Government College of Engineering Aurangabad

Chh.Sambhajinagar

NEP

Compliant Curriculum

Final year B.Tech.

w.e.f. 2026-27

Electronics & Telecommunication

Dr. S. R. Hirekhan
Head, E&TC

Dr. Anil Karwankar
Dean Academics

Approved Updated Curriculum in XXXIst Academic Council Meeting
Dated: 03rd February 2026

Government College of Engineering, Aurangabad, Chh. Sambhajinagar

(An Autonomous Institute of Government of Maharashtra)

Teaching and Evaluation Scheme from year 2026-2027

B.Tech. Program in Electronics & Telecommunication Engineering with Minor

Semester – VII

Course				Teaching Scheme			Continuous Evaluation in terms of Marks					
Sr No	**Category**	**Course Code**	**Course Name**	**TH**	**T**	**PR**	**Credits**	**ISE I**	**ISEII**	**ISEIII**	**ESE**	**Total (100)**
1	PCC	ETPCC4001	Cyber Security	2	-	-	2	10	10	-	30	50
2	VSEC-06	ETVSE4001	Lab Cyber Security	-	-	2	1	-	-	25	-	25
3	PEC	ETPECXXXX	PEC IV	2	-	-	2	15	15	10	60	100
4	PEC	ETPECXXXX	Lab PEC IV	-	-	2	1	-	-	25	-	25
5	PEC	ETPECXXXX	PEC V	2	-	-	2	15	15	10	60	100
6	PEC	ETPECXXXX	Lab-PEC V	-	-	2	1	-	-	25	-	25
	PEC	ETPECXXXX	PEC VI	3	-	-	3	15	15	10	60	100
	PEC	ETPECXXXX	Lab-PEC VI	-	-	2	1	-	-	25	-	25
7	Experiential Learning Course	ETRMC 4001	Research Methodology	2	-	-	2	10	10	-	30	50
8	Experiential Learning Course	ETPRJ4001	Project Phase II	-	-	4	2	-	-	50	50	100
	Total for B. Tech with one minor			10	-	12	**17**	**65**	**65**	**180**	**290**	**600**

Semester VIII

Sr No	**Category**	**Course Code**	**Course Name**	**TH**	**T**	**PR**	**Credits**	**ISE I**	**ISEII**	**ISEIII**	**ESE**	**Total**
1	Experiential Learning Course	ETINT4001	Internship	-	-	24	12	50	50	50	100	250
	Total for B. Tech with one minor					**24**	**12**	**50**	**50**	**50**	**100**	**250**

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Bridge Courses for exit:

After First Year:	**The candidate should complete the internship of two months for 8 credits** **OR** **The candidate should pass the following Two courses of 8 credits to get the certificate** 1.Consumer Electronic/Radio Engineering /Digital Electronics **(Any one course)** 2. Electronics Servicing and Maintenance
After Second Year:	**The candidate should complete the internship of two months for 8 credits** **OR** **The candidate should pass the following Two courses of 8 credits to qualify the Diploma.** 1. Data Communication and Networking 2. Electronics Servicing and Maintenance
After Third Year:	**The candidate should complete the internship of two months for 8 credits** **OR** **The candidate should pass the following Two courses of 8 credits to qualify B. Voc. Degree.** 1. Advanced Mobile Communication 3. Cyber Security

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Following courses will be offered as Professional Electives:

Professional Elective I – Following are the MOOC courses suggested

Sr. No.	Course Code	Course Name
1.	ETPEC3002	Computer Architecture
2.	ETPEC3003	Operating System Fundamentals
3.	ETPEC3004	Quantum Computing
4.	ETPEC3005	Ethical Hacking
5.	ETPEC3006	Natural Language Processing
6.	ETPEC3007	Artificial Intelligence Search Methods For Problem Solving
7.	ETPEC3008	Data Science for Engineers
8.	ETPEC3009	Introduction to Machine Learning
9.	ETPEC3031	Switching Circuits and Logic Design
10.	ETPEC3032	Neural Networks for Signal Processing
11.	ETPEC3033	Introduction to Internet of Things
12.	ETPEC3034	Programming in Java
Students may opt any other MOOC/NPTEL course on current technology with the permission of BoS Chairman as PEC I course.		

Following is the list of Professional Elective courses offered by the department

List of Professional Elective Courses:

(Each of the following course is of 3 + 0 + 1 = 4 Credits)

Sr. No.	**Course Title**
Professional Elective course II (2+0+1)	
01	ETPEC3011 Information Theory & Coding ETPEC3012 Lab Information Theory & Coding
02	ETPEC3013 Advanced Digital Signal Processing ETPEC3014 Lab Advanced Digital Signal Processing
03	ETPEC3015 Object Oriented Programming ETPEC3016 Lab Object Oriented Programming
04	ETPEC3017 Industrial Automation ETPEC3018 Lab Industrial Automation
05	ETPEC3019 Power Electronics ETPEC3020 Lab Power Electronics
Professional Elective course III (2+0+1)	
01	ETPEC3021 Digital Image Processing ETPEC3022 Lab Digital Image Processing
02	ETPEC3023 Deep Learning ETPEC3024 Lab Deep Learning
03	ETPEC3025 Digital System Design ETPEC3026 Lab Digital System Design

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04	ETPEC3027 Cloud Computing ETPEC3028 Lab Cloud Computing
05	ETPEC3029 Digital Communication using GNU Radio ETPEC3030 Lab Digital Communication using GNU Radio
Professional Elective course IV (2+0+1)	
01	ETPEC4001 Radar & Satellite Communication ETPEC4002 Lab Radar & Satellite Communication
02	ETPEC4003 Optical Fiber Communication ETPEC4004 Lab Optical Fiber Communication
03	ETPEC4005 Generative AI ETPEC4006 Lab Generative AI
04	ETPEC4007 Digital VLSI ETPEC4008 Lab Digital VLSI
Professional Elective course V (2+0+1)	
01	ETPEC4011 Microwave Engineering ETPEC4012 Lab Microwave Engineering
02	ETPEC4013 Mobile Communication ETPEC4014 Lab Mobile Communication
03	ETPEC4015 Agentic AI ETPEC4016 Lab Agentic AI
04	ETPEC4017 Automotive Electronics ETPEC4018 Lab Automotive Electronics
Professional Elective course VI (3+0+1)	
01	ETPEC4021 Robotics ETPEC4022 Lab Robotics
02	ETPEC4023 Wireless Communication beyond 5G ETPEC4024 Lab Wireless Communication beyond 5G

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ETPCC4001: Cyber Security

Teaching Scheme		Evaluation Scheme	
Lectures	02 Hrs/Week	ISE I	10 Marks
Total Credits	02	ISE II	10 Marks
		ESE	30 Marks

Course Outcomes:

Upon successful completion of this course, the students will be able to

CO1	Identify the issues and challenges in the Cyber security
CO2	Enumerate and Explain the function(s) of the security mechanisms
CO3	Demonstrate the different types of practical devices and their functions for providing cyber security
CO4	Demonstrate block chain basics, digital forensics, and compliance with cyber laws.

Detailed Syllabus:

Unit 1	Introduction to Cyber Space, Need for Cyber Security, Introduction to Cyber Attacks, Classification of Cyber Attacks, Classification of Malware, Threats, Vulnerability Assessment Risk Analysis, Cyber Security Awareness
Unit 2	Introduction to User Authentication Methods, Biometric Authentication Methods, Biometric Systems, Different Security Models and Security Mechanisms, Operating System Security, Firewall & Intrusion Detection & Prevention Systems
Unit 3	Web Security, Email Security, Mobile Device Security, Cloud Security, IoT Security, Cyber Physical System Security, Social Media Security
Unit 4	Virtual Currency, Block Chain Technology, Security Auditing, Digital Forensics, History, Challenges Digital Forensic Investigation Methods, Cyber Law-Basics, Information Technology Act 2000 Amendments to IT Act 2000

Text Books:

1. Cryptography and Network Security, Behrouz A. Forouzan, TMH, Third Edition
2. Cryptography and Network Security, William Stalling, Pearson Education

Reference Books:

1. Cryptography and Network Security, Atul Kahate, TMH.
2. https://heimdalsecurity.com/pdf/cyber_security_for_beginners_ebook.pdf

Assessment:

ISE I, II	Shall be based on Class Tests / Assignments / Quizzes / Field visits / Presentations / Course Projects

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Mapping of Course outcomes with Program Outcomes:

PO →	1	2	3	4	5	6	7	8	9	1 0	11	1 2	PSO 1	2	3
CO1	2	3	2	-	2	-	-	-	-	-	-	2	1	-	-
CO2	2	3	2	-	2	-	-	-	-	-	-	2	1	-	-
CO3	2	3	2	2	2	-	-	-	-	-	-	2	2	-	-
CO4	2	3	2	2	2	-	-	-	-	-	-	2	3	-	-

3 –High 2–Medium 1–Low

Assessment table:

Assessment Tool	K1	K2	K3	K3
	CO1	CO2	CO3	CO4
ISE I (10 Marks)	05	05	00	00
ISE II (10 Marks)	00	05	05	00
ESE (30 Marks)	05	10	10	05

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ETVSE4001: Lab Cyber Security

Teaching Scheme		Evaluation Scheme	
Practical	02 Hrs/Week	ISE III	25 Marks
Total Credits	01	ESE	-

Course Outcomes:

As an outcome of completing the Laboratory course, students will be able to:

CO1	Perform Security Management of an organization
CO2	Provide protection to desk top and mobile operating system
CO3	Use various network protection tools
CO4	Analyze practical firewall system

List of Experiments: Any Six Experiments

Sr. No.	Details
1	Analysis of Security Management of Corporate
2	Hardening of Operating system
3	Demonstration of Cloud Security
4	Web application security implementation
5	Evaluation of Firewalls, VPNs, Intrusion Detection, and filters
6	Email Security Methods
7	Understanding Android Security.
8	Linux security system
9	Techniques of IoT security

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			1									1
CO2			3									1
CO3			3				1					3
CO4			3					2				2

3 –High 2 –Medium 1-Low

Assessment Table:

Assessment Tool	S1	S3	S4	S2
	CO1	CO2	CO3	CO4
ISE III (25Marks)	05	05	10	05

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ETPRJ4001: Project Phase – II

Teaching Scheme		Evaluation Scheme	
Practical	04 Hrs/Week	ISE III	50 Marks
Total Credits	02	ESE	50 Marks

Course Description:

Project - II is in continuation of Project - I undertaken by the candidates in earlier term. The group of students shall complete the work assigned to them with faculty guidance.

Group of students shall implement hardware and / or software for planned project. They shall carry module wise testing / debugging, analysis. They shall integrate and validate the specifications under faculty guidance. It is mandatory for students to report weekly progress to guide.

ISE III:

The evaluation is done through project reviews (2 to 3). The project batch has to prepare typed report of about 70 pages or more, on the work carried out by the batch of students in respect of the project assigned, during first both the semesters It should be in the prescribed format.

Practical Examination:

It shall consist of demonstration of designed, fabricated project and viva voce based on it. The said examination will be conducted by a panel of two examiners; one of them will be a guide and another will be an external examiner. The external examiner will be either from the allied industry or a senior faculty member from other institute.

Course Outcomes:

CO1	Identify, formulate and review the literature and frame problem statement
CO2	Implement hardware and/or software techniques for identified problems
CO3	Test and analyze the modules of planned project
CO4	Write technical report and deliver presentation
CO5	Apply engineering and management principles to achieve project goal

Mapping of Course Outcome with Program Outcomes, Program Specific Outcomes:

PO	01	02	03	04	05	06	07	08	09	10	11	12	PSO1	2	3
CO1	3	3	2	3	2	1	1	1	3	3	2	3	2	2	2
CO2	3	3	2	3	2	1	1	1	3	3	2	3	2	2	2
CO3	3	3	2	3	2	1	1	1	3	3	2	3	2	2	2
CO4	3	3	2	3	2	1	1	1	3	3	1	2	2	2	2
CO5	3	3	2	3	2	1	1		3	3	1	3	2	2	2

3 – High, 2 – Medium, 1- Low

Assessment Table:

Assessment Tool	K4	K4 & S3	K4 & S3	A3	A4
	CO1	CO2	CO3	CO4	CO5
ISE III (50 Marks)	10	10	15	10	05
Practical Examination (50 Marks)	10	10	15	10	05

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ETINT4001: Internship

Teaching Scheme		Evaluation Scheme	
		ISE I	50 Marks
		ISE II	50 Marks
		ISE III	50 Marks
Total Credits	12	ESE	100 Marks

Course Description: Industrial training (In-Plant Training / Internship) refers to work experience done during the program of study that is relevant to professional development prior to graduation. The training will provide an industrial exposure to the students and opportunity to develop as per the expectations and requirement of industry giving a good start of the career.

The students shall study the technology, processes, practices and work culture in the industry during the training. They shall also work on the project, if allotted. A Professor from the institute and one mentor from the industry will guide the students. The training period will be of minimum 90 working days.

ISE I, II and III: The evaluation is done through reviews. The student has to present his work during the internship. Every candidate has to give a presentation in presence of faculty members and students. The Head of the department will appoint two internal examiners to assess the term work; guide shall be one of the examiners. The student has to prepare typed report of about 25 pages or more, on the work carried out in the respective industry.

Course Outcomes:

CO1	Observe & experience the practices, processes and work culture of the industry
CO2	Apply engineering concepts to solve the problems
CO3	Develop employability skills and attitude

Mapping of Course outcome with Program Outcomes:

Program Outcome	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	2	3
CO1						1	1	1	2	2	2	2	1	1	1
CO2	3	3	3	3									3	3	3
CO3						1	1	1	3	2	2	2			

3 -High 2 – Medium 1 – Low

Assessment Table:

Assessment Tool	K2	K2	A3
	CO1	CO2	CO3
ISE I (50 Marks)	20	20	10
ISE II (50 Marks)	20	20	10
ISE III (50 Marks)	20	20	10
ESE (100 Marks)	40	40	20

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Electronics & Telecommunication Engineering Department

Curriculum: Professional Electives

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List of Professional Elective Courses

Professional Elective	Sr. No.	Course Code	Course Title
II (2+0+1)	01	ETPEC3011 & 3012	Information Theory and Coding & Lab
	02	ETPEC3013 & 3014	Advanced Digital Signal Processing & Lab
	03	ETPEC3015 & 3016	Object Oriented Programming & Lab
	04	ETPEC3017 & 3018	Industrial Automation & Lab
	05	ETPEC3019 & 3020	Power Electronics & Lab
III (2+0+1)	01	ETPEC3021 & 3022	Digital Image Processing & Lab
	02	ETPEC3023 & 3024	Deep Learning & Lab
	03	ETPEC3025 & 3026	Digital System Design & Lab
	04	ETPEC3027 & 3028	Cloud Computing & Lab
	05	ETPEC3029 & 3030	Digital Communication using GNU Radio & Lab
IV (2+0+1)	01	ETPEC4001 & 4002	Radar and Satellite Communication & Lab
	02	ETPEC4003 & 4004	Optical Fiber Communication & Lab
	03	ETPEC4005 & 4006	Generative AI & Lab
	04	ETPEC4007 & 4008	Digital VLSI & Lab
V (2+0+1)	01	ETPEC4011 & 4012	Microwave Engineering & Lab
	02	ETPEC4013 & 4014	Mobile Communication & Lab
	03	ETPEC4015 & 4016	Agentic AI & Lab
	04	ETPEC4017 & 4018	Automotive Electronics & Lab
VI (3+0+1)	01	ETPEC4021 & 4022	Robotics & Lab
	02	ETPEC4023 & 4024	Wireless Communication beyond 5G & Lab

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ETPEC4001: Radar and Satellite Communication

Teaching Scheme		Evaluation Scheme	
Lectures	02 Hrs./Week	ISE I	15 Marks
Total Credits	02	ISE II	15 Marks
		ISE III	10 Marks
		ESE	60 Marks

Course description: This course covers fundamental principles of Radar. It deals with various types of Radars and their applications. Exposure to Satellite communication, basic terms related to satellite, transponder, up link and down link budgets and also given accessing methods.

Course Outcomes

After completing the course, students will be able to:

CO1	Understand basics of Radar Communication and Satellite Communication
CO2	Explain operations of various types of Radar Systems
CO3	Interpret various access techniques for satellite applications
CO4	Describe design of satellite communication link sand tracking Radar systems

Detailed Syllabus:

Unit1	**Fundamentals of Radar** Introduction to Radars, Radar frequencies, Principles, Applications, Types & Displays, Pulse Radar: Block Diagram and Operation. Radar Range Equation, Range Performance of Radars, Minimum Detectable Signal, Noise Effects, Pulse Repetition Frequency and Range Ambiguities.
Unit2	**CW and FM-CW Radar** Doppler Effect, Continuous wave Radar Principle, Block diagram, Bank of filters, Isolation between transmitter and receiver, Radial Velocity, Application. Frequency Modulated Continuous wave Radars Principle, Block diagram, Multiple CW Radar. Airborne Radar, Altimeter.MTI and Pulse Doppler Radar, Delay line Cancellers, coherent and non-coherent MTI, Pulse Doppler Radar
Unit3	**Satellite Communication, satellite segment & Space Link** Basic concepts of Satellite Communications, Satellite Orbits, Space Segment Introduction, TT&C Subsystem, Transponders, Transmit-Receive Earth Stations. Space Link: Introduction, Equivalent Isotropic Radiated Power, Transmission Losses, Link –Power Budget Equation, System Noise, Carrier to Noise Ratio, The Uplink, Saturation flux density, Input back-off, Downlink, Output back-off, Combined Uplink and Downlink C/N Ratio
Unit4	**Introduction to Satellite Access** Introduction, Single Access, Pre-assigned FDMA, Demand Assigned FDMA, Spade System, TDMA, Pre-assigned TDMA, Demand Assigned TDMA, Satellite Switched TDMA, Code Division Multiple Access.

Text Books:

1. Merrill. Skolnik, “Introduction to Radar Systems”, McGraw-Hill International.
2. Dennis Roddy,“ Satellite Communications”, Tata Mc Graw Hill Publications, fourth

edition.

3. Robert M. Gagliardi, “Satellite Communication”, CBS Publishers &Distributors.

Text and Reference Books:

1. Bassem R. Mahafza, “Radar Signal Analysis & Processing Using MATLAB”, Chapman& Hall Book, Special Indian Edition.
2. Anil K. Maini, Varsha Agarwal, “Satellite Technology, Principles and Applications”, Wiley publications, Second Edition

Mapping of Course outcome with Program Outcomes:

Course Outcome	PO1	PO2	PO3	PO 4	PO5	PO6	PO7	PO 8	PO9	PO10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	2									1			2	2	
CO2	2									1			2	2	
CO3	2		1			1	1			1			2	2	
CO4	3	2	2			3	2			2			1	2	

3 – High **2 – Medium** **1 – Low**

Assessment:

ISE I, II, III	Shall be based on Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/ Course Projects

Assessment table:

Assessment Tool	**K2**	**K2**	**K2**	**K3**
	CO1	**CO2**	**CO3**	**CO4**
ISEI (15 Marks)	05	10	00	00
ISE II (15 Marks)	05	10	00	00
ISEIII (10 Marks)	00	05	05	00
ESE (60 Marks)	20	20	15	05

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ETPEC4002: Lab Radar and Satellite Communication

Teaching Scheme		Evaluation Scheme	
Practical	02 Hrs./Week	ISE III	25 Marks
Total Credits	01	ESE	-

Course Outcomes:

As an outcome of completing the Laboratory course, students will able to:

CO1	Understand fundamentals of Radar communication, satellite communication, satellite transponders and satellite accesses.
CO2	Measure and analyze different parameters of Radar Systems.
CO3	Measure and analyze different parameters of Satellite links.

List of Experiments:

Sr. No.	Details
1.	Understand and setup basic Radar System
2.	Measure Range of pulse radar for different values of radar peak power.
3.	MeasureSignaltoNoiseRatioagainsttargetdetectionrangefordifferentvaluesoftarget Radar cross section.
4	Object counting with the help of Radar.
5.	Understanding satellite communication frequency bands and orbits.
6.	To write a program to plot the degradation in downlink C/I.
7.	Time domain presentation of Echo wave pattern
8.	Understanding the antenna plane of transmission & reception for echo signal
9.	Antenna coupling & beam estimation of FMCW Radar
10	Time domain presentation of Echo wave pattern & comparison with and without target
11	Understanding the FFT, with and without target
12	DOPPLER Shift analysis and measurement using DSO
13	Characterization of σ, c, s for different target material & Comparison
15	MATLAB based RADAR signal processing.

Mapping of Course outcome with Program Outcomes:

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1				2	1							
CO2				3	3							
CO3				3	2							

3 – High 2 – Medium 1-Low

Assessment Table:

Assessment Tool	S1	S2	S3
	CO1	CO2	CO3
ISEIII (25Marks)	9	8	8

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ETPEC4003: Optical Fiber Communication

Teaching Scheme		Evaluation Scheme	
Lectures	02 Hrs/Week	ISE I	15 Marks
Total Credits	02	ISE II	15 Marks
		ISE III	10 Marks
		ESE	60 Marks

Course description: This course covers basics of light propagation in optical fiber, types and structure of optical fiber. It deals with the manufacturing process as well. Signal degradation which includes attenuation and dispersion are discussed in detail. Measurements related to optical fiber are covered.

Course Outcomes:
After completing the course, students will be able to

CO1	Define basic laws related to communication in optical fiber.
CO2	Illustrate operation of optical fiber communication components and their integration.
CO3	Formulate mathematical representation of light signal at various stages in optical fiber communication.
CO4	Understand the significance of dispersion and attenuation to design optical fiber link.

Detailed Syllabus:

Unit 1	Optical fiber communication link, fiber types and structure, manufacturing techniques, fiber connections, signal degradation in optical fiber wave guide : attenuation and dispersion
Unit 2	Optical Sources: Light emitting diode, LASER diode, Optical detectors : PIN diodes, Avalanche photo diode, Optical Amplifiers
Unit 3	Optical Receiver Performance Considerations: Fundamental receiver operation, Receiver noise, Receiver structures, Preamplifiers, High performance amplifiers.
Unit 4	Digital Transmission System: Point to point links, Digital system planning considerations, Analog systems, Distribution Systems, Advanced multiplexing strategies, OTDR.

Text Books:

1.G. Keiser, Optical Fiber Communications (4/e), TMH, 2008
2.G.P. Agrawal, Fiber Optic Communication Systems, (3/e), Wiley, 2002.

Reference Books:

1. Optical Fiber Communications Principles and Practices (4/e) PHI John M. Senior 2010
2. J. Gowar, Optical Communication Systems, (2/e), PHI, 2001.
3. Ghatak and K. Thygarajan, Introduction to Fiber Optics, Cambridge, 1999.

Mapping of Course Outcome with Program Outcomes, Program Specific Outcomes:

PO	01	02	03	04	05	06	07	08	09	10	11	12	PSO1	2	3
CO1	1	1	1	1	1				1	1		1	1	2	
CO2	1	1	2	1	1				1	1		1	1	2	
CO3	3	2	1	1	1				1	1		1	1	2	
CO4	1	2	3	1	1				1	1	2	1	1	2	

3 – High, 2 – Medium, 1- Low

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Assessment:

ISE I, II, III	Shall be based on Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/ Course Projects

Assessment table:

Assessment Tool	K1	K2	K3	K2
	CO1	CO2	CO3	CO4
ISE I (15 Marks)	04	06	05	00
ISE II (15 Marks)	04	06	05	00
ISEIII (10 Marks)	00	00	05	05
ESE (60 Marks)	12	18	12	18

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ETPEC4004: Lab Optical Fiber Communication

Teaching Scheme		Evaluation Scheme	
Practicals	02 Hrs/Week	ISE III	25 Marks
Total Credits	01	ESE	-

Course Outcomes:

As an outcome of completing the Laboratory course, students will able to:

CO1	Plot the characteristics of optical devices.
CO2	Organize various components of optical fiber communication and establish /set up Transmission-reception link.
CO3	Use modern tools to perform optical fiber communication related measurements.

List of Experiments:

1.	Draw the characteristics of optical sources and detectors
2.	Establish an optical fiber communication link
3.	Examine /measure attenuation
4.	Examine /Measure Numerical Apertures
5.	Measure pulse spreading
6.	Measure power using OTDR
7.	Demonstrate use of connectors, splicer
8.	Measure bit rate

Mapping of Course outcome with Program Outcomes:

Course Outcome	PO1	PO 2	PO 3	PO4	PO5	PO 6	PO7	PO 8	PO 9	PO10	PO11	PO1 2	PSO 1	PS0 2	PS0 3
CO1	1	1		2									1	2	
CO2	1	1	1	1									1	2	
CO3	1	1			3								1	2	

3 – High 2 – Medium 1 – Low

Assessment Table:

Assessment Tool	S1	S2	S3
	CO1	CO2	CO3
ISE III (25 Marks)	5	10	10

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ETPEC4005: Generative AI		
Teaching Scheme	**Examination Scheme**	
Lectures: 02 Hrs/ week	ISE I	15
Credits: 02	ISE II	15
	ISE III	10
	End Semester Examination	60

Course Outcomes:

After completing the course students will be able to

CO1	Understand the fundamentals, scope, and impact of generative AI
CO2	Identify different categories of generative models
CO3	Apply effective prompting techniques for tasks
CO4	Analyze real-world use cases through simple gen-AI models using open-source libraries

Detailed Syllabus:

Unit 1	Fundamentals of Generative AI: Evolution of AI, Deep Learning, Generative AI, Generative vs. Discriminative Models, Overview of generative AI ecosystem (models, tools, platforms)
Unit 2	Large Language Models (LLMs) & Prompting, Transformer architecture (self-attention, embeddings, positional encoding, Tools: GPT, Claude, Gemini, L La MA, Hugging Face models
Unit 3	Generative Models – VAEs, GANs, Diffusion Models, Comparison of generative model families, Multimodal Generative AI: Text-to-image, text-to-audio, text-to-video models, Cross-modal embeddings, Image editing, in painting, and enhancement, Generative tools for media creation
Unit 4	RAG Systems, Fine-Tuning & Model Evaluation: Retrieval-Augmented Generation (RAG): vector databases, embeddings, Fine-tuning: LoRA, PEFT, Model evaluation: Perplexity, BLEU, FID, CLIP Score, Limitations: hallucination, bias, outdated knowledge Ethics, Safety, and Applications of Generative AI
Text Books: 1.Generative Deep Learning by David Foster **Reference Books:** 1.Deep Learning by Ian Goodfellow, Yoshua Bengio, and Aaron Courville	

Assessment:

ISE I, II, III	Shall be based on Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/ Course Projects

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Mapping of course outcome with program outcomes:

PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	3	2	2	3				2	1	1	1	1	1	2
CO2	2	2	2	2	2				2	1	1	1	1	1	2
CO3	2	3	3	2	2				2	1	1	1	1	2	2
CO4	2	2	2	2	2				2	1	1	1	1	1	2

1-Low **2-Medium** **3-High**

Assessment Table

Assessment Tool	**K2**	**K2**	**K3**	**K3**
	CO1	**CO2**	**CO3**	**CO4**
ISE I (15)	09	06	00	00
ISE II (15)	00	00	09	06
ISE III (10)	00	00	06	04
ESE Assessment(60)	12	12	18	18

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ETPEC4006: Lab Generative AI		
Teaching Scheme	**Examination Scheme**	
Practicals: 02 Hrs/ week	ISE III	25
Credits: 01		

Course Outcomes: After completing the course students will be able to

CO1	Implement basic data handling and preprocessing techniques
CO2	Implement Generative AI models for Image, text and music generation (GANs, VAEs, LSTM networks, and Transformer)
CO3	Experiment with hyper parameters and optimization techniques to enhance Generative AI outcomes
CO4	Develop innovative applications in image, text, and music generation

Any 10 experiments from the following list:

Sr. No.	Details
1	Write Python scripts to implement basic operations using TensorFlow /PyTorch
2	Preparatory data analysis for Generative AI applications using various Python libraries.
3	Visualize data distributions and patterns in Generative AI datasets through histograms, scatter plots, and heat maps to analyze data characteristics.
4	Implement a Generative Adversarial Network (GAN) architecture using TensorFlow / PyTorch for Image generation.
5	Experiment with hyper parameters, loss functions, and optimization techniques to optimize GAN training for image generation.
6	Generate high resolution image using GAN model.
7	Generate images using trained Generative AI models.
8	Generate text using Long Short-Term Memory (LSTM) network
9	Generate text using Transformer-based language model.
10	Fine-tune a pre-trained language model using transfer learning techniques on a domain-specific dataset for text generation.
11	Develop applications for text generation tasks such as story generation, dialogue generation, or code generation using trained Generative AI models.
12	Music Generation: Preprocess music data and represent it in a suitable format for music generation tasks. Explore MIDI or audio representations for training Generative AI models.
13	Implement a LSTM network for music generation from dataset of music sequences.
14	Implement a Transformer-based model for music generation from dataset of music sequences. Fine-tune the model on a music dataset and generate novel music compositions.

Mapping of Course outcome with Program Outcomes:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS O1	PS O2	PS O3
CO1	2	3	1	2	2				1	1		1			2
CO2	3	2	2	2	2				1	1		1			2
CO3	2	2	1	3	2				1	1		1			2
CO4	3	2	2	2	2				1	1		1			2

3 – High 2–Medium 1-low

Assessment table:

Assessment Tool	S1	S2	S2	S3
	CO1	CO2	CO3	CO4
ISE III (25 Marks)	5	5	5	10

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ETPEC4007: Digital VLSI

Teaching Scheme		Evaluation Scheme	
Lectures	02 Hrs/Week	ISE I	15 Marks
Total Credits	02	ISE II	15 Marks
		ISE III	10 Marks
		ESE	60 Marks

Prerequisites: Knowledge of Digital Electronics

Course description: This course deals with the basics of MOS devices, fundamentals and concepts of digital VLSI design. An exposure will be given to static and dynamic characteristics of CMOS Inverter, CMOS Static and Dynamic Design and design of Latches and Registers.

Course Outcomes

After completing the course, students will be able to:

CO1	Gain the knowledge of digital circuit design using CMOS.
CO2	Design digital circuits using CMOS keeping in view the design metrics and Energy Delay product.
CO3	Understand the behavior of CMOS Inverter and CMOS gate
CO4	Evaluate the static and dynamic performance of CMOS gate and CMOS Inverter and design of sequencing elements

Detailed Syllabus:

Unit 1	Introduction to design Basic MOS structure and its static behavior, Quality metrics of digital design: Cost, functionality, robustness, power, and delay, Stick diagram and Layout, Electricals wire models.
Unit 2	The CMOS Inverter The static CMOS inverter, Static and Dynamic Behavior, Power, Energy and Energy Delay of CMOS Inverter.
Unit 3	Static CMOS Design Complementary CMOS, Ratioed Logic, Pass-Transistor Logic
Unit 4	Dynamic CMOS Design Dynamic Logic: Basic Principles, Speed and Power Dissipation of Dynamic Logic, Issues in Dynamic Design, Cascading Dynamic Gates, Introduction to sequential logic circuit design

Text Books

1. Digital integrated circuits: a design perspective, Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, PHI
2. CMOS VLSI Design, Weste and Harris, Addison Wesley.

Reference Books

1. Modern VLSI Design - System-on-chip Design, Wayne Wolf, Prentice Hall India/Pearson Education
2. CMOS Digital Integrated Circuits, Analysis and Design, Sung-Mo Kang and Yusuf Lablebici, Tata McGraw-Hill Edition.

Mapping of Course outcome with Program Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3														
CO2			2	3											
CO3			2			2									
CO4		1	2			1									

3 – High 2 – Medium 1 – Low

Assessment:

ISE I, II, III	Shall be based on Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/ Course Projects

Assessment table:

Assessment Tool	**K1**	**K2**	**K2**	**K3**
	CO1	**CO2**	**CO3**	**CO4**
ISE I (15 Marks)	05	10	00	00
ISE II (15 Marks)	03	06	06	00
ISE III (10 Marks)	00	00	05	05
ESE (60 Marks)	12	18	18	12

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ETPEC4008: Lab Digital VLSI

Teaching Scheme		**Evaluation Scheme**	
Practical	02 Hrs/Week	ISE III	25 Marks
Total Credits	01	ESE	-

Course Outcomes:
After completing the Laboratory course, students will be able to:

CO1	To understand the fundamentals of CMOS Technology in Digital Domain
CO2	Design a digital system using given specifications and design constraints
CO3	To demonstrate the ability for using backend tools in IC technology

List of Experiments:

Sr. No.	**Details**
1	Introduction to Hiper Silicon(tanner) software
2	Learn to use software for CMOS designing
3	Understand the behavior of MOS transistor by analyzing ID v/s VDS curve and ID v/s VGS curve
4	Design simulate, layout and test various logic gates
5	Design a CMOS inverter in schematic and simulate for Transient Characteristics
6	Design, prepare layout and simulate CMOS Inverter for the given specifications
7	Design and plot the characteristics of a positive and negative multiplexers based latches
8	Design and plot the characteristics of a 4x1 digital multiplexer using pass transistor logic
9	Design and plot the characteristics of a master-slave positive and negative edge triggered registers based on multiplexers

Mapping of Course outcome with Program Outcomes:

CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**	**PS O3**
CO1				2	3										
CO2				1	2										
CO3				1	1										

3 – High 2–Medium 1-low

Assessment table:

Assessment Tool	**S1**	**S2**	**S2**
	CO1	**CO2**	**CO3**
ISE III (25 Marks)	05	10	10

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ETPEC4011: Microwave Engineering

Teaching Scheme		Evaluation Scheme	
Lectures	02 Hrs/Week	ISE I	15 Marks
Total Credits	02	ISE II	15 Marks
		ISE III	10 Marks
		ESE	60 Marks

Course description: The course introduces Electromagnetic Propagation in free space and in transmission line structures, discusses operation and design of passive and active microwave components and circuits, microwave signal sources. The course introduces microwave measurement techniques.

Course Outcomes

After completing the course, students will be able to:

CO1	Comprehend propagation of microwaves in free space and its modal illustrations
CO2	Infer the techniques to generate microwaves
CO3	Understand microwave passive devices and packages
CO4	Estimate the parameters involved in microwaves communication

Detailed Syllabus:

Unit 1	Fundamental of microwaves: Free Space Wave and Guided Wave, Modes of Propagation in Rectangular waveguide, Coaxial Line, Flexible waveguide,
Unit 2	Microwave Passives Matching Networks, Microwave Filters, Power Divider/ Combiner, Hybrid, Directional Coupler, Circulator, BALUN, Attenuators & cavity resonator.
Unit 3	Microwave Actives Two cavity Klystron amplifier, Reflex klystron, Diodes, HBTs, and HEMTs, Small Signal Amplifiers, Low Noise Amplifiers, Power Amplifiers, Voltage Controlled Oscillators
Unit 4	Microwave Measurements Packaging Technology Noise Figure, Sources of Noise, Noise Figure Measurements, Phase Noise, Power Measurement, Plastic and Ceramic Package Analysis and effects on circuit performance, LTCC Process,

Text Books

1. Microwave Engineering by David M. Pozar, Fourth Edition Wiley E-Text Reg Card, John Wiley & Sons, Incorporated, 2013, ISBN 1118631439, 9781118631430
2. Foundations For Microwave Engineering, 2ND ED, Robert E. Collin, John Wiley & Sons, 2007, ISBN 8126515287, 9788126515288

Reference Books

1. Microstrip Lines and Slotlines, Third Edition (Artech House Microwave Library (Hardcover))3rd Edition, Ramesh Garg, Inder Bahl, Maurizio Bozzi, Artech House, 2013, ISBN 1608075354

Mapping of Course outcome with Program Outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	2	1	1			1			1	1		1		1	
CO2	2	1		1					1	1		1		2	
CO3	2	1		1	2				1	1		1		2	
CO4	2	1	1	1	2				1	1		1		1	

3 – High 2 – Medium 1 – Low

Assessment:

ISE I, II, III	Shall be based on Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/ Course Projects

Assessment table:

Assessment Tool	**K3**	**K2**	**K2**	**K2**
	CO1	**CO2**	**CO3**	**CO4**
ISE I (15 Marks)	05	10	00	00
ISE II (15 Marks)	00	05	05	05
ISE III (10 Marks)	00	05	05	00
ESE (60 Marks)	12	18	18	12

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ETPEC4012: Lab Microwave Engineering

Teaching Scheme		Evaluation Scheme	
Practicals	02 Hrs/Week	ISE III	25 Marks
Total Credits	01	ESE	-

Course Outcomes:
After completing the Laboratory course, students will be able to:

CO1	Demonstrate design of various microwave circuits in simulation
CO2	Demonstrate design of various microwave circuits on RF board
CO3	Layout MICs and MMICs
CO4	Demonstrate Measurements of various parameters

List of Experiments:

Sr. No.	Details
1	Design, Simulate, Layout and EM Simulate- Microstrip Line, Coplanar Waveguide with Ground, Coaxial Line, Rectangular Waveguide, Plot Current Distribution, E and H Fields
2	Design, Simulate, Layout and EM Simulate- Attenuation Pads, Phase Shifters
3	Design, Simulate, Layout and EM Simulate- Power Dividers, Hybrids, Lange Coupler
4	Design, create 3D geometry of MOSFET, HBT, Simulate and Plot DC characteristics
5	Illustrate the use of Microwave test bench
6	Measurement of frequency using Microwave test bench
7	Measurement of VSWR using Microwave test bench
8	Plot the characteristics of Microwave source using the complete test bench
9	Any other relevant practical as per the course teacher
10	Case study of any one of the Microwave application

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Mapping of Course outcome with Program Outcomes:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PS O1	PS O2	PS O3
CO1	1	1	1	3	2				1	2		1		3	1
CO2	1	1	1	2	2				1	2		1		3	1
CO3	1	1	1	2	2				1	2		2		3	1
CO4	1	1	1	3	2				1	2		3		3	1

3 – High 2–Medium 1-low

Assessment table:

Assessment Tool	**S1**	**S2**	**S2**	**S3**
	CO1	**CO2**	**CO3**	**CO4**
ISE III (25 Marks)	02	09	09	05

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ETPEC4013: Mobile Communication

Teaching Scheme		Evaluation Scheme	
Lectures	02 Hrs./Week	ISE I	15 Marks
Total Credits	02	ISE II	15 Marks
		ISE III	10 Marks
		ESE	60 Marks

Course Description:

This course gives exposure the students to the most recent technological developments in Mobile communication systems.

Course Outcomes

After completing the course, students will be able to:

CO1	Describe the basic cellular concepts in mobile communication.
CO2	Explore the characteristics of different types of Multiple Access Technologies.
CO3	Understand GSM and CDMA Cellular technologies.
CO4	Explore emerging technologies required for future generation mobile systems.

Detailed Syllabus:

Unit 1	Cellular Concepts: Frequency reuse, channel assignment strategies, handoff Strategies, Co-channel Interference (CCI), Adjacent Channel Interference (ACI), Interference reduction techniques, improving coverage and capacity in cellular system, Call Setup Processes, SAR value for mobile phone
Unit 2	Multiple access techniques: Frequency Division Multiple Access, Time Division Multiple Access, Code Division Multiple Access, Spread Spectrum Multiple Access, Space Division Multiple Access.
Unit 3	GSM & CDMA Overview: GSM architecture, GSM identifiers, localization and calling, Introduction to CDMA, CDMA forward & reverse link
Unit 4	Higher Generation cellular Standards:3G ,4G, 5G systems' ITU Standards, WCDMA, LTE, MIMO, Introduction of Android O.S.

Text Books

1. Wireless Communications by Andrea Goldsmith, Cambridge University Press.
2. Modern Wireless Communications by Simon Haykin, Pearson Edition.
3. Wireless Communications: Principles and Practice by Theodore Rappaport, Prentice Hall.

Reference Books:

1. IS-95 CDMA & CDMA 2000 by Vijay K. Garg, Pearson Education, William C.Y.Lee, Mobile Cellular Telecommunications Analog and Digital Systems, II Ed
2. Principle and Application of GSM by Vijay K. Garg, J.E.Wilkes, Pearson Education.

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Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	1	3		1				2			
CO2	1	1	1	1	1	3								2	
CO3	1	1	2	2	2	3						1		2	
CO4	1	1	1	3	2	3									

3 – High 2 – Medium 1 - Low

Assessment:

ISE I, II, III	Shall be based on Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/ Course Projects

Assessment table

Assessment Tool	K2	K2	K2	K2
	CO1	**CO2**	**CO3**	**CO4**
ISE I	08	07	00	00
ISE II	00	08	07	00
ISE III	00	05	05	00
ESE Assessment (60 Marks)	15	12	15	18

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ETPEC4014: Lab Mobile Communication

Teaching Scheme		Evaluation Scheme	
Practical	02 Hrs./Week	ISE III	25 Marks
Total Credits	01	ESE	-

Course Outcomes

As an outcome of completing the Laboratory course, students will able to:

CO1	Acquire knowledge of GSMAT commands for different applications
CO2	Understand the characteristics and limitations of mobile hardware devices.
CO3	To get familiar with future generation mobile systems.
CO4	Use contemporary development environment and languages (java, Android etc.) to develop mobile applications.

List of Experiments

Sr. No.	Details
1	Generation of following waveform using MATLAB code. ● Direct sequence spread spectrum (DSSS) modulation & demodulation ● TDM modulation and demodulation.
2	Understanding GSM handset for various signaling and fault insertion techniques
3	Working with various GSM- AT Commands.
4	Demonstration of DS-SS modulation/Demodulation Process on CDMA trainer.
5	To get familiar with front panel of 3G mobile phone trainer and to observe test point voltages of 3G mobile phone trainer
6	Understanding smart phone technology.
7	Development of any one android based application.
8	To study and observe system blocks/ sections in GSM handset like: clock, SIM card, charging, LCD module, Keyboard, etc.

Mapping of Course outcome with Program Outcomes

Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1				3	2									2	
CO2				2	2										
CO3				3	3	2									
CO4				3	3	2	3					2		3	

3 – High 2 – Medium 1 – Low

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ETPEC4015: Agentic AI		
Teaching Scheme	**Examination Scheme**	
Lectures: 02 Hrs/ week	ISE I	15
Credits: 02	ISE II	15
	ISE III	10
	End Semester Examination	60

Course Outcomes:

After completing the course students will be able to

CO1	Understand the fundamentals, scope, and impact of generative AI
CO2	Identify different categories of generative models
CO3	Apply effective prompting techniques for tasks
CO4	Build simple gen-AI models using open-source libraries

Detailed Syllabus:

Unit 1	Foundations of Agentic Reasoning: Evolution from Chatbots to Agents; LLM Architectures and Tokenization; Prompt Engineering for E&TC (System Prompts, Few-shot learning); Reasoning Patterns: Chain-of-Thought (CoT), Tree-of-Thought (ToT), and ReAct (Reason + Act) frameworks.
Unit 2	Agent Architectures & Tool Use: The "Brain-Body" analogy in Agentic AI; Tool Calling and Function Calling mechanics; Integration of API-based sensors and actuators; State Management; Designing custom tools for signal analysis and hardware control.
Unit 3	Multi-Agent Systems (MAS) & Orchestration: Introduction to Orchestration frameworks (LangGraph, CrewAI, AutoGen); Communication protocols between agents (A2A); Specialist vs. Generalist agent roles; Designing Hierarchical and Sequential workflows for complex engineering tasks.
Unit 4	Agentic RAG & Long-term Memory: Limitations of standard RAG; Agentic Retrieval-Augmented Generation (Self-RAG, Adaptive RAG); Vector Databases; Implementing Short-term (Context window) and Long-term (Persistent) memory for autonomous agents. Hardware-in-the-loop & Deployment: Deployment on Edge devices; Human-in-the-loop (HITL) patterns Ethics of autonomous agents in telecommunication; Evaluation and Monitoring using LangSmith/AgentOps.
Text Books: 1. Generative Deep Learning by David Foster **Reference Books:** 1. Deep Learning by Ian Goodfellow, Yoshua Bengio, and Aaron Courville	

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Assessment:

ISE I, II, III	Shall be based on Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/ Course Projects

Mapping of course outcome with program outcomes:

PO / CO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	3	2	2	2				2	1	1	1			2
CO2	3	3	2	2	2				1	1	1	1			2
CO3	2	2	2	2	2				2	1	1	1			2
CO4	2	2	2	2	2				1	1	1	1			2

1-Low **2-Medium** **3-High**

Assessment Table

Assessment Tool	**K2**	**K2**	**K3**	**K3**
	CO1	**CO2**	**CO3**	**CO4**
ISE I (15)	09	06	00	00
ISE II (15)	00	00	09	06
ISE III (10)	00	00	00	10
ESE Assessment(60)	12	12	18	18

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ETPEC4016: Lab Agentic AI		
Teaching Scheme	**Examination Scheme**	
Practicals: 02 Hrs/ week	ISE III	25
Credits: 01		

Course Outcomes: After completing the course students will be able to

CO1	Design and implement advanced prompt engineering and reasoning frameworks
CO2	Apply autonomous agent capable of using external tools and APIs for engineering tasks
CO3	Architect multi-agent collaborative systems using modern orchestration frameworks
CO4	Implement Agentic RAG systems for domain-specific knowledge retrieval in E&TC

Any 10 experiments from the following list:

Sr. No.	Details
1	Environment Setup: Setting up Python Virtual Environments, OpenAI/Gemini/Ollama APIs, and HuggingFace.
2	Basic Prompting: Implementing Zero-shot and Few-shot prompting for electronic component identification.
3	Reasoning Implementation: Coding a ReAct agent from scratch using Python.
4	Tool Creation: Building a Python tool that calculates filter coefficients for E&TC applications.
5	Function Calling: Designing an agent that can control a simulated motor via API function calls.
6	Recursive Reasoning: Implementing a Self-Correction agent that debugs Verilog/VHDL code snippets.
7	Knowledge Retrieval: Building a basic RAG system using a dataset of E&TC textbooks/manuals.
8	Vector DB Integration: Implementing semantic search using ChromaDB or Pinecone
9	Agentic RAG: Developing a "Self-Reflective" RAG system that identifies if retrieved information is irrelevant.
10	Stateful Agents: Creating a chatbot with persistent memory using SQLite or Redis.
11	Introduction to LangGraph: Building a cyclic agentic workflow for a circuit design assistant.
12	Multi-Agent Collaboration: Setting up a CrewAI team with a "Researcher" and "Writer" for technical reporting.
13	Hierarchical Teams: Implementing a Lead Agent and Sub-agents for a simulated network troubleshooting scenario.
14	Hardware Simulation: Connecting an AI agent to a Tinkercad/Wokwi simulation via WebSockets.
15	Visual Agents: Using Multimodal LLMs (Vision) to describe circuit diagrams and identify faults.
16	Edge Deployment: Quantizing an LLM and running a local agent on a Raspberry Pi or Jetson Nano.
17	Real-time Monitoring: Integrating LangSmith to trace and evaluate agent reasoning steps.

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18	Autonomous Troubleshooting: Designing an agent that monitors a simulated sensor stream and triggers alerts.
19	Ethics & Guardrails: Implementing NeMo Guardrails to prevent unauthorized hardware access.
20	Mini-Project: Designing an autonomous "Telecommunication Network Optimization Agent."

Mapping of Course outcome with Program Outcomes:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	2	2	2	2	2				1	1		1			2
CO2	3	1	2	2	3				1	1		1			2
CO3	2	2	2	3	2				1	1		2			2
CO4	2	2	2	2	3				1	1		2			2

3 – High 2–Medium 1-low

Assessment table:

Assessment Tool	S1	S2	S2	S3
	CO1	CO2	CO3	CO4
ISE III (25 Marks)	5	5	5	10

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ETPEC4017: Automotive Electronics		
Teaching Scheme	**Examination Scheme**	
Lectures: 02Hrs/Week	ISE I	15
Credit:02	ISE II	15
	ISE III	10
	End Semester Examination	60

Course Description:

The course introduces the electronic systems used in modern vehicles. It focuses on how electronics, Sensors, actuators and embedded controllers are applied to improve vehicle performance, safety, comfort, efficiency and emission control. Students also gain exposure to fault diagnostics, On board diagnostics and emerging technologies such as electric and hybrid vehicles.

Course Outcomes:

At the end of the course .the students will be able to–

CO1	Demonstrate the use of electronic systems in Automotive.
CO2	Describe the power train and chassis control in Automotive.
CO3	Discuss the use and controls of batteries in Automotive.
CO4	Explain various automotive controllers.

Detailed Syllabus:

Unit 1	Introduction Introduction to Electronic systems in Automotive—Sensors and Actuators for body electronics, power train and chassis systems.
Unit 2	Body electronics domain Automotive alarms, Lighting. Central locking and electric windows, Climatic Control, Driver information, Parking, CAN Protocol.
Unit 3	Power train and chassis control domain Engine management, Transmission control. ABS. ESP, Traction Control. Active Suspension, passive safety, Adaptive Cruise Control, etc. Hardware implementation example of simple automotive systems using Sensors. Controller, Actuators etc.
Unit 4	Battery Types and maintenance, Alternators in vehicles, starting motor systems, Electrical circuits and wiring in vehicles, vehicle network and communication buses — Digital engine control systems. Introduction to automotive controllers On-Board Diagnostics(OBD).Introduction to Electric vehicles.

Text books:

1. Bosch," Automotive Electrics and Automotive Electronics. System and components, Networking and Hybrid drive", Fifth edition.SpringerView2014
2. Naja Muzzainan, "Automotive Electronics Design Fundamental" first edition. Springer2015.
3. Hillier's ,'Fundamentals of Motor Vehicle Technology on Chassis and Body Electronics", Fifth
4. Edition, Nelson Thrones, 2007.

Reference Books:

1. William B. Ribbons, "Understanding Automotive Electronics" Sixth Edition, Elsevier Newnes.2002.

Mapping of Course Outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1					1	1		1
CO2	2	2	2	1					1	1		1
CO3	2	2	2	1					1	1		1
CO4	2	2	2	1					1	1		1

3-High 2-Medium 1-Low

Assessment:

ISE I, II, III	Shall be based on Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/ Course Projects

Assessment Table

Assessment Tool				
	CO1	**CO2**	**CO3**	**CO4**
ISE I (15 Marks)	05	10	--	--
ISE II (15 Marks)	05	10	--	--
ISE III (10 Marks)	--	--	10	--
ESE (60 Marks)	12	18	18	12

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ETPEC4018: Lab Automotive Electronics		
Teaching Scheme	**Examination Scheme**	
Practicals:02Hrs/Week	ISE III	25
Credits:01		

Course Outcomes

As an outcome of completing the Laboratory, Students will be able to.

CO1	Interface sensors with microcontrollers.
CO2	Demonstrate the concept of PWM Control.
CO3	Demonstrate the concept of controls using controllers.
CO4	Build prototype of automotive electronic system.

List of Experiments (any 8)

Sr. No.	Details
1	To study construction and working various sensors used in Automotive Electronics
2	To study architecture and IDE of generic microcontroller development board.
3	Interface Various temperature sensors with microcontrollers.
4	To study Rain Sensor, Parking Sensors, Tire Pressure monitoring sensors.
5	Interface speed sensor with microcontroller.
6	Demonstrate PWM control of DC motors.
7	Demonstrate amplification of Signal.
8	Demonstrate filtering of Signal.
9	Demonstrate ADC conversion of Signal.
10	To Study CAN bus communication Protocol.
11	Project development: design, construction, and testing of an automotive electronic System.

Mapping of Course Outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	1					1	1		1
CO2	2	2	2	1					1	1		1
CO3	2	2	2	2	1				1	1		1
CO4	2	2	2	1					1	1		1

3-High 2-Medium 1-Low

Assessment Table:

Assessment Tools	S1	S2	S3	S4
	CO1	**CO2**	**CO3**	**CO4**
ISE III (25)	10	05	05	05

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ETPEC4021: Robotics

Teaching Scheme		Evaluation Scheme	
Lectures	03 Hrs/Week	ISE I	15 Marks
Total Credits	03	ISE II	15 Marks
		ISE III	10 Marks
		ESE	60 Marks

Course description: The course gives exposure to fundamentals of Robotics. Robotics has become major field or future industries. The course covers the basic understanding of Kinematics and Dynamics and various controls involved in robotics. This also includes exposure to applications of Robotics and Robot vision.

Course Outcomes: After completing the course, the students will able to:

CO1	Learn classification and mechanics and controls involved in Robot
CO2	Understand Robotics, kinematics and dynamics
CO3	Explore role of robotics in modern era
CO4	Study Robotic systems and applications

Detailed Syllabus:

Unit 1	Introduction to Robotics and Components Automation and Robotics, Definition, Basic Structure of Robots, Classification of Robots based on coordinate system, Present trends and future trends in robotics, Overview of robot subsystems. Manipulator, Controller, Power conversion unit etc., Specifications of robot.
Unit 2	Kinematics & Dynamics Rigid body Kinematics, Inverse Kinematics, Rotation matrix, Homogenous transformation matrix, Denavit - Hardenberg convention, Euler angles, RPY representation, Direct and inverse Kinematics for industrial robots, Lagrangian Dynamics, link inertia tensor and manipulator inertia tensor, Newton-Euler Dynamics of Robot
Unit 3	Robot Control Control approaches: oscillatory based time varying control law, control law based on vector field orientation approach. Advanced strategies of control: conventional aerial vehicle, Bidirectional X4-flyer.
Unit 4	Applications Applications of Fuzzy Logic and Neural network in Robot Control, Neural controllers, Implementation of Fuzzy controllers: Trajectory tracking controller. Applications of Robotic system: complex control system, Human Robot Interaction: Architecture.AI systems
Unit 5	Robot Vision Machine vision system, description, sensing, digitizing, image processing and analysis, applications of machine vision system, Robotic assembly sensors & intelligent sensors, object recognition.

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Text Books:

1. Fundamentals of Robotics: Analysis and Control – *Robert J Schilling,* PHI, New Delhi
2. Robotic Engineering – *Klafter, Thomas, Negin,* PHI, New Delhi
3. Robotics, Fu, Gonzales and Lee, , McGraw Hill
4. Introduction to Robotics, J.J, Craig, , Pearson Education

Reference Books:

1. Robot Motion and Control (Recent Developments) by M. Thoma & M. Morari
2. Robotics And Automation Handbook, Thomas R. Kurfess, CRC Press, 2004, ISBN 0-8493-1804-1

Mapping of course outcome with program outcomes:

Program outcome	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	2	3
CO1	3												3		
CO2		2							2				3		
CO3						2			2		2		3		
CO4			3		2	2			2				3		

3-High 2-Medium 1-Low

Assessment:

ISE I, II, III	Shall be based on Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/ Course Projects

Assessment Table:

Assessment Tool	K1	K2	K3	K2
	CO1	CO2	CO3	CO4
ISE I (15 marks)	05	10	--	--
ISE II (15 marks)	04	06	--	05
ISE III (10 marks)	--	05	05	--
ESE (60 marks)	06	24	12	18

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ETPEC4022: Lab Robotics

Teaching Scheme		Evaluation Scheme	
Practical	02 Hrs/Week	ISE III	25 Marks
Total Credits	01	ESE	-

Course Outcomes:

As an outcome of completing the Laboratory course, students will able to:

CO1	Explore controllers, motors, actuators, encoders, sensors used in robots.
CO2	Develop an understanding of economic issues related to industrial Robotic and automation systems.
CO3	Participate in a group atmosphere for the defining, planning, and execution of an open ended robotic system.

List of Experiments:

Sr. No.	Details
1	Introduction of Robotic system, various configurations and DOF calculations
2	Basic robot Joints and its simulation using high end computer software
3	Direct kinematics for open/closed loop configurations analytically/simulation/coding
4	Inverse kinematics for open/closed loop configurations analytically/simulation/coding
5	Coding/simulation of direct kinematics for open/closed loop configurations along with work space generation using high end software
6	Formulation of DH parameters of robot configuration and its simulation using open source software
7	Simulation/ performance of a trajectory planning of a robot
8	Application of various robotic sensors along with specifications and their applications area
	Open ended problem 1. Design of robot for a given degree of freedom and required pay load capacity 2. Static force analysis of any robot or robotic arm configuration under consideration 3. Trajectory planning for a robot for a given industrial requirement Major Equipments: Robot kits, MATLAB/ High end Simulation software for mechanisms/robots

Mapping of Course outcome with Program Outcomes:

Program Outcome	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	2	3
CO1				3	2	1						3	2		
CO2		1		3	3							2	2		
CO3				3							2	1	2		
CO4				3	2	1						3	2		

3 – High 2 – Medium 1 - Low

Assessment Table

Assessment Tool	S1	S3	S4	S2
	CO1	CO2	CO3	CO4
ISE III (25 Marks)	05	05	10	05

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ETPEC4023: Wireless Communication beyond 5G network

Teaching Scheme		Evaluation Scheme	
Lectures	03 Hrs/Week	ISE I	15 Marks
Total Credits	03	ISE II	15 Marks
		ISEIII	10 Marks
		ESE	60 Marks

Course description: This course deals with the basics of optical wireless communication uses optical carrier in the near infrared (IR) and visible bands and is considered a viable solution for achieving high speed and large capacity communication link. The students will learn characteristics of the channel response for indoor, outdoor and underwater to enable efficient design of OWC system which is used to analyze and offer solutions to counter the channel distortions.

Course Outcomes:
After completing the course, students will able to:

CO1	Apply the knowledge of basic concepts of optical wireless communication.
CO2	Understand roadmap for beyond 5G technology in the advanced optical wireless communication.
CO3	Design basic optical Indoor-outdoor OWC Link Performance.
CO4	Understand use of modern tools for simulation of modulation.

Detailed Syllabus:

Unit 1	Introduction: Optical Wireless Communication Systems Existing wireless Access Schemes, OWC/Radio Comparison, Potential OWC Application Areas .Introduction: Optical Sources and Detectors: LEDs, Lasers, PIN, APD, Photo detector.5G wireless trends and technologies, Comparison 5G vs. optical Fiber.
Unit 2	Channel modeling: Indoor OWC Channel Modeling: LOS Propagation Model, Non-LOS Propagation Model, Interference from other Light sources Outdoor OWC Channel Modeling: Atmospheric Channel Loss, Beam Divergence, Pointing Loss, Different Atmospheric Turbulence Models. Underwater OWC Channel Modeling: Absorption, scattering, Turbulence, Multipath interference, Physical obstruction, and Background noise
Unit 3	Modulation Schemes: Digital Baseband Modulation Techniques PAM, PPM, PIM etc., Multi-carrier Modulation (OFDM) for OWC, Color Shift Keying, NOMA ,coherent OWC systems
Unit 4	System Performance Analysis: Indoor OWC links: Effect of Ambient Light Sources, Multipath Propagation. Outdoor OWC links: FSO Link Performance under the Effect of Atmospheric Turbulence-Induced Penalty and mitigation strategies.
Unit 5	O-OFDM and CSK Modulation Schemes, Challenges in VLC , Wi Fi /Li Fi Co-existence(hybrid network Li Fi and Wi Fi,V2V Communications

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Text Books:

1. "Advanced Optical Wireless Communication Systems" Shlomi Arnon, John Barry, George Karagiannidis, Robert Schober, and Murat Uysal
2. Optical Wireless Communications System and Channel Modeling Z. Ghassemlooy W. Popoola S. Rajbhandari

References Books:

1. G. Keiser, Optical Fiber Communications (4/e), TMH, 2008

Mapping of Course outcome with Program Outcomes:

Program Outcome	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	2	3
CO1	1	1											1	2	
CO2	1	1	2		1								1	2	
CO3	3	2							1	1			1	2	
CO4	1	2	3						1	2	2		1	2	

3 – High 2 – Medium 1 - Low

Assessment:

ISE I, II, III	Shall be based on Class Tests/ Assignments/ Quizzes/ Field visits/ Presentations/ Course Projects

Assessment table:

Assessment Tool	**K3**	**K2**	**K3**	**K2**
	CO1	**CO2**	**CO3**	**CO4**
ISE I (15 Marks)	10	05	00	00
ISE II (15 Marks)	10	05	00	00
ISE III (10 Marks)	00	00	05	05
ESE (60 Marks)	12	18	12	18

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ETPEC4024: Lab Wireless Communication beyond 5G network

Teaching		Evaluation Scheme	
Practical	02 Hrs/Week	ISE III	25 Marks
Total Credits	01	ESE	-

Course Outcomes

As an outcome of completing the Laboratory course, students will able to:

CO1	Plot the characteristics of optical devices.
CO2	Organize various components of optical wireless communication and establish /set up Transmission-reception link.
CO3	Understand use of modern tools to perform optical wireless communication related measurements.

List of Experiments: (Minimum eight)

1.	Draw the characteristics of optical sources and detectors
2.	Establish an optical wireless communication link in Optisystem.
3.	Study the potential of an optical wireless communication and make a comparison with 5G & 6G Wi-Fi (RF) technologies.
4.	Simulation analysis of underwater wireless optical communication.
5.	Simulation of Channel Estimation, Synchronization & Equalization techniques
6.	Simulation of indoor visible light communication system.
7.	Demonstrations of High-Capacity THz-Wireless Transmission Systems for Beyond 5G
8.	Design and Implementation of Color-Shift Keying for Visible Light Communications
9.	To determine the free space loss and the power received using Matlab program.
10.	Modeling and characterization of short range underwater OWC channels.
11.	Simulation of LOS propagation model environment using Optisystem.
12.	VLC transmitter and receiver using Optisystem.(LOS and NON LOS propagation model)

Mapping of Course outcome with Program Outcomes:

Course Outcome	PO1	PO 2	PO 3	PO4	PO5	PO 6	PO7	PO 8	PO 9	PO10	PO11	PO1 2	PSO 1	PS0 2	PS0 3
CO1	1	1		2									1	2	
CO2	1	1	1	1									1	2	
CO3	1	1			3								1	2	

3 – High 2 – Medium 1 – Low

Assessment Table:

Assessment Tool	S1	S2	S3
	CO1	CO2	CO3
ISE III (25 Marks)	5	10	10

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