DEPARTMENT OF ELECTRONICS & TELECOMMUNICATIONS ENGINEERING

DEOGIRI INSTITUTE OF ENGINEERING AND MANAGEMENT STUDIES, CHH. SAMBHAJINAGAR
StationRoad,Osmanpura,Chh.Sambhjinagar-431005(M.S.)
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NEP

Compliant

Curriculum

W.E.F.2025-26

Electronics & Telecommunications Engineering

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DEPARTMENT VISION

To provide valuable resources for Industry and Society through research and excellence in Electronics and Telecommunication Engineering.

DEPARTMENT MISSION

M1: Educating students with requisite technical expertise to meet the growing challenges of the industry.
M2:Promoting research through constant interaction with research bodies and various Industries.
M3:Equipping students with fundamental subject knowledge to enable them for continuing education.

Program Outcomes(PO's)

PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/development of solutions: Design solutions for complex engineering problems and design System components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems :Use research-based knowledge and research methods including design of experiments ,analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with An understanding of the limitations.
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Ethics: Apply ethical Principles and commit to professional ethics, human values, diversity and inclusion; adhere to national and international Laws.
PO8	Individual and collaborative teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO9	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and Receive clear instructions.
PO10	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO11	Life long learning: Recognize the need for and have the preparation and ability for i) Independent and life long learning ii)Adaptibility to new and emerging technologies and iii)critical thinking in the broadset context of technological change.

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MSPM'S

Deogiri Institute of Engineering and Management Studies,

Chhatrapati Sambhajinagar

(An Autonomous Institute)

Department of Electronics and Telecommunications Engineering

PEO	STATEMENTS
PEO1	Graduates would be able to provide the engineering solution with strong research capabilities in the areas of Electronics and Telecommunication Engineering.
PEO2	Graduates would be able to achieve good career using improved professional skill sets in the field of Electronics and Telecommunication.
PEO3	Graduates will possess a strong fundamental knowledge base and proficiency in circuit analysis and simulation in the field of electronics.

PSO	STATEMENTS
PSO 1	Apply knowledge to use modern tools and techniques for Electronics and Telecommunication Engineering.
PSO 2	Integrate communication systems, signal processing techniques and multidisciplinary knowledge to develop sustainable engineering solutions.

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GENERAL COURSE STRUCTURE & THEME

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
1 Hr. Practical (P) per week	0.5 Credit
2 Hours Practical (P) per week	1 Credit

B. Total Credits for the completion of B.Tech. in Electronics s Telecommunication Engineering:

The total number of credits proposed for the four-year B.Tech Electronics and Telecommunication Engineering (E&TC) with 1 Multidisciplinary minor (Compulsory) degree is **176** as per the structure given below:

Department of Electronics and Telecommunication Engineering

Credit Framework under Four-Years UG Engineering Programme with Multiple Entry and Multiple Exit options:

- The Four-year Bachelor"s Multidisciplinary Engineering Degree Programme allows the students to experience the full range of holistic and multidisciplinary education in addition to a focus on the chosen major and minors as per their choices and the feasibility of exploring learning from different institutions.
- The minimum and maximum credit structure for different levels under the Four-year Bachelor"s Multidisciplinary Engineering UG Programme with multiple entry and multiple exit options are as given below:

Credit Framework

Levels	Qualification Title	Credit Requirements		Semester	Year
		Minimum	Maximum		
4.5	One Year UG Certificate in Engg./ Tech.	40	44	2	1
5.0	Two Years UG Diploma in Engg./ Tech.	80	88	4	2
5.5	Three Years Bachelor's Degree in Vocation (B. Voc.) or B. Sc. (Engg./ Tech.)	120	132	6	3
	4-Years Bachelor's degree				

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Levels	Qualification Title	Credit Requirements		Semester	Year
		Minimum	Maximum		
6.0	(B.E./ B.Tech. or Equivalent) in Engg./ Tech. with Multidisciplinary Minor	160	176	8	4
6.0	4-Years Bachelor's degree (B.E./ B.Tech. or Equivalent) in Engg./ Tech.- Honors and Multidisciplinary Minor	180	194	8	4
6.0	4-Years Bachelor's degree (B.E./ B.Tech. or Equivalent) in Engg./ Tech.- Honors with Research and Multidisciplinary Minor	180	194	8	4
6.0	4-Years Bachelor's degree (B.E./ B.Tech. or Equivalent) in Engg./ Tech.- Major Engg. Discipline with Double Minors (Multidisciplinary and Specialization Minors)	180	194	8	4

- There are multiple exit options at each level. Student will be given a specific Qualification mentioned in the table depending on the level at which he/she decide to have an exit. Ex. If a student decides to exit after completion of two years (level 5.0) of the program, he will be given a Diploma in Engineering with specific exit condition mentioned in the syllabus of the specific branch. He/she can rejoin the program with the multiple entry option at the level next where he/she chose to exit previously. (Student can join at level 5.5 if successfully completed level 5.0 previously at the time of exit).
- Minimum credit requirements of each level are mentioned in the credit framework table.

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- There are 4 distinct options available at level 6.0.
- First one is basic level 6.0 option where minimum 160-maximum 176 credits are mandatory which can be completed as per the Semester-wise Credit distribution structure mentioned in the table given below.

  Here, the Bachelor"s Engineering Degree in chosen Engg./ Tech. Discipline with multidisciplinary minor (min.160-max.176 Credits) i.e. "**B. Tech in Electronics and Telecommunication Engineering with Computer Engineering**" (160-176 credits) enables students to take up five-six or required additional courses of 14 credits in the discipline other than Electronics and Telecommunication Engineering distributed over semesters III to VIII. Here in the case of "**B. Tech in Electronics and Telecommunication Engineering with Computer Engineering**" (160-176 credits) student is supposed to take up 50% or more courses to complete the 50% or more credits (from assigned 14 credits) from **Computer Engineering minor bucket**. The remaining courses to complete the assigned 14 credits can be covered from other discipline"s minor buckets.
- Remaining three level 6.0 options are the advanced options where the student is given an opportunity to get extra qualification by earning some extra credits(18-20 extra credits). These three options are given below:
- Level 6.0: The **Bachelor's Engineering Degree with Honours** in chosen Major Engg./ Tech. Discipline i.e. in Electronics and Telecommunication Engineering with Honours with Multidisciplinary Minor (180-194 credits) enables students of Electronics and Telecommunication Engineering to take up five-six additional courses of 18 to 20 credits in the Electronics and Telecommunication Engineering discipline distributed over semesters III to VIII. The decision regarding the mechanism of distribution of these 18-20 credits over semesters III to VIII, which are over and above the min.160-max.176 Credits prescribed for the duration of four years will be taken by Academic Authorities of University. **Student must have CGPA equal to or greater than 7.5 at the end of second semester to go for this option**.

  - Level 6.0: The **Bachelor's Engineering Degree with Research** in i.e. in Electronics and Telecommunication Engineering with Research with Multidisciplinary Minor (180-194 credits) enables students of Electronics and Telecommunication Engineering to take up a research project of 18 to 20 credits in the Electronics and Telecommunication Engineering discipline distributed over semesters VII to VIII. **Student must have CGPA equal to or greater than 7.5 at the end of sixth semester to go for this option**.
- Level 6.0: The **Bachelor's Engineering Degree in chosen Engg./ Tech. Discipline with Double Minor** (Multidisciplinary and Specialization Minor, 180-194 credits), i.e. "**B. Tech in Electronics and Telecommunication Engineering with *other selected discipline in* Engineering (as MDM) with Specialization Minor in Computer Engineering**" (180-194 credits) enables students to take up five-six additional courses of 14 credits in the discipline other than Electronics and Telecommunication Engineering(for completion of multidisciplinary minor) and 18 to 20 extra credits in the **Computer Engineering discipline** distributed over semesters III to VIII. Here, the ***other selected discipline* in Engineering should be different from Specialization Minor i.e. Computer Engineering**. This enables students to take up five-six or required additional courses of 18 to 20 credits in the **Computer Engineering** discipline distributed over semesters III to VIII, which are over and

above the min.160-max.176 Credits. The decision regarding the mechanism of distribution of these 18-20 credits over semesters III to VIII, prescribed for the duration of four years will be taken by Academic Authorities of University. **Student must have CGPA equal to or greater than 7.5 at the end of second semester to go for this option**.

B.TECH. (E&TCENGINEERING) PROGRAM STRUCTURE(2025-29)

Semester		I	II	III	IV	V	VI	VII	VIII	Total Credits
Basic Science Course	BSC/ESC	08	07		--	--	--	--	--	15
Engineering Science Course		08	07		--	--	--	--	--	15
Program Core Course(PCC)	Program Courses	--	02	10	10	10	10	12	--	54
Program Elective Course(PEC)		--	--	--	--	04	06	04	06	20
Vocational Courses (**Industrial Collaboration Course)**	Skill Courses	--	--	--	--	--	--	02	--	10
Skill Enhancement Course **(Professional Development)**		01	01	01	01	02	02	--	--	
Ability Enhancement Course(AEC -01,AEC-02)**(Ex. LanguageLab, CS, EEE)**	Humanities Social Science and Management (HSSM)	02	--	--	02	--	--	--	--	04
Entrepreneurship/Economics/ Management Courses		--		02	02	--	--	--	--	04
Indian Knowledge System(IKS)			02		--	--	--	--	--	02
Value Education Course(VEC)(Ex, UHV-II, Environmental Courses)		--	--	02	02	--	--	--	--	04
Constitution of India							AU			AU
Do It Yourself (DIY)	Experiential Learning Courses	AU	AU	01	01	01	01	01	--	05
PBL		01	01	01	01	01	01	01	--	07
Internship/OJT		--	---			--	--	--	12	12
Co-curricular Courses(CC) (NSS /YOGA/Health &Wellness)	Liberal Learning Courses	01	01	--	--	--	--	--	--	02
Open Elective(OE)		--	--	04	02	02	--	--	--	08
Total Credits(Major)		**21**	**21**	**21**	**21**	**20**	**20**	**20**	**18**	**162**
Multidisciplinary Minor (MDM)	Multidisciplinary Courses		-	02	02	04	02	04	--	**14**
• **(B.E./B.Tech. or Equivalent)in Engg./Tech. with Multidisciplinary Minor** • **Major+ MDM=162+14=176Credits**										**176**
Honors and Multidisciplinary Minor		-	-	2	4	4	4	4	-	**18**
• **4-Years Bachelor's degree (B.E . / B.Tech .or Equivalent) in Engg. /Tech. –Honors and Multidisciplinary Minor** • **Major +Honors +MDM=162+18+14= 194Credits** • Students with minimum **CGPA of 7.5**without backlog courses at the end of Second semester and should have earned **42credits** are eligible for admission to the UG Bachelor's Degree with Honors.										**194**
Honors with Research and Multidisciplinary Minor								08	10	**18**

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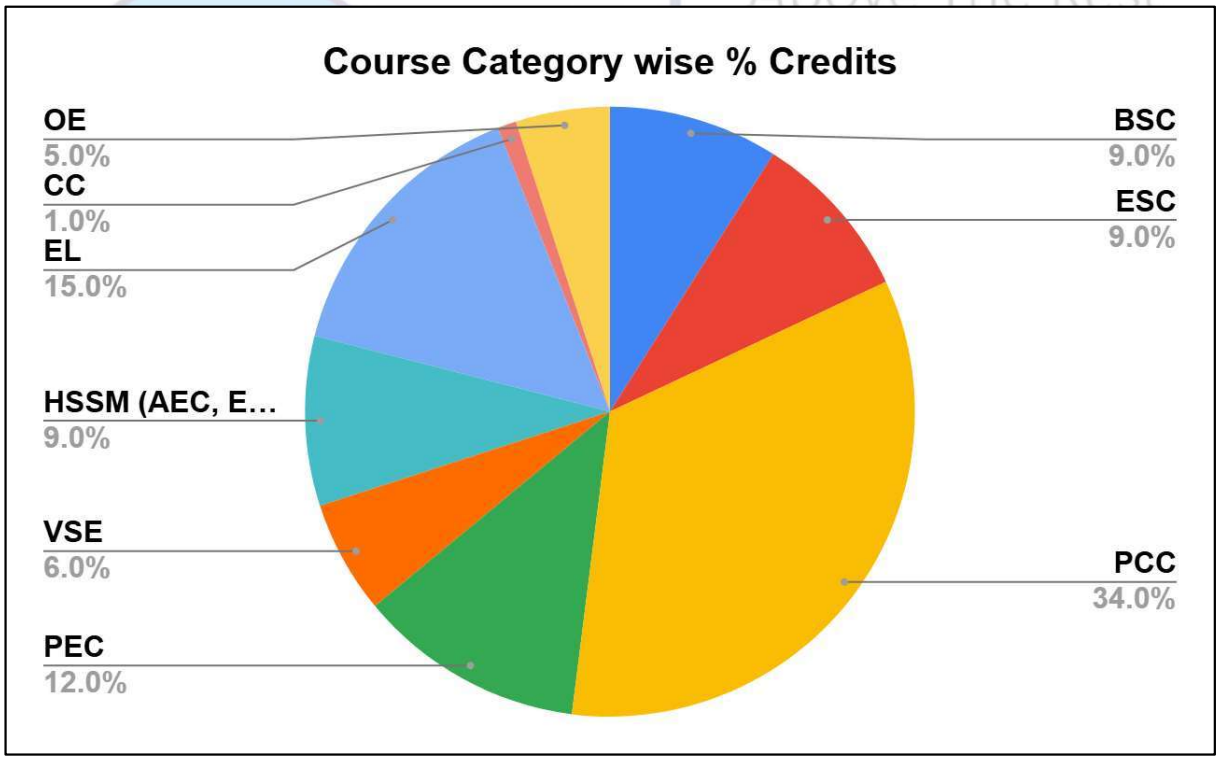
• **4-Years Bachelor's degree (B.E./B.Tech. or Equivalent) in Engg./Tech. - Honors with Research and Multidisciplinary Minor** • **Major+ Research MDM = 162+18+14=194 Credits** • Students with minimum **CGPA of 7.5** without backlog courses at the end of Sixth semester and should have earned **124 credits** are eligible for admission to the UG Bachelor's Degree with Research.										**194**
Double Minors(Multidisciplinary and Specialization Minors)				2	4	4	4	4		**18**
• **4-Years Bachelor's degree (B.E. / B.Tech. or Equivalent) in Engg /Tech. –Major Engg. Discipline with Double Minors (Multidisciplinary and Specialization Minors)** • **Major+ MDM+ Specialized Minor =162 +14 +18 = 194Credits** • Students with minimum **CGPA of 7.5** without backlog courses at the end of Second semester and should have earned **42credits** are eligible for admission to the UG Bachelor's Degree with Double Minor.										**194**

B.Tech. in Electronics and Telecommunication Engineering		
Course Category	**Credits**	**% Credits**
Basic Science **(BSC)**	15	9%
Engineering Science **(ESC)**	15	9%
Program Core Courses **(PCC)**	54	34%
Program Elective Courses **(PEC)**	20	12%
Vocational & Skill Enhancement **(VSE)**	10	6%
Humanity, Social Science & Management (AEC, EM, IKS, VEC) **HSSM**	14	9%
Experiential Learning **(EL)**	24	15%
Co-Curriculum Courses **(CC)**	02	1%
Open Electives **(OE)**	08	5%
Total Credits	**162**	



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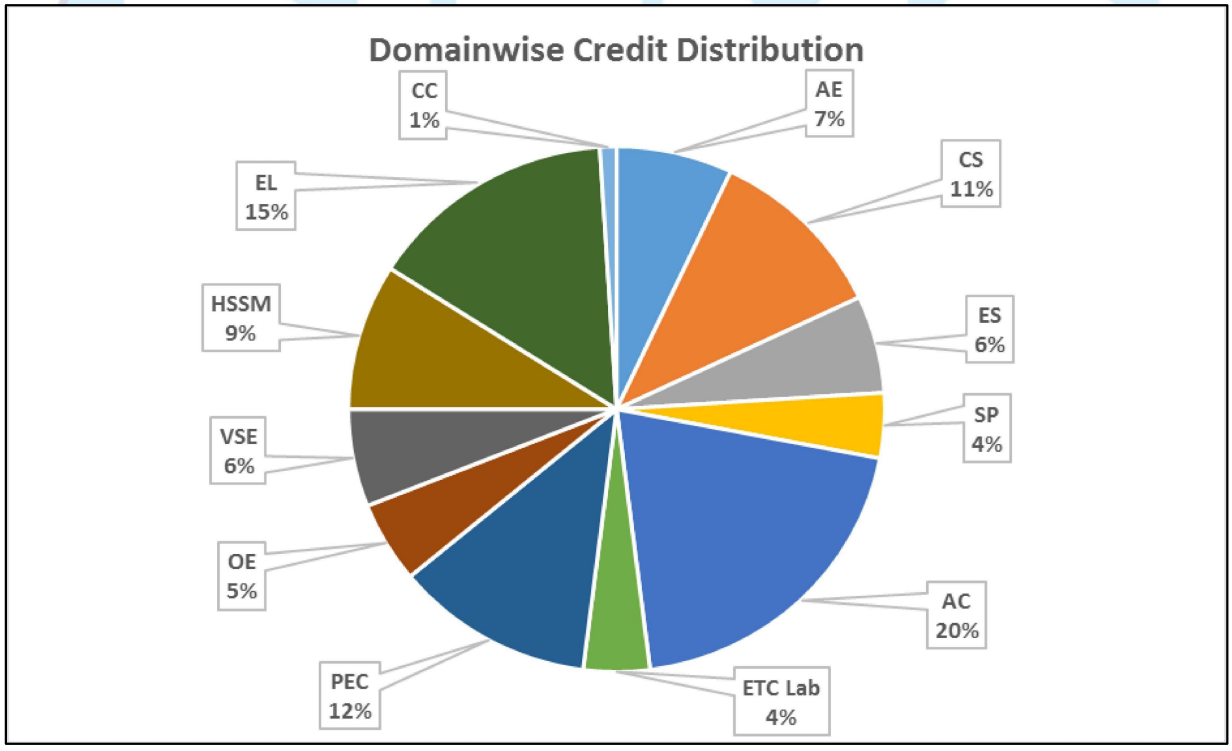
B.Tech. in Electronics & Telecommunication Engineering		
Domain	**Credits**	**% Credits (162)**
Analog Electronics **(AE)**	12	7%
Communication Systems **(CS)**	18	11%
Embedded Systems **(ES)**	09	6%
Signal Processing **(SP)**	06	4%
Allied Courses **(AC)**	33	20%
ETC Lab	06	4%
Program Elective Courses (**PEC**)	20	12%
Open Electives (**OE**)	08	5%
Vocational & Skill Enhancement (**VSE**)	10	6%
Humanity, Social Science & Management (AEC, EM, IKS, VEC) **HSSM**	14	9%
Experiential Learning (**EL**)	24	15%
Co-Curriculum Courses (**CC**)	02	1%
Total Credits	**162**	



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Deogiri Institute of Engineering and Management Studies, Chhatrapati Sambhajinagar
(An Autonomous Institute)
Department of Electronics and Telecommunications Engineering

SEMESTER III													
Category	Course Code	BOS	Name of the Course	Teaching Scheme				Evaluation Scheme					Credits
				L	T	PR	Total	CA-I	CA-II	MSE	ESE	Total	
PCC	ET253202	ETC	Probability Theory and Transforms	3	-	-	3	10	10	20	60	100	3
PCC	ET253203	ETC	Electronics Devices and Circuits	3	-	-	3	10	10	20	60	100	3
PCC	ET253204	ETC	Network Analysis	3	-	-	3	10	10	20	60	100	3
VEC	GE253703	ETC	Universal Human Values II	2			2	10	10	20	60#	100	2
EM	ET253704	ETC	Financial Management	2			2	10	10	20	60#	100	2
OE	ET253501-503	ETC	Open Elective I *	4			4	10	10	20	60	100	4
PCC	ET253205	ETC	EDC & NA Lab			2	2	15	15	-	20	50	1
EL	ET253805	ETC	PBL: Problem based Learning			2	2	15	15	-	20	50	1
VSE	ET253603	ETC	Professional Development III			2	2	15	15	-	20	50	1
EL	ET253806	ETC	Do It Yourself III			2	2	15	15	-	20	50	1
TotalforMajor				**17**		**8**	**25**			-		**800**	**21**
MDM	ET253401	ETC	MDM-I *	2			2	10	10	20	60	100	2
Total for Major with Multidisciplinary Minor (Mandatory Credits)													**23**
HMM	ET253206	ETC	HMM-I	2			2	10	10	20	60	100	2
OR (Students will be allotted either HMM or DM as per defined criteria)													
DM	ET253207	ETC	DM-I	2			2	10	10	20	60	100	2
Total for Major with MDM+ (HMM/DM)				**21**		**8**	**29**					**1000**	**25**

SEMESTER IV													
Category	Course Code	BOS	Name of the Course	Teaching Scheme				Evaluation Scheme					Credits
				L	T	PR	Total	CA-I	CA-II	MSE	ESE	Total	
PCC	ET254208	ETC	Signal & Systems	3	-	-	3	10	10	20	60	100	3
PCC	ET254209	ETC	Digital Electronics	3	-	-	3	10	10	20	60	100	3
PCC	ET254210	ETC	Analog & Digital Communication	3	-	-	3	10	10	20	60	100	3
OE	ET254504 - 506	ETC	Open Elective II *	2			2	10	10	20	60	100	2
AEC	GE254705	BSH	Modern Indian Language II	2			2	10	10	20	60#	100	2
EM	ET254706	ETC	Entrepreneurship Development	2			2	10	10	20	60$	100	2
VEC	ET254707	ETC	Environmental and Sustainable Engineering	2			2	10	10	20	60#	100	2
PCC	ET254211	ETC	SS & DE Lab			2	2	15	15		20	50	1
EL	ET254807	ETC	PBL: Problem to Project based Learning			2	2	15	15		20	50	1
VSE	ET254604	ETC	Professional Development IV			2	2	15	15		20	50	1
EL	ET254808	ETC	Do It Yourself IV			2	2	15	15		20	50	1
Total for Major				**17**		**08**	**25**					**900**	**21**
MDM	ET254402	ETC	MDM-II *	2			2	10	10	20	60	100	2
Total for Major with Multidisciplinary Minor (Mandatory Credits)													**23**
HMM	ET254212	ETC	HMM-II	4			4	10	10	20	60	100	4
OR (Students will be allotted either HMM or DM as per defined criteria)													
DM	ET254213	ETC	DM-II	4			4	10	10	20	60	100	4
Total for Major with MDM+ (HMM/DM)				**23**		**08**	**31**					**1100**	**27**

*Courses offered by E&TC department for other department students.

#End semester Evaluation will be done at department level. $End semester Evaluation will be done at department level by Open-Book Examination.

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Open Elective Bucket Offered by All Departments						
Department	**OE I (SEM III)**		**OE II (SEM IV)**		**OE III (SEM V)**	
	Credit : 4		Credit : 2		Credit : 2	
	Course code	Course Name	Course code	Course Name	Course code	Course Name
Mechanical	ME253501	Mechatronics	**ME254504**	**3D Printing Technologies**	**ME255507**	**3D Printing and Rapid Prototyping**
	ME253502	Project Management for Engineers	ME254505	Robotics and Automation	ME255508	EV Technology
	ME253503	Numerical Methods in Engineering	ME254506	Energy Storage and Management Systems	ME255509	Renewable Energy Sources
Civil	**CE253501**	Environmental Impact Assessment	**CE254504**	**Remote Sensing and Geographic Information Systems**	**CE256507**	Interior Designs and Drawing
	CE253502	Experimental Stress Analysis	CE254505	Town Planning	CE256508	Development Engineering
	CE253503	Composite Materials	CE254506	Operation Research	CE256509	Planning for Sustainable Development
E&TC*	**ET253501**	**Digital Electronics**	**ET254504**	**Sensors and Actuators**	**ET255507**	**Internet of Things**
	ET253502	Signals & Systems	ET254505	Electrical Machines	ET255508	Instrumentation Engineering
	ET253503	Electronic Devices and Circuits	ET254506	Computer Architecture	ET255509	Wireless Communication Basics
CSE	**CS253501**	**C Programming**	**CS254504**	**Object Oriented Programming using Java**	**CS255507**	**Advanced JAVA**
	CS253502	Data Science and Analytics	CS254505	Fundamentals of Machine Learning	CS255508	Artificial Intelligence and Applications
	CS253503	Open Source and Software Technology	CS254506	Web Development Technologies	CS255509	Computer Network and Security
AIML	**AI253501**	**Python Programming**	AI254504	Cyber Security Fundamentals	**AI255507**	**Internet of Things**
	AI253502	Prompt Engineering	AI254505	Artificial Intelligence & Data Science	AI255508	Autonomous Intelligent System
	AI253503	Components and Applications of the Internet of Things	AI254506	Ethical Hacking	AI255509	Quantum Computing

***The Open Elective (OE) courses offered by the Department of E&TC are exclusively intended for students of other departments and are not open to students of the E&TC Department.**

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Multidisciplinary Minor (MDM) Courses Offered by All Departments

Department	MDM-I (SEM III) Credit : 2		MDM-II (SEM IV) Credit : 2		MDM- III (SEM V) Credit : 4		MDM- IV (SEM VI) Credit : 2		MDM-V (SEM VII) Credit : 4	
	Course code	Course Name	Course code	Course Name	Course code	Course Name	Course code	Course Name	Course code	Course Name
Mechanical	ME253401	Basic Mechanical Engineering	ME254402	Metrology and Mechanical Measurements	ME255403	Product Design and Development	ME256404	Smart Materials	ME257405	Automobile Engineering
Civil	CE253401	Basic Civil Engineering	CE254402	Building Construction and Materials	CE255403	Building Planning & Drawing	CE254404	Building Estimates & Tendering	CE254405	Construction Management
E&TC*	ET253401	Basic Electronics and Communication Engineering	ET254402	Digital Electronics and Logic Design	ET255403	Microprocessors and Microcontrollers	ET256404	Communication Systems and Networking	ET257405	Embedded Systems
CSE	CS253401	Database Systems	CS254402	Computational Statistics for AI	CS255403	Predictive Analytics and Visualization	CS256404	Advanced Machine Learning	CS257405	Prompt Engineering
AIML	AI253401	Database Systems	AI254402	Computational Statistics for AI	AI255403	Predictive Analytics and Visualization	AI256404	Advanced Machine Learning	AI257405	Prompt Engineering

***The MDM courses offered by the Department of E&TC are exclusively intended for students of other departments and are not open to students of the E&TC Department.**

Honours with Multidisciplinary Minor (HMM) Courses

Department	HMM-I (SEM III) Credit : 2		HMM-II (SEM IV) Credit : 4		HMM- III (SEM V) Credit : 4		HMM- IV (SEM VI) Credit : 4		HMM-V (SEM VII) Credit : 4	
	Course code	Course Name	Course code	Course Name	Course code	Course Name	Course code	Course Name	Course code	Course Name
E&TC	ET253206	MOOCs/SWAYAM/ NSQF courses.	ET253212	MOOCs/SWAYAM/ NSQF courses.		MOOCs/SWAYAM/ NSQF courses.		MOOCs/SWAYAM/ NSQF courses.		MOOCs/SWAYAM/ NSQF courses.

The HMM courses are exclusively intended for eligible students of the E&TC Department, as per the NEP guidelines.

OR

Double Minor (DM) Courses

Department	DM-I (SEM III) Credit : 2		DM-II (SEM IV) Credit : 4		DM- III (SEM V) Credit : 4		DM- IV (SEM VI) Credit : 4		DM-V (SEM VII) Credit : 4	
	Course code	Course Name	Course code	Course Name	Course code	Course Name	Course code	Course Name	Course code	Course Name
E&TC	ET253207	MOOCs/SWAYAM/ NSQF courses.	ET253213	MOOCs/SWAYAM/ NSQF courses.		MOOCs/SWAYAM/ NSQF courses.		MOOCs/SWAYAM/ NSQF courses.		MOOCs/SWAYAM/ NSQF courses.

The DM courses are exclusively intended for eligible students of the E&TC Department, as per the NEP guidelines.

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Course Title: Probability Theory and Transforms **Course Code: ET253202**		**Course Category: PCC**
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs./ week	CA-1	10 Marks
Tutorial:0	CA-2	10 Marks
Credits: 03	MSE	20 Marks
Semester: Second Year (Semester III)	ESE	60 Marks

Course Prerequisite:

- Basic Calculus and Statistics
- Set theory

Course Description:

This course introduces the foundational principles of probability theory and Laplace transforms providing essential tools for analyzing and modeling uncertainty in various engineering and scientific applications. It focuses on the mathematical framework for understanding random phenomena and their behavior over time, with applications in fields like communication systems, signal processing, control systems, and data science.

Course Objectives:

1. To provide mathematical background and sufficient experience so that students can read, write and understand sentences in the language of Probability Theory.
2. To introduce students to the basic methodology of "Probabilistic thinking" and apply it to problems
3. To study basic concepts of Probability theory and Random Variables, how to deal with Multiple Random Variables.
4. To learn various techniques for finding Laplace and Inverse Laplace Transforms for solving ordinary differential equations arising in engineering problems.

Course Outcomes:

COs	**After completion of the course: Student will be able to**	**Bloom's Level**
CO1	**Define** probability, random variables, distributions, Laplace and inverse transform and compute transforms of elementary functions.	Remember (Level 1)
CO2	**Explain** Bay's theorem, total probability, probability functions, distributions, methods of finding Laplace and inverse Laplace transform.	Understand (Level 2)
CO3	**Solve** problems involving probability, random variables, distributions, Laplace transforms, and inverse Laplace transform.	Apply (Level 3)
CO4	**Examine** probability distribution, Laplace transform of periodic, Heaviside and Dirac delta functions and solution of ordinary differential equations using Laplace Transform techniques.	Analyze (Level 4)

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CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	1	1	-
CO2	3	2	1	-	-	-	-	-	-	-	1	1	-
CO3	3	2	1	-	-	-	-	-	-	-	1	1	-
CO4	3	2	1	-	-	-	-	-	-	-	1	1	-

Assessment	
CA-1 (a)	Assignment/ Subjective test/ MCQ test
CA-2 (b)	Assignment/Subjective test / Presentations
MSE (c)	Mid Sem Examination

Course Contents		
Unit 1	**Probability Theory** Definition and axioms of probability, conditional probability, total probability theorem, Bayes' theorem	6 Hrs.
Unit 2	**One-dimensional Random Variable** Discrete random variable, Probability function, Continuous random variable, Probability Density function, Cumulative distribution function and its properties	6 Hrs.
Unit 3	**Special Distributions** Binomial, Poisson, Uniform, Exponential, Gaussian (Normal), Conditional Distribution, Conditional Density	6 Hrs.
Unit 4	**Two-dimensional Random Variable** Joint probability, cumulative distribution function and its properties. Marginal probability distribution ,conditional probability distribution .	6 Hrs.
Unit 5	**Laplace Transform** Transforms of elementary functions, Properties of Laplace transform. Evaluation of integrals using Laplace Transform. Laplace transforms periodic functions, Heaviside and Dirac delta functions.	6 Hrs.
Unit 6	**Inverse Laplace Transform** Introduction, Inverse transforms of some elementary functions, properties of inverse Laplace transform. General methods of finding inverse transforms: Partial fraction method, Convolution theorem Applications to differential equations.	6 Hrs.

Text Books	
1.	T. Veerrajan, "Probability, Statistics and Random Processes", Third Edition, McGraw Hill.
2.	Gupta, S.C. and Kapoor, V.K. Fundamentals of Mathematical Statistics. Sultan Chand and Sons, New Delhi, 1997
3.	Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, New Delhi.

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4.	Higher Engineering Mathematics by H. K. Das and Er. Rajnish Verma, S. Chand & CO. Pvt. Ltd., New Delhi.
Reference Books	
1.	Probability and Random Processes by Geoffrey Grimmett, David Stirzaker
2.	Probability, random processes, and estimation theory for engineers by Henry Stark, John William Woods
3	Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, New York
4	Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, Tata Mc Graw Hill Publishing Company Ltd., New Delhi.
Web Resources	
1	https://ocw.mit.edu/courses/res-6-012-introduction-to-probability-spring-2018/resources/lecture-notes/
2	https://nptel.ac.in/courses/111106139

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Course Title: Electronic Devices and Circuits Course Code: ET253203		Course Category: PCC
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs./ week	CA-1	10 Marks
Tutorial: -----	CA-2	10 Marks
Credits: 03	MSE	20 Marks
Semester: Second Year (Semester III)	ESE	60 Marks
Course Prerequisite: Knowledge of Semiconductor Physics, Mathematics and Basics of Electrical Engineering.		
Course Description: This course introduces the construction, working, and characteristics of key semiconductor devices, including BJT, JFET, and MOSFET. Students will analyze and design various amplifier circuits, explore power amplifiers, feedback amplifiers, and oscillators, and understand their performance parameters. The course also emphasizes voltage regulator design using both discrete components and integrated circuits.		
Course Objectives: 1. To introduce semiconductor devices BJT, JFET and MOSFET, their characteristics, operations, circuits and applications. 2. To analyze and interpret BJT, FET and MOSFET circuits for small signal at low and high frequencies. 3. To provide an understanding of power amplifiers and their classifications, focusing on efficiency, and power output. 4. To introduce the principles of feedback and oscillation in electronic circuits and their applications in amplifiers and signal generation. 5. To simulate electronics circuits using computer simulation software and verify desired results.		

Course Outcomes:		
COs	**After completion of the course student will be able to**	**Bloom's Level**
CO1	**Recall** concepts of BJT, JFET, MOSFET, amplifiers, feedback, oscillators, and regulators.	Remember (Level 1)
CO2	**Explain** working of biasing, amplifier configurations, feedback, oscillators, and voltage regulators.	Understand (Level 2)
CO3	**Apply** transistor principles to analyze amplifiers, oscillators, and regulator circuits.	Apply (Level 3)
CO4	**Analyze** performance of amplifiers, feedback circuits, and oscillators.	Analyze (Level 4)
CO5	**Analyze** and implement voltage regulator circuits using discrete components and IC regulators.	Analyze (Level 4)
CO6	**Evaluate** and compare amplifier classes, feedback methods, and regulator circuits.	Evaluate (Level 5)

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COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	1	-	-	-	-	-	-	-	-	-	1	-	-	1
CO2	3	2	-	-	-	-	-	-	-	-	-	1	-	-	1
CO3	3	3	2	2	1	-	-	-	1	-	1	3	-	-	1
CO4	3	3	2	-	1	-	-	-	-	-	-	1	-	-	1
CO5	3	3	2	1	-	-	-	-	-	-	-	1	-	-	1
CO6	3	2	2	2	2	-	-	-	1	-	1	2	-	-	1

Assessment	
CA-1 (a)	Subjective Test.
CA-2 (b)	CA II based on Simulation of electronic circuits etc.
MSE (c)	Mid Sem Examination Assessment is based on 50% of course contents
Practical (d)	

CO-PO Mapping

Course Contents		
Unit 1	**Bipolar Junction Transistor: BJT:** Construction, working, characteristics, Transistor as switch, Transistor configurations, current gain equation, stability factor. **BJT Biasing and basic amplifier configurations:** Need for biasing BJT, Transistor biasing methods, Transistor as an amplifier, Analysis of Single Stage Amplifier, RC coupled Amplifiers, Effects of bypass and coupling capacitors, Frequency response of CE amplifier, Emitter follower, Cascaded Amplifier, Need for multistage amplifiers.	6 hrs.
Unit 2	**Junction Field Effect Transistor: JFET:** JFET and its characteristics, JFET amplifiers, CS, CD, CG amplifiers, their analysis using small signal JFET model, Biasing the FET, The FET as VVR (Voltage Variable Resistor).	6 hrs.
Unit 3	**Metal Oxide Semiconductor Field Effect Transistor: MOSFET:** Overview of DMOSFET, EMOSFET, MOSFET as an Amplifier and Switch, Biasing in MOSFET, Small signal operation and models, Single stage MOS amplifier.	6 hrs.
Unit 4	**Power Amplifiers:** Introduction, classification of power amplifiers -A, B, AB, C and D, transformer coupled class A amplifier, Class B push pull and complementary symmetry amplifier, efficiency, calculation of power output, power dissipation, cross over distortion and its elimination methods.	6 hrs.
Unit 5	**Feedback Amplifiers:** Principle of Negative feedback in electronic circuits, Voltage series, Voltage shunt, Current series, Current shunt types of Negative feedback, Typical transistor circuits effects of Negative feedback on Input and Output impedance, Voltage and Current gains, Bandwidth.	6 hrs.
Unit 6	**Oscillators & Voltage Regulator Circuits:** Principle of Positive feedback, Concept of Stability in electronics circuits, Barkhausen criteria for oscillation, RC, Wien Bridge, Hartley, Colpitt, Clapp, UJT Relaxation Oscillators. **Transistor application:** Discrete transistor voltage Regulation, series voltage regulator, shunt voltage regulator. **IC Voltage Regulators:** Three terminal voltage regulator, Variable voltage regulator.	6 hrs.

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Text Books	
1.	J. B. Gupta, "Electronic Devices and Circuits", Katson Education Series (6th Edition)
2.	A. S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College Publishing, 1991.
3.	Donald Neaman, "Electronic Circuit Analysis and Design", Tata McGraw Hill, (3rd Edition), (2007).
4.	R. L. Boylestad, L. Nashlesky, "Electronic Devices and Circuits Theory", Prentice Hall of India, (11th Edition), (2013).
Reference Books	
1.	David A. Bell, "Electronic Devices and Circuits", Oxford, (5th Edition) (2008).
2.	Millman Halkias, "Integrated Electronics- Analog and Digital Circuits and Systems", Tata McGraw Hill, (2nd Edition) (2010).
3.	K. Lal Kishore, *Electronic Devices and Circuits*, Pearson Education, 2nd Edition.
4.	S. Salivahanan, N. Suresh Kumar and A. Vallavaraj, *Electronic Devices and Circuits*, McGraw-Hill Education, 3rd Edition.
Web Resources	
1.	https://onlinecourse s.nptel.ac.in/noc24_ ee106/preview
2.	https://onlinecourses.swayam2.ac.in/e-learning/preview/ntr26_ed101

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Course Title: Network Analysis **Course Code: ET253204**		**Course Category:PCC**
Teaching Scheme	**Examination Scheme**	
Lectures: 3Hrs/week	CA-1	10 Marks
Tutorial: -----	CA-2	10 Marks
Credits: 03	MSE	20 Marks
Semester: Second Year (Semester III)	ESE	60 Marks

Course Pre-requisite:

- Basics of electrical engineering

Course Description:

Network analysis is the process of determining the behavior and performance of electrical circuits. This involves calculating the voltages, currents, and power in various components like resistors, capacitors, inductors, and power sources within the circuit. The goal of circuit analysis is to understand how each component interacts and contributes to the overall performance of the circuit. This is essential for designing, optimizing, and troubleshooting electrical and electronic systems.

Course Objectives:

1. To learn different circuit simplification techniques.
2. To introduce the network theorems and apply them to solve complex DC and AC circuits
3. To familiarize with the time domain and frequency domain responses of RLC circuits.
4. To introduce two port network concepts to determine network parameters
5. To introduce graph theory and passive filters

Course Outcomes:

COs	**After completion of the course: Student will be able to**	**Bloom's Level**
CO1	**Recall** the basic laws, behavior of circuit elements and initial conditions for circuit elements and their responses for different standard inputs.	Remember (Level 1)
CO2	**Explain** the different circuit simplification techniques, theorems and RLC circuits.	Understand (Level 2)
CO3	**Solve** complex circuits using theorems & the time-domain & frequency domain response of RLC circuits.	Apply (Level 3)
CO4	**Implement** simple circuits to verify circuit theorems.	Apply (Level 3)
CO5	**Implement** simple circuits to verify circuit theorems.**Examine** two-port networks, graph theory, and filter circuits to determine various network parameters and their interrelationships.	Analyze (Level 4)
CO6	**Analyze** frequency response of RLC circuits	Analyze (Level 4)

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CO-PO Mapping

CO-PO Mapping												
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	3	-	-	-	-	-	-	-	-	-	2	
CO2	3	3	2	-	-	-	-	-	-	-	-	2	
CO3	3	3	2	2	-	-	-	-	-	-	-	3	2
CO4	3	3	2	2	-	-	-	-	-	-	-	3	2
CO5	-	-	3	2	2	-	-	-	-	-	-	3	2
CO6	3	2	-	2	2	-	-	-	-	-	-	3	3

Assessment	
CA-1 (a)	Subjective examination (Numerical answer type)
CA-2 (b)	Circuit Simulation/Assignment
MSE (c)	Subjective examination on unit no 1, 2, & 3
Practical (d)	

Course Contents		
Unit 1	**Basic circuit concepts:** Classification of Networks, Circuit elements, Circuit simplifications, Star-Delta Transformation, Energy sources and Source Transformation, Mesh Analysis, Supermesh Analysis, Node Analysis, Supernode Analysis.	6 Hrs
Unit 2	**Network Theorems (DC & AC Analysis)**: Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem, Reciprocity Theorem.	6 Hrs
Unit 3	**Time domain analysis of RLC circuits:** Introduction, Initial Conditions, Resistor–Inductor Circuit, Resistor–Capacitor Circuit, Resistor–Inductor–Capacitor Circuit	6 Hrs
Unit 4	**Frequency domain analysis of RLC circuits:** Basic standard input functions and its Laplace Transformation, initial and final value theorems, Frequency Domain Representation of RLC Circuits, Resistor–Inductor Circuit, Resistor–Capacitor Circuit, Resistor–Inductor–Capacitor Circuit, Response of RL Circuit to Various Functions, Response of RC Circuit to Various Functions	6 Hrs

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Unit 5	**Two-port networks**: Introduction, Open-Circuit Impedance Parameters (Z Parameters), Short-Circuit Admittance Parameters (Y Parameters), Transmission Parameters (ABCD Parameters), Hybrid Parameters (h Parameters), Inter-relationships between the Parameters, Interconnection of Two-Port Networks, T-Network, Pi-Network, Lattice Networks, Terminated Two-Port Networks.	6 Hrs
Unit 6	**Basics graph theory and passive filter:** Graph Terminologies, Incidence Matrix, Loop Matrix or Circuit Matrix, Cutset Matrix, Classification of Filters, T-Network, Pi-Network, Characteristic of Filters, Constant-k Low Pass Filter, Constant-k High-pass Filter, Band-pass Filter, Band-stop Filter.	6 Hrs

TextBooks	
1	D. Roy Choudhury, "Networks and Systems", New Age International Publications.
2	A. Chakrabarti, "Circuit Theory: Analysis and Synthesis", Dhanpat Rai Publications.
3	Sudhakar & Palli, "Circuits and Networks: Analysis and Synthesis", McGraw Hill.
4	Ravish R Singh,"Circuit Theory and Networks",McGraw Hill Education (India) Private Limited.
Reference Books	
1	M. E. Van Valkenburg, "Network Analysis", Pearson Education.
2	William H. Hayt, Jack E. Kemmerly, Steven M. Durbin, "Engineering Circuit Analysis", McGraw Hill.
3	Edminister, J. A., and Nahvi, M., "Electric Circuits", Schaum's Outline Series, McGraw Hill.
4	Van Valkenburg, M. E., "Analog Filter Design", Holt, Rinehart and Winston.
Web Resources	
1.	NPTEL Circuit Theory https://nptel.ac.in/courses/108104139
2.	NPTEL Basic Electrical Circuits https://nptel.ac.in/courses/108106172

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Course Title: Universal Human Values II **Course Code: GE253703**		**Course Category: VEC**
Teaching Scheme	**Examination Scheme**	
Lectures: 02 hrs. / Week	CA-1	10 Marks
Tutorial: -	CA-2	10 Marks
Credits: 02	MSE	20 Marks
Semester: Second Year (Semester III)	ESE	60 Marks
Course Prerequisite: Universal Human Values I		
Course Description: This course introduces the fundamentals of **value education**, focusing on self-exploration, human aspirations, and continuous happiness. It emphasizes harmony within the individual, in relationships, society, and nature. The course develops understanding of **human values, ethics, and professional responsibility**. It encourages students to adopt a **holistic and sustainable approach** to life and decision-making. Learners are guided to apply these values in personal and professional contexts.		
Course Objectives: 1. Explain the concept of value education, self-exploration, and the relationship between happiness, prosperity, and basic human aspirations. 2. Distinguish between the needs of self and the body and apply methods to achieve harmony within the individual and between the self and the body. 3. Demonstrate understanding of harmony in the family and society by applying foundational values such as trust and respect in human relationships. 4. Analyze the interconnectedness and mutual fulfilment among the four orders of nature and relate it to sustainable living and coexistence. 5. Apply a holistic understanding of human values to professional ethics, decision-making, and strategies for value-based life and profession.		

Course Outcomes:		
COs	**After completion of the course students will be able to**	**Bloom's Level**
CO1	**Define** the concepts of value education, human aspirations, harmony in human beings, family, society, nature and professional ethics.	Remember (Level 1)
CO2	**Explain** the role of self-exploration, human values, relationships and harmony in achieving continuous happiness and prosperity.	Understand (Level 2)
CO3	**Demonstrate** the interrelationship among human beings, society, nature and ethical conduct for universal human order.	Apply (Level 3)
CO4	**Distinguish** the human values and professional ethics in personal and professional life.	Analyze (Level 4)

CO-PO-PSO Mapping													
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1						2	3	1			3		
CO2						2	3	2			3		
CO3						3	3	2			2		
CO4						3	3	3			3		

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Assessment	
CA-1 (a)	Subjective Test / Assignment/ MCQ Test
CA-2 (b)	Subjective Test / Assignment/ MCQ Test
MSE (c)	Subjective Test
ESE (d)	Exam

Course Contents		
Unit 1	**Introduction to Value Education:** Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity, the Basic Human Aspirations, Right Understanding, Relationship and Physical Facility, Happiness and Prosperity, Current Scenario, Method to Fulfill the Basic Human Aspirations.	4 Hrs.
Unit 2	**Harmony in the Human Being** Understanding human beings as the Co-existence of the Self and the Body, distinguishing between the Needs of the Self and the Body, Harmony of the Self with the Body, self-regulation, and Health.	4 Hrs.
Unit 3	**Harmony in the Family and Society:** Harmony in the Family, the Basic Unit of Human Interaction, Values in Human-to-Human Relationship, 'Trust' – the Foundational Value in Relationship, 'Respect'– as the Right Evaluation, Understanding Harmony in the Society, Vision for the Universal Human Order	4 Hrs.
Unit 4	**Harmony in Nature (Existence)** Understanding Harmony in Nature, Interconnectedness, self-regulation and Mutual Fulfillment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence.	4 Hrs.
Unit 5	**Implications of Holistic Understanding** Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order.	4 Hrs.
Unit 6	**Value-Based life and Professional Practices** Competence in Professional Ethics- Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession.	4 Hrs.

Sr. No.	Textbooks
1.	A Foundation Course in Human Values and Professional Ethics R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1.
2.	Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2
Sr. No.	**Reference Books**
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.

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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
11.	India Wins Freedom - Maulana Abdul Kalam Azad
12.	Vivekananda - Romain Rolland (English)
13.	Gandhi - Romain Rolland (English)
Sr. No.	**Web Resources**
1.	https://uhv.org.in/UHV-II_Course_Material

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Course Title: Financial Management **Course Code: ET253704**		**Course Category: HSSM-EM**
Teaching Scheme	**Examination Scheme**	
Lectures: 02 hrs./ week	CA-1	10 Marks
Tutorial: -----	CA-2	10 Marks
Credits: 02	MSE	20 Marks
Semester: Second Year (Semester III)	ESE	60 Marks

Course Prerequisite:

- Basic knowledge of mathematics, economics, and business concepts, along with familiarity with MS Excel or spreadsheet tools for basic financial calculations.

Course Description:

This course introduces the fundamental concepts of financial management, including financial statements, time value of money, capital budgeting, cost of capital, and working capital management. It enables engineering students to analyze financial information and apply financial decision-making techniques in engineering and business projects.

Course Objectives:

1. To introduce the fundamental concepts, scope, and objectives of financial management and the role of financial decision-making in engineering organizations.
2. To develop the ability to understand and interpret financial statements and analyze financial performance using various financial ratios and analytical techniques.
3. To familiarize students with the concept of Time Value of Money and enable them to apply financial tools for evaluating loans, investments, and financial decisions.
4. To provide knowledge of capital budgeting, cost of capital, capital structure, and working capital management for effective financial planning and decision-making in engineering projects.

Course Outcomes:

COs	**After completion of the course: Student will be able to**	**Bloom's Level**
CO1	**Recall** the fundamental concepts, objectives, functions, financial decisions, and sources of business finance.	Remember (Level 1)
CO2	**Explain** the concepts of financial planning, financial statement analysis, cost of capital, capital budgeting, and working capital management.	Understand (Level 2)
CO3	**Apply** financial management tools and techniques such as ratio analysis, capital budgeting methods, and working capital financing in business situations.	Apply (Level 3)
CO4	**Analyze** financial performance, investment decisions, and working capital requirements using appropriate financial management techniques.	Analyze (Level 4)

CO-PO Mapping

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	-	1	-	-	-	1	-	1	-	3	1	-	1
CO2	-	1	-	-	-	1	-	1	-	3	1	-	1
CO3	-	1	-	-	-	1	-	1	-	3	1	-	1
CO4	-	1	-	-	-	1	-	1	-	3	1	-	1

Assessment	
CA-1 (a)	MCQ Test / Subjective Test
CA-2 (b)	Presentation / Case Study
MSE (c)	Subjective Test

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Course Contents		
Unit 1	**Finance Management – Conceptual Foundations** Introduction to Business Finance, Objectives of Financial Management, Roles and Responsibilities of Finance Manager, Finance Decisions: Investment Decision, Financing Decisions, and Dividend Decisions, Wealth maximization vs. profit maximization.	4 Hrs
Unit 2	**Planning and Analysis** Meaning and importance of financial planning, Introduction to Income Statement and Balance Sheet, Theoretical overview of Ratio based analysis: liquidity, solvency, profitability, and turnover ratios.	4 Hrs
Unit 3	**Sources of Finance and Cost of Capital** Internal and External Financing: Concept and difference. Long-term and short-term sources of finance. Concept of cost of capital: cost of equity, cost of debt, preference shares, and weighted average cost of capital (WACC) – theoretical overview.	4 Hrs
Unit 4	**Capital Budgeting** Meaning of Capital Budgeting, Nature and Characteristic, Importance, Objective, Capital Budgeting Techniques: Payback Period; Discounted Payback Period; IRR; ARR; NPV, Factors Affecting Capital Budgeting Decisions, Limitations of Capital Budgeting.	4 Hrs
Unit 5	**Working Capital** Concept of working capital, operating cycle, Nature of working capital, Types of Working Capital, Profitability v/s Liquidity, Inventory Management: Types, Motives of holding inventory, Cash Management- Motives of Holding Cash, Factors Determining Cash, Receivables in credit management. Brief overview of credit policy decisions (collection period, credit terms).	4 Hrs
Unit 6	**Working Capital Financing** Meaning of Working Capital Financing, Need, Short term and long-term Financing, Trade Credit, Bank credit: OD; Term Loan; CC; Hypothecation Loan; Bill Discounting.	4 Hrs

Text Books	
1.	Financial Management—I M Pandey (Vikas Publishing House)
2.	Financial Management---Prassana Chandra (Tata McGraw Hill)
3.	Financial Management-Rajiv Srivastava and Anil Mishra (Oxford University press)
Reference Books	
1.	Financial Management Theory & Practice and Eugene F. Brigham/Michael C. Ehrhardt's
2.	Fundamentals of Financial Management by James C. VanHorne
3.	Financial Management: Text and Problems---MY Khan and PK Jain
4.	Brealey., & Myers., Principles of corporate finance (710h ed.). Tata McGraw Hill
Web Resources	
1.	Financial Management for Managers—Prof. Anil K Sharma https://onlinecourses.nptel.ac.in/noc20_mg31/preview
2.	Corporate Finance---By Prof. Abhijeet Chandra IIT Kharagpur https://onlinecourses.nptel.ac.in/noc21_mg93/preview

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Course Title: Digital Electronics		
Course Code: ET253501		**Course Category:OE**
Teaching Scheme	**Examination Scheme**	
Lectures: 04 hrs/ week	CA-1	10 Marks
Tutorial: -----	CA-2	10 Marks
Credits: 04	MSE	20 Marks
Semester: Second Year (Semester III)	ESE	60 Marks

Course Prerequisite:

- Basic number system
- Boolean Algebra
- Logic gates

Course Description:

The **Digital Electronics** course introduces the fundamental principles of digital logic design, combinational and sequential circuits, and digital logic families. Students will be able to explore the design and analysis of circuits. The course also covers programmable logic devices and semiconductor memories, emphasizing practical applications and system design using modern digital components.

Course Objectives:

1. Develop understanding of Boolean algebra and logic simplification.
2. Design combinational and sequential logic circuits.
3. Analyze and implement finite state machines
4. Understand logic families, PLDs, and data converters

Course Outcomes:

COs	After completion of the course: Student will be able to	**Bloom's Level**
CO1	**Define and recall** fundamental concepts of digital electronics, logic gates, Boolean algebra, and digital systems	Remember (Level 1)
CO2	**Explain** the principles of digital logic, combinational and sequential circuits, and interpret their behavior.	Understand (Level 2)
CO3	**Implement** Boolean algebra and design techniques to implement digital circuits using logic gates and ICs	Apply (Level 3)
CO4	**Demonstrate** and realize digital systems such as adders, code converters, multiplexers, and sequential circuits.	Analyze (Level 4)

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	1	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	-
CO3	3	2	2	1	-	-	-	-	-	-	-	-	-
CO4	3	2	3	1	-	-	-	-	-	-	-	-	-

Assessment	
CA-1 (a)	Subjective Test / Open book test / etc
CA-2 (b)	CL PBL
MSE (c)	Mid Sem Examination

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Course Contents		
Unit 1	**Boolean Function Optimization** Boolean Functions: Canonical and standard forms (SOP and POS), Simplification of Boolean functions using algebraic methods, Gate-Level Minimization: Karnaugh Map (K-map) method for up to 4 variables, Minterm and maxterm; Don't-care conditions, Sum of Products (SOP) and Product of Sums (POS) simplification NAND and NOR gate implementation of simplified expressions	8 Hrs
Unit 2	**Combinational Logic Design** Design methodology for combinational logic circuits, Arithmetic circuits: half adder, full adder, subtractors, Look-ahead carry adders for high-speed addition, BCD and code converter circuits, Digital comparators (1-bit and 2-bit), Parity generators and checkers, Multiplexers and De-multiplexers: design and applications, Decoders and encoder.	8 Hrs
Unit 3	**Flip-Flops** 1-bit memory cell and the concept of bistable storage, Clocked flip-flops: SR, JK, Master-Slave JK, D, and T types, Preset and clear terminals and their applications, Excitation tables for flip-flops; flip-flop conversion techniques.	8 Hrs
Unit 4	**Sequential Circuits** Registers and shift registers (SISO, SIPO, PISO, PIPO), Sequence generators using shift registers, Ripple counters, up/down counters, and synchronous counters.	8 Hrs
Unit 5	**Digital Logic Families** Characteristics of Logic Families, Classification of logic families: RTL, DTL, ECL, TTL, CMOS, Operation of the TTL NAND gate; active pull-up circuit, Tri-State logic, CMOS inverter operation; CMOS NAND and NOR gates	8 Hrs
Unit 6	**PLDs & Semiconductor Memories** Overview and architecture of Programmable Logic Devices (PLDs),PROM as a programmable logic device.	8 Hrs

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Text Books	
1.	M. Morris Mano, —Digital Logic and Computer Design‖ 4th edition, Prentice Hall of India, 2013.
2.	Anand Kumar, —Fundamentals of digital circuits‖ 1st edition, Prentice Hall of India,2001
3.	Bakwad K.M. ,Deshmane A.K.-Digital Electronics
Reference Books	
1.	R.P. Jain, —Modern digital electronics, 3rd edition, 12threprint Tata McGraw Hill **Publication, 2007.**
2.	Albert Paul Malvino and Donald P. Leach -Digital Principle and Applications
Web Resources	
1	https://nptel.ac.in/courses/108105132 Prof. Goutam Saha, IIT Kharagpur

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Course Title: Signals and Systems Course Code:ET253502		Course Category: OE
Teaching Scheme	**Examination Scheme**	
Lectures: 04 hrs/ week	CA-1	10 Marks
Tutorial: -----	CA-2	10 Marks
Credits: 04	MSE	20 Marks
Semester: Second Year (Semester III)	ESE	60 Marks

Course Prerequisite:

- Basics of Engineering Mathematics.

Course Description:

This course introduces the fundamental concepts of signals and systems, focusing on their mathematical representations, classifications, and applications in real-world scenarios, including communications, control systems, and signal processing

Course Objectives:

1. To understand, classify signals and systems based on their characteristics and perform basic operations on signals.
2. To study Linear Time Invariant (LTI) Systems.
3. To provide the spectral properties of signals using Fourier Series and Transform.
4. To prepare students for advanced topics in communication, control systems, and signal processing.

Course Outcomes:

COs	After completion of the course student will be able to	Bloom's Level
CO1	**Define** the fundamental concepts of signals and systems with their mathematical representation and applications.	Remember, (Level 1)
CO2	**Explain** the concept of computational techniques for determining system behavior and responses.	Understand (Level 2)
CO3	**Use** of simulation and programming tools such as MATLAB for modeling, visualization, and analysis of signals and systems.	Apply (Level 3)
CO4	**Examine**signals and systems analysis concepts to real-world applications in communication, control systems, audio processing, and biomedical engineering.	Analyze (Level 4)

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	1	1	1	1	1	-	-	-	-	-		
CO2	3	3	2	2	2	1	-	-	-	-	-		
CO3	3	3	3	2	2	1	-	-	-	-	-		
CO4	3	2	2	3	3	1	-	-	-	-	-		

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Assessment	
CA-1 (a)	Subjective Test /Open Book Test etc.
CA-2 (b)	Assignment / Presentation / Model Making
MSE (c)	Mid Sem Examination

Course Contents		
Unit 1	**Basics of Signals and Their Operations** Definition of Signals: Continuous-Time (CT) and Discrete-Time (DT) signals. Classification of Signals: Even, odd, and periodic signals. Elementary Test Signals: Sine wave, step, ramp, and rectangular signals. Basic Signal Operations: Amplitude scaling, time shifting, and time reversal.	8 Hrs
Unit 2	**Convolution & Correlation of Signals** Definition and Concept of Convolution, Convolution integral for CT signals, Convolution sum for DT signals, Properties of convolution and applications, Definition and Concept of Correlation: Cross-correlation and auto-correlation, Application of Correlation.	8 Hrs
Unit 3	**Introduction to MATLAB and Signal Representation** Introduction to MATLAB Environment, Signal Representation in MATLAB, Signal Operations in MATLAB, Plotting Results in MATLAB, Apply MATLAB tools to solve practical problems in communication, control systems, and signal processing.	8 Hrs
Unit 4	**Fundamentals of Systems** Definition of LTI Systems and Impulse Response: Continuous-Time and Discrete-Time systems, Classification of Systems: Causal and non-causal, linear and nonlinear systems, Properties of Systems: Stability, invertibility, and time invariance, Convolution for DT-LTI Systems: Convolution sum for discrete-time linear time-invariant systems,	8 Hrs
Unit 5	**Transform Analysis of CT Signals** Fourier series (FS) representation of periodic Continuous Time (CT) signals, Dirichlet condition for existence of Fourier series, Properties of Fourier Series for CT signals, Fourier Transform (FT): Representation of aperiodic CT signals, Dirichlet conditions for Fourier Transform, FT of Standard Signals: Sine wave, exponential, and step signals	8 Hrs
Unit 6	**Advanced Trends and Applications of Signal and System Analysis** Application of signals in audio and speech processing (e.g., noise reduction, compression), Introduction to signal analysis in feature extraction for biomedical applications.	8 Hrs

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Text Books	
1.	S. Palani, "Signals and Systems", Springer, 2nd Edition.
2.	B. P. Lathi," Principles of Signal Processing and Linear Systems", Oxford University Press,2nd Edition.
3.	Alan V. Oppenheim, Alan S. Willsky and S. Hamid Nawab, "Signals and Systems" , Pearson Education, 2nd Edition.
4.	Stephen J. Chapman, "MATLAB Programming for Engineers, Cengage Learning", 7th Edition, 2024.
Reference Books	
1.	Simon Haykins and Barry Van Veen, "Signals and Systems", John Wiley and sons.
2.	Shaila D. Apte, "Signals and Systems: Principles and Applications" , Cambridge University Press, 1st Edition, 2016.
3	Hwei P. Hsu, "Signals and Systems, Schaum's Outline Series, McGraw Hill Education", 2nd Edition, 2011.
4.	Brian R. Hunt, Ronald Lipsman, Jonathan Rosenberg, A Guide to MATLAB for Beginners and Experienced Users, Cambridge University Press.
Web Resources	
1.	https://onlinecourses.nptel.ac.in/noc25_ee78/preview
2.	https://ocw.mit.edu/courses/res-6-007-signals-and-systems-spring-2011/video_galleries/video-lectures/
3.	https://www.mathworks.com

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Course Title: Electronic Devices and Circuits Course Code: ET253503		Course Category: OE
Teaching Scheme	**Examination Scheme**	
Lectures: 04 hrs./ week	CA-1	10 Marks
Tutorial: -----	CA-2	10 Marks
Credits: 04	MSE	20 Marks
Semester: Second Year (Semester III)	ESE	60 Marks
Course Prerequisite: Knowledge of Semiconductor Physics, Mathematics and Basics of Electrical Engineering.		
Course Description: This course introduces the construction, working, and characteristics of key semiconductor devices, including BJT, JFET, and MOSFET. Students will analyze and design various amplifier circuits, explore power amplifiers, feedback amplifiers, and oscillators, and understand their performance parameters. The course also emphasizes voltage regulator design using both discrete components and integrated circuits.		
Course Objectives: 1. To introduce semiconductor devices BJT, JFET and MOSFET, their characteristics, operations, circuits and applications. 2. To analyze and interpret BJT, FET and MOSFET circuits for small signal at low and high frequencies. 3. To provide an understanding of power amplifiers and their classifications, focusing on efficiency, and power output. 4. To introduce the principles of feedback and oscillation in electronic circuits and their applications in amplifiers and signal generation. 5. To simulate electronics circuits using computer simulation software and verify desired results.		

Course Outcomes:		
COs	**After completion of the course student will be able to**	**Bloom's Level**
CO1	**Recall** concepts of BJT, JFET, MOSFET, amplifiers, feedback, oscillators, and regulators.	Remember (Level 1)
CO2	**Explain** working of biasing, amplifier configurations, feedback, oscillators, and voltage regulators.	Understand (Level 2)
CO3	**Apply** transistor principles to analyze amplifiers, oscillators, and regulator circuits.	Apply (Level 3)
CO4	**Analyze** performance of amplifiers, feedback circuits, and oscillators.	Analyze (Level 4)
CO5	**Analyze** and implement voltage regulator circuits using discrete components and IC regulators.	Analyze (Level 4)
CO6	**Evaluate** and compare amplifier classes, feedback methods, and regulator circuits.	Evaluate (Level 5)

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CO-PO Mapping

CO-PO Mapping													
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	-	-	-	1	-
CO2	3	2	-	-	-	-	-	-	-	-	-	1	-
CO3	3	3	2	2	1	-	-	-	1	-	1	3	-
CO4	3	3	2	-	1	-	-	-	-	-	-	1	-
CO5	3	3	2	1	-	-	-	-	-	-	-	1	-
CO6	3	2	2	2	2	-	-	-	1	-	1	2	-

Assessment	
CA-1 (a)	Subjective Test.
CA-2 (b)	CA II based on Simulation of electronic circuits etc.
MSE (c)	Mid Sem Examination Assessment is based on 50% of course contents
Practical (d)	

Course Contents		
Unit 1	**Bipolar Junction Transistor: BJT:** Construction, working, characteristics, Transistor as switch, Transistor configurations, current gain equation, stability factor. **BJT Biasing and basic amplifier configurations:** Need for biasing BJT, Transistor biasing methods, Transistor as an amplifier, Analysis of Single Stage Amplifier, RC coupled Amplifiers, Effects of bypass and coupling capacitors, Frequency response of CE amplifier, Emitter follower, Cascaded Amplifier, Need for multistage amplifiers.	8 hrs.
Unit 2	**Junction Field Effect Transistor: JFET:** JFET and its characteristics, FET Configurations (CS/CD/CG) and their Comparison. Biasing of FET (Self). FET as an amplifier and its analysis (CS) and its frequency response.	8 hrs.
Unit 3	**Metal Oxide Semiconductor Field Effect Transistor: MOSFET:** Overview of DMOSFET, EMOSFET, Biasing in MOSFET, MOSFET as an Amplifier and Switch, Current sink and source, current mirror, Voltage references, Basic principle of band gap reference, CMOS Inverter as amplifier: Active load, Current source and Push pull configurations.	8 hrs.
Unit 4	**Power Amplifiers:** Introduction, classification of power amplifiers -A, B, AB, C and D, transformer coupled class A amplifier, Class B push pull and complementary symmetry amplifier, efficiency, calculation of power output, power dissipation, cross over distortion and its elimination methods.	8 hrs.
Unit 5	**Feedback Amplifiers:** Principle of Negative feedback in electronic circuits, Voltage series, Voltage shunt, Current series, Current shunt types of Negative feedback, Typical transistor circuits effects of Negative feedback on Input and Output impedance, Voltage and Current gains, Bandwidth.	8 hrs.
Unit 6	**Oscillators & Voltage Regulator Circuits:** Principle of Positive feedback, Concept of Stability in electronics circuits, Barkhausen criteria for oscillation, RC, Wien Bridge, Hartley, Colpitt, Clapp, UJT Relaxation Oscillators.	8 hrs.

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	Transistor application: Discrete transistor voltage Regulation, series voltage regulator, shunt voltage regulator. **IC Voltage Regulators:** Three terminal voltage regulator, Variable voltage regulator.	

Text Books	
1.	Gupta, J.B. "Electronic Devices And Circuits", S.K Kataria and Sons.
2.	Sedra, A. S. "Microelectronics Circuits" , Oxford University Press.
3.	Neamen, Donald A., "Electronic Circuit Analysis and Design", Tata McGraw Hill Edu. Pvt. Ltd
4.	Boylestad, R. L., "Electronic Devices and Circuits Theory", PHI Learning Pvt. Ltd.
Reference Books	
1.	Bell, D.A, "Electronic Devices and Circuits", Oxford University Press.
2.	Millman Halkias, "Integrated Electronics- Analog and Digital Circuits and Systems", Tata McGraw Hill Edu. Pvt. Ltd.
3.	K. Lal Kishore, Electronic Devices and Circuits, Pearson Education.
4.	S. Salivahanan, N. Suresh Kumar and A. Vallavaraj, Electronic Devices and Circuits, McGraw-Hill Education.
Web Resources	
1.	https://onlinecourse s.nptel.ac.in/noc24_ ee106/preview
2.	https://onlinecourses.swayam2.ac.in/e-learning/preview/ntr26_ed101

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Course Title: Electronic Devices and Circuits & Network Analysis Lab.		
Course Code: ET253205	**Course Category: PCC**	
Teaching Scheme	**Examination Scheme**	
Practical's/Sessions: 02 Hours/Week	CA-I	15 Marks
Credits: 01	CA-II	15 Marks
Semester: Second Year (Semester III)	ESE	20 Marks

Course Prerequisite:

- Basics of Electrical and Electronics Engineering.

Course Description: The EDC and NA laboratory provides practical exposure to the behavior and characteristics of electronic devices and electrical networks. Students perform experiments on semiconductor devices such as diodes and transistors, analyze amplifier circuits, and verify fundamental network theorems. The laboratory helps students understand circuit behavior through practical implementation and measurement.

Course Objectives:

1. To understand characteristics of semiconductor devices such as diode, BJT and FET.
2. To analyze amplifier circuits and observe their performance parameters.
3. To verify basic network theorems using practical circuits.
4. To study frequency response and parameters of electrical networks.

Assessment	
CA-I (a)	Based on Actual conduction of First 6 Experiments.
CA-II (b)	Based on Actual conduction of next 6 Experiments.
ESE (c)	Practical examination and oral.

Sr. No.	List of Experiments
1.	To plot the V–I characteristics of a PN junction diode in forward and reverse bias and determine the cut-in voltage.
2.	To construct and analyze half-wave and full-wave rectifier circuits with capacitor filter and compare their output characteristics.
3.	To analyze Input–Output Characteristics of Common Emitter Configuration.
4.	To analyze the operation of a transistor as an amplifier.
5.	To analyze Drain Characteristics and Transfer Characteristics of a Field Effect Transistor (FET).
6.	To verify MOSFET as a switching device.

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7.	To solve and verify Superposition Theorem for a given circuit.
8.	To solve and verify Thevenin's Theorem for a given circuit.
9.	To solve and verify Norton's Theorem for a given circuit.
10.	To solve and verify Reciprocity Theorem for a given circuit.
11.	To solve and verify the frequency response of series RLC circuits.
12.	To solve and verify Two Port Network parameters for a given circuit.

Note: The Course Outcomes (COs) and the corresponding CO-PO mapping for this laboratory course are aligned with and detailed in the respective Theory Course Syllabus (ET253203, ET253204).

Web Resourses	
V Lab for EDC	https://be-iitkgp.vlabs.ac.in/ https://ade2-iitr.vlabs.ac.in/ https://asnm-iitkgp.vlabs.ac.in/List%20of%20experiments.html
V Lab for NA	https://na-iiith.vlabs.ac.in/List%20of%20experiments.html

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Course Title: PBL: Problem based Learning **Course Code:ET253805**		**Course Category: EL**
Teaching Scheme	**Examination Scheme (As Applicable)**	
Practicals/Sessions: 02 Hours/Week	CA-I	15 Marks
Credits: 01	CA-II	15 Marks
Semester: Second Year (Semester III)	ESE	20 Marks
Course Prerequisite: Use of analytical skills and drawing tools, Design Thinking Module.		
Course Description: This course enables students to learn engineering concepts through solving real-world course related technical problems at detailed project level. It emphasizes application of domain knowledge, critical thinking, and systematic problem-solving. In this course students will remain engaged in need identification, solution development, prototyping, and validation within given constraints. The course promotes teamwork and hands-on learning. Outcomes are demonstrated through a representational prototype of proposed solution along with detailed documentation. The course coordinators will guide to the students in the journey of problem solving by providing the resources in the lab activity sessions and also monitor the students progress.		
Course Objectives: 1. To enable students to apply domain knowledge for solving real-world course related technical problems through a structured problem-based learning approach. 2. To guide students in analyzing problems, generating feasible solutions, and making informed engineering decisions. 3. To facilitate the development of design, implementation, and testing skills through project-based activities. 4. To cultivate teamwork, communication, and professional skills through continuous mentoring and evaluation.		

Course Outcomes:		
COs	**After completion of the course: Student will be able to**	**Bloom's Level**
CO1	**Understand** real-world engineering problems by identifying basic requirements, limitations, and relevant knowledge.	L2 Understand
CO2	**Apply** engineering concepts, tools, and methods to develop a working solution.	L3 Apply
CO3	**Analyze** engineering problems by connecting theory with practical situations and finding possible solution approaches.	L4 Analyze
CO4	**Evaluate** different engineering solutions based on factors like feasibility, cost, efficiency, and sustainability.	L5 Evaluate

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CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2		1								2	2
CO2	3	2	2	2	2			2			1	3	2
CO3	3	3	3	1	1			2			1	3	2
CO4	2	2	3	2	2	1		1			1	3	3

Assessment	
CA-I (a)	Identify a real-life problem related to your subject. Clearly explain the problem, understand the needs of users, and list the important constraints (such as cost, materials, and time). Study existing solutions for the same problem. Then, generate different possible solutions and select the best one based on practicality, cost, and effectiveness.
CA-II (b)	Based on the selected solution, design and build a representational model of prototype. Prepare a proper plan, use suitable tools and methods to develop it. Make improvements if needed, and finally demonstrate the representational model with clear documentation.
ESE (c)	Assigned Task Completion.

Sr. No.	**List of Experiments/Activities**
1.	To identify a course-related technical problems.
2.	To define the problem clearly with objectives, basic requirements, and constraints.
3.	To study existing solutions or methods related to the problem and find the gap
4.	To generate different possible solutions using basic engineering concepts.
5.	To select the best solution based on different applicable criteria's i.e. feasibility, simplicity, and cost-effectiveness.
6.	To prepare the design, list of materials and use the required tools for the solution.
7.	To develop a basic representational model of prototype using available resources.

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8.	To test the developed solution based on the peer-reviewed feedback.
9.	To improve the solution based on test results and feedback.
10.	To present the final solution and prepare a simple technical report.

Sr. No.	Textbooks
1.	Nigel Cross,Design Thinking: Understanding How Designers Think and Work, Berg Publishers.
2.	Nigel Cross,Engineering Design Methods: Strategies for Product Design, John Wiley & Sons.
	Reference Books
1.	Guerra, Aida, Ulseth, Ronald, Kolmos, Anette, PBL in Engineering Education: International Perspectives on Curriculum Change, Springer, 2017.
	Web Resources
1.	NPTEL Online Courses- Problem Based learning, NITTTR. (https://onlinecourses.swayam2.ac.in/e-learning/preview/ntr20_ed12)

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Course Title: Professional Development III **Course Code: ET253603**		**Course Category: VSE**
Teaching Scheme	**Examination Scheme**	
Practicals/Sessions: 02 Hours/Week	CA-I	15 Marks
Credits: 01	CA-II	15 Marks
Semester: Second Year (Semester III)	ESE	20 Marks
Course Prerequisite: Basic Computer Literacy, Mathematical Knowledge, Keyboard Skills.		
Course Description: This course introduces students to essential office productivity tools used for professional documentation, presentations, and data management. Students will learn to create and format documents using word processing software, design effective presentations using presentation tools, and organize and analyze data using spreadsheet applications. The course emphasizes hands-on practice with features such as formatting, charts, data validation, pivot tables, and spreadsheet functions. Through practical exercises, students will develop skills in preparing professional documents, visual presentations, and structured data sheets. The course is important for improving digital literacy and enabling students to efficiently handle academic, professional, and workplace documentation tasks.		
Course Objectives: 1. To introduce students to the fundamental features and tools of office productivity software used for document preparation, presentations, and spreadsheet management. 2. To provide practical exposure to creating, formatting, and presenting professional documents and presentations using appropriate digital tools. 3. To familiarize students with spreadsheet techniques for organizing, managing, and visualizing data using charts, tables, and formatting tools. 4. To develop digital competency by training students in spreadsheet functions, data validation, pivot tables, and other tools for efficient data handling and analysis in academic and professional environments.		

Course Outcomes:		
COs	**After completion of the course, students will be able to**	**Bloom's Level**
CO1	**Recall** fundamental concepts, features, and interfaces of office productivity tools including word processing, presentation software, spreadsheets, and professional email communication.	Remember (Level 1)
CO2	**Explain** the working principles, functionalities, and best practices of word processing, presentation design, spreadsheet operations, and email writing etiquettes for professional communication.	Understand (Level 2)
CO3	**Apply** office productivity tools to create structured documents, professional emails, effective presentations, and organized spreadsheets using appropriate features and formatting techniques.	Apply (Level 3)
CO4	**Analyze** and **interpret** data using spreadsheet techniques such as charts, validation, pivot tables, and functions to support information processing and decision-making in real-world scenarios.	Analyze (Level 4)

CO-PO-PSO Mapping:

CO-PO-PSO Mapping													
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	1	-	-	-	2	-	-	-	1	-	1	2	-
CO2	1	-	-	-	2	-	1	-	2	-	1	2	-
CO3	1	-	-	-	3	-	1	-	3	1	1	2	-
CO4	1	-	-	-	3	-	-	-	2	1	2	2	-

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Assessment	
CA-I (a)	Performance & Evaluation of activities on word & Presentation Module.
CA-II (b)	Performance & Evaluation of activities on spreadsheet Module
ESE (c)	Viva-voce/Activity Evaluation of different module.

Sr. No.	List of Experiments/Activities
1.	To explore word processor interface and navigation tools for efficient document handling and professional drafting.
2.	To apply basic text entry and formatting tools in word processor for creating structured documents.
3.	To apply advanced formatting techniques for consistency and improved presentation of created report.
4.	To create presentations using slides, themes, and multimedia elements for effective communication.
5.	To analyze and modify presentation designs using software tools for improving visual impact.
6.	To perform data entry and worksheet formatting in spreadsheet software for organized data management.
7.	To apply conditional formatting and create charts in spreadsheets for data visualization.
8.	To implement data validation and filtering techniques in spreadsheets for accurate data analysis.
9.	To generate pivot tables using spreadsheet tools for summarizing and analyzing large datasets.
10.	To apply spreadsheet functions (text, date-time, mathematical, statistical, and logical) for data processing and decision-making.
11.	To explore email significance, navigation tools and Id creation to inculcate essential principles.
12.	To compose professional emails using proper email writing etiquettes for effective workplace communication.

Sr. No.	Textbooks
1.	Abigail Rusu, Andrea Long, Heather Maye, Jennifer Evans, Amy Ledgerwood, and Jeanine Preuss, Introduction to Microsoft Office, Maricopa Millions Grant.
2.	Helen Holding, Clare Martin, Mastering Microsoft Office, Red Globe Press.
3.	R. P. Soni, Harshal Arolkar, Sonal Jain, Working with Personal Computer Software, Wiley India.
	Reference Books

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1.	Stephanie Krieger, Documents, Presentations, and Workbooks: Using Microsoft Office to Create Content That Gets Noticed, Microsoft Press.
2.	Marjorie S. Hunt, Barbara Clemens, Illustrated Microsoft Office 365 & Office 2016, Cengage Learning.
3.	Linda Foulkes, Learn Microsoft Office 2019, Packt Publishing.
	Web Resources
1.	Step-by-step learning resources for office software, https://www.tutorialspoint.com/word https://www.tutorialspoint.com/excel https://www.tutorialspoint.com/powerpoint
2.	Spreadsheet concepts and functions tutorials, https://www.w3schools.com/excel

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Course Title: Do It Yourself-III **Course Code: ET253806**		**Course Category: EL**
Teaching Scheme	**Examination Scheme**	
Practical's/Sessions: 02 Hours/Week	CA-I	15 Marks
Credits: 01	CA-II	15 Marks
Semester: Second Year (Semester III)	ESE	20 Marks
Course Prerequisite: Students should have basic knowledge of fundamental electrical and electronic concepts, including voltage, current, resistance, Ohm's law, power calculation, and basic electronic components such as diodes, resistors, capacitors, and integrated circuits. Familiarity with basic electrical appliances and simple circuit connections will help students perform laboratory experiments effectively.		
Course Description: This laboratory course provides practical exposure to electrical load calculation, domestic appliances, wiring systems, and basic analog electronic circuits. Students will learn to organize different types of electrical loads and calculate load requirements for residential, office, and industrial applications. The course also includes experiments on common household appliances such as ceiling fan, mixer grinder, and extension board, enabling students to understand their working and maintenance. In addition, the course introduces the construction and analysis of regulated power supply circuits, and applications of IC 555 timer and IC 741 operational amplifier using breadboards. Through these experiments, students develop practical skills in circuit construction, testing, troubleshooting, and measurement using laboratory instruments.		
Course Objectives: 1. Understand the classification and rating of different electrical loads used in residential, commercial, and industrial environments. 2. Develop the ability to calculate electrical load requirements for homes, offices, and industries. 3. Study the operation, testing, and maintenance of common domestic electrical appliances such as ceiling fans, mixer grinders, and extension boards. 4. Design and construct fixed and variable regulated power supply circuits using breadboards and voltage regulator ICs. 5. Understand the working and applications of IC 555 timer and IC 741 operational amplifier through practical circuit implementation.		

Course Outcomes:		
Cos	**After completion of the course Students will be able to:**	**Bloom's Level**
CO1	**Apply** the knowledge of electrical loads, components, and wiring techniques to organize load data, calculate electrical consumption for homes/offices, and estimate electricity bills.	Apply (Level 3)
CO2	**Analyze** and perform practical operations such as series and parallel wiring, and dismantling of electrical appliances (ceiling fan, mixer grinder, extension board) to understand their construction and working principles.	Analyze (Level 4)
CO3	**Apply** the principles of analog electronics to design, construct, and analyze fixed and variable power supply circuits	Apply (Level 3)
CO4	**Implement** and test basic applications of IC 555 timer and IC 741 operational amplifier using breadboard and laboratory instruments	Apply (Level 3)

CO-PO Mapping

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COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	2	2	2	2	1	1	2		2		
CO2	3	2	2	3	3	2	2	1	2		2		
CO3	3	1	3	2	3	1	1	1	2		2		
CO4	3	1	2	3	3	1	1	1	2		2		

Assessment	
CA-I (a)	Based on Practical performance and journal.
CA-II (b)	Based on Practical performance and journal.
ESE (c)	Practical Examination and Viva Voce / Oral Examination.

Sr. No.	List of Experiments	Hours
1	To Organize the different types of electrical loads and components with their voltage, current and power rating.	2 hrs.
2	To Calculate the load of Home, Offices, Colleges, etc. To determine the light bill.	2 hrs.
3	To Study and Perform Series and Parallel wiring to test the voltage and current values.	2 hrs.
4	To Study and Perform Ceiling Fan dismantling to examine the connections and working.	2 hrs.
5	To Study and Perform Mixer Grinder dismantling to examine the connections and working.	2 hrs.
6	To Study and Perform Extension Board wiring to examine the connections and working.	2 hrs.
7	To design a fixed power supply circuits using 78XX and 79XX voltage regulator IC's	2 hrs.
8	To design an adjustable power supply circuits using LM317 and LM337 Voltage regulator IC'S	2 hrs.
9	To design and implement 555 Timer IC in astable mode for Sound Generation	2 hrs.
10	To design and implement a doorbell circuit using 555 Timer IC.	2 hrs.
11	To design and Implementation of Square Wave Generator Using IC 741 Op-Amp	2 hrs.
12	To design and Implementation of Triangular Wave Generator Using IC 741 Op-Amp	2 hrs.

Text Books	
1.	B.L. Theraja and A.K. Theraja, A Textbook of Electrical Technology (Vol. I – Basic Electrical Engineering), S. Chand Publications.
2.	S.K. Bhattacharya, Basic Electrical and Electronics Engineering, Pearson Education.

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3.	V.K. Mehta and Rohit Mehta, Principles of Electronics, S. Chand Publications.
4.	Ramakanth A. Gayakwad,Op-Amps and Linear Integrated Circuits, Pearson Education.
5.	Malvino and Bates, Electronic Principles, McGraw Hill Education.
Reference Books	
1.	Jacob Millman and Christos C. Halkias, Integrated Electronics: Analog and Digital Circuits and Systems, McGraw Hill.
2.	Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, Pearson Education.
Web Resources	
1	https://onlinecourses.nptel.ac.in/noc20_ee64/preview
2	https://nptel.ac.in/courses/122106025
3	https://nptel.ac.in/courses/108101091

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Course Title: Basic Electronics and Communication Engineering		
Course Code: ET253401	**Course Category:MDM**	
Teaching Scheme	**Examination Scheme**	
Lectures: 02 hrs/ week	CA-1	10 Marks
Tutorial: -----	CA-2	10 Marks
Credits: 02	MSE	20 Marks
Semester: Second Year (Semester III)	ESE	60 Marks

Course Prerequisite:

- A basic understanding of electric circuits (Ohm's law, AC/DC concepts), semiconductors (diodes and transistors), and signals & waves (frequency, analog/digital signals).knowledge of basic mathematics (algebra, graphs) and simple digital logic (binary and logic gates).

Course Description:

To prepare students with fundamental knowledge/overview in the field of Electronics and Communication Engineering.

To equip students with a basic foundation in electronic engineering required for comprehending the operation and application of electronic circuits, logic design, embedded systems, and communication systems.

Course Objectives:

1. To understand the fundamentals of power supplies, rectifiers, filters, voltage regulators, and amplifier characteristics used in electronic circuits.
2. To study the principles and working of oscillators and operational amplifiers, including their configurations and applications in electronic circuits.
3. To introduce the concept of embedded systems, their architecture, classification, and comparison between microprocessors and microcontrollers.
4. To understand the basic communication system model, analog and digital modulation techniques, and different types of communication channels.
5. To study the applications of digital modulation techniques in modern communication systems such as mobile phones, Wi-Fi, and broadband networks

Course Outcomes:

cos	After completion of the course Student will be able to	Bloom's Level
CO1	**Recall** the basic concepts, block diagrams, and components of power supplies, amplifiers, oscillators, operational amplifiers, microprocessors, and communication systems.	Remember level (LI)
CO2	**Explain** the working principles and characteristics of electronic circuits, op-amps, oscillators, microprocessors/microcontrollers, and communication techniques.	Understand level (L2)
CO3	**Apply** the principles of electronic circuits and operational amplifiers to analyze and solve problems related to amplifiers, rectifiers, oscillators, and signal processing.	Apply level (L3)
CO4	**Apply** the concepts of microprocessors, microcontrollers, and communication systems to identify and implement suitable solutions in real-world applications like digital communication and embedded systems.	Apply level (L3)

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	POS	PO6	PO7	POS	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
CO1	3	3									2				
CO2	3	3									2				
CO3	3	3									2				
CO4	3	3									2				

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Assessment	
CA-1 (a)	Subjective, /Quiz
CA-2 (b)	Case Study
MSE (c)	Mid Sem Examination

Course Contents		
Unit 1	**Introduction: Power Supplies** Block diagram, Half-wave rectifier, Full-wave rectifiers and filters, Voltage regulators, Amplifiers– Types of amplifiers, Gain, Input And output resistance, Frequency Response, Bandwidth,	4 Hrs
Unit 2	**Oscillators** Barkhausen criterion, sinusoidal and non-sinusoidal oscillators, Ladder network oscillator, Wein bridge oscillator, Multivibrators, Single-stage astable oscillator, Crystal controlled oscillators (No mathematical derivations) **Operational amplifiers** -Operational amplifier parameters, Operational amplifier characteristics, Operational amplifier configurations, Operational amplifier circuits.	4 Hrs
Unit 3	**Introduction to Microprocessor and Microcontroller** Features, Block diagram, Pin Configuration,Comparision and Applications of Microprocessor 8085 & Microcontroller 8051	4 Hrs
Unit 4	**Basic Communication** Basic Communication System Scheme, Information source, an input transducer, Transmitter, Channel or Medium – Hardwired and Soft wired, Noise, Receiver, Multiplexing	4 Hrs
Unit 5	**Communication Schemes** Types of Modulation (only concepts)–AM, FM, Concept of Radio wave propagation (Ground, space, sky) Advantages of digital communication over analog communication ASK, FSK, PSK.	4 Hrs
Unit 6	**Application on Electronics & Communication** Digital modulation techniques used in mobile phones, Wi-Fi, and broadband systems.	4 Hrs

Text Books	
1.	Principal of Digital Electronics by R.P.Jain
2.	Linear Integrated circuit by D.Roy Chiudhary
3.	Principal of Microprocessor by B.Ram
4.	Op-Amps and Linear Integrated Circuits – *Ramakant A. Gayakwad*, PHI Learning.
5.	Digital Electronics – *Morris Mano*, Pearson.
Reference Books	
1.	Electronic Devices and Circuit Theory" by Robert Boylestad and Louis Nashelsky
2.	"Electronic Devices and Circuit Analysis" by David A. Bell
3.	"Digital Electronics: Principles and Applications" by William Kleitz
4.	Principal of Communication by. Kennedy

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Web Resources	
1.	https://nptel.ac.in/courses/122106025

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Course Title: Signals and Systems Course Code:ET254208		Course Category: PCC
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs/ week	CA-1	10 Marks
Tutorial: ------	CA-2	10 Marks
Credits: 03	MSE	20 Marks
Semester: Second Year (Semester IV)	ESE	60 Marks

Course Prerequisite:

- Basic Knowledge Engineering Mathematics.

Course Description:

This course introduces the fundamental concepts of signals and systems, focusing on their mathematical representations, classifications, and applications in real-world scenarios, including communications, control systems, and signal processing

Course Objectives:

1. To understand, classify signals and systems based on their characteristics and perform basic operations on signals.
2. To study Linear Time Invariant (LTI) Systems.
3. To provide the analysis of spectral properties of periodic and aperiodic signals.
4. To prepare students for advanced topics in communication, control systems, and signal processing.

Course Outcomes:

COs	After completion of the course student will be able to	Bloom's Level
CO1	**Define** the fundamental concepts of signals and systems with their mathematical representation and applications.	Remember (Level 1)
CO2	**Classify** the signals and systems with their operations and mathematical representation.	Understand (Level 2)
CO3	**Explain** the concept of computational techniques for determining system behavior and responses.	Understand (Level 2)
CO4	**Use** of signals and systems concepts to real-world applications in communication, control systems, audio processing, and biomedical engineering.	Apply (Level 3)
CO5	**Implement** various transforms for frequency domain representation of signals.	Apply (Level 3)
CO6	**Examine** signals and systems by using tools such as MATLAB for modeling, visualization by means of simulation and programming.	Analyze (Level 4)

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	1	1	1	2	-	-	-	-	-	-	2	3
CO2	3	3	2	2	2	-	-	-	-	-	-	1	3
CO3	3	3	3	2	3	-	-	-	-	-	-	2	3
CO4	3	2	2	3	3	-	-	-	-	-	-	2	3
CO5	3	2	3	2	3	-	-	-	-	-	-	2	3
CO6	3	2	2	2	3	-	-	-	-	-	-	3	3

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Assessment	
CA-1 (a)	Subjective Test / Open Book Test etc.
CA-2 (b)	Assignment / Presentation / Model Making
MSE (c)	Mid Sem Examination
Practical(d)	

Course Contents		
Unit 1	**Introduction to Signals** Definition of Signals, Classification of signals: Continuous Time (CT) and Discrete Time (DT), Even, Odd, Periodic and aperiodic, Deterministic and random, Energy and power, Operations on signals: Amplitude scaling, Time scaling, Time shifting and Folding, Addition, Elementary signals: Impulse, Step, Ramp, Exponential, Sine, Rectangular, Triangular, Signum and Sinc.	6 Hrs
Unit 2	**Fundamentals of Systems** Definition of System, Classification of Systems: Linear and nonlinear, Time variant and invariant, Causal and Non causal, Static and dynamic, Stable and unstable, Invertible and non invertible, System modeling: Input output relation, Impulse response.	6 Hrs
Unit 3	**System Analysis** Convolution integral using graphical method, Convolution sum using equation method, tabular method, Properties of convolution, System interconnection, System properties in terms of impulse response, Step response in terms of impulse response.	6 Hrs
Unit 4	**Periodic Signal Analysis** Introduction to Fourier Analysis, Fourier series (FS) representation of periodic Continuous Time (CT) signals using Complex Exponential, Dirichlet condition for existence of Fourier series, Properties of Fourier Series.	6 Hrs
Unit 5	**Aperiodic Signal Analysis** Fourier transform: Introduction to CTFT with its properties, FT of discrete standard test signals. Inverse Fourier Transform and Application of Fourier Transforms.	6 Hrs
Unit 6	**Discrete Time Signal Analysis & Applications of Signal and System** Introduction to Z-transform, and its properties, Significance and Properties of Region of Convergence, Application of signals in audio and speech processing (e.g., noise reduction, compression, voice recognition). Introduction to signal analysis in feature extraction for biomedical applications.	6 Hrs

Text Books	
1	S. Palani, "Signals and Systems", Springer, 2nd Edition.
2	B. P. Lathi," Principles of Signal Processing and Linear Systems", Oxford University Press,2nd Edition.
3	A. Anand Kumar, "Signals and Systems", PHI Learning Pvt. Ltd., 2nd Edition, 2013.
4	Michael J. Roberts, "Fundamentals of Signals and Systems", McGraw Hill, 2nd Edition, 2008.

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Reference Books	
1	Simon Haykins and Barry Van Veen, "Signals and Systems", John Wiley and sons.
2	Alan V. Oppenheim, Alan S. Willsky and S. Hamid Nawab, "Signals and Systems" , Pearson Education, 2nd Edition.
3	Shaila D. Apte, "Signals and Systems: Principles and Applications" , Cambridge University Press, 1st Edition, 2016.
4	Hwei P. Hsu, "Signals and Systems, Schaum's Outline Series", McGraw Hill Education, 2nd Edition, 2011.
Web Resources	
1	https://onlinecourses.nptel.ac.in/noc25_ee78/preview
2	https://ocw.mit.edu/courses/res-6-007-signals-and-systems-spring-2011/video_galleries/video-lectures/

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Course Title: Digital Electronics		
Course Code: ET254209	**Course Category:PCC**	
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs/ week	CA-1	10 Marks
Tutorial: -----	CA-2	10 Marks
Credits: 03	MSE	20 Marks
Semester: Second Year (Semester IV)	ESE	60 Marks

Course Prerequisite:

- Basic number system
- Boolean Algebra
- Logic gates

Course Description:

The **Digital Electronics** course introduces the fundamental principles of digital logic design, combinational and sequential circuits, and digital logic families. Students will be able to explore the design and analysis of circuits. The course also covers programmable logic devices and semiconductor memories, emphasizing practical applications and system design using modern digital components.

Course Objectives:

1. Develop understanding of Boolean algebra and logic simplification.
2. Design combinational and sequential logic circuits.
3. Analyze and implement finite state machines
4. Understand logic families, PLDs, and data converters

Course Outcomes:

COs	After completion of the course: Student will be able to	**Bloom's Level**
CO1	**Define and recall** fundamental concepts of digital electronics, logic gates, Boolean algebra, and digital systems	Remember (Level 1)
CO2	**Explain** the principles of digital logic, combinational and sequential circuits, and interpret their behavior.	Understand (Level 2)
CO3	**Implement** Boolean algebra and design techniques to implement digital circuits using logic gates and ICs	Apply (Level 3)
CO4	**Demonstrate** and realize digital systems such as adders, code converters, multiplexers, and sequential circuits.	Apply (Level 3)
CO5	**Differentiate** digital circuits and systems to interpret behavior, identify logical errors, and compare performance characteristics.	Analyze (Level 4)
CO6	**Examine** modern digital systems including memory elements, counters, programmable logic devices, and logic families.	Analyze (Level 4)

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	1										1	1
CO2	3	2	1									1	2
CO3	3	2	2	1								3	2

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CO4	3	2	3	1								3	2
CO5	3	3	2	2								2	3
CO6	3	2	2	1								3	3

Assessment	
CA-1 (a)	Subjective Test / Open book test / etc
CA-2 (b)	CL PBL
MSE (c)	Mid Sem Examination

Course Contents		
Unit 1	**Boolean Function Optimization** Boolean Functions: Canonical and standard forms (SOP and POS), Simplification of Boolean functions using algebraic methods, Gate-Level Minimization: Karnaugh Map (K-map) method for up to 4 variables, Minterm and maxterm; Don't-care conditions, Sum of Products (SOP) and Product of Sums (POS) simplification NAND and NOR gate implementation of simplified expressions	6 Hrs
Unit 2	**Combinational Logic Design** Design methodology for combinational logic circuits, Arithmetic circuits: half adder, full adder, subtractors, Look-ahead carry adders for high-speed addition, BCD and code converter circuits, Digital comparators (1-bit and 2-bit), Parity generators and checkers, Multiplexers and De-multiplexers: design and applications, Decoders and encoder.	6 Hrs
Unit 3	**Sequential Logic Design** 1-bit memory cell and the concept of bistable storage, Clocked flip-flops: SR, JK, Master-Slave JK, D, and T types, Preset and clear terminals and their applications, Excitation tables for flip-flops; flip-flop conversion techniques, Registers and shift registers (SISO, SIPO, PISO, PIPO), Sequence generators using shift registers, Ripple counters, up/down counters, and synchronous counters.	6 Hrs
Unit 4	**Finite State Machines** Basic design steps for Finite State Machines (FSMs), State diagrams and state tables, State reduction and state assignment techniques, Mealy and Moore machine models: representation and comparison, FSM implementation from state diagrams, Sequence detector design using Mealy/Moore models	6 Hrs
Unit 5	**Digital Logic Families** Characteristics of Logic Families, Classification of logic families: RTL, DTL, ECL, TTL, CMOS, Operation of the TTL NAND gate; active pull-up circuit, Tri-State logic, CMOS inverter operation; CMOS NAND and NOR gates	6 Hrs
Unit 6	**PLDs & Semiconductor Memories Data Converters** Overview and architecture of Programmable Logic Devices (PLDs),PROM as a programmable logic device, PAL: structure and design, PLA: structure and design DAC: Binary weighted resistor type DAC and R-2R ladder DAC, Specifications Resolution, non-linearity, gain error ,settling time, ADC: Successive approximation ADC, Dual slope ADC and Flash ADC, Specifications of ADC – Resolution, input range, linearity, conversion time, Applications of data converters.	6 Hrs

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Text Books	
1.	M. Morris Mano, —Digital Logic and Computer Design‖ 4th edition, Prentice Hall of India, 2013.
2.	Anand Kumar, —Fundamentals of digital circuits‖ 1st edition, Prentice Hall of India,2001
3.	Albert Paul Malvino and Donald P. Leach -Digital Principle and Applications
Reference Books	
1.	R.P. Jain, —Modern digital electronics, 3rd edition, 12threprint Tata McGraw Hill **Publication, 2007.**
2.	Anil K. Maini, Digital Electronics: Principles, Devices and Applications, Wiley Publication
Web Resources	
1	https://nptel.ac.in/courses/108105132 Prof. Goutam Saha, IIT Kharagpur

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Course Title: Analog & Digital Communication Course Code: ET254210		Course Category:PCC
Teaching Scheme	**Examination Scheme**	
Lectures: 03 hrs/ week	CA-1	10 Marks
Tutorial: -----	CA-2	10 Marks
Credits: 03	MSE	20 Marks
Semester: Second Year (Semester IV)	ESE	60 Marks

Course Prerequisite:

- Basic understanding of signals, waveforms, modulation concepts, noise, sampling, and fundamental communication system blocks (transmitter–channel–receiver).

Course Description:

After completing this course, students will have a clear and fundamental understanding of Communication theory. Topics range from an overview of types of modulation. Subject develops the understanding of students to treat the modulation in time and frequency domain.

Course Objectives:

1.To introduce the basic concepts of communication systems, need for modulation, types of noise, and multiplexing techniques used in signal transmission.
2.To explain the principles of amplitude modulation and angle modulation (FM and PM), including generation, detection, bandwidth, and receiver structures.

3.To familiarize students with pulse modulation techniques and methods for digital transmission of analog signals such as PCM, DPCM, DM, and vocoders.

4.To develop understanding of digital communication concepts including sampling, quantization, companding, baseband transmission, synchronization, multiplexing, and intersymbol interference.

5.To provide knowledge of practical applications of analog and digital communication systems in modern technologies such as landline telephony, mobile communication (4G/5G), SMS, MMS, and VoIP.

Course Outcomes:

COs	After completion of the courseStudent will be able to	Bloom's Level
CO1	**Recall** the concept of analog and digital communication system	Remember (Level L1)
CO2	**Explain** fundamentals of analog and digital communication systems.	Understand (Level 2)
CO3	**Apply** modulation, sampling, and transmission techniques to solve problems.	Apply (Level 3)
CO4	**Analyze** performance of communication systems considering noise, bandwidth, and distortion	Analyze (LevelL4)
CO5	**Evaluate** and compare various communication techniques.	Evaluate (LevelL5)

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CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	2										
CO2	3	3	3	2								1	1
CO3	3	2	2	2							2	3	3
CO4	3	2	2	2							2	3	3
CO5	3	3	3	3	3						2	1	3

Assessment	
CA-1 (a)	Quiz, /Subjective etc
CA-2 (b)	Case Study, /Poster Presentation etc
MSE (c)	Mid Sem Examination

Course Contents		
Unit 1	**Amplitude Modulation** Introduction to communication system, Need for modulation, Noise in Electronic communication, types of noise, Frequency Division Multiplexing, Time division multiplexing, Amplitude Modulation, power relations in AM waves, Generation of AM waves, Demodulators, DSB, SSB and VSB, AM receivers	6 Hrs
Unit 2	**Angle Modulations:** Introduction, Mathematical analysis of FM and PM, Modulation index for FM and PM Frequency Modulation: Single tone frequency modulation, Spectrum Analysis of Sinusoidal FM Wave, Narrow band FM, Wide band FM, Constant Average Power, Transmission bandwidth of FM Wave - Generation of FM Waves, FM, Detection of FM Waves, Comparison of FM and AM, FM Receivers	6 Hrs
Unit 3	**Pulse modulation** PAM, PWM, PPM, Sampling, Quantization, Pulse code modulation, line coding, DPCM, DM, ADM, Voice coder (Vocoders)	6 Hrs
Unit 4	**Digital Transmission of Analog Signal:** Introduction to Digital Communication System: Concept of Digital Signal, Block Diagram and transformations, Basic Digital Communication Nomenclature. Digital Versus Analog Performance Criteria, Sampling Process, PCM Generation and construction, Quantization Noise, Non-uniform Quantization and Companding, PCM with noise: Decoding noise, Error threshold, Delta Modulation, Adaptive Delta Modulation	6 Hrs
Unit 5	**Baseband Digital Transmissions:** Digital Multiplexing: Multiplexers and hierarchies, Data Multiplexers. Data formats and their spectra, synchronization: Bit Synchronization, Scramblers, Frame Synchronization. Intersymbol interference, Equalization.	6 Hrs
Unit 6	**Application of Analog & Digital Communication** :	6 Hrs

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	Analog systems for traditional landline telephony, digital technologies in mobile communication, including 4G, 5G, SMS, MMS, and VoIP	

Text Books	
1.	B.P.Lathi, Zhi Ding, Modern Digital & Analog Communication, Oxford, 4th Edition2011
2.	Simon Haykin,Introduction to Analog and Digital Communications, 2nd ed., JohnWiley, 2012
3.	Proakis J. G. and Salehi M., Communication Systems Engineering, Pearson Education,2002
4.	Taub H. and Schilling D.L., Principles of Communication Systems,Tata McGraw Hill,2001
5.	Proakis J.G., Digital Communications', 4th Edition, McGraw Hill, 2000
Reference Books	
1.	R. Anand, Communication Systems, Khanna Book Publishing Company, 2011
2.	George F. Kennedy, Davis,Electronic Communication System, 4th ed., Tata McGraw Hill
3	K. Sam Shanmugam , Digital & Analog and Digital Communication Systems, WileyIndia ed., Wiley,2006
Web Resources	
1	https://onlinecourses.nptel.ac.in/noc21.ee74/preview
2	https://onlinecourses.nptel.ac.in/noc21.ee11/preview

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Course Title: Sensors and Actuators Course Code: ET254504	Course Category: Open Elective-II	
Teaching Scheme	**Examination Scheme**	
Lectures: 02 hrs/ week	CA-1	10 Marks
Tutorial: -------- hrs/ week	CA-2	10 Marks
Credits: 02	MSE	20 Marks
Semester: Second Year (Semester IV)	ESE	60 Marks

Course Prerequisite:

- Basic knowledge of electronics.
- Basic understanding of measurement systems.
- Familiarity with basic industrial control concepts.

Course Description: This course introduces the fundamentals of sensors, transducers, and actuators used in engineering and industrial systems. It covers the basic characteristics and selection criteria of sensors and transducers, signal transmission methods, and operating principles of commonly used sensing elements. The course includes inductive and capacitive transducers, their construction, characteristics, and industrial applications. In addition, the course provides a comprehensive introduction to pneumatic, hydraulic, and electrical actuators and their selection for practical applications.

Course Objectives:

1. To understand the fundamentals, characteristics, and selection criteria of sensors and transducers.
2. To study the operating principles, construction, and applications of inductive and capacitive transducers.
3. To understand the types, working principles, and selection of pneumatic, hydraulic, and electrical actuators.
4. To develop the ability to identify suitable sensors, transducers, and actuators for engineering and industrial applications.

Course Outcomes:

COs	After completion of the course Students will be able to:	Bloom's Level
CO1	**Define** the fundamentals, characteristics, and selection criteria of sensors and transducers.	Remember (Level 1)
CO2	**Explain** the working principles, construction, and applications of inductive and capacitive transducers.	Understand (Level 2)
CO3	**Select** suitable pneumatic, hydraulic, and electrical actuators for industrial applications based on performance and selection criteria.	Apply (Level 3)
CO4	**Differentiate** the role of sensors, transducers, and actuators in practical engineering systems and industrial automation.	Analyze (Level 4)

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CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	1	-	2	1	-	-	1	-	-	-	-
CO2	3	2	2	-	2	1	-	-	1	-	-	-	-
CO3	3	3	3	-	2	2	-	-	2	-	-	-	-
CO4	3	3	2	-	2	2	-	-	2	-	-	-	-

Assessment	
CA-1 (a)	Subjective Test / MCQ Test
CA-2 (b)	Case Study / Assignment
MSE (c)	Descriptive Test

Course Contents		
Unit 1	**Sensors** Introduction, Definitions of sensor, transducer - primary measuring elements - selection and characteristics: Range; resolution, Sensitivity, error, repeatability, linearity and accuracy, impedance, Response time, Dead band.	4 Hrs
Unit 2	**Signal transmission** Types of signals: Pneumatic signal; Hydraulic signal; Electronic Signal. Principle of operation, construction details, characteristics and applications of potentiometer, Strain Gauges, Resistance Hygrometer, Photo-resistive sensor.	4 Hrs
Unit 3	**Inductive Transducer** Inductive transducers: Principles of operation, construction details, characteristics and applications of LVDT, Induction potentiometer, variable reluctance transducer.	4 Hrs

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Unit 4	**Capacitive Transducer** Capacitive transducers: Principle of operation, construction details, characteristics of Capacitive transducers – different types & signal conditioning- Applications: capacitor microphone, capacitive pressure sensor, proximity sensor.	4 Hrs
Unit 5	**Actuators** Definition, types and selection of Actuators; linear; rotary; Logical and Continuous Actuators, Pneumatic actuator- Electro-Pneumatic actuator, rotary actuators.	4 Hrs
Unit 6	**Mechanical actuating systems** Hydraulic actuator - Control valves; Construction, Characteristics and Types, Selection criteria. Electrical actuating systems: Solid-state switches, Solenoids, Electric Motors- D.C motors - AC motors, Stepper motors.	4 Hrs

Text Books	
1.	"Sensors and Transducers", D. Patranabis, PHI Learning.
2.	"Industrial Instrumentation and Control", S. K. Singh, McGraw Hill Education India
3.	"Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering", W. Bolton, Pearson India.
4.	"Mechatronics System Design", Devdas Shetty and Richard A. Kolk, Cengage Learning India.
Reference Books	
1.	"Principles of Industrial Instrumentation", D. Patranabis, Tata McGraw Hill Education.
2.	"Transducers and Instrumentation", D. V. S. Murty, PHI Learning.
3	"Fluid Power with Applications", Anthony Esposito, Pearson India.
4	"Electrical Machines, Drives and Power Systems", Theodore Wildi, Pearson Education.
Web Resources	
1	NPTEL: Sensors and Actuators (IIT Bangalore) https://onlinecourses.nptel.ac.in/noc26_ee13/preview
2	MIT OpenCourseWare: Sensor Technologies – https://ocw.mit.edu/courses/mas836-sensor-technologies-for-interactive-environments-spring-2011/pages/lecture-notes/

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Course Title: Electrical Machines		
Course Code: ET254505	**Course Category: Open Elective-II**	
Teaching Scheme	**Examination Scheme**	
Lectures: 02 hrs/ week	CA-1	10 Marks
Tutorial: ------	CA-2	10 Marks
Credits: 02	MSE	20 Marks
Semester: Second Year (Semester IV)	ESE	60 Marks

Course Prerequisite:

- A basic understanding of electrical circuits and electromagnetism.

Course Description:

Electrical Machines is a course designed to introduce students to the fundamental principles, working mechanisms, and applications of electrical machines in various engineering fields.

Course Objectives:

1. To focus on the study of electromechanical energy conversion & different parts of electrical machines.
2. To address the underlying concepts & methods behind Electrical machines.
3. To Apply the concepts which will be utilized in the electrical machines with its performance and theory of operation.
4. To test the Electrical machines required for different applications, considering the parameters like voltage, current, torque and speed.

Course Outcomes:

COs	After completion of the course Students will be able to:	Bloom's Level
CO1	**Define** the working principle of electric machines.	Remember (Level 1)
CO2	**Explain** the performance of electric machines which can be used for household applications.	Understand (Level 2)
CO3	**Classify** various machines and understand - characteristics, performance parameters of DC motors, transformer, 3-Phase Induction Motor, and equivalent circuit parameters.	Understand (Level 2)
CO4	**Interpret** the performance of a single phase transformer and motor based on appropriate test results and working.	Apply (Level 3)

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PS01	PSO2
CO1	3	2		1	1	1					2		
CO2	3	3		2	2	2					2		
CO3	3	3		2	2	1					2		
CO4	3	3		3	3	2					2		

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Assessment	
CA-I	Presentation / Descriptive Test
CA-II	Assignment/ Case Study
MSE	Descriptive Test

Course Contents		
Unit 1	**DC Generator** DC machines construction, working principle, EMF equation, Types, characteristics, applications, simple numericals.	4 Hrs
Unit2	**DC Motor** DC machines construction, working principle, Types, back emf, armature torque equation, characteristics, Speed control methods, application, simple numericals.	4 Hrs
Unit3	**Three Phase Induction Motor** Construction, working principle, types, starting torque equation, power stages, losses and efficiency, speed control, Starters(D-O-L, Star Delta, Auto Transformer), applications.	4 Hrs
Unit 4	**Three Phase Synchronous motor** Construction, working principle, starting methods, effect of load, V-curve, synchronous condenser, hunting, applications.	4 Hrs
Unit 5	**Single Phase Transformer** Construction, Types, Principle of operation, EMF equation, Operation at no load and on load, losses and efficiency, OC and SC tests, efficiency and regulation, maximum efficiency, all day efficiency, simple numerical problems.	4 Hrs
Unit 6	**Special Purpose Electric Machines** Construction, working and applications of variable reluctance stepper motor, servo motor(ac and dc), hysteresis motor, linear Induction Motor, brushless DC motor.	4 Hrs

Text Books	
1.	"Electrical Technology", B. L. Theraja, S. Chand publication, volume 2
2.	"Principles of Electrical Machines", V. K. Mehta & Rohit Mehta, S. Chand Publication
3.	"Electrical Machines", Abhijit Chakrabarti & S udipta Debnath, Tata McGraw-hill Publication
4.	"Electric Machines", Ashfaq Husain, Dhanpatrai and publication, Third Edition

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Reference Books	
1.	"Electrical Machinery" by P.S. Bimbhra
2.	"Electrical Machines", P.K. Sen, Tata McGraw-Hill Education, 3rd Edition
3.	"Electrical Machines", S.K. Bhattacharya, Tata McGraw-Hill Education, 2nd Edition
4.	"Electrical Machines", I.J Nagarath & D.P Kothari, Tata McGraw-hill Publication 4th Edition
Web Resources	
1.	NPTEL: Electrical Machines - I & II (IIT Kharagpur) https://www.nptel.ac.in/courses/108105131
2.	MIT Open CourseWare: Electric Machines https://ocw.mit.edu/courses/6-685-electric-machines-fall-2013/

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Course Title: Computer Architecture Course Code:ET254506	Course Category: OE	
Teaching Scheme	**Examination Scheme**	
Lectures: 02 hrs/ week	CA-1	10 Marks
Tutorial: ------	CA-2	10 Marks
Credits: 02	MSE	20 Marks
Semester: Second Year (Semester IV)	ESE	60 Marks

Course Prerequisite:

- Basic knowledge of computer fundamentals,
- Digital logic, Computer organization, memory concepts

Course Description:

This course introduces the basic concepts of computer architecture and the internal organization of computer systems. It covers processor organization, instruction execution, data representation, memory organization, input/output systems, and performance improvement techniques such as pipelining and parallel processing. The course helps students understand how modern computer systems work and how their performance is improved.

Course Objectives:

1. To understand the fundamental concepts of computer architecture and processor organization.
2. To study instruction set architecture, data representation, and arithmetic operations used in computer systems.
3. To study the organization and operation of memory systems and input/output mechanisms in a computer.
4. To familiarize students with modern processor performance enhancement techniques, including pipelining and parallel processing.

Course Outcomes:

COs	After completion of the course student will be able to	Bloom's Level
CO1	**Define** the fundamental concepts of computer architecture, and organization	Remember (Level 1)
CO2	**Explain** the organization and working of the processor, instruction set, memory, input/output system, and pipelining in a computer system.	Understand (Level 2)
CO3	**Apply** the concepts of instruction execution, data representation, arithmetic operations, memory organization, and input/output techniques to solve basic computer architecture problems. .	Apply (Level 3)
CO4	**Analyze** the processor architecture, memory organization, input/output system, and performance improvement techniques to evaluate the performance of computer systems.	Analyze (Level 4)

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CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	-	-	-	1	1
CO2	3	2	1	-	-	-	-	-	-	-	-	1	1
CO3	3	3	2	1	1	-	-	-	-	-	-	3	2
CO4	3	3	2	2	2	-	-	-	-	-	-	3	2

Assessment	
CA-1 (a)	Subjective Test / Open Book Test etc.
CA-2 (b)	Assignment / Presentation / Model Making
MSE (c)	Mid Sem Examination

Course Contents		
Unit 1	**Introduction to Computer Architecture** Evolution of Computer Architecture, Computer Organization vs. Computer Architecture, Functional Units of a Computer, Von Neumann and Harvard Architectures, Performance Metrics, Performance Equation and Benchmarking	4 Hrs
Unit 2	**CPU Organization and Data Path** CPU Organization, Register Transfer Language (RTL), Bus Organization and Data Path Design, Data representation, Number Systems and Number Representation , Signed and Unsigned Number Representation, 1's Complement and 2's Complement Representation, Binary Arithmetic (Addition and Subtraction using 2's Complement), Overflow and Underflow, Fixed-Point Number Representation, ALU Design	4 Hrs
Unit 3	**Instruction Set Architecture (ISA)** Instruction Cycle, Machine Instructions and Instruction Formats, Addressing Modes, Types of Instructions, Register Organization, Stack Organization, Hardwired and Microprogrammed Control Unit, RISC vs CISC Architecture, Floating Point Arithmetic, IEEE 754 Floating Point Representation	4 Hrs
Unit 4	**Memory Organization** Memory Hierarchy, Cache Memory, Main Memory Organization, Virtual Memory, Associative Memory, Memory Mapping Techniques, Cache Mapping Techniques, Interleaved Memory, Memory Performance Parameters	4 Hrs
Unit 5	**Input/Output Organization** I/O Interface, Programmed I/O, Interrupt-Driven I/O, Direct Memory Access (DMA), Interrupt Handling, Priority Interrupts, Bus Standards and Bus Arbitration	4 Hrs
Unit 6	**Pipeline and Parallel Processing** Instruction Pipelining, Pipeline Hazards, Hazard Resolution Techniques, Flynn's Classification, Multicore Processors, Multiprocessor Systems, GPU	4 Hrs

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	Architecture, Modern Processor Trends	

Text Books	
1	M. Morris Mano, "Computer System Architecture", 3rd Edition, Pearson Education
2	William Stallings, "Computer Organization and Architecture: Designing for Performance, 11th Edition, Pearson
3	Carl Hamacher, Zvonko Vranesic, Safwat Zaky, and Naraig Manjikian, "Computer Organization and Embedded Systems", 6th Edition, McGraw-Hill
Reference Books	
1	Andrew S. Tanenbaum and Todd Austin, "Structured Computer Organization", 6th Edition, Pearson
2	John P. Hayes – Computer Architecture and Organization, 3rd Edition, McGraw-Hill
3	V. Carl Hamacher, "Computer Organization", 5th Edition McGraw-Hill
Web Resources	
1	https://nptel.ac.in/courses/106102157

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Course Title: Modern Indian Language II		
Course Code: GE254705		**Course Category: AEC**
Teaching Scheme	**Examination Scheme**	
व्याख्याने (Lectures): ०२ तास/आठवडा (02 hrs / week)	CA-1	10 Marks
ट्युटोरियल (Tutorial): -	CA-2	10 Marks
श्रेयांक (Credits): 02	MSE	20 Marks
सत्र (Semester): द्वितीय वर्ष (सत्र ४) (Second Year (Semester IV))	ESE	60 Marks

Course Prerequisite: देवनागरी लिपी वाचण्याचे आणि लिहिण्याचे प्राथमिक ज्ञान

Course Description:

हा अभ्यासक्रम सर्व शाखांच्या अभियंत्यांना मराठी भाषेचे व्यावहारिक आणि उद्योगभिमुख ज्ञान प्रदान करण्यासाठी तयार करण्यात आला आहे. यामध्ये विद्यार्थी मराठी भाषेचा इतिहास आणि व्याकरणाचा भक्कम पाया रचतील आणि त्यानंतर आकलन कौशल्ये व शब्दसंपत्ती वाढवण्यावर लक्ष केंद्रित करतील. हा अभ्यासक्रम प्रामुख्याने व्यावसायिक उपयोजनावर भर देतो, ज्यामध्ये अधिकृत पत्रव्यवहार, इतिवृत्त लेखन आणि अचूक पारिभाषिक व प्रशासकीय संज्ञांचा वापर शिकवला जाईल. याव्यतिरिक्त, तांत्रिक संकल्पनांचे अचूक संप्रेषण सुनिश्चित करण्यासाठी विद्यार्थी इंग्रजी आणि मराठी या दोन्ही भाषांमधील भाषांतर कौशल्ये विकसित करतील. सरतेशेवटी, हा अभ्यासक्रम भावी अभियंत्यांना स्थानिक उद्योग, कॉर्पोरेट क्षेत्र आणि शासकीय कार्यालयांमध्ये आत्मविश्वासाने आणि प्रभावीपणे संवाद साधण्यास सक्षम बनवतो.

Course Objectives:

1. विद्यार्थ्यांना मराठी भाषेचा उगम, विकास, देवनागरी लिपी आणि विविध साहित्य प्रकारांची ओळख करून देणे.
2. विद्यार्थ्यांना मराठी व्याकरणाचे मूलभूत नियम, शुद्धलेखन आणि अचूक वाक्यरचना यांचे सखोल ज्ञान देणे.
3. विद्यार्थ्यांची शब्दसंपत्ती वाढवणे आणि दैनंदिन तसेच व्यावसायिक संवादात वाक्प्रचार व म्हणींचा योग्य वापर करण्यास शिकवणे.
4. विद्यार्थ्यांमध्ये तांत्रिक आणि प्रशासकीय उताऱ्यांचे वाचन, विश्लेषण आणि अचूक आकलन करण्याची क्षमता विकसित करणे.
5. विद्यार्थ्यांना कार्यालयीन कामकाज, पत्रव्यवहार आणि अभियांत्रिकी क्षेत्रात वापरल्या जाणाऱ्या पारिभाषिक संज्ञांचे व्यावहारिक प्रशिक्षण देणे.
6. विद्यार्थ्यांना भाषांतराची तत्त्वे आणि पद्धती समजावून सांगणे आणि इंग्रजी-मराठी भाषांतराचा (विशेषतः तांत्रिक संदर्भात) सराव करून घेणे.

Course Outcomes:

COs	अभ्यासक्रम पूर्ण झाल्यानंतर विद्यार्थी सक्षम असतील (**After completion of the course: Students will be able to)**	**Bloom's Level**
CO1	मराठीचा इतिहास आणि विकास, मराठी व्याकरण, शब्दसंपत्ती आणि भाषासमृद्धी, आकलन कौशल्ये, व्यावहारिक आणि उपयोजित मराठी आणि भाषांतर कौशल्ये यांच्याशी संबंधित मूलभूत तथ्ये, माहिती, नियम आणि मानकांचे स्मरण करणे.	स्मरण Remember (Level 1)
CO2	मराठीचा इतिहास आणि विकास, मराठी व्याकरण, शब्दसंपत्ती आणि भाषासमृद्धी, आकलन कौशल्ये, व्यावहारिक आणि उपयोजित मराठी आणि भाषांतर कौशल्ये यांच्याशी संबंधित विविध संकल्पना, रचना, आशय आणि कार्यपद्धती स्पष्ट करणे.	समज Understand (Level 2)
CO3	मराठीचा इतिहास आणि विकास, मराठी व्याकरण, शब्दसंपत्ती आणि भाषासमृद्धी, आकलन कौशल्ये, व्यावहारिक आणि उपयोजित मराठी आणि भाषांतर कौशल्ये यांमधील शिकलेल्या नियमांचे, तत्त्वांचे आणि कौशल्यांचे प्रत्यक्ष कामकाजात उपयोजन करणे.	उपयोजन Apply (Level 3)

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CO4	मराठीचा इतिहास आणि विकास, मराठी व्याकरण, शब्दसंपत्ती आणि भाषासमृद्धी, आकलन कौशल्ये, व्यावहारिक आणि उपयोजित मराठी आणि भाषांतर कौशल्ये यांच्याशी संबंधित विविध भाषिक घटक, रचना, साहित्याचा आशय आणि माहितीचे पृथक्करण व विश्लेषण करणे.	विश्लेषण Analyze (Level 4)

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1									2				1
CO2									2				1
CO3									3		1		1
CO4									3		1		1

Assessment	
CA-1 (a)	**वर्णनात्मक चाचणी / गृहपाठ / बहुपर्यायी प्रश्न चाचणी इत्यादी. (**Subjective Test / Assignment / MCQ Test etc.)
CA-2 (b)	**वर्णनात्मक चाचणी / गृहपाठ / बहुपर्यायी प्रश्न चाचणी इत्यादी. (**Subjective Test / Assignment / MCQ Test etc.)
MSE (c)	**वर्णनात्मक चाचणी (**Subjective Test)
ESE (d)	**अंतिम सत्र परीक्षा** (End Semester Exam)

Course Contents		
Unit 1	**मराठीचा इतिहास आणि विकास (History and Literature of Marathi)** मराठी भाषेचा उगम (Origin of Marathi Language), मराठी भाषेचा विकास (Development of Marathi Language), विविध मराठी साहित्य प्रकारांचा परिचय (Introduction to Various Marathi Literary Forms), प्रसिद्ध मराठी साहित्यिक (Famous Marathi Authors), निवडक साहित्यकृतींचा परिचय (Introduction to Selected Literary Works).	4 Hrs.
Unit 2	**मराठी व्याकरण (Marathi Grammar)** मराठी वर्णमाला (Marathi Alphabet), शब्दांच्या जाती (Parts of Speech), काळांचे प्रकार (Types of Tenses), अचूक वाक्यरचना (Correct Sentence Formation), शुद्धलेखनाचे नियम (Rules of Orthography/Spelling), विरामचिन्हांचा योग्य वापर (Proper Use of Punctuation).	4 Hrs.
Unit 3	**शब्दसंपत्ती आणि भाषासमृद्धी (Vocabulary Building)** समानार्थी शब्द (Synonyms), विरुद्धार्थी शब्द (Antonyms), शब्दांची उत्पत्ती: तत्सम, तद्भव, देशी शब्द (Word Origin), शुद्ध आणि अशुद्ध शब्दांची ओळख व दुरुस्ती (Identifying and Correcting Spelling Errors), दैनंदिन संवादात म्हणींचा वापर (Use of Proverbs in Daily Communication), वाक्प्रचारांचा वापर (Use of Idioms).	4 Hrs.
Unit 4	**आकलन कौशल्ये (Reading & Comprehension)**	4 Hrs.

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	दिलेल्या उताऱ्याचे वाचन, विश्लेषण आणि त्यावरील प्रश्नांची अचूक उत्तरे लिहिणे (Reading, Analysis, and Answering Questions on a Given Passage), तांत्रिक किंवा प्रशासकीय उताऱ्यांचे वाचन आणि सारांश लेखन (Reading technical or administrative passages in Marathi and summarizing them).	
Unit 5	**व्यावहारिक आणि उपयोजित मराठी (Practical & Applied Marathi)** औपचारिक पत्रे (Formal Letters), इतिवृत्त लेखन (Meeting Minutes Writing), पारिभाषिक संज्ञा (Technical Terminology), अभियांत्रिकी कामात वापरले जाणारे इंग्रजी-मराठी शब्द (English-Marathi Words Used in Engineering Work), प्रशासकीय कामात वापरले जाणारे इंग्रजी-मराठी शब्द (English-Marathi Words Used in Administrative Work).	4 Hrs.
Unit 6	**भाषांतर कौशल्ये (Translation Skills)** भाषांतराची तत्त्वे (Principles of Translation), भाषांतराच्या पद्धती (Methods of Translation), शब्दशः भाषांतर (Literal Translation), आशयनिष्ठ भाषांतर (Contextual/Sense Translation), मराठीतून इंग्रजीत भाषांतर (Marathi to English Translation), इंग्रजीतून मराठीत भाषांतर (English to Marathi Translation).	4 Hrs.

Sr. No.	Textbooks
1.	मो. रा. वाळिंबे, सुगम मराठी व्याकरण व लेखन, नितीन प्रकाशन.
2.	डॉ. ल. रा. नसिराबादकर, व्यावहारिक मराठी, फडके प्रकाशन.
	Reference Books
1.	यास्मिन शेख, मराठी लेखन मार्गदर्शिका, पद्मगंधा प्रकाशन.
2.	डॉ. स्नेहल तावरे, व्यावहारिक मराठी, स्नेहवर्धन प्रकाशन.
3.	भाषा संचालनालय, शासन व्यवहार कोश, महाराष्ट्र शासन.
4.	डॉ. कल्याण काळे, डॉ. अंजली सोमण, भाषांतर मीमांसा, प्रतिमा प्रकाशन
5.	अ. ना. देशपांडे, मराठी साहित्याचा इतिहास (खंड १ आणि २), व्हीनस प्रकाशन.
6.	शब्दकोश आणि शास्त्रीय व तांत्रिक परिभाषा कोश, महाराष्ट्र राज्य साहित्य आणि संस्कृती मंडळ.
7.	कृ. पां. कुलकर्णी, मराठी भाषा: उद्गम व विकास, मेहता पब्लिशिंग हाऊस.
	Web Resources
1.	महाराष्ट्र शासन, भाषा संचालनालय (Directorate of Languages, Govt. of Maharashtra): https://languages.maharashtra.gov.in
2.	राज्य मराठी विकास संस्था (RMVS): https://rmvs.maharashtra.gov.in
3.	मराठी विश्वकोश (Marathi Vishwakosh): https://marathivishwakosh.org
4.	भारत वाणी (Bharatavani Portal): https://bharatavani.in
5.	महाराष्ट्र राज्य साहित्य आणि संस्कृती मंडळ: https://sahitya.marathi.gov.in

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Course Title: Entrepreneurship Development **Course Code: ET254706**		**Course Category: HSSM-EM**
Teaching Scheme	**Examination Scheme**	
Lectures: 02 hrs / week	CA-1	10 Marks
Tutorial: -----	CA-2	10 Marks
Credits: 02	MSE	20 Marks
Semester: Second Year (Semester IV)	ESE	60 Marks

Course Prerequisite:

- General awareness of how business operates, computer proficiency, Basic knowledge of economics, management principles, and interest in entrepreneurship and innovation.

Course Description:

This course introduces the different aspects of Entrepreneurship, business and start-up ventures and Various funding mechanisms. The course illustrates the details of components of entrepreneurship Programs.

Course Objectives:

1. To develop an understanding of entrepreneurial mindset and competencies.
2. To introduce the fundamentals of business planning and startup management.
3. To explore funding opportunities and financial strategies for startups.
4. To provide insights into market research, product development, and business growth.
5. To familiarize students with government policies, incubation centers, and industry trends.

Course Outcomes:

COs	**After completion of the course: Student will be able to**	**Bloom's Level**
CO1	**Recall** and explain fundamental concepts related to entrepreneurship and business practices.	Remember (Level 1)
CO2	**Understand** and apply systematic methods for identifying opportunities and making decisions.	Understand (Level 2)
CO3	**Apply** appropriate techniques for planning, organizing, and managing activities in an entrepreneurial context.	Apply (Level 3)
CO4	**Analyze** various factors influencing performance, growth, and sustainability in business environments.	Analyze (Level 4)

CO PO Mapping

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	1	-	-	-	-	2	-	-	-	2	1	2	2
CO2	1	-	-	-	-	2	-	1	-	2	1	2	2
CO3	1	-	1	-	-	2	2	1	-	3	1	2	2
CO4	1	-	1	-	-	2	2	1	-	3	1	2	2

Assessment	
CA-1 (a)	Subjective Test/ Assignment
CA-2 (b)	Presentation/Case Study
MSE (c)	Subjective Test

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Course Contents		
Unit 1	**Introduction To Entrepreneurship** Concept And Importance of Entrepreneurship, Competencies of Successful Entrepreneurs, Types of Entrepreneurs, Role of Entrepreneurship in Economic Development, Entrepreneurial Mindset and Motivation Theories, Barriers to Entrepreneurship.	4 Hrs
Unit 2	**Business Idea Generation and Market Research** Advanced Techniques for Idea Generation and Opportunity Recognition, Opportunity Screening and Feasibility Analysis (Technical, Financial, Market), Market Research Methods, Customer Segmentation and Consumer Behavior Analysis, Competitor Analysis.	4 Hrs
Unit 3	**Business Plan Development** Business Model Canvas (BMC): Value Proposition, Channels, Revenue Streams, And Cost Structure, Structure and Components of A Business Plan, Marketing and Operational Planning, Financial Planning Including Costing, Pricing, Budgeting, and Break-Even Analysis, Risk Assessment and Mitigation Strategies.	4 Hrs
Unit 4	**Funding And Financial Management** Sources of Startup Funding: Bootstrapping, Angel Investors, Venture Capital, Crowd funding, Institutional Finance, Stages of Funding, Financial Statement Preparation, Cash Flow Management and Financial Control, Valuation Basics, Overview of Government Initiatives and Schemes.	4 Hrs
Unit 5	**Business Operations and Legal Aspects** Forms Of Business Organization, Business Registration Procedures and Regulatory Compliance, Intellectual Property Rights, Contract Management Basics, Taxation Policies Applicable to Startups, Ethical Issues in Entrepreneurship, Corporate Social Responsibility (CSR) And Sustainability.	4 Hrs
Unit 6	**Growth Strategies and Case Studies** Startup Growth and Scaling Strategies, Branding and Positioning, Digital Marketing Strategies, Technology-Driven Entrepreneurship, Startup Ecosystem, Startup Pitching, Case Studies of Successful and Failed Startups.	4 Hrs

Text Books	
1.	Vasant Desai, “Entrepreneurial Development”, Himalaya Publishing House, Mumbai.
2.	S.S. Khanka, “Entrepreneurial Development”, S. Chand Publishing, New Delhi.
3.	Robert D. Hisrich, “Entrepreneurship”, McGraw-Hill Education.
4.	Rajeev Roy, “Entrepreneurship”, Oxford University Press, New Delhi.
Reference Books	
1.	Saravanavel, P. (2020): Entrepreneurial Development, Margham Publication, Chennai
2.	Mohanty, Fundamentals of Entrepreneurship, PHI Learning.
3.	Entrepreneurship: Business and Management – Dr. R.C. Bhatia, Sultan Chand & Sons, 2020
Web Resources	
1.	https://www.coursera.org/specializations/entrepreneurship
2.	https://onlinecourses.nptel.ac.in/noc26_mg50/preview

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Course Title: Environmental and Sustainable Engineering **Course Code: ET254707**		**Course Category: VEC**
Teaching Scheme	**Examination Scheme**	
Lectures: 02 hrs / week	CA-1	10 Marks
Tutorial: -	CA-2	10 Marks
Credits: 02	MSE	20 Marks
Semester: Second Year (Semester IV)	ESE	60 Marks

Course Prerequisite:
Basic knowledge of science (physics, chemistry basics)
Fundamental understanding of engineering concepts
Awareness of environmental issues and energy usage.

Course Description:
This course consists of different energy resources, environmental issues, and sustainable development. It also covers conventional and renewable energy systems, including solar, wind and hydropower, along with their working principles and applications. The course also covers environmental pollution and its causes, effects, and control measures. It also involves solid waste management techniques. Emphasis is given to sustainability concepts such as life cycle assessment, green technologies, and environmental impact assessment. Additionally, the course explores sustainable design practices, energy-efficient systems, e-waste management, and global initiatives like the United Nations Sustainable Development Goals (SDGs).

Course Objectives:

- To introduce concepts of energy resources and environmental impacts.
- To understand renewable energy systems and their applications.
- To develop knowledge of pollution control and waste management techniques
- To familiarize with sustainability principles and assessment tools (EIA)
- To promote awareness of sustainable design, green technologies, and SDGs

Course Outcomes:

COs	**After completion of the course: Students will be able to**	**Bloom's Level**
CO1	**Define** basic concepts of energy and environment.	Remember (Level 1)
CO2	**Identify** energy systems, environmental issues, and sustainability principles.	Understand (Level 2)
CO3	**Describe** methods for renewable energy use and pollution control.	Understand (Level 2)
CO4	**Apply** methods to address environmental impacts and sustainable solutions.	Apply (Level 3)

CO-PO Mapping

CO-PO Mapping													
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	3	1	-	-	-	1	-	-	-	-	1	-	-
CO2	3	2	1	-	-	2	-	-	-	-	1	-	-
CO3	3	3	2	1	-	3	-	1	-	-	2	-	-
CO4	2	3	2	2	-	3	-	1	-	-	2	-	-

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Assessment	
CA-1 (a)	Subjective Test / Assignment/ MCQ Test etc.
CA-2 (b)	Subjective Test / Assignment/ MCQ Test/ Case study/ PPT etc.
MSE (c)	Subjective Test
ESE (d)	Exam

Course Contents		
Unit 1	**Energy and Environmental Studies** Introduction, Renewable and Non-renewable Energy Resources, Global Energy Scenario, Indian Energy Scenario, Energy demand and environmental impacts: Climate Change; Global Warming; Necessity of Decarbonization; Carbon Foot Printing Basics.	4 Hrs.
Unit 2	**Solar Energy Systems** Introduction, Solar radiation fundamentals and measurement, Operational Principles of Flat-plate and Concentrating Solar Thermal Collectors, Solar photovoltaic (PV) systems: principles and components, Design basics of solar PV systems, Applications: Rooftop Systems; Solar Pumps; Street Lighting.	4 Hrs.
Unit 3	**Renewable Energy Sources** Introduction, Basic Working Principles and Plant Layout: Wind Energy; Nuclear Energy; Biomass Energy; Hydropower; Geothermal; Tidal Energy.	4 Hrs.
Unit 4	**Environmental Pollution and Control** Introduction, Environmental Pollution: Definition, Cause, Effects & Control Measures of Air Pollution; Water Pollution; Soil Pollution; Marine Pollution, Solid Waste Management: Landfill; Incineration; Composting.	4 Hrs.
Unit 5	**Sustainable Engineering** Introduction, Principles of Sustainability, Life Cycle Assessment (LCA), Green Technology and Green Business, Sustainable Materials and Manufacturing, Sustainable Agriculture, Environmental Impact Assessment (EIA).	4 Hrs.
Unit 6	**Sustainable Design and Development** Introduction, Energy-Efficient Machines and Thermal Systems, E- Waste Reduction and Recycling, Green Computing and Data Center Efficiency, United Nations Sustainable Development Goals (SDGs).	4 Hrs.

Sr. No.	Textbooks
1.	G. D. Rai, Non-Conventional Energy Sources, Khanna Publishers
2.	B. H. Khan, Non-Conventional Energy Resources, McGraw Hill Education
3.	C. S. Rao, Environmental Pollution Control Engineering, New Age International
4.	Bhavik R. Bakshi, Sustainable Engineering: Principles & Practice, Cambridge University Press
	Reference Books
1.	S. P. Sukhatme and J.K. Nayak, Solar Energy: Principles of Thermal Collection and Storage, Tata McGraw Hill
2.	D. P. Kothari, K. C. Singal and Rakesh Ranjan, Renewable Energy Sources and Emerging Technologies, PHI Learning
3.	R. C. Gaur, Basic Environmental Engineering, New Age International
4.	D. L. Reeg, Industrial Energy Conservation, Pergamon Press
5.	Catherine N. Mulligan, Sustainable Engineering:Principles & Implementation, CRC Press

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6.	Kailas L. Wasewar and Sunita Neti Rao, Sustainable Engineering, Energy & the Environment, CRC Press
	Web Resources
1.	Prof. Vaibhav Vasant Goud and Prof. R. Anandalakshmi, Renewable Energy Engineering: Solar, Wind and Biomass Energy Systems, IIT Guwahati (https://nptel.ac.in/courses/103103206)
2.	Prof. P. Mondal, Basic Environmental Engineering and Pollution Abatement, IIT Roorkee (https://nptel.ac.in/courses/103107215)
3.	Prof. Prasanta Kumar Das and Prof. A Bhattacharya, Energy Conservation and Waste Heat Recovery, IIT Kharagpur (https://nptel.ac.in/courses/112105221)
4.	Prof. Brajesh Kumar Dubey, Sustainable Engineering Concepts and Life Cycle Analysis, IIT Kharagpur (https://onlinecourses.nptel.ac.in/noc21_ce47/preview)

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Course Title: Signals & Systems & Digital Electronics Lab Course Code: ET254211	Course Category: PCC	
Teaching Scheme	**Examination Scheme**	
Practicals/Sessions: 02 Hours/Week	CA-I	15 Marks
Credits: 01	CA-II	15 Marks
Semester: Second Year (Semester IV)	ESE	20 Marks

Course Prerequisite:

- Basics of Engineering Mathematics and fundamentals of digital electronics.
- Basic programming and breadboard skills.

Course Description: The objective of this laboratory course is to provide students with practical exposure to the generation and manipulation of signals and to perform various signal operations. The course also aims to help students understand the analysis of linear time-invariant (LTI) systems through convolution, and transform techniques to interpret behaviour of system. Another objective of the course is to develop student's skills in using MATLAB for signal visualization, feature extraction, and basic graphical user interface (GUI) development, which supports practical signal processing applications. The course further focuses on providing hands-on experience in implementing and verifying digital logic circuits using integrated circuits, allowing students to understand the practical behavior of digital components used in combinational and sequential circuit design.

Course Objectives:

1. To help students to understand and perform operations on signals and systems.
2. To develop practical skills in MATLAB for signal visualization and analysis.
3. To help students for hardware implementation and verification of digital logic circuits .

Assessment	
CA-I (a)	Based on Actual conduction of 6 practicals: Sr. No. 1 to 12(SS & DE Lab)
CA-II (b)	Based on remaining 6 practicals: Sr. No. 1 to 12(SS & DE Lab)

CO of this practical course is explained in the Theory course with Codes (**ET254206, ET254207**).

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Sr. No.	List of Experiments
1	To perform Standard Test Continuous & Discrete time Signals (Impulse, Step, Ramp, Exponential, Sine etc.)
2	To perform various operations (Scaling, Shifting, folding, etc.) on given signals.
3	To perform use of Convolution Tool for LTI system analysis.
4	To perform Fourier series of CT signals.
5	To perform Transforms of CT and DT signals.
6	Implementation of signal visualization using MATLAB and Graphical User Interface (GUI).
7	To perform operations on logic gates by using ICs
8	To implement half adder and full adder using basic logic gates.
9	To implement binary to gray code converter using logic gates.
10	To implement multiplexer and demultiplexer by using ICs.
11	To implement 1-bit memory cell using NAND or NOR gates.
12	To implement counter circuits by using ICs.

Web Resourses	
V Lab for DE	https://dec-iitkgp.vlabs.ac.in, https://de-iitr.vlabs.ac.in/List%20of%20experiments.html https://de-iitg.vlabs.ac.in/List%20of%20experiments.html https://he-coep.vlabs.ac.in/List%20of%20experiments.html
V Lab for SS	https://ss-iiith.vlabs.ac.in/List%20of%20experiments.html

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Course Title: PBL: Problem to Project Based Learning **Course Code: ET254807**		**Course Category: EL**
Teaching Scheme	**Examination Scheme (As Applicable)**	
Practicals/Sessions: 02 Hours/Week	CA-I	15 Marks
Credits: 01	CA-II	15 Marks
Semester: Second Year (Semester IV)	ESE	20 Marks
Course Prerequisite: Use of analytical skills and drawing tools, Design Thinking Module, Course Level-Problem Based Learning.		
Course Description: This course extends problem-based learning into project realization, where students convert identified problems into working engineering solutions. It emphasizes design, development, and validation of mini-project prototypes using domain knowledge. Students apply systematic engineering approaches to build functional systems within constraints. The course promotes innovation, teamwork, and hands-on skills. Outcomes are demonstrated through a working prototype and technical presentation. The course coordinators will guide to the students in the journey of problem solving by providing the resources in the lab activity sessions and also monitor the students progress.		
Course Objectives: 1. To guide students in transforming identified problems into implementable engineering solutions. 2. To facilitate the design, development, and testing of working prototypes using domain knowledge. 3. To mentor students in applying systematic engineering and project management approaches. 4. To develop students technical competency, teamwork, and communication through mini-project execution.		

Course Outcomes:		
COs	**After completion of the course: Student will be able to**	**Bloom's Level**
CO1	**Interpret** engineering problems and establish solution requirements in a practical context	L2 Understand
CO2	**Apply** suitable tools and techniques to develop a working model or prototype.	L3 Apply
CO3	**Analyze** and formulate solution strategies using relevant engineering principles	L4 Analyze
CO4	**Evaluate** alternative approaches and select appropriate design solutions	L5 Evaluate

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CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2		1								2	2
CO2	3	2	2	2	2			2			1	3	2
CO3	3	3	3	1	1						1	3	2
CO4	2	2	3	2	2	1		1			1	3	3

Assessment	
CA-I (a)	Identify a real-life problem related to the course, clearly explain it with its needs and limitations, study existing solutions, suggest different possible solutions, and choose the best one based on cost, simplicity, and practicality.
CA-II (b)	Design a working model using suitable tools, test its performance, improve it based on results, and finally present the working solution with a simple report.
ESE (c)	Assigned Task Completion.

Sr. No.	**List of Experiments/Activities**
1.	To identify an open-ended problem related to the course for the mini-project.
2.	To define the problem with its objectives, basic requirements, and limitations.
3.	Literature review/survey of existing solutions and understand their drawbacks.
4.	To identify different possible solutions using course-related concepts.
5.	To select the best solution based on different criteria i.e. simplicity, cost, and practicality.
6.	To prepare the design, list of materials and use the required tools for the solution.
7.	To build a basic working model or prototype using available resources.

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8.	To test the model and check whether it meets the expected results.
9.	To improve the model based on testing results and feedback.
10.	To present the final mini-project with a simple report including method, results, and conclusion.

Sr. No.	Textbooks
1.	Nigel Cross,Design Thinking: Understanding How Designers Think and Work, Berg Publishers.
2.	Karl T. Ulrich, Steven D. Eppinger, Product Design and Development, McGraw-Hill Education.
	Reference Books
1.	Mahnaz MoallemWoei Hung Nada Dabbagh, The Wiley Handbook of Problem-Based Learning, Wiley, 2019.
2.	Kothari, C. R., & Garg, Research Methodology: Methods and Techniques, 2nd Revised Edition, 2019- New Age International Publishers, New Delhi.
	Web Resources
1.	NPTEL Online Courses- Problem Based learning, NITTTR. (https://onlinecourses.swayam2.ac.in/e-learning/preview/ntr20_ed12)

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Course Title: Professional Development– IV **Course Code: ET254604**		**Course Category: SC-SEC(VSE)**
Teaching Scheme	**Examination Scheme**	
Practical/Sessions: 02 Hours/Week	CA-I	15 Marks
Credits: 01	CA-II	15 Marks
Semester: Second Year (Semester IV)	ESE	20 Marks

Course Prerequisite:

- Basic knowledge of computer operations and programming concepts.
- Understanding of basic mathematics and arithmetic operations.

Course Description: This course introduces the fundamentals of Python programming including syntax, arithmetic operations, conditional statements, loops, and functions.
It covers data structures such as lists, strings, nested lists, and sets for data manipulation and problem solving. The course also explores modules, lambda functions, and regular expressions to develop efficient Python programs for practical applications.

Course Objectives:

1. To introduce fundamental Python programming concepts including syntax, print statements, arithmetic operations, conditional statements, and loops for solving basic computational problems.
2. To develop modular programs using functions and data structures such as lists, nested lists, strings, and sets to efficiently process and organize data.
3. To implement Python programming techniques for problem solving, including pattern generation, string manipulation, list comprehensions, and lambda functions.
4. To utilize Python standard libraries and advanced concepts such as regular expressions, calendar/date-time modules, and input validation to build practical applications.

Course Outcomes:

COs	**After completion of the course: Students will be able to**	**Bloom's Level**
CO1	**Recall** the fundamental concepts of Python, including syntax, data types, control structures, functions, and object-oriented programming.	Remember (Level 1)
CO2	**Explain** how to develop modular applications using exception handling, file handling, standard libraries, and basic GUI programming.	Understand (Level 2)
CO3	**Implement** Python programming skills and logical algorithms to solve real-world problems effectively.	Apply (Level 3)
CO4	**Examine** and manipulate data using Python data structures such as lists, nested lists, strings, and sets.	Analyze (Level 4)

CO-PO Mapping

COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	1	1	1	2	3	-	-	-	-	-	3	1	3
CO2	1	1	1	2	3	-	-	-	-	-	3	1	3
CO3	1	1	1	2	3	-	-	-	-	-	3	1	3
CO4	1	1	1	2	3	-	-	-	-	-	3	1	3

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Assessment	
CA-I (a)	Based on actual conduction of 6 practical
CA-II (b)	Based on remaining 6 practical

Sr. No.	List of Experiments
1	Introduction to Python & Print Statements: Print "Hello, World!", Print formatted multi-line text, take user input and display it, Print variables of different data types. Practice Problems (HackerRank): Say "Hello, World!", Python If-Else (basic intro)
2	Arithmetic Operations & Division Program: Add, subtract, multiply two numbers, Integer division vs float division, Modulus and power operations, create calculator using user input. Practice Problems: Arithmetic Operators (HackerRank), Basic Calculator (LeetCode Easy)
3	Conditional Statements Implementation: Check even/odd number, Find largest of 3 numbers, Grade classification system, Leap year checker. Practice Problems: Python If-Else (HackerRank), Palindrome Number (LeetCode)
4	Loop-Based Pattern Programs: Print number patterns (triangle, pyramid), Print star patterns, Sum of N numbers, Multiplication table. Practice Problems: Loops (HackerRank), FizzBuzz (LeetCode)
5	Function Design and Implementation: Define and call functions, Functions with arguments and return values, Recursive function (factorial, Fibonacci). Practice, Problems: Functions (HackerRank), Climbing Stairs (LeetCode)
6	List Operations and List Comprehension: Create and modify lists, Sorting and slicing, lists, List comprehension for filtering, Remove duplicates. Practice Problems: Lists (HackerRank), Two Sum (LeetCode)
7	Nested Lists and Runner-Up Score Problem: Create nested lists, Sort nested lists, Find second highest number (Runner-up problem), Student records handling. Practice Problems: Nested Lists (HackerRank).
8	String Manipulation and Validation: String slicing and indexing, Check palindrome, Count vowels and consonants, String validation (isalnum, isalpha, etc.). Practice Problems: String Validators (HackerRank), Valid Palindrome (LeetCode)
9	String Formatting and Text Alignment: Use format (), f-strings, align text (left, right, centre), Print tables. Practice Problems: String Formatting (HackerRank), Pretty Print problems.
10	Set Operations and Lambda Functions: Create and modify sets, Union, intersection, difference, use lambda with map, filter, remove duplicates using set. Practice Problems: Set Operations (HackerRank), Contains Duplicate (LeetCode)
11	Calendar Module and Date-Time Calculations: Find day of a given date, print calendar of a month, Calculate age from DOB, Time difference between two dates. Practice Problems: Calendar Module (HackerRank)
12	Regex Validation and Minion Game Optimization: Validate email using regex, Validate phone number, Password strength checker, Solve Minion Game efficiently. Practice Problems: Regex (HackerRank), Minion Game (HackerRank)

Text Books	
1.	Core Python Programming, 2ed by R. Nageswara Rao
2.	Learning Python – Mark Lutz, O'Reilly Media.

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3.	Python Programming: Using Problem Solving Approach – Reema Thareja, Oxford University Press.
4.	Think Python: How to Think Like a Computer Scientist – Allen B. Downey, O'Reilly Media.
Reference Books	
1.	Head First Python – by Paul Barry, O'Reilly Media.
2.	Automate the Boring Stuff with Python – by Al Sweigart, No Starch Press.
3.	Fundamentals of Python: First Programs – by Kenneth A. Lambert, Cengage Learning.
4.	Python Crash Course: A Hands-On, Project-Based Introduction to Programming – Eric Matthes, No Starch Press.
Web Resources	
1	https://nptel.ac.in/courses/106106145
2	https://ocw.mit.edu/courses/6-189-a-gentle-introduction-to-programming-using-python-january-iap-2008/download/

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Course Title: Do It Yourself-IV Course Code:ET254808		Course Category: EL
Teaching Scheme	**Examination Scheme**	
Practical's/Sessions: 02 Hours/Week	CA-I	15 Marks
Credits: 01	CA-II	15 Marks
Semester: Second Year (Semester IV)	ESE	20 Marks
Course Prerequisite: Students should have basic knowledge of electronic components, analog and digital circuits, and basic computer operation. Familiarity with circuit diagrams, electronic symbols, and basic electronics laboratory practices will help students understand PCB design tools and manufacturing processes effectively.		
Course Description: This course provides practical knowledge of Printed Circuit Board (PCB) design, layout, manufacturing, and assembly techniques. Students learn to design schematics and PCB layouts using EDA tools, including component placement, routing, and generation of manufacturing files. The course also introduces PCB fabrication processes, soldering techniques, and assembly methods. Through hands-on experiments, students develop skills in PCB design, fabrication, testing, and troubleshooting of electronic circuits.		
Course Objectives: 1) Introduce students to Printed Circuit Board (PCB) design concepts and product development flow. 2) Develop skills in schematic capture and PCB layout design using EDA tools. Understand PCB fabrication processes and materials used in PCB manufacturing. 3) Study PCB assembly techniques including through-hole and Learn soldering, de-soldering, troubleshooting, and repair techniques for PCBs. 4) To develop fundamental practical skills in safe handling of electronic servicing tools, safety procedures, and identification of internal components of Smart TV and computer hardware devices. 5) To enable students to perform basic testing, voltage tracing, and fault observation in electronic equipment such as Smart TV, CPU, and computer peripherals like mouse.		

Course Outcomes:		
COs	**After completion of the courseStudents will be able to:**	**Bloom's Level**
CO1	**Understand** and apply PCB design concepts using EDA tools, including schematic capture, component placement, routing, copper pour, library creation, and generation of manufacturing output files.	Apply (Level 3)
CO2	**Explain** and demonstrate PCB manufacturing, assembly, soldering, fault finding, and repair techniques for electronic circuits.	Apply (Level 3)
CO3	**Identify** and test the basic electronic components, voltage points, and functional sections of Smart TV, CPU, and computer mouse using appropriate tools and instruments.	Apply (Level 3)
CO4	**Perform** voltage tracing and observe basic faultsin Smart TV, CPU, and computer mouse for preliminary troubleshooting and maintenance.	Analyze (Level 4)

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	1	3		3	1		1	2		3			
CO2	3	1	2		3	2		1	2		3			
CO3	3	3	1		3	1		1	2		3			
CO4	3	3	1		3	2		1	2		2			

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Assessment	
CA-I (a)	Based on Practical performance Sr. No. 1 to 6 and journal.
CA-II (b)	Based on Practical performance Sr. No. 7 to 12 and journal.
ESE (c)	Practical Examination and Viva Voce / Oral Examination.

Sr. No.	List of Experiments	Hours
1	To demonstrate safe handling of electrical tools and implement safety measures in electrical work.	2 hrs.
2	To analyze internal and external components of a Smart TV for understanding their functions.	2 hrs.
3	To apply voltage tracing and electrical testing techniques on a Smart TV to verify circuit functionality.	2 hrs.
4	To examine the architecture and components of a computer CPU to understand its operational principles.	2 hrs.
5	To identify components of a computer mouse to explain their functionality.	2 hrs.
6	To study the PCB design process and types of PCBs (Single sided, double sided, multilayer boards) and to familiarize with PCB design software.	2 hrs.
7	To design a schematic diagram of a simple electronic circuit using EDA tools (e.g., LED flasher or power supply circuit).	2 hrs.
8	To create PCB layout from schematic, including component placement, routing, and copper pour using PCB design software.	2 hrs.
9	To generate PCB manufacturing output files such as Gerber files, drill files, and netlist for PCB fabrication.	2 hrs.
10	To study and demonstrate PCB manufacturing processes such as film generation, etching, drilling, plating, and routing.	2 hrs.
11	To perform soldering and de-soldering techniques using soldering tools and PCB boards.	2 hrs.
12	To identify, test, and repair faults in PCB circuits	2 hrs.

Text Books	
1.	Christopher T. Robertson, Printed Circuit Board Designer's Reference: Basics.
2.	Printed Circuit Boards: Design and Technology, Walter C. Bosshart
3.	Bruce R. Archambeault and James Drewniak, *PCB Design for Real-World EMI Control*, Springer.
Reference Books	
1.	Quality Hand Soldering and Circuit Board Repair (6th Edition) – H. Ted Smith Cengage Learning.
2.	Newnes Electronics Assembly Handbook – Keith Brindley Elsevier / Newnes.
Web Resources	
1	EasyEDA Official Documentation – https://docs.easyeda.com
2	KiCad Official Website & Documentation – https://www.kicad.org

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Course Title: : Digital Logic Design		
Course Code: ET254402	**Course Category: MDM**	
Teaching Scheme	**Examination Scheme**	
Lectures: 02 hrs/ week	CA-1	10 Marks
Tutorial: -----	CA-2	10 Marks
Credits: 02	MSE	20 Marks
Semester: Second Year (Semester IV)	ESE	60 Marks

Course Prerequisite:

- Basic number system
- Boolean Algebra
- Logic gates

Course Description:

The Digital Electronics course introduces the fundamental principles of digital logic design, combinational and sequential circuits, and digital logic families. Students will explore the design and analysis of circuits such as adders, multiplexers, flip-flops, and state machines. The course also covers programmable logic devices and semiconductor memories, emphasizing practical applications and system design using modern digital components.

Course Objectives:

1. Provide an understanding of Boolean algebra and logical functions
2. Develop the knowledge of combinational and sequential logic circuit design
3. To understand sequential circuits and memory elements.
4. To know logic families, memories, and PLDs.
5. To introduce basic VHDL design and simulation.

Course Outcomes:

COs	After completion of the course: Student will be able to	Bloom's Level
CO1	**Understand** basic application of logic simplification.	Remember (Level 1)
CO2	**Apply** knowledge to solve combinational circuits.	Apply (Level 3)
CO3	**Apply** knowledge to DAC/ADC and FSMs; analyze sequences and operations.	Apply (Level 3)
CO4	**Analyze** asynchronous circuit operations and assess the effect of hazards on system reliability and performance.	Analyze (Level 4)

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	-	3	-	2	-	-	-	-	-	-	-	-
CO3	-	3	3	2	-	-	-	-	-	-	-	-	-
CO4	-	-	2	-	3	-	-	-	-	-	-	-	-

Assessment	
CA-1 (a)	Subjective Test / Open book test
CA-2 (b)	Model Making / Assignment / Presentation
MSE (c)	Mid Sem Examination

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Course Contents		
Unit 1	**Digital Circuit Optimization** Review of Logic Gates and Boolean Algebra, Karnaugh Map Simplification, Quine–McCluskey Method	4Hrs.
Unit 2	**Arithmetic and Data handling Circuits using IC's** Half Adder and Full Adder, Ripple Carry Adder, Introduction to Carry Look Ahead Adder, Multiplexer and Demultiplexer, Encoder and Decoder, Parity Generator and Checker, Basic ALU Concept	4Hrs.
Unit 3	**Data Converters** DAC: Binary weighted resistor type DAC and R-2R ladder DAC, Specifications Resolution, non-linearity, gain error ,settling time, ADC: Successive approximation ADC, Dual slope ADC and Flash ADC, Specifications of ADC – Resolution, input range, linearity, conversion time, Applications of data converters.	4Hrs.
Unit 4	**Finite State Machines** Basic design steps for Finite State Machines (FSMs), State diagrams and state tables, State reduction and state assignment techniques, Mealy and Moore machine models: representation and comparison, FSM implementation from state diagrams, Sequence detector design using Mealy/Moore models	4Hrs.
Unit 5	**Programmable Array Logic** PAL: structure and design, PLA: structure and design, Compare PAL and PLA Advantages and Limitations , Applications : Address decoding , Control logic circuits	4Hrs.
Unit 6	**Hazards** Introduction to Hazards and Glitches, Static and Dynamic Hazards, Hazard Removal using K-Map, Applications of Hazard-Free Circuits	4Hrs.

Text Books
M. Morris Mano, —Digital Logic and Computer Design, 4th edition, Prentice Hall of India, 2013.
Anand Kumar, —Fundamentals of digital circuits, 1st edition, Prentice Hall of India, 2001
Reference Books
R.P. Jain, —Modern digital electronics, 3rd edition, 12threprint Tata McGraw Hill Publication, 2007.
Albert Paul Malvino and Donald P. Leach -Digital Principle and Applications
M. Morris Mano -Digital Design
Web Resources
https://nptel.ac.in/courses/108105132 Prof. Goutam Saha, IIT Kharagpur

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