity of a bad conductor- Lee's disc method -Fermi-Dirac distribution function - Effect of temperature on Fermi-Dirac distribution function- Density of energy states – Total energy and average energy of an electron at 0 K.

(Theory -9)
1. Determination of thermal conductivity of a bad conductor- Lee's disc method
(Laboratory -3)

UNIT II SEMICONDUCTING MATERIALS   15

Elemental and Compound semiconductors – Energy-wave vector diagram – Intrinsic semiconductor- carrier concentration in intrinsic semiconductors- Determination of Fermi energy and Bandgap - Extrinsic semiconductors - Carrier concentration in n-type and p-type semiconductors – Law of mass action -Variation of Fermi level with temperature and impurity concentration - Hall effect and its applications.

(Theory-9)

1. Band gap determination of intrinsic semiconductor
2. Determination of Hall-coefficient of semiconductor

(Laboratory -6)

UNIT III LASER AND OPTICAL DEVICES   18

Laser characteristics - Spatial and Temporal Coherence - Population inversion - Relation between Einstein's A and B coefficients - Components of Laser - Optical amplification (qualitative) - Semiconductor lasers: Homojunction and Heterojunction- Principle and propagation of light through an optical fiber -Acceptance angle and Numerical aperture, LED, PN photodiodes - PIN photodiode and Avalanche photodiode - -Engineering applications of lasers (qualitative)-.

(Theory -9)

1. Determination of divergence of laser beam
2. Determination of acceptance angle and numerical aperture of an optical fiber
3. Determination of wavelength of semiconductor laser

(Laboratory-9)

UNIT IV   QUANTUM PHYSICS   15

Planck's quantum theory- Black body radiation- Newton's law of Cooling – Heisenberg's Uncertainty principle – Schrodinger's wave equations (time independent and time dependent)- Physical significance of wave function - de Broglie hypothesis -Particle in a one-dimension box – Particle in a three- dimensional box (Qualitative) – Degenerate and Non degenerate energy states - Tunneling through a potential barrier.

(Theory -9)

1. Determination of Planck's constant
2. Determination of emissivity – Newton's law of cooling

(Laboratory -6)

UNIT V NANO ELECTRONIC DEVICES   15

Introduction to Nano materials – synthesis by sol gel method, properties – Moore's law - Electron density in bulk material (qualitative) -Size dependence of Fermi energy- Band gap of nanomaterial - Quantum confinement -Quantum Structures-Density of states in quantum well, quantum wire and quantum dot structures – Application: Quantum dot laser.

(Theory -9)

1. Synthesis of nano-powders by sol-gel method
2. Determination of particle size using laser source

(Laboratory -6)

TOTAL: 75 PERIODS

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

CO1: Derive electrical and thermal conductivities using classical free electron theory

CO2: Use Fermi Dirac distribution function to determine the density of energy states

CO3: Distinguish between the types of semiconductors using the hall effect experiment

CO4: Associate the basic principles of working of laser and their applications in opto-electronic devices

CO5: Calculate the energy eigen value and eigen function for a particle in a one- dimensional and three dimensional box using Schrodinger wave equations

CO6: Relate the quantum properties of nanoscale materials with their applications

TEXT BOOKS

1. Arthur Beiser, Concepts of Modern Physics, Tata McGraw-Hill, New Delhi, 2010.
2. M.N. Avadhanulu and P.G. Kshirsagar, A text book of Engineering Physics, S. Chand and Company, New Delhi, 2014.
3. Kasap, S.O. Principles of Electronic Materials and Devices, McGraw-Hill Education, 2007.
4. Wahab, M.A., Solid State Physics: Structure and Properties of Materials. Narosa Publishing House,2009.
5. William T. Silfvast, Laser Fundamentals, 2nd Edition, Cambridge University press, New York, 2004.

REFERENCES

1. R.K. Gaur and S.L. Gupta, Engineering Physics, Dhanpat Rai Publications (P) Ltd., Eighth Edition., New Delhi, 2001.
2. Hanson, G.W., Fundamentals of Nanoelectronics, Pearson Education, 2009
3. R. A. Serway and J.W. Jewett, Physics for Scientists and Engineers, Ninth Edition. Cengage Learning, 2014.
4. Rogers, B., Adams, J. & Pennathur, S. Nanotechnology: Understanding Small Systems. CRC Press, 2014.
5. Marikani, Materials Science, PHI Learning Private Limited, Eastern Economy Edition, 2017.
6. R. Wolfson, Essential University Physics, Volume 1 and 2 with Mastering Physics, Global Edition,3rd Edition, Pearson 2017.

7. B.K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Learning India, 2012.
8. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc., 1995.
9. Garg, H.P., Treatise on Solar Energy, John Wiley & Sons, 2006.
10. Wilson J.D. and Hernandez C.A., Physics Laboratory Experiments, Houghton Mifflin Company, New York 2005.
11. NPTEL course on "Introduction to LASER" by Prof. M. R. Shenoy, IIT Delhi : https://onlinecourses.nptel.ac.in/noc24_ph45/preview
12. NPTEL course on "Introduction to Semiconductor Devices" by Prof. Naresh Kumar Emani, IIT Hyderabad : https://onlinecourses.nptel.ac.in/noc24_ee99/preview
13. Physics for Electronics Engineering – Laboratory Manual, R.M.K. College of Engineering and Technology, 2022.

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S. No.	Description of Equipment	Quantity
1.	Semiconductor Laser Apparatus	6 Nos.
2.	Determination of optical fiber parameters	6 Nos.
3.	Lee's disc apparatus	6 Nos.
4.	Emissivity Determination Apparatus	6 Nos.
5.	Bandgap determination set up	6 Nos.
6.	Sol-gel synthesis of nano powders	6 Nos.
7.	Planck's constant apparatus	6 Nos.
8.	Hall effect set-up	2 Nos.

COURSE CODE	COURSE TITLE	L	T	P	C
24EC101	**ELECTRONIC DEVICES AND CIRCUIT THEORY** (Theory course with laboratory component)	3	0	2	4

COURSE OBJECTIVES:

- To discuss the behavior of semiconductor diodes in various applications.
- To familiarize the operation of BJT and FET.
- To construct electronic circuits using special semiconductor devices.
- To understand the fundamental laws of electric circuits.
- To analyze the response of electric circuits using network theorems.

UNIT I	Overview of Electronic Devices and Electrical Circuits	9+6

Basic Electronic Components: Resistors, Capacitors, Inductors; Diodes types-PN Junction, Special purpose diodes- Zener Diode, Photodiode, LED, Solar Cell-Characteristics. **Basic Electrical Circuits:** Ohm's Law, Short and open circuits, Voltage division in series, current division in parallel. Analysis of series and parallel circuits.

List of Experiments:

1. VI Characteristics of PN diode.
2. VI Characteristics of Zener diode.

UNIT II	Bipolar Junction Transistor	9+6

BJT Types - NPN and PNP transistors, Transistor Characteristics: Input and output characteristics, and the concept of operating regions (active, cutoff, saturation) in common base, common emitter and common collector Configurations -Advantages and Disadvantages of BJT.

List of Experiments:

3. VI Characteristics of BJT in Common Emitter Configuration & also Simulate using PSPICE

4. VI Characteristics of BJT in Common Base Configuration & also Simulate using PSPICE

5. VI Characteristics of BJT in Common Collector Configuration & also Simulate using PSPICE

UNIT III	Field Effect Transistors	9+6

Theory and Operation of JFET: Structure, types, operation and characteristics of JFET. Advantages and Disadvantages of JFET. **Theory and Operation of MOSFET**: Structure, types, operation and characteristics of MOSFET (enhancement-mode, depletion-mode). Advantages andDisadvantages of MOSFET.

List of Experiments:

6. Characteristics of JFET & also Simulate using PSPICE or Multisim.

7. Characteristics of MOSFET & also Simulate using PSPICE or Multisim

UNIT IV	Circuit Theory	9+6

Equivalent resistance, Star-Delta conversion; Kirchhoff's Laws: Kirchhoff's Voltage Law (KVL) and Kirchhoff's Current Law (KCL); Mesh Analysis and Node Analysis (AC and DC).

List of Experiments:
8. Verification of Kirchhoff's current law and Kirchhoff's voltage law

UNIT V	Network Theorems	9+6

Thevenin's and Norton's theorems – Superposition Theorem –Maximum power transfer theorem, Millman's theorem.

List of Experiments:

9. Verification of Thevenin's theorem.
10. Verification of Norton's theorem.

TOTAL: 45 Theory + 30 Lab = 75 PERIODS

COURSE OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Explain the operating principles of electronic devices

CO2: Analyze the V-I characteristics of electronic devices.

CO3: Design basic electronic circuits using various electron

devices.CO4: Analyze electric circuits using network theorems.

CO5: Evaluate the Performance of Electrical and Electronic Circuits Using Simulation Tools

CO6: Develop simple circuits for real time applications.

TEXTBOOKS:

1. Charles K. Alexander, Matthew N. O. Sadiku, Fundamentals of Electric Circuits, 7thEdition, McGraw Hill, 2022.
2. Robert L. Boylestad, Louis Nashelsky, Electronic Devices and Circuit Theory, 11thEdition, 2017.

REFERENCES:

1. W.H.Hayt, J.E.Kemmerly and S.M.Durbin, Engineering Circuit Analysis, 9th Edition, McGraw Hill Education, New Delhi, India, 2019.
2. Joseph Edminister and Mahmood Nahvi, Electric Circuits, Schaum's Outline Series, 5thEdition Reprint, Tata McGraw Hill Publishing Company, New Delhi, 2016.
3. David A Bell, Electric Circuits and Electronic Devices, Oxford University Press, 2010.
4. Thomas L.Floyd, Electronic Devices, 9th Edition, Pearson, 2017.
5. Donald A.Neaman, Semiconductor Physics and Devices, 4th Edition, McGraw Hill, 2017.
6. Dr.R.S.Sedha, A Textbook of Applied Electronics, S Chand and company limited, 2019.

NPTEL LINK

1. https://archive.nptel.ac.in/courses/108/108/108108122/2.
2. https://onlinecourses.nptel.ac.in/noc22_ee93/preview

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Bread Boards -15 Nos CRO (30MHz) - 10 Nos

Signal Generator /Function Generators (3 MHz) - 15 Nos Transistor/FET/BJT(NPN-PNP) and

MOSFET(NMOS/PMOS) - 25 Nos Dual power supply/ single mode power supply - 15 Nos

Multimeter -15 Nos Ammeter(0-50) mA -15 Nos Voltmeter (0-30) V-15 Nos

Standalone desktops PC with SPICE

Course Code	MATRICES AND CALCULUS	L	T	P	C
	Theory Course				
24MA101	(Common to All I Semester B.E./B.Tech Programmes)	3	1	0	4

OBJECTIVES:
The course will enable the learners to:
- Explain the concepts of matrix algebra techniques.
- Understand various techniques to solve second and higher order differential equations.
- Demonstrate simple applications of functions of several variables.
- Comprehend the basic concepts of multiple integrals.
- Illustrate elementary ideas of vector calculus.

UNIT I   MATRICES   **12**

Eigenvalues and Eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors – Statement and applications of Cayley-Hamilton Theorem – Diagonalization of matrices by orthogonal transformation (excluding similarity transformation) – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms.

UNIT II   DIFFERENTIAL EQUATIONS   **12**

Second and Higher order linear differential equations with constant coefficients - Method of variation of parameters – Homogeneous equation of Euler's and Legendre's type – System of simultaneous linear differential equations with constant coefficients.

UNIT III FUNCTIONS OF SEVERAL VARIABLES   **12**

Total derivative – Differentiation of implicit functions – Jacobians and properties – Taylor's series for functions of two variables – Maxima and minima of functions of two variables– Lagrange's method of undetermined multipliers.

UNIT IV MULTIPLE INTEGRALS   **12**

Double integrals – Change of order of integration – Area enclosed by Cartesian Coordinates (excluding polar coordinates) – Triple integrals (excluding spherical and cylindrical coordinates) – Volume of solids (Cartesian Coordinates only).

UNIT V VECTOR CALCULUS   **12**

Gradient, divergence and curl (excluding vector identities) – Directional derivative – Irrotational and Solenoidal vector fields – Green's theorem in a plane, Stoke's theorem and Gauss divergence theorem (Statement only) - Simple applications involving cubes and rectangular parallelopipeds.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Compute the matrix inverse and their higher powers.

CO2: Solve the second and higher order differential equations.

CO3: Determine the maxima and minima of functions of two variables.

CO4: Determine the volume and surface area using multiple integrals.

CO5: Evaluate integrals using the concept of vector calculus.

CO6: Apply matrix algebra techniques to diagonalize the matrix.

TEXT BOOKS:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.

2. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition, 2021.

REFERENCES:

1. James Stewart, "Calculus: Early Transcendentals", Cengage Learning, 7th Edition, New Delhi, 2015.
2. M. K. Venkataraman, "Engineering Mathematics", Volume I, 4th Edition, The National Publication Company, Chennai, 2003.
3. Sivaramakrishna Dass, C. Vijayakumari, "Engineering Mathematics", Pearson Education India, 4th Edition 2019.
4. H. K. Dass, and Er. Rajnish Verma, "Higher Engineering Mathematics",S. Chand Private Limited, 3rd Edition 2014.
5. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, 6th Edition, New Delhi, 2008.
6. NPTEL course on "Engineering Mathematics – I", by Prof. Jitendra Kumar, IIT Kharagpur: https://onlinecourses.nptel.ac.in/noc21_ma58/preview

COURSE CODE	HERITAGE OF TAMILS (Theory Course)	L	T	P	C
24GE101	(Common to All I Semester B.E./B.Tech Programmes)	1	0	0	1

OBJECTIVES:
The course is designed to
- Recognize Tamil literature and its significance in Tamil culture.
- Introduce the Tamils' rich artistic and cultural legacy.
- Familiarize the different types of folk and martial arts that are unique to Tamil Nadu.
- Acquaint the concept of Thinai in Tamil literature and culture.
- Comprehend the significance of Tamil in developing Indian culture.

UNIT I   LANGUAGE AND LITERATURE   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 Thirukural - 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.

UNIT II   HERITAGE-ROCK ART PAINTINGS TO MODERN ART - SCULPTURE   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.

UNIT III   FOLK AND MARTIAL ARTS   3
Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT IV   THINAI CONCEPT OF TAMILS   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.

**UNIT V   CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT
                AND INDIAN CULTURE   3**
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.

TOTAL: 15 PERIODS

OUTCOMES:

At the end of the course, the learners will be able to

CO1: Imbibe the local wisdom and its contribution in the makeup of our general knowledge of universe

CO2: Critically appreciate Tamil literature for its societal ethical principles.

CO3: Explore the essence of heritage and its importance in the present contexts.

CO4: Decipher the relevance of Thirukkural and Sangam literature in contemporary times.

CO5: Analyze, interrogate and redefine the multi-faceted aspects of the heritage of Tamils.

TEXT - CUM - REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் 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– (inprint)
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, TamilNadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

24GE101   தமிழர் மரபு   **L T P C**
                                                                                1 0 0 1

அலகு I மொழி மற்றும் இலக்கியம்:   **3**

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

அலகு II   மரபு — பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை — சிற்பக் கலை:   **3**

நடுகல் முதல் நவீக சிற்பங்கள் வரை — ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை — சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு III   நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:   **3**

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

அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள்:   **3**

தமிழகத்தின் தாவரங்களும், விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு — சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறை முகங்களும் - சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி — கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு   **3**

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு -கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

TOTAL: 15 PERIODS

TEXT - CUM - REFERENCE BOOKS
1. தமிழக வரலாறு — மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் 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 - (inprint)
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, TamilNadu)

12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) — Reference Book.

Course Code	INTERPERSONAL SKILLS, PSYCHOMETRIC ANALYSIS AND CAREER DEVELOPMENT (Common to all the branches)	L	T	P	C
24HS111		1	0	0	1

OBJECTIVES

The course will enable the learners to:

- Evaluate and enhance language proficiency by using SMART Vox to assess communication skills and linguistic abilities.

- Explore future technologies, solve real-time problems, and prepare students for campus recruitment.

- Assess and develop work style, cognitive abilities, emotional intelligence, and work competencies

- Explore placements, internships, higher education options, GATE and CAT exams, and career development.

- Understand career milestones, assess personal skills and personality, and develop effective goal-setting strategies for successful career planning

UNIT I   LANGUAGE PROFICIENCY EVALUATION   3

Identification of Strengths and Weaknesses - Assessing Language Skills (Diagnostic tests and interactive exercises) - Measuring Language Competence (Proficiency Levels) - Identifying Support Needs - Developing Individual Learning Plans - Enhancing Student Experience (Building Confidence) – Evaluation using SMART Vox

UNIT II   CAREER GUIDANCE   3

Future of Engineering- Various aspects of Technology and its Applications - Future of Technologies – Branch Specific emerging technologies - Problems solving through open source - Campus recruitment process.

UNIT III   PSYCHOMETRIC EVALUATION   3

Understanding Behavioural work style (Personality)- Testing of numerical, logical, and verbal reasoning skills (Cognitive Abilities / Aptitude) – Measure of emotional intelligence and interpersonal skills – Determination of Culture Preferences in various workplace scenarios – Evaluation of Work Competencies through targeted games and simulations

UNIT IV CAREER PREPARATION   3

Present Scenario of Engineering - Placement Opportunities - Internship Opportunities - Types of Internships- Higher Education opportunities in India and Abroad - Understanding GATE and CAT Exams - Other Opportunities - Career path development plans.

UNIT V CAREER VISION AND PLANNING 3

Introduction to career milestones - Overview of the Vision Assessment and its benefits - Psychometric evaluation - Numeracy, Literacy, Visual Reasoning, Algorithmic Thinking - Introduction to a goal-setting model - Identification career pathways aligned with personality profiles - Evaluate personal skills and abilities in various areas.

COURSE OUTCOMES **TOTAL: 15 PERIODS**

Upon completion of the course, the students will be able to:

CO1: Assess and improve their English language proficiency using SMART Vox, gaining insights into their communication skills and linguistic competence

CO2: Understand future engineering trends, emerging technologies, importance of solving real-time problems, and the process of campus recruitment.

CO3: Evaluate their behavioral work style, cognitive abilities, emotional intelligence, cultural preferences, and work competencies.

CO 4: Understand the current engineering landscape, placement opportunities, and higher education prospects to develop effective career path plans

CO5: Develop a clear and actionable vision for their future career path.

Course Code	ENVIRONMENTAL SCIENCE AND SUSTAINABILITY	L	T	P	C
	(Common for I semester B.E. – CSE(CS), ECE, EE(VLSI)				
24CH102	and II semester B.E. – CSE, B.Tech – AIDS)	2	0	0	MC

OBJECTIVES:

The course will enable the learners

- To gain knowledge of the environment and various natural resources.
- To identify the Scientific and Technological solutions to pollution issues and waste management.
- To understand the significance of the conservation of biodiversity.
- To recognize the needs and benefits of sustainability and its management.
- To comprehend the effects of human population on the environment.

UNIT I   NATURAL RESOURCES   7

Definition, scope and importance of environment – need for public awareness. Introduction to natural resources - types - forest resources: use and over-exploitation, deforestation and its impacts, food resources: effects of modern agriculture, organic farming, renewable energy sources - solar, wind, geothermal, tidal, OTE and biomass. field activity -tree plantation

UNIT II   POLLUTION AND WASTE MANAGEMENT   7

Pollution - definition –causes, effects and control measures of (a) air pollution (b) water pollution (c) soil pollution (d) noise pollution (e) nuclear hazards - nuclear accidents and holocaust - role of an individual in prevention of pollution –case studies.

Waste management- municipal solid wastes, E- waste, plastic waste.

Field study – Solid waste management of the institution

UNIT III   BIODIVERSITY AND ITS CONSERVATION   6

Biodiversity: types – values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity – endangered and endemic species, extinct, rare, vulnerable species of India – conservation of biodiversity: in-situ and ex-situ method.

Field study – Biodiversity of the institution

UNIT IV   SUSTAINABILITY AND MANAGEMENT   5

Sustainability-concept, needs and challenges- circular economy - sustainable development goals-concept of carbon footprint, environmental impact assessment, clean development mechanism, solutions.

Field study – Alternate energy sources and its impacts

Introduction - population growth, variation among nations, population explosion, environment and human health – endemic/epidemic/pandemic – role of information technology in environment and human health.

Case Study – Pandemics of 21st century

TOTAL: 30 PERIODS

COURSE OUTCOMES:

Upon completion of the course, the students will be able

CO1: To investigate and use conservational practices to protect natural resources.

CO2: To identify the causes of pollutants and illustrate suitable methods for pollution abatement.

CO3: To analyze the values of biodiversity and its conservational methods.

CO4: To classify suitable sustainable development practices and apply it in day-to-day life.

CO5: To assess the impacts of human population and suggest suitable solutions.

CO6: To develop innovative solutions and strategies to address sustainability challenges.

TEXTBOOKS:

1. Anubha Kaushik and C.P. Kaushik, "Perspectives in environmental studies", New Age International Publishers, 8th edition, 2024.
2. Benny Joseph, Environmental Science and Engineering, McGraw-Hill, 1st edition, 2017.
3. Gilbert M. Masters, Introduction to Environmental Engineering and Science, Pearson Education, 3rd edition, 2014.
4. Erach Bharuch, Textbook of Environmental Studies for Undergraduate Courses, Universities Press(I) Pvt. Ltd., 3rd edition, 2021.

REFERENCES:

1. William P. Cunningham and Mary Ann Cunningham Environmental Science: A Global Concern, McGraw Hill, 14th edition, 2017.
2. Rajagopalan, R, Environmental Studies-From Crisis to Cure, Oxford University Press, 2015.
3. G. Tyler Miller and Scott E. Spoolman, ―Environmental Science, Cengage Learning India Pvt, Ltd., Delhi, 2014.
4. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall, 2012.
5. Bradley. A.S; Adebayo, A.O. and Maria, P. Engineering applications in sustainable design and development, Cengage learning, 2015.
6. Environment Impact Assessment Guidelines, Notification of Government of India, 2006 and subsequent amendments, 2022

COURSE CODE	COURSE TITLE	L	T	P	C
24EC111	**IDEA LAB –I** (Common to all Branches)	0	0	1	0

The students may be grouped into 3 to 4. The device/Machine/system/component are studied by the students and a final presentation to be done by the students about the study of various devices or machinery at the end of the semester.

COURSE OBJECTIVES:

Students completing this course are expected to
- Understand the functionalities and limitation of various machines/equipment
- Demonstrate various operations that can be performed using various machines

LIST OF EXPERIMENTS

1. Study of fundamental operations of 3D Printer and Scanner with Software.
2. Study of Laser cutting machine.
3. Study of CNC Router machine.
4. Study of Fundamentals of basic circuit design, Soldering and Desoldering.
5. Study of PCB Milling Machine.

TOTAL: 15 PERIODS

COURSE OUTCOMES:

After successful completion of the course the students will be able to do

CO1: Describe the working of the machine element.

CO2: Discuss the various applications of engineering materials.

CO3: Describe the process for converting ideas into prototypes.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S. No	Equipment Name	Quantity
1	CNC Router	1 No
2	3D Printer	1 No
3	3D Scanner	1 No
4	Laser cutting Machine	1 No
5	Multimeter	5 Nos
6	Solder Stations	5 Sets
7	Desoldering Machine	1 No
8	PCB Milling Machine	1 No

9	Variable Power Supply	1 No
10	Electronic Components like Resistors, Transistors, Diode, Inductor, Capacitor, etc.	10 Sets

Course Code	Student Induction Program (SIP)	L	T	P	C
24MC101	(Common to all branches of First Year B.E. / B. Tech)	3 Weeks			

OBJECTIVES

The course will enable the learners to:

- Facilitate the adjustment of new students to the new environment, ensuring they feel comfortable and supported.
- Inculcate the institution's ethos and culture in new students, helping them internalize these values.
- Encourage the building of bonds among students and between students and faculty members.
- Expose students to a sense of larger purpose and guide them in their journey of self-exploration.

The various modules or core areas recommended for the 3-week SIP are

Module 1: Universal Human Values I   **18**

Welcome and Introductions - Aspirations and Concerns - Self- Management - Health - Relationships - Society - Natural Environment - Sum Up - Self-evaluation and Closure.

Module 2: Physical Health and Related Activities   **6**

Special Lecturers: Happy and Healthy lifestyle - Physical Health -Mental Health - Health and Fitness.

Module 3: Familiarization of Department/ Branch and Innovation   **8**

Principal Address - Address by Head of Science and Humanities - Addresses by Respective Department HoDs – Campus Tour – CoE introduction – Introduction of Student Activity Cell (SAC).

Module 4: Visit to a Local Area   **4**

Virtual tour: Government Museum - Theosophical Society - Fort St. George - Ripon Building - Kalakshetra Foundation - Anna Centenary Library - Marina Beach - St. Thomas Mount - Vivekananda House.

Module 5: Lectures by Eminent People   **10**

Special Lecturers: Academics – industry – Careers – Art - Self-management.

Module 6: Proficiency Modules   **30**

Basic Competencies: C Programming, Foundation in Mathematics, Interpersonal Communication.

Module 7: Literature / Literary Activities   **7**

Literary Debate - Creative Writing Workshop - Literature Circle Discussions - Author Study and Presentation.

Module 8: Creative Practices   **10**

 Activity: Handicrafts (Painting / Drawing / Pottery / Knitting / Jewellery making, etc.)

Module 9: Extra Curricular Activities   **10**

Students Activity Cell: Activities from Coding Club – Math Club -- Language Club - Astronomy Club - ECO Club - Photography Club - Tedx Club -Yoga Club.

Valedictory and Closing Ceremony   **2**

                                                           TOTAL: 105 PERIODS

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

- Achieve a smooth transition where students feel comfortable and confident in their new environment.
- Demonstrate a strong understanding and practice of the institution's ethos and culture within the campus community.
- Build meaningful and supportive relationships with peers and faculty members.
- Develop a clear sense of purpose and engage in self-exploration, leading to a deeper understanding of personal goals and aspirations.

REFERENCE:

 https://www.aicte-india.org/sites/default/files/Detailed%20Guide%20on%20Student%20Induction%20program.pdf

Course Code	TRANSFORMS AND COMPLEX ANALYSIS	L	T	P	C
24MA202	Theory with Laboratory Component (Common to II Semester B.E. ECE and EE(VLSI) Branches)	3	0	2	4

OBJECTIVES:

The course will enable the learners to:
- Comprehend the concepts of Laplace transforms.
- Understand the basic ideas of Z-transforms.
- Illustrate the application of transforms in solving differential and difference equations.
- Understand the concepts of analytic functions and conformal mapping.
- Impart the knowledge of complex integration.

UNIT I LAPLACE TRANSFORMS   15

Laplace transforms – Sufficient condition for existence – Transform of elementary functions – Basic properties – Transforms of derivatives and integrals of functions – Derivatives and integrals of transforms –Transforms of unit step function and impulse function – Transform of periodic functions – Inverse Laplace transforms – Convolution theorem (Statement only).

Experiments using C Program:

1. Find the Laplace Transform of simple functions.
2. Find the Inverse Laplace Transform of simple functions.

UNIT II Z – TRANSFORMS   15

Z-transforms – Elementary properties – Inverse Z-transforms – Partial fractions method – Residue method – Convolution theorem.

Experiments using C Program:

1. Find the Poles of X(z).
2. Resolve the X(z) by partial fraction method.

UNIT III SOLUTION OF DIFFERENTIAL AND DIFFERENCE EQUATIONS   15

Solution of linear ordinary differential equations of second order with constant coefficients and first order simultaneous equations with constant coefficients using Laplace transform. Formation of difference equations – Solution of first and second order difference equations with constant coefficients using Z-transform.

Experiments using C Program:

1. Find the solution of Ordinary Differential Equations
2. Find the solution of Difference Equations

UNIT IV   ANALYTIC FUNCTIONS   15

Analytic functions – Necessary and sufficient conditions in Cartesian coordinates (statement only) – Properties (only Cartesian coordinates) – Harmonic conjugates – Construction of an analytic function – Conformal mapping – Mapping by functions W= c+z, cz, 1/z – Bilinear transformation.

Experiments using C Language:

1. Compute Real and Imaginary Parts of the Exponential Function.
2. Compute the harmonic conjugate of a given function.

UNIT V COMPLEX INTEGRATION   15

Cauchy's integral theorem (statement only) – Cauchy's integral formula (statement only) – Taylor's and Laurent's series – Singularities – Residues – Cauchy's Residue theorem (statement only) – Evaluation of real integrals using circular and semicircular contour (excluding poles on real axis).

Experiments using C Language:

1. Find the Taylor's series expansion of X(z) at any point.
2. Find the Residues of X(z).

TOTAL: 75 PERIODS

COURSE OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Determine Laplace transform and Inverse Laplace transform of simple functions.

CO2: Determine Z- transform and Inverse Z- transform of simple functions.

CO3: Solve ordinary differential equations using Laplace transform and difference equations using Z-Transform.

CO4: Construct an analytic function and analyze conformal mapping.

CO5: Evaluate the real integrals using complex integration.

CO6: Identify singularities using Taylor's and Laurent's series.

TEXT BOOKS:

1. N. Bali, M. Goyal and C. Watkins, "Advanced Engineering Mathematics", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
2. B.S. Grewal, and J.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, New Delhi, 2021.

REFERENCES:

1. Erwin. Kreyszig, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. R.K. Jain and S.R.K Iyengar "Advanced Engineering Mathematics", Narosa Publications, New Delhi, 3rd Edition, 2007.
3. R.C. Wylie and L.C. Barrett, "Advanced Engineering Mathematics", Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.
4. M.K. Venkataraman, "Engineering Mathematics, Volume II", 4th Edition, The National Publication Company, chennai, 2003.
5. B.V. Ramana"Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, 6th Edition, New Delhi, 2008.
6. NPTEL course on "Transform Techniques for Engineers", by S.R.Manam, IIT Madras: https://archive.nptel.ac.in/courses/111/106/111106111/
7. NPTEL course on "Advanced Engineering Mathematics", by Prof. P. N. Agarwal, IIT Roorkee: https://onlinecourses.nptel.ac.in/noc23_ma90/preview

24CS202	JAVA PROGRAMMING (Common to All Branches)	L	T	P	C
		3	0	3	4.5

OBJECTIVES:
The Course will enable learners to:
- To explain object oriented programming concepts and fundamentals of Java
- To apply the principles of packages, interfaces and exceptions
- To develop a Java application with I/O streams, threads and generic programming
- To build applications using strings and collections.
- To apply the JDBC concepts

UNIT I	JAVA FUNDAMENTALS	9+9

An Overview of Java - Data Types, Variables, and Arrays – Operators - Control Statements – Class Fundamentals – Declaring objects – Methods – Constructors – this keyword – Overloading methods - Overloading constructors - Access Control – Static – Final

List of Exercise/Experiments:
1. Develop a Java application to generate Electricity bill. You must use one super class called EB Bill and must have two sub classes namely Domestic Bill and Commercial Bill. Create a class with the following members: Consumer no., consumer name, previous month reading, current month reading, type of EB connection (i.e domestic or commercial). Compute the bill amount using the following tariff
If the type of the EB connection is domestic, calculate the amount to be paid as
follows: First 100 units - Rs. 1 per unit
101-200 units - Rs. 2.50 per unit 201 -500 units - Rs. 4 per unit
> 501 units - Rs. 6 per unit
 If the type of the EB connection is commercial, calculate the amount to be paid as
follows: First 100 units - Rs. 2 per unit
101-200 units - Rs. 4.50 per unit 201 -500 units - Rs. 6 per unit
> 501 units - Rs. 7 per unit
2.   Arrays Manipulations: (Use Methods for implementing these in a Class)
a.   Find kth smallest element in an unsorted array
b.   Find the sub array with given sum
c.   Matrix manipulations – Addition, Subtraction, Multiplication
d.   Remove duplicate elements in an Array
e.   Accept an integer value N and print the Nth digit in the integer sequence 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 and so on till infinity.
Example: The 11th digit in the sequence 12345678910111213…. is 0.

UNIT II	INHERITANCE, INTERFACES AND EXCEPTION HANDLING	9+9

Inheritance: Inheritance basics, Using super, Method Overriding, Using Abstract Classes, Using final with Inheritance - Package and Interfaces: Packages, Packages and member access, Importing Packages, Interfaces, Static Methods in an Interface – Exception Handling: Exception- Handling Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch Clauses, Nested try Statements, throw,

throws, finally, Java's Built-in Exceptions.

List of Exercise/Experiments:
1. Develop a Java application to implement currency converter (Dollar to INR, EURO to INR, Yen to INR and vice versa), distance converter (meter to KM, miles to KM and vice versa), time converter (hours to minutes, seconds and vice versa) using packages.
2. Develop a Java application with Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club fund. Generate pay slips for the employees with their gross and net salary.
3. Design a Java interface for ADT Stack. Implement this interface using array and built-in classes. Provide necessary exception handling in both the implementations.
4. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named print Area(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains the methods print Area () that prints the area of the given shape and Numberofsides() that prints the number of sides of the given shape.
5. Write a Java program to apply built-in and user defined exceptions.

UNIT III	MULTITHREADING, I/O AND GENERIC PROGRAMMING	9+9

Multithreaded Programming: Creating a Thread, Thread Priorities, Synchronization, Interthread Communication – I/O: I/O Basics, Reading Console Input, Writing Console Output, Reading and Writing Files – Generics: Introduction, Generic class, Bounded Types, Generic Methods, Generic Interfaces, Generic Restrictions.

List of Exercise/Experiments:
1.Write a Java program to read and copy the content of one file to other by handling all file related exceptions.

UNIT IV	STRING HANDLING AND COLLECTIONS	9+9

Lambda Expressions - String Handling – Collections: The Collection Interfaces, The Collection Classes – Iterator – Map - Regular Expression Processing.

List of Exercise/Experiments:
1.String Manipulation:
a. Reversing a set of words and count the frequency of each letter in the string.
b. Pattern Recognition - Find the number of patterns of form 1[0]1 where [0] represents any number of zeroes (minimum requirement is one 0) there should not be any other character except 0 in the [0] sequence in a given binary string.
c. Remove all the occurrences of string S2 in string S1 and print the remaining.
d. Find the longest repeating sequence in a string
e. Print the number of unique string values that can be formed by rearranging the

letters in the string S.
2. Write a Java program that correctly implements producer consumer problem using the concept of inter thread communication.
3. Collections:
a. Write a program to perform string operations using ArrayList. Write functions for the following
i. Append - add at end
ii. Insert – add at particular index
iii. Search
iv. List all string starts with given letter
b. Find the frequency of words in a given text.

UNIT V	JDBC CONNECTIVITY	9+9

JDBC – DataSource, Configurations, Connection, Connection Pools, Driver Types, ResultSet, Prepared Statement, Named Parameter, Embedded SQL (Insert, Update, Delete, Join, union etc), ResultSet Navigation, Connection Close and Clean up.

List of Exercise/Experiments:
- Mini Project (using JDBC)

TOTAL: 45 (L) + 45 (P) = 90 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to:
CO1: Solve core Java programming concepts.
CO2: Utilize object-oriented programming (OOP) principles.
CO3: Demonstrate competency in handling exceptions and implementing multithreading.
CO4: Develop expertise in input/output (I/O) operations and file handling.
CO5: Apply advanced Java programming concepts with generics and lambda expressions.
CO6: Implement database connectivity using JDBC.

TEXTBOOKS:
1. Herbert Schildt, "Java: The Complete Reference", 11th Edition, McGraw Hill Education, 2019.

REFERENCES:
1. Cay S. Horstmann, Gary Cornell, "Core Java Volume – I Fundamentals", 11th Edition, Prentice Hall, 2019.
2. Paul Deitel, Harvey Deitel, Java SE 8 for programmers, 3rd Edition, Pearson, 2015.
3. Steven Holzner, Java 2 Black book, Dream tech press, 2011.
4. Timothy Budd, Understanding Object-oriented programming with Java, Third Edition, Pearson Education, 2008.
5. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_29959473947367270000_shared/overview

LIST OF EQUIPMENTS:
1. Java and Eclipse / NetBeans IDE or Equivalent

24CS203	DATA STRUCTURES AND ALGORITHMS	L	T	P	C
		3	0	3	4.5

OBJECTIVES:
The Course will enable learners to:
- To understand the concepts of linear structures ADTs.
- To gain the knowledge of searching and sorting algorithms.
- To learn hashing algorithms and its applications.
- To understand the tree data structures.
- To understand graph structures.

UNIT I	INTRODUCTION	9+9

Asymptotic Notations and Analysis of algorithms- Introduction to Data Structures, abstract data types, Linear list – singly linked list implementation - circular linked list implementation - Double linked list implementation -Applications of linked lists. Stack: Operations, array and linked representations of stacks, stack applications. Queues: Operations, array and linked representations of Queue, Queue applications.

List of Exercise/Experiments:

1. Implementation of Singly,Doubly and Circular Linked List
2. Implementation of Stack using Arrays and Linked List
3. Implementation of Stack applications
4. Implementation of Queue using Arrays and Linked List
5. Implementation of Queue applications

UNIT II	SEARCHING AND SORTING ALGORITHMS	9+9

Incremental Design Strategies- Searching: Linear and binary search, Sorting: Bubble sort,Insertion sort -Selection sort–Divide & Conquer -Quick sort –Merge sort.

List of Exercise/Experiments:

1. Implementation of searching and sorting algorithms

UNIT III	TREES	9+9

Trees: Binary Tree - Terminology and Properties - Binary Search Tree - Insertion, Deletion, Traversal – In order, Preorder and Post order, Level order traversal, finding min and max, finding the kth minimum element in a BST
List of Exercise/Experiments:

1. Implementation of Binary Search Tree

UNIT IV	GRAPHS	9+9

Graphs –Representation-Traversal - BFS and DFS, Greedy Algorithms: Minimum spanning Tree-Prims and Kruskal's, Shortest path algorithm- Dijkstra, Floyd and Warshall – Backtracking

List of Exercise/Experiments:

1. Implementation of Graph Traversal algorithms
2. Implementation of Minimum spanning tree algorithm
3. Implementation of Prims and Kruskal'salgorithm
4. Implementation of Shortest path algorithm

UNIT V	HEAPS AND HASHING	9+9

Heaps and Hashing - Implementation of Heaps, Binary Heap, Heap sort - Applications - Hash functions, open hashing-separate chaining, closed hashing - linear probing, quadratic probing, double hashing, random probing, rehashing

List of Exercise/Experiments:

1. Implementation of Hashing techniques
2. Implementation of Heap

TOTAL:45+45=90 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Analyze and compare functions using asymptotic analysis and understand the concepts of basic data structures such as array and linked list.

CO2: Applying a suitable algorithm for searching and sorting.

CO3: Analyze the various tree algorithms for solving real time computing problems.

CO4: Understanding graph algorithms, operations, and applications

CO5: Understanding the importance of hashing.

CO6: Apply the appropriate data structure to solve real world problems

TEXTBOOKS:

1. Thomas H. Cormen, C.E. Leiserson, R L.Rivest and C. Stein, Introduction to Algorithms, Third edition, MIT Press, 2009.

2. Anany Levitin, Introduction to the Design and Analysis of Algorithms, 3rdedition, Pearson Education, 2021

REFERENCES:

1. Kurt Mehlhorn, and Peter Sanders – Algorithms and Data Structures - The Basic Toolbox, Springer-Verlag Berlin Heidelberg, 2008.

2. Debasis Samanta, "Classic Data Structures", Prentice Hall of India, 2nd edition, 2014.

LIST OF EQUIPMENTS:

1. Systems with Linux Operating System and GNU Compiler

Course Code	CHEMISTRY FOR ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	C
24CH201	Theory Course with Laboratory Component (Common for II Semester B.E.- ECE and EE(VLSI))	3	0	2	4

OBJECTIVES:

The course will enable the learners

- To acquire knowledge on the fundamental principles of energy storage devices.
- To provide an overview of corrosion, its types and corrosion control methods.
- To gain insights into the basic concepts and applications of chemical sensors and cheminformatics.
- To identify the different types of smart materials and explore their applications in engineering and technology.
- To assimilate the preparation, properties and applications of nanomaterials in various fields.

UNIT I   ENERGY STORAGE DEVICES AND GREEN FUEL   15

Introduction to electrochemical cell and its terminology - electrochemical series and its applications.

Batteries – classification - construction and working principle -primary alkaline battery - secondary battery - Pb-acid battery.

Green fuel – Hydrogen - production (photo electrocatalytic and photo catalytic water splitting), construction, working principle and applications in H_2 -O_2 fuel cell.

Batteries used in E-vehicle: Ni-metal hydride battery, Li-ion battery- Recycling of Li-ion batteries by direct cycling method; environmental effects of different energy storage devices.

(Theory-9)

1. Construction of electrochemical cell.
2. Determination of discharging state of Pb-acid battery by estimating the strength of the acid correlates with specific gravity.
3. Study of performance of a battery using battery analyzing module.

(Laboratory-6)

UNIT II   CORROSION AND ITS CONTROL   15

Corrosion – causes of corrosion – principles of chemical corrosion – Pilling – Bedworth rule – principles of electrochemical corrosion – differences between chemical and electrochemical corrosion – factors influencing corrosion – types of corrosion – galvanic corrosion – differential aeration corrosion – stress corrosion– pitting corrosion, water line corrosion, impacts of corrosion on power plants.

Corrosion control and prevention – selection of materials and proper designing - cathodic protection – sacrificial anode — protective coatings - anodization, galvanization, anti-corrosive agents – molybdates and phosphates.

1. Determination of influence of pH on the rate of corrosion.
2. Demonstrate the effectiveness of the sacrificial anode in protecting the metal from corrosion.
3. Determination of corrosion rate at various % of NaCl - by weight loss method.

(Laboratory-6)

UNIT III   CHEMICAL SENSORS AND CHEMINFORMATICS   15

Introduction - classification of chemical sensors -principle, construction and working of chemical sensors; pH sensor – Glass electrode; Breath analyzer; Industrial sensor – CO_2 sensors- sensor for health care – Glucose sensor.

Cheminformatics – definition, scope, and significance; applications in environmental sector – carbon footprint measurements, data analysis and interpretation.

(Theory-9)

1. Determination of the amount of given hydrochloric acid using a pH meter.
2. Calculate the carbon footprint from the provided dataset, analyze the results, and draw conclusions

(Laboratory-6)

UNIT IV   SMART MATERIALS   15

Shape Memory Alloys: introduction - shape memory effect – functional properties of SMAs – types of SMA - Nitinol (Ni-Ti) alloy and its applications.

Chromogenic materials: introduction – types, applications in chemical and biological detection, display technologies, smart windows and light-modulating devices, biomedical and healthcare.

Smart Hydrogels – Introduction - Super Absorbent Polymers (SAP)- preparation, properties and applications of polyacrylic acid and sodium polyacrylate.

(Theory-9)

1. Demonstrate the shape memory effect using Nitinol wire.
2. Determination of pH sensitivity of bromothymol blue.
3. Determination of absorption efficiency of hydrogel by using kinetic study.

(Laboratory-6)

UNIT V   NANO CHEMISTRY   15

Introduction – synthesis – top-down process (laser ablation, chemical vapor deposition), bottom-up process (precipitation, electrochemical deposition) – properties of nanomaterials – types – nanotubes -carbon nanotubes, applications of CNT - nanocomposites – General applications of nanomaterials in electronics, information technology, medical and healthcare, energy, environmental remediation, construction and transportation industries.

(Theory-9)

1. Synthesis of nano $BaSO_4$ by precipitation method.

2. Demonstrate the efficiency of nano adsorbents in polluted water.

(Laboratory-6)

TOTAL: 75 PERIODS

COURSE OUTCOMES:

Upon completion of the course, the students will be able

CO1: To identify the suitability of batteries for various fields.

CO2: To analyze the different types and impacts of corrosion, and evaluate methods for corrosion control and prevention.

CO3: To apply the fundamental principles of chemical sensors, cheminformatics and their applications across various industries.

CO4: To analyze the types of smart materials used in various engineering fields.

CO5: To explore the applications of nanomaterials in various fields, considering their advantages and limitations.

CO6: To integrate the concepts of chemistry for various engineering applications.

TEXTBOOKS:

1. P. C. Jain and Monika Jain, "Engineering Chemistry", Dhanpat Rai Publishing Company Pvt. Ltd., New Delhi, 19th Edition, 2024.
2. Sivasankar B., "Engineering Chemistry", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2nd reprint, 2012.

REFERENCES:

1. S.S. Dara and S.S. Umare, "A Textbook of Engineering Chemistry",S. Chand & Company, New Delhi, 12th Edition, 2022.
2. J. C. Kuriacose and J. Rajaram, "Chemistry in Engineering and Technology", Volume -1 & Volume -2, Tata McGraw-Hill Education Pvt. Ltd., 2010.
3. Barry A. Bunin, Brian Siesel, and J. Bajorath, "Chemoinformatics: Theory, Practice, & Products", Springer, First Edition, 2007.
4. Geoffrey A. Ozin, Andre C. Arsenault and Ludovico Cademartiri, "Nanochemistry: A Chemical Approach to Nanomaterials", RSC publishers, 2nd Edition, 2015.
5. J. Mendham, R. C. Denney, J. D. Barnes, M. J. K. Thomas and B. Sivasankar, "Vogel's Quantitative Chemical Analysis", Pearson Education Pvt. Ltd., 6th edition, 2019.
6. Pierre R. Roverge, Handbook of Corrosion Engineering, McGraw-Hill Publishers, 3rd Edition, 2019.

7. NPTEL course on "Electrochemical Energy Storage"
   Prof. Subhasish Basu Majumder, IIT Kharagpur,
   https://onlinecourses.nptel.ac.in/noc21_mm34/preview

8. NPTEL course on "Corrosion Protection Methods"
   Prof. Kallol Mondal, IIT Kanpur,
   https://onlinecourses.nptel.ac.in/noc24_mm01/preview

9. NPTEL course on "Nanotechnology, Science and Applications"
   Prof. Prathap Haridoss, IIT-M,
   https://onlinecourses.nptel.ac.in/noc22_mm33/preview

LIST OF EQUIPMENTS FOR A BATCH OF 30 STUDENTS

S. No.	Description of Equipment	Quantity
1.	Potentiometer	12 Nos.
2.	Conductivity meter	12 Nos.
3.	pH meter	12 Nos.
4.	CAN Enabled BMS unit	4 Nos.
5.	UV-Visible Spectrophotometer	2 Nos.

24AI201	INTRODUCTION TO ARTIFICIAL INTELLIGENCE	L	T	P	C
		2	0	2	3

OBJECTIVES:

The Course will enable learners to:
- Understand the basics and applications of Artificial Intelligence.
- Apply the basics of Python programming.
- Use python libraries to solve simple problems.
- Understand the different types of Machine Learning algorithms.
- Solve real world problems using AI/ML.
- Explore the various applications in the field of Artificial Intelligence and Machine Learning.

UNIT I	ARTIFICIAL INTELLIGENCE	6+6

Introduction – Types of AI – ANI, AGI, ASI – Narrow, General, Super AI, Examples - AI problems – Production Systems – State space Representation – Applications of AI in various industries.

List of Exercise:
1. Build a simple AI model using python.

UNIT II	BASICS OF PYTHON	6+6

Introduction to Python programming – Arithmetic Operators - values and types - variables, expressions, statements – Functions – Conditionals and Recursion –Iteration. Lists: Sequence, Mutable, Traversing, Operations, list slices, list methods - Tuples: Immutable, Tuple Assignment, Tuple as Return Values, Comparing and Sorting.

List of Exercises:
1. Compute the GCD of two numbers.
2. Operations on Tuples: a) finding repeated elements, b) slice a tuple c) reverse a tuple d) replace last value of a tuple.

UNIT III	PYTHON LIBRARIES	6+6

Introduction to Numpy - Multidimensional Ndarrays – Indexing – Properties – Constants – Data Visualization: Ndarray Creation – Matplotlib - Introduction to Pandas – Series – Dataframes – Visualizing the Data in Dataframes - Pandas Objects – Data Indexing and Selection – Handling missing data – Hierarchical indexing – Combining datasets – Aggregation and Grouping – Joins- Pivot Tables - String operations – Working with time series – High performance Pandas.

List of Exercises:
1. Download, install and explore the features of R/Python for data analytics
   - Installing Anaconda
   - Basic Operations in Jupyter Notebook
   - Basic Data Handling
2. Working with Numpy arrays - Creation of numpy array using the tuple, Determine the size, shape and dimension of the array, Manipulation with array Attributes, Creation of Sub array, Perform the reshaping of the array along the row vector and column vector, Create two arrays and perform the concatenation among the arrays.
3. Working with Pandas data frames - Series, DataFrame , and Index, Implement the Data Selection Operations, Data indexing operations like: loc, iloc, and ix, operations of handling the missing data like None, Nan, Manipulate on the

operation of Null Vaues (is null(), not null(), dropna(), fillna()).
4. Perform the Statistics operation for the data (the sum, product, median, minimum and maximum, quantiles, arg min, arg max etc.).
5. Use any data set compute the mean ,standard deviation, Percentile.

UNIT IV	MACHINE LEARNING	6+6

Introduction – ML Algorithms Overview – Types – Supervised – Unsupervised – Reinforcement Learning – Introduction to Neural Networks – Working of Deep Learning – Applications of DL – Ethical consideration in AI and ML.

List of Exercise:
1. Apply any Machine Learning model to predict the sales in a store.

UNIT V	CASE STUDIES	6+6

Disease Prediction – Share Price Forecasting – Weather Prediction – Domain Specific Case Studies.
List of Domain Specific Case Studies:
- For CSE & allied: Sentiment analysis of product reviews using machine learning.
- For ECE & allied: Smart homes using AI.
- For EEE: Forecasting of Renewable energy availability during a specified period using AI.
- Civil: Application of ML for crack detection on concrete structures.
- Mech: Predictive Maintenance for CNC Machines Using AI and Machine Learning.

List of Exercise:
1. Build a machine learning model to solve any real-world problem from your domain.

	TOTAL: 30 + 30 = 60 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to:
CO1: Elaborate the basics and applications of Artificial Intelligence.
CO2: Apply the basics of Python programming to solve problems.
CO3: Use python libraries to solve simple ML problems.
CO4: Outline the different types of Machine Learning algorithms.
CO5: Use Machine Learning Algorithms to solve real world problems.
CO6: Outline the recent developments in the field of Artificial Intelligence.

TEXT BOOKS:
1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016.
2. Jake VanderPlas, "Python Data Science Handbook – Essential tools for working with data", O'Reilly, 2017.
3. Steve Abrams, "Artificial Intelligence and Machine Learning for Beginners: A simple guide to understanding and Applying AI and ML", Independently published, May 14, 2024.

REFERENCES:
1. Vinod Chandra S S, Anand Hareendran S, Artificial Intelligence and Machine Learning, PHI Learning, 2014.
2. Russell, S. and Norvig, P, Artificial Intelligence: A Modern Approach, Third Edition, Prentice Hall, 2010.
3. Ethem Alpaydın, Introduction to Machine Learning, Second Edition, the MIT Press, Cambridge, Massachusetts, London, England.
4. Stephen Marsland, Machine Learning - An Algorithmic Perspective, 2nd Edition, 2015, by Taylor & Francis Group, 2015.

5. Tom M. Mitchell, Machine Learning, McGraw-Hill Science, ISBN: 0070428077
6. Mayuri Mehta, Vasile Palade, Indranath Chatterjee, Explainable AI: Foundations, Methodologies and Applications, Springer, 2023.
7. Siddhartha Bhattacharyya, Indrajit Pan, Ashish Mani, Sourav De, Elizabeth Behrman, Susanta Chakraborti, "Quantum Machine Learning", De Gruyter Frontiers in Computational Intelligence, 2020.
LIST OF EQUIPMENTS:
1. Systems with Anaconda, Jupyter Notebook, Python.

COURSE CODE	TAMILS AND TECHNOLOGY (Theory Course) (Common to All II Semester B.E./B.Tech Programmes)	L	T	P	C
24GE201		1	0	0	1

OBJECTIVES:

The course is designed to

- Recognize the historical significance of weaving and pottery technologies in ancient Tamil civilization.
- Highlight the concepts of design and construction technology during the Sangam age.
- Provide an overview of manufacturing technology and its role in Tamil society.
- Illustrate the agricultural and irrigation techniques employed in ancient Tamil society.
- Promote scientific Tamil and Tamil computing.

UNIT I   WEAVING AND CERAMIC TECHNOLOGY   3

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

UNIT II   DESIGN AND CONSTRUCTION TECHNOLOGY   3

Designing and Structural construction House & Designs in household materials during 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.

UNIT III   MANUFACTURING TECHNOLOGY   3

Art of Ship Building – Metallurigcal 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 evidences – Gem Stone types described in Silappathikaram.

UNIT IV   AGRICULTURE AND IRRIGATION TECHNOLOGY   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.

UNIT V   SCIENTIFIC TAMIL & TAMIL COMPUTING   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.

TOTAL: 15 PERIODS

OUTCOMES:

At the end of the course, the learners will be able to

CO1: Analyze the technological advancements of Tamils in weaving and ceramics.

CO2: Explore the architectural superiority of Tamils through inscriptions and structural designs of temples and palaces.

CO3: Examine the manufacturing culture of Tamils before and during Sangam period through various sources.

CO4: Critically appreciate the agricultural and food processing techniques of Tamils.

CO5: Demonstrate adequate information on the Scientific Tamil and Tamil Computing.

TEXT CUM – REFERENCE –BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் 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.L.L.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 of Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Achaeology & Tamil Nadu text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

24GE201	தமிழரும் தொழில்நுட்பமும்	**L T P C**
		1 0 0 1

அலகு I   நெசவு மற்றும் பானைத் தொழில்நுட்பம்:   3

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

அலகு II   வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்:   3

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

அலகு III   உற்பத்தித் தொழில் நுட்பம்:   3

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.

அலகு IV   வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்:   3

அணை, ஏரி, குளங்கள், மதகு – சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேலாண்மைச் சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு – மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகம்.

அலகு V   அறிவியல் தமிழ் மற்றும் கணித்தமிழ்:   3

அறிவியல் தமிழின் வளர்ச்சி -கணித்தமிழ் வளர்ச்சி-தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.

TOTAL: 15 PERIODS

TEXT –CUM – REFERENCE BOOKS

1. தமிழக வரலாறு – மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் 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.L.L.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 of Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Achaeology & Tamil Nadu text Book and Educational Services Corporation, Tamil Nadu)
    Journey of civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

Course Code	INNOVATION AND CREATIVITY SKILLS AND DEVELOPMENT (Common to all the branches)	L	T	P	C
24HS211		1	0	0	1

OBJECTIVES

The course will enable the learners to:

- Understand study plans, co-curricular activities, programming skills, recruitment test patterns, and hiring strategies through national qualifiers and hackathons.

- Equip students with strategies for higher education, resume enhancement, project management, and securing internships

- understand entrepreneurship fundamentals, including key differences, global hubs, business ideas, and scalability.

- develop essential entrepreneurial skills such as opportunity recognition, patience, risk management, communication, persistence, and leadership

- Understand life, success, self-confidence, health, scientific heritage, personal counseling, and cybercrime awareness

UNIT I   STEPPING STONE – ENGINEERING CAREERS AND SKILL DEVELOPMENT   3

Study Plans and Resources - Identification of key resources and job opportunities - career prospects and academic growth through co-curricular activities - importance of programming/coding skills - Overview of test patterns and essential skills for popular campus recruiters - Comparison of IT Services, Dream, and Super Dream offers and their recruitment processes - National Qualifier Tests and their impact on hiring processes – Overview of Corporate contests and hackathons (e.g., TCS Codevita, HackerRank)

UNIT II   STEPPING STONE – HIGHER EDUCATION AND CAREER DEVELOPMENT   3

Overview of higher education opportunities: GATE, GRE, GMAT, XAT, CAT, MAT - Exam formats, preparation strategies, and timelines - Resume Enhancement Strategies - Project Management - Steps to develop projects from proposal to prototype - Internship Pathways - Strategies for maximizing internship experiences for career advancement

UNIT III   FUNDAMENTALS OF ENTREPRENEURSHIP: FROM IDEAS TO VENTURES   3

Introduction to Entrepreneurship – Intrapreneur vs. entrepreneur - Roles and Contributions - Global Entrepreneurship Hubs - Overview of Key Global Locations - Idea vs. Commercial Value - Transforming Ideas into Viable Business Models - Characteristics of Successful Business Ideas - Understanding Market Competition - Basics of Copyrights and Intellectual Property - Scalability in Business Ventures - Strategies for Scaling a Business

UNIT IV   HUMAN SKILLS FOR ENTREPRENEURSHIP   3

Identifying and capitalizing on business opportunities - Case studies and anecdotes - Patience and

Risk Management - The role of patience in entrepreneurial success and decision-making - Effective Communication - Techniques for clear and persuasive communication - Importance of communication in building and leading teams - Leadership qualities and their impact on entrepreneurial ventures - Analyzing success and failure stories

UNIT V   FOUNDATIONS OF PERSONAL DEVELOPMENT AND WELL-BEING   3

 Understanding Life and Success - Self-Confidence and Fear - Practical strategies for enhancing self-esteem - Adolescent Issues - Health Management - Basics of a balanced diet - Benefits of physical activity - Scientific Heritage of India - Overview of India's scientific achievements and contributions - Cyber Crime Awareness - Types and prevention strategies.

TOTAL: 15 PERIODS

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

CO1: Create study plans, value co-curricular activities, develop programming skills, and navigate for career advancement

CO2: Understand about higher education options, resume enhancement, project management, and securing internships

CO3: Learn entrepreneurship skills and strategies to develop successful business ideas. CO4: Develop key entrepreneurial skills like opportunity recognition, risk management, and leadership through real-world examples

CO5: Explore personal development, health management, scientific heritage, and cybercrime awareness.

COURSE CODE	COURSE TITLE	L	T	P	C
24EC211	**IDEA LAB –II** (Common to all Branches)	0	0	2	1

The students may be grouped into 3 to 4. The device/Machine/system/component are studied by the students and a final presentation to be done by the students about the study of various devices or machinery at the end of the semester.

COURSE OBJECTIVES:

Students completing this course are expected to
- Develop hands-on experience and practical application of theoretical knowledge.
- Access to technology, software, prototyping materials, and other resources necessary for innovation.
- Develop their ability to explain the process involved.

LIST OF EXPERIMENTS

1. Printing of a 3D part.
2. Scanning of a 3D part.
3. Design and fabrication of press fit object using laser cutting machine.
4. Design and fabrication of 3D part using CNC Router.
5. Design and fabrication of simple PCB.
6. Soldering and desoldering of given electronic circuit.

TOTAL: 15 PERIODS

COURSE OUTCOMES:

After successful completion of the course the students will be able to do

CO1: Analyze the latest manufacturing methods in advancements and technologies related to their field.

CO2: Develop technical proficiency and problem-solving abilities, making more competent and confident in their field.

CO3: Develop themselves with the skills needed to address industry-specific problems.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

S. No	Equipment Name	Quantity
1	CNC Router	1 No
2	3D Printer	1 No
3	3D Scanner	1 No
4	Laser cutting Machine	1 No

5	Multimeter	5 Nos
6	Solder Stations	5 Sets
7	Desoldering Machine	1 No
8	PCB Milling Machine	1 No
9	Variable Power Supply	1 No
10	Electronic Components like Resistors, Transistors, Diode, Inductor, Capacitor, etc.	10 Sets

PLAN FOR THE COMING PRODUCT DEVELOPMENT LAB FROM SEM 3 TO 6.

Product Development lab -1 - Literature review

Product Development lab -2 - Prepare the design concepts for an identified literature gap.

Product Development lab -3 - Create a methodology and Implementation of Design Process.

Product Development lab -4 - Develop a prototype

Course Code	Yoga for Stress Management	L	T	P	C
24MC201	(Common to all branches of First Year B.E. / B. Tech)	0	0	1	0

OBJECTIVES:

The course will enable the learners to:

- Understanding the different types of stress and managing stress.
- Develop an understanding of practicing yoga
- Learning to do asanas, including sitting, standing and lying postures

Unit I: Stress Management   **3**

Definition of Stress - Stress in Daily Life - Impact of Stress on Life - Identifying the Causes of Stress - Symptoms of Stress - Managing Stress (Habits, Tools, Training, Professional Help) - Complications of Stress Mismanagement - The Importance of Sleep for Mental Wellness - Connection Between Sleep and Digestion.

Unit II: Introduction to Yoga   **3**

Meaning and Definition of Yoga - Aims and Objectives of Yoga - Guidelines for Practicing Asanas - Benefits of Yoga

Unit III: Different Asanas   **3**

Methods of Performing Asanas - Pranayama - Suryanamaskar Asanas - Sitting Postures: Uttanpadasana, Paschimottanasana ,Janu Sirsasana , Baddha Konasana - Shishupal Asana - Vajrasana

Unit IV: Standing Postures   **3**

Uttanasana -Trikonasana -Vrikshasana -Tadasana - Superbrain asana

Unit 5: Lying Postures   **3**

Pavana Muktasana - Pada Sanchalanasana – Jhulana Lurhakanasana -Dhanurasana – Marjaryasana. BitilasanaDictionaries – Sorkuvai Project.

TOTAL: 15 PERIODS

COURSE OUTCOMES:

Upon completion of the course, the students will be able to:

   CO1: relieve stress and achieve mental wellness.

   CO2: experience the benefits of yoga

   CO3: keep self and body healthy

REFERENCE BOOK:

1. Iyengar, Bellur Krishnamukar Sundara. "Light on yoga." (1965).

2. Desikachar, Tirumalai Krishnamacharya Venkata. The heart of yoga: Developing a personal practice. Simon and Schuster, 1999.

3. Davis, Martha, Elizabeth Robbins Eshelman, and Matthew McKay. The relaxation and stress reduction workbook. New Harbinger Publications, 2008.

4. Krishnamacharya, Tirumalai, et al. "Yoga makaranda: The nectar of yoga." Swathi Soft (2013).

COURSE CODE	COURSE TITLE	L	T	P	C
24EV301	**DIGITAL ELECTRONICS (Lab Integrated)**	2	0	2	3

COURSE OBJECTIVES:

- To acquire the knowledge in basic number systems, Boolean algebra, and simplification techniques used in digital circuits
- To understand how to design and implement basic combinational logic circuits using logic gates.
- To study different types of flip-flops and how they are used in sequential circuit design.
- To design and analyze counters, shift registers, and sequence detectors.
- To introduce various digital IC families and their characteristics, especially CMOS logic.
- To apply knowledge of programmable devices like PLA and PAL to implement logic functions.

UNIT I	**INTRODUCTION TO DIGITAL ELECTRONICS**	6+6

Introduction to Digital Systems and Switching Circuits, Number Systems: Decimal, binary, octal, hexadecimal number system and conversion, binary weighted codes, signed numbers, 1s and 2s complement codes, Binary arithmetic. Boolean Algebra: Boolean laws, truth tables, Basic Theorems and laws, Realization of switching functions using logic gates. SOP & POS simplification, Canonical forms, Introduction to Logic Gates and its operations.

Experiments:
1. Verification of logic gates
2. Implementation of Boolean expression using logic gates

UNIT II	**MINIMIZATION OF SWITCHING FUNCTIONS**	6+6

Simplification using Boolean algebra, Karnaugh map method: two, three, four and five variable Karnaugh maps, simplification of expressions; Quine-McCluskey Tabular Minimization Method

Logic function realization: AND-OR, OR-AND and NAND/NOR realizations. Problem formulation and basic design of combinational circuits with multiple output functions: Code converters - Binary to Gray, BCD to excess3, vice versa, BCD to Seven Segment display, Parity Generator.

Experiments:
3. Design and implementation of Code Converters
4. Implementation of Boolean expression using universal logic gates.

UNIT III	**COMBINATIONAL LOGIC DESIGN**	6+6

Binary Adders – Half & Full adder, Half &Full Subtractor, Binary Parallel adder - Carry look ahead Adder, Decoders, Encoders, Priority Encoders, Multiplexers, Demultiplexers, Magnitude Comparator, Implementations of Logic Functions using Decoders and Multiplexers.

Experiments:

5. Design of adders and Subtractors

6. Design and implementation of logic functions using Decoder and Multiplexers

UNIT IV	SEQUENTIAL LOGIC DESIGN	6+9

Introduction to glitches and hazards, Latches, Flipflops, Types of flipflops like S-R, D, JK, T, Master Slave JK Flip Flop, Flip flop conversions, Setup and Hold times

Synchronous and Asynchronous Sequential Circuits: State transition diagrams, state tables, state assignments, realization with different types of Flipflops. Counters –Mod n, Shift registers – SISO, PIPO, SIPO, PISO

Finite State Machine- Moore and Mealy models, Implementation of sequence detector 3bits. Introduction to reset (synchronous and asynchronous).

Experiments:

7. Design and implementation of 3-bit ripple counters.

8. Design and implementation of 3-bit synchronous counter

9. Design and implementation of shift registers (SIPO, PISO).

UNIT V	LOGIC FAMILIES AND INTRODUCTION TO MEMORIES and PLDs	6+3

Logic Families: Digital IC characteristics; Propagation Delay, Fan-in, Fan-out, Noise margin; Overview of logic families, Realising basic gates using CMOS Logic family

Memory and PLD: Basic memory structure ROM: PROM - EPROM - EEPROM -RAM - Static and dynamic RAM - Programmable Logic Devices: Programmable Logic Array (PLA) – Programmable Array Logic (PAL) - Implementation of combinational logic circuits using PLA, PAL.

Experiments:

10. Design a CMOS Inverter using Simulation

TOTAL: 30 Theory + 30 Lab = 60 PERIODS

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

CO1: Apply number systems, binary arithmetic, and Boolean algebra to analyze and simplify logic expressions for digital circuit design.

CO2: Minimize switching functions using Boolean algebra, Karnaugh maps, and Quine-McCluskey methods, and realize logic functions using basic gate structures.

CO3: Design and implement combinational logic circuits using standard and universal logic

gates, including adders, subtractors, encoders, decoders, and multiplexers.

CO4: Analyze and model sequential logic systems including flip-flops, counters, shift registers, and sequence detectors using synchronous and asynchronous designs.

CO5: Explore the characteristics and performance parameters of logic families and memory devices including ROM, RAM, and programmable logic devices.

CO6: Implement combinational logic circuits using programmable logic devices (PLDs) and effectively document and present the design using modern tools.

TEXT BOOKS:

1. M. Morris Mano and Michael D. Ciletti, Digital Design, With an introduction to the Verilog HDL, VHDL, and System Verilog, 6th Edition, Pearson, 2018.
2. S.Salivahanan and S.Arivazhagan, Digital Circuits and Design, 5th Edition, Oxford University Press, 2018.

REFERENCES:

1. A.Anandkumar, Fundamental of digital circuits, 4 th Edition, PHI Publication,2016.
2. William Kleitz, Digital Electronics-A Practical approach to VHDL, Prentice Hall International Inc, 2012.
3. Charles H.Roth, Jr. and Larry L. Kinney, Fundamentals of Logic Design, 7th Edition, Thomson Learning, 2014.
4. Thomas L. Floyd, Digital Fundamentals, 11th Edition, Pearson Education Inc, 2017.
5. John.M Yarbrough, Digital Logic: Applications and Design, 1st Edition, Cengage India, 2006.

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CADENCE BADGE EXAM

Digital Design and signoff learning map: Course - **Semiconductor 101**

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

IC Trainer Kit   -15 Nos
ICs each   -30 Nos
(7400 (NAND)/ 7402(NOR)/ 7404 (NOT)/ 7486 (EX-OR) / 7408(AND) / 7432 (OR)/ 7483(Binary Adder) / 7473 (JK Flip Flop) / 7411(3-Input AND)/ 7474 (D Flip Flop))

COURSE CODE	COURSE TITLE	L	T	P	C
24EV302	SIGNALS AND SYSTEMS	3	0	0	3

COURSE OBJECTIVES:

- To understand the basic types of continuous and discrete time signals and systems.
- To learn mathematical tools like Fourier, Laplace, and Z transforms used in analyzing signals.
- To analyze the behavior of continuous-time systems using differential equations and transforms.
- To explore the analysis of discrete-time signals using DTFT and Z-transforms.
- To use convolution techniques to determine system responses in both continuous and discrete domains.

UNIT I	CLASSIFICATION OF SIGNALS AND SYSTEMS	9

Signals: Continuous time signals (CT signals) - Discrete time signals (DT signals) - Step, Ramp, Pulse, Impulse, Sinusoidal, Exponential, Operations on Signals, Classification of CT and DT signals - Periodic & Aperiodic signals, Deterministic & Random signals, Even & Odd, Causal & Non-Causal, Energy & Power signals

Systems: Continuous time systems and Discrete time systems - Classification of CT systems and DT systems – Static & Dynamic, Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable.

UNIT II	ANALYSIS OF CONTINUOUS TIME SIGNALS	9

Analysis: Fourier series -Spectrum of Continuous Time (CT) signals- Fourier and Laplace transforms - Properties.

UNIT III	LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS	9

Differential Equations – Block Diagram Representation - Impulse response, Convolution integrals, Fourier and Laplace transforms analysis of Continuous Time systems.

UNIT IV	ANALYSIS OF DISCRETE TIME SIGNALS	9

Discrete Time Fourier Transform (DTFT) – Properties of DTFT - Z transform – Properties of Z transform.		
UNIT V	**LINEAR TIME INVARIANT DISCRETE TIME SYSTEMS**	**9**

Difference Equations-Block diagram representation -Impulse response - Convolution sum-Discrete Fourier transform and Z transform analysis of Discrete Time systems

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

CO1: Classify different types of continuous-time and discrete-time signals and systems based on their properties and behaviors.

CO2: Apply Fourier series, Fourier transform, and Laplace transform to analyze and interpret the frequency-domain characteristics of continuous-time signals.

CO3: Analyze continuous-time linear time-invariant (LTI) systems using convolution integrals, differential equations, and system transforms.

CO4: Compute the frequency-domain representations of discrete-time signals using DTFT and Z-transform, and explore their properties.

CO5: Model and analyze discrete-time LTI systems using difference equations, convolution sums, and Z-transform techniques.

CO6: Construct and interpret block diagram representations and system responses of both CT and DT systems to determine stability, causality, and linearity.

TEXT BOOKS:

1. Allan Oppenheim, S.Wilsky and S.H.Nawab, Signals and Systems, 2nd Edition, Pearson, 2015.

2. Simon Haykin and Barry Van Veen, Signals & Systems, 2nd Edition, Wiley, 2018.

REFERENCES:

1. B. P. Lathi, Principles of Linear Systems and Signals, 3rd Edition, Oxford, 2017.

2. M.J.Roberts, Signals & Systems Analysis using Transform Methods & MATLAB, 3rd Edition, Tata McGraw Hill, 2019.

3. R.E.Zeimer, W.H.Tranter and R.D.Fannin, Signals & Systems - Continuous and Discrete, 4th Edition, Pearson, 2014.

4. Nagoor Kani, Signals and Systems, 1st Edition, McGraw Hill, 2018.

5. Anand Kumar, Signals and Systems, 3rd Edition, PHI Learning Private Limited, 2013.

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https://nptel.ac.in/courses/108104100

CADENCE BADGE EXAM

PCB Design and Analysis Learning Map: Course - **Analog Simulation with Pspice®**

COURSE CODE	COURSE TITLE	L	T	P	C
24EV401	**RTL DESIGN AND SYNTHESIS USING VERILOG HDL (Lab Integrated)**	3	0	2	4

COURSE OBJECTIVES:

- To introduce the concepts of Hardware Description Languages (HDLs) and familiarize students with Verilog HDL syntax and programming structure.
- To expose students to different levels of digital circuit abstraction, including Gate-Level, Dataflow, and Behavioral modeling in Verilog.
- To enable students to design and implement fundamental combinational and sequential circuits using Verilog HDL.
- To develop skills for writing efficient Verilog codes for various digital building blocks like adders, multiplexers, encoders, counters, and registers.
- To impart knowledge on creating effective testbenches for verifying the functionality of combinational and sequential circuits.
- To prepare students for simulation, debugging, and analysis of digital designs, bridging the gap between digital system theory and practical FPGA/ASIC implementation.

UNIT I	INTRODUCTION TO VERILOG HDL	9+6

Introduction to HDL: Evolution of CAD, Importance of HDLs, Design Flow, Design Methodologies – Top Down and Bottom Up Approach;

Introduction to Verilog: Module, Instances, components of Simulation, Design and Stimulus blocks. Language Constructs and Conventions (Keywords, Identifiers, White Space Characters, Comments, Numbers, Strings, Logic Values, Strengths, Data Types, Scalars and Vectors, Parameters, Memory, Operators, System Tasks); Modules and Ports: Module definition, port declaration, connecting ports, hierarchical name referencing.

Experiments**:**

1. Introduction to Verilog simulation environment (Vivado /ModelSim)

2. Basic structure of a Verilog program: Simple AND, OR, NOT gates

UNIT II	GATE-LEVEL AND DATA FLOW MODELING	9+6

Gate Level Modeling: Introduction, Gate Primitives, Gate Types, Buffer gates, Array instances, Gate delays, Rise, Fall and Turnoff delays. Digital logic circuits Examples with Gate Level modelling along with test bench and design verification.

Data Flow Modeling: Introduction, Continuous Assignment Structures, Delays and Continuous Assignments, Assignment to Vectors, Operators. Digital logic circuits examples with Data Flow modelling along with test bench and design verification

Experiments:

3. Gate-level modeling of Half Adder, Full Adder

4. Dataflow model for 8:1 MUX, 3:8 Decoder

UNIT III	BEHAVIORAL MODELING	9+6

Procedural Assignments, Initial and always constructs, Blocking and non-blocking statements, Delay control, Conditional statements, Multiway branching, Loops, Sequential and parallel blocks, Design of Decoders, Multiplexers, Flip-flops, Registers, and Counters in behavioural modelling along with test bench and design verification.

Experiments:

5. Behaviour modeling of priority encoder

6. Behavioral modeling of 3-bit synchronous counter

UNIT IV	LOGIC SYNTHESIS AND DESIGN CONSIDERATIONS SYSTEM DESIGN VERILOG	9+6

Overview of PLDs - CPLD, and FPGA, FPGA Architectures and Interconnects – Xilinx Artix 7 Architecture

Logic Synthesis Concepts: Role of Logic Synthesizer in Digital Design Flow, Synthesisable vs Non-synthesisable constructs, Combinational and Sequential Logic Synthesis of Verilog code.

Design Metrics and Timing Analysis (Definitions): Setup Time, Hold Time, Clock Skew, Clock Latency, Slack (Positive and Negative Slack); Area, Speed, and Power Trade-offs in Digital Design. Pipelining with FFs, Concept of throughput and latency, Concept of retiming, Constraints definition.

Experiments:

7. Compare the performance of carry look ahead adder with serial adder

8. Design and verify the functionality of sequence detector (overlapping)

UNIT V	SYSTEM DESIGN VERILOG	9+6

Combinational Circuit Design- ALU Design – Sequential circuit design – Finite State Machine, Memory design - Case Study: UART interface

Experiments:

9. Design and verify a 4-bit ALU supporting ADD, SUB, AND, OR operations with flags

10. Design and verify 16X4 memory module

TOTAL: 45 Theory + 30 Lab = 75 PERIODS

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

CO1: Understand the evolution and significance of Hardware Description Languages (HDLs) and the structure of Verilog programs.

CO2: Model and simulate basic digital logic gates and circuits using gate-level and dataflow modeling techniques in Verilog.

CO3: Develop behavioral models for sequential and combinational circuits using procedural constructs in Verilog.

CO4: Analyze logic synthesis processes and evaluate design trade-offs (area, delay, power) in FPGA/CPLD-based digital system implementations.

CO5: Design and verify complex digital systems such as ALUs, counters, memory units, and FSMs using Verilog for practical applications.

CO6: Use industry-standard simulation tools (Vivado / ModelSim) to perform functional verification and validate HDL-based digital designs.

TEXT BOOKS:

1. Samir Palnitkar-Verilog HDL: A Guide to Digital Design and Synthesis, Pearson Education, 2nd Ed., 2009.

2. Vaibbhav Taraate, Digital Logic Design Using Verilog Coding and RTL Synthesis, Springer India 2016.

REFERENCES:

1. Michel D. Ciletti- Advanced Digital Design with Verilog HDL,2nd Ed., PHI, 2009

2. Padmanabhan, Tripura Sundari -Design through Verilog HDL, Wiley, 2016

3. S.Brown, Zvonko – Vranesic, Fundamentals of Digital Logic with Verilog Design, TMH, 3rd Ed., 2014.

4. P. Uyemura, Introduction to VLSI Circuits and Systems, John Wiley, 2009

5. Neil H. E. Weste and David Money Harris, CMOS VLSI Design - A Circuits and Systems Perspective, 4th Edition, Pearson, 2010

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CADENCE BADGE EXAM

System design and verification learning Map: Course - **Verilog Language and Application**

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Standalone Desktop with Vivado Software -30 Nos
Basys 3 AMD Artix™ 7 FPGA Trainer Board- 20 Nos

COURSE CODE	COURSE TITLE	L	T	P	C
24EV402	**ANALOG CIRCUITS –I (Lab Integrated)**	2	0	2	3

COURSE OBJECTIVES:

- To understand the working principles of rectifiers, power supply filters, and voltage regulators.
- To learn different methods of biasing BJT and MOSFET to ensure stable amplifier operation.
- To analyze and design single-stage and multi-stage BJT amplifiers using small signal models.
- To explore various MOSFET amplifier configurations and perform small-signal analysis.
- To study the frequency response characteristics of both BJT and MOSFET amplifiers.
- To gain hands-on experience in designing and simulating analog circuits using electronic tools.

UNIT I	RECTIFIERS AND POWER SUPPLY CIRCUITS	6+6

Rectifier: Half-wave and full-wave rectifiers - Bridge rectifiers - Calculation of Ripple factor, rectification efficiency, Transformer utilization factor and regulation

Power Supply: Filters - L, C, L-Section and Pi - Voltage Regulators - Series and Shunt type.

Experiment:
1. Full-wave rectifier and Bridge Rectifier
2. Voltage Regulator

UNIT II	BIASING OF DISCRETE BJT AND MOSFET	6

DC Load line, operating point, Various biasing methods for BJT – Design – Stability – Bias compensation, Thermal stability, DC bias analysis of MOSFET circuits.

UNIT III	DISCRETE BJT AMPLIFIERS	6+6

Small signal Analysis of Common Emitter – AC Load line, Voltage swing limitations, Common Collector and Common Base amplifiers – Differential amplifiers – CMRR – Darlington Amplifier – Multi-stage amplifiers – Cascode Amplifier.

Experiments:
3. Darlington Amplifier

4. BJT Cascode amplifier		

UNIT IV	DISCRETE MOSFET AMPLIFIERS	6+9

Small signal Analysis of amplifiers – Common Source amplifier, Voltage swing limitations, Small signal Analysis of Source Follower and Common Gate amplifiers, Cascode amplifiers, Differential amplifiers.

Experiments:
5. Differential Amplifier
6. MOSFET Cascode amplifier
7. MOSFET Cascode amplifier (Simulation)

UNIT V	FREQUENCY RESPONSE OF BJT AND MOSFET	6+9

Frequency response of BJT – Transistor amplifier with circuit capacitors, short circuit current gain, Miller effect and Miller capacitance, High-frequency analysis of CE amplifier. Frequency response of MOSFET – High-frequency MOSFET model, Unit gain bandwidth, Miller effect and Miller capacitance, High-frequency analysis of MOSFET CS amplifier.

Experiments:
8. Frequency response of CE amplifier
9. Frequency response of CS amplifier
10. Frequency response of CS amplifier (Simulation)

TOTAL: 30 Theory + 30 Lab = 60 PERIODS

COURSE OUTCOMES:

On successful completion of this course, the student will be able to:

CO1: Understand and analyze rectifier and power supply circuits.

CO2: Analyze the DC biasing and stability of BJT and MOSFET circuits.

CO3: Perform small-signal analysis and design of discrete BJT amplifier circuits.

CO4: Perform small-signal analysis and design of discrete MOSFET amplifier circuits.

CO5: Analyze the frequency response of BJT and MOSFET amplifiers.

CO6: Design and simulate practical analog circuits using BJT and MOSFET.

TEXT BOOKS:

1. Donald A. Neamen, Electronic Circuits Analysis and Design, 3rd Edition, McGraw Hill Education (India) Private Ltd., 2010.
2. Adel. S. Sedra, Kenneth. C. Smith, "Micro Electronic Circuits: Theory and Applications",7th Edition, Oxford University Press,2017.

3. Robert L. Boylestad and Louis Nasheresky, Electronic Devices and Circuit Theory, 11th Edition, Pearson Education, 2015.

REFERENCES:

1. Behzad Razavi, "Design of Analog CMOS Integrated Circuits", Tata McGraw Hill,2017.
2. Paul Gray, Hurst, Lewis, Meyer, "Analysis and Design of Analog Integrated Circuits", John Willey & Sons, 5th Edition,2009.
3. Sedra and Smith, Micro Electronic Circuits, 7th Edition, Oxford University Press, 2015.
4. Millman.J, Halkias C.C and Chetan Parikh "Integrated Electronics-", 2nd Edition, McGraw Hill,2017.
5. Jacob Millman and Arvin Grabel, Micro Electronics, 2nd Edition, McGraw Hill Education (India) Pvt Limited, 2017.
6. Floyd, Electronic Devices, 9th Edition, Pearson Education, 2012.

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https://nptel.ac.in/courses/108102112

CADENCE BADGE EXAM

Custom IC/Analog Physical Design and Verification Learning Map: Course - **Cadence Analog IC Design Flow**

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

Requirements for a batch of 30 students

Sl. No.	Equipment	Quantity
1	CRO/DSO (Min 30MHz)	15
2	Signal Generator/Function Generators (3 MHz)	15
3	Dual Regulated Power Supplies (0-30V)	15
4	Digital Multimeter	15
5	Components and Accessories	30

Components and Accessories:

Transistors, Resistors, Capacitors, Diodes, Bread Boards and wires.

Simulation Tool: PSpice / Open Source

COURSE CODE	COURSE TITLE	L	T	P	C
24EV403	**DIGITAL CIRCUIT DESIGN WITH CMOS**	3	0	0	3

COURSE OBJECTIVES:

- Understand how MOS transistors work and how they are used in digital circuits.
- Learn how CMOS technology is used to make chips, including layout and design rules.
- Analyze and design CMOS inverters and understand how delays and power affect the performance.
- Explore various logic circuit styles like static, dynamic, and pass-transistor logic.
- Design and analyze sequential circuits like flip-flops and latches using CMOS.
- Learn about timing issues in digital systems such as clock skew and time borrowing.

UNIT I	MOS TRANSISTOR THEORY	9

+

MOS Transistors – Enhancement Mode Transistor Action – Output and transfer Characteristics – Threshold Voltage and Body Effect – Surface Conditions and Inversion (Weak, Moderate, Strong) – MOS Capacitance Models: Gate Capacitance, Diffusion Capacitance.

Second-Order Effects: Carrier Velocity Saturation – Channel Length Modulation – Drain-Induced Barrier Lowering (DIBL) – Punch through – Hot Carrier Effects and Impact Ionization – Junction Leakage.

UNIT II	CMOS TECHNOLOGY, LAYOUT, AND DESIGN RULES	9

CMOS Technologies: Fabrication steps, P-Well Process, N-Well Process, Twin-Tub Process – Latch-Up and Prevention Methods.

Layout: Stick Diagrams and Layout Diagrams – Design Rules: Lambda-Based and Micron-Based Design Rules – Overview of Design Rule Check (DRC) Concepts – Overview of CMOS Process Enhancements: Scaling – Metal Gate – SOI – Introduction to FinFET.

UNIT III	CMOS INVERTER DESIGN	9

Invertor Design: NMOS and CMOS Inverters – DC and Transient Characteristics – Inverter Ratio (PMOS/NMOS Sizing and Aspect Ratio) – Design Considerations and Noise Margins – Rise Time, Fall Time, and Propagation Delay – Switching Time Calculation

Delay Models: RC Delay, Elmore Delay – Delay Estimation: Logical Effort – Transistor Sizing for Delay Minimization – Power Dissipation and Interconnect.	

UNIT IV	**LOGIC CIRCUIT DESIGN**	**9**

CMOS Logic Structures: CMOS Logic (NAND, NOR, XOR Gates) – Pseudo-NMOS Logic, Domino Logic– Pass-Transistor Logic – Transmission Gates

CMOS Design: Static CMOS - Pull-up and Pull-down Network; Dynamic CMOS- Precharge and Evaluation Phases.

UNIT V	**SEQUENTIAL CIRCUIT DESIGN**	**9**

Latches and Flip-Flops Using pass transistors &Transmission Gates –Setup and Hold Violations – Incorrect Clocking Assumptions – Delay Constraints – Clock Skew and Timing: Clock Distribution Basics. Pipelining with FFs and Latches, Time borrowing.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

CO1: Understand the operation of MOS transistors, including threshold voltage, body effect, inversion conditions, and capacitance models.

CO2: Explain and compare CMOS fabrication processes and apply layout design rules and latch-up prevention techniques.

CO3: Analyze and Design CMOS inverters considering DC/Transient characteristics, delay models, noise margins, and power dissipation.

CO4: Design combinational logic circuits using CMOS logic styles including static, dynamic, pass-transistor, and transmission gate logic.

CO5: Design and evaluate sequential circuits using CMOS logic, addressing timing constraints, setup/hold times, pipelining, and clocking issues.

CO6: Use EDA tools to simulate and verify CMOS circuits and timing behavior.

TEXT BOOKS:

1. Neil H.E. Weste and David Harris, CMOS VLSI Design: A Circuits and Systems Perspective, 4th/5th Edition, Pearson.
2. Jan M. Rabaey, Anantha Chandrakasan, and Borivoje Nikolic, Digital Integrated Circuits: A Design Perspective, 2nd Edition, Pearson.

3. Sung-Mokang, Yusufleblebici, ChulwooKim — CMOS Digital Integrated Circuits: Analysis & Design, 4th Edition Mc Graw Hill Education, 2013.

REFERENCES:

1. Wayne Wolf, Modern VLSI Design: Systems on Silicon, 4th Edition, Pearson.
2. Neil Weste and Kamran Eshraghian, Principles of CMOS VLSI Design: A Systems Perspective, 2nd Edition.
3. M.J.Smith, Application Specific Integrated Circuits, Addisson Wesley, 1997.
4. Wayne Wolf, Modern VLSI Design: System On Chip, Pearson Education, 2007

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CADENCE BADGE EXAM

System Design and Verification learning map: Course – **Digital IC Design Fundamentals**

COURSE CODE	COURSE TITLE	L	T	P	C
24EV404	CONTROL SYSTEMS ENGINEERING	3	0	0	3

COURSE OBJECTIVES:

- To introduce the components and structure of control systems with practical examples.
- To develop understanding of time domain analysis for first and second-order systems.
- To analyze system behavior in frequency domain using various plotting techniques.
- To study and apply methods for determining system stability.
- To explore state-space modeling and analyze controllability and observability.
- To introduce digital control systems and design controllers using state feedback.

UNIT I	COMPONENTS OF THE CONTROL SYSTEM	8

Terminology and Basic Structure-Feed forward and Feedback control theory, Mechanical Transfer Function Models-Block Diagram Models-Signal flow graphs models

UNIT II	TIME RESPONSE WITH SYSTEM DESIGN	8

Transient Response-Steady State Response-Measures of performance of the standard first order and second order system-effect on an additional zero and an additional pole-steady error constant and system- type number- Overview of PID control systems.

UNIT III	FREQUENCY RESPONSE WITH SYSTEM ANALYSIS	12

Closed loop frequency Response-Performance specification in frequency domain- Frequency response of standard second order system- Bode Plot – Polar plot, Design of compensators using Bode plots- lead compensator, lag compensator, lag-lead compensator

UNIT IV	STABILITY ANALYSIS	9

Concept of stability-Bounded - Input Bounded - Output stability-Routh stability criterion-Relative stability-Root locus concept-Guidelines for sketching root locus- Nyquist stability criterion.

UNIT V	CONTROL SYSTEM ANALYSIS	9

State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability-Stability of linear systems- Equivalence between transfer function and state variable representations-State variable analysis of digital control system-Digital control design using state feedback.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On successful completion of this course, the student will be able to

CO1: Understand the components and structure of control systems, including basic terminologies, feedforward and feedback systems, and modelling techniques using block diagrams and signal flow graphs.

CO2: Analyze time-domain responses of first- and second-order systems, and evaluate performance measures, steady-state errors, and the impact of poles and zeros in system behavior, including the basics of PID control.

CO3: Analyse the frequency response characteristics for both open loop and closed loop system

CO4: Evaluate and design frequency response-based control systems using Bode plots, Polar plots, and compensator design techniques such as lead, lag, and lag-lead compensators.

CO5: Assess system stability using techniques like Routh-Hurwitz, Root Locus, and Nyquist criteria and apply these for controller tuning and feedback analysis.

CO6: Model and analyze systems using state-space techniques, including transfer function conversions, solving state equations, and understanding controllability, observability, and digital control system design using state feedback.

TEXT BOOKS:

1. M.Gopal,"Control System – Principles and Design", Tata McGraw Hill, 4th Edition, 2012.
2. J.Nagrath and M.Gopal, "Control System Engineering", New Age International Publishers, 7th Edition, 2021.

REFERENCES:

1. K.Ogata, "Modern Control Engineering", PHI, 5th Edition, 2012.
2. S.K.Bhattacharya, "Control System Engineering", Pearson, 3rd Edition, 2013.
3. Benjamin.C.Kuo, "Automatic Control Systems", Prentice Hall of India, 10th Edition, 2017.

4. Houpis C H and Sheldon S N ,Linear Control System Analysis and Design with MATLAB Fifth Edition, CRC Press Taylor and Francis, 2014.
NPTEL LINK
https://onlinecourses.nptel.ac.in/noc20_ee90/preview

24CS302	ADVANCED JAVA PROGRAMMING (Lab Integrated) (Common to All Branches)	L	T	P	C
		3	0	3	4.5

OBJECTIVES:

The Course will enable learners to:

- Gain a comprehensive understanding of the Java Collections Framework and its various interfaces and implementations.
- Learn the details of Java I/O streams and utility classes for managing dates, numbers, and currencies.
- Develop a thorough understanding of the Stream API introduced in Java 8 and its various operations.
- Explore advanced object serialization and string tokenizing techniques, including pattern matching with regular expressions.
- Understand advanced Stream API features and gain proficiency in using regular expressions for text processing.

UNIT I	COLLECTIONS FRAMEWORK AND UTILITY CLASSES	9+9

Introduction to Collections Framework - Collection Interface- Methods in Collection Interface - Iterable and Iterator Interfaces - List Interface- ArrayList - LinkedList - Set Interface - HashSet-LinkedHashSet - TreeSet - Map Interface - HashMap -LinkedHashMap- TreeMap - Queue Interface -PriorityQueue - Deque Interface - Utility Classes.

List of Experiments

1. Write a program that measures the time taken for insertion, deletion, and search

operations on ArrayList, LinkedList, HashSet, and TreeSet for varying sizes of input

data.

2. Implement a custom data structure that combines features of a list and a set.

3. Write a Java program to create a HashMap where the keys are strings, and the values

are integers Add five key-value pairs to the map. Print all the keys and values in the

map. Remove an entry by key. Update the value associated with a specific key. Check

if the map contains a specific key and a specific value.

UNIT II	DATE HANDLING AND SERIALIZATION	9+9

Date – Calendar – Comparable interface – Observer Interface — Serialization – Dates - Numbers, and Currency - Working with Dates - Numbers and Currencies - Object Serialization - Serializable Interface - Writing and Reading Serializable Objects -Transient Keyword-SerialVersionUID.

List of Experiments

1. Create a class representing a complex object with nested data structures. Serialize the object to a file, then deserialize it back and verify that the object remains intact.

2. Write a program that formats dates and currencies according to different locales.

3. Create a class hierarchy representing different types of objects (e.g., Person,

Employee). Serialize instances of these classes to a file using object serialization.

UNIT III	STREAM API AND FUNCTIONAL PROGRAMMING PARADIGMS	9+9

Overview of Stream API - Importance of Stream API in Java 8 and Beyond – Functional

Programming Concepts - Creating Streams - Stream Interface Methods - Stream Operations - Intermediate Filtering (filter)-Mapping (map, flatMap)-Sorting (sorted)-Distinct (distinct) - Limit and Skip (limit, skip) - Terminal Operations -Collecting Results (collect) - Reducing and Summarizing (reduce, summaryStatistics)-Iterating (forEach) - Matching and Finding (anyMatch, allMatch, noneMatch, findFirst, findAny) -Counting (count).

List of Experiments

1. Write a program that performs stream operations like filtering, mapping, and reducing.

2. Create an infinite stream generator that generates prime numbers. Implement methods to check for primality and generate the next prime number.

3. Write a program that reads a text file containing sentences. Tokenize each sentence into words, filter out stopwords, and print the remaining words.

UNIT IV	ADVANCED STRING PROCESSING AND I/O TECHNIQUES	9+9

String Tokenizer – Parsing - Tokenizing and Formatting - Locating Data via Pattern Matching, Tokenizing - Streams - Types of Streams - The Byte-stream I/O hierarchy - Character Stream Hierarchy – Random Access File class – the java.io. Console Class - Advanced I/O - Piped Streams (PipedInputStream and PipedOutputStream) – SequenceInputStream - PushbackInputStream and PushbackReader.

List of Experiments

1. Write a program that reads a text file and tokenizes it into sentences using the

StringTokenizer class.

2. Implement a java program that allows users to open a text file, navigate through it using random access, insert, delete, and modify text at specific positions within the file.

3. Implement a program that uses advanced I/O techniques like PipedInputStream,

PipedOutputStream, SequenceInputStream, and PushbackInputStream.

UNIT V	ADVANCED STREAM FEATURES AND REGULAR EXPRESSIONS	9+9

Importance and Use Cases of Advanced Stream Features - Creating Custom Streams -Stream Generators (Stream.generate, Stream.iterate) - Infinite Streams - Using Spliterators – Advanced Stream Operations - FlatMapping - Chaining Stream Operations - Stream Peeking (peek) - Advanced Filtering Techniques - Introduction to Regular Expressions - Character Classes - Quantifiers - Pattern Matching - Groups and Capturing - Regex in Java -

java.util.regex Package Pattern Class - Matcher Class - String Manipulation with Regex - Splitting Strings - Replacing Text (replaceAll, replaceFirst) - Replacing with Backreferences.

List of Experiments

1. Implement custom stream generators using Stream.generate and Stream.iterate

methods.

2. Write a program that demonstrates advanced stream operations like flatMapping,

chaining stream operations, and peeking.

3. Develop a program that utilizes regular expressions to perform string manipulation

tasks such as splitting strings, replacing text, and extracting specific patterns.

	TOTAL: 45+45 = 90 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Implement various data structures by utilizing core Java features and libraries

CO2: Demonstrate proficiency in handling Java I/O operations, including file manipulation for efficient data storage and retrieval.

CO3: Apply and Analyze the Stream API for functional programming and data processing.

CO4: Implement advanced object serialization for complex data structures.

CO5: Utilize regular expressions for text parsing and string manipulation.

CO6: Build applications using advanced Java programming techniques.

TEXT BOOK:

1. Cay S. Horstmann, "Core Java Volume I--Fundamentals," 12th Edition, 2019.
2. Joshua Bloch, "Effective Java," 3rd Edition, 2018.
3. Raoul-Gabriel Urma, "Java 8 in Action: Lambdas, Streams, and Functional-Style Programming," 1st Edition, 2014.
4. Herbert Schildt, "Java: The Complete Reference," 11th Edition, 2018.
5. Alan Mycroft and Martin Odersky, "Programming in Scala," 4th Edition, 2020.

REFERENCES:

1. Bruce Eckel, "Thinking in Java," 4th Edition, 2006.
2. Herbert Schildt, "Java: A Beginner's Guide," 8th Edition, 2019.
3. Richard Warburton, "Java 8 Lambdas: Pragmatic Functional Programming," 1st Edition, 2014.

LIST OF EQUIPMENTS:
JDK/Eclipse

24CS303	DATABASE MANAGEMENT SYSTEMS (Lab Integrated)	L	T	P	C
		3	0	3	4.5

COURSE OBJECTIVES:

The Course will enable the learners:

- To understand the basic concepts of Data Modeling and Database Systems.

- To understand SQL and effective relational database design concepts.

- To learn relational algebra, calculus and normalization.

- To know the fundamental concepts of transaction processing, concurrency control techniques, recovery procedure and data storage techniques.

- To understand query processing, efficient data querying and advanced databases.

UNIT I	DATABASE CONCEPTS	9+9

Concept of Database and Overview of DBMS - Characteristics of databases -Data Models, Schemas and Instances - Three-Schema Architecture - Database Languages and Interfaces-Introductions to data models types- ER Model- ER Diagrams - Enhanced ER Model - reducing ER to table Applications: ER model of University Database Application – Relational Database Design by ER- and EER-to-Relational Mapping.

List of Exercise/Experiments

Case Study using real life database applications anyone from the following list

     a)   Inventory Management for a EMart Grocery Shop

     b)   Society Financial Management

     c)   Cop Friendly App – Eseva

     d)   Property Management – eMall

     e)   Star Small and Medium Banking and Finance

- Build Entity Model diagram. The diagram should align with the business and functional goals stated in the application.

UNIT II	STRUCTURED QUERY LANGUAGE	9+9

SQL Data Definition and Data Types – Constraints – Queries – INSERT, UPDATE, and DELETE in SQL - Views - Integrity Procedures, Functions, Cursor and Triggers - Embedded SQL - Dynamic SQL.

List of Exercise/Experiments

Case Study using real life database applications anyone from the following list and do the following exercises.

  a) Inventory Management for a EMart Grocery Shop

  b) Society Financial Management

c) Cop Friendly App – Eseva

d) Property Management – eMall

e) Star Small and Medium Banking and Finance

1. Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving Tables and Transaction Control statements

2. Database Querying – Simple queries, Nested queries, Sub queries and Joins

3. Views, Sequences, Synonyms

4. Database Programming: Implicit and Explicit Cursors

5. Procedures and Functions

6. Triggers

7. Exception Handling

UNIT III	RELATIONAL ALGEBRA, CALCULUS AND NORMALIZATION	9+9

Relational Algebra – Operations - Domain Relational Calculus- Tuple Relational Calculus - Fundamental operations.

Relational Database Design - Functional Dependency – Normalization (1NF, 2NF 3NF and BCNF) –Multivalued Dependency and 4NF –Joint Dependencies and 5NF - De-normalization.

List of Exercise/Experiments

1. Case Study using real life database applications anyone from the following list

a) Inventory Management for a EMart Grocery Shop

b) Society Financial Management

c) Cop Friendly App – Eseva

d) Property Management – eMall

e) Star Small and Medium Banking and Finance.

Apply Normalization rules in designing the tables in scope.

UNIT IV	TRANSACTIONS, CONCURRENCY CONTROL AND DATA STORAGE	9+9

Transaction Concepts – ACID Properties – Schedules based on Recoverability, Serializability – Concurrency Control – Need for Concurrency – Locking Protocols – Two Phase Locking – Transaction Recovery –Concepts – Deferred Update – Immediate Update.

Organization of Records in Files – Unordered, Ordered – Hashing Techniques – RAID – Ordered Indexes – Multilevel Indexes - B+ tree Index Files – B tree Index Files.

List of Exercise/Experiments

Case Study using real life database applications anyone from the following list

a) Inventory Management for a EMart Grocery Shop

b) Society Financial Management
c) Cop Friendly App – Eseva
d) Property Management – eMall
e) Star Small and Medium Banking and Finance

Ability to showcase ACID Properties with sample queries with appropriate settings for the above scenario.

UNIT V	QUERY OPTIMIZATION AND ADVANCED DATABASES	9+9

Query Processing Overview – Algorithms for SELECT and JOIN operations – Query optimization using Heuristics.

Distributed Database Concepts – Design –Concurrency Control and Recovery – NOSQL Systems – Document-Based NOSQL Systems and MongoDB.

Explain Plan Statement – Parsing Output – Join Orders and Methods – Indexes - Standard Issues – Query Tuning - Explain Plan vs Explain Analyses.

List of Exercise/Experiments

Case Study using real life database applications anyone from the following list

a) Inventory Management for a EMart Grocery Shop

b) Society Financial Management
c) Cop Friendly App – Eseva
d) Property Management – eMall
e) Star Small and Medium Banking and Finance

Build PL SQL / Stored Procedures for Complex Functionalities, ex EOD Batch Processing for calculating the EMI for Gold Loan for each eligible Customer.

TOTAL: 45 + 45 = 90 PERIODS

OUTCOMES:

After completing the course, students will have the ability to
CO1: Map ER model to Relational model to perform database design effectively.
CO2: Implement SQL and effective relational database design concepts.
CO3:Apply relational algebra, calculus and normalization techniques in database design.
CO4: Understand the concepts of transaction processing, concurrency control, recovery procedure and data storage techniques.
CO5:Evaluate and implement transaction processing, concurrency control mechanisms, and recovery procedures to maintain data integrity.
CO6:Analyze and optimize database queries and understand the features and applications of advanced and distributed database systems, including NoSQL.

TEXTBOOKS:

1. Elmasri R. and S. Navathe, "Fundamentals of Database Systems", Pearson Education, 7th Edition, 2016.

2. Abraham Silberschatz, Henry F.Korth, "Database System Concepts", Tata McGraw Hill , 7th Edition, 2021.

REFERENCES:

1. Elmasri R. and S. Navathe, Database Systems: Models, Languages, Design and Application Programming, Pearson Education, 2013.Raghu Ramakrishnan, Gehrke "Database Management Systems", MCGraw Hill, 3rd Edition 2014.
2. Plunkett T., B. Macdonald, "Oracle Big Data Hand Book" , McGraw Hill, First Edition, 2013
3. Gupta G K , "Database Management Systems" , Tata McGraw HillEducation Private Limited, New Delhi, 2011.
4. C. J. Date, A.Kannan, S. Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2015.
5. Maqsood Alam, Aalok Muley, Chaitanya Kadaru, Ashok Joshi, Oracle NoSQL Database: Real-Time Big Data Management for the Enterprise, McGraw Hill Professional, 2013.
6. Thomas Connolly, Carolyn Begg, "Database Systems: A Practical Approachto Design, Implementation and Management", Pearson, 6th Edition, 2015.
7. Database Management System Part – 1
https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0127580666
7282022456_shared/overview
8. Database Management System Part – 2
   https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0127673
   005629194241_shared/overview
9. Online Resources:https://infyspringboard.onwingspan.com/web/en/page/home

LIST OF EQUIPMENTS:

1. MySql and Eclipse / NetBeans IDE or Equivalent

Course Code	PROBABILITY AND RANDOM PROCESSES (Theory Course) (Common to III Semester ECE and EEV Branches)	L	T	P	C
24MA302		3	1	0	4

OBJECTIVES

The course will enable the learners to:

✓ Provide the necessary basic concepts of random variables and introduce some standard distributions.

✓ Comprehend the concepts of joint distributions, marginal and conditional distributions.

✓ Understand the classification of random processes.

✓ Introduce the concept of auto correlation, cross correlation, and its spectral densities.

✓ Acquire the knowledge of linear systems with random inputs.

UNIT I ONE-DIMENSIONAL RANDOM VARIABLES 12

Basic probability, Independent events, Conditional probability (definition) - Random variable - Discrete and continuous random variables - Moments - Moment generating functions - Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

UNIT II TWO-DIMENSIONAL RANDOM VARIABLES 12

Joint distributions - Marginal and conditional distributions - Covariance - Correlation and linear regression - Transformation of random variables.

UNIT III RANDOM PROCESSES 12

Classification - Stationary process - Poisson process - Markov process - Discrete time Markov chain - Random telegraph process.

UNIT IV CORRELATION AND SPECTRAL DENSITIES 12

Auto correlation functions - Cross correlation functions - Properties - Power spectral density (continuous) - Cross spectral density (continuous) - Properties.

UNIT V LINEAR SYSTEMS WITH RANDOM INPUTS 12

Linear time invariant system - System transfer function - Linear systems with random inputs - Auto correlation and cross correlation functions of input and output.

TOTAL: 60 PERIODS

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

CO1: Compute the statistical measures of standard distributions.

CO2: Determine the correlation and regression for two dimensional random variables. CO3: Analyze various types of Random Processes.

CO4: Compute the auto correlation and power spectral densities of the random processes.

CO5: Determine the output power spectral density of a linear system with random inputs.

CO6: Apply the concept of correlation and spectral density in random telegraph signal processes.

TEXT BOOKS:

1. R.D. Yates and D.J. Goodman, "Probability and Stochastic Processes", Wiley India Pvt. Ltd., 3 rd Edition, 2021.

2. O.C. Ibe, "Fundamentals of Applied Probability and Random Processes", 2nd Edition, Elsevier, 2019.

REFERENCES:

1. G.R. Cooper and C.D. McGillem, "Probabilistic Methods of Signal and System Analysis", Oxford

University Press, New Delhi, 3rd Indian Edition, 2012.

2. Hwei Hsu, "Schaum's Outline of Theory and Problems of Probability, Random Variables and Random Processes", Tata McGraw Hill Edition, New Delhi, 2004.

3. S.L. Miller and D.G. Childers, "Probability and Random Processes with Applications to

Signal Processing and Communications", Academic Press, 2 nd Edition, 2012.

4. H. Stark and J.W. Woods, "Probability and Random Processes with Applications to Signal Processing ", Pearson Education, Asia, 3 rd Edition, 2002.

5. P.Z. Peebles, "Probability, Random Variables and Random Signal Principles", Tata McGraw Hill, 4 th Edition, New Delhi, 2002

Course Code	UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY	L	T	P	C
24GE301	(Common to All Branches)	2	1	0	3

OBJECTIVES

The course will enable the learners to:

- Development of a holistic perspective based on self-exploration about themselves (human beings), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society, and nature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act.

UNIT I NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION 9

Purpose and motivation for the course - recapitulation from Universal Human Values-I -Self-Exploration–what is it? – It's content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration - Continuous Happiness and Prosperity- A Look at Basic Human Aspirations - Right understanding, Relationship and Physical Facility- the basic requirements for the fulfilment of aspirations of every human being with their correct priority - Understanding Happiness and Prosperity Correctly- A critical appraisal of the current scenario - Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Practice sessions: To discuss natural acceptance in human beings as the innate acceptance of living with responsibility (living in relationship, harmony, and co-existence) rather than as arbitrariness in choice based on liking-disliking.

UNIT II UNDERSTANDING HARMONY IN THE HUMAN BEING – HARMONY IN MYSELF! 9

Understanding human beings as a co-existence of the sentient 'I' and the material 'Body' - Understanding the needs of Self ('I') and 'Body' - happiness and physical facility -Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) - Understanding the characteristics and activities of 'I' and harmony in 'I' - 'Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, the meaning of Prosperity in detail - Programs to ensure

Sanyam and Health.

Practice sessions: To discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss programs for ensuring health vs dealing with the disease.

UNIT III   UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY- HARMONY IN HUMAN-HUMAN RELATIONSHIP   9

Understanding values in a human-human relationship - the meaning of Justice (nine universal values in relationships) and the program for its fulfillment to ensure mutual happiness -Trust and Respect as the foundational values of relationship - Understanding the meaning of Trust; Difference between intention and competence - Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in a relationship - Understanding the harmony in the society (society being an extension of the family) - Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals - Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Practice sessions: To reflect on relationships in family, hostel and institute as extended family, real-life examples, teacher-student relationship, the goal of education etc. Gratitude as a universal value in relationships. Discuss scenarios. Elicit examples from students' lives.

UNIT IV   UNDERSTANDING HARMONY IN NATURE AND EXISTENCE - WHOLE EXISTENCE AS COEXISTENCE   9

Understanding the harmony in Nature - Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature - Understanding Existence as the Co-existence of mutually interacting units in all-pervasive Space - Holistic perception of harmony at all levels of existence.

Practice sessions: To discuss human beings as the cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

UNIT V   IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY IN PROFESSIONAL ETHICS   9

Natural acceptance of human values - Definitiveness of Ethical Human Conduct - Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order - Competence in professional ethics: a. Ability to utilize professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for the above production systems - Case studies of typical holistic technologies, management

models and production systems - Strategy for the transition from the present state to Universal Human Order: a. At the level of the individual: as socially and ecologically responsible engineers, technologists, and managers b. At the level of society: as mutually enriching institutions and organizations - Sum up. Practice Exercises and Case Studies e.g. To discuss the conduct as an engineer or scientist etc.

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon completion of the course, the students will be able to:

CO1: develop self-awareness and a deeper understanding of their surroundings, including family, society, and nature.

CO2: identify and resolve inner conflicts based on natural acceptance.

CO3: become more responsible towards life, and handle problems with sustainable solutions by considering human relationships and natural harmony.

CO4: enhance their critical thinking and analyzing skills.

CO5: develop a stronger commitment towards human values, relationships, and societal well-being.

CO6: apply what they have learnt in different day-to-day settings in real life, and take the initial steps towards integrating these values into daily life.

TEXTBOOKS:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, First edition: New Delhi, 2010, ISBN: 978-81-7446-781-2 Reprint: 2010, 2011, 2013, 2016, 2018, 2019 (Second edition: New Delhi, 2019, ISBN: 978-93-87034-47-1)

2. A foundation course in Human Values and Professional Ethics RR Gaur, R Asthana, GP Bagaria, Third revised edition: New Delhi, 2023, ISBN: 978-81-957703-7-3 (Printed Copy), ISBN: 978-81-957703-6-6 (e-book), UHV Publications.

REFERENCES:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful-E. F Schumacher.
6. Slow is Beautiful-Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India – by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi

24CS311	APTITUDE AND CODING SKILLS – I (Common to All Branches)	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

The Course will enable learners to:

● Develop vocabulary for effective communication and reading skills.
● Build the logical reasoning and quantitative skills.
● Develop error correction and debugging skills in programming.

List of Exercises:

1. **English – Phase I**

Vocabulary: Synonyms, Antonyms, Grammar: Subject-Verb Agreement, Tenses and Articles, Prepositions and Conjunctions, Speech and Voices, Comprehension: Inferential and Literal Comprehension, Contextual Vocabulary, Comprehension ordering

2. **Logical Reasoning – Phase I**

Deductive Reasoning: Coding deductive logic, Directional sense, Blood relations, Objective Reasoning, Selection decision tables, Puzzles, Inductive reasoning: Coding pattern and Number series pattern recognition, Analogy and Classification pattern recognition, Abductive Reasoning: Logical word sequence, Data sufficiency

3. **Quantitative Ability - Phase I**

Basic Mathematics: Divisibility, HCF and LCM, Numbers, decimal fractions and power, Applied Mathematics: Profit and Loss, Simple and Compound Interest, Time, Speed and Distance, Engineering Mathematics: Logarithms, Permutation and Combinations, Probability

4. **Automata Fix – Phase I**

Logical, Compilation and Code reuse

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

 CO1: Develop vocabulary for effective communication skills.
 CO2: Build the logical reasoning enhance critical thinking.
 CO3: Develop error correction and debugging skills in programming.
 CO4: Apply programming skills to develop programs efficiently
 CO5: Solve problems using quantitative skills
 CO6: Develop effective reading and listening skills.

COURSE CODE	COURSE TITLE	L	T	P	C
24EV311	**PRODUCT DEVELOPMENT LAB - I**	**0**	**0**	**2**	**1**

LIST OF EXPERIMENTS

1. Implementation of Design Process.

2. Present the product idea.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

CO1: Develop their intellectual skills for understanding the concepts, rules or procedures.

CO2: Develop their cognitive strategy to think, organize, learn and behave.

CO3: Demonstrate the ability to provide conceptual design strategies for a product.

 CO4: Describe procedure for designing a prototype.

CO5: Recognize interdisciplinary strategies for solving complex problems.

CO6: Apply integrative strategies for solving complex problems.

LIST OF EQUIPMENT:

Sl. No.	Equipment	Quantity
1.	CNC Router	1
2.	3D Printer	1
3.	3D Scanner	1
4.	Laser Cutting Machine	1
5.	Centre lathe	2
6.	Arc Welding transformer with cables and holders	2
7.	Plumbing tools	2 Sets
8.	Carpentry Tools	2 Sets
9.	Multimeter	10
10.	Drilling Machine	1
11.	Solder Stations	5 Sets
12.	Desoldering Machine	1
13.	PCB Milling Machine	1
14.	Variable Power Supply	1
15.	Electronic Components like Resistors, Transistors, Diode, Inductor, Capacitors, IC etc.,	10 Sets
16.	Personal Desktop Computers	30

COURSE CODE	COURSE TITLE	L	T	P	C
24EV411	**PRODUCT DEVELOPMENT LAB - II**	**0**	**0**	**2**	**1**

LIST OF EXPERIMENTS

1. Develop a prototype.

2. Demonstration of the project/product and submission of report.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

At the end of this course, the students will be able to:

CO1: Understand and explain the real time problems through literatures.

CO2: Analyze the methods to develop solution to the systems.

CO3: Classify, compare and analyze business opportunities for a new product.

CO4: Summarize and prepare reports for the experimental determinations.

CO5**:** Evaluate the performance and effectiveness of the existing problems.

CO6: Develop life-long learning skills for a productive career.

LIST OF EQUIPMENT:

S.NO	EQUIPMENT NAME	QUANTITY
1.	CNC Router	1
2.	3D Printer	1
3.	3D Scanner	1
4.	Laser Cutting Machine	1
5.	Centre lathe	2
6.	Arc Welding transformer with cables and holders	2
7.	Plumbing tools	2 Sets
8.	Carpentry Tools	2 Sets
9.	Multimeter	10
10.	Drilling Machine	1
11.	Solder Stations	5 Sets
12.	Desoldering Machine	1
13.	PCB Milling Machine	1
14.	Variable Power Supply	1
15.	Electronic Components like Resistors, Transistors, Diode, Inductor, Capacitors, IC etc.,	10 Sets
16.	Personal Desktop Computers	30

COURSE CODE	COURSE TITLE	L	T	P	C
24MC301	**INDIAN CONSTITUTION**	**1**	**0**	**0**	**0**

UNIT I	INTRODUCTION	3

History of Making of the Indian Constitution-Drafting Committee- (Composition & Working) - Philosophy of the Indian Constitution-Preamble-Salient Features

UNIT II	CONTOURS OF CONSTITUTIONAL RIGHTS & DUTIES	3

Fundamental Rights-Right to Equality-Right to Freedom-Right against Exploitation Right to Freedom of Religion-Cultural and Educational Rights-Right to Constitutional Remedies Directive Principles of State Policy-Fundamental Duties

UNIT III	ORGANS OF GOVERNANCE	3

Parliament-Composition-Qualifications and Disqualifications-Powers and Functions-Executive President-Governor-Council of Ministers-Judiciary, Appointment and Transfer of Judges, Qualifications Powers and Functions.

UNIT IV	EMERGENCY PROVISIONS	3

Emergency Provisions - National Emergency, President Rule, Financial Emergency

UNIT V	LOCAL ADMINISTRATION	3

District's Administration head- Role and Importance-Municipalities- Introduction- Mayor and role of Elected Representative-CEO of Municipal Corporation-Pachayati raj- Introduction- PRI- Zila. Panchayat - Elected officials and their roles- CEO Zila Pachayat- Position and role-Block level Organizational Hierarchy (Different departments)-Village level- Role of Elected and Appointed officials-Importance of grass root democracy.

TOTAL: 15 PERIODS

COURSE OUTCOMES:
After the completion of this course, the student will be able to :

CO1: Able to understand history and philosophy of Indian Constitution.

CO2: Able to understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.

CO3: Able to understand powers and functions of Indian government.

CO4: Able to understand emergency rule

CO5: Able to understand structure and functions of local administration.

TEXT BOOKS:

1. Basu D D, Introduction to the Constitution of India, Lexis Nexis, 2015.

2. Busi S N, Ambedkar B R framing of Indian Constitution, 1st Edition, 2015.

REFERENCES:

1. Jain M P, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
2. The Constitution of India (Bare Act), Government Publication,1950

3. Durga Das Basu, "Introduction to the Constitution of India ", Prentice Hall of India, New Delhi..
4. R.C.Agarwal, (1997) "Indian Political System", S.Chand and Company, New Delhi.

5. Sharma, Brij Kishore, "Introduction to the Constitution of India", Prentice Hall of India, New Delhi

	STATISTICS AND LINEAR ALGEBRA	L	T	P	C
24MA402	(Theory Course with Laboratory Component)	**3**	**0**	**2**	**4**

COURSE OBJECTIVES:

The course will enable the learners to:

- test the hypothesis for small and large samples.
- introduce the concept of analysis of variance.
- understand the concept of statistical quality control.
- explain the concepts of vector space, bases, and dimensions.
- acquire knowledge on linear transformations and diagonalization.

UNIT I	**TESTING OF HYPOTHESIS**	**15**

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal `distribution for single mean and difference of means - Tests based on t, F distributions for mean and variance-Chi-square test - Goodness of fit and Contingency table (test for independence).

List of Exercises/Experiments using R Programming:

1. Testing of hypothesis for given data using z - test.

2. Testing of hypothesis for given data using t - test

UNIT II	**DESIGN OF EXPERIMENTS**	**15**

One-way and two-way classifications - Completely randomized design - Randomized block design - Latin square design.

List of Exercises/Experiments using R Programming:

1. Perform one way ANOVA test for the given data.

2. Perform two way ANOVA test for the given data

UNIT III	**STATISTICAL QUALITY CONTROL**	**15**

Control charts for measurements $\bar{X}$ and R charts) - Control charts for attributes (p, c and np charts) - Tolerance limits.

List of Exercises/Experiments using R Programming:

1. Interpret the results for $\bar{X}$-Chart for variable data.

2. Interpret the results for R-Chart for variable data

UNIT IV	**VECTOR SPACES**	**15**

Vector spaces - Subspaces - Linear combinations and linear system of equations - Linear independence and linear dependence - Bases and dimensions.

List of Exercises/Experiments using R Programming:

1. Plot the vector subspace in 3-dimensional space.

2. Compute the null space of the matrix.

Unit V	**LINEAR TRANSFORMATION AND DIAGONALIZATION**	**15**

Linear transformation - Null spaces and ranges - Dimension theorem - Matrix representation of linear transformations - Eigenvalues and eigenvectors - Diagonalizability.

List of Exercises/Experiments using R Programming:

1. Write Matrix representation of linear transformations.

2. Find eigenvalue and eigenvector of linear transformation

	TOTAL: 75 PERIODS

OUTCOMES

Upon completion of the course, the students will be able to:

CO1: implement the concept of testing of hypothesis to solve real life problems.

CO2: apply the concept of ANOVA for various experimental designs.

CO3: prepare the control charts for variables and attributes for analyzing the data.

CO4: identify the bases and dimensions of vector space.

CO5: apply linear transformations to practical problems in various fields.

CO6: solve problems involving eigenvalues, eigenvectors, and diagonalization.

TEXT BOOKS

1. R.A. Johnson, I. Miller and J. Freund, "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 9th Edition, 2023.
2. Stephen H. Friedberg, A. J. Insel, and L. Spence, "Linear Algebra" 5th Edition, Prentice Hall of India, New Delhi, 2022.

REFERENCES

1. J.L. Devore, "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 9th Edition, Reprint, 2020.

2. S.M. Ross, "Introduction to Probability and Statistics for Engineers and Scientists", 6th Edition, Elsevier, 2020.

3. M.R. Spiegel, J. Schiller and R.A. Srinivasan, "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill, 4th Edition, 20013.

4. R. E. Walpole, R. H. Myers, S.L. Myers and K. Ye, "Probability and Statistics for Engineers and Scientists". Pearson Education, Asia, 9th Edition, Reprint 2021.

5. J.S. Milton and J.C. Arnold, "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2019.

6. Steven J. Leon, "Linear Algebra with Applications", Pearson Educational International", 9th Edition, United States of America, 2015

24CS411	APTITUDE AND CODING SKILLS – II (Common to All Branches)	L	T	P	C
		0	0	3	1.5

OBJECTIVES:

The Course will enable learners to:
- Develop advanced vocabulary for effective communication and reading skills.
- Build an enhanced level of logical reasoning and quantitative skills.
- To develop error correction and debugging skills in programming.
- To apply data structures and algorithms in problem solving.

List of Exercises:
1. **English – Phase II**
Vocabulary: Synonyms, Antonyms, Grammar: Subject-Verb Agreement, Tenses and Articles, Prepositions and Conjunctions, Speech and Voices, Comprehension: Inferential and Literal Comprehension, Contextual Vocabulary, Comprehension ordering
2. **Logical Reasoning – Phase II**
Deductive Reasoning: Coding deductive logic, Directional sense, Blood relations, Objective Reasoning, Selection decision tables, Puzzles, Inductive reasoning: Coding pattern and Number series pattern recognition, Analogy and Classification pattern recognition, Abductive Reasoning: Logical word sequence, Data sufficiency
3. **Quantitative Ability - Phase II**
Basic Mathematics: Divisibility, HCF and LCM, Numbers, decimal fractions and power, Applied Mathematics: Profit and Loss, Simple and Compound Interest, Time, Speed and Distance, Engineering Mathematics: Logarithms, Permutation and Combinations, Probability
4. **Automata Fix – Phase II**
Logical, Compilation and Code reuse
5. **Automata - Phase II**
Data Structure Concepts: Array and Matrices, Linked list, String processing and manipulation, Stack/Queue, Sorting and Searching
Advanced Design and Analysis Techniques: Greedy Algorithms, Minimum Spanning Trees, String Matching, Divide and Conquer, Computational Geometry

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of the course, the students will be able to:

CO1: Develop advanced vocabulary for effective communication skills.
CO2: Build an enhanced level of logical reasoning and quantitative skills.
CO3: Develop error correction and debugging skills in programming.
CO4: Apply data structures and algorithms in problem solving.
CO5: Develop advanced vocabulary for effective reading skills
CO6: Apply advanced algorithm design techniques to develop programs

24CS403	WEB DEVELOPMENT FRAMEWORKS (Lab Integrated)	L	T	P	C
		3	0	3	4.5

COURSE OBJECTIVES:

The Course will enable the learners:

- To understand web semantics and related tools and framework
- To get hands on latest JS based web frameworks
- To develop a scalable and responsive web application
- To develop an industry ready application web enterprise feature

UNIT I	ADVANCED TYPESCRIPT	9+9

Introduction to HTML5 and CSS3, Media Queries, JS, DOM, BootStrap, Variables, Loops, Operators, Scope, Hoisting, Arrays, Spread, REST, DeStructuring

Introduction, Advantage of Using TS over JS, and where to Use and not to use TS - Understanding the Compiler (Transpiler), and its options, Scope of TS - Variable Scopes, Static Data Types - String, Number, Interface, Date - Union, Tuple, Undefined Data Types, Unknown vs any vs Never - Object Oriented , Arrow Funcions - Types, KeyOf, TypeOf, InstanceOf ,Narrowing, Conditional Types - Generics, Enum ,Required / Partial / Optional - Arrays, Modules ,Async Processing w Call backs ,Type Inference, Type Compatibility, Utility Type - Unit Testing, TSLint

List of Exercise/Experiments

1) Create a TS Object for Bank Account (with attributes like à customer name, account type, balance, data of creation, bank name, branch name, pan card number). Using JS Object keyword, try to perform following activities
   - ➢ List down all the entries of the bank object
   - ➢ Check the existence of a key
   - ➢ If key found, get the value for the key
2) Spread Operator
   - ➢ Merge Customer and Account Arrays
   - ➢ Update the Customer Object with the new values
   - ➢ Develop a function that takes an Spread Argument and calculates total balance.

UNIT II	INTRODUCTION TO REACTJS	9+9

Introduction to React - ES6 Features, What is React?, React Features - Setting up React Development Environment:- Node.js and npm installation, Create React App, Project structure - JSX (JavaScript XML):- What is JSX?,JSX Syntax and Rules,JSX Expressions - Components in React:- Functional Components, Class Components, Props and PropTypes - State and Lifecycle :- State and setState, Lifecycle Methods, Mounting, Updating, and Unmounting, Handling Events in React - Event Handling in React :- Synthetic Events, Event Binding, - Conditional Rendering:-If-else Statements, Ternary Operator, Logical && Operator
Lists and Keys:- Rendering Lists, Keys and Reconciliation, Extracting Components.

List of Exercise/Experiments

1) A leading bank from APAC wants to modernize their banking services and decided to build a online multi channel mobile ecommerce platform. As part of the drive, starting building following feature set in a staggered model emplying ReactJS as front end library and associated libs from React eco system. Feature to be implemented are
    a. User Login Page
    b. Account Summary
    c. Funds Transfer (within bank and outside bank)
    d. Recurring and Fixed deposits
    e. Letter of Credit
    f. Salary or 3rd Party Payment

2) Unit 2 Scope – Project Setup, Web App Layout Completion using BootStrap or Tailwind, Login Page Implementation, Landing Page Implementation, Authentication and Authorization Implementation.

UNIT III	REACTJS COMPONENTS	9+9

Forms and Controlled Components :- Form Handling in React, Controlled Components, Uncontrolled Components - Basic Hooks :- useState, useRef, useEffect, - Routing in React:- Introduction to React Router, Route, Link, and Switch Components, Route Parameters, useNavigate, useParams, - REST API – Axios GET/PUT/Delete/Remove, Interceptor, Headers, Authorization Token, Promise and Observables (via rxjs)

List of Exercise/Experiments

1) Extend the Project developed in previous section with newly learnt concepts
    a. Unit 3 Scope – Forms and Validation (React Form Validation), Integration of Back End Apis via Axios, API Security Implementation, Routes and Navigation with Private Routes, Usage of useEffect, UseContext hooks

UNIT IV	REACT PRO TOOLKIT: ERROR MANAGEMENT, ABSTRACTIONS & DATA HANDLING	9+9

Error Handling :- Error Boundaries, componentDidCatch, Error Handling Strategies
Higher-Order Components (HOCs) :- What are HOCs?, Creating and Using HOCs, HOCs vs Render Props, Code Splitting and Lazy Loading, Server-Side Rendering - Data Fetching with React Query :- React Query, Introduction to React Query, Query Keys and Query Functions, Query Invalidation and Refetching.

List of Exercise/Experiments

1) Extend the Project developed in previous section with newly learnt concepts
    a. Unit 4 Scope – Completion of Remaining Modules, Error Handling, HOC and AUX implementation, Lazy loaded components for improved performance
Extend the Project developed in previous section with newly learnt concepts

UNIT V	REACT UNDER THE HOOD: TESTING, CONTEXT API, AND REDUX	9+9

Testing React Components :- Introduction to Testing, Jest Framework, React Testing Library
Context API :- Creating Context, Providing and Consuming Context, useContext Hook
Redux Overview :- What is Redux?, Redux Principles, Single Source of Truth - Redux Actions and Reducers :- Redux Actions, Redux Reducers, Combining Reducers.

List of Exercise/Experiments

1) Extend the Project developed in previous section with newly learnt concepts
   a. Unit 5 Scope – Unit Testing using JEST, Redux implementation for state management.

Business Use Case Implementations

1) Student Management System
2) Retail Bank System
3) eCommerce System
4) Student LMS Management System

TOTAL: 45+45=90 PERIODS

COURSE OUTCOMES:

After completing the course, students will have the ability to

CO1. Understand and apply modern web technologies including HTML5, CSS3, JavaScript, and advanced TypeScript concepts to build dynamic web components.

CO2. Develop responsive and modular front-end applications using ReactJS, including component creation, state management, and routing.

CO3. Implement advanced React features like hooks (useState, useEffect, useRef), React Router, and REST API integration using Axios for dynamic content handling.

CO4. Utilize higher-order components (HOCs), lazy loading, and server-side rendering to optimize and abstract React applications.

CO5. Perform unit testing using Jest and RTL, and manage global application state efficiently using Context API and Redux.

CO6. Design and deliver scalable and real-world enterprise web applications with complete user interface flow, security, and error handling.

TEXTBOOKS:

1) <u>David Flanagan</u>, Javascript The Definitive Guide, Paperback, 7th Edition, 2020.
2) David Choi ,Full-Stack React, TypeScript, and Node: Build cloud-ready web applications using React 17 with Hooks and GraphQL Paperback – Import, 18 December 2020.
3) Mehul Mohan, Advanced Web Development with React Paperback – 1 January 2020.

E-RESOURCES:

1. Parental Website - https://reactjs.org/
2. The Road to Learn React: Your journey to master plain yet pragmatic React.js by Robin Wieruch
3. Learning React: Functional Web Development with React and Redux by Alex Banks and Eve Porcello
4. Learning React by KirupaChinnathambi
5. "React Up & Running" by StoyanStefanov
6. https://www.edureka.co/reactjs-redux-certification-training
7. CodePen

8. CodeSandbox (Preferred)
9. Stackblitz

LIST OF EQUIPMENTS:

- NodeJS (v22.11.2)
- Github as code repository
- Visual studio code as IDE
- RTL as unit testing framework
- Responsive design w bootstrap
- ReactJS installation (v17)
- Chrome / FIreFox Browsers (latest)
- Responsive using Media Queries & Bootstrap Material & Antdesign
- Design based Apps