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: 2022-2026

With Effect from Academic Year 2024-25

Shahada Road, Near Nimzari Naka, Shirpur, Maharashtra 425405

www.rcpit.ac.in

Semester-V (w.e.f. Academic Year 2024-25)													
Sr. No	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme					Total	Credit
							Continuous Assessment (CA)				ESE		
				L	T	P	TA	TT1	TT2	Average of (TT1&TT2)			
							A			B	C	A+B+C	
1	PC	22PCET5010T	Analog Communication	3	--	--	25	10	10	10	65	100	3
2	PC	22PCET5010L	Analog Communication Laboratory	--	--	2	25	--	--	--	25	50	1
3	PC	22PCET5020T	Radio Frequency Circuit Design	3	--	--	25	10	10	10	65	100	3
4	PC	22PCET5020L	Radio Frequency Circuit Design Laboratory	--	--	2	25	--	--	--	25	50	1
5	PC	22PCET5030T	Microcontroller & Applications-II	3			25	10	10	10	65	100	3
6	PC	22PCET5030L	Microcontroller & Applications-II Laboratory	--	--	2	25	--	--	--	25	50	1
7	PC	22PCET5040T	Digital Signal Processing	3	--	--	25	10	10	10	65	100	3
8	PC	22PCET5040L	Digital Signal Processing Laboratory	--	--	2	25	--	--	--	25	50	1
9	PC	22PCET5050T	Data Structures & Algorithms	1	--	--	25	10	10	10	--	35	1
10	PC	22PCET5050L	Data Structures & Algorithms Laboratory	--	--	2	25	--	--	--	25	50	1
11	PJ	22PJET5060L	Semester Project-III	--	--	2	25	--	--	--	25	50	1
12	HM	22HMET5070L	Employability Skill Development Program-II	--	--	2	50	--	--	--	--	50	1
13	MC	22MCET5080T	Environmental Engineering	1	--	--	--	--	--	--	--	--	Audit
			Total	**14**	**--**	**14**	**325**	**--**	**--**	**50**	**410**	**785**	**20**

PC: Program Core, **HM:** Humanities, **PJ:** Project, **MC:** Mandatory Course, **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

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Semester-VI (w.e.f. Academic Year 2024-25)													
Sr. No	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme					Total	Credit
							Continuous Assessment (CA)				ESE		
				L	T	P	TA	TT1	TT2	Average of (TT1&TT2)			
							A			B	C	A+B+C	
1	PC	22PCET6010T	Digital Communication	3	--	--	25	10	10	10	65	100	3
2	PC	22PCET6010L	Digital Communication Laboratory	--	--	2	25	--	--	--	25	50	1
3	PC	22PCET6020T	Radiating Systems	3	--	--	25	10	10	10	65	100	3
4	PC	22PCET6020L	Radiating Systems Laboratory	--	--	2	25	--	--	--	25	50	1
5	PC	22PCET6030T	Computer Networks	3	--	--	25	10	10	10	65	100	3
6	PC	22PCET6030L	Computer Networks Laboratory	--	--	2	25	--	--	--	25	50	1
7	PC	22PCET6040T	Fundamentals of Digital Image Processing	3	--	--	25	10	10	10	65	100	3
8	PC	22PCET6040L	Fundamentals of Digital Image Processing Laboratory	--	--	2	25	--	--	--	25	50	1
9	PE	22PEET605-T	Professional Elective Course	3	--	--	25	10	10	10	65	100	3
10	PE	22PEET605-L	Professional Elective Course Laboratory	--	--	2	25	--	--	--	25	50	1
11	HM	22HMET6060T	Professional & Business Communication Tutorial	--	2	--	50	--	--	--	--	50	2
12	PJ	22PJET6070L	Project Stage - I	--	--	4	25	--	--	--	25	50	2
			Total	**15**	**2**	**14**	**325**	**--**	**--**	**50**	**475**	**850**	**24**

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

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Semester-VI-Professional Elective Courses		
Sr. No.	**Course Code**	**Course Title**
1	RCP22PEET6051	Basic VLSI
2	RCP22PEET6052	Control Systems
3	RCP22PEET6053	Neural Network & Fuzzy Logic
4	RCP22PEET6054	Operating Systems
5	RCP22PEET6055	Big Data Analytics
6	RCP22PEET6056	Radar Engineering
7	RCP22PEET6057	Linear Algebra

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-V
Analog Communication (22PCET5010T)	
Analog Communication Laboratory (22PCET5010L)	

Pre-requisite:

- Electronics Circuit Design
- Signals and Systems

Course Objectives:

- To understand basics of communication systems and effect of noise on communication
- To understand various continuous and pulse modulation, demodulation techniques
- Get acquainted with various types of multiplexing techniques and their use in communication

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain internal and external noise and describe their effects on communication systems.	L2	Understand
CO2	Examine analog modulation and demodulation techniques along with various analog receivers.	L4	Analyze
CO3	Apply the sampling theorem to analog and digital pulse modulation and demodulation techniques.	L3	Apply
CO4	Compare frequency division and time division multiplexing and de-multiplexing techniques for communication systems.	L4	Analyze

Analog Communication (22PCET5010T)

COURSE CONTENTS

Unit-I **Basics of Communication System** **4 Hrs.**

Block diagram, electromagnetic spectrum, signal bandwidth and power, types of communication channels, Introduction to time and frequency domain; Types of noise, signal to noise ratio, noise figure and noise temperature

Unit-II **Amplitude Modulation and Demodulation** **12 Hrs.**

Introduction, need for modulation

DSBFC: Mathematical analysis, modulation index, bandwidth, voltage distribution and power calculations. Low level and high level modulation, simple diode detector, practical diode detector.

DSBSC: Mathematical analysis, modulation index, bandwidth, voltage distribution, power calculations, balanced modulator.

SSBSC: Mathematical analysis, voltage distribution and power calculations

SSB generation: Filter method. ISB: Transmitter and receiver block diagram, applications.

VSB: Application in television

Unit-III **Angle Modulation and Demodulation** **10 Hrs.**

Introduction, mathematical analysis, time domain waveform, spectrum of FM wave, modulation index, bandwidth requirement, narrowband FM and wideband FM, Effect of noise, noise triangle, pre-emphasis and de-emphasis, FET reactance modulator, varactor diode modulator, frequency stabilized reactance modulator, indirect method of FM generation. Comparison between FM and PM, FM demodulation: Balance slope detector, Foster-Sealy discriminator, ratio detector, amplitude limiting and Thresholding.

Unit-IV **Radio Receivers** **4 Hrs.**

Receiver parameters, TRF receiver, problems in TRF receiver, Super - heterodyne receiver, choice of IF, Comparison of FM receiver with AM receiver.

Unit-V **Pulse Modulation & Demodulation** **6 Hrs.**

Sampling theorem, Nyquist criteria. Sampling techniques, aliasing error and aperture effect PAM, PWM, PPM generation and detection, Quantization and its types, Pulse Code Modulation, delta modulation, adaptive delta modulation, principle, generation and detection. Applications of pulse communication.

Unit-VI **Multiplexing & De-Multiplexing** **6 Hrs.**

Frequency Division Multiplexing transmitter & receiver block diagram, Time Division Multiplexing transmitter & receiver block, Examples and applications of FDM and TDM

Analog Communication Laboratory (22PCET5010L)

List of Laboratory Experiments: (Any 8)

1. Study of Amplitude Modulation
2. Study of Double Side Band Suppressed Carrier and Single Side Band Amplitude Modulation
3. Simulate of AM system and generate time and frequency domain output
4. To study different types of frequency modulators and Demodulators
5. Simulate Frequency Modulation system and generate time and frequency domain output.
6. Implement Pre-emphasis and De-emphasis circuit required for FM and analyze the output
7. Study of Natural Sampling and its reconstruction.
8. Study of Flat top sampling and its reconstruction
9. Study of Pulse Amplitude Modulation
10. Study of Pulse Width Modulation.
11. Study of Pulse Position Modulation.
12. Study of PAM-TDM system.
13. Study of FDM.

Text Books

1. Kennedy and Devis, “Electronic Communication System”, McGraw Hill Education Pvt. Ltd., Fourth Edition, 2017
2. Wayne Tomasi, “Electronic Communication System”, Pearson, Fifth Edition, 2012.

Reference Books

1. Toub Schilling and Shaha, “Principles of Communication System”, Tata McGraw Hill, Fourth Edition
2. B. P. Lathi, Zhi Ding, “Modern digital and analog communication system”, Oxford University Press, Fourth Edition.
3. Symon Haykin, Michal Moher, “Introduction to Analog and Digital Communication”, Wiley, Fourth Edition.

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-V
Radio Frequency Circuit Design (22PCET5020T)	
Radio Frequency Circuit Design Laboratory (22PCET5020L)	

Pre-requisite:

- Electromagnetics Wave Propagation
- Electrical Network Analysis and Synthesis
- Engineering Mathematics-III

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

Radio Frequency Circuit Design (22PCET5020T)

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 sol-der 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 Multi-section Matching Transformer.

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 (22PCET5020L)

List of Laboratory Experiments: (Any Eight)

1. Characterisation of resistor at high frequency.
2. Characterization of capacitor at high frequency
3. Characterisation of inductor at high frequency.
4. Analysis of Parallel and Series Connection of Lumped Elements and verification using Smith chart.
5. Filter Design by the Image Parameter Method.
6. Filter Design by the Insertion Loss Method.
7. Matching of Lumped Elements.
8. Design of quarter wave transformer.
9. Design of Binomial Multi-Section Matching Transformer.
10. Numerical from previous years GATE Examination paper.

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 Design. Prentice Hall, Inc., USA.
2. Matthew M. Radmanesh, “Radio Frequency and Microwave Electronics Illustrated”, Prentice Hall PTR, 2001.

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-V
Microcontroller & Applications-II (22PCET5030T)	
Microcontroller & Applications-II Laboratory(22PCET5030L)	

Pre-requisite:

- Digital System Design
- Microcontroller & Applications- I

Course Objectives:

- To develop background knowledge and core expertise in microcontrollers.
- To understand peripheral devices and their interfacing to microcontrollers.
- To develop programming skill for microcontroller and their applications in Assembly and Embedded C language

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain different functionalities and architecture of ARM 7 Processor	L2	Understand
CO2	Explain different hardware components and use relevant software for programming of LPC2148 microcontroller-based development system.	L3	Apply
CO3	Write assembly language programing and Embedded C programming for LPC2148 microcontroller-based systems.	L3	Apply
CO4	Interface different input/output devices with LPC2148 microcontroller for various applications	L3	Apply

Microcontroller & Applications-II (22PCET5030T)

COURSE CONTENTS

Unit-I **ARM7 Architecture** **6 Hrs.**

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

Unit-II **Introduction to ARM Programming** **10 Hrs.**

Introduction to THUMB, Differences between ARM and THUMB, Register usage in Thumb, ARM Thumb Interworking. General Structure of ARM assembly module, Assembler directives- Simple ALP programs on Arithmetic & logical operations, Factorial, string operation, sorting, searching, and Scan

Unit-III **LPC2148 ARM CPU** **10 Hrs.**

Salient features, Pin diagram, block diagram, memory mapping. Functional features of Interrupt controller, RTC, USB, UART, I2C, SPI, SSP controllers, watch dog timers and other system control unit

Unit-IV **LPC2148 Peripherals** **8 Hrs.**

Registers, GPIOs, PLL-Features, PLL structure, Timers Features, applications, Architecture of timer module, register description, Simple C programs for application using -GPIO, PLL, Timer.

Unit-V **LPC2148 based Applications** **8 Hrs.**

Design of system using GPIO's Blink a group of 8 LEDs with a delay, Stepper motor control, DC motor control, LCD interface, ADC, DAC, UART.

Microcontroller & Applications-II Laboratory(22PCET5030L)

List of Laboratory Experiments: (Any Eight)

1. To study ARM (LPC2148) Embedded Trainer kit and its software tools.
2. Write a program to generate LED sequence using ARM 7(LPC2148).
3. To display message on multiplexed four common anode7-segment display.
4. To read DIP switch status and display its position on 7-segment.
5. To display message on Alphanumeric LCD
6. To verify LDR operation using on-chip ADC of LPC2148.
7. Waveforms generation using DAC
8. To display room temperature on LCD using LM35 sensor
9. Write a program to control DC motor speed using PWM
10. Write a program for Interfacing keyboard and LCD
11. Write a program for Interfacing EPROM and EEPROM
12. Write a program for Interfacing stepper motor.
13. Write a program to transmit and receive data serially using UART.
14. Implementing ZIGBEE protocol with ARM.

Text Books

1. Andrew N. Sloss, “ARM System Developers Guide”, Elsevier, First Edition, 2008.
2. Lyla Das, “Embedded Systems: An Integrated Approach”, Pearson Publication, First Edition, 2012

Reference Books

1. William Hohl, “ARM Assembly Language Fundamentals and Techniques”, CRC Press, First Edition, 2009.
2. Steve Furber, “Arm System on Chip Architecture”, Pearson Publication, First Edition, 2012
3. J.R. Gibson, “ARM Assembly Language: An Introduction”, Cengage Learning, First Edition, 2010.

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-V
Digital Signal Processing (22PCET5040T)	
Digital Signal Processing Laboratory (22PCET5040L)	

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	Implement DFT and FFT algorithms 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

Digital Signal Processing (22PCET5040T)

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, and Blackman), 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.

Digital Signal Processing Laboratory (PCET5040L)

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.
13. Perform basic signal processing operations with DSP processor TMS 320C6713.
14. Generation of Sine Wave with Key Pressing in DSP processor TMS 320C6713
15. Capturing a real time signal by the Processor and display on a DSO.
16. Implementation of Real Time Low Pass filtering by DSP Processor.

Text Books

1. Proakis J., Manolakis D., Digital Signal Processing, 4st Edition, Pearson Education.
2. 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
Data Structures & Algorithms (22PCET5050T)	
Data Structures & Algorithms Laboratory (22PCET5050L)	

Pre-requisite:

- Programming Fundamentals

Course Objectives:

- Understand and remember algorithms and its analysis procedure.
- Introduce the concept of data structures through ADT including List, Stack, Queues.
- To design and implement various data structure algorithms.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Implement and use various data structures such as arrays, linked lists, stacks, queues and trees.	L3	Apply
CO2	Explain the working of operations of data structures.	L2	Understand
CO3	Determine and analyze the complexity of given Algorithms.	L4	Analyze

Data Structures & Algorithms (22PCET5050T)

COURSE CONTENTS

Unit-I **Introduction to Data structures and Algorithms** **2 Hrs.**

Introduction to Data structures, Types of Data structures: Linear and nonlinear data structures, Arrays, Stacks, Queue, Linked list and Tree, Recursion

Unit-II **Stack and Queue data structure** **4 Hrs.**

Introduction to Stack, Operations on Stack Introduction to Queue, Queue as ADT, Operations on Queue, Linear representation of queue, Circular Queue.

Unit-III **Linked List data structure** **4 Hrs.**

Introduction to Linked List, Singly Linked list, Doubly Linked list, Operations on linked list, Linked representation of stack, Linked representation of Queue.

Unit-IV **Tree** **4 Hrs.**

Introduction to Trees, Definitions & Tree terminologies, Binary tree representation, Operations on binary tree, Traversal of binary trees, Binary search tree.

Data Structures & Algorithms Laboratory (22PCET5050L)

List of Laboratory Experiments: (Any 7)

1. To implement stack.
2. To implement parenthesis checking using stack
3. Implementation of Infix to Postfix conversion
4. To implement Implementation of prefix and postfix evaluation using menu driven approach.
5. To implement Linear queue.
6. To implement Circular queue.
7. To implement different operations on linked list copy, concatenate, split, reverse, count no. of nodes
8. To implement various operations on doubly linked list
9. To implement Stack using Linked List
10. To implement Queue using Linked List
11. To create a binary tree and traverse it in Inorder, preorder and Postorder
12. To implement binary search tree

Text Books

1. Tenenbaum, Langsam, Augenstein, "Data structures using C", Pearson Education, First Edi-tion, 2019
2. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, "Fundamentals of Data Structures in C", W. H. Freeman and Company, Second Edition, 2008.
3. Reema Thareja, "Data Structures using C", Oxford, Second Edition, 2017.

Reference Books

1. Mark A. Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education, Fourth Edition, 2014.
2. M. T. Goodritch, R. Tamassia, D. Mount, "Data Structures and Algorithms in C++", Wiley, Second Edition, 2011.
3. Kruse, Leung, Tondo, "Data Structures and Program Design in C", Pearson Education, Second Edition, 2013.
4. Seymour Lipschutz, "Data Structures", Schaum's Outline Series, Tata McGraw-Hill, First Edition, 2014.

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-V
Semester Project- III (22PJET5060L)	

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 (22PJET5060L)

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 (22HMET5070L)	

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 (22HMET5070L)

COURSE CONTENTS

Unit-I **5 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 **5 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 **5 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 **6 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 **7 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, Working 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-V
Environmental Engineering (22MCET5080T)	

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	Understand how human activities affect environment.	L2	Understand
CO2	Understand the various technology options that can make a difference.	L2	Understand

Environmental Engineering (22MCET5080T)

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** **5 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.

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-VI
Digital Communication (22PCET6010T)	
Digital Communication Laboratory (22PCET6010L)	

Pre-requisite:

- Signals and Systems
- Engineering Mathematics
- Analog Communication

Course Objectives:

- To learn about theoretical bounds on the rates of digital communication system and represent a digital signal using several modulation methods.
- To 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	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 (22PCET6010T)

COURSE CONTENTS

Unit-I **Information theory and source coding** **11 Hrs.**

Block diagram and sub-system description of a digital communication system, measure of information and properties, entropy and it's 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** **6 Hrs.**

Discrete PAM signals and its power spectra, Inter-symbol interference, correlative coding, equalizers, and eye pattern.

Unit-III **Band pass Modulation and Demodulation** **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), Quadrature Amplitude Modulation (QAM), Comparison between bandwidth and bit rate, applications of digital modulation schemes

Unit-IV **Error Control Systems** **13 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 (22PCET6010L)

List of Laboratory Experiments: (Any 8)

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.

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.
5. Lathi B P, and Ding Z., Modern Digital and Analog Communication Systems, Oxford University Press, 4th Edition, 2009.

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-VI
Radiating Systems (22PCET6020T)	
Radiating Systems Laboratory (22PCET6020L)	

Pre-requisite:

- Engineering Mathematics
- Electromagnetic Fields & Waves
- Radio Frequency Circuit Design

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 the basic antenna parameters like radiation pattern, input impedance, gain and polarization.	L2	Understand
CO2	Derive the field equations for basic radiating elements like linear wire antenna and loop antenna.	L4	Analyze
CO3	Design uniform linear and planar antenna arrays using isotropic and directional sources.	L6	Create
CO4	Design regular shape microstrip antennas and aperture antennas.	L6	Create

Radiating Systems (22PCET6020T)

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 applications. 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 (22PCET6020L)

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 Microstrip antenna using Antenna trainer kit
8. Design of Broad side-end fire array
9. Study of pattern multiplication
10. Design of phase scanning array.
11. Gain measurement using three antenna methods.
12. Radiation pattern measurement.

Text Books

1. C. A. Balanis, Antenna Theory: Analysis and Design 3rd Edition, John Wiley & Sons, Hoboken, NJ, 2005.
2. G. Kumar, K. P. Ray, Broadband Microstrip Antenna, Artech House, 2002.

Reference Books

1. R. E. Collin, Antennas and Radio Wave Propagation, International Student Edition, McGraw Hill.

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-VI
Computer Networks (22PCET6030T)	
Computer Networks Laboratory (22PCET6030L)	

Pre-requisite:

- Analog Communication
- 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	Compare OSI layered architecture with TCP/IP protocol suite and differentiate functions of each layer.	L4	Analyze
CO2	Define characteristics of physical media and differentiate multiplexing techniques.	L4	Analyze
CO3	Explain responsibilities of the data link layer and data link layer protocols.	L2	Understand
CO4	Design network and subnetwork and list the commands required to carry out investigations and troubleshooting.	L6	Create
CO5	Distinguish transport layer protocols based on application.	L4	Analyze

Computer Networks (22PCET6030T)

COURSE CONTENTS

Unit-I **Introduction to computer network** **8 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** **4 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 (22PCET6030L)

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
Fundamentals of Digital Image Processing (22PCET6040T)	
Fundamentals of Digital Image Processing Laboratory (22PCET6040L)	

Pre-requisite:

- Engineering Mathematics
- Digital Signal Processing (DSP)

Course Objectives:

- Apply various image processing techniques and algorithms for developing different practical applications.
- Apply different classification and clustering techniques for object recognition and classification.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Describe concept 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 representation / segmentation techniques and classify objects 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 (22PCET6040L)

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
Basic VLSI (22PEET6051T)	
Basic VLSI Laboratory (22PEET6051L)	

Pre-requisite:

- Electronics Circuit Design
- Digital System Design
- Integrated Circuits

Course Objectives:

- To highlight the circuit design issues in the context of VLSI technology.
- To provide understanding of VLSI circuit design using different design styles.
- To provide introduction 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 (22PEET6051T)

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 **CMOS INVERTER Circuit Analysis** **14 Hrs.**

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 (22PEET6051L)

List of Laboratory Experiments: (Any Eight)

1. To study MOS characterization using simulation software. bias).
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 Verilog Program for flip flops.
8. To write Verilog Program for adders.
9. To write Verilog Program for multiplexers.
10. To design of Wilson current mirror.
11. Design and simulation of barrel shifter circuit in SPICE.
12. To write Verilog code and simulation of barrel shifter.
13. To study MOS characterization using simulation software.

Text Books

1. Sung-Mo Kang and Yusuf Leblebici, CMOS Digital Integrated Circuits Analysis and Design, Tata McGraw Hill, Third Edition, 2012.
2. Samir Palnitkar, Verilog HDL: A Guide to Digital Design and Synthesis, PHI, Second Edition, 2017.

Reference Books

1. Jan M. Rabaey, Anantha Chandrakasan and Borivoje Nikolic, Digital Integrated Circuits: A Design Perspective, Pearson Education, Second Edition, 2003.
2. JP. Uyemura, Introduction to VLSI Circuits and Systems, John Wiley Sons, First Edition, 2006.
3. Frank Vahid, Digital Design with RTL design, VHDL and VERILOG, John Wiley and Sons Publisher, Second Edition, 2011.
4. Neil H. E. Weste, David Harris and Ayan Banerjee, CMOS VLSI Design: A Circuits and Systems Perspective, Pearson Education, 3rd Edition, 2006.

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-VI
Control Systems (22PEET6052T)	
Control Systems Laboratory (22PEET6052L)	

Pre-requisite:

- Basic Electrical Engineering & Digital Electronics
- Digital System Design
- Engineering Mathematics-I
- Engineering Mathematics-II

Course Objectives:

- To provide fundamental concept of control systems.
- To introduce mathematical modelling, time domain analysis frequency domain analysis.
- To develop concepts of stability and its assessment criteria of the system.
- To study basic concepts of controllers.

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 (22PEET6052T)

COURSE CONTENTS

Unit-I **Introduction to Control System** **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** **7 Hrs.**

Basic concepts, state variable and state models for electrical systems, general state space representation, conversion between state space and transfer function, concept of state transition matrix, properties of state transition matrix, controllability and observability, analysis of LTI systems, with Examples

Unit-IV **Stability Analysis** **10 Hrs.**

Concept of stability, Routh stability criterion, Root-locus, general rules for constructing root-locus, Magnitude and phase plot; Method of plotting Bode plot; Stability margins on the Bode plots, Nyquist stability criterions gain and phase margins. Case study on stability of Control System in Thermal Power Plant.

Unit-V **Controllers Compensators** **7 Hrs.**

Introduction of PI, PD, and PID Controllers, Lead and Lag compensators. Case study on a model driven PID control system.

Control Systems Laboratory (22PEET6052L)

List of Laboratory Experiments: (Any Eight)

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

Text Books

1. I. J. Nagrath, Madan.Gopal, Control System Engineering, New Age International Publication, Seventh Edition, 2021.
2. K.Ogata, Modern Control Engineering, Pearson Education, Fifth Edition, 2015.
3. Normon S. Nise, Control System Engineering, John Wiley sons, Eighth Edition, 2020.

Reference Books

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

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-VI
Neural Networks & Fuzzy Logic (22PEET6053T)	
Neural Networks & Fuzzy Logic Laboratory (22PEET6053L)	

Pre-requisite:

- Engineering Mathematics
- Signals and Systems

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	Explain training of Neural Networks using various training rules with consideration of different parameters like overfitting, under fitting.	L2	Understand
CO2	Calculate and update the weights of the neural networks to specify the working and applications of different types of neural networks.	L3	Apply
CO3	Design fuzzy sets for various applications and solve fuzzy set theory problems.	L6	Create
CO4	Design various engineering application using Neural Networks/ Fuzzy Logic.	L6	Create

Neural Networks & Fuzzy Logic (22PEET6053T)

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 Networks & Fuzzy Logic Laboratory (22PEET6053L)

List of Laboratory Experiments: (Any Eight)

1. Fuzzy Set Operations: AND, OR, D-Morgan's 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 AND & OR gate function.
6. Write a program for training and testing of Multilayer Perceptron for 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. To Study the use of Microsoft Machine Learning Studio (classic) in Neural Network and Machine Learning.

Text Books

1. S. N. Sivanandam and S. N. Deepa, Introduction to Soft computing, Wiley India Publications, Third Edition, 2018.
2. S. Rajasekaran, G.A. Vijayalakshmi Pai, Neural Networks, Fuzzy Systems and Evolutionary Algorithms: Synthesis and Applications, Second Edition, 2017.

Reference Books

1. Thimothy J. Ross, Fuzzy Logic with Engineering Applications, Wiley India Publications, Third Edition, 2011.
2. John Yen and Reza Langari, Fuzzy Logic- Intelligence, Control and Information, Pearson Publications, First Edition, 1998.
3. J. S. R. Jang, C.T. Sun, and E. Mizutani, Neuro-Fuzzy and Soft Computing, PHI, First Edition, 1996.
4. Simon Haykin, Neural Networks and Learning Machines, Pearson Education, Third Edition, 2016.
5. S. N. Sivanandam, S. Sumathi, and S. N. Deepa, Introduction to Neural Network Using Matlab, Tata McGraw-Hill Publications, First Edition, 2017.

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-VI
Operating Systems (22PEET6054T)	
Operating Systems Laboratory (22PEET6054L)	

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	Explain the fundamental concepts of OS.	L2	Understand
CO2	Analyze the management policies adopted by processes, memory, File handling and I/O operations.	L4	Analyze
CO3	Apply the algorithms used for memory management, CPU scheduling and disk scheduling.	L3	Apply
CO4	Apply concepts related to deadlock to solve the problems.	L3	Apply
CO5	Analyze the functionalities of OS like Unix, Linux and Real Time Operating System.	L4	Analyze

Operating Systems (22PEET6054T)

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 System (RTOS)** **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 (22PEET6054L)

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 pre-emptive and non-pre-emptive 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.
10. To implement file organization techniques.

Text Books

1. Tanenbaum, Modern Operating Systems, 3rd Edition, PHI.
2. William Stallings, Operating System-Internal & Design Principles, 6th Edition, Pearson.

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-VI
Big Data Analytics (22PEET6055T)	
Big Data Analytics Laboratory (22PEET6055L)	

Prerequisite:

- Data Base Management System laboratory

Course Objectives:

- To Provide an Overview of an exciting growing field of Big Data Analytics.
- To introduce the tools required to manage and analyze big data like Hadoop, NoSQL, Map Reduce, and Spark.
- To teach the fundamental techniques in achieving big data analytics with scalability and streaming capability.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain the key issues in big data management and its associated applications for business decisions and strategy.	L2	Understand
CO2	Understand and Develop problem solving and critical thinking skills in fundamental enabling techniques like Hadoop and NoSQL in big data analytics.	L3	Apply
CO3	Evaluate Big Data processing by using Map Reduce.	L5	Evaluate
CO4	Interpret business models and scientific computing paradigms and apply software tools for big data analytics.	L3	Apply
CO5	Exploring the capabilities of big data using Apache Spark.	L4	Analyze

Big Data Analytics (22PEET6055T)

COURSE CONTENTS

Unit-I **Introduction to Big Data Analytics Hadoop** **6 Hrs.**

Introduction to Big Data, Big Data characteristics, Types of Big Data, Traditional vs. Big Data business approach. Technologies available for Big Data, Infrastructure for Big Data, Big Data challenges. Case Study of Big Data solutions. Introduction to Hadoop, Core Hadoop components, Hadoop Ecosystem, Physical architecture, Hadoop limitations.

Unit-II **NoSQL** **8 Hrs.**

Introduction to NoSQL, NoSQL business drivers, NoSQL case studies. NoSQL data architecture pat- terns: Key-value stores, Graph stores, Column family (Big table) stores, Document stores, Variations of NoSQL architectural patterns, Analysing big data with a shared-nothing architecture; Choosing distribution models: master-slave versus peer-to-peer Introduction to MongoDB, MongoDB commands.

Unit-III **MapReduce** **8 Hrs.**

MapReduce and The New Software Stack: Distributed File Systems, Physical organization of compute Nodes, Large scale file-system organization. MapReduce: The Map tasks, grouping by key, The Reduce tasks, Combiners, Details of MapReduce execution, Coping with node failures. Matrix vector multiplication using MapReduce.

Unit-IV **Techniques in Big Data Analytics** **12 Hrs.**

Finding Similar Item: Nearest Neighbour Search, Similarity of Documents. Mining Data Streams: Data Stream Management Systems, Data Stream Model, Examples of Data Stream Applications: Sensor Networks, Network Traffic Analysis. Frequent Item set Mining: Market Basket Model-Applications, Association Rule- Confidence, Interest, Support, Apriori Algorithm - Pass1, Pass2 Recommendation Systems: Introduction, Collaborative-Filtering System, Content based recommendation system Link analysis: Page rank algorithm, Structure of web.

Unit-V **Big Data Analytics using Apache Spark** **8 Hrs.**

Introduction to Spark: Features, Spark built on Hadoop, Components of Spark Resilient Distributed Datasets: Data sharing using Spark RDD, Iterative operations on Spark RDD, Interactive operations on Spark RDD, Spark installation, Core programming, RDD transformations, Execution of word count transformation.

Big Data Analytics Laboratory (22PEET6055L)

List of Laboratory Experiments: (Any Eight)

1. Forward Kinematics
2. Downloading and installing Hadoop; Understanding different Hadoop modes. Start-up scripts, Configuration files.
3. Execution of Hadoop file handling commands.
4. Installation of MongoDB and execution of CREATE, INSERT, DELETE and UPDATE operations.
5. Querying in MongoDB using FIND command, aggregate functions etc.
6. Designing of graphical data store and querying in Neo4j.
7. Execution of PIG SCRIPTING language.
8. Execution of HIVE SCRIPTING language.
9. Execution of Matrix Multiplication Using MapReduce.
10. Execution of Word Count using MapReduce.
11. Execution of Word Count using Apache Spark.

Text Books

1. Radha Shankarmani, M Vijayalakshmi, Big Data Analytics, Wiley, Second Edition, 2016.
2. Alex Holmes, Hadoop in Practice, Manning Press, Dreamtech Press, Second Edition, 2015.
3. Holden Karau, Andy Konwinski, Matei Zaharia, Learning Spark OReilly, Second Edition, 2015.

Reference Books

1. Bart Baesens, Analytics in a Big Data World: The Essential Guide to Data Science and its Applications, Wiley Big Data Series, Edition, 2017.
2. Vignesh Prajapati, Big Data Analytics with R and Hadoop, Packt Publishing Limited First Edition, 2013.
3. Tom White, Hadoop: The Definitive Guide, O'Reilly Publications, Second Edition, 2016.

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-VI
Radar Engineering (22PEET6056T)	
Radar Engineering Laboratory (22PEET6056L)	

Pre-requisite:

- Electromagnetic Field Theory
- Analog Communication

Course Objectives:

- To interpret Radar range equations.
- To explain different types of Radar.
- To design Radar transmitters and receivers for given conditions.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Describe generalized concept of RADAR & its applications.	L2	Understand
CO2	Solve problems using radar equations.	L3	Apply
CO3	Describe different types of radar for specific application.	L2	Understand
CO4	Explain concept of tracking radar.	L2	Understand
CO5	Evaluate the design constraints for transmitter and receiver.	L5	Evaluate

Radar Engineering (22PEET6056T)

COURSE CONTENTS

Unit-I **Introduction to Radar** **8 Hrs.**

Basic Radar, Radar range equation. Block Diagram, Radar Frequencies. Applications of Radar.

Unit-II **Radar Range Equation** **8 Hrs.**

Detection of signal in noise. Receiver Noise and Signal-to-noise Ratio. Probability of detection and false alarm: Simple, complex Targets. Pulse Repetition Frequency.

Unit-III **MTI and Pulse Doppler Radar** **10 Hrs.**

Introduction to Doppler and MTI radar, Doppler frequency shift. Simple CW Doppler radar, MTI radar block diagram. Delay line canceler. Moving-target-detection. Pulse Doppler radar.

Unit-IV **Tracking Radar** **8 Hrs.**

Mono pulse tracking. Conical scan and sequential lobbing. Limitation of tracking accuracy. Low angle tracking.

Unit-V **Radar Transmitter and Receiver** **8 Hrs.**

Radar RF power sources: Klystron, Travelling wave tube , Magnetron, Low power transmitter, high power transmitter, Advantages of solid state RF power source, Duplexer, and Mixer and their types, Receiver noise figure, Radar Display: Types of displays .

Radar Engineering Laboratory (22PEET6056L)

List of Laboratory Experiments: (Any Eight)

1. To study basic Radar and range equation.
2. To Study CW Radar and find the relative speed of the object.
3. Derive Radar range equation with noise figure and find the distance.
4. To study MTI Radar and find the blind speed.
5. Calculate pulse repetition frequency and velocity of the moving object.
6. To study various displays used in Radar systems.
7. To study clutters and its effects on Radar range equation.
8. To study delay line canceller.
9. Find the speed of the fan using Doppler Radar.
10. To study duplexer and mixer.
11. To study tracking Radar.

Text Books

1. Merrill Skolnik, Introduction to Radar Systems, 2nd Edn, Tata McGra Hill.
2. G S N Raju , Radar Engineering, 1st Edn, Wiley Publication.
3. Bassem R. Mahafza, Radar Signal Analysis, 1st Edn, CRC press.

Reference Books

1. E David Jansing, Introduction to Synthetic Aperture Radar, McGraw Hill, Second Edition, 2021.
2. Clive Alabaster, Pulse Doppler Radar, SciTech Publishing, Second Edition, 2012.
3. William L Melvin, James A Scheer, Principals of Modern Radar, SciTech Publishing, First Edition, 2014.

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-VI
Linear Algebra (22PEET6057T)	
Linear Algebra Laboratory/Tutorial (22PEET6057L)	

Pre-requisite:

- Engineering Mathematics-IV

Course Objectives:

- Understanding basic concepts of linear algebra to illustrate its power and utility through applications.
- Apply the concepts of vector spaces, linear transformations, matrices and inner product spaces in Engineering.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Explain the abstract concepts of matrices and system of linear equations using decomposition Methods.	L2	Understand
CO2	Demonstrate the basic notion of vector spaces and subspaces.	L3	Apply
CO3	Apply the concept of vector spaces using linear transforms and inner product spaces applications in cryptography.	L3	Apply

Linear Algebra (22PEET6057T)

COURSE CONTENTS

Unit-I **System of Linear Equations** **6 Hrs.**

Gaussian elimination and Gauss Jordan method Elementary matrices Permutation matrix inverse matrices System of linear equations LU factorizations.

Unit-II **Vector Spaces** **12 Hrs.**

The Euclidean space and vector space, subspace linear combination, span-linearly dependent-independent bases, dimensions, finite dimensional vector space, The four fundamental spaces, Rank and nullity Bases for subspace.

Unit-III **Linear Transformations** **10 Hrs.**

Linear transformations, Basic properties, invertible linear transformation, matrices of linear transformations, vector space of linear transformations, change of bases

Unit-IV **Inner Product Spaces and Applications** **8 Hrs.**

Dot products and inner products, the lengths and angles of vectors, matrix representations of inner products, Gram-Schmidt Orthogonalization, QR factorization- Projection - orthogonal projections

Unit-V **Applications** **6 Hrs.**

An Introduction to coding - Classical Cryptosystems Plain Text, Cipher Text, Encryption.

Linear Algebra Laboratory/Tutorial (22PEET6057L)

List of Tutorial: (Any Eight)

1. Gaussian elimination and Gauss Jordan Method
2. LU Factorizations.
3. The Four Fundamental Spaces.
4. Linear Transformations.
5. Gram-Schmidt Orthogonalization.
6. QR Factorization.
7. Linear Dependence and Independence.
8. Least Squares Approximation.
9. Case Study: Classical Cryptosystems.

Text Books

1. Jin Ho Kwak and Sungpyo Hong, Linear Algebra, Springer, Second Edition, 2004.
2. Bernard Kolman and David, R., Introductory Linear Algebra- An applied first course, Pearson Education, Ninth Edition, 2011.

Reference Books

1. Stephen Andrilli and David Hecker, Elementary Linear Algebra, Academic Press, Fifth Edition, 2016.
2. Rudolf Lidl and Guter Pilz, Applied Abstract Algebra, Springer, Second Edition, 2004.
3. Howard Anton, Robert C Busby, Contemporary linear algebra, Wiley, First Edition, 2003.
4. Gilbert Strang, Introduction to Linear Algebra, Cengage Learning, Fifth Edition, 2015.

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-VI
Professional Business Communication Tutorial (22HMET6060T)	

Pre-requisite:

- Basic course in Effective Communication Skills

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	Apply appropriate style, format, and language to prepare technical documents.	L3	Apply
CO2	Use employability skills to optimize career opportunities.	L3	Apply
CO3	Employ storytelling techniques in corporate situations.	L3	Apply
CO4	Conduct effective meetings and document the process.	L3	Apply
CO5	Demonstrate interpersonal skills in professional and personal situations.	L2	Understand
CO6	Describe cultural differences, etiquettes and professional ethics.	L2	Understand

Professional Business Communication Tutorial (22HMET6060T)

COURSE CONTENTS

Unit-I **Technical Writing** **6 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** **8 Hrs.**

Group Discussion: Purpose of a GD, types of GD, criteria for evaluating GD, Dos and Don'ts of GD Resume Writing: 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 Presentation Skills: Presentation strategies, overcoming stage fear, techniques to prepare effective Power Point presentation.

Unit-III **Corporate Story Telling** **3 Hrs.**

Basics of storytelling: Setting, characters, plot, crisis, climax, resolution, Benefits of storytelling Types of stories: Elevator pitch, product stories, event stories, stories in presentations, storytelling in SOPs and interviews, storytelling to manage conflict or to motivate Storytelling techniques: Narration using verbal and non-verbal communication, Analysis of storytelling strategies of corporate master story-tellers.

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

Planning and preparation for meetings: Planning layout of meetings, arranging logistics, defining roles and responsibilities Strategies for conducting effective meetings: Follow the agenda, record discussion, observe meeting decorum Documentation: Draft notice, agenda and minutes of meeting Business meeting etiquettes: Verbal and non-verbal aspects of etiquettes.

Unit-V **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 teamwork, 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-VI Cross-cultural communication and Professional ethics 2 Hrs.

Communication across cultures: Understanding cultures and developing sensitivity towards cultural differences corporate etiquettes: Telephone, dining, cubicle etiquette, etc. Professional ethics: Effective work habits, accountability, integrity and excellence.

Text Books

1. Fred Luthans, "Organizational Behavior", 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 McGrawHill Education
7. Ghosh, B. N., "Managing Soft Skills for Personality Development", Tata McGraw Hill.Lehman
8. Bell, Smith, "Management Communication" Wiley India Edition, 3rdedition
9. Dr. Alex, K., "Soft Skills", S Chand and Company
10. Subramaniam, R., "Professional Ethics" Oxford University Press
11. Sandeep Das, "How Business Story Telling Works: Increase Your Influence and Impact" Penguin Random House India Pvt. Ltd.

Program: Electronics and Telecommunication Engineering	T.Y.B. Tech
	Sem-VI
Project Stage-I (22PJET6070L)	

Course Objectives:

- 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	L2	Understand

Project Stage-I (22PJET6070L)

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.