Shirpur Education Society's

R. C. Patel Institute of Technology, Shirpur
(An Autonomous Institute)

Syllabus Booklet
Electronics and Telecommunication Engineering

Final Year Year B.Tech.

With Effect from Academic Year 2025-26

Shahada Road, Near Nimzari Naka, Shirpur, Maharashtra 425405
Ph: 02563 259 802, Web: www.rcpit.ac.in

Final Year B. Tech Electronics and Telecommunication Engineering Semester-VII (w.e.f. 2025-2026)

Sr. No.	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				ESE	Total	Credit	
				L	T	P	TA	Term Test 1 (TT 1)	Term Test 2 (TT 2)	Average of TT1 & TT2			Credit	Total Credit
							[A]			[B]	[C]	[A+B+C]		
1	PC	22PCET7010T	Microwave Engineering	3			25	10	10	10	65	100	3	4
2	PC	22PCET7010L	Microwave Engineering Laboratory			2	25				25	50	1	
3	PC	22PCET7020T	Mobile Communication System	3			25	10	10	10	65	100	3	4
4	PC	22PCET7020L	Mobile Communication System Laboratory			2	25				25	50	1	
5	PC	22PCET7030T	Internet of Things	3			25	10	10	10	65	100	3	4
6	PC	22PCET7030L	Internet of Things Laboratory			2	25				25	50	1	
7@	PE	22PEET7041T	Artificial Intelligence & Machine Learning	3			25	10	10	10	65	100	3	4
		22PEET7041L	Artificial Intelligence & Machine Learning Laboratory			2	25				25	50	1	
		22PEET7042T	Robotics	3			25	10	10	10	65	100	3	
		22PEET7042L	Robotics Laboratory			2	25				25	50	1	
		22PEET7043T	Power Electronics	3			25	10	10	10	65	100	3	
		22PEET7043L	Power Electronics Laboratory			2	25				25	50	1	
		22PEET7044T	Data Compression & Encryption	3			25	10	10	10	65	100	3	
		22PEET7044L	Data Compression & Encryption Laboratory			2	25				25	50	1	
		22PEET7045T	Speech Processing	3			25	10	10	10	65	100	3	
		22PEET7045L	Speech Processing Laboratory			2	25				25	50	1	
		22PEET7046T	Embedded Systems	3			25	10	10	10	65	100	3	
		22PEET7046L	Embedded Systems Laboratory			2	25				25	50	1	
		22PEET7047T	Advanced VLSI	3			25	10	10	10	65	100	3	
		22PEET7047L	Advanced VLSI Laboratory			2	25				25	50	1	
8#	OE	22OEET7051T	Product Life Cycle Management	3			25	10	10	10	65	100	3	3
		22OEET7052T	Management Information System	3			25	10	10	10	65	100	3	
		22OEET7053T	Operations Research	3			25	10	10	10	65	100	3	
		22OEET7054T	Cyber Security and Laws	3			25	10	10	10	65	100	3	
		22OEET7055T	Personal Finance Management	3			25	10	10	10	65	100	3	
		22OEET7056T	Energy Audit and Management	3			25	10	10	10	65	100	3	
		22OEET7057T	Public Systems and Policies	3			25	10	10	10	65	100	3	

		22OEET7058T	Science of Well-being	3			25	10	10	10	65	100	3	
		22OEET7059T	Research Methodology	3			25	10	10	10	65	100	3	
9	PC	22PCET7050L	Industrial Automation Laboratory			2	25				25	50	1	1
10	PJ	22PJET7060L	Project Stage-II			4	25				25	50	2	2
11	ES	22ESET7070L	Full Stack Development			2	25				25	50	1	1
			Total	**15**	**0**	**16**	**300**	**50**	**50**	**50**	**500**	**850**	**23**	**23**

@ Any 1 Professional Elective Course # Any 1 Open Elective Courses

TA-Teacher Assessment, ESE- End Semester Examination

Prepared by:
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Final Year B. Tech Electronics and Telecommunication Engineering Semester-VIII (w.e.f. 2025-2026)														
Sr. No.	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				ESE	Total	Credit	
				L	T	P	TA	Term Test 1 (TT 1)	Term Test 2 (TT 2)	Average of TT1 & TT2			Credit	Total Credit
							[A]			[B]	[C]	[A+B+C]		
1@	PE	22PEET8011T	5G Technology *	3			25	10	10	10	65	100	3	3
		22PEET8012T	Computer Vision *	3			25	10	10	10	65	100	3	
		22PEET8013T	Satellite Communication *	3			25	10	10	10	65	100	3	
		22PEET8014T	Internet Engineering & Network Security *	3			25	10	10	10	65	100	3	
			NPTEL / Swayam Course #	3			25	10	10	10	65	100	3	
2#	PE	22PEET8021T	Machine Learning for Signal Processing*	3			25	10	10	10	65	100	3	3
		22PEET8022T	Advanced Digital Signal Processing *	3			25	10	10	10	65	100	3	
		22PEET8023T	Microwave Amplifier & Oscillator Design *	3			25	10	10	10	65	100	3	
			NPTEL / Swayam Course #	3			25	10	10	10	65	100	3	
3	INT	22INTET8030L	Internship			20	150				150	300	10	10
4	MC	22MCET8040T	Disaster Management and Preparedness	2									Audit	Audit
Total				**8**		**20**	**200**	**20**	**20**	**20**	**280**	**500**	**16**	**16**

@ Any 1 Professional Elective 1 Course # Any 1 Professional Elective 2 Courses

TA-Teacher Assessment, ESE- End Semester Examination

1. @ Any 1 Elective Course.
2. * Professional Elective Courses offered for the students doing Internship at institute level.
3. # Professional Elective Courses offered for the students doing Internship at Industry. These courses are to be studied in self-study mode using NPTEL/Swayam platform.
4. Students doing internship at industry shall submit certificate of NPTEL examination OR they have to appear examinations conducted by institute like TT1, TT2 and ESE.
5. Students undergoing internship have the option to appear for both the NPTEL examination and the End Semester Examination (ESE) conducted by the institute for the respective course. In such cases, the better of the two scores (NPTEL or ESE) shall be considered for final grading.
6. List of NPTEL Courses will be declared by concerned BOS at the beginning of the Semester-VIII.

Prepared by:
Prof. B. V. Patil

Checked by:
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Prof. Dr. V. S. Patil
B.O.S. Chairman

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Dept. of TO Department R.C.P.I.T. OFFICE SEAL SHIRPUR

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Director

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Shirpur Dist. Dhule (MS)

Program: Electronics and Telecommunication Engineering	B.Tech	Semester: VII
Microwave Engineering (22PCET7010T)		
Microwave Engineering Laboratory (22PCET7010L)		

Pre-requisite

1. Applied Physics
2. Electromagnetic Wave Propagation
3. Analog Communication
4. Radio Frequency Circuit Design
5. Radiating Systems

Course Objectives

1. To understand the basics of Microwave Communication Systems.
2. To understand various Microwave Devices and Measuring Techniques.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Analyze propagation through guiding media using Wave equation and design various Impedance Matching Techniques.	L4	Analyze
CO2	Analyze functioning of different Microwave components.	L4	Analyze
CO3	Analyze Microwave Tubes and derive expressions of necessary performance parameters for them.	L4	Analyze
CO4	Understand measurement techniques to measure various circuit parameters at microwave frequency and carry out experimental verification for the same.	L2	Understand

Microwave Engineering (22PCET7010T
Course Contents

Unit-I Basics of Microwave Communication Systems 06 Hrs.

Microwave Frequency Bands in Radio Spectrum, Characteristics, Advantages and Applications of Microwaves.

Review of Low frequency parameters: Impedance, Admittance, Hybrid and ABCD parameters, Different types of interconnections of Two port networks. High Frequency parameters, Formulation of S- parameters, Properties of S- parameters.

Unit-II Waveguides and Impedance matching Network and Passive Devices 10 Hrs.

Rectangular waveguides: Construction, Working and Mode analysis and Applications.

Circular and Ridge Waveguide: Construction and Applications, Design of Impedance matching network using distributed parameters.

Unit-III Passive and Semiconductor Microwave Devices 12 Hrs.

Tees, Hybrid ring, Directional couplers, Phase shifters, Terminations, Attenuators and Ferrite devices such as Isolators, Gyrators, and Circulators.

Diodes: Varactor, PIN, Tunnel, Point Contact, Schottky Barrier, Gunn, IMPATT.

Transistors: BJT, Hetro junction BJT, MESFET, and HEMT

Application of Tunnel, Gunn and IMPATT diode as a Microwave Oscillator

construction, working, equivalent circuit and performance characteristics

Unit-IV Microwave Generation and Amplification 10 Hrs.

Two Cavity Klystron, Multi-Cavity Klystron and Reflex Klystron, Helix Travelling Wave Tube and Cross Field Amplifier, Backward Wave Oscillator, Cylindrical Magnetron and Gyrotron.

Unit-V Microwave Measurements 03 Hrs.

VSWR, Frequency, Power, Impedance, Attenuation, Dielectric Constant.

Unit-VI Microwave Application and Modern Trends in Microwave Engineering 03 Hrs.

Effects of Microwave radiation on human body, Microwave hazards. Medical (Microwave ining, Microwave Diathermy) and Civil applications (Microwave heating, Instrumentatior ing Systems, Radar Navigation Systems) of microwaves.

Microwave Engineering Laboratory (22PCET7010L)

List of Laboratory Experiments:

1. Study of Microwave Components.
2. Measurement of Microwave frequency using Microwave Bench Setup.
3. Measurement of Attenuation using Microwave Bench Set-up.
4. Study of Various Modes of Reflex Klystron
5. Compare Analytical and Graphical Method of Impedance Matching for Single Stub.
6. Study of Microwave Hazards.
7. Measurement of Wavelength, VSWR and Unknown load using Microwave Bench Set-up.
8. Measurement of S-parameters for various microwave components.
9. Design and Simulation of Branch line coupler.
10. Mode Pattern Analysis for Rectangle Waveguide.
    (Minimum eight experiments from the above suggested list or any other experiment based on syllabus to be included, which would help the learner to apply the concept learnt.)

Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Text Books

1. Samuel Liao, "Microwave Devices and Circuits", 3^{rd} Edition, Prentice Hall,1999.
2. M. Kulkarni, "Microwave and Radar Engineering", 3^{rd} Edition, Umesh Publication, 2023.

Reference Books

1. D. M. Pozar, "Microwave Engineering", Wiley Publications, 4^{th} Edition, 2012.

2. Annapurna Das, Sisir K. Das, "Microwave engineering", Tata McGraw Hill, 5^{th} Edition, 2021.

3. Peter A. Rizzi, "Microwave Engineering: Passive Circuits" Prentice Hall, 2^{nd} Edition, 1998.

Program: Electronics and Telecommunication Engineering	BTech	Semester: VII
Mobile Communication System (22PCET7020T)		
Mobile Communication System Laboratory (22PCET7020L)		

Pre-requisite

1. Analog Communication (22PCET5010T)
2. Digital Communication (22PCET6010T)
3. Computer Networks (22PCET6030T)

Course Objectives

1. To understand the cellular fundamentals and different types of radio propagation models..
2. To study the system architecture of 2G, 2.5 G, 3G and 4 G standards and beyond.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Classify different types of propagation models	L1	Understand
CO2	Explain the cellular fundamentals and estimate the coverage and capacity of cellular systems.	L4	Analyze
CO3	Illustrate the fundamentals and system architecture of GSM, 2.5G, IS-95 and UMTS	L4, L5	Analyze, Evaluate
CO4	Elaborate on the concepts and principles 4G network deployment and optimization.	L1, L4	Understand, Analyze
CO5	Discuss the emerging technologies for upcoming mobile communication systems. .	L3	Apply

Mobile Communication System (22PCET7020T)
Course Contents

Unit-I Mobile Radio Propagation 06 Hrs.

Large scale fading: Free space propagation model, the three basic propagation mechanisms, reflection, ground Small scale fading: Small scale multipath propagation, types of small-scale fading, Rayleigh and Rician distributions.

Unit-II Fundamentals of Mobile Communication 06 Hrs.

The Cellular Concept System Design Fundamentals: Frequency Reuse, Handoff, Channel Assignment Strategies, Interference and System Capacity, Trunking and Grade of Service, Improving Coverage and Capacity in Cellular Systems

Features of conventional multiple access techniques: Frequency division multiple access (FDMA), Time division multiple access (TDMA), OFDM.

Unit-III Digital Telephony System (2G and 3G Systems) 10 Hrs.

GSM: GSM Network architecture, GSM channels, frame structure for GSM, GSM speech coding, authentication and security in GSM, GSM call procedures, GSM hand-off procedures, GSM evolution: GPRS and EDGE- architecture, radio specifications, IS-95: Architecture of CDMA system, CDMA air interface, power control in CDMA system, rake receiver. UMTS: Objectives, evolution path to 3G, network architecture, WCDMA air interface, attributes of W-CDMA system, Cdma2000 cellular technologies: Forward and Reverse Channels.

Unit-IV Advanced Techniques for 4G Deployment 08 Hrs.

LTE network Architecture, Physical layer: Frames, slots, and symbols, modulation, coding. Multi-antenna Techniques: Smart antennas, multiple input multiple output systems Cognitive radio: Architecture, spectrum sensing Relaying multi-hop and cooperative communications: Principles of relaying, fundamentals. SDR: Architecture, limitations, advantages, disadvantages.

Unit-V 4G Network Planning and Optimization 06 Hrs.

Network Elements in a LTE Radio Network, User Equipment (UE), Base Station (eNodeB), Key Phenomena in LTE, Interference in LTE, Scheduling, Quality of Service, Radio Network Planning Process, Pre-Planning Phase, Detailed Network Planning, LTE Radio Network Optimisation Initial Tuning, Cluster Tuning, Market Level/Network Tuning, Self- organizing, Networks, Key Performance Indicators, LTE Advanced, Carrier Aggregation, MIMO, Coordinated Multi-point Transmission and Reception (CoMP), Relay Nodes.

Unit-VI Road map towards 5G 04

Introduction 5G enabling technologies, Introduction to Femtocell, Femtocell Attributes, Femtocell Standards, Concept of Femtocells, Types of Femtocells Applications of Femtocells.

Mobile Communication System Laboratory (22PCET7020L)

List of Laboratory Experiments:

1. Study of frequency reuse using Matlab/Scilab.
2. To study performance evaluation of handover for absolute signal strength measurement.
3. Tutorial based on fundamentals of frequency reuse and capacity of cellular communication system..
4. Implementation of adaptive modulation for wireless environment.
5. Study of Rayleigh and Rician fading distribution using Simulink and computation of link budget using Okumura model..
6. Tutorial based on emerging technologies of 4G.
7. Tutorial based on 3GPP LTE.
8. Scilab Based GSM, CDMA Implementations.
9. Verify use of Orthogonal Walsh codes in CDMA environment.
10. Tutorial based on Propagation Models.

List of Laboratory Experiments: Minimum eight experiments from the belwo suggested list or any other experiment based on syllabus to be included, which would help the learner to apply the concept learnt.

Text Books

1. Theodore S. Rappaport, "Wireless communications principles and practice", Pearson Publication, 2nd edition,2010.
2. T L Singal, "Wireless Communications", Mc Graw Hill Education, 1st edition, 2010.
3. Andreas F. Molisch, "Wireless Communication", Wiley India Pvt Ltd, 2nd edition, 2013.

Reference Books

1. Upena Dalal, "Wireless and Mobile Communications", Oxford University Press, 1 st edition, 2015..

2. Vijay K. Garg, “Wireless Communication and Networking”, Morgan, Kaufmann Series in Networking, Elsevier, 1 st edition, 2007.

Program: Electronics and Telecommunication Engineering	B.Tech	Semester: VII
Internet of Things (22PCET7030T)		
Internet of Things Laboratory (22PCET7030L)		

Pre-requisite

1. Digital Communications
2. Computer Networks

Course Objectives

1. To introduce the concept of network connected IOT devices.
2. To introduce methods to generate and acquire analog and digital sensor data.
3. To introduce various data communications and role of layers.
4. To introduce methods for data storage and retrieval.
5. To outline the formal procedure for connecting to data networks for data transfer.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Summarize the concepts, features and functions of network connected embedded devices.	L2	Understand
CO2	Adopt a suitable communication model for a given IOT application	L3	Apply
CO3	Identify and summarize different components and resources required for IOT applications.	L1	Remember
CO4	Adopt a suitable data model for a given IOT application	L3	Apply
CO5	Analyze the data generated or received in system through Data Analytics tools.	L4	Analyze

Internet of Things (22PCET7030T)
Course Contents

Unit-I IOT Introduction 08 Hrs.

Concepts and Definitions of the Internet of Things (IoT), Requirements, Functionalists, and structure of IOT, IoT enabling technologies, IoT Architecture, The major component of IOT (Hardware & Software), IoT communication models and networking protocols, Role of wired and wireless communication, IoT services and applications, IoT Standards, Examples of IoT.

Unit-II IOT Data Acquisition & Platforms 10 Hrs.

Micro Controllers (Arduino uno/mega2560, Rasberry-Pi, ARM Cortex M), Real-time systems, and embedded software, OS and Drivers (End Device Program), Hardware & Software Requirements.

Unit-III IOT Data Communication 10 Hrs.

Data transfer data by Wireless / Wired connectivity, Ipv4/Ipv6, Ethernet/GigE, MIPI, M-PHY, UniPro, SPMI, BIF, SuperSpeed USB Inter-Chip (SSIC), Mobile PCIe (M-PCIe) and SPI, GSM , 2g ,3g ,4g & 5g, IEEE 802.15.4, IEEE 802.15.4e, 802.11ah, Relay Access Point (AP), Grouping of station, Target Wake Time (TWT)

Unit-IV IOT Data Storage & Retrieval 08 Hrs.

Overview and Role of Storage in Cloud / Server /Inhouse Storage, Databases Connectivity with IOT and uses, Case Study over Mysql / NoSql / NewSql, Case Study over Cloud Services and Administration, Case Study of Big Data & Hadoop Platforms.

Unit-V IOT Data Analytics & Visualization 04 Hrs.

Analysis of data using the Python language libraries (modules), Visualization and interpretation of Data, Data Cleaning in IoT.

Internet of Things Laboratory (22PCET7030L)

List of Laboratory Experiments:

1. Basic Embedded operations – I/O toggling, Interrupt handling, Timer operations, periodic

event generations, ADC operations, Serial data transfer – numbers and string transmissions.

2. Data Generation – ADC conversion of analog sensors including temperature using NTC, their calibrations and data transfer to PC terminal.
3. Data Generation – Reading digital sensors and data transfer to PC terminal.
4. State machine design – Data flow planning, design and deployment of communication model through coding.
5. Communication across network – TCP method.
6. Communication across network – UDP Method.
7. Actuations across network - Trigger of relays and solenoids, DC motor.
8. Actuations across network - Demonstration of the DC motor speed control.
9. Data Display across network – Display data on LCD 16X2 Display and OLED module.
10. IOT Product Development & Testing with Project.
    (Minimum eight experiments from the above suggested list or any other experiment based on syllabus to be included, which would help the learner to apply the concept learnt.)

Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Text Books

1. Raj Kamal, "Internet of Things Architecture and Design Principles", Tata McGraw Hill, 2017.
2. Colin Dow, "Internet of Things Programming Projects: Build modern IoT solutions with the Raspberry Pi 3 and Python", Packt Publishing, 2018.
3. Anand Tamboli, "Build Your Own IoT Platform: Develop a Fully Flexible and Scalable Internet of Things Platform in 24 Hours", Apress, 2019.

Reference Books

1. Kamal, R.,"Internet of Things – Architecture and Design Principles", 1 st Edition, Mcgraw Hill,2017.

2. Simone Cirani, “Internet of Things- Architectures, Protocols and Standards”, WILEY, 2018.

3. Alessandro Bassi, “Enabling Things to Talk- Designing IoT solutions with the IoT Architectural Reference Model”, Springer, 2013.

4. Constandinos X. Mavro Moustakis, George Mastorakis, Jordi Mongay Batalla, “Internet of Things (IoT) in 5G Mobile Technologies”, Springer International Publication, 2016.

5. Fadi Al-Turjman, “Artificial Intelligence in IoT”, 1st Edition, Springer International Publishing.

6. Shampa Sen, Leonid Datta, Sayak Mitra, “Machine Learning and IoT: A Biological Perspective”, CRC Press, 2019.

Program: Electronics and Telecommunication Engineering	B.Tech.	Semester: VII
Artificial Intelligence & Machine Learning (22PEET7041T)		
Artificial Intelligence & Machine Learning Laboratory (22PEET7041L)		

Prerequisite: Engineering Mathematics - IV

Course Objectives

1. To teach the basics of Artificial Intelligence and Optimization Algorithms.
2. To deliver the fundamental concepts and techniques of Machine Learning.
3. To make students familiar with regression, classification and clustering methods.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Recall the concepts introduced in Artificial Intelligence (AI), machine learning and neural network fundamentals.	L2	Understand
CO2	Understand searching, optimization algorithms, basics of knowledge representation and reasoning in AI, supervised and unsupervised Machine learning techniques.	L3	Application
CO3	Apply different search and optimization algorithms, logic rules, machine learning techniques, including supervised and unsupervised learning, to solve various problems.	L3	Application
CO4	Analyze various search and optimization algorithms, performance of different machine learning techniques identifying their strengths, weaknesses.	L4	Application

Artificial Intelligence & Machine Learning (22PEET7041T) Course Contents

Unit-I Introduction to Artificial Intelligence (AI) 04 Hrs.

Introduction and Definition of Artificial Intelligence. Intelligent Agents: Agents and Environments, Concept of Rationality, Nature of Environments, Structure of Agents.

Unit-II Problem Solving by Searching 08 Hrs.

Problem Solving Agent, Formulating Problems, Example Problems. Uninformed Search Methods: Depth Limited Search, Depth First Iterative Deepening (DFID). Informed (Heuristic) Search Methods: Greedy best-first search, A* Search. Optimization Problems: Hill climbing Search, Simulated annealing, Genetic algorithm, Ant colony optimization Case study: Travelling salesman problem

Unit-III Knowledge representation and Reasoning 08 Hrs.

Knowledge based agents, Knowledge representation using logic, Propositional logic, Properties of propositional logic statements, Semantics of propositional logic, Resolution algorithm, Inference in Semantics of propositional logic, Resolution algorithm, case study: Wumpus world. Introduction to knowledge representation in FOL.

Unit-IV Introduction to Machine Learning 05 Hrs.

Machine Learning basics, Types of Machine Learning. Introduction to Artificial Neural Network Fundamental concept, Biological Neuron, Artificial Neural Networks, NN architecture, Activation functions

Unit-V Supervised Learning 04 Hrs.

Linear Regression Case study: Predicting house prices with Linear Regression, Linear Regression with one variable, Cost function, Gradient descent. Classifying with k-Nearest Neighbors, Splitting datasets one feature at a time: decision trees, Classifying with probability theory: Naïve Bayes, Logistic regression, Support Vector Machines.

Unit-VI Unsupervised Learning 05 Hrs.

Grouping unlabeled items using k-means clustering. Dimensionality Reduction Principal Component Analysis (PCA).

Artificial Intelligence & Machine Learning Laboratory (22PEET7041L)

List of Laboratory Experiments

Suggested Experiments:(Any 08)

1. Find a goal by Breadth First Search (BFS) algorithm.

2. Find a goal by Depth First Search (DFS) algorithm.
3. Find a goal by Deepening Depth First Search (DFID) algorithm.
4. Predicting house prices by Linear Regression.
5. K Nearest neighbour (KNN) classification of Iris dataset.
6. Decision Tree classification with Tennis Dataset.
7. Generate Confusion Matrix for Naïve Bayes Classifier.
8. Clustering data by K means clustering algorithm.
9. Find the minimum of a polynomial by Gradient Descent Method.
10. To implement Support Vector Machines.

Text Books

1. Stuart J. Russell and Peter Norvig, "Artificial Intelligence", A Modern Approach, Pearson Education,3^{rd} edition,1997.
2. Tom M. Mitchell, "Machine Learning", McGraw Hill Education,1^{st} edition, 2017.

Reference Books

1. Deepak Khemani, "A First Course in Artificial Intelligence", McGraw Hill (India) Pvt. Ltd,1^{st} edition, 2013.
2. Kevin P. Murphy, "Machine Learning", A Probabilistic Perspective, MIT Press, 2012, 1^{st} edition.

Program: Electronics and Telecommunication Engineering	B.Tech.	Semester: VII
Robotics (22PEET7042T)		
Robotics Laboratory(22PEET7042L)		

Prerequisite: Engineering Mathematics III, Microcontroller & Applications-I, Microcontroller & Applications-II.

Course Objective(s):

1. To understand the functional elements of Robotics.
2. To impart the knowledge on direct and inverse Kinematics.
3. To cover various path planning methodologies for robotic navigation and task execution.
4. To introduce the dynamics of robotic manipulators and the control mechanisms.
5. To develop understanding of localization, navigation strategies, and planning techniques.

Course Outcomes:

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the basic concept of robotics.	L2	Understand
CO2	Understand the principle of direct and inverse Kinematics in robotic operation.	L2	Understand
CO3	Describe the various path planning techniques, dynamics and control in robotic applications.	L2	Understand
CO4	Write program to use the robot for the various applications.	L3	Application

Robotics (22PEET7042T)
Course Contents

Unit-I 04 Hrs.

Basic Concepts: Brief History, Types of Robot–Technology-Robot classifications and specifications, Design and Control issues, Various manipulators, Sensors, work cell, Programming languages.

Unit-II 08 Hrs.

Direct and Inverse Kinematics: Mathematical representation of Robots, Homogeneous transformation Various joints, Degrees of freedom Representation using the Denavit-Hartenberg parameters, Direct kinematics-Inverse kinematics, Solvability–Solution methods-Closed form solution, SCARA robots.

Unit-III 08 Hrs.

Path Planning: Joint space technique, Use of p-degree polynomial, Cubic polynomial, Cartesian space technique, Parametric descriptions, Straight line and circular paths, Position and orientation planning.

Unit-IV 07 Hrs.

Dynamics and Control: Lagrangian mechanics, 2DOF Manipulator, Lagrange Euler formulation, Dynamic model, Manipulator control problem-Linear control schemes-PID control scheme-Force control of robotic manipulator.

Unit-V 07 Hrs.

Service Robotics: Need for service robots, Challenges of Localization, Map Representation, Probabilistic Map based Localization, Monte carlo localization, Landmark based navigation, Globally unique localization, Route based localization, Path planning overview, Cell decomposition path planning, Potential field path planning, Obstacle avoidance.

Unit-VI 06 Hrs.

Applications: Ariel robots, Collision avoidance, Robots for agriculture, mining, exploration, underwater, civilian and military applications, nuclear applications, Space applications, Humanoids.

Robotics Laboratory (22PEET7042L)

List of Laboratory Experiments

Suggested Experiments:(Any 8)

1. Robot Classification and Specifications.
2. Composite Rotation Transformation Matrix.
3. Composite Homogenous Transformation Matrix.
4. Evaluate Denavit-Hartenberg representation of three axis planar robot with ARM matrix computation.

5. Joint Space Path Planning Using Cubic Polynomial Interpolation in MATLAB.
6. Comparing Joint Space and Cartesian Space Path Planning Techniques in MATLAB.
7. Dynamic Response Analysis of a 2DOF Manipulator Under PID Control in MATLAB.
8. Simulating Path Planning and Obstacle Avoidance.
9. Perform experiment no 1 (Movemaster) and 2 (Forward Kinematics of PUMA 560) available at the link: https://mr-iitkgp.vlabs.ac.in.
10. Programming a 6-DoF Articulated Robot for Automated Loading and Unloading Operations.

Any other experiment based on syllabus may be included which would help the learner to understand topic/concept.

The Oral/Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Text Books:

1. R. K. Mittal and I. J. Nagrath, "Robotics and Control", Tata McGraw Hill, 4^{th} Edition, 2005.
2. John J. Craig, "Introduction to Robotics Mechanics and Control", Pearson Education, 3^{rd} Edition, 2009.

Reference Books:

1. Ashitava Ghoshal, "Robotics-Fundamental Concepts and Analysis", Oxford University Press, 6^{th} Edition, 2010.
2. Edwin Wise, "Applied Robotics", Cengage Learning, 1^{st} Edition, 2003.
3. K. K. Appu Kuttan, "Robotics", I K International, 1^{st} Edition, 2007.

Program: Electronics and Telecommunication Engineering	B.Tech.	Semester: VII
Power Electronics (22PEET7043T)		
Power Electronics Laboratory (22PEET7043L)		

Prerequisite: Engineering Mathematics III, Electronic Devices and Circuits

Course Objectives

1. To develop the understanding of fundamental principles of power electronics.
2. To disseminate various power electronic semiconductor devices and their characteristics.
3. To develop the concept of power electronic converters and their topologies.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Describe the features and characteristics of power semiconductor devices.	L2	Understand
CO2	Analyze and design triggering, commutation and protection circuits.	L3	Application
CO3	Illustrate, analyze and design AC-DC converters.	L3	Application
CO4	Illustrate, analyze and design DC-DC converters.	L3	Application
CO5	Illustrate, analyze and design DC-AC converters.	L2	Application
CO6	Illustrate, analyze and design AC-AC converters.	L6	Evaluate

Power Electronics (22PEET7043T)
Course Contents

Unit-I Power Semiconductor Devices 04 Hrs.

Principle of operation, constructional features and characteristics of: SCR, TRIAC, DIAC, GTO, MOSFET and IGBT.

Unit-II Triggering, Commutation and Protection 06 Hrs.

Basic Gate Drive circuits for SCR, TRIAC, MOSFET and IGBT, Methods of commutation of SCR, Methods of protection of SCR.

Unit-III AC-DC Converters 06 Hrs.

Uncontrolled half and full wave rectifiers with R and RL load, SCR controlled half and full wave rectifier with R and RL load. Power factor of the controlled rectifier. Effect of source and load inductances.

Unit-IV DC-DC Converters 08 Hrs.

Buck, Boost and Buck-Boost converters, Flyback and Cúk converter, DC-DC converters with R and RL load.

Unit-V DC-AC Converters 08 Hrs.

Principle of operation and performance parameters, Voltage control of single phase inverters

Unit-VI AC-AC Converters 08 Hrs.

Principle of on-off and phase angle control; performance parameters, Single phase full-wave AC-AC converter with R and RL load

Power Electronics Laboratory (22PEET7043L)

List of Laboratory Experiments

Suggested Experiments:(Any 08)

1. To study V-I characteristics of SCR, DIAC and TRIC.
2. To study V-I characteristics of IGBT.
3. To study different triggering circuits for SCR R Triggering circuit, RC triggering circuit
4. To study class B commutation circuit of SCR.
5. To study Half wave controlled rectifiers using SCR.
6. To study AC phase control circuit using DIAC and TRIAC.

7. To study totem pole gate triggering circuit for MOSFET.
8. To study uncontrolled and controlled rectifiers.
9. To Study a controlled rectifier with (i) Source Inductance (ii) Freewheeling diode.
10. To study buck and boost converters.
11. To study flyback converters.
12. To study single phase DC to AC converters.
13. To study AC to AC converters.

Text Books

1. N. Mohan, T. M. Undeland, W. P. Robbins, "Power Electronics: Converters Application and Design", John Wiley & Sons, 2nd edition, 2003.
2. M. H. Rashid, "Power Electronics: Circuits, Devices, and Applications", Pearson Education India, 4^{th} edition, 2014.
3. P.S. Bhimbra, "Power Electronics", Khanna Publishers, 5^{th} edition, 2012.

Reference Books

1. P.C. Sen, "Modern Power Electronics", Wheeler publications, 1^{st} edition, 2005.
2. Ramamurthy, "Thyristor & Their Applications", East-West Press, 2^{nd} edition,1998.

Program: Electronics and Telecommunication Engineering	Final Year B.Tech	Semester: VII
Data Compression & Encryption(22PEET7044T)		
Data Compression & Encryption Laboratory(22PEET7044L)		

Pre-requisite

1. Engineering Mathematics—III
2. Signals and Systems

Course Objectives

1. To introduce different lossy and lossless compression for text audio, image and video.
2. To introduce the concept of Symmetric and Asymmetric key cryptography and its applications in security protocols.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Describe various lossy and lossless techniques.	L2	Understand
CO2	Apply various compression techniques for compression of text, image, audio and video.	L3	Apply
CO3	Describe the range of different cryptosystems and various network security related protocols.	L1	Remember
CO4	Analyze how the basic design criteria for various cryptosystems like confusion, diffusion and number theory are used in cryptographic techniques.	L3	Apply

Data Compression & Encryption (22PEET7044T) Course Contents

Unit-I Text compression 10 Hrs.

Introduction to data compression, Comparison of lossy and lossless compression, Modelling and Coding, Compression Parameters. Huffman Coding, Adaptive Huffman Coding, Arithmetic coding. Dictionary based compression: Static and Dynamic Dictionary, LZ77, LZ78, LZW.

Unit-II Image Compression 06 Hrs.

Differential lossless compression DPCM, JPEG-LS, DCT, JPEG, JPEG 2000.

Unit-III Audio and Video Compression 04 Hrs.

Digital Audio, μ law and A law companding, MPEG-1 Audio layer (MP3 audio format). Digital Video, MPEG-2, H.261 encoder and decoder.

Unit-IV Symmetric key cryptography Key management 08 Hrs.

Introduction: Security Goals, Security techniques – Cryptography and Steganography, Cryptographic attacks.

Symmetric Key Cryptography: Substitution cypher, Transposition Cypher, Stream and Block cypher, DES, Double DES, Triple DES, AES. Key management, Diffie- Hellman Key Exchange.

Unit-V Asymmetric key cryptography and Message Integrity 08 Hrs.

Prime numbers, Fermat's and Euler's theorem, Chinese Remainder theorem. Principles of Public Key cryptosystem, RSA. Message Integrity: Message authentication and Hash functions, SHA, HMAC, Digital Signature Standard.

Unit-VI Network Security 04 Hrs.

Email, PGP, S/MIME, Intrusion detection system. Web security considerations, SSL, TLS, Secure Electronic transaction. Kerberos, X.509 authentication service, Public Key Infrastructure.

Data Compression & Encryption Laboratory(22PEET7044L)

List of Laboratory Experiments:

1. To find compression ratio after compression of various file formats.
2. To implement Huffman coding.
3. To implement Arithmetic coding.
4. To implement μ law and A law companding for Audio compression.
5. To implement DCT for image compression.
6. To implement Substitution cypher for text/ image.
7. To implement Transposition cypher for text/ image.
8. To implement square and multiply algorithm.
9. To implement Fermat's theorem.
10. To implement RSA.
11. To implement Diffie-Hellman Key exchange mechanism.
12. To implement PGP.
13. Case study on specific topics.
14. To study X.509 certificate format by downloading few samples from internet.

    (Minimum eight experiments from the above suggested list or any other experiment based on the syllabus to be included, which would help the learner to apply the concept learnt.)

Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions

Text Books

1. Khalid Sayood , "Introduction to Data Compression", Elsevier, 5th Edition, 2017.
2. William Stallings, "Cryptography and Network Security Principles and Practices", Pearson Education, 5th Edition, 2020.

Reference Books

1. David Saloman, “Data Compression: The Complete Reference”,4th Edition, Springer, 2007.

2. Mark Nelson, Jean- Loup Gailly, “The Data Compression Book”, 2nd Edition, BPB Publications,2014.

3. Atul Kahate, “Cryptography and Network Security”, McGraw-Hill ,4th Edition, 2019.

Program: Electronics and Telecommunication Engineering	B.Tech	Semester: VII
Speech Processing (22PEET7045T)		
Speech Processing Laboratory (22PEET7045L)		

Pre-requisite

1. Digital Signal Processing

Course Objectives

1. To acquire the fundamentals of the digital signal processing that allows them to assimilate the concepts related to the speech processing.
2. To introduce the fundamentals of speech signal processing.
3. To present basic principles of speech analysis.
4. To give an overview of speech processing applications including speech enhancement, speech recognition and speaker recognition.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the mechanism of human speech production and digital models of speech signals.	L1	Understand
CO2	Apply standard digital signal processing tools to analyze speech signals in terms of their Time and frequency domain representations.	L4	Analyze
CO3	Understand Linear Predictive analysis of speech signal and different pitch period estimation methods	L1	Understand
CO4	Understand the Homomorphic processing of speech signal and applications of speech processing, including speech enhancement.	L5	Evaluate
CO5	Understand the applications of speech processing including speaker recognition and speech recognition.	L4	Analyze

Speech Processing (22PEET7045T)
Course Contents

Unit-I Introduction to Speech Processing 04 Hrs.

Introduction to Speech Processing, Fundamentals of Digital Speech Processing, The Mechanism of speech production, Acoustic phonetics: vowels, diphthongs, semivowels, nasals, fricatives, stops and affricates, Applications of Speech Signal Processing, Digital Models for Speech Signals: Vocal Tract, Radiation, Excitation, The complete Model.

Unit-II Speech Analysis 12 Hrs.

Short-Time Speech Analysis : Windowing , Spectra of Windows , Time-Domain Parameters: signal analysis in Time Domain, Short-Time average magnitude, Short-Time Average zero-crossing rate (ZCR) and Short-Time auto correlation function Short-Time Average Magnitude Difference Function, Frequency Domain (Spectral) Parameters : Short-Time Fourier Transform Analysis, Spectral Displays, Formant Estimation and Tracking.

Unit-III Linear predictive coding (LPC) of Speech 12 Hrs.

Linear predictive coding (LPC) of Speech: Introduction, Basic principles of Linear Predictive Analysis, Solution of the LPC Equation: Cholesky Decomposition Solution for covariance method, Durbin's Recursive Solution for the Autocorrelation Equations, Frequency domain interpretation of mean squared prediction error, Applications of LPC parameters: pitch detection using LPC parameters and Formant analysis using LPC parameters. Pitch Period Estimation using Parallel Processing Approach ,Pitch Period Estimation using Autocorrelation Function.

Unit-IV Frequency Analysis 12 Hrs.

Frequency Analysis, Homomorphic Speech processing: Homomorphic Speech processing: Introduction, Homomorphic systems for Convolution, The complex cepstrum of speech, The Homomorphic Vocoder. Speech enhancement : Introduction, Background, Nature of interfering sounds, speech enhancement techniques: spectral subtraction, Multi-Microphone Adaptive Noise Cancellation.

Unit-V Speech Recognition 03 Hrs.

Speech Recognition: Basic pattern recognition approaches, Preprocessing, Parametric Representation, speech recognition systems: Isolated Digit Recognition system and continuous Digit Recognition system. Speaker Recognition : Verification vs recognition, Speaker Recognition Systems: speaker verification system and speaker identification system.

Speech Processing Laboratory (22PEET7045L)

List of Laboratory Experiments:Any 8

1. To study the effects of sampling (aliasing) and quantization on speech signals by playing them at different sampling rates and bits per sample (upto 16 bps).
2. To study the time-varying nature of the speech signal in the time domain.
3. To study the varying nature of the speech signal in the frequency domain.
4. Short-Time Spectrum Analysis of Speech.
5. Spectrographic analysis of speech.
6. Cepstral analysis of speech.
7. Linear prediction analysis of speech.
8. Formant synthesis.
9. Analysis by synthesis of speech.
10. Dynamic Time Warping for Automatic Speech recognition.
11. Audio segmentation.
12. Audio Source separation.

    (Minimum eight experiments from the above suggested list or any other experiment based on syllabus to be included, which would help the learner to apply the concept learnt.)

Text Books

1. Douglas O'Shaughnessy, "Speech Communications: Human Machine", University Press, 2nd Edition,1999.
2. Rabiner and Schafer, "Digital Processing of Speech Signals", Prentice Hall,3rd Edition, 1978.

Reference Books

1. ThomasF.Quatieri, "Discrete-Time Speech Signal Processing: Principles and Practice", Prentice Hall, 3rd Edition, 2001
2. Nelson Morgan and Ben Gold, "Speech and Audio Signal Processing: Processing and Perception of Speech and Music", John Wiley & Sons, 2nd Edition, 2011.
3. J. L. Flanagan, "Speech Analysis Synthesis and Perception", Springer-Verlag, 2nd Edition, 1972.
4. Gold Morgan, "Speech and Audio Signal Processing", Wiley and Sons 2nd Edition, 1999.
5. Dr. Shaila D. Apte, "Speech and Audio Processing", Wiley Precise Textbook, 1st Edition, 2015.

Program: Electronics and Telecommunication Engineering	Final Year.B.Tech	Semester: VII
Embedded System (22PEET7046T)		
Embedded System Laboratory(22PEET7046L)		

Pre-requisite

1. Digital System Design
2. Microcontroller Applications-I
3. Microcontroller Applications- II

Course Objectives

1. To develop background knowledge of Embedded Systems.
2. To understand Embedded Systems communication techniques.
3. To write programs for Embedded Systems based applications.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand Embedded Systems design metrics and development life cycle.	L2	Understand
CO2	Describe various processor design techniques and architectures through relevant examples.	L2	Understand
CO3	Recognize and differentiate between communication types, buses, and protocols in Embedded Systems.	L4	Analyze
CO4	Illustrate the concepts and essential components of a Real Time Operating System.	L4	Analyze

Embedded System (22PEET7046T)
Course Contents

Unit-I Embedded System Overview 06 Hrs.

Definition of embedded system, Embedded System vs General computing system, Classification, Major application areas, Characteristics and quality attributes (Design Metric) of embedded system, Real time systems requirements, real time issues, interrupt latency, Embedded product development life cycle.

Unit-II Processor 09 Hrs.

Overview of Custom single purpose processors, General purpose processors, Standard single purpose processors, RISC and CISC architectures,GCD example.

Unit-III Communication 09 Hrs.

CAN bus, I2C, MOD bus, SPI, Examples on Parallel communication, Serial communication, Wireless communication.

Unit-IV Real Time Operating Systems (RTOS) 10 Hrs.

Operating system basics, Types of OS, Tasks, Process, Threads, Multiprocessing and, Multitasking, Task scheduling,Task communications, Task synchronization, Device drivers, RTOS selection criterion, RTOS examples.

Unit-V Design examples 09 Hrs.

Requirements and specifications, Digital Camera, Automatic Chocolate Vending Machine, Adaptive Cruise Control in car.

Embedded System Laboratory(22PEET7046L)

List of Laboratory Experiments:

1. Interfacing of I2C, CAN, SPI with ARM controller.
2. Speed Control of DC Motor using ARM controller.
3. Interface humidity sensor to ARM controller and display it on LCD.
4. Interface temperature sensor to ARM controller and display it on LCD.

5. Simulation of multitasking using RTOS.
6. Simulation of mutex using RTOS.
7. Simulation of mailboxes using RTOS.
8. Inter process communication using semaphore in RTOS.
9. Simulation of message queues using RTOS.
10. Mini Project.

(Minimum eight experiments from the belwo suggested list or any other experiment based on syllabus to be included, which would help the learner to apply the concept learnt.)

Text Books

1. Frank Vahid and Tony Givargis, Embedded System Design: A Unified Hardware/Software Introduction, Wiley Publication, 3^{ed} Edition, 2006.
2. Raj Kamal, Embedded Systems: Architecture, Programming and Design, Tata McGrawHill, 1^{st} Edition,Pearson, 2003.
3. P. E. Allen and D. R. Holberg, CMOS Analog Circuit Design, Oxford University Press, 3^{rd} Edition,Pearson, 2012.

Reference Books

1. David Simon, An Embedded Software Primer, Pearson Publication, 1^{st} Edition, 2009.
2. K. V. Shibu, Introduction to Embedded Systems, 2^{nd} Edition, 2017.
3. K.V.K. Prasad, Embedded Systems/Real-Time Systems: Concepts, Design and Programming, Dreamtech, 1^{st} Edition, 2003.

Program: Electronics and Telecommunication Engineering	B.Tech.	Semester: VII
Advanced VLSI Design (22PEET7047T)		
Advanced VLSI Design Laboratory (22PEET7047L)		

Prerequisite: Electronic Circuit Design, Integrated Circuits, Basic VLSI

Course Objective(s):

1. To highlight the circuit design issues in the context of Analog VLSI technology.
2. To provide the understanding of different design styles.
3. To provide an exposure to drawing layout of circuits.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Describe MOSFET operation and analyze small signal MOS models.	L2	Understand
CO2	Design single stage amplifier based on MOSFET.	L3	Application
CO3	Design differential amplifier based on MOSFET.	L3	Application
CO4	Design the MOSFET-based operational amplifier.	L3	Application

Advanced VLSI Design (22PEET7047T)
Course Contents

Unit-I CMOS Analog building blocks 10 Hrs.

MOS Models: Necessity of CMOS Analog Design, Review of Characteristics of MOS Device, MOS Small Signal Model, MOS SPICE Models. Passive and Active Current Mirrors: Basic Current Mirrors, Cascode Current Mirrors and Active Current Mirrors. Band Gap References: General Considerations, Supply-Independent Biasing, Temperature-Independent References, PTAT Current Generation and Constant Gm Biasing.

Unit-II Single Stage Amplifiers 10 Hrs.

Configurations: Basic concepts, Common-Source stage, Source follower, Common-Gate stage, Cascade stage. Frequency Response and Noise: General Considerations, Common-Source stage, Source followers, Common-Gate stage, Cascode stage and Noise in Single Stage Amplifier.

Unit-III Differential Amplifiers 08 Hrs.

Configurations: Single-Ended and Differential Operation, Basic Differential Pair, Common-Mode Response, Differential Pair with MOS Loads, Gilbert Cell. Frequency response and noise in differential Amplifiers: Differential pair with Passive Loads, Differential Pair with Active Loads.

Unit-IV MOS Operational Amplifiers 08 Hrs.

Op-amp Design: General Considerations, Performance parameters, One-stage opamps, Two-stage opamps, Gain Boosting, Common-Mode Feedback, Input Range Limitations, Slew Rate, Power Supply Rejection, Noise in op-amps. Stability and Frequency Compensation: General Considerations, Multi pole systems, Phase margin, Frequency compensation.

Unit-V Analog Layout and other concepts 04 Hrs.

Analog Layout Techniques: Antenna Effect, Resistor Matching, Capacitor Matching, Active Device Design, Current Mirror Matching, Floor Planning, Shielding and Guard Rings.

Advanced VLSI Design Laboratory (22PEET7047L)

List of Laboratory Experiments

Suggested Experiments:(Any 08)

1. To study trans-conductance plots of MOSFET device (voltage bias, current bias and technology bias).
2. To design basic amplifier using MOSFETs.

3. To design cascode amplifier.
4. To design basic current sink.
5. To design current sink by using negative feedback resistor.
6. To design cascode current sink.
7. To design of positive feedback boot strap current sink.
8. To design of regulated cascode current sink.
9. To design of simple current mirror.
10. To design Wilson current mirror.

Text Books

1. B. Razavi, "Design of Analog CMOS Integrated Circuits", Tata McGraw Hill,2^{nd} Edition, 2017.
2. R. Jacob Baker, Harry W. Li, David E. Boyce, "CMOS Circuit Design, Layout, and Stimulation", Wiley, 3^{rd} Edition, 2010.
3. P. E. Allen and D. R. Holberg, "CMOS Analog Circuit Design", Oxford University Press, 3^{rd} Edition, 2012.

Reference Books

1. Mohammed Ismail and Terri Faiz, "Analog VLSI Signal and Information Process", McGraw-Hill Book company,1994.
2. John P. Uyemura,"CMOS Logic Circuit Design", Springer US, 2001.
3. Gray, Meyer, Lewis, Hurst, "Analysis and design of Analog Integrated Circuits", Willey,6^{th} Edition, 2024.

Program: Electronics and Telecommunication Engineering	Final Year B.Tech.	Semester: VII
Product Life Cycle Management (22OEET7051T)		

Prerequisite: Knowledge of basic concepts of Management.

Course Objective(s):

1. To familiarize the students with the need, benefits and components of PLM.
2. To acquaint students with Product Data Management & PLM strategies.
3. To give insights into new product development program and guidelines for designing and developing a product.
4. To familiarize the students with Virtual Product Development.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Gain knowledge about phases of PLM, PLM strategies and methodology for PLM feasibility study and PDM implementation	L2	Understand
CO2	Illustrate various approaches and techniques for designing and developing products.	L3	Apply
CO3	Apply product engineering guidelines / thumb rules in designing products for moulding, machining, sheet metal working etc.	L3	Apply
CO4	Acquire knowledge in applying virtual product development tools for components, machining and manufacturing plant	L4	Analyze

Product Life Cycle Management (22OEET7051T) Course Contents

Unit-I 09 Hrs.

Introduction to Product Lifecycle Management (PLM): Product Lifecycle Management (PLM), Need for PLM, Product Lifecycle Phases, Opportunities of Globalization, Pre-PLM Environment, PLM Paradigm, Importance & Benefits of PLM, Widespread Impact of PLM, Focus and Application, A PLM Project, Starting the PLM Initiative, PLM Applications.

PLM Strategies: Industrial strategies, Strategy elements, its identification, selection and implementation, Developing PLM Vision and PLM Strategy, Change management for PLM.

Unit-II 08 Hrs.

Product Design: Product Design and Development Process, Engineering Design, Organization and Decomposition in Product Design, Typologies of Design Process Models, Reference Model, Product Design in the Context of the Product Development Process, Relation with the Development Process Planning Phase, Relation with the Post design Planning Phase, Methodological Evolution in Product Design, Concurrent Engineering, Characteristic Features of Concurrent Engineering, Concurrent Engineering and Life Cycle Approach, New Product Development (NPD) and Strategies, Product Configuration and Variant Management, The Design for X System, Objective Properties and Design for X Tools, Choice of Design for X Tools and Their Use in the Design Process.

Unit-III 08 Hrs.

Product Data Management (PDM): Product and Product Data, PDM systems and importance, Components of PDM, Reason for implementing a PDM system, financial justification of PDM, barriers to PDM implementation.

Virtual Product Development Tools: For components, machines, and manufacturing plants, 3D CAD systems and realistic rendering techniques, Digital mock-up, Model building, Model analysis, Modelling and simulations in Product Design, Examples/Case studies.

Unit-IV 07 Hrs.

Integration of Environmental Aspects in Product Design: Sustainable Development Design for Environment, Need for Life Cycle Environmental Strategies, Useful Life Extension

Strategies, End-of-Life Strategies, Introduction of Environmental Strategies into the Design Process, Life Cycle Environmental Strategies and Considerations for Product Design.

Unit-V 07 Hrs.

Life Cycle Assessment and Life Cycle Cost Analysis: Properties, and Framework of Life Cycle Assessment, Phases of LCA in ISO Standards, Fields of Application and Limitations of Life Cycle Assessment, Cost Analysis and the Life Cycle Approach, General Framework for LCCA, Evolution of Models for Product Life Cycle Cost Analysis.

Text Books:

1. John Stark, "Product Lifecycle Management: Paradigm for 21st Century Product Realization", Springer-Verlag, 2004.
2. Guido La Rosa, Antonino Risitano, Taylor & Francis, "Product Design for the environment-A life cycle approach", Fabio Giudice, 2006.

Reference Books:

1. Saaksvuori Antti, Immonen Anselmie, "Product Life Cycle Management", Springer, Dreamtech, 2009.
2. Michael Grieve, "Product Lifecycle Management: Driving the next generation of lean thinking", Tata McGraw Hill, 2006.
3. François Villeneuve, Luc Mathieu, Max Giordano, "Product Life-Cycle Management: Geometric Variations", Wiley, 2010.

Program: Electronics and Telecommunication Engineering	Final Year B.Tech.	Semester: VII
Management Information System (22OEET7052T)		

Prerequisite: Knowledge of basic concepts of Management

Course Objective(s):

1. The course is blend of Management and Technical field.
2. To discuss the roles played by information technology in today's business and define various technology architectures on which information systems are built.
3. To define and analyze typical functional information systems and identify how they meet the needs of the firm to deliver efficiency and competitive advantage.
4. To identify the basic steps in systems development.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain how information systems Transform Business.	L2	Understand
CO2	Identify the impact information systems have on an organization.	L3	Apply
CO3	Describe IT infrastructure and its components and its current trends.	L2	Understand
CO4	Understand the principal tools and technologies for accessing information from databases to improve business performance and decision making.	L2	Understand
CO5	Identify the types of systems used for enterprise-wide knowledge management and how they provide value for businesses.	L3	Apply

Management Information System (22OEET7052T) Course Contents

Unit-I 03 Hrs.

Foundation Concepts: Information Systems in Business, Functional Area Information System, The Components of Information Systems, Impact of IT on organizations and society, Organizational Strategy, Information systems for strategic advantage.

Unit-II 07 Hrs.

Information Technologies: Hardware and Software

Computer Systems: End User and Enterprise Computing

Computer Peripherals: Input, Output, and Storage Technologies

Application Software: End User Applications

System Software: Computer System Management

Data Resource Management: Technical Foundations of Database Management, Managing Data Resources, Big data, Data warehouse and Data Marts, Knowledge Management.

Networks: The Networked Enterprise (Wired and wireless), Pervasive computing, Cloud Computing models.

Unit-III 08 Hrs.

MIS Tools and applications for Decision making: ERP and ERP support of Business Process Reengineering.

Business intelligence (BI): Managers and Decision Making, BI for Data analysis and Visualization.

Artificial Intelligence Technologies in Business

Unit-IV 06 Hrs.

Security and Ethical Challenges: Security, Ethical, and Societal Challenges of IT Security Management of Information Technology.

Unit-V 07 Hrs.

Social Computing (SC): Web 2.0 and 3.0, SC in business-shopping, Marketing, Operational and Analytic CRM, E-business and E-commerce – B2B B2C, Mobile commerce.

Unit-VI 08 Hrs.

Information System within Organization: Acquiring Information Systems and Applications: Various System development life cycle models.

Enterprise and Global Management of Information Technology: Managing Information Technology, Managing Global IT.

Reference Books:

1. James A O'Brien, George M., Ramesh Behl, "Management Information Systems", 11^{th} Edition, Tata McGraw Hill, 2019.
2. Kelly Rainer, Brad Prince, "Management Information Systems", 2^{nd} Edition, Wiley, 2013.
3. K.C. Laudon and J.P. Laudon, "Management Information Systems: Managing the Digital Firm", 10^{th} Edition, Prentice Hall, 2007.
4. D. Boddy, A. Boonstra, "Managing Information Systems: Strategy and Organization", Prentice Hall, 2008.

Program: Electronics and Telecommunication Engineering	Final Year B.Tech.	Semester: VII
Operations Research (22OEET7053T)		

Prerequisite: Basic Knowledge of Algebra, Probability and Statistics

Course Objective(s):

- To formulate a real-world decision problem as a mathematical programming model.
- To learn the mathematical tools that are employed to solve mathematical programming models.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Convert a real-world problem in to a Linear Programming Problem and analyse the solution obtained using Simplex method or other algorithms.	L4	Analyze
CO2	Identify real-world problems as Transportation Problem and Assignment Problem and Solve the decision problem by choosing appropriate algorithm.	L3	Apply
CO3	Identify the decision situations which vary with time and analyse them using principle of dynamic programming to real life situations.	L3	Apply
CO4	Explain reasons of formation of queues, classify various queuing systems and apply parameters defined for various queuing systems for decision making in real life situations.	L2	Understand
CO5	Understand the concept of decision making in situation of competition and recommend strategies in case of two-person zero sum games.	L2	Understand
CO6	Describe concept of simulation and apply Monte Carlo Simulation technique to systems such as inventory, queuing and recommend solutions for them.	L2	Understand
CO7	Understand need for right replacement policy and determine optimal replacement age.	L2	Understand

Operations Research (22OEET7053T)
Course Contents

Unit-I — 10 Hrs.

Introduction to Operations Research: Concept of decision making. Definition of OR. Formulation of decision problem as OR model, Concept of Optimization.

Linear Programming Problem: Mathematical Formulation. Finding optimal solution - Graphical method, Simplex Method, Big M-method, Two Phase Method. Duality, Primal – Dual construction, Symmetric and Asymmetric Dual. Dual Simplex Method.

Unit-II — 08 Hrs.

Assignment Problems: Mathematical Formulation, Finding optimal solution - Hungarian Method **Transportation problem:** Mathematical Formulation, Finding initial basic feasible solution- Northwest corner rule, row minima, column minima, least cost method and Vogel's approximation method.

Optimality test: the stepping stone method and MODI method. Improving the solution.

Unit-III — 06 Hrs.

Dynamic Programming: Bellman's Principle of optimality - Applications of dynamic programming- Employment smoothening problem, capital budgeting problem, shortest path problem, cargo loading problem.

Unit-IV — 10 Hrs.

Queuing Models: Characteristics of queuing models. Single Channel – Single and multi phase servers, Poisson arrivals, exponential service time - with infinite population and finite population models – with infinite and finite capacity.

Multichannel- Single phase server - Poisson arrivals, exponential service time with infinite population.

Game Theory: Introduction, Minimax & Maximin Criterion and optimal strategy, Solution of games with saddle points, rectangular games without saddle points - 2 x 2 games, dominance principle.

Approximate methods- Iterative method, m x 2 & 2 x n games-Graphical method and method of sub-games. Expressing game as LPP.

Unit-V 08 Hrs.

Simulation: Definition. Types of simulation models. Monte Carlo simulation technique. Applications of simulation - Inventory and Queuing problems. Simulation Languages.

Replacement Models: Replacement of items that deteriorate with time - when money value is not counted and counted, Replacement of items that fail suddenly – individual and group replacement policy.

Text Books:

1. Sharma J. K., "Operations Research", Trinity Press.
2. Gupta P. K., Hira D. S., "Operations Research", S. Chand Limited.

Reference Books:

1. Taha, H. A., "Operations Research - An Introduction", Prentice Hall.
2. Ravindran A., Phillips D. T., and Solberg J. J., "Operations Research: Principles and Practice", John Willey and Sons.
3. Hiller F. S., and Liebermann G. J., "Introduction to Operations Research", Tata McGraw Hill.
4. Pradeep Prabhakar Pai, "Operations Research Principles and Practice", Oxford University Press.
5. R. Panneerselvam, "Operations Research", PHI Publications.
6. A. M. Natarajan, P. Balasubramani, A. Tamilarasi, "Operations Research", Pearson Education.
7. Kanti Swarup, P. K. Gupta and Man Mohan, "Operations Research", Sultan Chand & Sons.

Program: Electronics and Telecommunication Engineering	Final Year B.Tech.	Semester: VII
Cyber Security and Laws (22OEET7054T)		

Prerequisite: Knowledge of basic concepts of security

Course Objective(s):

1. To understand and identify different types cybercrime and cyber offences.
2. To recognized Indian IT Act 2008 and its latest amendments.
3. To learn various types of security standards compliances.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the different types of cybercrime and security issues in E-Business.	L2	Understand
CO2	Analyses different types of cyber threats and techniques for security management.	L4	Analyze
CO3	Explore the legal requirements and standards for cyber security in various countries to regulate cyberspace.	L4	Analyze
CO4	Impart the knowledge of Information Technology Act and legal frame work of right to privacy, data security and data protection.	L2	Understand

Cyber Security and Laws (22OEET7054T Course Contents

Unit-I 10 Hrs.

Introduction to Cybercrime: Cyber Crime, Cyber Law, Cyber Security, History of Cyber Crime, Hacking, Data Theft, Cyber Terrorism, Virus and Worm's, Email Bombing, Pornography, online gambling, Forgery, Web Defacements, Web Jacking, Illegal online Selling, Cyber Defamation, Software Piracy, Electronics/ Digital Signature, Phishing, Password Cracking, Key loggers and Spywares, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Over Flow,, Phishing Identity Theft (ID Theft) ,How criminal plan the attacks, Social Engineering, Cyber stalking.

Unit-II 06 Hrs.

Cyber Threats Analysis: Knowledge of Dynamic and Deliberate Targeting, Knowledge of Indications and Warning, Knowledge of Internal Tactics to Anticipate and/or, Emulate Threat Capabilities and Actions, Knowledge of Key Cyber Threat Actors and their EquitiesKnowledge of Specific Target Identifiers and Their Usage.

Unit-III 06 Hrs.

Electronic Business and legal issues: Evolution and development in Ecommerce, Policy Frameworks for Secure Electronic. Business, paper vs paper less contracts, E-Commerce models-B2B, B2C, E security. E- Payment Mechanism; Payment through card system, E-Cheque, E-Cash, E-Payment Threats and Protections, Security for E-Commerce.

Unit-IV 08 Hrs.

Indian IT Act : Cyber Crime and Criminal Justice, Penalties, Adjudication and Appeals Under the IT Act, 2000, IT Act. 2008 and its Amendments

Security aspect in cyber Law:

The Contract Aspects in Cyber Law , The Security Aspect of Cyber Law, The Intellectual Property Aspect in Cyber Law ,The Evidence Aspect in Cyber Law ,The Criminal Aspect in Cyber Law.

Unit-V 09 Hrs.

Security Industries Standard Compliances: IT Security v/s IT Compliance, Cyber Security Standards, critical security controls for cyber security, GRC (Governance, Risk Manage-

ment, and Compliance), SOX, GLBA, HIPAA, ISO/IEC 27001, NIST Cyber Security Framework (CSF), PCI-DSS.

OWASP Top Ten Project, GDPR (General Data Protection Regulation), NIST (National Institute of Standards and Technology), CIS Controls (Center for Internet Security Controls)

Reference Books:

1. Nina Godbole, Sunit Belapure, "Cyber Security", Wiley India, New Delhi, 2012.
2. Suresh T. Vishwanathan, "The Indian Cyber Law", 3rd Edition, Bharat Law House, New Delhi, 2022.
3. "The Information Technology Act, 2000", Bare Act- Professional Book Publishers, New Delhi, 2022.
4. Anup K. Ghosh, "E-Commerce Security and Privacy", Springer Science and Business Media, 2012.
5. Izzat Alsmadi, "The NICE Cyber Security Framework Cyber Security Intelligence and Analytics", 1st Edition, Springer, 2019.
6. Advocate Prashant Mali, "Cyber Law & Cyber Crimes", 2nd Edition, Snow White Publications, Mumbai, 2015.
7. Nina Godbole, "Information Systems Security", 2nd Edition, Wiley India, New Delhi, 2017.
8. Kennetch J. Knapp, "Cyber Security & Global Information Assurance", Information Science Publishing.
9. William Stallings, "Cryptography and Network Security", 8th Edition, Pearson Publication, 2023.

Web Resources:

1. The Information Technology ACT, 2008- TIFR: https://www.tifrh.res.in
2. A Compliance Primer for IT professional: https://www.sans.org/reading-room/whitepapers/compliance/compliance-primer- professionals-33538

Program: Electronics and Telecommunication Engineering	Final Year B.Tech.	Semester: VII
Personal Finance Management (22OEET7055T)		

Prerequisite: Basic Knowledge of Algebra, Probability and Statistics.

Course Objective(s):

1. To create awareness and educate consumers on access to financial services.
2. To make the students understand the basic concepts, definitions and terms related to direct taxation.
3. To help the students compute the Goods and Service Tax (GST) payable by a supplier after considering the eligible input tax credit.
4. To familarise the students with microfinance for accelerating the expansion of local microbusinesses.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Use a framework for financial planning to understand the overall role finances play in his/her personal life.	L3	Apply
CO2	Compute income from salaries, house property, business/profession, capital gains and income from other sources.	L3	Apply
CO3	Compute the amount of CGST, SGST and IGST payable after considering the eligible input tax credit.	L3	Apply
CO4	Understand how Microfinance can help in financial inclusion.	L2	Understand

Personal Finance Management
(22OEET7055T)
Course Contents

Unit-I 07 Hrs.

Overview of Indian Financial System: Characteristics, Components and Functions of Financial System. Financial Instruments and Financial Markets, Financial inclusion.

Introduction to Personal Finance: Person Financial Planning in Action, Money Management Skills, Taxes in Your Financial Plan, Savings and Payment Services. Consumer Credit: Advantages, Disadvantages, Sources and Costs.

Unit-II 07 Hrs.

Personal Financial Management :

Loans: Home, Car, Education, Personal, Loan against property and Jewel loan.

Insurance: Types of Insurance – ULIP and Term; Health and Disability Income Insurance, Life Insurance.

Investment: Investing Basics and Evaluating Bonds, Investing in Stocks and Investing in Mutual Funds, Planning for the Future.

Unit-III 07 Hrs.

Income Tax Act Basics : Introduction to Income Tax Act, 1961.

Heads of Income and Computation of Total Income and Tax Liability:

Income and Computation of Total Income under various heads, Clubbing Provisions, Set off and Carry forward of Losses, Deductions, Assessment of Income and tax liability of different persons. **Tax Management, Administrative Procedures and ICDS :** - TDS, TCS and Advance Tax Administrative Procedures, ICDS.

Unit-IV 09 Hrs.

Goods and Services Tax : GST Constitutional framework of Indirect Taxes before GST (Taxation Powers of Union and State Government); Concept of VAT: Meaning, Variants and Methods; Major Defects in the structure of Indirect Taxes prior to GST; Rationale for GST; Structure of GST (SGST, CGST, UTGST and IGST); GST Council, GST Network, State Compensation Mechanism, Registration.

Levy and Collection of GST:

Taxable event - "Supply" of Goods and Services; Place of Supply: Within state, Interstate, Import and Export; Time of supply: Valuation for GST - Valuation rules, taxability of reimbursement of expenses; Exemption from GST: Small supplies and Composition Scheme: Classification of Goods and Services.

Unit-V 09 Hrs.

Introduction to Micro–finance: Micro-Finance: Definitions, Scope and Assumptions, Types of Microfinance, Customers of Micro-finance, Credit Delivery Methodologies, SHG concept, origin, Formation and Operation of Self Help Groups (SHGs).

Models in Microfinance: Joint Liability Groups (JLG), SHG Bank Linkage Model and GRAMEEN Model: Achievements and Challenges.

Institutional Mechanism: Current Challenges for Microfinance, Microfinance Institutions (MFIs): Constraints and Governance Issues, Institutional Structure of Microfinance in India: NGO-MFIs, NBFC-MFIs, Co-operatives, Banks, Microfinance Networks and Associations; Demand and Supply of Microfinance Services in India, Impact assessment and social assessments of MFIs.

Reference Books:

1. Asha Singh, M. S. Gupta, "Banking and Financial Sector Reforms in India", Serials Publication.
2. M. S. Gupta & J. B. Singh, "Indian Banking Sector: Essays and Issues", 1st Edition, Serials Publication.
3. K. M. Bhattacharya, O. P. Agarwal, "Basics Of Banking & Finance", 3rd Edition, Himalaya Publishing House.
4. S. Subba Reddy , P. Raghu Ram, "Agricultural Finance And Management".
5. Dr. Vasant Desai, "The Indian Financial System And Development", 4th Edition, Himalaya Publishing House.
6. Sanjay Kumar Satapathy, "Income Tax Management Simple Way of Tax Management, Tax Planning and Tax Saving".
7. Dr. R. K. Jain, "Direct Tax System Income Tax", 2021-22 Edition, SBPD Publications.

8. S K Mishra, “Simplified Approach to GST Goods and Services Tax”, Educreation Publishing.

9. Todd A. Watkins, “Introduction To Microfinance”, World Scientific Publishing Company.

Program: Electronics and Telecommunication Engineering	Final Year B.Tech.	Semester: VII
Energy Audit and Management (22OEET7056T)		

Course Objective(s):

- To understand the importance of energy security for sustainable development and the fundamentals of energy conservation.
- To identify and describe the basic principles and methodologies adopted in energy audit of a utility.
- To introduce performance evaluation criteria of various electrical and thermal installations to facilitate the energy management.
- To relate the data collected during performance evaluation of systems for identification of energy saving opportunities.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	To identify and describe present state of energy security and its importance.	L1	Remember
CO2	To identify and describe the basic principles and methodologies adopted in energy audit of a utility.	L1	Remember
CO3	To describe the energy performance evaluation of some common electrical installations and identify the energy saving opportunities.	L2	Understand
CO4	To describe the energy performance evaluation of some common thermal installations and identify the energy saving opportunities.	L2	Understand
CO5	To analyze the data collected during performance evaluation and recommend energy saving measures.	L4	Analyze

Energy Audit and Management (22OEET7056T) Course Contents

Unit-I 05 Hrs.

Energy Scenario: Present Energy Scenario, Energy Pricing, Energy Sector Reforms, Energy Security, Energy Conservation and its Importance, Energy Conservation Act- 2001 and its Features. Basics of Energy and its various forms, Material and Energy balance.

Unit-II 10 Hrs.

Energy Audit: Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution. Elements of monitoring & targeting, Energy audit instruments. Technical and economic feasibility, Classification of energy conservation measures. Safety considerations during energy audit.

Financial analysis techniques: Simple payback period, NPV, Return on investment(ROI) Internal rate of return (IRR).

Unit-III 10 Hrs.

Energy Management and Energy Conservation in Electrical System: Electricity billing, Electrical load management and maximum demand Control; Power factor improvement, Energy efficient equipments and appliances, star ratings. Energy efficiency measures in lighting system, lighting control: Occupancy sensors, daylight integration, and use of intelligent controllers. Energy conservation opportunities in water pumps, compressor, fan and blower. industrial drives, induction motors, motor retrofitting, soft starters, variable speed drives.

Unit-IV 10 Hrs.

Energy Management and Energy Conservation in Thermal Systems: Review of different thermal loads; Energy conservation opportunities in: Steam distribution system, Steam leakages, Steam trapping, Condensate and flash steam recovery system. Waste heat recovery, use of insulation- types and application. Energy conservation opportunities in: Boiler system. Refrigeration system and HVAC system.

Unit-V 07 Hrs.

Energy conservation in Buildings: Energy Conservation Building Codes (ECBC): Green Building, LEED rating, Application of Non-Conventional and Renewable Energy Sources, Energy sources and energy management in electric vehicles.

Reference Books:

1. Geofry Stokes, "Handbook of Electrical Installation Practice", Blackwell Science.
2. Anil Valia, "Designing with light: Lighting Handbook", Lighting System.
3. W. C. Turner, "Energy Management Handbook", John Wiley and Sons.
4. A. K. Tyagi, "Handbook on Energy Audits and Management", Tata Energy Research Institute (TERI).
5. C. B. Smith, "Energy Management Principles", Pergamon Press.
6. Dale R. Patrick, S. Fardo, Ray E. Richardson, "Energy Conservation Guidebook", Fairmont Press.
7. Albert Thumann, W. J. Younger, T. Niehus, "Handbook of Energy Audits", CRC Press.

Web Resources:

1. www.energymanagertraining.com
2. www.bee-india.nic.in

Program: Electronics and Telecommunication Engineering	Final Year B.Tech.	Semester: VII
Public Systems and Policies (22OEET7057T)		

Prerequisite: Basic Knowledge of Social science and Current affairs

Course Objective(s):

1. To analyze the transformations in public systems with emphasis on current initiatives and emerging challenges in the field.
2. To understand public systems in a fast-changing environment in the global context.
3. To provide an in-depth understanding of the ills prevailing in the society and aids to identify the solutions for them.
4. To explain public policy and its operations with special focus on policy relating to Government finance.
5. To analyze and evaluate the impact of the public policy on firms and economy at large.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the importance of public systems in a fast-changing environment in the global context.	L2	Understand
CO2	Analyze the transformations in public systems with emphasis on current initiatives and emerging challenges in the field.	L4	Analyze
CO3	Explain public policy and its operations with special focus on policy relating to Government finance.	L2	Understand
CO4	Make policies and know about the happenings in the world, in the nation and those in their locality.	L6	Create
CO5	Analyze and evaluate the impact of the public policy on firms and economy at large and work under various fields as policymakers.	L5	Evaluate

Public Systems and Policies (22OEET7057T) Course Contents

Unit-I 09 Hrs.

Introduction and Overview of Public Systems: Ideology of Public Systems; Mechanistic and Organic view of Society and Individuals, The Legal Framework; Federal Government; State and Local Governments, Government growth; The size of Government.

Unit-II 06 Hrs.

Public Sector in the Economics Accounts: Public Sector in the circular flow; Public Sector in the National Income Accounts.

Unit-III 07 Hrs.

Public Choice and Fiscal Politics: Direct Democracy; Representative Democracy; The Allocation Function; The Distribution Function; The Stabilization Function; Coordination of Budget Functions; The Leviathan Hypothesis.

Unit-IV 11 Hrs.

Introduction and Overview of Public Policy: Markets and Government; Social goods and Market failure, Public expenditure and its evaluation; Cost Benefit Analysis, Public policy and Externalities, Taxation Policy and its impact, Income distribution, redistribution and social security issues Fiscal and Budgetary Policy, Fiscal Federalism in India.

Unit-V 06 Hrs.

Case Studies in Expenditure Policy: Public Services: A) National Defense B) Highways C) Outdoor Recreation D) Education.

Reference Books:

1. Introduction to Public Policy by Charles Wheelan, W.W. Norton and Company.
2. Understanding Public Policy by Thomas R. Dye, Prentice Hall.
3. Public Policy-Making: An Introduction by Anderson J.E., Boston, Houghton.

4. Public Administration by Avasthi and Maheshwari, Lakshminarayan Agarwal, Agra.

5. New Horizons of Public Administration by Bhattacharya, Mohit, Jawahar Publishers, New Delhi.

6. Public Administration and Public Affairs by Henry, Nicholas, Prentice Hall of India, New Delhi.

7. Public Finance 10th Edition by Harvey S Rosen and Ted Gayer, McGraw-Hill Education, 2013.

8. Public Finance in Theory and Practice by Musgrave and Musgrave.

Program: Electronics and Telecommunication Engineering	Final Year B.Tech.	Semester: VII
Science of Well-being (22OEET7058T)		

Course Objective(s):

1. To create consciousness about importance of holistic health and physical as well as mental well-being.
2. To make learners aware of the concepts of Happiness, Gratitude, Self-Compassion, Empathy etc.
3. To introduce the learners to the means of mental and physical well-being, ill effects of mal- practices like alcoholism, smoking etc.
4. To equip the learners to manage and cope up with stress in their daily living.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Describe concepts of holistic health and well-being, differentiate between its true meaning and misconceptions and understand the benefits of well-being.	L2	Understand
CO2	Recognize meaning of happiness, practice gratitude and self-compassion and analyze incidents from one's own life.	L4	Analyze
CO3	Understand the causes and effects of stress, identify reasons for stress in one's own surrounding and self.	L2	Understand
CO4	Recognize the importance of physical health and fitness, assess their life style and come up with limitations or effectiveness.	L5	Evaluate
CO5	Inspect one's own coping mechanism, assess its effectiveness, develop and strategize for betterment and execute it.	L4	Analyze

Science of Well-being (22OEET7058T)
Course Contents

Unit-I 06 Hrs.

Health and Well-being: The concept of health, dimensions of health, the notion of well-being, various facets of well-being, relation between health and well-being.

Concept of holistic health, its principles and importance, concept and benefits of holistic care, misconceptions about holistic health approach, the application of a true holistic approach to our well-being.

Unit-II 08 Hrs.

Concepts of Happiness

Happiness: what is it and how do we measure it? Philosophical perspectives on happiness, Happiness: Nature or Nurture? Happiness in the modern world: impediments and accelerators, Narrow vs. Broad Band Approaches to Happiness, Benefits of Happiness, Self-Compassion and Gratitude. Misconceptions of happiness.

Unit-III 09 Hrs.

Stress and Mental Health / Well-being: Nature and concept of stress, meaning and definitions of stress, types of stress, meaning of stressors, types of stressors, symptoms of stress, effects of stress, different models of stress.

Sources of stress and how does stress cause illness, various sources of stress, delineate between external and internal sources of stress, differentiate between continuous and discrete stressors, the effects of these stressors on health and well-being, diversity of stressors and their health consequences, relation between stress and illness from different perspectives association between stress related physiological mechanisms and different illnesses.

Unit-IV 08 Hrs.

Physical Well-being / Health Management: Concept of health behaviours, dimensions of health behaviours. Health enhancing behaviors: Exercise and Weight control, application and importance of these health enhancing behaviours. Health protective behaviors and illness management: concept of illness management, effectiveness of illness management.

Concept of Nutrition, Role of Nutrition, Components of Nutrition, concept of Malnutrition,

Health compromising behaviours: Alcoholism, Smoking and its effects on health.

Unit-V 08 Hrs.

Dealing with Difficult Times / Coping mechanisms: The concept of chronic stress, Health and safety risks of chronic stress, Forms and Treatment of chronic stress, Coping with Acute and Chronic stress, theories of the stress-illness link, role of stress in mental disorders. Concept of coping, Ways of coping and stress management, basic knowledge about stress management, various techniques of stress management, stress management programs. Mental strengths and virtues, Hope, Optimism, Resilience - concept, pathways and models, Meditation and Self-introspection.

Text Books:

1. Felicia Huppert, Nick Baylis, Barry Keverne, "The Science of well-being", Oxford University Press, 2005.
2. S. Ojha, U. Rani Srivastava, Shobhna Joshi, "Health and Well-Being: Emerging Trends", Global Vision Publishing House, 2010.
3. Charles Richard Snyder, Shane, J. Lopez, Jennifer Teramoto Pedrotti, "Positive psychology: The scientific and practical explorations of human strengths", 2^{nd}Edition, Sage Publications, 2011.

Reference Books:

1. Kitayama S. and Markus H. R., "The pursuit of happiness and the realization of sympathy: Cultural patterns of self, social relations, and well-being", Culture and subjective well-being, The MIT Press, 2000.
2. Dubos R., "Man Adapting New Haven", Yale University Press, 1980.
3. McMahon D. M., "Happiness a history", Atlantic Monthly Press, 2006.
4. D. Kahneman, E. Diener and N. Schwarz, "Well-being: The foundations of hedonic psychology", New York: Russell Sage Foundation, 1999.
5. Selye H., "The Stress of Life", New York, McGraw-Hill, 1984.

Program: Electronics and Telecommunication Engineering	Final Year B.Tech.	Semester: VII
Research Methodology (22OEET7059T)		

Prerequisite: Basic Knowledge of Probability and Statistics.

Course Objective(s):

- To understand Research and Research Process.
- To acquaint learners with identifying problems for research and develop research strategies.
- To familiarize learners with the techniques of data collection, analysis of data and interpretation.

Course Outcomes:

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the fundamental concepts of research and types of research.	L2	Understand
CO2	Analyze and evaluate different research methodologies.	L4	Analyze
CO3	Apply the knowledge of research and sample design to create effective research plans.	L3	Apply
CO4	Generate and present research findings through data collection and analysis methods.	L6	Create

Research Methodology (22OEET7059T)
Course Contents

Unit-I — 07 Hrs.

Basic Research Concepts: Meaning of research, Objectives of research, Types of research, Significance of research Research process.

Unit-II — 10 Hrs.

Research Methodology: Identification of research problem, Literature review, Formulation of hypothesis, Formulation of Research design.

Unit-III — 10 Hrs.

Research and Sample Design: Meaning of research and sample design, Need of research design, Features of good research design, Important concepts, Different research designs, Types of sampling designs.

Unit-IV — 10 Hrs.

Data Collection and Data Analysis: Types of data, Methods for collecting data: Experiments and surveys, Collection of primary and secondary data, Hypothesis testing and interpretation of Data.

Unit-V — 05 Hrs.

Interpretation and Report Writing: Interpretation and drawing conclusions on the research, Preparation of the report, Ethical Issues.

Reference Books:

1. Dawson, Catherine, "Practical Research Methods", 1st Edition, New Delhi, UBS Publishers Distributors, 2002.
2. Kothari C. R., "Research Methodology- Methods and Techniques", 2nd Edition, New Delhi, Wiley Eastern Limited, 2004.
3. Kumar, Ranjit, "Research Methodology- A Step-by-Step Guide for Beginners", 3rd Edition, Singapore, Pearson Education, 2010.

Program: Electronics and Telecommunication Engineering	B.Tech.	Semester: VII
Industrial Automation Laboratory (22PCET7050L)		

Prerequisite: Basic Electrical and Electronics, Digital System Design, Control Systems, Microprocessor and Microcontroller

Course Objective(s):

1. To learn Industrial automation and various systems.
2. To learn Industrial automation techniques.
3. To identify the differences between PLCs, SCADA, DCS.
4. To provide the skills to install and trouble shoot Automation systems.
5. To provide working experience in various programming techniques.

Course Outcomes:

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Identify different components of an automation system.	L1	Remembering
CO2	Interface the given I/O device with appropriate PLC module.	L3	Applying
CO3	Prepare PLC ladder program for the given application.	L6	Creating
CO4	Prepare a simple SCADA application.	L6	Creating
CO5	Use Internet of Things for industrial automation.	L3	Applying

Industrial Automation Laboratory (22PCET7050L) Course Contents

Unit-I 08 Hrs.

Introduction: Need and benefits of Industrial Automation, Basic components of automation system, Types of automation, Fixed, Programmable, Flexible, Different systems used for Automation i.e. PLC, HMI, SCADA, DCS, Drives.

Unit-II 10 Hrs.

Programmable Logic Controller (PLC): Introduction, Block diagram, memory organization, IO modules (discrete and Analog), I/O modules selection criteria, Fixed and Modular PLC, PLC selection, PLC Installation, Advantage, Application.

Unit-III 08 Hrs.

PLC Programming: I/O addressing, Programming instructions (Relay, Timer, Counter, Delay, Logical, Data Handling, Comparison), Functional Block Diagram (FBD), Ladder Programming.

Unit-IV 08 Hrs.

Supervisory Control and Data Acquisition System (SCADA): Introduction, Architecture/Block diagram, editors of SCADA, Interface SCADA with PLC, create SCADA screen for simple object, Application of SCADA like Traffic light control, water distribution, Industrial PCs, Mini Rugged PCs, Industrial Open Frame Panel PCs.

Unit-V 06 Hrs.

Distributed Control System (DCS): Overview of DCS, DCS software configuration, DCS communication, DCS Supervisory Computer Tasks, DCS integration with PLC and Computers, Advantages of DCS

Industrial Automation Laboratory (22PCET7050L)

List of Laboratory Experiments

Suggested Experiments:(Any 8)

1. Develop/Execute ladder diagram using timer, counter, logical and arithmetic instructions.
2. Use PLC to control the devices, lamp, motor switches, sensors.
3. Measure Temperature of the given liquid using RTD or Thermocouple and PLC.
4. Design ladder diagram for Blink LEDs.
5. Design ladder diagram for sequential control of DC motor.
6. Develop and test ladder program for pulse counting using switch/ proximity sensor.

7. Use various functions of SCADA simulation editors to develop simple project.
8. Develop SCADA mimic diagram for water tank level control.
9. Industrial PC based control system.
10. Identify various automation systems available in different appliances/devices/machines in day-to-day use.
11. Identify various parts and front panel status indications of the given PLC.
12. Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Any other experiment based on syllabus may be included which would help the learner to understand topic/concept.

The Oral/Practical examination will be based on the entire syllabus including, the practicals performed during laboratory sessions.

Text Books:

1. Petruzella F. D, "Programmable Logic Controller", Tata McgGaw Hill, 4^{th} Edition, 2021.
2. Mitra Madhuchandra, Sengupta, "Programmable logic controller and industrial automation", Penram International publication, 5^{th} Edition, 2008.
3. Bhoyar S A,"Supervisory control & Data acquisition", ISA publication, 4^{th} Edition, 2016.

Reference Books:

1. S.K. Singh, "Industrial Instrumentation and Control", 2^{nd} Edition, Tata McGraw Hill, 2021.
2. Richard L. Shell, "Handbook of Industrial Automation", 1^{st} Edition, CRC Press, 2000.
3. Bailey, David, "Practical SCADA for Industry", 1^{st} Edition, Newness international publication, 2003.
4. Stenerson John, "Industrial Automation & Process Control", 1^{st} Edition, Pearson publication, 2002.

Program: Electronics and Telecommunication Engineering	B.Tech.	Semester: VII
Project Stage-II (22PJET7060L)		

Course Objectives:

- Expose technical students to the industrial environment, allowing them to gain real-world experience and develop into competent professionals.
- Provide opportunities to learn and enhance the practical technical skills required for professional roles.
- Familiarize students with current technological developments relevant to their field of study.
- Encourage the application of technical knowledge in real industrial situations.
- Develop skills in writing technical reports and projects.
- Introduce students to the responsibilities and ethics of the engineering profession.
- Familiarize students with various materials, processes, products, and quality control practices.
- Promote academic, professional, and personal growth.
- Facilitate connections between students and potential future employers.
- Foster an understanding of the social, economic, and administrative factors influencing industrial organizations and their working environments.
- Develop an understanding of worker psychology, habits, attitudes, and problem-solving approaches.

CO	Course Outcomes	Blooms Level	Blooms Description
CO1	Apply engineering knowledge to produce solution of a problem considering cultural, social, environmental, and economic factors using appropriate tool and method.	L4	Analyze
CO2	Demonstrate project based learning that allows students to transfer existing ideas into new applications.	L2	Understand
CO3	Develop an ability to work in teams and manage the conduct of the research study.	L3	Apply
CO4	Integrate different perspectives from relevant disciplines which help them to get internships, jobs and admission for higher studies.	L3	Apply
CO5	Present the research in the form of technical writing, understand what constitutes to plagiarism and how to use proper referencing styles.	L2	Understand

Syllabus:

- Project-I work done in VI semester shall be continued as Project-II in semester VII.
- Students should complete remaining implementation of ideas given in synopsis/Abstract of semester VII.
- Students / group must plan their execution of project, so that project work should be completed before end of semester.
- Project-II involves fabrication, design, experimentation, data analysis within realistic constraints such as economic, environmental, social, ethical, health and safety, manufacturability, and sustainability. The stage also includes testing, possible results and report writing.
- Each project group is required to maintain log book for documenting various activities of Project-II and submit group project report at the end of Semester-VII in the form of Hard bound.
- Domain knowledge (any beyond) needed from the following areas for the effective implementation of the project:

  Things, Data science and Big data, Communication, Web and Application development, Robotics, AI and Machine learning.
  The above areas can be updated based on the technological innovations and development needed for specific project.

Guidelines:

The Training and Placement (TP) cell of the institute will arrange internships for students in industries/organizations after the seventh semester. Alternatively, students can individually apply for industry internships, adhering to the prescribed guidelines. To secure an internship slot, students must submit a "Student Internship Program Application" before the specified deadline.

Students are expected to accept internship offers regardless of the company, job profile, location, or stipend offered. For allotment of internship slots all the students will be required to submit "student internship program application" before the prescribed date (Format attached).

Expected Activity in Industry Internship:

Students may choose either to work on innovation or entrepreneurial activities resulting in start-ups or undergo internship with Industry/NGO/ Government organizations/Micro/ Small/ Medium enterprises to make themselves ready for the industry.

Every student is required to prepare a file containing documentary proofs of the activities done by him. The evaluation of these activities will be done by the committee constituted by the Head of the Department which shall include TP representative, faculty mentor, Industry supervisor and two senior faculties. The evaluation report is as given below.

- Each group will be reviewed twice in a semester and marks will be allotted based on the various points mentioned in the evaluation scheme.
- In the first review of this semester, each group is expected to complete 70 % of project. (may consist theoretical design of project, block diagram and circuits / components required for realization of block, algorithm and its implementation details, simulation of circuits etc)
- In the second review of this semester, each group is expected to complete 100 % of project. (may consist practical hardware fabrication, interconnection of all PCBs/ boards, final testing of project, implementation of algorithm, testing, debugging, programming).
- The students may use this opportunity to learn different computational techniques towards development of a product.
- Interaction with alumni mentor will also be appreciated for the improvement of project.

Assessment Criteria:

- At the end of the semester, after confirmation by the project guide, each project group will submit project completion report in prescribed format for assessment to the departmental committee (including project guide).
- Assessment of the project (at the end of the semester) will be done by the departmental committee (including project guide).
- The candidate must bring the project part- 1 report and the final report completed in all respect while appearing for End Semester Examination.
- Oral examination should be conducted by Internal and External examiners. Students have to give presentation and demonstration based on their project.

Prescribed project report guidelines:

Every group should prepare hard bound report (preferrable LaTeX) of about minimum 40 pages on the work carried out by a batch of students in respect of the project work done during semester-VII. Project Report should include appropriate content for:

- Title
- Abstract
- Introduction
- Problem identification and project objectives

- Literature Survey
- Related Theory
- Project design and Implementation details
- Case study/Analysis/Design Methodology
- Project Outcomes
- Result and Conclusion
- Future scope
- References

Assessment criteria for the departmental committee (including project guide) for Continuous Assessment:

Assessment criteria for the departmental committee (including project guide) for End Semester Exam:

Each group will be reviewed twice in a semester by faculty guide and faculty coordinator based on the following criteria:

- Project progress
- Documentation/Technical paper writing
- Key findings
- Validation of results
- Product Development

Each review consists of 25 marks. Average of the marks scored in both the two reviews will be considered for final grading. The final certification and acceptance of TW ensures the satisfactory performance on the above aspects.

Table 1: Log Book Format

Sr	Week (Start Date:End Date)	Work Done	Sign of Guide	Sign of Coordinator
1				
2				

Table 2: Continuous Assessment Sheet

Sr	Exam Seat No	Name of Student	Student Attendance	Log Book Maintain	Literature Review	Depth of Understanding	Report	Total
			5	5	5	5	5	25

Table 3: Evaluation Sheet

Sr	**Exam Seat No**	**Name of Student**	**Project Selection**	**Design/ Simulation/ Logic**	**PCB/ hardware/ programming**	**Result Verification**	**Presentation**	**Total**
			5	5	5	5	5	25

Program: Electronics and Telecommunication Engineering	B.Tech	Semester: VII
Full Stack Development		

Pre-requisite

1 Basic understanding of computers and web browsers
2 Familiarity with basic programming concepts (variables, loops, functions, etc.)
3 Introductory knowledge of HTML and CSS
4 Basic understanding of JavaScript (optional but beneficial)

Course Objectives

1 To introduce students to the fundamentals of web development using HTML, CSS, and JavaScript.
2 To provide in-depth knowledge of modern JavaScript (ES6+) features used in frontend development.
3 To enable students to build interactive user interfaces using React and its component-based architecture.
4 To develop skills in managing state, handling events, and using React Hooks for building dynamic applications.
5 To empower learners to build and deploy real-world React projects including a personal portfolio.

COs	Course Outcomes	Bloom's Level	Bloom's Description
CO1	Design responsive web pages using HTML5, CSS, and modern layout techniques.	L3	Apply
CO2	Apply core JavaScript and ES6+ features to build interactive web functionalities.	L3	Apply
CO3	Develop dynamic user interfaces using React components, props, state, and event handling.	L6	Create
CO4	Manage application state and side effects using React Hooks and advanced patterns.	L4	Analyze
CO5	Build and deploy real-world React projects and a personal portfolio showcasing frontend skills.	L6	Create

Full Stack Development(22ESET7070L)

Course Content

Learn React JS for Front-end development

ES6+ Features
- Let and Const (Replacing var)
- Arrow functions
- Promises(async / await)
- Spread / Rest operators
- Destructuring

Javascript Functions
- Array Map Method
- JavaScript forEach Method
- JavaScript Filter() Method
- JavaScript Reduce Method

React Fundamentals
- About React
- About JSX in React
- Components in React
- Iteration in React
- Conditional Rendering
- Range Utility & styling in React

Working With State in React
- Event Handlers
- The useState Hook
- Forms in React
- Props Vs. State

React Hooks
- About Hooks
- Immutability Revisited & Refs
- Side Effects
- Custom hooks & Data Fetching
- Memoization

Project - Interactive Forms with Dynamic Tabs
- Project - The Job Application Form

Component API Design
- The Spectrum of Components
- Polymorphism & Compound Components
- React Context
- Understanding Modals

Portfolio Project
- Portfolio Website

Project - 2048 Game
- 2048 - Game

Advanced Patterns and Smarter State in React
- React State and Visual Updates
- Smarter Component Design in React
- Managing Complex State with use Reducer
- Advanced UI and Safe State Updates in React

Learn HTML / CSS

Introduction to HTML
- Introduction to HTML tags and structure
- List / Images / Links / Table using HTML
- Semantic HTML
- Quiz: HTML
- Project: HTML

Introduction to CSS
- Ways to style using CSS
- CSS selectors and properties
- CSS layout and positioning - Box model
- Quiz: CSS
- Project: CSS

Learn Javascript

Output / Print in JavaScript
- Introducing output/printing
- Printing on multiple lines
- Print text and numbers using single print

Variables and datatypes
- Introduction to variables and datatypes
- Quiz on variables
- Boolean data type and negative numbers

Strings
- Introduction to strings
- Quiz on strings

Functions in JavaScript
- Learn about functions
- Use functions in problems

Conditional statements
- Intro to if / else
- Quiz on conditions
- Combining conditions - And / or

Debug your code
- Learn to debug common errors
- Practice debugging

Arrays
- Introduction to arrays
- Quiz on Arrays

Loops
- While loops
- For loops
- Quiz on loops
- Break / continue

ES6+ Features in JavaScript
- Introduction to let and const
- Arrow Functions
- Spread and Rest Operators
- Destructuring in JavaScript

User Inputs
- How to take user input
- Practice problems

Getting started with algorithmic problems
- What are test cases?

- What are custom inputs?
- Review problems

Experiment list for Full Stack Web Development

1. Creation of HTML Skeleton
2. Creation of a Paragraph in HTML
3. Add the elements in HTML - images and videos. Links to external websites, Create lists, Add tables
4. Use semantic HTML
5. Do inline styling in CSS
6. Create a style sheet in CSS - internal and external
7. Use class / ID selector in CSS
8. do font stying in CSS
9. do layout and positioning in CSS
10. Printing a number/text in JS
11. Arithmetic Operations in JS
12. Inserting text Between Outputs in JS
13. Create and Declare Variables in JS
14. Use of String datatype/Float Datatype
15. Create a boolean variable
16. Use a function in JS
17. Call a function within a function
18. Render Dynamic Data in JSX
19. Do Inline Styles in JSX
20. Update the given React component to display dynamic values and additional information inside the in React
21. Create a basic react component in React
22. Create flexible and reusable components in React
23. Create a component with an input field and two buttons in React
24. Interact with DOM elements and handle side effects in React using useRef and useEffect
25. Handle Form Submissions with Fetch in React

Text Book

[1] A. Banks and E. Porcello, *Learning React: Modern Patterns for Developing React Apps*, 3rd ed. Sebastopol, CA, USA: O'Reilly Media, 2020.

Reference Books

[1] S. Stefanov, *React – Up & Running: Building Web Applications*, Sebastopol, CA, USA: O'Reilly Media, 2016.

[2] A. Accomazzo, N. Murray, A. Lerner, C. Blank, and D. Gallo, *Fullstack React: The Complete Guide to ReactJS and Friends*, San Francisco, CA, USA: Fullstack.io, 2017.

[3] D. Crockford, *JavaScript: The Good Parts*, Sebastopol, CA, USA: O'Reilly Media, 2008.

[4] M. Haverbeke, *Eloquent JavaScript: A Modern Introduction to Programming*, 3rd ed. San Francisco, CA, USA: No Starch Press, 2018.

[5] J. Duckett, *HTML and CSS: Design and Build Websites*, Indianapolis, IN, USA: Wiley, 2011.

Program: Electronics and Telecommunication Engineering	B.Tech	Semester: VIII
5G Technology (22PEET8011T)		

Pre-requisite

1. Analog Communication
2. Digital Communication
3. Computer Networks
4. Mobile Communication

Course Objectives

1. To learn the Basics of 5G and Beyond Wireless communication.
2. To provide basic understanding of the key technologies and modulation techniques of 5G.
3. To study architecture of 5G.
4. To develop the concepts of spectrum requirements, MIMO, antennas for 5G.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Describe the fundamentals of 5G and beyond communication.	L2	Understand
CO2	Characterize and analyze various modulation and multiplexing techniques used in 5G.	L4	Analyze
CO3	Elaborate system architecture of 5G technology.	L4	Analyze
CO4	Illustrate spectrum requirement, antenna design and radio propagation for 5G technology.	L2	Understand
CO5	Design security architecture of 5G	L6	Create

5G Technology (22PEET8011T)
Course Contents

Unit-I Basics of Wireless Networks 09 Hrs.

Introduction – Historical trend of wireless communication – Evolution of LTE Technology to Beyond 4G.Internet of Things and context – Awareness – Network Reconfiguration and Virtualization support – Mobility – quality of Service Control – Emerging approach for resource over provisioning the 5G radio-access technologies-OFDMA, NOMA, SCMA, IDMA.

Unit-II Architecture of the Core Network 09 Hrs.

The Evolved Packet Core - Release 8 Architecture. Control and User Plane Separation The 5G Core Network- Representation Using Reference Points, Representation Using Service-based Interfaces, Data Transport, Roaming Architectures, Data Storage Architectures, Non-3GPP Access to the 5G Core. Network Areas, Slices and Identities-Signalling Protocol.

Unit-III Architecture of the Radio Access Network 08 Hrs.

The Evolved UMTS Terrestrial Radio Access Network – 3GPP Architecture, Carrier Aggregation, Dual Connectivity the Next-generation Node B - High Level Architecture, Internal Architecture, and Deployment Options. Network Areas and Identities - Tracking Areas, RAN Areas, Cell Identities. Signaling Protocols - Signaling Protocol Architecture, Signaling Radio Bearers.

Unit-IV MIMO systems and Communication Devices 08 Hrs.

Introduction, MIMO in LTE, Theoretical background, Single user MIMO, Multi-user MIMO, Capacity of massive MIMO: a summary, Fundamentals of baseband and RF implementations in massive MIMO. Device To Device D2D Communication – D2D: from 4G to 5G – Radio resource management for mobile brand D2D.

Unit-V Spectrum, Antennas and Radio Propagation 08 Hrs.

Spectrum - Spectrum landscape and requirements, Spectrum Allocations for 5G, Bandwidth requirements, Spectrum access modes and sharing scenarios, Spectrum technologies- Spectrum toolbox, Main technology component. Antennas - Antennas and Propagation, Antenna Gain Radio Propagation - Radio Propagation Issues for Millimetre Waves, Diffraction and Reflection, 08 Penetration Losses, Foliage Losses, Atmospheric Losses, Multipath, Fading and Coherence.

Text Books

1. Christopher Cox, Chris Cox, *"An Introduction to 5G: The New Radio, 5G Network and Beyond"*, John Wiley & Sons Ltd, 1st Edition, 2020.

2. Afif Osseiran, Jose F. Monserrat, Patrick Marsch, *"5G Mobile and Wireless Communications Technology"*, 4th Edition Pearson, 2021.

Reference Books

1. Raj Kamal, *"Internet of Things Architecture and Design Principles"*,, McGraw Hill Education private Limited, 2017.

2. Jonathan Rodriguez, *"Fundamentals of 5G Mobile Networks"*, Wiley publication, 2015.

Program: Electronics and Telecommunication Engineering	B.Tech	Semester: VIII
Computer Vision (22PEET8012T)		

Pre-requisite

1. Fundamentals of Digital Image Processing

Course Objectives

1. Review of image acquisition, enhancement, filtering, and transformations in spatial and frequency domains.
2. Develop an understanding of feature extraction methods (e.g., edges, corners, SIFT, HOG) and their applications in image analysis and pattern recognition.
3. Learn algorithms for object detection, segmentation, and classification using traditional methods and machine learning approaches.
4. Understand 3D reconstruction, stereo vision, and depth estimation techniques used for scene understanding.
5. Explore methods for motion detection, tracking, and optical flow estimation in videos and dynamic environments.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain the principles of image preprocessing, feature extraction, and object recognition Techniques.	L2	Understand
CO2	Extract and utilize advanced features (e.g. SIFT, SURF, or learned embedding) for specific tasks like tissue differentiation in medical images or lane detection in autonomous driving.	L3	Apply
CO3	Analyze the techniques of 3D reconstruction, stereo vision, and depth estimation techniques used for scene understanding.	L4	Analyze
CO4	Develop solutions for tracking moving objects using motion analysis techniques like optical flow.	L6	Create

Computer Vision (22PEET8012T)
Course Contents

Unit-I Fundamentals of Image Formation, Transformation 08 Hrs.

Orthogonal, Euclidean, Affine, Projective, etc; Fourier Transform, Convolution and Filtering, Image Enhancement, Histogram Processing.

Unit-II Feature Extraction and Matching 10 Hrs.

Canny edge detector, Harris corner detector. Hessian, LOG, DOG, HOG, Line detectors (Hough Transform) Descriptors and Key points: SIFT, SURF.

Unit-III Camera Calibration, Depth from Stereo 06 Hrs.

Use stereo image pairs to estimate depth using disparity maps. 3D Reconstruction: Reconstruct a 3D scene from multiple 2D images using Structure from Motion (SfM).

Unit-IV Introduction to Machine Learning for Image Classification 10 Hrs.

Object Detection, Semantic Segmentation. Convolutional Neural Networks (CNNs) Build and train a simple CNN for image classification using frameworks like TensorFlow or PyTorch. Object Segmentation with Deep Learning Implement semantic segmentation using UNet or Mask R-CNN. Transfer Learning: Fine-tune a pre-trained model (e.g., ResNet or MobileNet) for a custom dataset.

Unit-V Optical Flow 08 Hrs.

Horn and Shunck method: algorithm using discrete formulation, steps of Jacobi's method for matrix inversion, Lucas-Kanade algorithm for optical flow, Comparison of Horn-Shunck and Lucas-Kanade algorithms. Applications of optical flow.

Text Books

1. Richard Szeliski, *"Computer Vision: Algorithms and Applications"*, Springer, 2nd Edition, 2022.
2. Rafael C. Gonzalez and Richard E. Woods, *"Digital Image Processing"*, 4th Edition Pearson, 2021.
3. David A. Forsyth and Jean Ponce, *"Computer Vision – A Modern Approach"*, PHI Learning, 2nd Edition, 2009.

Reference Books

1. Gary Bradski and Adrian Kaehler, *"Learning OpenCV"*,, O'Reilly Media, 2nd Edition, Inc,2008.
2. Adrian Rosebrock, *"Deep Learning for Computer Vision with Python"*, 1st Edition, 2017.

Program: Electronics and Telecommunication Engineering	B.Tech	Semester: VIII
Satellite Communication (22PEET8013T)		

Pre-requisite

1. Analog Communication
2. Digital Communication

Course Objectives

1. To understand the basics of satellite communications and different satellite communication orbits.
2. Provide an in-depth understanding of satellite communication system Operation, launching techniques, satellite link design, and earth station technology.
3. To explain the tools necessary for the calculation of basic parameters in a satellite communication system..
4. Review the state of the art in new research areas such as satellite networking, satellite personal communications, mobile satellite communication, Laser satellite.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	**Explain basics of satellite communication, space segment and earth segment.**	**L2**	Understand
CO2	**Classify different satellite orbits and orbital parameters.**	**L2**	Understand
CO3	**Design and analyze link budget of satellite signal for proper communication.**	**L6**	**Create**
CO4	**Explain various applications of satellite communications.**	**L2**	Understand

Satellite Communication (22PEET8013T) Course Contents

Unit-I Overview of Satellite Systems, Orbits and Launching 09 Hrs.

Frequency allocation for satellite communication, Polar orbiting satellites, Kepler's Laws, orbital parameters, orbital perturbations, effects of a non-spherical earth, atmospheric drag. Wave Propagation Polarization, Atmospheric Losses, Ionospheric Effects, Rain Attenuation, Antenna Polarization, Polarization of Satellite signals. Sub-satellite Point, predicting satellite position, antenna look angels, polar mount antenna, limits of visibility, near geostationary orbits, earth eclipse of satellite, sun transit outage. Selection of launching site, launch window, launch vehicles; satellite launch vehicle (SLV), augmented satellite launch vehicle (ASLV), polar SLV, geostationary satellite launch vehicle (GSLV).

Unit-II Space Segment 08 Hrs.

Satellite subsystems: Transponder sub-system, Antenna subsystem, AOC Sub-system, TTC Sub-system, power sub-system, Thermal sub-system, reliability and quality Assurance. Satellite stabilization, stabilization techniques.

Unit-III Earth station 06 Hrs.

Design consideration, General configuration- Block diagram, receive only type earth, transmit-receive type earth station, Antenna system, Feed system, Tracking system, LNA, HPA.

Unit-IV Satellite Link 10 Hrs.

Isotropic radiated power, transmission losses, free-space transmission, feeder losses, antenna misalignment losses, fixed atmospheric and ionosphere losses, link power budget, System noise, antenna noise, amplifier noise temperature, amplifiers in cascade, noise factor, noise temperature of absorptive networks, overall system noise temperature, carrier to noise ratio, Uplink: Saturation flux density, input back off, earth station HPA, Downlink: Output back off, satellite TWTA output, Effects of rain, uplink rain-fade margin, downlink rain-fade margin, combined uplink and downlink C/N ratio, inter-modulation noise.

Unit-V The Space Segment Access and Utilization 09 Hrs.

Space segment access methods, pre-assigned FDMA, demand assigned FDMA, SPADE system, Code Division Multiple Access: Direct-sequence spread spectrum– acquisition and tracking, TDMA: Reference Burst; Preamble and Postamble, carrier recovery, frame efficiency, channel capacity, preassigned TDMA, demand assigned TDMA, Satellite Applications : VSAT systems: Advantages, configurations, frequency bands, Television broadcast systems, DAB , Laser Satellite Communication: Link analysis, optical satellite link transmitter, optical satellite link receiver, satellite beam acquisition, tracking positioning, deep space optical communication link.

Text Books

1. Dennis Roddy, "Satellite Communications", Mc. Graw-Hill International,4^{th} Edition, 2019.
2. M. Richharia, "Satellite Communication Systems Design Principles", Macmillan Press Ltd, 2^{nd} Edition, 2003.
3. R. N. Mutangi, "Satellite Communication", Oxford university press, 1^{st}, Edition, 2016.
4. Gerard Maral and Michel Bousquet, "Satellite Communication Systems", Wiley Publication, 4^{th}, Edition, 2018.

Reference Books

1. Gerard Maral, "VSAT Networks", John Willy Sons, 2^{nd} Edition, 2004.
2. Timothy Pratt, Charles Bostian, and Jeremy Allmuti," Satellite Communications", John Willy Sons (Asia) Pvt. Ltd, 2^{nd} Edition, 2017.
3. Wilbur L. Pritchard, Henri G. Suyderehoud, and Robert A. Nelson, "Satellite Communication Systems Engineering", Pearson Publication, 2^{nd} Edition, 2017.

Program: Electronics and Telecommunication Engineering	Final Year B.Tech.	Semester: VIII
Internet Engineering & Network Security (22PEET8014T)		

Prerequisite: Computer Networks

Course Objectives

1. To understand Internet protocol, standards, services and administration.
2. To discuss voice over IP as a real-time interactive audio/video service.
3. To introduce various techniques to implement security mechanisms for network and cyber security.
4. To discuss security implications on Organizations with the help of Risk Management and Incident preparation.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Configure various application layer protocols.	L2	Understand
CO2	Analyze services of network layer provided by advanced protocols.	L4	Analyze
CO3	Compare and analyze various audio and video digitization and compression mechanism and explain voice over IP in the context of real-time interactive audio/video service.	L4	Analyze
CO4	Explain network security fundamentals, analyze IP security mechanisms (IPsec), and evaluate web security protocols to ensure secure data transmission.	L2	Understand
CO5	Explain firewall systems, intrusion detection, biometric security, and operational security centres, while understanding security solutions for modern networks, including cloud, Wi-Fi, and mobile environments	L2	Understand

Internet Engineering & Network Security (22PEET8014T) Course Contents

Unit-I Introduction to Application layer protocols 08 Hrs.

What is the Internet, Evolution of the Internet, Review of TCP/IP layer functions, Application Layer protocols: HTTP, DHCP, DNS, FTP, TFTP, SMTP, MIME, IMAP, POP3, TELNET, SSH.

Unit-II Network Layer 05 Hrs.

IPv6, Packet format, Transition from IPv4 to IPv6, ICMP(v4 and v6) Review of IP addresses, Special addresses, NAT, CIDR: Address aggregation

Unit-III Multimedia Communication 08 Hrs.

Digitizing audio and video, Audio Compression, video compression, streaming stored audio / video Characteristics of real time interactive audio/video, RTP, RTP Packet format, UDP Port, RTCP,RTCP messages VOIP:SIP,H.323, Flow characteristics, Flow classes, techniques to improve QoS, Resource reservation, admission control.

Unit-IV Security in Networks 10 Hrs.

Introduction to Information Security, Network Security Domains, Attacks and their classification, Security services and mechanisms Network security basics, Overview of IP Security (IPsec), IP Security Architecture, Modes of Operation, Security Associations (SA), Authentication Header (AH), Encapsulating Security Payload (ESP), Internet Key Exchange, Web Security Requirements, Secure Socket Layer (SSL), Transport Layer Security (TLS), Secure Electronic Transaction (SET).

Unit-V Firewalls and IDS 06 Hrs.

Designing and Configuring Firewall Systems, Firewall Components, Firewalls – Types, Comparison of Firewall Types, Firewall Configurations, Installing and Configuring FW, Proxy Server ,Honey pot, Digital Immune System.

Unit-VI System security and case study 05 Hrs.

Signature verification, Finger print recognition, Voice recognition, Iris Recognition system, Security Operations Centre (SOC), Network Operations Centre (NOC), Network Security Audit, Cloud Security, Wi-Fi Security, Mobile and Cellular Security.

Text Books:

1. B. Forouzan, “TCP/IP Protocol Suite”, McGraw Hill Publication, 4th Edition, 2009.

2. B. Forouzan, “Cryptography and Network Security”, McGraw Hill Publications, 2nd Edition, 2010.

3. Nina Godbole, “Cyber Security”, John Wiley Publications, 1st Edition 2011.

Reference Books:

1. Leon Garcia, “Communication Networks”, McGraw-Hill Publication, 2nd Edition, 2004.

2. Kurose and Ross, “Computer Networking”, Pearson Publication, 5th Edition, 2012.

3. Pfleeger and Pfleeger, “Security in Computing”, Pearson Publications, 5th Edition, 2011. Prepared by

Program: Electronics and Telecommunication Engineering	Final Year B.Tech.	Semester: VIII
Machine Learning for Signal Processing (22PEET8021T)		

Prerequisite: Engineering Mathematics - IV, Digital Signal Processing

Course Objectives

1. Introduce students to the fundamentals of machine learning (ML) techniques useful for various signal processing applications.
2. To discuss various mathematical methods and algorithms involved in ML for Signal Processing.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Recall key concepts in linear algebra, probability theory and fundamentals relevant to machine learning for Signal Processing.	L1	Remember
CO2	Explain theoretical foundations of linear, non-linear models, and the principles behind probabilistic and advanced Signal Processing models.	L2	Understand
CO3	Apply various machine learning and Signal Processing algorithms and techniques, in problem solving.	L3	Apply
CO4	Analyze the performance and suitability of different learning techniques for specific tasks such as time series analysis, speech recognition, and image processing.	L4	Analyze

Machine Learning for Signal Processing (22PEET8021T) Course Contents

Unit-I Linear Algebra & Probability Theory 06 Hrs.

Vectors, Matrices and Tensors, Linear Dependence and Span, Norms, Eigen decomposition, Singular Value Decomposition. Probability Theory: The Chain Rule of Conditional Probabilities, Independence and Conditional Independence, Expectation, Variance and Covariance, Bayes' Rule.

Unit-II Linear Models for Regression 06 Hrs.

Polynomial Curve fitting, Maximum likelihood and least squares, Geometry of least squares, Sequential learning, Regularized least squares, Multiple outputs.

Unit-III Linear Models for Classification 06 Hrs.

Two class Classification, Multiclass Classification, Least Squares for Classification, Problems with Least Squares Loss, Perceptron Algorithm.

Unit-IV Non-Linear Models-Neural Networks 08 Hrs.

Non-Linear Regression, Parameter Optimization, Gradient descent Optimization, Evaluation of error-function derivatives, A simple example, Efficiency of backpropagation. Regularization for Neural Networks: Data set Augmentation, Early Stopping, Bagging, Dropout.

Unit-V Probabilistic models and Expectation Maximization Algorithm 08 Hrs.

k-means clustering, Gaussian Mixture Model, Maximum likelihood for Gaussian Mixtures, EM for Gaussian Mixtures.

Unit-VI Machine Learning for Audio Classification 08 Hrs.

Time Series Analysis, LSTMs and CNNs. Machine Learning for Speech Recognition: Hidden Markov Models, Finite State Transducers and Dynamic Programming. Machine Learning for Image Processing: Transfer Learning, Attention models, Attribute-based learning.

Text Books:

1. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 1st Edition, 2006.

2. Ian Goodfellow, Yoshua Bengio and Aaron Courville, "Deep Learning", The MIT Press,1st

Edition, 2006.

Reference Books:

1. Christopher M. Bishop, "Neural Networks for Pattern Recognition", Clarendon Press, Oxford, 1995.

2. Tom M. Mitchell, "Machine Learning", McGraw-Hill, 1st Edition, 1997.

Program: Electronics and Telecommunication Engineering	B.Tech	Semester: VIII
Advanced Digital Signal Processing (22PEET8022T)		

Pre-requisite

1. Engineering Mathematics – III.
2. Engineering Mathematics – IV.
3. Signals & Systems.
4. Digital Signal Processing.

Course Objectives

1. To understand the effect of hardware limitations on performance of digital filters.
2. To understand the concept of multirate signal processing.
3. To understand linear prediction and optimum linear filtering.
4. To understand Adaptive Filtering and Wavelet.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Analyze the effect of hardware limitations on performance of digital filters.	L4	Analyze
CO2	Implement multistage sampling rate conversion.	L3	Apply
CO3	Analyze linear prediction methods and optimum linear filters.	L4	Analyze
CO4	Implement adaptive filters for given applications.	L3	Apply
CO5	Analyze wavelet theory for various applications.	L4	Analyze

Advanced Digital Signal Processing (22PEET8022T) Course Contents

Unit-I System realization forms 08 Hrs.

System realization forms: Direct form I, Direct form II, Cascade form and Parallel form realization, Frequency sampling realization, Lattice realization for FIR & IIR filters and Lattice-ladder realization structure.

Unit-II Multirate DSP and Filter Bank 08 Hrs.

Multirate DSP and Filter Banks: Introduction and concept of Multirate Processing, Block Diagram of Decimator and Interpolator, Decimation and Interpolation by Integer Numbers, Multistage Approach to Sampling rate converters, Sample rate conversion using Polyphase filter structure, Type I and Type II Polyphase Decomposition.

Unit-III Linear Prediction and Optimum Linear Filters 09 Hrs.

Linear Prediction and Optimum Linear Filters: Representation of Stationary Random Process, Forward and Backward Linear Prediction, Solution of Normal Equation (Levinson-Durbin and Schur Algorithm), AR Lattice and ARMA Lattice Ladder Filters, Weiner Filters for Filtering and Prediction, Discrete Kalman Filter.

Unit-IV Adaptive Filters 09 Hrs.

Adaptive Filters: Applications of Adaptive Filters: System Identification, Adaptive Channel Equalization, Echo Cancellation, Adaptive Noise Cancellation, Suppression of Narrowband Interference in Wideband Signals, Adaptive Arrays, Adaptive Algorithms: LMS Algorithm, RLS Algorithm, Lattice-ladder Algorithm.

Unit-V Wavelet Transform 08 Hrs.

Wavelet Transform: Introduction to Time Frequency Analysis, Short Time Fourier Transform, Continuous Wavelet Transform, Discrete Wavelet Transform, Multiresolution Analysis, Application.

Text Books

1. Monson H. Hayes, "Statistical Digital Signal Processing and Modeling," John Wiley & Sons, 2nd Edition, 2008

2. John G. Proakis, Dimitris G. Monolakis, "Digital Signal Processing," Pearson Education, 4th Edition, 2014.

3. Emmanuel C. Ifeachor, Barrie W. Jervis, "Digital Signal Processing- A Practical Approach," Pearson Education, 2nd Edition, 2002

Reference Books

1. Simon Haykin, "Adaptive Filter Theory," Pearson Education, 5th Edition, 2014.

2. S. Salivahanan, A. Vallavaraj, and C. Gnanapriya, "Digital Signal Processing," McGraw-Hill Education, 2nd Edition, 2010.

3. Tarun Kumar Rawat, "Digital Signal Processing," Oxford University Press, 1st Edition, 2015.

4. Simon Haykin, "Adaptive Filter Theory," Pearson Education, 5th Edition, 2014.

5. P. P. Vaidyanathan, "Multirate Systems and Filter Banks", Pearson Education, 2nd Edition, 2008.

6. Raghuveer M. Rao and Ajit S. Bopardikar, "Wavelet Transforms- Introduction to Theory and Applications," Pearson Education Asia, 1st Edition, 2nd Impression, 2008

Program: Electronics and Telecommunication Engineering	Final Year B.Tech	Semester: VIII
Microwave Amplifier & Oscillator Design (22PEET8023T)		

Pre-requisite

1. Electromagnetic Wave Propagation
2. Analog Communication
3. Radio Frequency Circuit Design
4. Radiating Systems
5. Microwave Engineering

Course Objectives

1. To understand basics of microstrip lines and coupled lines
2. To understand the concept of Microwave Amplifier design.
3. To understand the concept of Microwave Oscillator design.
4. To understand design and operation of printed microwave circuits and related concepts.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain the design concepts of microstrip lines.	L2	Understand
CO2	Design microwave amplifier and analyze its functioning.	L6	Create
CO3	Design and analyze microwave oscillator and understand design concepts of mixers.	L6	Create
CO4	Describe various microwave system components like power dividers, directional couplers and attenuators.	L2	Understand
CO5	Explain the concepts of EMI and EMC techniques for microwave system.	L2	Understand

Microwave Amplifier & Oscillator Design(22PEET8023T)
Course Contents

Unit-I Microstrip Lines and Coupled Line Propagation 10 Hrs.

Microstrip Lines: Planar wave guides, Microstrip field configurations, Microstrip transitions and microstrip measurements, non-TEM propagation, line impedance. Microstrip Discontinuities: Microstrip open circuits and gaps, micro strip corners, step change in width, microstrip-T junction, bends and microstrip cross junctions. Co-planar Lines: Co-planar waveguides, co-planar strips and co-planar transitions. Coupled Microstrip Lines: Analysis of coupled lines, wave equations for coupled lines, propagation models and coupled line parameters.

Unit-II Microwave Amplifier Design 10 Hrs.

Introduction: Definitions of Two-Port Power gains, derivation of power gains, stability circles, Test for unconditional stability. Single-Stage Transistor Amplifier Design: Maximum gain amplifier design (Conjugate Matching), constant-gain circles, Specific gain amplifier design and Low noise amplifier design. Broadband Transistor Amplifier Design: Balanced amplifier, Distributed amplifiers, differential amplifiers. Power Amplifiers: Characteristics of power amplifiers, Design of class A power amplifiers.

Unit-III Oscillators and Mixers 09 Hrs.

Oscillator Design: One-port and two-port microwave oscillator design, dielectric resonator oscillator design. Oscillator Phase Noise: Analysis of phase noise in oscillators. Mixers: Characteristics, Various types of Mixers: Single ended diode mixers, FET mixers, Balanced mixers, Image reject mixers and other types of mixers.

Unit-IV Power Dividers, Directional Couplers, Attenuators 07 Hrs.

Power Dividers: Two-way, Three-way and Four-way Equal Power Dividers, Unequal, Broadband and Compact Power Dividers. Directional Couplers: Coupled Line Directional Couplers, Branch Line Couplers, and Rat Race Coupler. Attenuators: Fixed and Variable Attenuators.

Unit-V Microwave Systems and EMI, EMC Techniques 06 Hrs.

Microwave Systems: RF Harvesting System, High Power Microwave System, Microwave Imaging System. EMI Sources: Natural sources of EMI, EMI from Circuits, apparatus and open site test area. Radiated and conducted EMI measurements. EMC Techniques: Grounding, shielding, bonding, shielding and EMI filters, cables, connectors, components and EMC Standards.

Text Books:

1. K.C. Gupta et.al., "Micorstrip Lines and Sotlines" Artech House, 2nd Edition, 1996.
2. D. Pozar, "Microwave Engineering", Wiley Publication, 4th Edition, 2015.
3. R. Ludwig R. & G. Bogdanov, "RF Circuit Design", Pearson Education Inc. 2nd Edition, 2009.
4. W. Prasad Kodali, "Engineering Electromagnetic Compatibility: Principles, Measurements, Technologies, and Computer Models", Wiley-IEEE Press, 2nd Edition,2001

Reference Books:

1. G. Gonzalez, "Microwave Transistor Amplifiers Analysis and Design "Prentice Hall, 2nd Edition, 1997.
2. M. L. Sisodia & G. S. Raghuvanshi, "Microwave Circuits and Passive Devices", John Wiley & Sons, 3rd Edition, 1987.
3. Clayton R. Paul, "Electromagnetic Compatibility", John Wiley & Sons, 2nd Edition, 2006.

Program: Electronics and Telecommunication Engineering	Final Year B.Tech	Semester: VIII
Internship(22INTET8030L)		

Course Objectives

1. To get exposure of industrial ecosystem.
2. To enhance student's knowledge in the particular terminology.
3. To nurture student's leadership ability and responsibility to perform or execute the given task individually or in team.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Apply engineering principles and technical knowledge to perform tasks and solve practical problems in the internship environment.	L3	Apply
CO2	Analyze specialized or emerging technologies used in the organization to determine their suitability and effectiveness for specific engineering applications.	L4	Analyze
CO3	Evaluate personal skill gaps and professional growth needs, and develop strategies for continuous improvement and life-long learning.	L5	Evaluate
CO4	Create ethical, socially responsible, and environmentally conscious engineering solutions or recommendations based on the internship experience.	L6	Create

Guidelines

Internships offer valuable educational and career development opportunities by providing students with practical experience in their field of study. In Semester-VIII, students have two options for their internship: Industry Internship and In-house Internship.

1. **Industry Internship**

   Industry Internship Guidelines:

   - The Training and Placement (T & P) cell of the institute will arrange internships for students for students in industries/organizations after the seventh semester.
   - Students are expected to accept internship offers regardless of the company, job profile, location, or stipend offered.
   - Alternatively, students can individually apply by submitting "Student Internshipp Program Application" (avaliable on Institute Website) for industry internships, adhering to the prescribed guidelines as follows:
     1. Only T & P department granted internship will be considered.
     2. The internship duration should be of minimum 12 weeks.
     3. Each students need to take prior permission form T & P department before proceeding for any internship opportunity on his/her own.
     4. Each student will be monitored twice (virtually/through online meetings) during the internship period in the presence of an industry mentor and the department faculty mentor and the concerned TPC.
     5. If any student want to withdraw from the Internship, he/she can only be allowed within two weeks of joining the same. Such students will have to continue the semester VIII academic activities regularly along with In-house internship.

   Expected Activity in Industry Internship:

   - Students may choose to work on innovation or entrepreneurial activities resulting in start-ups or undergo internship with Industry/NGO/ Government organizations/Micro/Small/Medium enterprises to prepare for the industry.
   - Every student is required to prepare a file containing documentary proofs of the activities done by him/her. The evaluation of these activities will be done twice (virtually/through online meetings) during the internship by the committee constituted

by the Head of the Department which shall include Industry mentor, faculty mentor and Department T & P Co-ordinator(TPC).

The assessment criteria for continuous assessment is as per Table 1.

Table 1: Continuous Assessment for Industry Internship

Internship Objectives and Goals (30 Marks)	**Internship Experience Skills Gained / Enhanced (30 Marks)**	**Professional Development and Growth (30 Marks)**	**Internship Report (30 Marks)**	**Presentation (30 Marks)**

- The ESE will be jointly evaluated by an industry mentor, faculty member and department T & P co-ordinator(TPC). The evaluation criteria is as per Table 2.

Table 2: Continuous Assessment for Industry Internship

Internship Objectives and Goals (30 Marks)	**Internship Experience Skills Gained / Enhanced (30 Marks)**	**Professional Development and Growth (30 Marks)**	**Internship Report (30 Marks)**	**Presentation (30 Marks)**

Industry Internship Report:

- Upon completion of the internship, students should prepare a comprehensive report that reflects their observations and leanings during the internship period. Students can consult their Industrial Supervisor, Faculty Mentor, or T & P co-ordinator /Officer for guidance on selection special topics and problems for the report.
- The internship report will be evaluated based on the following criteria:
  (a) Adequacy and purposeful write-up.
  (b) Variety and relevance of learning experience.
  (c) Practical applications and connections with the fundamental theories and concepts covered in the course (Semester I to VII)

2. **In-house Internship**

The inhouse internship provides students with research-oriented opportunities to cultivate a research mindset. It serves as an extensive of the project completed in VI and VII semesters (Project Stage I & II) or offers new objectives provided by the department or research guide.

1. The in-house internship can be pursued individually or as a group activity.
2. If extending a project from Stage-II, at least one student in the group must have participated in Stage I & II.
3. If working on the topic offered by the department or in-house mentor, a group of fresh students can form a team.
4. The maximum group size is limited to four students.
5. In case of extension of project stage II, the outcomes should be in the form of product development/technology transfer along with patent and copyright / one research publication (UGC care listed journal/conference). Students can work jointly with any government funding agency or industry. In such cases, a detailed project report shall be submitted after verification by the in-house mentor and industry/funding agency mentor/authority. In case of standalone/non-sponsored activity, i.e. without any funding agency/industry collaboration, the detailed report shall be submitted after verification by the in-house mentor.
6. If pursuing a Topic offered by the department or in-house mentor, the outcome of the in-house internship should include the publication of a research paper, preferably in an SCI/Scopus/UGC care listed/Indexed Journal/Conference. The detailed project report must be submitted and verified by the in-house mentor.
7. All the designed work shall be submitted to the department in the form of a report in hardbound as well as soft copy.
8. **Evaluation Scheme:**
   I. **Continuous Assessment:**
      (a) A logbook (as per Table 3) of the work done must be maintained by each group.
      (b) Each in-house internship activity will be reviewed twice in the semester. In the first review (as per Table 4), at least 40% work shall be completed include the topic identification/ introduction/scope of the work, literature survey, problem definition and objectives. The remaining 60% of work shall be completed in the second review(as per Table 5) including implementations, key findings, publications &/ patenting &/ copyright &/ product development etc.
   II. **End Semester Examination:** End Semester Examination (as per Table 6 will be jointly evaluated by the faculty mentor and as external examiner appointed

by the HOD in consultation with the COE.

9. **Assessment Formats:**

Table 3: Log Book Format

SN	**Week (Start Date: End Date**	**Work Done**	**Sign of In-house mentor**	**Sign of Coordinator**

Table 4: First Review

Topic Identification & Validation(20 Marks)	**Literature Survey(20 Marks)**	**Problem Definition(20 Marks)**	**Objectives(15 Marks)**

Table 5: End Semester Examination

Topic Identification & Validation (30 Marks)	**Literature Survey & Problem Definition (30 Marks)**	**Objectives & Implementation or Product Development (30 Marks)**	**Presentation (30 Marks)**	**Report, Publications / Patent / IPR Documents (30 Marks)**

Program: Electronics and Telecommunication Engineering	B.Tech	Semester: VIII
Disaster Management and Preparedness (22MCET8040T)		

Pre-requisite

1. Basic knowledge of environmental studies.

Course Objectives

1. To provide a basic understanding of hazards, disasters, and their various types and categories.
2. To identify the extent and damaging capacity of disasters.
3. To study loss mechanisms and effective methods for their mitigation.
4. To understand the roles and responsibilities of individuals and organizations during and after disasters.
5. To appreciate the significance of GIS and GPS in disaster management.
6. To understand emergency government response structures before, during, and after disasters.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Apply disaster management principles & guidelines.	L3	Apply
CO2	Analyze risk assessments.	L4	Analyze
CO3	Determine community awareness & participation.	L3	Apply
CO4	Use Science & Technology tools (GIS, GPS).	L3	Apply
CO5	Outline disaster management plans.	L4	Analyze

Disaster Management and Preparedness (22MCET8040T) Course Contents

Unit-I Understanding Disasters & Hazards 06 Hrs.

• Definition and types of disasters: Natural, Man-made and hybrid disasters, Study of Natural disasters: Flood, drought, cloud burst, Earthquake, Landslides, Avalanches, Volcanic eruptions, Mudflow, Cyclone, Storm, Storm Surge, climate change, global warming, sea level rise, ozone depletion etc. Study of Human/Technology Induced Disasters: Chemical, Industrial and Nuclear disasters, internally displaced persons, road and train accidents Fire Hazards, terrorism, militancy.

• Hazard & Vulnerability profiles of India (seismic zones, flood-prone areas).

• India's vulnerability to disasters, and the impact of disasters on National development.

Unit-II Disaster Risk Reduction (DRR)& Mitigation 06 Hrs.

• Disaster Management Cycle: Prevention, Mitigation, Preparedness, Response, Recovery. Need for disaster prevention and mitigation, mitigation guiding principles, challenging areas, structural and non-structural measures for disaster risk reduction.

• Risk Assessment & Vulnerability Analysis.

• Science & Technology: Use of information management, Geo informatics like RS, GIS, GPS and remote sensing mitigation measure.

Unit-III Disaster Preparedness & Response 04 Hrs.

• Preparedness Planning, Early Warning Systems (EWS),& Communication.

• Emergency Response: Search & Rescue, Logistics, Medical Aid.

• Psychological Response & Management (Trauma, Stress).

• Role of IT, Media, Govt., NGOs, & Community.

Unit-IV Recovery, Rehabilitation & Reconstruction 04 Hrs.

• Post-disaster damage assessment.

• Rehabilitation, Reconstruction,& Livelihood Restoration.

• Sanitation, Hygiene, & Waste Management.

Unit-V Policy, Governance & Capacity Building 04 Hrs.

• National Disaster Management Authority (NDMA) & Legislation.

• Institutional Mechanisms & Community Mobilization. Non-Structural Mitigation:Community based disaster preparedness, capacity development and training, awareness and education, contingency plans.

Unit-VI Case studies on disaster (National /International) 04 Hrs.

• Case study discussion of National Disasters: Tsunami (2004), Bhopal gas tragedy, Kerala and Uttarakhand flood disaster, 26th July 2005 Mumbai flood

• Case study discussion of International Disasters: Hiroshima – Nagasaki (Japan), Cyclone Phailin (2013), Fukushima, Daiichi nuclear disaster (2011), Chernobyl meltdown.

Books Recommended:
Reference Books:

1. Disaster Management, by Harsh K. Gupta, Universities Press Publications (2003).
2. Disaster Management: An Appraisal of Institutional Mechanisms in India, by O. S. Dagur, published by Centre for Land Warfare Studies, New Delhi, 2011.
3. Introduction to International Disaster Management, by Damon Copolla, Butterworth Heinemann Elsevier Publications (2015).
4. Disaster Management Handbook, by Jack Pinkowski, CRC Press, Taylor and Francis group (2008).
5. Disaster management & rehabilitation, by Rajdeep Dasgupta, Mittal Publications, New Delhi (2007).
6. Natural Hazards and Disaster Management, Vulnerability and Mitigation, by R B Singh, Rawat Publications (2006).
7. Concepts and Techniques of GIS, by C. P. Lo Albert, K.W. Yonng, Prentice Hall (India) Publications (2006).
8. Risk management of natural disasters, by Claudia G. Flores Gonzales, KIT Scientific Publishing (2010).

9. Disaster Management – a disaster manager's handbook, by W. Nick Carter, Asian Development Bank (2008).

10. Disaster Management in India, by R. K. Srivastava, Ministry of Home Affairs, GoI, New Delhi (2011)

11. The Chernobyl Disaster: Legacy and Impact on the Future of Nuclear Energy, by Wil Mara, Marshall Cavendish Corporation, New York, 2011.

12. The Fukushima 2011 Disaster, by Ronald Eisler, Taylor & Francis, Florida, 2013.

(Learners are expected to refer to reports published at the national and international levels and updated information available on authentic websites.)