Shirpur Education Society's

R. C. Patel Institute of Technology, Shirpur

An Autonomous Institute

Affiliated to DBATU, Lonere (M.S.),

Approved by AICTE, New Delhi and Govt. of Maharashtra

(DTE: EN - 5172)

Accredited by NAAC 'A' Grade, Bangalore.

Course Curriculum Structure

Electronics & Telecommunication Engineering

Third Year B. Tech

Batch: 2021-2025

With Effect from Academic Year 2023-2024

Shahada Road, Near Nimzari Naka, Shirpur, Maharashtra 425405

www.rcpit.ac.in

Semester-V (w.e.f. Academic Year 2023-24)													
Sr. No	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme					Total	Credit
							Continuous Assessment (CA)				ESE		
				L	T	P	TA	TT1	TT2	Best of TT1 & TT2			
							A			B	C	A+B+C	
1	PC	PCET5010T	Microprocessor & Microcontroller	3	--	--	20	15	15	15	65	100	3
2	PC	PCET5010L	Microprocessor & Microcontroller Laboratory	--	--	2	25	--	--	--	25	50	1
3	PC	PCET5020T	Digital Signal Processing	3	--	--	20	15	15	15	65	100	3
4	PC	PCET5020L	Digital Signal Processing Laboratory	--	--	2	25	--	--	--	25	50	1
5	PC	PCET5030T	Radio Frequency Circuit Design	3	--	--	20	15	15	15	65	100	3
6	PC	PCET5030L	Radio Frequency Circuit Design Laboratory	--	--	2	25	--	--	--	25	50	1
7	HM	HMET5040T	Professional & Business Communication	2	--	--	50	--	--	--		50	2
8	PE	PEET505-T	Professional Elective Course	3	--	--	20	15	15	15	65	100	3
9	PE	PEET505-L	Professional Elective Course Laboratory	--	--	2	25	--	--	--	25	50	1
10	PC	PCET5060T	Data Structures & Algorithms	2	--	--	20	15	15	15	65	100	2
11	PC	PCET5060L	Data Structures & Algorithms Laboratory	--	--	2	25	--	--	--	25	50	1
12	PC	PCET5070L	Database Management System Laboratory	--	--	2	25	--	--	--	25	50	1
13	PJ	PJET5080L	Semester Project-III	--	--	2	25	--	--	--	25	50	1
14	HM	HMET5090L	Employability Skill Development Program -II	--	--	2	50	--	--	--	--	50	1
			Total	**16**	**--**	**16**	**375**	**--**	**--**	**75**	**500**	**950**	**24**

PC: Program Core, **HM:** Humanities, **PE:** Program Elective, **PJ:** Project, **TA:** Teachers Assessment, **TT1:** Term Test-1, **TT2:** Term Test-2

Prepared By
Prashant M. Goad

Checked By
Vinit V Patel

BOS Chairman
Prof.Dr. Vijay S. Patil

E & TC Department R.C.P.I.T. OFFICE SEAL SHIRPUR

Dean Academics
Prof.Dr. Pramod J. Deore
Dean, Academics
R. C. Patel Institute of Technology
Shirpur, Dist: Dhule (MS)

COE
Prof.S.P. Shukla
Controller of Examination
R. C. Patel Institute of Technology
Shirpur Dist: Dhule (MS)

Director
Prof.Dr. J.B. Patil
DIRECTOR
R.C. Patel Institute of Technology
Shirpur Dist Dhule (MS)

Semester-VI (w.e.f. Academic Year 2023-24)													
Sr. No	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme					Total	Credit
							Continuous Assessment (CA)				ESE		
				L	T	P	TA	TT1	TT2	Best of TT1 & TT2			
							A			B	C	A+B+C	
1	PC	PCET6010T	Digital Communication	3	--	---	20	15	15	15	65	100	3
2	PC	PCET6010L	Digital Communication Laboratory	--	--	2	25	--	--	--	25	50	1
3	PC	PCET6020T	Radiating Systems	3	--	--	20	15	15	15	65	100	3
4	PC	PCET6020L	Radiating Systems Laboratory			2	25	--	--	--	25	50	1
5	PC	PCET6030T	Fundamentals of Digital Image Processing	3	--	--	20	15	15	15	65	100	3
6	PC	PCET6030L	Fundamentals of Digital Image Processing Laboratory	--	--	2	25	--	--	--	25	50	1
7	PC	PCET6040T	Computer Networks	3	--	--	20	15	15	15	65	100	3
8	PC	PCET6040L	Computer Networks Laboratory	--	--	2	25	--	--	--	25	50	1
9	PE	PEET605-T	Professional Elective Course	3	--	--	20	15	15	15	65	100	3
10	PE	PEET605-L	Professional Elective Course Laboratory	--	--	2	25	--	--	--	25	50	1
11	PC	PCET6060L	Microcontroller & Applications Laboratory	--	--	4	25	--	--	--	25	50	2
12	PJ	PJET6070L	Project Stage-I	--	--	4	25	--	--	--	25	50	2
13	MC	MCET6090T	Environmental Engineering	1	--	--	--	--	--	--			Audit
			Total	**16**	**--**	**18**	**275**	**--**	**--**	**75**	**500**	**850**	**24**

PC: Program Core, **MC:** Mandatory Course, **PE:** Program Elective, **PJ:** Project, **TA:** Teachers Assessment, **TT1:** Term Test-1, **TT2:** Term Test-2

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Semester-V-Professional Elective Courses		
Sr. No.	**Course Code**	**Course Title**
1	PEET5051	Control Systems
2	PEET5052	Computer Organization & Architecture
3	PEET5053	Basic VLSI
4	PEET5054	Neural Network & Fuzzy Logic
5	PEET5055	Operating Systems
6	PEET5056	Power Electronics

Semester-VI-Professional Elective Courses		
Sr. No.	**Course Code**	**Course Title**
1	PEET6051	Advanced VLSI
2	PEET6052	Data Compression & Encryption
3	PEET6053	Television & Broadcast Technology
4	PEET6054	Artificial Intelligence & Machine Learning
5	PEET6055	Robotics
6	PEET6056	Advanced Power Electronics

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-V
Microprocessor & Microcontroller (PCET5010T)	
Microprocessor & Microcontroller Laboratory (PCET5010L)	

Pre-requisite:

- Basic Electrical Engineering
- Digital Logic Design
- Programming Fundamentals (C / Assembly basics)

Course Objectives:

- To develop background knowledge and core expertise in microcontrollers.
- To understand peripheral devices and their interfacing to microcontrollers.
- To write programs for microcontrollers and their applications in Assembly language.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Identify different functionalities and architecture of 8085 microprocessor.	L2	Understand
CO2	Identify different functionalities and architecture of 8051 microcontroller.	L2	Understand
CO3	Write programs for 8051 microcontroller based systems with the help of appropriate instruction set.	L3	Apply
CO4	Interface different I/O's with 8051 microcontroller for various applications.	L3	Apply
CO5	Identify different functionalities and architecture of ARM 7.	L2	Understand

Microprocessor & Microcontroller (PCET5010T)

COURSE CONTENTS

Unit-I **8085 Architecture and Programming** **10 Hrs.**

8085 microprocessor architecture and its functional blocks, 8085 microprocessor pin diagram,8085 microprocessor Addressing modes, Instruction set.

Unit-II **8051 Microcontroller** **10 Hrs.**

Features, architecture and pin configurations, CPU timing, Input / Output ports, Memory organization, Counters and timers, Interrupts.

Unit-III **8051 Programming** **10 Hrs.**

Instruction set, addressing mode, Assembler Directives Programs related to: arithmetic, logical, delay, input, output, timer, counters, port, serial communication, and interrupts.

Unit-IV **Interfacing and Applications** **6 Hrs.**

Interfacing of Display: LED, LCD and Seven Segment display, Stepper motor, Relay and UART.

Unit-V **ARM7: A 32-bit Core Architecture** **6 Hrs.**

Features of ARM core architecture, Data Flow Model, Pipeline, Registers, operating modes.

Microprocessor & Microcontroller Laboratory (PCET5010L)

List of Laboratory Experiments: (Any Eight)

1. To find smallest and largest number from given data string using 8051.
2. To perform multi byte addition.
3. To exchange data blocks using 8051.
4. To generate waveform using 8051.
5. To interface 7-segment display with 8051.
6. To measure pulse width using 8051.
7. To transfer and receive data serially using 8051.
8. To interface key matrix with 8051.
9. To generate waveforms using DAC and 8051.
10. To display the message on LCD using 8051.

Text Books

1. Ramesh S. Gaonkar, Microprocessor - Architecture, Programming and Applications with the 8085, Penram International Publication.
2. Ajay Deshmukh, Microcontrollers, Tata McGraw Hill Publication.
3. M. A. Mazidi, J. G. Mazidi and R. D. Mckinlay, The 8051 Microcontroller and Embedded systems, Pearson Publication.
4. Lyla Das, Embedded Systems: An Integrated Approach, Pearson Publication.

Reference Books

1. Brarry B. Bray, The 8085A Microprocessor Software, Programming and Architecture, Prentice Hall India Publication.
2. C. Kenneth J. Ayala and D. V. Gadre, the 8051 Microcontroller and Embedded System Using Assembly and C, Cengage Learning Publication.
3. Andrew Sloss, Dominic Symes, and Chris Wright, ARM System Developers Guide, Morgan Kaufmann Publication.

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-V
Digital Signal Processing (PCET5020T)	
Digital Signal Processing Laboratory (PCET5020L)	

Pre-requisite:

- Signals and Systems
- Engineering Mathematics

Course Objectives:

- To develop a thorough understanding of DFT and FFT and their applications.
- To teach the design techniques and performance analysis of digital filters.
- To introduce the students to digital signal processors and its applications.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Apply the efficient computing algorithms of DFT and FFT in finding the response of the system.	L4	Analyze
CO2	Design different types of IIR filters.	L6	Create
CO3	Design different types of FIR filters.	L6	Create
CO4	Evaluate the effects of Poles and Zeros in design of digital filters.	L5	Evaluate
CO5	Explain the architecture of DSP Processors.	L2	Understand
CO6	Explain the applications of Digital Signal Processing in different areas of Telecommunication.	L2	Understand

Digital Signal Processing (PCET5020T)

COURSE CONTENTS

Unit-I Discrete Fourier Transform & Fast Fourier Transform 10 Hrs.

Definition and Properties of DFT, IDFT, Circular convolution of sequences using DFT and IDFT. Filtering of long data sequences: Overlap-Save and Overlap-Add Method for computation of DFT. Fast Fourier Transforms (FFT), Radix-2 decimation in time and decimation in frequency FFT algorithms, inverse FFT, composite Radix FFT N=2.3, N=3.2

Unit-II IIR Digital Filters 10 Hrs.

Types of IIR Filters (Low Pass, High Pass, Band Pass, Band Stop), Analog filter approximations: Butterworth, Chebyshev I. Mapping of S-plane to Z-plane, impulse invariance method, bilinear trans- formation method, Design of IIR digital filters (Butterworth and Chebyshev-I) from Analog filters with numerical examples. Effect of Poles and Zeros on the Frequency Response of IIR filters. Position of Poles and Zeros of Low Pass, High Pass, Band Pass, Band Stop, All Pass filters.

Unit-III FIR Digital Filters 8 Hrs.

Characteristics of FIR digital filters, Minimum Phase, Maximum Phase, Mixed Phase and Linear Phase (Type 1 to Type 4) FIR Filters. Design of FIR filters using Window techniques (Rectangular, Hamming, Hanning, Blackman, Kaiser), Design of FIR filters using Frequency Sampling technique, Comparison of IIR and FIR filters.

Unit-IV Poles, Zeros and Filters 6 Hrs.

Effects of poles and zeros in the frequency response of IIR filters (LP, HP, BP, BR/Notch, All Pass filters). Placement of zeros and design of filters in Type1 to Type 4 Linear Phase FIR filters. Finite Word Length effects in Digital Filters Quantization, truncation and rounding, Error due to truncation and rounding.

Unit-V DSP Processors 4 Hrs.

Introduction to General Purpose and Special Purpose DSP processors, fixed point and floating-point DSP processor, Computer architecture for signal processing, Harvard Architecture, Pipelining, multiplier and accumulator (MAC), Special Instructions, Special purpose DSP hardware, Architecture of TMS320CX fixed and floating DSP processors.

Unit-VI Applications of Digital Signal Processing 4 Hrs.

Application of DSP for ECG signals analysis. Application of DSP for Dual Tone Multi Frequency signal detection. Application of DSP for Radar Signal Processing.

Digital Signal Processing Laboratory (PCET5020L)

List of Laboratory Experiments: (Any Eight)

1. Plot of Discrete Time Signals.
2. Frequency response of LTI systems by DTFT.
3. To perform Discrete Fourier Transform.
4. To implement Circular Convolution of two discrete time sequences.
5. To perform Overlap, Add method of DFT for long data sequence.
6. To implement the algorithm of DIT-Fast Fourier Transform.
7. To plot the FFT of Sinusoids with noise.
8. Magnitude and phase response of FIR filter.
9. Design an Analog Butterworth filter with given specifications.
10. Design a Digital IIR Butterworth filter with given specifications.
11. Design an FIR filter by window method.
12. Removal of Noise by a designed filter.

Text Books

1. Proakis J., Manolakis D., Digital Signal Processing, 4st Edition, Pearson Education.
2. Oppenheim A., Schafer R., Buck J., Discrete Time Signal Processing, 2st Edition, Pearson Education.
3. B. Venkata Ramani and M. Bhaskar, Digital Signal Processors, Architecture, Programming and Applications, Tata McGraw Hill, 2004.

Reference Books

1. Emmanuel C. Ifeachor, Barrie W. Jervis, Digital Signal Processing, A Practical Approach by, Pearson Education.
2. Sanjit K. Mitra, Digital Signal Processing A Computer Based Approach, 4th Edition McGraw Hill Education (India) Private Limited.
3. Tarun Kumar Rawat, Digital Signal Processing, Oxford University Press, 2015.

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-V
Radio Frequency Circuit Design (PCET5030T)	
Radio Frequency Circuit Design Laboratory (PCET5030L)	

Pre-requisite:

- Analog Circuit Design
- Electrical Network Analysis and Synthesis

Course Objectives:

- To develop the model for inductor, capacitor and resistor at high frequency.
- To analyse transmission line using Smith Chart.
- To study application of smith chart for impedance matching.
- To synthesize filter for given specifications.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Apply their knowledge in analyzing inductor, capacitor and resistor at high frequency.	L4	Analyze
CO2	Calculate various parameters of transmission line analytically and using Smith Chart.	L3	Apply
CO3	Design matching network using various techniques.	L6	Create
CO4	Analyze the single and Multiport network using parameters.	L4	Analyze
CO5	Design the filters for given specifications using insertion loss and image parameter method.	L6	Create

Radio Frequency Circuit Design (PCET5030T)

COURSE CONTENTS

Unit-I **Single- and Multiport Networks** **6 Hrs.**

Basic Definitions Interconnecting Networks, Series Connection of Networks, Parallel Connection of Networks, Cascading Networks the Scattering Matrix Reciprocal Networks and Lossless Networks, A Shift in Reference Planes, Power Waves and Generalized Scattering Parameters, Practical Measurements of S-Parameters the Transmission (ABCD) Matrix, Relation to Impedance Matrix and Scattering Matrix, Equivalent Circuits for Two-Port Networks.

Unit-II **Importance of Radio Frequency Design** **6 Hrs.**

RF behaviour of Passive Components High-Frequency Resistors, High-Frequency Capacitors, High- Frequency Inductors Chip Components and circuit Board Considerations Chip Resistors, Chip Capacitors, Surface-Mounted Inductors SMD Assembly Process Solders for SMD Applications, Fluxing and Cleaning, Types of Flux- Organic Soluble Fluxes, R Flux, RMS Flux, RA Flux, Water Soluble Fluxes and Types Flux Selection, Solder Applications, Curing solder Paste, The Reflow Process, Assembly Methods, Adhesive Applications and Curing, Solder Creams

Unit-III **Smith Chart** **10 Hrs.**

From Reflection Coefficient to Load Impedance Reflection coefficient in Phasor Form, Normalised Impedance Equation, Parametric Reflection Coefficient Equation, Graphical Representation Impedance Transformation Impedance Transformation for General Load, Standing Wave Ratio, Special Transformation Conditions Admittance Transformation Parametric Admittance Equation, Additional Graphical Displays Z-Y Smith Chart Parallel and Series Connection of Lumped Elements and their analysis using Smith Chart Parallel Connection of R and L, Parallel Connection of R and C, Series Connection of R and L, Series Connection of R and C, T and π Network.

Unit-IV **Impedance Matching and Tuning** **10 Hrs.**

Matching with Lumped Elements (L Networks) Analytic Solutions, Smith Chart Solutions Impedance Transformers Single-Section Quarter-Wave Transformer, Multi-section Quarter-Wave Transformer, Transformers with Uniformly distributed section reflection coefficient, Binomial Multisection Matching Transformer, Chebyshev Multisection Matching Transformer, Exact formulation and design of Multisection Matching Transformer Tapered Lines Exponential Taper, Triangular Taper, Klopfen- stein Taper.

Unit-V **RF Filter Design** **10 Hrs.**

Basic Resonator and Filter configurations Filter Types and Parameters, Low-Pass Filter, High-Pass Filter, Band pass and Band stop Filters, Insertion Loss Special Filter Realizations using Insertion Loss Method Butterworth-Type Filters, Chebyshev-Type Filters, Denormalization of Standard Low- Pass Design Filter Implementation Unit Elements, Kurodas Identities, Micro strip Filter Design Filter Design by the Image Parameter Method Image Impedances and Transfer Functions for Two-Port Networks, Constant-k Filter sections, m-derived Filter Sections, Composite Filters.

Radio Frequency Circuit Design Laboratory (PCET5030L)

List of Laboratory Experiments: (Any Eight)

1. Characterisation of resistor at high frequency.
2. Characterisation of inductor and capacitor at high frequency.
3. Analysis of Parallel and Series Connection of Lumped Elements and verification using Smith chart.
4. Filter Design by the Image Parameter Method.
5. Filter Design by the Insertion Loss Method.
6. Matching of Lumped Elements.
7. Design of quarter wave transformer.
8. Design of Binomial Multi-Section Matching Transformer.
9. Numerical from previous years GATE Examination paper.
10. Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Text Books

1. Ludwig, Reinhold & Bretchko, Pavel (2007). RF Circuit Design: Theory and Applications, 2nd Edition, Prentice-Hall, Upper Saddle River, N.J.
2. Pozar, David M. (2012). Microwave Engineering. Hoboken, NJ: Wiley Publication.
3. Traister, John (2012). Design Guidelines for Surface Mount Technology, Elsevier.

Reference Books

1. Guillermo Gonzalez. (1996). Microwave Transistor Amplifiers 2nd Edition: Analysis and De- sign. Prentice Hall, Inc., USA.

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-V
Professional & Business Communication (HMET5040T)	

Course Objectives:

- To inculcate professional and ethical attitude at the workplace.
- To enhance communication and interpersonal skills.
- To develop effective presentation skills.
- To hone written skills for technical documentation.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Design and produce well-structured technical documents such as reports, proposals, and research papers by organizing content, composing original text, and integrating ethical standards in written communication.	L6	Create
CO2	Apply techniques of writing resume, participating in a group discussion and facing interviews.	L3	Apply
CO3	Use the principles of interpersonal skills and describe their application in professional and personal situations.	L3	Apply
CO4	Create professional meeting documentation and design effective meeting procedures demonstrating advanced communication and leadership skills.	L6	Create
CO5	Apply effective communication strategies to interact across diverse cultures and demonstrate appropriate professional work ethics in real-life scenarios.	L3	Apply
CO6	Design and deliver effective professional presentations using appropriate PowerPoint tools and presentation strategies.	L6	Create

Professional & Business Communication (HMET5040T)

COURSE CONTENTS

Unit-I **Technical Writing** **8 Hrs.**

Report Writing: Types of report, parts of formal report, collection of data and survey analysis, pre- writing of report, language and style in reports, formatting of reports, referencing in report Proposal Writing: Types of technical proposals, format of proposal, language and style, presentation of proposal Technical Paper Writing: Parts of a technical paper, language and formatting, referencing in IEEE format Plagiarism: Types of plagiarism, consequences of plagiarism.

Unit-II **Employment Skills** **6 Hrs.**

Group Discussion: Purpose of a GD, types of GD, criteria for evaluating a GD, Dos and Don'ts of a GD, Tips to be successful in GD Cover Letter & Resume Writing: Format and content of cover letter, types of resumes, structure, content and formatting of resume Interview Skills: Types and modes of interview, Preparation for interview, Dos and Don'ts of interview, frequently asked questions during interview

Unit-III **Introduction to Interpersonal Skills** **5 Hrs.**

Emotional Intelligence: Definition, difference between IQ and EQ, how to develop EQ Leadership: Types of leadership, leadership styles, case studies Team Building: Difference between group and team, importance of team work, strategies to be a good team player Time Management: Importance of time management, cultural views of time, 80/20 rule, time wasters, setting priorities and goals, Conflict Management: Types of conflicts, strategies to manage conflict, case studies.

Unit-IV **Meetings and Documentation** **2 Hrs.**

Planning and preparation for meetings, strategies for conducting effective meetings, notice, agenda and minutes of a meeting, business meeting etiquettes.

Unit-V **Cross-cultural communication and Ethics** **3 Hrs.**

Communication across cultures, professional and work ethics, responsible use of social media, introduction to Intellectual Property Rights.

Unit-VI **Presentation Skills** **2 Hrs.**

Presentation strategies, overcoming stage fear, techniques to prepare effective PowerPoint presentation.

Professional & Business Communication (HMET5040T)

List of Assignments

1. Business Proposal (PowerPoint presentation)
2. Resume writing.
3. Interpersonal Skills (documentation of activity).
4. Meetings and Documentation (Notice, Agenda, Minutes of Mock Meetings)
5. Business ethics.
6. Presentation Skills.

Text Books

1. Fred Luthans, Organizational Behaviour, McGraw Hill, edition.
2. Lesiker and Petit, Report Writing for Business, McGraw Hill, edition.
3. Huckin and Olsen, Technical Writing and Professional Communication, McGraw Hill.
4. Wallace and Masters, Personal Development for Life and Work, Thomson Learning, 12th edition.
5. Heta Murphy, Effective Business Communication, Mc Graw Hill, edition.
6. Sharma R.C. and Krishna Mohan, Business Correspondence and Report Writing, Tata McGraw Hill Education.
7. Ghosh, B. N., Managing Soft Skills for Personality Development, Tata McGraw Hill. Lehman,
8. Bell, Smith, Management Communication Wiley India Edition, 3rd edition.
9. Dr. Alex, K., Soft Skills, S Chand and Company.
10. Subramaniam, R., Professional Ethics Oxford University Press.

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-V
Control Systems (PEET5051T)	
Control Systems Laboratory (PEET5051L)	

Pre-requisite:

- Engineering Mathematics
- Network Theory / Circuit Theory
- Signal and Systems

Course Objectives:

- To provide fundamental concept of control systems such as mathematical modelling, time response and frequency response of the system.
- To develop concepts of stability and its assessment criteria of the system.
- To study basic concepts of advanced control systems and servo motor.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain the basic concepts of control system.	L2	Understand
CO2	Derive the mathematical model of different type of the systems.	L3	Apply
CO3	Apply state-space techniques to analyse controllability, observability, and system behaviour.	L3	Apply
CO4	Evaluate system stability using Routh, Root Locus, Bode, and Nyquist methods.	L5	Evaluate
CO5	Apply the control theory to design the conventional controllers widely used in the industries.	L3	Apply

Control Systems (PEET5051T)

COURSE CONTENTS

Unit-I **Introduction to Control System Analysis** **8 Hrs.**

Introduction: Open loop and closed loop systems, feedback and feed forward control structure, examples of control systems. Modelling: Types of models, impulse response model, state variable model, transfer function model. Dynamic Response: Standard test signals, transient and steady state behaviour of first and second order systems, steady state errors in feedback control systems and their types.

Unit-II **Mathematical Modelling of Systems** **10 Hrs.**

Conversion of block diagram to signal Flow Graph and Vice-versa., Transfer Function models of various Electrical systems, Block diagram reduction for MIMO and SISO systems, signal flow graph, Masons gain rule.

Unit-III **State Variable Models** **6 Hrs.**

State Transition Equation: Concept of state transition matrix, properties of state transition matrix, solution of homogeneous systems, solution of nonhomogeneous systems. Controllability and Observability: Concept of controllability, controllability analysis of LTI systems, concept of observability, observability with Examples.

Unit-IV **Stability Analysis** **12 Hrs.**

Concepts of Stability and Compensators: Concept of absolute, relative and robust stability, Routh stability criterion, Lead and Lag Compensator. Root Locus Analysis: Root-locus concepts, general rules for constructing root-locus, Bode plot: Magnitude and phase plot; Method of plotting Bode plot; Stability margins on the Bode plots; Stability analysis using Bode plot. Nyquist Criterion: Po- lar plots, Nyquist stability criterions; Nyquist plot; Gain and phase margins.

Unit-V **Adaptive Control Systems and Servomechanism** **6 Hrs.**

Servomotors, Stepper Motors, Synchronous Motors. Optimal Control System, Adaptive control sys- tem, Basics of P, PI, and PID Controller and their applications.

Control Systems Laboratory (PEET5051L)

List of Laboratory Experiments: (Any Eight)

1. Effect of zero and pole to the second order closed loop control system.
2. Static errors for type 0, type 1, type 2 Control System.
3. Frequency response of a 1st order and 2nd order control systems.
4. Transfer function of a 1st order and 2nd order control systems.
5. Effect of Zero and pole to open loop transfer function of a second order system with unity feedback.
6. Design root locus for given control system.
7. Design Bode plot for first and second order control system.
8. Design Nyquist plot for given control system
9. Verification of observability and controllability for given control system.
10. Transfer functions of P, PI, and PID controller.
11. Servo mechanism and characteristics of servo motor.
12. Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Text Books

1. Nagrath, M.Gopal, Control System Engineering, Tata McGraw Hill.
2. K.Ogata, Modern Control Engineering, Pearson Education, 3rd edition
3. V.K. Mehta, Rohit Mehta, Principles of Power Systems, S. Chand publications.

Reference Books

1. Madan Gopal, Control Systems Principles and Design, Tata McGraw hill, 7th edition, 1997.
2. Normon, Control System Engineering, John Wiley & sons, 3rd edition
3. Ajit K.Mandal, Introduction to Control Engineering, New Age International Publication, 2nd edition.
4. S.Hasan Saeed, Automatic Control System, Katson Books, 7th revised edition.

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-V
Computer Organization and Architecture (PEET5052T)	
Computer Organization and Architecture Laboratory (PEET5052L)	

Pre-requisite:

- Programming Fundamentals
- Digital Logic Design

Course Objectives:

- To conceptualize the basics of organizational and architectural issues of a digital computer.
- To analyse performance issues in processor and memory design of a digital computer.
- To understand various data transfer techniques in digital computer.
- To analyse processor performance improvement using instruction level parallelism.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Demonstrate basic structure of computer and its performance.	L2	Understand
CO2	Apply the concepts of ALU and control unit designs to explain their functions in a processor.	L3	Apply
CO3	Apply the concepts of memory organization to explain various memory structures.	L3	Apply
CO4	Analyse instruction level parallelism with case study of 8086 processor.	L4	Analyze
CO5	Compare and contrast different Memory/IO mapping techniques.	L4	Analyze

Computer Organization and Architecture (PEET5052T)

COURSE CONTENTS

Unit-I Introduction of Computer Organization and Architecture 4 Hrs.

Basic organization of computer, Evolution of Computers, Von Neumann model. Performance measure of Computer Architecture. Architecture of 8086 families, 8086 Hardware Design, Minimum mode & Maximum mode of Operation. Study of bus controller 8288 & its use in Maximum mode.

Unit-II Data Representation and Arithmetic Algorithms 6 Hrs.

Number representation: Binary Data representation, two's complement representation and Floating- point representation. Integer Data arithmetic: Addition, Subtraction. Multiplication: Unsigned & Signed multiplication Add & Shift Method, Booth's algorithm. Division of integers: Restoring and non-restoring division, signed division, Basics of floating-point representation IEEE 754 floating point (Single & double precision) number representation. Floating point arithmetic: Addition, subtraction.

Unit-III Control Unit 8 Hrs.

Soft wired (Micro programmed) and hardwired control unit, Design methods. Microinstruction sequencing and execution. Micro operations, concepts of Nano programming. Introduction to RISC and CISC architectures and design issues. Introduction to parallel processing concepts, Flynn's classifications, Pipeline processing, instruction pipelining, pipeline stages, pipeline hazards. Case study: 8086.

Unit-IV Programming 8086 10 Hrs.

Instruction formats, basic instruction cycle, Instruction interpretation and sequencing. Addressing modes, Instruction Set, Assembly Language Programming, Mixed Language Programming, Programs based on Stacks, Strings, Procedures, Macros, Timers, Counters & delay.

Unit-V Memory Organization 10 Hrs.

Introduction to Memory and Memory parameters. Classifications of primary and Secondary memories. Types of RAM and ROM, Allocation policies, Memory Hierarchy and characteristics. Cache memory: Concept, architecture (L1, L2, L3), Mapping techniques. Cache Coherency, Interleaved and Associative memory.

Unit-VI I/O Organization 4 Hrs.

Input/output systems, I/O modules and 8089 IO processor. Types of data transfer Techniques: Programmed I/O, Interrupt driven I/O and DMA.

Computer Organization and Architecture Laboratory (PEET5052L)

List of Laboratory Experiments: (Any Eight)

1. To study Full Adder (7483).
2. To study ALU (74181).
3. To study MASM (Micro Assembler).
4. A program for hexadecimal addition and multiplication.
5. A program for binary multiplication.
6. A program for Hamming code generation, detection and correction.
7. A program for Booth's multiplication
8. A program for LRU page replacement algorithm.
9. A program for FIFO page replacement algorithm.
10. A program to simulate the mapping techniques of Cache memory.
11. A program to simulate memory allocation policies.
12. A program to implement serial communication (PC - PC communication).
13. A program to implement parallel communication. (PC - Printer communication).
14. A program for printer simulation.
15. A program for keyboard simulation.
16. Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Text Books

1. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, Computer Organization, 5th Edition, Tata McGraw-Hill.
2. Douglas V Hall- Microprocessors and Interfacing, Tata McGraw-Hill., 3rd edition, 2005 Micro- computer Systems
3. John P. Hayes, Computer Architecture and Organization, 3rd Edition.
4. William Stallings, Computer Organization and Architecture: Designing for Performance, 8rd Edition, Pearson.
5. B. Govindarajulu, Computer Architecture and Organization: Design Principles and Applications, 2nd Edition, Tata McGraw-Hill.

Reference Books

1. Dr. M. Usha, T. S. Srikanth, Computer System Architecture and Organization, 1st Edition, Wiley-India.
2. Computer Organization by ISRD Group, Tata McGraw-Hill.
3. The 8086 8088 Family Y C Liu And G A Gibson

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-V
Basic VLSI (PEET5053T)	
Basic VLSI Laboratory (PEET5053L)	

Pre-requisite:

- Electronic Devices & Circuits
- Digital Logic Design

Course Objectives:

- To provide understanding of VLSI circuit design using different design styles.
- To provide an exposure to HDL programming.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain transistor scaling and VLSI circuit performance.	L2	Understand
CO2	Realize logic circuits using different design styles.	L3	Apply
CO3	Describe operation of memory, storage circuits and data path elements.	L2	Understand
CO4	Design digital circuits using HDL language.	L6	Create

Basic VLSI (PEET5053T)

COURSE CONTENTS

Unit-I **MOSFET Layout and Scaling** **6 Hrs.**

MOSFET Scaling: Types of scaling, short channel effects Layout: Lambda based design rules (CMOS), MOSFET capacitances.

Unit-II **Data Representation and Arithmetic Algorithms** **14 Hrs.**

CMOS INVERTER Circuit Analysis: Static and dynamic analysis (Noise, propagation delay and power dissipation) of resistive load and CMOS inverter. Comparison of all types of MOS inverters. Design of CMOS inverters and its layout.

Design styles: Static CMOS, Dynamic CMOS, pass transistor logic, transmission gate, Pseudo NMOS, Domino logic, C2MOS, NORA logic, NP Domino logic, Realization of Multiplexer (up to 4:1 Mux), Encoder, Decoder, SR Latch, JK FF, D FF, 1 Bit Shift Register design in different design styles and their layouts.

Unit-III **Memory and Storage circuits** **8 Hrs.**

ROM array, SRAM (operation, design strategy, leakage currents, read /write circuits), layout of SRAM. DRAM (Operation of 1T, 3T, operation modes, refresh operation, Input-Output circuits), layout of DRAM.

Unit-IV **Data path design** **8 Hrs.**

Full adder, Ripple carry adder, CLA adder, Carry Skip Adder, Carry Save Adder and carry select adder, Array Multiplier, Barrel shifter.

Unit-V **Design methods** **6 Hrs.**

Semi-custom Full custom design PLA PAL PROM FPGA PLD. Introduction to VHDL.

Basic VLSI Laboratory (PEET5053L)

List of Laboratory Experiments: (Any Eight)

1. To study MOS characterization using simulation software.
2. Static analysis of CMOS Inverter.
3. Dynamic analysis of CMOS Inverter.
4. Multiplexer design using pass transistor and transmission gate logic style.
5. 1-bit CMOS Adder design using static CMOS logic style.
6. 1-bit CMOS mirror Adder design.
7. To write VHDL/Verilog Program for flip flops.
8. To write VHDL/Verilog Program for adders.
9. To write VHDL/Verilog Program for multiplexers.
10. Design and simulation of barrel shifter circuit in SPICE.
11. To write HDL code and simulation of barrel shifter.

Text Books

1. Sung-Mo Kang and Yusuf Leblebici, CMOS Digital Integrated Circuits Analysis and Design, Tata McGraw Hill,3rd Edition, 2012.
2. P. Uyemura, Introduction to VLSI Circuits and Systems, John Wiley & Sons.
3. Frank Vahid, Digital Design with RTL Design, VHDL and VERILOG, John Wiley and Sons Publisher 2011.
4. Neil H. E. Weste, David Harris and Ayan Banerjee, CMOS VLSI Design: A Circuits and Systems Perspective, Pearson Education, 3rd Edition.
5. Samir Palnitkar, Verilog HDL: A Guide to Digital Design and Synthesis, PHI, 2nd Edition
6. Douglas L. Perry VHDL: Programming by Example, McGraw Hill, 4rd Edition

Reference Books

1. Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, Digital Integrated Circuits: A Design Perspective, Pearson Education, 2nd Edition.
2. Volnei A. Pedroni, Circuit Design and Simulation with VHDL, MIT Press, 2nd Edition

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-V
Neural Network & Fuzzy Logic (PEET5054T)	
Neural Network & Fuzzy Logic Laboratory (PEET5054L)	

Pre-requisite:

- Engineering Mathematics
- Signals and Systems
- Programming Fundamentals

Course Objectives:

- To introduce the concepts and understanding of artificial neural networks and fuzzy logic.
- To introduce neural network design concepts.
- To expose neural networks based methods to solve real world complex problems.
- To provide knowledge of fuzzy logic to design the real world fuzzy systems.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Train, calculate and update the weights of the neural networks according to various training rules.	L3	Apply
CO2	Specify the working and applications of different types of neural networks.	L2	Understand
CO3	Apply neural networks in pattern/character recognition, Function approximation classification.	L3	Apply
CO4	Design fuzzy sets for various applications and solve fuzzy set theory problems.	L6	Create
CO5	Design fuzzy controller for various engineering application.	L6	Create

Neural Network & Fuzzy Logic (PEET5054T)

COURSE CONTENTS

Unit-I **Introduction to Neural Networks** **4 Hrs.**

Introduction, humans and computers, Organization of the brain, Biological Neuron, Biological and artificial neuron models, Characteristics of ANN, McCulloch-Pitts Model, Historical developments, Potential applications of ANN.

Unit-II **Essentials of Artificial Neural Networks** **4 Hrs.**

Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN Connectivity, Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules.

Unit-III **Supervised Neural Networks** **10 Hrs.**

Feed forward neural network, Single-Layer feed forward architecture, Multiple-Layer feed forward architecture, Types of feed forward networks, Multi-layer perceptron, Training MLP: The back- propagation algorithm, Introduction to the concept of Support Vector Machine based classifier, GRADIENT-DESCENT algorithm, Generalization, Factors to be considered, Assessing the success of learning, Metrics for evaluation of classification method, Steps to use neural networks to data, Over fitting, Detecting over fit models: Cross validation.

Unit-IV **Unsupervised Learning Neural Networks** **10 Hrs.**

Competitive Learning Networks Maxnet, Mexican Hat Net, Kohonen Self-Organizing Networks architecture, training algorithm, K-means and LMS algorithms, Radial Basis Function (RBF) neural network architecture and algorithm, and Discrete Hopfield networks.

Unit-V **Fuzzy logic** **7 Hrs.**

Introduction to fuzzy logic, Basic Fuzzy logic theory, Fuzzy sets - properties & operations, Fuzzy relation - Operations on fuzzy relations, Fuzzy Membership functions, Fuzzy Rules and Fuzzy Reasoning, Fuzzification and Defuzzification methods, Fuzzy Inference Systems, Mamdani Fuzzy Models, Fuzzy knowledge-based controllers, Sugeno Fuzzy Models.

Unit-VI **Applications of Fuzzy Logic and Fuzzy Systems** **7 Hrs.**

Fuzzy pattern recognition, fuzzy C-means clustering, fuzzy image processing, Simple applications of Fuzzy knowledge-based controllers like washing machines, home heating system, and train break control.

Neural Network & Fuzzy Logic Laboratory (PEET5054L)

List of Laboratory Experiments: (Any Eight)

1. Fuzzy Set Operations: AND, OR, D-Morgans theorem.
2. (a)Simulation of Mamdani Fuzzy Inference System for washing machine control.
   (b) Summery of research paper based on Fuzzy logic
3. Simulation of Sugeno Fuzzy Inference System for given application.
4. Simulation of Mamdani Fuzzy Inference System for image processing application.
5. Write a program for perceptron training algorithm and test it for two input AND & OR gate function.
6. Write a program for training and testing of Multilayer Perceptron for two input EX-OR gate.
7. Write a program for training and testing of Multilayer Perceptron for character recognition application.
8. Program for Radial basis neural network for interpolation application.
9. Write a program for training and testing of RBF for pattern classification application.
10. Kohenan Self Organising map for image classification.
11. Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Text Books

1. S. N. Sivanandam and S. N. Deepa Introduction to Soft computing, Wiley India Publications.
2. Thimothy J. Ross, Fuzzy Logic with Engineering Applications, Wiley India Publications.
3. John Yen and Reza Langari, Fuzzy Logic- Intelligence, Control and Information, Pearson Pub- lications.
4. S. Rajasekaran and G. A. Vijayalakshmi Pai, Neural Networks, Fuzzy Logic, and Genetic Algorithms, PHI.

Reference Books

1. J. S. R. Jang, C.T. Sun, and E. Mizutani, Neuro-Fuzzy and Soft Computing, PHI.
2. Simon Haykin, Neural Network- A Comprehensive Foundation, Pearson Education.
3. J. M. Zurada, Introduction to Artificial Neural Systems, Jaico publishers.
4. S. N. Sivanandam, S. Sumathi, and S. N. Deepa, Introduction to Neural Network Using Matlab Tata McGraw-Hill Publications.
5. Bart Kosko, Neural networks and Fuzzy Systems, Pearson Education.

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-V
Operating Systems (PEET5055T)	
Operating Systems Laboratory (PEET5055L)	

Pre-requisite:

- Discrete Mathematics
- Programming Fundamentals

Course Objectives:

- To introduce operating system as a resource manager, its evolutions and fundamentals.
- To help student understand concept of process and different process (linear and concurrent) Scheduling policies.
- To help student familiar with memory, file and I/O management policies.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Identify the role of an operating system along with its functions and associated issues.	L2	Understand
CO2	Compare between different algorithms used for management and scheduling of processes, Memory and input-output operation.	L4	Analyze
CO3	Appreciate the role of various productivity enhancing tools.	L4	Analyze

Operating Systems (PEET5055T)

COURSE CONTENTS

Unit-I **Fundamental of Operating System (OS)** **5 Hrs.**

Definition, objectives, functions, evolution, services, types, and different views of OS Operating System as a resource manager, system calls, and shell, Monolithic systems, layered systems, client server model, monolithic kernel and Microkernel.

Unit-II **Data Representation and Arithmetic Algorithms** **8 Hrs.**

Process, process creation, process control block, process states, process state transition diagram, Scheduling queues and schedulers, pre-emptive and non- pre-emptive scheduling algorithms, types of threads, multithreading models, Race condition, critical section, mutual exclusion, semaphores, monitors,

Multiprogramming with fixed and variable partitions, memory allocation strategies, Logical and physical address space, paging and segmentation, Concept, performance of demand paging, page replacement algorithms, Deadlock Problem, deadlock characterization, deadlock prevention and dead- lock avoidance deadlock detection and recovery.

Unit-III **File Management and Input Output Management** **8 Hrs.**

File Naming, File Structure, File Types, File Access, File Attributes, File Operations, Memory Mapped Files, Implementing Files, contiguous allocation, linked list allocation, indexed allocations, Single level directory system, two level directory system, Hierarchical Directory System,

Principles of Input/output H/W: I/O Devices, Device Controllers, Direct Memory Access, Principles of In- put/output S/W: Goals Of I/O S/W, Interrupt Handler, Device Driver, Device Independent I/O Software, Disks: RAID levels, Disks Arm Scheduling Algorithms, Management of free blocks.

Unit-IV **Unix Operating System** **8 Hrs.**

History of UNIX, UNIX Goals, Unix Shell, interfaces to Unix, UNIX utility programs, Traditional UNIX Kernel, Modern UNIX Systems, Unix process management: Concept, Scheduling in Unix, Unix Memory management: Paging, Page replacement strategies, Unix file management: I-node, File allocation, I/O management, Unix Security measures.

Unit-V **Linux Operating System** **8 Hrs.**

History, Linux Processes and Thread management, Scheduling in Linux, Linux System calls, Memory management: Virtual memory, Buddy Algorithm, Page replacement policy, Linux File System, I/O management: Disk Scheduling, Advantages of Linux and Unix over Windows.

Unit-VI **Real Time Operating Systems** **5 Hrs.**

Introduction, Characteristics of real-time operating systems, Real Time task Scheduling, modelling Timing constraints, Table-driven scheduling, Cyclic schedulers, Earliest Deadline First (EDF) scheduling, Rate Monotonic Algorithm (RMA).

Operating Systems Laboratory (PEET5055L)

List of Laboratory Experiments: (Any Eight)

1. To implement Linux commands.
2. To implement Linux shell script.
3. To implement any one, the basic commands of Linux like ls, cp, mv and others using kernel APIs.
4. To implement preemptive and non-preemptive algorithms.
5. To implement concept of deadlock.
6. To implement concept of memory management.
7. To implement demand and virtual memory implementation.
8. To implement file allocation strategies.
9. To implement disk scheduling techniques.

Text Books

1. Tanenbaum, Modern Operating Systems, 3rd Edition, PHI.
2. William Stallings, Operating System-Internal & Design Principles, 6th Edition, Pearson.
3. Achyut S. Godbole, Operating Systems, 2nd edition, Tata McGraw Hill

Reference Books

1. Silberschatz A., Galvin P., and Gagne G, Operating Systems Concepts, 8th Edition Wiley.
2. Richard Blum and Christine Bresnahan, Linux Command Line & Shell Scripting, 2nd edition, Wiley
3. Rajib Mall, Real-Time Systems: Theory and Practice, Pearson, 2008.

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-V
Power Electronics (PEET5056T)	
Power Electronics Laboratory (PEET5056L)	

Pre-requisite:

- Basic Electronics / Electronic Devices & Circuits
- Network Theory / Circuit Theory

Course Objectives:

- Understand power electronic devices and their characteristics.
- Analyze power electronics-based rectifiers, inverters, and choppers.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Discuss trade-offs involved in power semiconductor devices.	L2	Comprehend
CO2	Design of triggering, commutation and protection circuits for SCRs.	L4	Analyze
CO3	Analyze different types of single-phase rectifiers and DC-DC converters.	L4	Analyze
CO4	Analyze different types of DC-AC converters (inverters).	L4	Analyze
CO5	Analyze different types of AC Voltage Controllers and Cyclo convertors.	L4	Analyze

Power Electronics (PEET5056T)

COURSE CONTENTS

Unit-I **Power semiconductor devices** **8 Hrs.**

Principle of operation of SCR, static and dynamic characteristics, gate Characteristics. Principle of operation, characteristics, ratings and applications of: TRIAC, DIAC, MOSFET and power BJT. IGBT: basic structure, principle of operation, equivalent circuit, latch-up in IGBTs and V-I characteristics.

Unit-II **SCR: Triggering, commutation and Protection Circuits** **8 Hrs.**

Methods of turning ON SCR (types of gate signal), firing circuits (using R, RC, UJT, Ramp and pedestal, inverse cosine). Design of commutation circuits. Protection of SCR.

Unit-III **Single-phase Controlled Rectifiers** **10 Hrs.**

Introduction to uncontrolled rectifiers, half wave-controlled rectifiers with R, RL load, effect of free- wheeling diode Full wave fully controlled rectifiers (centre-tapped, bridge configurations), full-wave half controlled (semi-converters) with R, RL load, effect of freewheeling diode and effect of source inductance. Calculation of performance parameters, input performance parameters (input power factor, input displacement factor (DF), input current distortion factors (CDF), input current harmonic factor (HF/THD), Crest Factor (CF)), output performance parameters.

Unit-IV **Inverters** **8 Hrs.**

Introduction to basic and improved series/parallel inverters, limitations. Introduction, principle of operation, performance parameters of Single-phase half / full bridge voltage source inverters with R and R-L load, Voltage control of single-phase inverters using PWM techniques, harmonic neutralization of inverters, applications.

Unit-V **DC-DC Converters** **8 Hrs.**

Basic principle of step up and step-down DC-DC converters, DC-DC switching mode regulators: Buck, Boost, Buck-Boost, Cuk Regulators (CCM mode only). Voltage commutated, current commutated and load commutated DC-DC converters Applications in SMPS, Battery charging systems. Introduction, single phase and three phase Cyclo convertors, applications.

Power Electronics Laboratory (PEET5056L)

List of Laboratory Experiments: (Any Eight)

1. To study characteristics of SCR, DIAC, TRAIC.
2. To study characteristics of IGBT, MOSFET and Power BJT.
3. To implement Firing circuit for SCR using UJT.
4. To study of Half wave and Full wave rectifiers using diodes.
5. To study of half wave and Full wave-controlled rectifiers.
6. To implement Buck converter, Boost converter and Buck-Boost converter.
7. To Study Cyclo-convertors.
8. Simulation of single-phase half wave and Full wave rectifier circuit.
9. Simulation of controlled rectifier with R and RL load.
10. Simulation of controlled rectifier with (i) Source Inductance (ii) Freewheeling diode.
11. Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Text Books

1. M. H. Rashid, Power Electronics, Prentice-Hall of India.
2. Ned Mohan, Power Electronics, Undeland, Robbins, John Wiley Publication.
3. P. S. Bhimbra, Power Electronics, Khanna Publishers, 2012.

Reference Books

1. M.D. Singh and K. B. Khanchandani, Power Electronics, Tata McGraw Hill.
2. Ramamurthy, Thyristors and Their Applications, East-West Publications, 2nd edition.
3. P. C. Sen, Modern Power Electronics, Wheeler Publication.

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-V
Data Structures and Algorithms (PCET5060T)	
Data Structures and Algorithms Laboratory (PCET5060L)	

Pre-requisite:

- Programming Fundamentals

Course Objectives:

- Understand basic data structures such as arrays, linked lists, stacks and queues.
- Solve problem involving graphs, trees and heaps.
- Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data.
- Determine and analyse the complexity of given Algorithms.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain basic data structures such as arrays, linked lists, stacks and queues.	L2	Understand
CO2	Solve problem involving graphs, trees and heaps.	L3	Apply
CO3	Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data.	L3	Apply
CO4	Determine and analyze the complexity of given Algorithms.	L4	Analyze

Data Structures and Algorithms (PCET5060T)

COURSE CONTENTS

Unit-I **Introduction to Data structures and Algorithms** **6 Hrs.**

Introduction to Data structures, Need of Data structures, Types of Data structures: Linear and non- linear data structures Arrays, Stacks, Queue, Linked list and Tree, Graph, Recursion, ADT (Abstract Data type). Introduction to Analysis, Algorithms, characteristics of an algorithms, Time and Space complexities, Order of growth functions, Asymptotic notations.

Unit-II **Stack** **6 Hrs.**

Introduction to Stack, Stack as ADT, Operations on stack, Application of stack: reversing string, Polish notations.

Unit-III **Queue** **4 Hrs.**

Introduction to Queue, Queue as ADT, Operations on Queue, Linear representation of queue, Circular Queue, Priority Queue, De-queue, Application of Queues.

Unit-IV **Linked List** **8 Hrs.**

Introduction to Linked List, Basic concept of Linked List, Memory allocation & de allocation of Linked list, Singly Linked list, Doubly Linked list, Circular linked list, Operations on linked list, Linked representation of stack, Linked representation of Queue, Application of linked list.

Unit-V **Sorting and searching** **8 Hrs.**

Introduction to Sorting: Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort, Shell Sort, Radix sort. Analysis of Sorting Techniques. Comparison of sorting Techniques Introduction to Searching: Linear search, Binary search, Hashing Techniques, Different Hash functions, Collision & Collision resolution techniques, Analysis of searching Techniques.

Unit-V **Trees & Graph** **10 Hrs.**

Introduction to Trees, Definitions & Tree terminologies, Binary tree representation, Operations on binary tree, Traversal of binary trees, Binary search tree, Threaded Binary tree, Expression tree, Application of Trees Introduction to Graph, Introduction Graph Terminologies, Graph Representation, Type of graphs, Graph traversal: Depth first search (DFS)& Breadth First search (BFS), Minimum Spanning Tree: Prims & Kruskals Shortest Path Algorithm Dijkstras Algorithm. Applications of graph.

Data Structures and Algorithms Laboratory (PCET5060L)

List of Laboratory Experiments: (Any 7)

1. WAP to implement stack menu driven program.
2. WAP to implement Infix to Postfix Transformation and its evaluation program.
3. WAP to implement double ended queue menu driven program.
4. WAP to implement different operations on linked list copy, concatenate, split, reverse, count no. of nodes.
5. WAP to implement construction of expression tree using postfix expression.
6. WAP to implement Quick Sort, Merge sort and Heap Sort menu driven program.
7. WAP to implement hashing functions with different collision resolution techniques.

Text Books

1. Data structures using C by Tenenbaum, Langsam, Augenstein, Pearson.
2. Data Structures using C, ReemaThareja, Oxford.
3. C and Data structures, Prof. P.S. Deshpande, Prof. O.G. Kakde, Dreamtech Press.
4. Introduction to Data Structure and its Applications Jean-Paul Tremblay, P. G. Sorenson

Reference Books

1. Data Structures Using C & C++, Rajesh K. Shukla, Wiley- India.
2. Data Structures and Algorithm Analysis in C, Mark A. Weiss, Pearson
3. ALGORITHMS Design and Analysis, Bhasin, OXFORD.
4. Computer Algorithms by Ellis Horowitz and Sartaj Sahni, Universities Press.

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-V
Database Management System Laboratory (PCET5070L)	

Pre-requisite:

- Database Management Systems
- Programming Fundamentals

Course Objectives:

- Learn and practice data modelling using the entity-relationship and developing database designs.
- Understand the use of Structured Query Language (SQL) and learn SQL syntax.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Analyze a case study and create ER diagram of the scenario and able to create Database schema from this using given software and SQL.	L6	Create
CO2	Write basic SQL queries to apply constraints, insert rows, do basic operations like alter, update and delete, to use basic aggregate functions and retrieve information from databases.	L3	Apply
CO3	Perform normalization on tables by analyzing functional dependencies.	L4	Analyze
CO4	Write SQL queries to make joins and views on table.	L3	Apply
CO5	Perform nested queries and triggers.	L3	Apply

Database Management System Laboratory (PCET5070L)

COURSE CONTENTS

Experiments are based on theory topics given below

Introduction to databases: Characteristics of databases, Users of Database system, Database architecture, Data abstraction, Different data models.

The Entity-Relationship (ER) Model: Types of entities and Attributes, Keys, Relationship constraints: Cardinality and Participation.

Relational Database: Relational schema and concept of keys, Mapping ER model to Relational Model, Constraints, types of constrains, Integrity constraints, Normalization 1NF,2NF,3NF, BCNF

List of Laboratory Experiments:

1. Identify the case study and detail statement of problem. Design an Entity-Relationship (ER) model.
2. Convert the designed ER model to a Relational Database and create required tables (DATA DEFINITION STATEMENTS) and apply the constraints like Primary Key, Foreign key, NOT NULL to the tables.
3. SQL: SQL Data Definition and Data Types, Specifying Constraints in SQL, Basic Retrieval
4. Queries in SQL, INSERT, DELETE, and UPDATE Statements in SQL, Views (Virtual Tables) in SQL, aggregate functions, nested sub queries, JOINTS, Triggers.
5. Write SQL statements for inserting rows (INSERT) and implementing ALTER, UPDATE and DELETE
6. Perform following aggregate functions: MAX (), MIN (), AVG (), COUNT ()
7. Identify dependencies in a table and accordingly convert it to 1NF, 2NF, 3NF and BCNF
8. Perform SELECT statement for retrieval of data from Database.
9. Perform various JOIN operations on Tables.
10. Create views and access data from it using SQL statements.
11. Perform queries for triggers
12. Perform Nested queries
13. Case Study

Text Books

1. A Silberschatz, H Korth, S Sudarshan, Database System and Concepts, 5th Edition McGraw- Hill
2. Rob, Coronel, Database Systems, Seventh Edition, Cengage Learning.
3. Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database System, Seventh Edition, Person.
4. G. K. Gupta: Database Management Systems, McGraw Hill.

Reference Books

1. Peter Rob and Carlos Coronel, Database Systems Design, Implementation and Management, Thomson Learning, 5th Edition.
2. P.S. Deshpande, SQL and PL/SQL for Oracle 11g, Black Book, Dreamtech Press
3. Mark L. Gillenson, Paulraj Ponniah, Introduction to Database Management, Wiley
4. Raghu Ramkrishnan and Johannes Gehrke, Database Management Systems, TMH
5. Debabrata Sahoo Database Management Systems Tata McGraw Hill, Schaums Outline

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-V
Semester Project- III (PJET5080L)	

Course Objectives:

- To determine the goals, resource requirements of project and produce them in the form of documentation.
- To learn effective utilization of time and project management skills.
- To address the real-world projects, to connect theory with practice as per recent industrial trends.
- To integrate knowledge and skills from various areas through more complex and multidisciplinary projects.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Analyze a survey of several available literatures in the preferred field of study.	L4	Analyze
CO2	Describe various/alternate approaches to complete a project.	L2	Understand
CO3	Apply a collaborative project environment by interacting and dividing project work among team members.	L3	Apply
CO4	Use technical communication skills to present project work in the form of a technical report/paper.	L3	Apply
CO5	Apply teamwork and project management skills to plan, execute, and manage the research study.	L3	Apply

Semester Project- III (PJET5080L)

COURSE CONTENTS

Domain knowledge (any beyond) needed from the following areas for the effective implementation of the project:

Microcontroller and Embedded Systems, Signal Processing, Microwave and Antennas, Networking and Internet of 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 main purpose of this activity is to improve the students' documentation and technical skills to find the cost-effective solution. Guidelines are as follows:

- The project work is to be carried out by a group of 4/5/6 students (2/3 second year and 2/3 third year students)
- Each group is allotted a final year student as a mentor and a faculty member as a guide.
- Project topics will be floated in various domains. Each group submits three project topic preferences, out of which one topic is allotted in discussion with faculty guide and faculty coordinator.
- Each group will identify the hardware and software requirement for their problem statement.
- Each group will be reviewed twice in a semester (August and October) 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 the literature survey, documentation and budgeting of the project.
- In the second review of this semester, each group is expected to complete 30 % of project.
- Subsequent reviews will be carried out in sixth semester.

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).
- 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:

Size of report shall be of minimum 25 pages. Project Report should include appropriate content for:

- Introduction
- Literature Survey
- Related Theory
- Implementation details
- Project Outcomes
- Conclusion
- References

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

Table 1: Log Book Format

Sr. No	Week (Start Date: End Date)	Work Done	Sign of Guide	Sign of Coordinator
1				
2				

Guide will monitor weekly progress and marks allocation will be as per Table 2.

Table 2: Continuous Assessment Sheet

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

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

Departmental committee (including project guide) will evaluate project as per Table 3.

Table 3: Evaluation Sheet

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

Each group shall present/publish a paper based on the semester project in reputed/peer reviewed Conference/Journal/Tech Fest/Magazine/ before the end of the semester.

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

- Objective and Expected outcome
- Long term social impact
- Innovativeness and Motivation
- Documentation
- Simulation effectiveness
- Literature survey and Comparative Methodology
- Project Progress/Implementation
- Overall Presentation and Team work

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.

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-V
Employability Skill Development Program - II (HMET5090L)	

Pre-requisite:

- Basic Mathematics
- Basic knowledge of C programming

Course Objectives:

- To enhance the problem-solving skills with real life examples.
- To enable the students to express their thoughts and knowledge on various platforms.
- Able to describe the basic database management system.
- Able to implement basic programming project using python.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Solve logical problems based on words, Venn diagrams, etc.	L4	Analyze
CO2	Solve English comprehension, sentence completion, and sentence correction problems.	L4	Analyze
CO3	Illustrate the concepts of Exception Handling and Garbage Collection.	L3	Apply
CO4	Describe the fundamentals of DBMS, NoSQL, and MongoDB.	L2	Understand

Employability Skill Development Program - II (HMET5090L)

COURSE CONTENTS

Unit-I **10 Hrs**

Reasoning: Data sufficiency, Logical Deductions, Logical Sequence of Words, Logical Venn Diagrams, Statement and Arguments, Statement and Assumptions, Statement and Conclusions Syllogism.

English: Reading Comprehension, Para Jumbles, Cloze Test, Tenses/ Voice/ Speech, Prepositions/ SVA/ Articles, Vocab /Verbal Analogy, Sentence completion, Sentence Correction.

Unit-II **10 Hrs**

Modules: Introduction, Importance of Modularity programming, import keyword, User defined modules creation, Function based modules, Classes based modules, Connecting modules, from keyword. Files Handling: Reading file char by character, reading file line by line, Modes of files, writing into file, append data to a file, Reading CSV file, Pickling and Un pickling. Garbage collection: Introduction, Importance of manual GC, Self-referenced objects, gc module, Collect () method, Threshold function.

Unit-III **10 Hrs**

Collections Framework: Introduction to collection of data types, Importance of Data processing, DS algorithm's introduction.

List: Create a list, adding elements, Deleting elements, pre-defined functionality of List, Nested List, Immutability and Mutability of List.

Set: The functionality of Set object, Frozen set, Dictionaries, create a dictionary, adding elements Dict: Pre-defined functions of Dict class, Programs using Collection types

Unit-IV **10 Hrs**

Tkinter GUI Types of Layouts, Create Labels and Display images, Create Buttons, Create Events, StringVar class, Calculator program using GUI.

Basic ML AI including Projects Iterators, Nested functions, Generators, Closures, Decorators, Basic ML and AI, PIP, Visualization etc. Project Domain (Per domain 1 or 2 project)

ML/AI Based Projects

Data Analysis Based projects

Test Summarization based projects web scrapping and crawling

Unit-V **10 Hrs**

DBMS Using Python: Introduction to Mysql, Mysql Python connectivity, DDL, DRL, DML, Trans- action management examples (rollback and commit), GUI Database connectivity.

NoSql Using Python: Installation and Configuration, MongoDB Tools, Collection and Documents, CRUD and the MongoDB Shell, Introduction to CRUD, Introduction to the MongoDB API, Creating a Database, Collection and Documents.

Data Modelling and Schema Design: MongoDB Database References Model Tree Structures, MongoDB Analysing Queries, Atomic Operations, Map Reduce, Text Search, Regular Expression, Capped Collections.

Administration: MongoDB Deployment and Cluster setup, MongoDB GridFS, Trident Spout, Work- ing with Replica Sets, MongoDB Sharding.

Reference Books

1. Dr. R S Aggarwal, Quantitative Aptitude for Competitive Examinations, S. Chand Publication.
2. M. G. Venkateshmurthy, Programming Techniques through C, Pearson Publication.
3. Behrouz Forouzan, A Computer Science Structure Programming Approaches using C, Cengage Learning.
4. Yashwant Kanetkar, Let Us C, BPB Publication.

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-VI
Digital Communication (PCET6010T)	
Digital Communication Laboratory (PCET6010L)	

Pre-requisite:

- Engineering Mathematics
- Signals and Systems
- Analog Communication

Course Objectives:

- Apply theoretical bounds on the rates of digital communication system and represent a digital signal using several modulation methods
- Draw signal space diagrams, compute spectra of modulated signals and apply redundancy for reliable communication.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Describe the basics of information theory and coding techniques.	L2	Understand
CO2	Determine the minimum number of bits per symbol required to represent the source and the maximum rate at which a reliable communication can take place over the channel.	L3	Apply
CO3	Describe and determine the performance of different waveform techniques for the generation of digital representation of signals.	L5	Evaluate
CO4	Determine methods to mitigate inter symbol interference in base- band transmission system.	L4	Analyze
CO5	Describe and determine the performance of different error control coding schemes for the reliable transmission of digital representation of signals and information over the channel of Communication systems.	L5	Evaluate

Digital Communication (PCET6010T)

COURSE CONTENTS

Unit-I Information theory and source coding 8 Hrs.

Block diagram and sub-system description of a digital communication system, measure of information and properties, entropy and its properties, Source Coding, Shannon's Source Coding Theorem, Shannon-Fano Source Coding, Huffman Source Coding, Differential Entropy, joint and conditional entropy, mutual information and channel capacity, channel coding theorem, channel capacity theorem.

Unit-II Baseband Modulation and Transmission Band pass Modulation and Demodulation 4 Hrs.

Discrete PAM signals and its power spectra, Inter-symbol interference, Nyquist criterion for zero ISI, sinusoidal roll-off filtering, correlative coding, equalizers, and eye pattern.

Unit-III Baseband Modulation and Transmission 12 Hrs.

Band pass digital transmitter and receiver model, digital modulation schemes Generation, detection, signal space diagram, spectrum, bandwidth efficiency, and probability of error analysis of: Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK)Modulations, Binary Phase Shift Keying (BPSK) Modulation, Quaternary Phase Shift Keying (QPSK), M-ary PSK Modulations, Quadrature Amplitude Modulation (QAM), Minimum Shift Keying (MSK) , Comparison between bandwidth and bit rate, applications of digital modulation schemes.

Unit-IV Optimum Reception of digital Signal 6 Hrs.

Baseband Receiver, Probability of Error, Optimum Receiver and filter, Matched filter and its probability of error, Coherent Reception.

Unit-V Error Control Systems 12 Hrs.

Types of error control, error control codes Linear Block Codes: vector spaces, vector sub spaces, generator matrix, systematic linear block codes, parity check matrix, syndrome testing ,error correction, and decoder implementation Cyclic codes: Algebraic structure of cyclic codes, binary cyclic code properties, encoding in systematic form, circuits for dividing polynomials, systematic encoding with shift register and error detection Convolution Codes: Time domain and transform domain approach, graphical representation, code tree, trellis, state diagram, decoding methods, maximum likelihood decoding, and free distance.

Digital Communication Laboratory (PCET6010L)

List of Laboratory Experiments: (Any 7)

1. Entropy and Mutual Information
2. Source Coding Algorithms (Huffman coding)
3. Linear block codes (Error detection and correction)
4. Cyclic codes (comparison of performance of coded and uncoded system)
5. Convolutional Encoding - Time domain approach
6. ASK, FSK and PSK
7. Generation and Detection of Binary Amplitude shift keying (BASK)
8. Generation of Binary FSK signal modulation (FSK)
9. Observing Eye pattern

Text Books

1. Haykin Simon, Digital Communication Systems, John Wiley and Sons, New Delhi,4th Edition, 2014.
2. H. Taub, D. Schlling, and G. Saha, Principles of Communication Systems, Tata Mc-Graw Hill, New Delhi, 3rd Edition, 2012.
3. Lathi B P, and Ding Z., Modern Digital and Analog Communication Systems, Oxford University Press, 4th Edition, 2009.

Reference Books

1. Sklar B, and Ray P. K., Digital Communication: Fundamentals and applications, Pearson, Dorling Kindersley (India), Delhi, 2nd Edition, 2009.
2. T L Singal, Analog and Digital Communication, Tata Mc-Graw Hill, New Delhi, 1th Edition, 2012.
3. P Ramakrishna Rao, Digital Communication, Tata Mc-Graw Hill, New Delhi, 1th Edition, 2011.
4. M F Mesiya, Contempory Communication systems, Mc-Graw Hill, Singapore, 1th Edition, 2013.

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-VI
Radiating Systems (PCET6020T)	
Radiating Systems Laboratory (PCET6020L)	

Pre-requisite:

- Engineering Mathematics
- Analog Communication
- Electromagnetic Fields & Waves

Course Objectives:

- To learn fundamental parameters of Antenna
- To learn about linear wire antenna elements and Antenna arrays
- To learn about Special types of Antennas
- To learn measurement procedures of Antenna parameters

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain and measure basic antenna parameters like radiation pattern, input impedance, gain and polarization.	L2	Understand
CO2	Derive the field equations for the basic radiating elements like linear wire antenna and loop antenna.	L4	Analyze
CO3	Design of uniform linear and planar antenna arrays using isotropic and directional Sources.	L6	Create
CO4	Design regular shape micro strip antennas and aperture antennas.	L6	Create

Radiating Systems (PCET6020T)

COURSE CONTENTS

Unit-I **Antenna Fundamentals** **10 Hrs.**

Review of Maxwell's equations and vector potential wave equation. Antenna Parameters: Near field and far field radiation, dual equations for electric and magnetic current sources, radiation Mechanism, basic antenna parameters, Radiation pattern, radiation power density, radiation intensity, beam width, directivity, Antenna efficiency, Gain, beam efficiency, bandwidth, polarization, input impedance, antenna vector effective length and equivalent areas, antenna radiation efficiency, FRIIS transmission equation.

Measurement of Antenna Parameters Input Impedance, Radiation Pattern, Gain (Two and Three antenna, method), Polarization.

Unit-II **Wire Elements: Dipoles, Monopoles, Loops and Helical** **10 Hrs.**

Infinitesimal dipole, radiation fields, radiation resistance, radiation sphere, near field, far field directivity, small dipole, finite length dipole, half wave length dipole, linear elements near or on infinite perfect conductors, Monopole antenna, Folded dipole. Design of dipole and monopole antenna' Loop Antenna: Small circular loop, comparison of small loop with short dipole, Ferrite loop, radiation patterns its parameters and their application.

Helical Antennas: Input impedance matching, Axial mode and normal mode propagation, Circular polarization using Helical Antenna.

Unit-III **Arrays** **10 Hrs.**

Linear arrays, Array of two isotropic point sources, linear arrays of N elements, principle of pattern multiplication applicable to non-isotropic sources, Phase scanning arrays, broadside and End-fire Array, Increased Directivity end fire array, Calculations of Directivity, Beam width, Maxima and null directions for N-element Array, basics of planar arrays. Design of Yagi antenna and Log Periodic antenna.

Unit-IV **Micro strip Antenna** **6 Hrs.**

Micro strip antenna (MSA): Introduction, Feeding Techniques, Regular Shape MSAs (Rectangular, Circular, Equilateral Triangular), Design of Regular shape MSAs

Unit-V **Aperture Antennas** **6 Hrs.**

Horn Antennas: E-Plane Sectoral Horn, H-Plane Sectoral Horn, Pyramidal Horn, Conical Horn Reflector Antennas: Introduction, Plane Reflector, Corner Reflector, Parabolic Reflector, Design considerations.

Radiating Systems Laboratory (PCET6020L)

List of Laboratory Experiments: (Any 8)

1. Study of Antenna types
2. Plot Radiation Pattern of dipole and monopole using Antenna trainer kit/ simulation software
3. Plot Radiation Pattern of dipole for varying length using simulation software
4. Design of RMSA using simulation software
5. Design of CMSA using simulation software
6. Design of ETMSA using simulation software
7. Plot Radiation Patterns of micro strip antenna using Antenna trainer kit
8. Design of Broad side-end fire array
9. Study of pattern multiplication
10. Design of phase scanning array.

Text Books

1. C. A. Balanis, Antenna Theory: Analysis and Design 3rd Edition, John Wiley & Sons, Hoboken, NJ, 2005.
2. J. D. Kraus, R. J. Marhefka, A.S. Khan Antennas & Wave Propagation, McGraw Hill Publications, 4th Edition, 2011
3. G. Kumar, K. P. Ray, Broadband Microstrip Antenna, Artech House, 2002.

Reference Books

1. Stutzman, Theile, Antenna Theory and Design, John Wiley and Sons, 3rd Edition
2. R. E. Collin, Antennas and Radio Wave Propagation, International Student Edition, McGraw Hill.

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-VI
Fundamentals of Digital Image Processing (PCET6030T)	
Fundamentals of Digital Image Processing Laboratory (PCET6030L)	

Pre-requisite:

- Engineering Mathematics
- Digital Signal Processing (DSP)

Course Objectives:

- To cover the fundamentals, mathematical models and transformation techniques in digital image processing.
- To develop time and frequency domain techniques for image enhancement.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain the concepts of sampling, quantization, and various color models in image processing.	L2	Understand
CO2	Implement various image enhancement algorithms in spatial domain.	L3	Apply
CO3	Apply different image Transforms in applications.	L3	Apply
CO4	Apply various filters for image restoration.	L3	Apply
CO5	Recognize different shapes using various representation/segmentation techniques and classify the object using different classification methods.	L4	Analyze

Fundamentals of Digital Image Processing (PCET6030T)

COURSE CONTENTS

Unit-I **Digital Image Fundamentals** **4 Hrs.**

Steps in Digital Image Processing, Components, Image Sampling and Quantization Color Image Processing: Color Fundamentals Color models.

Unit-II **Image Enhancement (point processing)** **12 Hrs.**

Image Negative, Thresholding, Gray level slicing with and without background, power law and log transform, Contrast Stretching, Histogram equalization and Histogram Specification Image Enhancement in Spatial Domain (Neighborhood processing): Basics of Spatial Filtering, Generating Spatial Filter Masks Smoothing and Sharpening Spatial Filtering Image Transforms: 1-D DFT, 2-D Discrete Fourier Transform and Its Inverse, Some Properties of 2D DFT, Walsh -Hadamard, Discrete Cosine Transform, Haar Transform, Slant Transform Image Enhancement in Frequency Domain: The Basics of Filtering in the Frequency Domain, Smoothing and Sharpening frequency domain filters.

Unit-III **Morphology** **6 Hrs.**

Erosion and Dilation, Opening and Closing, The Hit or-Miss Transformation. Restoration: Noise models Mean Filters Order Statistics Adaptive filters wiener filter.

Unit-IV **Point, Line, and Edge Detection** **12 Hrs.**

Detection of Isolated Points, Line detection, edge models, basic and advance edge detection, Edge linking and boundary detection, Canny's edge detection algorithm Thresholding: Foundation, Role of illumination, Basic Global Thresholding, Otsu's method Region Based segmentation: Region Growing, Region Splitting and merging, Relationships between pixels, Hough transform Region Identification: chain code, simple geometric border representation, Fourier Transform of boundaries, Boundary description using segment sequences.

Unit-V **Object Recognition** **8 Hrs.**

Knowledge representation, Classification Principles, Classifier setting, Classifier Learning, Support vector machine, Kernels, cluster analysis, K means Clustering.

Fundamentals of Digital Image Processing Laboratory (PCET6030L)

List of Laboratory Experiments: (Any 8)

1. To perform basic Image Processing, Geometric, Arithmetic and Logical operations on images
2. To perform Spatial Domain Image Enhancement using different Point Processing techniques
3. To perform Spatial Domain Image Enhancement using different Neighbourhood Processing techniques
4. To perform Histogram equalization
5. Application of Harr transform in image processing
6. To perform frequency domain Image Enhancement techniques
7. To perform region-based segmentation
8. To perform morphological operations on Image
9. To perform edge detection using basic and advanced techniques
10. To perform Image restoration using various filters
11. To perform classification using Support Vector Machine
12. To perform clustering using K-means algorithm

Text Books

1. Gonzales and Woods, Digital Image Processing, Pearson Education, India, 3rd Edition,
2. Milan Sonka, Vaclav Hlavac, Roger Boyle, Image Processing, Analysis, and Machine Vision, Cengage Engineering, 3rd Edition, 2013

Reference Books

1. Anil K. Jain, Fundamentals of Image Processing, Prentice Hall of India, First Edition, 1989.
2. W Pratt, Digital Image Processing, Wiley Publication, 3rd Edition, 2002

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-VI
Computer Networks (PCET6040T)	
Computer Networks Laboratory (PCET6040L)	

Pre-requisite:

- Operating Systems
- Digital Communication

Course Objectives:

- To learn various hardware network components.
- To understand network reference models and process involved in data communication.
- To understand the protocols working at different layers.
- To design and configure a network for an organization.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain basics of networks, models, protocols, devices	L2	Understand
CO2	Describe physical media & multiplexing techniques	L2	Understand
CO3	Analyze data link layer protocols & error control	L4	Analyze
CO4	Apply & evaluate routing algorithms and IP addressing	L5	Evaluate
CO5	Explain & analyze transport layer (TCP/UDP) services	L4	Analyze

Computer Networks (PCET6040T)

COURSE CONTENTS

Unit-I **Introduction to computer network** **7 Hrs.**

Reference Models, OSI model, overview of TCP/IP, layer functions, services, peer to peer protocols, sockets and ports, Data encapsulation, Networking devices: Repeater, hub, bridge, switch and routers, Network topology.

Unit-II **Introduction to Physical layer Services** **5 Hrs.**

Introduction to physical media, Coax, RJ 45, Optical fiber, twisted pair, bit transmission, frequency division multiplexing. Time division multiplexing.

Unit-III **The Data Link Layer** **10 Hrs.**

Data link Layer Design Issues, Error Detection and Correction, Elementary Data Link Protocols, Sliding Window Protocols: Stop and Wait protocol, Go-back-n protocol, Selective-repeat protocol, Example Data Link Protocols: HDLC: High-Level Data Link Control, The Data Link Layer in The Internet, Channel Allocation Problem, Multiple Access Protocols.

Unit-IV **The Network Layer** **10 Hrs.**

Network functions for the Network Layer Functions, Routing Algorithms: Distance vector and Link state routing, shortest path first algorithm: Dijikstra and Bellman Ford algorithm, Quality of Service. Network Layer in The Internet: The IP Protocol, IPv4 header, IP Addressing class full and classless, CIDR notation, Subnetting, supper netting, Internet Control Protocols, The Interior Gateway Routing Protocol: RIP, OSPF, and The Exterior Gateway Routing Protocol: BGP.

Unit-V **The Transport Layer** **10 Hrs.**

The Transport Service, Elements of Transport Protocols, The Internet Transport Protocol: TCP and UDP, The Internet Transport Protocol

TCP: Introduction to TCP, The TCP, Service Model, The TCP Protocol, The TCP Segment Header, TCP Connection Establishment, TCP Connection Release, Modelling TCP Connection Management, TCP Transmission Policy, TCP Congestion Control, TCP Timer Management.

Computer Networks Laboratory (PCET6040L)

List of Laboratory Experiments: (Any 8)

1. To implement different networking command using cisco packet tracer.
2. To study various hardware and software network components.
3. To configure the Web (HTTP and DNS), FTP and SMTP server using cisco packet tracer
4. To configure RIP protocol in a network using Cisco packet tracer.
5. To configure OSPF protocol in a network using Cisco packet tracer.
6. To establish TELNET session using Cisco packet tracer.
7. To design Firewall using standard and extended ACLs.
8. To study VLSM using Cisco packet tracer
9. To implement Dijikstras algorithm
10. To implement Bellman Ford algorithm
11. To analyze network traffic: HTTP, TCP, UDP using Wireshark

Text Books

1. A. S. Tanenbaum, Computer Network, 4th edition, Prentice Hall
2. B. F. Ferouzan, Data and Computer Communication, Tata McGraw Hill.

Reference Books

1. Kurose, Ross, Computer Networking, Addison Wesley
2. W. Richard Stevens, TCP/IP Volume1, 2, 3, Addison Wesley.
3. D.E.Comer, Computer Networks And Internets, Prentice Hall.
4. B. F.Ferouzan , TCP/IP Protocol Suite, Tata Mc-Graw Hill.

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-VI
Advanced VLSI (PEET6051T)	
Advanced VLSI Laboratory (PEET6051L)	

Pre-requisite:

- Basic VLSI Design
- Digital Electronics / Digital Logic Design

Course Objectives:

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

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Identify and evaluate the trade-offs involved in analog VLSI design.	L5	Evaluate
CO2	Design a single stage and differential amplifier based on MOSFET.	L6	Create
CO3	Design the MOSFET-based operational amplifier.	L6	Create
CO4	Analyze the mixed signal circuits	L4	Analyze
CO5	Describe the techniques of layout for analog circuits.	L2	Understand

Advanced VLSI (PEET6051T)

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** **8 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 pair.

Unit-IV **MOS Operational Amplifiers** **8 Hrs.**

Op-amp Design: General Considerations, performance parameters, one stage op-amps, Two-stage op-amps, 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** **6 Hrs.**

Analog Layout Techniques: Antenna effect, Resistor matching, capacitor matching, active device de- sign, current mirror matching, floor planning, shielding and guard rings.

Advanced VLSI Laboratory (PEET6051L)

List of Laboratory Experiments: (Any 8)

1. To study trans-conductance plots of MOSFET device (voltage bias, current bias and technology bias).
2. To design of basic amplifier
3. To design of cascode amplifier
4. To design of basic current sink
5. To design current sink by using negative feedback resistor
6. To design of 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 of cascode current mirror
11. To design of Wilson current mirror

Text Books

1. B Razavi, Design of Analog CMOS Integrated Circuits, Tata McGraw Hill, 1st Edition.
2. R. Jacob Baker, Harry W. Li, David E. Boyce, CMOS Circuit Design, Layout, and Stimulation, Wiley, Student Edition.
3. P. E. Allen and D. R. Holberg, CMOS Analog Circuit Design, Oxford University Press, 3rd Edition.
4. Gray, Meyer, Lewis, Hurst, Analysis and design of Analog Integrated Circuits, Willey, 5th Edition.

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 2001, Springer US

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-VI
Data Compression & Encryption (PEET6052T)	
Data Compression & Encryption Laboratory (PEET6052L)	

Pre-requisite:

- Digital Electronics / Digital Logic Design

Course Objectives:

- Apply lossy and lossless compression techniques for text, audio, image and video.
- Apply Symmetric and Asymmetric key cryptography for data security.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Implement compression/encryption algorithms for text, audio and image data using appropriate simulation tools.	L3	Apply
CO2	Analyze the performance of various compression/encryption algorithms using appropriate simulation tools.	L4	Analyze
CO3	Simulate concepts of number theory and apply them to cryptographic techniques using appropriate simulation tools.	L3	Apply
CO4	Report and present experimental study conducted with valid conclusions.	L6	Create

Data Compression & Encryption (PEET6052T)

COURSE CONTENTS

Unit-I **Text Compression** **5 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** **8 Hrs.**

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

Unit-III **Audio and Video Compression** **8 Hrs.**

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

Unit-IV **Symmetric key cryptography & Key management** **8 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** **8 Hrs.**

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

Unit-VI **Network Security** **5 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 (PEET6052L)

List of Laboratory Experiments: (Any 8)

1. To find compression ratio after compression of various file formats.
2. To implement Huffman coding/ Arithmetic coding/ LZ78 dictionary coding.
3. To implement μ law and a law companding for Audio compression.
4. To implement DCT for image compression.
5. To implement Substitution cypher/ Transposition cypher for text/ image
6. To implement square and multiply algorithm.
7. To implement Fermats theorem.
8. To implement RSA.
9. To implement Diffie-Hellman Key exchange mechanism.
10. To implement PGP.
11. To study X.509 certificate format by downloading few samples from internet.
12. Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Text Books

1. Khalid Sayood, Introduction to Data Compression, 2nd Edition Morgan Kaufman.
2. William Stallings, Cryptography and Network Security Principles and Practices, 5th Edition Pearson Education.
3. Behrouz A. Forouzan, Cryptography and Network Security, Tata McGraw-Hill.

Reference Books

1. David Saloman, Data Compression: The Complete Reference, Springer.
2. Mark Nelson, Jean- Loup Gailly, The Data Compression Book, 2nd edition, BPB Publications
3. Matt Bishop, Computer Security Art and Science, Addison- Wesley.

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-VI
Television & Broadcast Technology (PEET6053T)	
Television & Broadcast Technology Laboratory (PEET6053L)	

Pre-requisite:

- Analog & Digital Communication
- Signals and Systems
- Electronic Circuits / Analog Electronics

Course Objectives:

- Apply lossy and lossless compression techniques for text, audio, image and video.
- Apply Symmetric and Asymmetric key cryptography for data security.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain different parameters of Sound and picture transmission.	L2	Understand
CO2	Describe the working of colour TV systems.	L2	Understand
CO3	Recognize the principle of various advanced TV technologies.	L3	Apply
CO4	Compare various display technologies.	L4	Analyze
CO5	Explain the Radio Broadcasting Systems, Internet Radio, Podcasting and Satellite Radio.	L2	Understand

Television & Broadcast Technology (PEET6053T)

COURSE CONTENTS

Unit-I **Video and Broadcast Technology** **8 Hrs.**

Analogue and Digital technology, frame and field, scanning process, Interlaced and Progressive scanning, Composite video signal, Component video signal, Resolution, Aspect ratio, Broadcast standards– NTSC, PAL, SECAM and HDTV, Telecine, Camera tubes: basic principle, Vidicon and Image orthicon.

Unit-II **Video Format and Compression Techniques** **6 Hrs.**

Types of Videotapes; Analogue tape, Digital tape, Video compression, Sampling, Intra and Inter frame compression, TBC, Camera cables, connectors, SMPTE Time Code, Control track, eyeballing- monitor setup.

Unit-III **Radio and Sound Technology** **10 Hrs.**

Public Vs Private broadcasting systems in India; Radio Broadcasting Systems–MW, SW, FM. Inter- net Radio, Podcasting: Satellite Radio, Community Radio. Evolution of film sound, optical sound track, Audio formats, Dolby, digital sound, Types of recorders-open reel, cassette recorders and Digital. Analogue and Digital Audio, bit, sampling, multitrack recording.

Unit-IV **Color TV** **10 Hrs.**

Compatibility considerations, Color theory, chromaticity diagram, generation of color TV signals, luminance signal, chrominance signal, Frequency interleaving process, color subcarrier frequency, NTSC system- transmitter and receiver, PAL system transmitter and receiver. Displays: Principle, working, advantages and disadvantages of Plasma, LED, LCD.

Unit-V **Transmission Technologies** **8 Hrs.**

Terrestrial transmission; Satellite and Cable broadcasting; Up linking and down linking, Conditional Access System, DTH; IPTV.MAC signal, D2-MAC/packet signal, MAC decoding.

Television & Broadcast Technology Laboratory (PEET6053L)

List of Laboratory Experiments: (Any 8)

1. To understand working of various stages of Colour TV receiver.
2. To observe and measure Composite video signal for various video patterns and corresponding sweep waveform in the Colour TV receiver.
3. To observe the construction of Monochrome, colour picture tube, Vidicon camera tube and measuring various voltages.
4. To find out various faults and trace circuits in Colour TV receiver.
5. Installation of satellite dish antenna and measurement of LNB frequency, RF power with DTH system for reception of TV channels.
6. Comparison of Analog (CRT), LCD TV, Plasma TV and HDTV.
7. Measuring different voltages using Switch mode power supply (SMPS).
8. Understanding principle of Light emitting Diode (LED) TV and comparing LED TV and LCD TV technology
9. Generation of colour signal and various video patterns.
10. Video signal sampling and compression techniques.
11. Transmission and reception of D2-MAC/ packet signals.
12. Audio and video signal transmission using satellite uplink and downlink.

Text Books

1. Gulati R.R, Monochrome and Color Television, Wiley Eastern Limited publication.
2. R.G. Gupta, Television and Video Engineering, Tata Mc Graw Hill publication.
3. Dhake A.M, Television and Video Engineering, Tata McGraw Hill publication.
4. Keith Jack, Video Demystified, 4e, Elsevier
5. Charles Poynton, San Francisco, Digital video and HDTV, Algorithms and Interfaces, Morgan Kaufmann publishers, 2003.
6. Stan Prentiss, High-Definition TV, 2nd edition, Tata McGraw Hill publication

Reference Books

1. Digital Television (Practical guide for Engineers) by Fischer.

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-VI
Artificial Intelligence & Machine Learning (PEET6054T)	
Artificial Intelligence & Machine Learning Laboratory (PEET6054L)	

Pre-requisite:

- Data Structures & Algorithms

Course Objectives:

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

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Identify the various characteristics of Artificial intelligence.	L2	Understand
CO2	Choose an appropriate problem-solving method for an agent to find a sequence of actions to reach the goal state.	L4	Analyze
CO3	Analyse the strength and weakness of AI approaches to knowledge representation, reasoning and planning.	L4	Analyze
CO4	Construct supervised and unsupervised ANN for real world applications.	L6	Evaluate

Artificial Intelligence & Machine Learning (PEET6054T)

COURSE CONTENTS

Unit-I **Introduction to Artificial Intelligence (AI)** **4 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** **8 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** **8 Hrs.**

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

Unit-IV **Introduction to Machine Learning** **5 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** **12 Hrs.**

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

Unit-VI **Unsupervised Learning** **5 Hrs.**

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

Artificial Intelligence & Machine Learning Laboratory (PEET6054L)

List of Laboratory Experiments: (Any 8)

1. Problem solving by any one search method.
2. Travelling Salesman Problem with Genetic Algorithm/Ant Colony Optimization.
3. Predicting house prices by Linear Regression.
4. Classify items using Logistic Regression.
5. Find the minimum of a polynomial by Steepest Descent Method.
6. Data segregation by K means clustering.
7. Train a Single Layer Perceptron Learning algorithm.
8. To implement Support Vector Machines.
9. Dimensionality reduction by Principal Component Analysis.
10. To implement Nave Bayesian algorithm.

Text Books

1. Stuart J. Russell and Peter Norvig, Artificial Intelligence a Modern Approach, 2nd Edition, Pearson Education.
2. Deepak Khemani, A First Course in Artificial Intelligence, McGraw Hill
3. N.P. Padhy, Artificial Intelligence and Intelligent Systems, Oxford University Press.
4. Peter Harrington, Machine Learning in Action, DreamTech Press
5. Ethem Alpaydin, Introduction to Machine Learning, MIT Press
6. Tom M. Mitchell, Machine Learning, McGraw Hill

Reference Books

1. Elaine Rich and Kevin Knight, Artificial Intelligence 3rd Edition, Tata McGraw-Hill Education Pvt. Ltd., 2008.
2. Stephen Marsland, Machine Learning an Algorithmic Perspective, CRC Press
3. Kevin P. Murphy, Machine Learning a Probabilistic Perspective.

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-VI
Robotics (PEET6055T)	
Robotics Laboratory (PEET6055L)	

Pre-requisite:

- Control Systems
- Microprocessors / Microcontrollers

Course Objectives:

- To study basics of robotics.
- To familiarize students with kinematics and dynamics of robots.
- To familiarize students with trajectory and task planning of robots.
- To familiarize students with robot vision.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain the basic concept of robotics.	L2	Understand
CO2	Perform the kinematic and the dynamic analysis of robots.	L4	Analyze
CO3	Perform trajectory and task planning of robots.	L3	Apply
CO4	Describe importance of visionary system in robotic manipulation.	L2	Understand

Robotics (PEET6055T)

COURSE CONTENTS

Unit-I **Fundamentals of Robotics** **6 Hrs.**

Fundamentals of Robotics: Robot classification, robot components, robot specifications, joints, coordinates, coordinate frames, workspace, languages, and applications.

Unit-II **Kinematics of Robots** **8 Hrs.**

Homogeneous transformation matrices, Inverse transformation matrices, forward and reverse kinematic equations, position and orientation, Denavit-Hatenberg representation of forward kinematics, forward and reverse kinematic solution of three and four axis robot.

Unit-III **Velocity Kinematics & Dynamics** **10 Hrs.**

Differential motions and velocities, its relationship, Jacobian, differential motion of a frame and robot, inverse Jacobian, singularities, dynamic analysis of forces, Lagrangian mechanics, Newton Euler formulation, dynamic equations of two axis robot.

Unit-IV **Robot Vision** **10 Hrs.**

Basics of Trajectory Planning, joint-space trajectory planning, Cartesian-space trajectories, Image representation, template matching, polyhedral object, shape analysis, segmentation, Iterative processing, and perspective transform and camera calibration.

Unit-V **Task Planning** **8 Hrs.**

Task level programming, Uncertainty, Configuration space, Gross motion planning, Fine-motion planning, Simulation of planner motion, Source and goal scenes and Task planner simulation.

Robotics Laboratory (PEET6055L)

List of Laboratory Experiments: (Any 8)

1. Forward Kinematics
2. Inverse Kinematics
3. Dynamic analysis
4. Dynamic equations for two axis robots
5. Joint-space trajectory
6. Cartesian-space trajectory
7. Template matching.
8. Iterative processing
9. Segmentation
10. Simulation of planner motion
11. Object shape analysis
12. Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Text Books

1. Robert Shilling, Fundamentals of Robotics-Analysis and control, Prentice Hall of India, 2009
2. Saeed Benjamin Niku, Introduction of Robotics-Analysis, control, Applications, Wiley India Pvt. Ltd., 2nd Edition, 2011.

Reference Books

1. John J. Craig, Introduction to Robotics-Mechanics and Control, 3rd Edition, Pearson Education, India,2009
2. Mark W. Spong, Seth Hutchinson, M. Vidyasagar, Robot Modelling and Control, Wiley India Pvt. 2006
3. Mikell P. Groover et.al. Industrial Robots-Technology, Programming and Applications, McGraw Hill, New York, 2008.

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-VI
Advanced Power Electronics (PEET6056)	
Advanced Power Electronics Laboratory (PEET6056L)	

Pre-requisite:

- Power Electronics
- Electrical Machines

Course Objectives:

- Design three phase inverter and DC-DC converters.
- Apply power electronics in AC and DC drives.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain the modern methods of analysis and control of power electronic systems.	L2	Understand
CO2	Carry out the theoretical analysis of the power electronic systems from the Systems Theory point of view.	L4	Analyze
CO3	Simulate and analyze power electronic systems.	L3	Apply

Advanced Power Electronics (PEET6056)

COURSE CONTENTS

Unit-I **Three-phase Rectifiers** **8 Hrs.**

3-phase half-wave and full-wave controlled rectifiers with R and RL load, Effect of source inductance Distortion in line current, calculation of performance parameters.

Unit-II **Three-phase inverters and control** **8 Hrs.**

Three phase bridge inverters (120^0 and 180^0 conduction mode) with R and RL load. PWM for 3- phase voltage source inverters, Space Vector Modulation (SVM) technique for phase voltage source inverters, hysteresis control.

Unit-III **DC-DC Converters & Dynamics** **9 Hrs.**

Average model, linearized transfer function models, state-space average models of basic buck, boost and buck-boost converters. 3Feedback control of these converters (PI and PID).

Unit-IV **Power Electronic Applications in DC Drives** **9 Hrs.**

Introduction to DC motors, speed control of DC motor, drives with semi converters, full converters and dual converters. Chopper-based drive. Electric braking of DC motors.

Unit-V **Power Electronic Applications in AC Drives** **8 Hrs.**

Introduction to three-phase induction motor, speed control methods for three-phase induction motor: Stator Voltage, Variable Frequency, Rotor resistance, V/F Control, Slip Power Recovery Schemes.

Advanced Power Electronics Laboratory (PEET6056L)

List of Laboratory Experiments: (Any 8)

1. Single Phase Full Controlled Bridge Rectifier.
2. Speed control of separately excited DC motor using Armature Voltage Control.
3. Speed control of 3-phase Induction Motor using V/F control.
4. Simulation of 3-phase fully controlled Bridge rectifier with R and RL load.
5. Simulation of 1-phase fully controlled Bridge rectifier and study of various parameters.
6. Simulation of 1-phase Inverter and study of various Performance parameters.
7. Simulation of SVM Inverter.
8. Simulation of Closed loop dc-dc converter.
9. Study High Frequency Induction heating & Dielectric heating.
10. Study of operation and control of solid-state relays.
11. Any other experiment based on syllabus may be included, which would help the learner to understand topic/concept.

Text Books

1. M. Rashid, Power Electronics: Circuits, Devices, and Applications, PHI, 3rd Edition.
2. R. W. Erickson, D. Maksimovic, Fundamentals of Power Electronics, Springer, 2nd Edition.
3. Mohan, Undeland and Robbins, Power Electronics: Converters, Applications and Design, Wiley (Student Edition), 2nd Edition.

Reference Books

1. P.S. Bimbhra, Power Electronics, Khanna Publishers, 2012.
2. M. D. Singh, K. B. Khanchandani, Power Electronics, Tata McGraw Hill, 2nd Edition.
3. J. P. Agrawal, Power Electronics Systems: Theory and Design, Pearson Education, 2002

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-VI
Microcontroller & Applications Laboratory (PCET6060L)	

Pre-requisite:

- Microprocessors / Microcontrollers
- Digital Electronics
- Programming (C / Embedded C)

Course Objectives:

- To develop background knowledge and core expertise in advanced microcontrollers.
- To understand peripheral devices and their interfacing to advanced microcontrollers.
- To write programs for microcontrollers and their applications in assembly and embedded C language.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Illustrate the detailed architecture of LPC2148 microcontroller, Arduino & R-Pi Board.	L4	Analyze
CO2	Interface various peripheral devices to the LPC2148 microcontroller, Arduino & R-Pi Board.	L3	Apply
CO3	Develop Assembly language & Embedded C programming for micro- controllers.	L3	Apply
CO4	Report and present experimental study conducted with valid conclusions.	L6	Create

Microcontroller & Applications Laboratory (PCET6060L)

COURSE CONTENTS

LPC 2148 - Salient features, applications, block diagram, memory mapping. Functional features of Interrupt controller, RTC, USB, UART, I2C, SPI, SSP controllers, watch dog timers and other system control units.

LPC 2148 Peripherals Duration: Pin Connect Block- Features, Register description with example. GPIO-Features, Applications, Pin description, Register description with examples PLL-Features, block diagram, bit structure of PLLCON, PLLCFG, & PLLSTAT, and PLLFEED.

PLL frequency Calculation- procedure for determining PLL settings, examples for PLL Configuration Timers Features, applications, Architecture of timer module, register description, Simple C programs for application using -GPIO, PLL, Timer.

List of Laboratory Experiments: (Any 8)

1. To Study of ARM evaluation system.
2. Interfacing ADC and DAC.
3. Interfacing LED and PWM.
4. Interfacing real time clock and serial port.
5. Interfacing of seven segment displays.
6. Interfacing keyboard and LCD.
7. Interfacing EPROM and EEPROM
8. Interfacing DC and servo motors.
9. Interfacing stepper motor and temperature sensor
10. Implementing ZIGBEE protocol with ARM

Text Books

1. Andrew Sloss, Dominic Symes, and Chris Wright, ARM System Developers Guide, Morgan Kaufmann Publication.
2. Lyla Das, Embedded Systems: An Integrated Approach, Pearson Publication.
3. James A. Langbridge, Professional Embedded Arm Development, Wrox, John Wiley Brand & Sons Publication.

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-VI
Project Stage-I (PJET6070L)	

Course Objectives:

- To implement the solution as per the problem statement.
- To develop the team building, writing, logical reasoning and management skills.
- To provide the connections between the designs and concepts across different disciplinary boundaries.
- To encourage students to become independent personnel, critical thinkers and lifelong learners

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Analyze the problem statement and produce solution of the problem considering cultural, social, environmental and economic factors using appropriate tool and method.	L4	Analyze
CO2	Interpret project based learning that allows students to transfer existing ideas into new applications.	L2	Understand
CO3	Apply the ability to work in teams and manage to conduct the project development activity.	L3	Apply
CO4	Use different perspectives from relevant disciplines which help them to get internships, jobs, and admission for higher studies.	L3	Apply
CO5	Explain the project development in the form of technical writing, and interpret what constitutes plagiarism and the use of proper referencing styles.	L2	Understand

Project Stage-I (PJET6070L)

COURSE CONTENTS

Syllabus:

Domain knowledge (any beyond) needed from the following areas for the effective implementation of the project:

Microcontroller and Embedded Systems, Signal Processing, Microwave and Antennas, Networking and Internet of Things, Data science and big data, Communication, Web and Application development, Robotics, AI and Machine learning, etc.

The above areas can be updated based on the technological innovations and development needed for specific project.

Guidelines:

The main purpose of this activity is to improve the students' technical skills, communication skills by integrating writing, presentation and teamwork opportunities.

- 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 30 % of project.
- In the second review of this semester, each group is expected to complete 50 % of project.
- 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 stage I (at the end of the semester) will be done by the departmental committee (including project guide).
- 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:

Size of report shall be of minimum 25 pages. Project Report should include appropriate content for:

- Introduction
- Literature Survey
- Related Theory
- Implementation details
- Project stage I Outcomes

- Conclusion
- References

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

Table 1: Log Book Format

Sr. No	Week (Start Date: End Date)	Work Done	Sign of Guide	Sign of Coordinator
1				
2				

Table 2: Continuous Assessment Sheet

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

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

Table 3: Evaluation Sheet

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

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

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 TA ensures the satisfactory performance on the above aspects.

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-VI
Environmental Engineering (MCET6090T)	

Course Objectives:

- Understand environmental issues such as depleting resources, pollution, ecological problems and the renewable energy scenario.
- Familiarise environment related legislation

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Describe how human activities affect environment.	L2	Understand
CO2	Describe the various technology options that can make a difference.	L2	Understand

Environmental Engineering (MCET6090T)

COURSE CONTENTS

Unit-I **Social Issues and Environment** **4 Hrs.**

Ecological footprint and Carrying Capacity, Depleting nature of Environmental resources such as soil, water minerals and forests, Carbon emissions and Global Warming.

Unit-II **Technological growth for Sustainable Development** **4 Hrs.**

Technological growth for Sustainable Development: Social, Economic and Environmental aspects of Sustainable Development, Renewable Energy Harvesting, Concept of Carbon credit, Green Building, Power and functions of Central Pollution Control Board and State Pollution Control Board.

Unit-III **Environmental impact due to technology** **5 Hrs.**

Environmental impact due to technology: Impact of Energy on Environment, Flow of Energy in Eco- logical system, Environment Degradation due to Energy, Control of pollution from Energy, Consumer electronics, power saving devices, energy from waste, energy use and conservation.

Text Books

1. Environmental Studies from Crisis to Cure, R. Rajagopalan, 2012.
2. Textbook for Environmental Studies for Undergraduate Courses of all Branches of Higher Education, Erach Bharucha.
3. Environmental Management Science and Engineering for industry by Iyyanki V. Murlikrishna and valli Manickam.