Shirpur Education Society's

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

Syllabus Booklet
Electronics and Telecommunication Engineering

Third Year B.Tech.

With Effect from Academic Year 2025-26

Shahada Road, Near Nimzari Naka, Shirpur, Maharashtra 425405
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NEP Third Year B. Tech Electronics and Telecommunication Engineering Semester-V (w.e.f. 2025-2026)

Sr. No.	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme						Credit	
				L	T	P	TA [A]	Term Test 1 (TT 1)	Term Test 2 (TT 2)	Average of TT1 & TT2 [B]	ESE [C]	Total [A+B+C]	Credit	Total Credit
1	PC	RCP23ECPC501	Digital Signal Processing	3			25	15	15	15	60	100	3	4
2	PC	RCP23ELPC501	Digital Signal Processing Laboratory			2	25				25	50	1	
3	PC	RCP23ECPC502	Wave Theory & Radio Frequency Design	3			25	15	15	15	60	100	3	4
4	PC	RCP23ELPC502	Wave Theory & Radio Frequency Design Laboratory			2	25				25	50	1	
5	PC	RCP23ECPC503	Analog & Digital Communication	3			25	15	15	15	60	100	3	4
6	PC	RCP23ELPC503	Analog & Digital Communication Laboratory			2	25				25	50	1	
7#	PE #	RCP23ECPE501	Radar Engineering	3			25	15	15	15	60	100	3	4
		RCP23ELPE501	Radar Engineering Laboratory			2	25				25	50	1	
		RCP23ECPE502	Computer Organization & Architecture	3			25	15	15	15	60	100	3	
		RCP23ELPE502	Computer Organization & Architecture Laboratory			2	25				25	50	1	
		RCP23ECPE503	Control Systems	3			25	15	15	15	60	100	3	
		RCP23ELPE503	Control Systems Laboratory			2	25				25	50	1	
		RCP23ECPE504	Linear Algebra	3			25	15	15	15	60	100	3	
		RCP23ELPE504	Linear Algebra Laboratory			2	25				25	50	1	
		RCP23ECPE505	Advanced Microcontroller	3			25	15	15	15	60	100	3	
		RCP23ELPE505	Advanced Microcontroller Laboratory			2	25				25	50	1	
		RCP23ECPE506	Neural Network & Fuzzy Logic	3			25	15	15	15	60	100	3	
		RCP23ELPE506	Neural Network & Fuzzy Logic Laboratory			2	25				25	50	1	
8	MD	RCP23ECMD501	Database Management System	2			25	15	15	15	60	100	2	2
9	MD	RCP23ELMD501	Database Management System Laboratory			2	25				25	50	1	1
10	HS	RCP23ITHSX06	Environmental Science Tutorial		1		25					25	1	1
11	SC	RCP23IPSC501	Semester Project-III			2	25				25	50	1	1
Total				**14**	**1**	**12**	**300**	**75**	**75**	**75**	**450**	**825**	**21**	**21**

Prepared by:
Prof. Dr. P.M.Goad

Checked by:
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NEP Third Year B. Tech Electronics and Telecommunication Engineering Semester-VI (w.e.f. 2025-2026)

Sr. No.	Course Category	Course Code	Course Title	Teaching Scheme			Evaluation Scheme				ESE	Total	Credit	Total Credit
				L	T	P	TA [A]	Term Test 1 (TT 1)	Term Test 2 (TT 2)	Average of TT1 & TT2 [B]	[C]	[A+B+C]		
1	PC	RCP23ECPC601	Computer Networks	3			25	15	15	15	60	100	3	4
2	PC	RCP23ELPC601	Computer Networks Laboratory			2	25				25	50	1	
3	PC	RCP23ECPC602	Image Processing	3			25	15	15	15	60	100	3	4
4	PC	RCP23ELPC602	Image Processing Laboratory			2	25				25	50	1	
5	PC	RCP23ECPC603	Radiating System	3			25	15	15	15	60	100	3	4
6	PC	RCP23ELPC603	Radiating System Laboratory			2	25				25	50	1	
7#	PE#	RCP23ECPE601	Power Electronics	3			25	15	15	15	60	100	3	4
		RCP23ELPE601	Power Electronics Laboratory			2	25				25	50	1	
		RCP23ECPE602	Digital VLSI design	3			25	15	15	15	60	100	3	
		RCP23ELPE602	Digital VLSI design Laboratory			2	25				25	50	1	
		RCP23ECPE603	Operating Systems	3			25	15	15	15	60	100	3	
		RCP23ELPE603	Operating Systems Laboratory			2	25				25	50	1	
		RCP23ECPE604	Big Data Analytics	3			25	15	15	15	60	100	3	
		RCP23ELPE604	Big Data Analytics Laboratory			2	25				25	50	1	
		RCP23ECPE605	Data Compression & Encryption	3			25	15	15	15	60	100	3	
		RCP23ELPE605	Data Compression & Encryption Laboratory			2	25				25	50	1	
		RCP23ECPE606	Data Analytics	3			25	15	15	15	60	100	3	
		RCP23ELPE606	Data Analytics Laboratory			2	25				25	50	1	
		RCP23ECPE607	Basics of IOT	3			25	15	15	15	60	100	3	
		RCP23ELPE607	Basics of IOT Laboratory			2	25				25	50	1	
8	MD	RCP23ECMD601	Machine Learning & Applications	3			25	15	15	15	60	100	3	4
9	MD	RCP23ELMD601	Machine Learning & Applications Laboratory			2	25				25	50	1	
10	SC	RCP23IPEL601	Project Stage-1			4	50				50	100	2	2
11	HS	RCP23ICHSX07	Constitution of India	1									Audit	Audit
12	SC	RCP23ELSC601	Full Stack Development-I			2	25				25	50	1	1
			Total	**16**	**0**	**16**	**325**	**75**	**75**	**75**	**500**	**900**	**23**	**23**

Any 1 Programme Elective Course will offered.

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

Program: Electronics and Telecommunication Engineering	T.Y.BTech	Semester: V
Digital Signal Processing (RCP23ECPC501)		
Digital Signal Processing Laboratory (RCP23ELPC501)		

Pre-requisite

1. Engineering Mathematics III
2. Signals and Systems

Course Objectives

1. To develop a thorough understanding of DFT and FFT and their applications.
2. To design digital filters and analyse their performance.
3. To understand the effects of poles and zeros in the frequency response of digital filters.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the concept of DFT and FFT and their use in analysis of the LTI system.	L4	Analyze
CO2	Apply the knowledge of LTI system to design FIR and IIR filter for given specifications and realize them.	L1	Remember
CO3	Analyze the discrete time LTI systems and processors for measuring the performance of digital filters.	L2	Understand
CO4	Evaluate the effect of finite word length on FIR and IIR filter performance.	L1	Remember

Digital Signal Processing (RCP23ECPC501)
Course Contents

Unit-I Discrete Fourier Transform Fast Fourier Transform 08 Hrs.

Definition and Properties of DFT, IDFT, Linear and Circular convolution of sequences using DFT and IDFT. Filtering of long data sequences: Overlap-Save and Overlap-Add Method for computation of DFT, Frequency Analysis of Signals Using the 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 Analysis of Linear Time Invariant System 08 Hrs.

Ideal Filter Characteristics, Position of Poles and Zeros for Low Pass, High Pass, Band Pass, Band Stop, All pass filters, Effect of Poles and Zeros on the Frequency Response, Digital Resonators, Notch Filters, Comb Filters, All-Pass Filters, Digital Sinusoidal Oscillators, Minimum-Phase, Maximum-Phase, and Mixed-Phase Systems.

Unit-III FIR Digital Filters and realization 08 Hrs.

Characteristics of FIR digital filters, Design of Symmetric and Antisymmetric FIR Filters (Type 1 to Type 4) and its realization, Design of Linear Phase FIR filters using Window techniques (Rectangular, Bartlett, Hamming, Hanning, Blackman), Design of Linear Phase FIR filters using Frequency Sampling technique. FIR filter realization: Direct Form, Cascade and frequency sampling realization.

Unit-IV IIR Digital Filters and realization 10 Hrs.

Mapping of S-plane to Z-plane using impulse invariance method (IIM) and bilinear transformation method (BLT), Conversion of analog filter to digital filter, Analog filter approximations: Butterworth, Chebyshev I, Types of IIR filter (Butterworth, Chebyshev-I, Chebyshev-II, Elliptical), Design of IIR digital filters (Butterworth and Chebyshev-I), Frequency Transformations, Compare FIR and IIR filter, IIR filter realization: Direct Form, Cascade and Parallel Form.

Unit-V Finite word length effect on FIR and IIR filter performance 06 Hrs.

Errors Resulting from Rounding and Truncation, Analysis of Sensitivity to Quantization of Filter Coefficients, Quantization of Coefficients in FIR Filters, Output noise power from a digital system, Product quantization, Noise model for direct form and cascaded IIR structure (first order), Coefficient quantization error and zero input limit cycle, Limit-Cycle Oscillations in Recursive Systems, Scaling to Prevent Overflow

Digital Signal Processing Laboratory (RCP23ELPC501)

List of Laboratory Experiments:

1. To determine linear and circular convolution using DFT/FFT.
2. To perform Overlap-Add/Overlap-Save methods for long data sequence using DFT/FFT.
3. To find the effect of poles and zeros on FIR/IIR filters (Frequency response).
4. To design linear phase filters and plot magnitude and phase responses.
5. To Design a FIR filter by window method.
6. To Design a FIR filter by frequency sampling method
7. To design Butterworth and Chebyshev-I IIR filters.
8. To perform basic signal processing operations with DSP processor (fixed point/Floating point).
9. To Generate elementary signal (Sine/Cosine) and find its frequency response using DSP processor (fixed point/Floating point).
10. To implement a system for Real time signal filtering by DSP Processor.
11. To design a FIR/IIR filter to remove a noise (sine wave with a given frequency) corrupting ECG/Speech signal.
12. To measure the effect of finite word length on FIR/IIR filter performance.
13. To realize FIR and IIR Filters using Direct Form, Cascade/Parallel form structures.
14. To simulate a system for signal analysis or synthesis.
15. To implement a discrete time system for signal processing using DSP Processor.

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

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

Text Books

1. J. G. Proakis, D. G. Manolakis, "Digital Signal Processing," Pearson Education, Fourth Edition, 2007.
2. S. Salivahan, C. Gnanapriya, "Digital Signal Processing," McGraw Hill Education (India), Fourth Edition, 2015.
3. B. Venkata Ramani and M. Bhaskar, "Digital Signal Processors, Architecture, Programming and Applications," Tata McGraw Hill, Second Edition, 2004.

Reference Books

1. Alan V. Oppenheim, Ronald W. Schafer, "Discrete Time Signal Processing," Pearson Education, Third Edition, 2021.
2. Sanjit K. Mitra, "Digital Signal Processing – A Computer Based Approach," McGraw Hill Education, Fourth Edition, 2013.
3. Emmanuel C. Ifeachor, Barrie W. Jervis, "Digital Signal Processing - A Practical Approach," Pearson Education, Second Edition, 2001
4. Monson H. Hayes, "Digital Signal Processing" Schaum's Outline Series, Second Edition, 2011

NPTEL / Swayam Course:

1. Course: Digital Signal Processing by Prof. S. C. Dutta Roy, IIT Delhi
   http://www.nptelvideos.in/2012/12/digital-signal-processing.html
2. Course: Digital Signal Processing by Prof. V. M. Gadre, IIT Bombay
   https://nptel.ac.in/courses/108/101/108101174/
3. Course: Digital Signal Processing by Prof. T. K. Basu, IIT Kharagpur
   https://nptel.ac.in/courses/108/105/108105055/

Program: Electronics and Telecommunication Engineering	T.Y. B.Tech.	Semester: V
Wave Theory & Radio Frequency Design (RCP23ECPC502)		
Wave Theory & Radio Frequency Design Laboratory (RCP23ELPC502)		

Prerequisite: Mathematics for Telecommunication Engineering, Electrical Networks.

Course Objective(s):

1. To learn concept of static and time varying electromagnetic fields.
2. To solve problems related to EM fields using Vectors and Partial differential equations.
3. To learn Electromagnetic radiation and propagation in space and within transmission lines.

Course Outcomes:

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Compute electric and magnetic fields for symmetrical charge and current configurations using basic static and time varying principles of electromagnetics.	L2	Understand
CO2	Explain the basic concept of S matrix and ABCD matrix in network analysis.	L2	Understand
CO3	Explain the behaviour of Inductor, Capacitor and Resistor at high frequency.	L2	Understand
CO4	Calculate various parameters of transmission line analytically and using Smith Chart.	L3	Application
CO5	Develop passive RF filter configurations for given specifications.	L3	Application

Wave Theory & Radio Frequency Design (RCP23ECPC502) Course Contents

Unit-I 08 Hrs.

Electrostatics: Coulomb's Law, Gauss's Law and its applications, Electric Potential, Relationship between E and V, Electric Dipole and flux lines, Convection and Conduction Currents, Electric Boundary Conditions, Poisson's and Laplace's Equations, Uniqueness Theorem, General Procedure for solving Poisson's or Laplace's Equations.

Magnetostatics: Biot-Savart's Law, Ampere's Circuital Law and its applications, Magnetic Flux density, Maxwell's equations for Static Fields, Magnetic Scalar and Vector potentials, Magnetic boundary conditions.

Unit-II 08 Hrs.

Time varying Fields: Faraday's Law, Transformer and Motional Electromotive Forces, Displacement Current Maxwell's equations in point form and integral form, Boundary conditions for time varying field, magnetic vector potential, Time harmonic fields.

Electromagnetic Wave Propagation: Derivation of Wave equation and its solution, Wave Propagation in lossy dielectrics, Plane waves in loss less dielectrics, free space and good conductors, Power and Poynting Vector, Reflection of a Plane wave at normal incidence and oblique incidence.

Unit-III 05 Hrs.

Single and Multiport Networks: 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.

Unit-IV 04 Hrs.

Importance of Radio Frequency Design: RF behaviour of Passive Components High-Frequency Resistors, High-Frequency Capacitors, High-Frequency Inductors.

Unit-V 07 Hrs.

Transmission Lines: Parameters, Transmission line equations, Input impedance, reflection coefficient, Standing wave ratio.

Smith Chart

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.

Unit-VI 08 Hrs.

RF Filter Design: Basic Resonator and Filter configurations

Filter Types and Parameters, Low-Pass Filter, High-Pass Filter, Bandpass and Bandstop Filters, Insertion Loss.

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.

Special Filter Realizations using Insertion Loss Method

Butterworth-Type Filters, Chebyshev-Type Filters, Denormalization of Standard Low-Pass Design.

Filter Implementation

Unit Elements, Kuroda's Identities, Microstrip Filter Design.

Wave Theory & Radio Frequency Design Laboratory (RCP23ELPC502)

List of Laboratory Experiments

Suggested Experiments:(Any 8)

1. Numericals on Electrostatics & Electric Boundary conditions
2. Numericals on Magnetostatics
3. Numericals on Time varying fields and Maxwell Equations
4. Numericals on Wave Propagation in different material
5. Numericals on network parameters and properties
6. Characterization of R/L/C at high frequency
7. Transmission line impedance calculations Analytical and Smith chart
8. Transmission line reflection coefficient calculations Analytical and Smith chart
9. Filter Design by the Image Parameter Method
10. Filter Design by the Insertion Loss Method

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

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

Text Books:

1. William H. Hayt and John A Buck, "Engineering Electromagnetics", Tata McGraw-Hill Publishing Company Limited, 9^{th} Edition, 2020.

2. Ludwig, Reinhold & Bretchko, Pavel, "RF circuit design: Theory and applications, Prentice-Hall, 2^{nd} Edition, Upper Saddle River, N.J, 2011.

Reference Books:

1. Matthew N. O. Sadiku, S. V. Kulkarni, "Principles of electromagnetics", Oxford University Press, 6^{th} Edition, 2015.

2. Pozar, David M, "Microwave Engineering", Hoboken, NJ: Wiley Publication, 2012.

Program: Electronics and Telecommunication Engineering	T.Y.BTech	Semester: V
Analog and Digital Communication (RCP23ECPC503)		
Analog and Digital Communication Laboratory (RCP23ELPC503)		

Pre-requisite

1. Signal Systems

Course Objectives

1. To Learn various Analog and Digital Communication Systems.
2. To equip students with the knowledge and skills to design, analyse, and implement efficient source and error coding techniques for data compression, error detection, and correction, enabling reliable and optimized communication across various digital systems.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Analyze Analog Communication techniques and reception	L4	Analyze
CO2	Describe pulse communication and pulse code modulation systems	L1	Remember
CO3	Demonstrate and compare various digital modulation techniques	L2	Understand
CO4	Design and implement source and error control coding scheme.	L6	Create

Analog and Digital Communication (RCP23ECPC503) Course Contents

Unit-I Analog Communication systems and reception 08 Hrs.

Introduction to communication system, Amplitude modulation, Frequency modulation, mathematical analysis of FM signal, Modulation index, BW requirement, pre-emphasis and de-emphasis, narrow wideband FM. Radio receivers characteristics and TRF and super-Heterodyne receiver.

Unit-II Sampling Theorem and Pulse-Modulation Techniques 08 Hrs.

Sampling theorem and aliasing error. Types of Pulse modulation- PAM, PWM and PPM. PCM Generation and Reconstruction, Quantization Noise, Non-Uniform Quantization and Commanding, DPCM, Adaptive DPCM, DM and Adaptive DM, Noise in PCM and DM.

Unit-III Digital Modulation Techniques 10 Hrs.

ASK- Modulator, M-ary scheme, Coherent ASK Detector, FSK- Modulator, Non- Coherent FSK Detector, BPSK- Modulator, Coherent BPSK Detection. Principles of QPSK, Differential PSK and QAM.

Unit-IV Baseband Transmission and Optimal Reception of Digital Signal 04 Hrs.

Baseband Transmission and Optimal Reception of Digital Signal A Baseband Signal Receiver, Probability of Error, Optimum Receiver, Coherent Reception, ISI, Eye Diagrams.

Unit-V Source and error control coding 08 Hrs.

Entropy, Source Encoding Theorem, Shannon Fano Coding, Huffman Coding, Mutual Information, Channel Capacity, Error Control Coding, Linear Block Codes, Cyclic Codes

Analog and Digital Communication Laboratory (RCP23ELPC503)

List of Laboratory Experiments:

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. Entropy and Mutual Information
14. Source Coding Algorithms (Huffman coding)
15. Linear block codes (Error detection and correction)
16. Cyclic codes (comparison of performance of coded and un-coded system)
17. Convolutional Encoding.
18. ASK, FSK And PSK
19. Generation and Detection of Binary Amplitude Shift Keying (BASK)
20. Generation of Binary FSK signal modulation (FSK)

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

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

Text Books

1. T. L. Singal, "Analog and Digital Communications", Tata Mc-Graw Hill, 1st Edition 2014..
2. Kennedy, Davis, "Electronics Communication Systems", Tata Mc-Graw Hill, 4th Edition,2012.

Reference Books

1. Toub Schilling and Shaha, "Principles of Communication Systems", Tata McGraw Hill, 4th Edition, 2016.
2. Sklar B, and Ray P. K., "Digital Communication: Fundamentals and applications", Pearson, Dorling Kindersley (India), Delhi, 2nd Edition, 2009.
3. P Ramakrishna Rao, "Digital Communication", Tata Mc-Graw Hill, New Delhi, 1st Edition.

Program: Electronics and Telecommunication Engineering	T.Y.B.Tech	Semester: V
Radar Engineering (RCP23ECPE501)		
Radar Engineering Laboratory (RCP23ELPE501)		

Pre-requisite

1. Electromagnetic Wave Propagation
2. Analog Communication

Course Objectives

1. To interpret Radar equations
2. To understand various types of Radar.
3. To identify various devices used in Radar transmitter and receiver.
4. To design Radar transmitter and receiver for given conditions.

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand generalized concept of RADAR & its applications	L2	Understand
CO2	Analyse radar range equations in various conditions.	L4	Analyze
CO3	Describe different types of radar for specific application.	L1	Remember
CO4	Explain concept of tracking radar.	L2	Understand
CO5	Evaluate the design constraints for transmitter and receiver.	L5	Evaluate

Radar Engineering (RCP23ECPE501)
Course Contents

Unit-I Introduction to Radar 06 Hrs.

Basic Radar, basic ranger equation, Block Diagram, Radar Frequencies, Applications of Radar.

Unit-II Radar Range Equation 08 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 08 Hrs.

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

Unit-V Radar Transmitter and Receiver 08 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, PPI, H-Scope, A-Scope, B-Scope, C-Scope, D-Scope, E-Scope, R-Scope etc.

Radar Engineering Laboratory (RCP23ELPE501)

List of Laboratory Experiments:

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.

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

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

Text Books

1. Merrill Skolnik," Introduction to Radar Systems", Tata McGra Hill, 2nd Edition, 2010.
2. G S N Raju, "Radar Engineering", Willey publication, 1st Edition, 2020.

Reference Books

1. E. David Jansing, "Introduction to Synthetic Aperture Radar", McGraw Hill, 2nd Edition, 2021.
2. Clive Alabaster,"Pulse Doppler Radar", SciTech Publishing, 2nd Edition, 2012.
3. William L Melvin, James A Scheer, "Principles of Modern Radar", SciTech Publishing, 1st Edition, 2014.
4. Bassem R. Mahafza, "Radar Signal Analysis", CRC press, 1st Edition, 2021.

Program: Electronics and Telecommunication Engineering	T.Y.B.Tech	Semester: V
Computer Organization and Architecture (RCP23ECPE502)		
Computer Organization and Architecture Laboratory(RCP23ELPE502)		

Pre-requisite

1. Digital System Design

Course Objectives

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

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the basic concepts and structure of computers and functionality of central processing unit.	L1	Understand
CO2	Implement computer arithmetic operations.	L3	Apply
CO3	Understand the basics of instructions sets and their impact on programming	L1	Understand
CO4	Understand the concepts of memory and I/O organization.	L1	Understand

Computer Organization and Architecture

(RCP23ECPE502)
Course Contents

Unit-I Introduction of Computer Organization and Architecture 04 Hrs.

Basic organization of computer, Evolution of Computers, Von Neumann model. Performance measure of Computer Architecture. The Evolution of the Intel 8086 Architecture , Embedded Systems and the ARM.

Unit-II Data Representation and Arithmetic Algorithms 08 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 04Hrs.

Soft wired (Micro programmed) and hardwired control unit design methods. Microinstruction sequencing and execution. Micro operations. Introduction to RISC and CISC architectures and design issues. Introduction to Concepts of multiprocessors.

Unit-IV Instruction Sets: Characteristics and Functions 12 Hrs.

Machine Instruction Characteristics, Types of Operands, Intel 8086 and ARM Data Types, Types of Operations, Intel 8086 and ARM Operation Types. Instruction Sets: Addressing Modes and Formats: Addressing, 8086 and ARM Addressing Modes, Instruction Formats, 8086 and ARM Instruction Formats, Assembly Language, Instruction cycle, Instruction Pipelining, For 8086, The ARM Processor Instruction-Level Parallelism and Superscalar Processors: Design Issues, Flynn's classifications, Pipeline processing.

Unit-V Memory Organization 08 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 04 Hrs.

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

Computer Organization and Architecture Laboratory (RCP23ELPE502)

List of Laboratory Experiments:

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. Direct Mapped cache.
12. Associative Mapped cache

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

Text Books

1. William Stallings, Computer Organization and Architecture: Designing for Performance, 8th Edition, Pearson Publication, 2019.
2. Douglas V. Hall, Microprocessors and Interfacing, 2nd Edition, Tata McGraw-Hill, 2006.
3. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian,Computer Organization and Embedded Systems, 6th Edition, McGraw-Hill, 2022.

Reference Books

1. B. Govindarajulu, "Computer Architecture and Organization: Design Principles and Applications", Second Edition, McGraw-Hill, 2017.
2. John P. Hayes, "Computer Architecture and Organization", Third Edition, McGraw-Hill, 1997.

Program: Electronics and Telecommunication Engineering	T.Y.B.Tech	Semester: V
Control Systems (RCP23ECPE503)		
Control Systems Laboratory (RCP23ELPE503)		

Pre-requisite

1. Basic Electrical Engineering & Digital Electronics
2. Engineering Mathematics –I
3. Engineering Mathematics - II

Course Objectives

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

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the basic concepts of control system	L1	Understand
CO2	Derive the mathematical model of different type of the systems.	L4	Analyze
CO3	Analysis of systems in time and frequency domain.	L4, L5	Analyze, Evaluate
CO4	Understand & Find stability of given system using appropriate criteria.	L1, L4	Understand, Analyze
CO5	Apply the control theory to design the conventional controllers widely used in the industries.	L3	Apply

Control Systems (RCP23ECPE503)
Course Contents

Unit-I Introduction to Control Systems 08 Hrs.

Introduction: Open loop, closed loop systems, feed forward control, adaptive control systems, examples of control systems. Modeling: Types of models, impulse response model, transfer function model. Dynamic Response: Standard test signals, transient and steady state behavior control systems, steady state errors in feedback control systems and their types.

Unit-II Mathematical Modeling 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 single inputs single outputs(SISO) and multiple inputs multiple outputs(MIMO) systems, signal flow graph, Mason's gain rule.

Unit-III State Variable Models 07 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 05 Hrs.

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

Control Systems Laboratory(RCP23ELPE503)

List of Laboratory Experiments:

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.
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. Verification of observability and controllability for given control system.
10. To design Nyquist plot for given control system.
11. To find Transfer functions of P, PI, and PID controller.

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

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

Text Books

1. I. J. Nagrath, Madan.Gopal, Control System Engineering, New Age International Publication, 7^{th} Edition, 2021.
2. K.Ogata, Modern Control Engineering, Pearson Education, 5^{th} Edition, 2015.

Reference Books

1. Madan Gopal, Control Systems Principles and Design, Tata McGraw hill, 7^{th} Edition, 2012.
2. Ajit K.Mandal, Introduction to Control Engineering: Modeling, Analysis and Design, New Age International Publication, 2^{nd} Edition, 2010.
3. S.Hasan Saeed, Automatic Control System, S.K. Kataria & Sons, 9^{th} Edition, 2017.
4. Normon S. Nise, Control System Engineering, John Wiley & sons, 8^{th} Edition, 2020.

Program: Electronics and Telecommunication Engineering	T.Y.B.Tech	Semester: V
Linear Algebra (RCP23ECPE504)		
Linear Algebra Laboratory(RCP23ELPE504)		

Pre-requisite

1. Mathematics for Telecommunication Engineering

Course Objectives

1. Understanding basic concepts of linear algebra to illustrate its power and utility through applications.
2. 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.	L1	Understand
CO2	Demonstrate the basic notion of vector spaces and sub-spaces.	L4	Analyze
CO3	Apply the concept of vector spaces using linear transforms and inner product spaces applications in cryptography.	L4	Evaluate

Linear Algebra (RCP23ECPE504)
Course Contents

Unit-I System of Linear Equations 06 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 Product Spaces and applications 07 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 05 Hrs.

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

Linear Algebra Laboratory(RCP23ELPE504)

List of Laboratory Experiments:

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
10. Gaussian elimination and Gauss Jordan method.

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

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

Text Books

1. J. H. Kwak and S. Hong, "Linear Algebra", Second Edition, Springer, Boston, 2012.
2. Kolman, Bernard, and Hill, David Ross, "Elementary Linear Algebra", United Kingdom, Prentice Hall, 2000.

Reference Books

1. Stephen Andrilli and David Hecker, "Elementary Linear Algebra", 5th Edition, Academic Press, 2016.
2. Rudolf Lidl, Guter Pilz, "Applied Abstract Algebra", 2nd Edition, Springer, 2004.
3. Howard Anton, Robert C Busby, "Contemporary Linear Algebra", Wiley, 2003.
4. Gilbert Strang, "Introduction to Linear Algebra", 5th Edition, Cengage Learning, 2015.

Program: Electronics and Telecommunication Engineering	T.Y. B.Tech.	Semester: V
Advanced Microcontroller (RCP23ECPE505)		
Advanced Microcontroller Laboratory (RCP23ELPE505)		

Prerequisite: Digital System Design, Microcontroller & Applications.

Course Objective(s):

1. To provide an in-depth understanding of the ARM Cortex-M architecture, focusing on the STM32F401RE microcontroller.
2. To equip students with the skills to program and debug advanced microcontrollers.
3. To enable the design and implementation of real-world embedded systems using STM32F401RE.

Course Outcomes:

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand the architecture and functionality of the ARM Cortex-M family.	L2	Understand
CO2	Understand the architecture and functionality of the STM32F401RE microcontroller.	L2	Understand
CO3	Develop the programs for peripherals, sensors and actuators.	L3	Application
CO4	Design and implement microcontroller-based systems for real world applications.	L6	Creat

Advanced Microcontroller (RCP23ECPE505) Course Contents

Unit-I 06 Hrs.

ARM Family and Cortex-M Architecture: Introduction to ARM Microcontrollers: ARM Cortex-M Family: ARM Cortex-M series overview (M0, M3, M4, M7), Features of ARM Cortex-M4: Harvard architecture, pipeline, and instruction set

Unit-II 08 Hrs.

Introduction to STM32 Microcontrollers: STM32 family overview (F0, F1, F4, L4 series), Features of STM32F401RE: processor core, clock speed, overview of bus architecture (AHB, APB), memory organization, memory mapping and peripherals, Introduction to STM32 development tools: STM32CubeIDE and STM32CubeMX.

Unit-III 8 Hrs.

GPIO and Interrupt Programming: GPIO Configuration: Input, output, alternate function, Pull-up/pull-down resistors and pin speed configuration, Basic input/output operations: LED blinking and push-button interfacing, Interrupt Handling NVIC and its configuration, External interrupts.

Unit-IV 9 Hrs.

Timers, PWM, and ADC: Timers and Delay Generation: Overview of STM32 timers, Configuring general-purpose timers for delay generation, PWM and Applications: PWM generation using timers, Controlling brightness of an LED and speed of a DC motor using PWM Analog-to-Digital Conversion (ADC): ADC architecture and configuration, Single-channel and multi-channel ADC, Interfacing analog sensors (e.g., temperature sensors).

Unit-V 9 Hrs.

Communication Protocols and Applications: Serial Communication (UART): Configuring UART for data transmission and reception, I2C and SPI Communication: Overview and comparison of I2C and SPI protocols, Configuring STM32F401RE for I2C and SPI communication, IoT Applications: Interfacing STM32F401RE with Wi-Fi modules (ESP8266/ESP32), Cloud integration using MQTT/HTTP protocols.

Advanced Microcontroller Laboratory (RCP23ELPE505)

List of Laboratory Experiments

Suggested Experiments:(Any 8)

1. Setting up STM32 IDE and writing a basic LED blinking program.
2. Interfacing an LED and Push-Button with GPIO Input and Output Operations.
3. Implementing Push-Button Controlled LED Toggle Using External Interrupt.

4. Implementing LED Blinking Using Delay Generation with General-Purpose Timers.
5. Interfacing and Speed Control of a DC Motor Using PWM.
6. Timer-based PWM generation for LED brightness control.
7. FADC-based temperature sensor interfacing.
8. UART communication for data transmission and reception.
9. Interfacing and Reading Sensor Data from MPU6050 using I2C Communication.
10. Interface an SPI device, such as an EEPROM, and perform read/write operations.
11. NInterfacing STM32F401RE with a Wi-Fi module (ESP8266/ESP32).

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

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

Text Books:

1. Joseph Yiu , "The Definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors", Newnes Publications, 3^{rd} Edition, 2013.
2. Indranil Sengupta and Kamalika Dutta, "Embedded System Design with ARM", NPTEL course book.
3. Muhammad Ali Mazidi, Shujen Chen, and Sepehr Naimi, "Microcontroller Programming and Interfacing with ARM Cortex-M Processor", MicroDigitalEd, 1^{st} Edition, 2017.

Reference Books:

1. STM32F401RE Reference Manual and Datasheet.
2. Donald Norris, "Programming with STM32: Getting Started with the Nucleo Board and C/C++" , McGraw-Hill Education , 1^{st} Edition, 2018.
3. Carmine Noviello, ""Mastering STM32"", Leanpub, 1^{st} Edition, 2018.

Program: Electronics and Telecommunication Engineering	T.Y.B.Tech	Semester: V
Neural Network and Fuzzy Logic (RCP23EPE506)		
Neural Network and Fuzzy Logic Laboratory(RCP23ELPE506)		

Pre-requisite

1. Mathematics for Telecommunication Engineering

Course Objectives

1. To introduce the concepts and understanding of artificial neural networks and fuzzy logic
2. To introduce neural network design concepts.
3. To expose neural networks based methods to solve real world complex problems.
4. 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	L1	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	L3	Apply
CO4	Design various engineering application using Neural Networks/ Fuzzy Logic.	L3	Apply

Neural Network and Fuzzy Logic

(RCP23EPE506)
Course Contents

Unit-I Essentials of Artificial Neural Networks 04 Hrs.

Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Characteristics of ANN, Artificial Neuron Model, Operation of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, McCulloch-Pitts Model, Potential Applications of ANN, Classification Taxonomy of ANN Connectivity, Learning Strategy (Supervised, Unsupervised, Reinforcement),Learning Rules

Unit-II Supervised Neural Networks 12 Hrs.

Feed forward neural network, Single-Layer feed forward architecture-Perceptron, 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, Metrics for evaluation of classification method, Steps to use neural networks to data, Over fitting, Detecting over fit models: Cross validation

Unit-III Unsupervised Learning Neural Networks 12Hrs.

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

Unit-IV Fuzzy logic 06 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-V Applications of Fuzzy Logic and Fuzzy Systems 06 Hrs.

Fuzzy pattern recognition, fuzzy C-means clustering, fuzzy image processing, Simple applica-

tions of Fuzzy knowledge-based controllers like washing machines, home heating system, and train break control.

Neural Network and Fuzzy Logic Laboratory (RCP23ELPE506)

List of Laboratory Experiments:

1. Fuzzy Set Operations: AND, OR, D-Morgan's theorem
2. (a)Simulation of Mamdani Fuzzy Inference System for washing machine control
3. (b) Summery of research paper based on Fuzzy logic
4. Simulation of Sugeno Fuzzy Inference System for given application
5. Simulation of Mamdani Fuzzy Inference System for image processing application. (Edge detection)
6. Write a program for perceptron training algorithm and test it for two input AND OR gate function
7. Write a program for training and testing of Multilayer Perceptron for two input EX-OR gate
8. Write a program for training and testing of Multilayer Perceptron for character recognition application
9. Program for Radial basis neural network for interpolation application
10. Write a program for training and testing of RBF for pattern classification application
11. Kohenan Self Organising map for image classification
12. To Study the use of Microsoft Machine Learning Studio (classic) in Neural Network and Machine Learning

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

Text Books

1. S. N. Sivanandam and S. N. Deepa, “Introduction to Soft computing”, Wiley India Publications , 3rd Edition, 2018

2. S. Rajasekaran, G.A. Vijayalakshmi Pai, “Neural Networks, Fuzzy Systems And Evolutionary Algorithms: Synthesis And Applications”, Prentice hall Learning India,2nd Edition, 2017.

Reference Books

1. Thimothy J. Ross, "Fuzzy Logic with Engineering Applications", Wiley India Publications, 3rd Edition,2010.

2. J. S. R. Jang, C.T. Sun, and E. Mizutani, "Neuro-Fuzzy and Soft Computing", Prentice hall Learning India, 1997

3. S. N. Sivanandam, S. Sumathi, and S. N. Deepa, "Introduction to Neural Network Using Matlab", Tata McGraw-Hill Publications , 2006

Program: Electronics and Telecommunication Engineering	T.Y.B.Tech	Semester: V
Database Management System(RCP23ECMD501)		
Database Management System Laboratory(RCP23ELMD501)		

Pre-requisite

1. Structured Programming using C
2. Object Oriented Programming using Java

Course Objectives

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

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand about the fundamental concepts of databases, including design, architecture, and data models.	L2	Demonstrate
CO2	Design E-R diagrams, convert to relational schema and use relational algebra queries.	L3, L4	Apply, Analyze
CO3	Construct SQL queries to perform operations on the database.	L3	Analyze
CO4	Understand transaction management technique.	L2	Understand

Course Contents (RCP23ECMD501)

Unit-I Introduction to Databases and Data models 06 Hrs.

Introduction, Characteristics of databases, File system vs. database system, Users of the database system, Schema and Instance, Data Independence, level of abstraction, DBMS system architecture, The importance of data models , Types of data models.

Unit-II Relational Data Model 08 Hrs.

Entity–Relationship Model: Entity types: Weak and strong entity sets, Entity sets, Types of Attributes, Keys, Relationship constraints: Cardinality and Participation.

Relational Model: Introduction to the Relational Model, relational schema and concept of keys, Mapping the ER Model to the Relational Model Relational Algebra: Unary and Set operations, Relational Algebra Queries.

Unit-III Structured Query Language (SQL) and Normalization 08 Hrs.

SQL: 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.

Normalization : Concept of normalization, Function Dependencies, Normal Forms- 1NF, 2NF, 3NF, BCNF.

Unit-IV Transaction management Concurrency control 06 Hrs.

Transaction management: ACID properties, serializability and concurrency control, Lock based concurrency control (2PL, Deadlocks), Time stamping methods, optimistic methods, database recovery management

Database Management System(RCP23ELMD501)

: **List of Laboratory Experiments:**

1. Output all the data entered in the table
2. Create a table from the given data
3. Insert Data into the table
4. Add a column to the table and set default values
5. Update the data in the given row(s) of the given table
6. Delete all rows in the table
7. Create a table with the given constraints
8. Use a select query to fetch data
9. Use distinct queries to fetch unique data
10. Use the where clause to obtain information that meets specific conditions
11. Use the BETWEEN clause along with WHERE to filter the table based on 2 values
12. Use the AND clause with WHERE to filter the table based on 2 separate conditions
13. Use the OR clause is used along with WHERE to filter the table that meets any one of the given multiple conditions.
14. Use the LIKE operator along with WHERE to filter similar values.
15. Use of additional queries - IS NULL, ORDER BY LIMIT
16. Renaming of columns during output
17. Use the MAX() and MIN() functions to retrieve the maximum and minimum values from a column
18. Combining table - Joins two tables and outputs a single table
19. Use a left join to output data

20. Use a cross join to output the data
21. Use UNION to place a table right on top of another table.
22. Use the WITH query to create temporary tables
23. Use the EXCEPT query to output the data
24. Use the INTERSECT query to output the data
25. Execute a non-correlated subquery independently of the outer query

Text Books

1. A. Silberschatz, H. Korth, S. Sudarshan, Database System and Concepts, McGraw Hill, 7^{th} Edition, 2019.
2. Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database System, 7^{th} Edition, 2017.

Reference Books

1. Peter Rob, Carlos Coronel,Database Systems Design, Implementation and Management, 8^{th} Edition, 2007.
2. Lynn Beighley, Head First SQL, O'Reilly Media, 1^{st} Edition, 2007.
3. Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, McGraw-Hill, 3^{rd} Edition, 2014.

Program: Electronics and Telecommunication Engineering	T.Y.B.Tech	Semester: V
Environmental Science Tutorial (RCP23ITHSX06)		

Course Objectives

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

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	Understand how human activities affect environment.	L1	Understand
CO2	Understand the various technology options that can make a difference	L1	Understand

Environmental Science Tutorial

(RCP23ITHSX06)
Course Contents

Unit-I PSocial Issues and Environment 04 Hrs.

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

Unit-II TDirective Principles of State Policy 04 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 05 Hrs.

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

Text Books

1. R. Rajagopalan, "Environmental Studies From Crisis to Cure",Generic; 3rd edition, 2015.
2. Erach Bharucha, "Textbook for Environmental Studies For Undergraduate Courses of all Branches of Higher Education",Orient Blackswan Pvt Ltd, 3rd Edition, 2019 .
3. I.V Murali Krishna, Valli Manickam, Anil Shah, Naresh Davergave, "Environmental Management Science and Engineering for Industry", Butterworth-Heinemann, 2017.

Evaluation Scheme

1. Student should submit a report on the case study declared by teacher.
2. Audit point shall be awarded subject to submission of report of the case study declared by teacher.

Program: Electronics and Telecommunication Engineering	T.Y.B.Tech	Semester: V
Semester Project- III (RCP23IPSC501)		

Pre-requisite

1. Electronics Circuit Design
2. Digital System Design
3. Integrated Circuit
4. Python Programming Laboratory

Course Objectives

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

COs	Course Outcomes	Blooms Level	Blooms Description
CO1	De neproblem statement, formulation and solution byreviewing relevant literature	L4	Analyze
CO2	Identify alternate approaches to complete a project	L1	Understand
CO3	Apply project management skills by interacting and dividing project work among team member	L3	Apply
CO4	Develop technical, communication, and presentation skills	L3	Apply

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

These areas may be updated based on technological innovations and project needs.

Guidelines

- Project group: 4 to 6 students (including 2/3 second year and 2/3 third year).
- Each group will be allotted a final year mentor and a faculty guide.
- Groups submit three topic preferences; one is finalized in discussion.
- Identify required hardware and software for the problem statement.
- Two reviews per semester: August and October.
- First review: literature survey, documentation, budgeting.
- Second review: at least 30% project completion.

Assessment Criteria

- Final submission of report in prescribed format post guide confirmation.
- Evaluation by departmental committee including guide.
- Oral exam by internal and external examiners with presentation/demo.

Prescribed Project Report Format

Minimum 25 pages, including:

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

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

Guide will monitor weekly progress and marks allocation will be as per Table 2.
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. Each group shall present/publish a paper based on the semester project in reputed/peer reviewed Conference/Journal/TechFest/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:

1. Objective and Expected outcome
2. Long term social impact
3. Innovativeness and Motivation
4. Documentation
5. Simulation effectiveness
6. Literature survey and Comparative Methodology
7. Project Progress/Implementation
8. Overall Presentation and Team work

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

Table 1: Log Book Format

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

Table 2: Continuous Assessment Sheet

Sr	**Seat No**	**Name**	**Attendance**	**Log Book**	**Lit. Review**	**Understanding**	**Report**
			5	5	5	5	5
						Total	25

Table 3: Evaluation Sheet

Sr	**Seat No**	**Name**	**Selection**	**Design/Logic**	**HW/Prog.**	**Verification**	**Presentation**
			5	5	5	5	5
						Total	25