



ST. VINCENT PALLOTTI COLLEGE OF ENGINEERING & TECHNOLOGY, NAGPUR

(An autonomous institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B. Tech. Scheme of Examination & Syllabus 2023-24

ELECTRONICS AND TELECOMMUNICATION ENGINEERING

VI SEMESTER

M Sr No	Course Category	Course Code	Course Title	Hours per Week			Credits	Maximum Marks			Total	No of Hours in ESE
				L	T	P		Mid Semester Examination	Continual Assessment	End Sem Examination		
1	PCC	23ET601T	Digital Signal Processing	3	-	-	3	15	15	70	100	3
2	PCC	23ET601P	Digital Signal Processing Lab	-	-	2	1	-	25	25	50	-
3	PCC	23ET602T	Digital System Design	3	-	-	3	15	15	70	100	3
4	PCC	23ET602P	Digital System Design Lab	-	-	2	1	-	25	25	50	-
5	PCC	23ET603T	Object Oriented Programming and Data Structure	3	-	-	3	15	15	70	100	3
6	PCC	23ET603P	Object Oriented Programming and Data Structure Lab	-	-	2	1	-	25	25	50	-
7	PEC	23ET604T	Program Elective - II	3	-	-	3	15	15	70	100	3
8	AEC	23AS601T	Economics & Management	2	-	-	2	7.5	7.5	35	50	1.5
9	OE	23ET661O	Open Elective- III	3	-	-	3	15	15	70	100	3
10	ELC	23ET605P	Project - I	-	-	2	1	-	50	50	100	-
11	SEC	23ET641P	Career Development - VI	-	-	2	1	-	50	-	50	-
12	MDM	23ET631M	Multidisciplinary Minor -IV	3	-	-	3	15	15	70	100	3
Total				20	-	10	25	97.5	272.5	580	950	-

Basket for Program Elective -II	
23ET604T(i)	5G Wireless Communication
23ET604T(ii)	Antenna Design and RF systems

Basket for Open Elective III	
23ET661O	Bio Medical Electronics

Basket for Multidisciplinary Minor -IV	
23ET631M	Wireless Communication

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23ET601T	Digital Signal Processing	3	-	-	3	15	15	70	100

Course Objectives	Course Outcomes
<ol style="list-style-type: none">To introduce fundamental concepts of discrete time signal and systems.To develop strong foundation in various transforms like FT,ZT for analyzing and characterizing discrete time signals and systems.To familiarize students with classical IFR and FIR filters design techniques and releasing it with suitable structure.	<p>After completion of the course students are able to,</p> <ol style="list-style-type: none">Represents and classify discrete time signal and systems in time domain.Analyze the discrete time systems and compute the response to any input by applying concept of z transform.Describe the concept of Fourier Transform and apply the same for Discrete time signals.Develop structures of IIR filters and design IIR filters using various design techniques like impulse invariance and bilinearDesign FIR filter using various windowing techniques for given desired response

UNIT- I:	[10 Hrs]
Basic elements of DSP and its requirement, Advantages of Digital over analog signal processing, sampling theorem, Multirate signal processing concept, Interpolation and decimation, Discrete time signals & systems: Discrete time signals & systems, classification of discrete time signals and systems, LTI systems, linear convolution, Correlation	
Unit –II:-	[10 Hrs]
The Z-transform: Definition, properties of the region of convergence for the Z-transform, Z-transform properties, Inverse Z-transform	
Unit –III:-	[10Hrs]
Discrete Fourier Transform Definition and properties of DFT, IDFT, Relation between DFT and Z-Transform, Radix-2 FFT algorithms, Linear filtering methods based on DFT, circular convolution, Frequency analysis of discrete time signals using DFT.	
UNIT- IV:	[7Hrs]
Filter design methods – Impulse invariance, bilinear transformation, characteristics & designing of Butterworth, frequency transformations, IIR filter structures- Direct form I-II, transpose form, parallel form, cascade, Lattice and Lattice-ladder structures.	
Unit -V:	[8 Hrs]
FIR Filter Design & Realization: Symmetric and antisymmetric FIR filters, design of FIR filters using windows (Rectangular, Bartlett, Hanning, Hamming & Blakman), FIR filter structures.	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Digital Signal Processing, Principles, algorithms	J.G. Proakis, D.G. Manolakis	1	Pearson Education
2	Discrete Time Signal Processing	A.V. Oppenheim, R.W.	1	Pearson Education
3	Theory and Application of DSP	Rabiner Gold	2	PHI

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Digital signal processing- A practical approach	E. C. Ifeachar, B. W. Jarvis	2	Pearson Education
2	Digital Signal Processing	S. salivahanan, A Vallavaraj,	2	McGraw Hill

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23ET601P	Digital Signal Processing Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
<p>After the successful completion of the course the student is able to,</p> <ol style="list-style-type: none">To understand principles and working of digital signal processing for various applications.To understand Z transforms and discrete time Fourier transforms for the analysis of digital signals and systems.To design and implement FIR & IIR filter and analyze of their frequency response	<p>After the successful completion of the course the student is able to,</p> <ol style="list-style-type: none">Develop programs for basic DSP operations like convolution, correlation using MATLAB.Design FIR filters using MATLAB and evaluate their frequency responsesImplement transforms like Z transform, DFT, FFT using MATLABApply the DSP concepts to using MATLAB

Experiment No	Title of Experiment
1	To plot and represent following basic discrete time signals using MATLAB functions: Unit impulse, unit step, ramp, exponential and sine wave representation
2	To plot linear convolution of discrete signals using MATLAB functions.
3	Write a program to compute autocorrelation of an audio signal
4	To plot the poles and zeroes of the given transfer function
5	To find inverse Z-transform of given transfer function.
6	To compute FFT & IFFT of discrete time signals.
7	To demonstrate Multirate processing of speech signal
8	To study filter windowing techniques.
9	To study FIR low pass filter.
10	To compute circular convolution using MATLAB functions.

Text Books

S.N	Title	Authors	Edition	Publisher
1	Digital Signal Processing, Principles, algorithms	J.G. Proakis, D.G. Manolakis	1	Pearson Education
2	Discrete Time Signal Processing	A.V. Oppenheim, R.W.	1	Pearson Education
3	Theory and Application of DSP	Rabiner Gold	2	PHI

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Digital signal processing- A practical approach	E. C. Ifeachar, B. W. Jarvis	2	Pearson Education
2	Digital Signal Processing	S. salivahanan, A Vallavaraj,	2	McGraw Hill

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23ET602T	Digital System Design	3	-	-	3	15	15	70	100

Course Objectives	Course Outcomes
<p>After completion of the course students are able to,</p> <ol style="list-style-type: none"> 1. Ability to use techniques, skills, and modern engineering tools necessary for engineering practice 2. To provide experience to analyze, design, simulate and experimentally validate combinational logic circuits using Programmable Logic Devices (FPGAs) 	<p>After completion of the course students are able to,</p> <ol style="list-style-type: none"> 1. Analyze digital system design using PLD and explain fundamentals of VHDL 2. Analyze and design combinational logic circuits 3. Analyze, design and validate combinational and sequential logic circuits 4. Design and Impart knowledge on basics of Synchronous and Asynchronous Sequential circuit. 5. Articulate synthesis, pipelining , optimization concept

Unit- I: [8Hrs]

Programmable Logic Devices: Overview of PLDs, CPLD, FPGA. Introduction to place & route, Architecture of CPLD (Xilinx / Altera), FPGA XILINX 4000 Series, Device technologies, System representation, Levels of abstraction, development flow, Hardware description language

Unit –II:- [11 Hrs]

Design unit in VHDL, Basic VHDL concepts, Skeleton/syntax of VHDL program elements and program format, Objects, Data type and operators, Concurrent Signal Assignment, Signal assignment statements, conditional/Selected signal assignment statement. Design example on combinational and Sequential circuits

Unit –III:- [8 Hrs]

Test bench, component declaration, instantiation, Design examples for test bench, configuration, Functions, Procedures, attributes, generic, generate, package, file I/O.

UNIT- IV: [9 Hrs]

FSM representation, Moore machine versus Mealy machine, VHDL representation of an FSM, State assignment, Some FSM design examples – sequence detector, FSM based binary counter, Design example of sequence detector. Introduction to asynchronous sequential circuits

Unit -V: [9 Hrs]

The Synthesis Concept, Timing Analysis of Logic Circuits, Efficient Coding Styles, Combinatorial Logic Synthesis, partitioning for Synthesis, Pipelining Resource sharing, Optimizing arithmetic expressions.

Text Books

S.N	Title	Authors	Edition	Publisher
1	VHDL	Douglas Perry	4	TMH
2	VHDL Primer	J Bhasker.	-	
3	Digital System Design Using VHDL	Charles H. Roth	-	TMH

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Digital System Design	John Wakerley	1	McGraw Hill
2	VHDL	D. Smith	1	McGraw Hill

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23ET602P	Digital System Design Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
After completion of the course students are able to, <ol style="list-style-type: none">To acquire knowledge of computer-aided design tools for design of complex digital logic circuits.To analyze the results of logic and timing simulations and to use these simulation results to debug digital systems.	After completion of the course students are able to, <ol style="list-style-type: none">Design structural, behavioral and dataflow models for digital systemsDesign of combinational and sequential circuitsSynthesize the digital systems at RTL LevelAnalyze the complex modules of digital system designs.Implement and verify combinational and sequential circuits on FPGA

Experiment No	Title of Experiment
1	Design of all basic logic gates using Data flow style of Modeling using VHDL and implement it on Xilinx Spartan 3E kit
2	Design of Half Adder and full adder using Data flow, Behavioral, Structural style of Modeling using VHDL and implement it on Xilinx Spartan 3E kit
3	Design of Priority encoder using Data flow , Behavioral, style of Modeling using VHDL and implement it on Xilinx Spartan 3E kit.
4	Design of BCD-to-Seven segment encoder and implement it on Xilinx Spartan 3E kit.
5	Design of 8-bit up-down counter and implement it on Xilinx Spartan 3E kit.
6	Design of 8-bit shift register using VHDL and implement it on Xilinx Spartan 3E kit
7	Design of sequence detector using Moore FSM
8	Design & Implementation of 4-bit barrel shifter using FPGA / CPLD
9	Design & Implementation of 4-bit multiplier using FPGA / CPLD
10	Design of 4-bit ALU using VHDL
11	Design a parking system with lot capacity of 10 cars. Count number of incoming and outgoing cars. According allow entry of car in parking lot.

S.N	Text Books	Title	Authors	Edition	Publisher
1	VHDL		Douglas Perry	4	TMH
2	VHDL Primer		J Bhasker.	-	
3	Digital System Design Using VHDL		Charles H. Roth	-	TMH

S.N	Reference Books	Title	Authors	Edition	Publisher
1	Digital System Design		John Wakerley	1	McGraw Hill
2	VHDL		D. Smith	1	McGraw Hill

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VI Semester

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23ET603T	Object Oriented Programming and Data Structure	3	-	-	3	15	15	70	100

Course Objectives	Course Outcomes
<p>This course is intended</p> <ol style="list-style-type: none"> Understand Object-Oriented Programming concepts and apply them in C++ using suitable data structures and algorithms. Select and implement appropriate data structures and algorithmic techniques in C++ for various applications. Design and analyse efficient C++ solutions using advanced features like inheritance, polymorphism, and dynamic data structures 	<p>Student will be able to,</p> <ol style="list-style-type: none"> Apply basic OOP concepts and overloading in C++ programs. Use inheritance and polymorphism to design C++ applications. Implement and analyze array-based sorting and searching. Develop stacks, queues, and linked lists using dynamic memory. Apply trees, BSTs, and graphs for problem solving.

Unit I : Introduction of Object-Oriented Programming and Overloading	[10 Hrs]
Basic concepts of OOP: Encapsulation, Inheritance, Polymorphism, Abstraction Benefits and applications of OOP in IoT, Class members, access control, constructors, and destructors, Parameter passing methods, inline functions, static class members, friend functions Function overloading and generic programming, Function and class templates Operator overloading: Unary and binary operator overloading, rules for operator overloading	
Unit II: Inheritance	[10 Hrs]
Basics of inheritance: Base and derived classes, Types of inheritance: Single, multilevel, multiple, hierarchical, hybrid, virtual base class, Runtime polymorphism: Virtual functions, pure virtual functions, abstract classes	
Unit III : Introduction to Data structure	8 Hrs]
Arrays: Introduction and linear arrays, representation in memory, Sorting algorithms: Selection sort, insertion sort, bubble sort, quick sort, merge sort, radix sort, searching algorithms: Linear search, binary search, Complexity analysis of sorting and searching algorithms, Multidimensional arrays and sparse matrices	
Unit IV : Introduction of Stack and Queue	8 Hrs]
Introduction to stack and queue, Dynamic memory allocation, Linked lists: Introduction, representation of singly linked list in memory, Traversing, insertion, and deletion in linked lists, Implementation of stack using linked representation, Implementation of queue using linked representation	
Unit V : Trees and Terminology	[9 Hrs]
Basic terminology of trees, Binary trees: Representation and traversal (in-order, pre-order, post-order), Algebraic expressions and complete binary trees, Array and linked representation of binary trees, Binary search tree (BST) implementation, Operations on, BST: Searching, insertion, deletion, Threaded binary trees and traversal methods, Generalization of trees to graphs: Representation and traversal, Dijkstra's shortest path algorithm	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Object Oriented Programming with C++	E.Balagurusamy	-	Tata McGraw Hill Publications.
2	Data Structure using C and C++	Y.Langsam	-	Pearson Education Publications

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Mastering C++	K.R.Venugopal,B. RajKumar, T.RaviShankar	-	Tata McGraw Hill publication.
2	Problem solving with C++ The OOP	W. Savitch	-	Pearson education.
3	C++, the Complete Reference	Herbert Scheldt	-	Tata McGraw Hill Publications.

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23ET603P	Object Oriented Programming and Data Structure Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
<ol style="list-style-type: none">Understand the concept of object-oriented programming and develop skills in C++ Language.To choose the appropriate data structure and algorithm design method for a specified application. Write programs using C++ Language.	<p>Student will be able to,</p> <ol style="list-style-type: none">Describe & Illustrate concept of object-Oriented Programming, function overloading, operator overloadingClassify Inheritance and develop program using C++.Implement searching and sorting techniques using C++.Implement operation like Searching, Insertion and Deletion, traversing mechanism on various data structure.Design programs using data structures such as Binary tree and graph.

Expt. No.	Title of the experiment
1	Develop a program to calculate the area of a circle using Object-Oriented Programming principles.
2	Implement the concept of classes and objects to model a simple real-world entity.
3	Create a program to calculate the area of a circle and rectangle using default and parameterized constructors.
4	Demonstrate function overloading by creating multiple functions with the same name but different parameters.
5	Implement operator overloading for a custom class to perform arithmetic operations.
6	Overload unary operators for a custom class.
7	Overload binary operators for a custom class.
8	Demonstrate inheritance by creating a derived class from a base class and showing inheritance features.
9	Develop a program to implement the linear search technique on an array of integers.
10	Implement sorting algorithms, such as selection sort or bubble sort, to arrange elements in ascending order.
11	Design a program to perform stack operations, including push and pop, using an array or linked list.
12	Create a program to insert and delete nodes in a singly linked list.
13	Design, develop, and implement a menu-driven program for various operations on a Binary Search Tree (BST), including creation, insertion, deletion, and traversal (in-order, pre-order, and post-order).

Text Books

S.N	Title	Authors	Edition	Publisher
1	Object Oriented Programming with C++	E.Balagurusamy	--	Tata McGraw Hill Publications.
2	Data Structure using C and C++	Y.Langsam	--	Pearson Education Publications
3	Fundamentals of data Structures	Horowitz and Sahani	--	Galgotia Publication Pvt. Ltd
4	Data Structures using C & C++	A. M. Tenenbaum	--	PHI Publications.

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Mastering C++	K.R.Venugopal,B.RajKumar,T. RaviShankar	--	Tata McGraw Hill publication.
2	Problem solving with C++ The OOP	W.Savitch	--	Pearson education.
3	C++, the Complete Reference	Herbert Scheldt	--	Tata McGraw Hill Publications.

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VI SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23ET604T(i)	PE II - 5G Wireless Communication	3	-	-	3	15	30	70	100

Course Objectives	Course Outcomes
<ol style="list-style-type: none"> Develop a comprehensive understanding of the evolution of mobile communication Explain the 5G New Radio (NR) physical layer Familiarize students with 5G network architecture Introduce AI/ML techniques in 5G RAN Expose learners to emerging 5G applications and future trends 	Students will be able to, <ol style="list-style-type: none"> Describe the evolution from 1G to 5G and explain 5G performance goals, spectrum bands, and core architectural principles. Analyze the 5G NR physical layer, including numerology, massive MIMO, beamforming, channel models, and coding schemes (LDPC/Polar). Explain the components of the 5G network architecture and evaluate the roles of SDN, NFV, SBA, MEC, and O-RAN in enabling flexible and scalable networks. Apply foundational AI/ML concepts to RAN optimization problems such as beam management, CSI feedback, spectrum access, and energy efficiency. Assess major 5G use cases, cybersecurity challenges, and future communication trends including RIS, XR, V2X, Digital Twins, and early concepts of 6G.

Unit I: Fundamentals and Evolution to 5G [10Hrs]

Evolution of mobile networks from 1G to 4G focusing on multiple access techniques like FDMA, TDMA, CDMA, and OFDM, three key use cases: eMBB (enhanced Mobile Broadband), URLLC (Ultra-Reliable Low-Latency Communications), and mMTC (massive Machine-Type Communications), and detailing the ambitious 5G Key Performance Indicators (KPIs) like latency 5G Spectrum Landscape, distinguishing between Sub-6 (FR1) and mmWave (FR2), and the shift in architecture the 5G Core (5GC).

Unit II: 5G New Radio (NR) Physical Layer [9 Hrs]

Massive MIMO and mmWave technology, Non-Orthogonal Multiple Access (NOMA) and technologies for massive IoT the 5G NR Numerology, sub-carrier spacing and the structure of the 5G Frame. Massive MIMO, covering its fundamental theory, the channel capacity formula, and advanced concepts like precoding and Beamforming Techniques (analog, digital, and hybrid). Channel Models, coding schemes, LDPC (data channel) and Polar Codes (control channel). Duplexing schemes {FDD, TDD, dynamic TDD}

Unit III: 5G Network Architecture and Slicing [8 Hrs]

Service-Based Architecture (SBA) and the functions of key Network Functions like AMF, SMF and UPF. The key enabling technologies—Software-Defined Networking (SDN) and Network Function Virtualization (NFV)—are covered in detail, emphasizing the separation of control and data planes and the use of Cloud. Network Slicing, Multi-access Edge Computing (MEC) for latency reduction and the principles of the Open-RAN (O-RAN) architecture, including the RAN Intelligent Controller (RIC).

Unit IV: AI/ML for 5G Radio Access Network (RAN) [10 Hrs]

Self-Organizing Networks (SON) and provides a review of ML Basics for Engineers (Supervised, Unsupervised, and Reinforcement Learning). The application-centric classes explore using Deep Learning (DL) techniques, such as Autoencoders for CSI feedback compression and Recurrent Neural Networks (RNNs) for ML-driven, Channel Prediction. Application of AI in Beam Management using DNNs and the use of Reinforcement Learning (RL), specifically Deep Q-Networks (DQN), for dynamic tasks like Dynamic Spectrum Access and power control. The unit also covers AI applications for Network Energy Efficiency and the concept of Federated Learning for distributed and privacy-preserving AI training in 5G.

Unit V: Emerging 5G Use Cases and Future Trends [8 Hrs]

The real-world impact of 5G and looks toward the future, applications of URLLC and mMTC Smart Cities A V2X & Vehicle-to-Everything communication types essential for Autonomous Driving. High-bandwidth applications like XR/AR/VR and the Digital Twin concept, Critical challenges like Cyber security in 5G and practical Edge Computing Implementations, 6G Vision and exploring future enabling technologies such as Terahertz (THz) Communication and Reconfigurable Intelligent Surfaces (RIS)

Text Books

S.N	Title	Authors	Edition	Publisher
1	5G NR: The Next Generation Wireless Access Technology	Erik Dahlman, Stefan Parkvall, Johan Skold	2 nd Edition	Elsevier
2	Fundamentals of 5G Communications: Connectivity for Enhanced Mobile Broadband and Beyond	Wanshi Chen, Peter Gaal, et al.	1 st Edition	Elsevier
3	AI in Wireless for Beyond 5G Networks	Sukhdeep Singh, Yulei Wu, et al. (Editors)	1 st Edition	IET (The Institution of Engineering and Technology)

Reference Books

S.N	Title	Authors	Edition	Publisher
1	5G Mobile and Wireless Communications Technology	Afif Osseiran, José F. Monserrat, Patrick Marsch (Editors)	--	-

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23ET604T(ii)	PE II - Antenna Design and RF systems	3	-	-	3	15	15	70	100

Course Objectives	Course Outcomes
<ol style="list-style-type: none"> Understand the fundamental concepts of antennas, radiation mechanisms, and key antenna parameters. Explain different antenna types, design approaches, and array formation techniques. Analyze RF system components, transmission lines, and front-end architectures. Apply microwave and RF measurement techniques using modern test equipment. Evaluate and design antennas and RF subsystems for modern wireless communication applications. 	<ol style="list-style-type: none"> Describe antenna fundamentals, radiation characteristics, and EM concepts. Explain and compare various antennas, patch antenna design equations, arrays, and special antennas. Analyze RF system components, transmission lines, matching networks, and RF front-end behavior. Perform RF and microwave measurements using VNA, spectrum analyzer, and other instruments. Design modern antennas and RF subsystems for applications like 5G, IoT, and SDR-based wireless systems

Unit I : Antenna Fundamentals [9Hrs]

Basics of radiation: radiation mechanism, current distribution, retarded potentials, Antenna parameters, Friis transmission, equation, link budget basics, Near-field and far-field regions, Antenna impedance, VSWR, return loss, S-parameters, Introduction to Electromagnetic simulation tools (HFSS/CST)

Unit II : Antenna Types and Design Principles [09 Hrs.]

Wire antennas: Dipole, monopole, loop antennas, Aperture antennas: Horn antennas, parabolic reflectors, Microstrip patch antennas: structure, modes, design equations, feeding techniques (coaxial, inset, proximity, aperture), Array antennas: linear, planar, circular arrays; array factor, beam steering, grating lobes, Special antennas: Yagi-Uda, Log-Periodic, Helical antennas, Antenna measurement basics (anechoic chamber, pattern plotting)

Unit III : RF System Components and Design 9 Hrs]

RF signals and spectrum: RF behaviour, high-frequency effects, Passive components: transmission lines, microstrip lines, Smith chart basics, Active RF components: mixers, LNA, PA, VCO, filters (LC, microstrip, SAW), RF PCB design basics: impedance matching, grounding, shielding

Unit IV: Microwave & RF Measurement Techniques [10 Hrs]

Vector Network Analyzer (VNA): S-parameter measurement, calibration, Spectrum analyser: RBW, VBW, power, measurements, spurious emissions, Antenna measurement techniques: gain, efficiency, polarization, Time-domain reflectometry, cable loss measurement, SAR, radiation safety standards (IEEE, ICNIRP)

UNIT 5: Modern RF & Wireless Systems [8Hrs]

Antenna systems for modern wireless technologies: - 4G/5G antennas, MIMO antennas, mm Wave antennas (patch, array, lens antennas- Basics), RF system design for wireless modules: Wi-Fi, BLE, LoRa, UWB, Software-Defined Radio (SDR) basics, Beamforming and smart antennas, reconfigurable antennas

Text Books

S.N	Title	Authors	Edition	Publisher
1	Antenna Theory: Analysis & Design	Constantine A. Balanis	3	Wiley
2	Antennas and Wave Propagation	John D. Kraus, Ronald J. Marhefka, Ahmad S. Khan;	4	Tata McGraw Hill
3	Antenna Theory & Design	Warren L. Stutzman, Gary A. Thiele	3	Wiley

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Electromagnetic Waves and Radiating Systems	Edward C. Jordan, Keith G. Balmain	2	PHI

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(An autonomous institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B. Tech. Scheme of Examination & Syllabus 2023-24**ELECTRONICS AND TELECOMMUNICATION ENGINEERING****VI SEMESTER**

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23AS601T	Economics & Management	2	-	-	2	7.5	7.5	35	50

Course Objectives	Course Outcomes
1. The course examines how the economics, business and industrial management practices are related and how business decision is taken.	1. Apply economic principles for business decisions by understanding production cost relationships 2. Assess impact of macroeconomics and government policies on business and economy. 3. Recognize key management, marketing, financial and HRM functions and their role in effective business decision-making

Unit I	[10Hrs]
Economics, Classification of economics, Industrial economics, Consumer demand, Law of Demand, Determinants of demand, Demand forecasting, Law of supply, Types of Elasticity of demand, Concept of Production, Factors of Production, types of cost, cost curves,	
Unit II	[10Hrs]
Market Structures-Perfect competition, Monopoly, and Monopolistic competition, Functions of central bank, Inflation, Deflation, Recession, National income, GDP, GNP, Liberalization, Privatization and Globalization	
Unit III	[10Hrs]
Definition of management, functions of management, Functions of human resources Management, Marketing Management, Functions of Marketing Management. Methods of pricing, advertising and sales promotion. Financial Management, functions of financial management, Sources of finance.	

Text Books

S. N	Title	Authors	Edition	Publisher
1.	Managerial Economics	D.N. Dwivedi	8th	Vikas Publishing
2.	Modern Economic Theory	K.K. Dewett	2005	S. Chand Publisher
3.	Industrial Management	Dr.I.K. Chopde, Dr.A.M. Sheikh	Revised edition	S. Chand Publisher

Reference Books

S. N	Title	Authors	Edition	Publisher
1.	Industrial Organization and Industrial economics	T.R. Banga, S.C. Sharma	2006	Khanna Publishers

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23ET6610	OE – III Bio Medical Electronics	3	-	-	3	15	15	70	100

Course Objectives	Course Outcomes
<ol style="list-style-type: none">To Illustrate origin of bio potentials and its propagationsTo understand the different types of electrodes and its placement for various recordingsTo design bio amplifier for various physiological recordingsTo learn the different measurement techniques for non- physiological parameters.To Summarize different biochemical measurements	After completion of the course students are able to, <ol style="list-style-type: none">To illustrate fundamentals of biomedical engineeringTo Illustrate different various physiological monitoring systemsTo explain telemedicine technology and illustrate different instruments in it.To Explain various technique for X-ray machines and digital radiographyTo Demonstrate Magnetic Resonance Imaging System and therapeutic Equipment with its parameters

UNIT- I: Fundamentals of Medical Electronics:**[10Hrs]**

Role of Technology in medicine, sources of biomedical signals, basic medical instrumentation system, intelligent medical instrumentation system, MEMS, wireless connectivity in medical instruments, regulation of medical devices. Bioelectric Signals and electrodes, Physiological transducers: classification, photoelectric transducers, pressure transducers, photoelectric transducer, optical fiber sensors, biosensors, smart sensors.

Unit –II: - Patient Monitoring Systems:**[10Hrs]**

System concepts, cardiac monitor, measurement of heart rate, temperature, respiration rate, catheterization lab instrumentation, Arrhythmia and ambulatory Monitoring Instruments, fetal Monitoring, oximeters, blood flow and cardiac output measurement.

Unit –III: - Telemedicine Technology**[8 Hrs]**

Telemedicine technology, Pulmonary analyzers and its parameters, Clinical laboratory instruments: spectrophotometry, pneumotachometers, colorimeters, spectrophotometers, clinical flame photometer

UNIT- IV: X-ray machines and digital radiography:**[7 Hrs]**

Basis of diagnostic radiology, x-ray computed tomography, nuclear medical imaging systems: radiation detectors, pulse height detectors

Unit -V: Magnetic Resonance Imaging System & Therapeutic Equipment's:**[10Hrs]**

Principle of NMR Imaging System, Image construction Techniques, its biological effect and advantages, ultrasonic imaging systems: diagnostics, physics of ultrasonic waves, medical ultrasound, imaging modes, duplex scanner, 3D system, Pyroelectric vivid icon, thermal camera based on IR sensor, Scanners. Cardiac pacemakers: types, Cardiac defibrillators and its types, Automated drug delivery System

Text Books

S.N	Title	Authors	Edition	Publisher
1	Biomedical Instrumentation and measurement	Leslie Cromwell	2	Prentice hall of India
2	Handbook of Biomedical Instrumentation	Khandpur R.S	3	Tata McGraw-Hill

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Medical Instrumentation Application and Design	John G. Webster	4	Wiley India Pvt Ltd

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SIXTH SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23ET605P	Project – I	-	-	2	1	50	50	100

Course Objectives	Course Outcomes
<p>The course aims to:</p> <ol style="list-style-type: none">1. Develop the ability to identify and define real-world engineering problems.2. Enable students to apply domain knowledge from Electronics & Telecommunication Engineering.3. Encourage systematic design, implementation, and testing of engineering solutions.	<p>Students will be able to</p> <ol style="list-style-type: none">1. Define, identify, formulate and give solution to the problem.2. Demonstrate a sound technical knowledge of their selected project topic.3. Design engineering solutions to complex problems utilizing a systematic approach.4. Demonstrate the knowledge, skills and attitudes of a professional engineer.5. Communicate with engineers and the community at large in written an oral form.

Projects are allotted to a group of students which focuses on : -

S.No	Content
1	Problem Identification & Planning Identification and formulation of real-world problems in Electronics & Telecommunication domains; defining objectives, scope, feasibility analysis, and project planning.
2	Literature Survey & Technical Study Study of existing systems, research papers, standards, and technologies related to selected domain such as Embedded Systems, Communication, VLSI, Signal Processing, IoT, Control, Antenna, or AI applications in Electronics.
3	System Design & Development Design of system architecture, hardware/software implementation, simulation/modeling, prototype development, testing, and validation using appropriate tools and platforms
4	Professional Practice & Ethics Teamwork, project management, documentation practices, engineering ethics, safety considerations, and awareness of intellectual property.
5	Report Writing & Presentation Preparation of technical report in standard format, oral presentation, demonstration of prototype, and effective communication of results.

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
23ET641P	Career Development – VI	-	-	2	1	50	--	50

Course Objectives	Course Outcomes
<ol style="list-style-type: none">The sole objective of imparting aptitude training is to make students able to critically evaluate various real-life situations by resorting to an analysis of key issues and factors.This Aptitude Training helps them to demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.To categorize, apply and use thought process to distinguish between concepts of Quantitative methods.	<ol style="list-style-type: none">Students shall solve real life problems comparison of various probabilities, Permutation and combinations to ascertain the best outcomes expectedStudents shall draw conclusions or understand geometrical terminology for angles, triangles, quadrilaterals and circles with the help of formulas.The ability to analyze and interpret different forms of data, including tables, graphs, charts, and more.Enable students to critically analyze material (information) to order to evaluate evidence, construct reasoned arguments, and communicate inferences and conclusions.The ability to analyses visual information and solve problems based on visual reasoning.

Unit I	[5Hrs]
Aptitude:- Permutation and Combinations:- Letter Arrangement, Number Arrangement, miscellaneous questions Probability:- Color balls, Dice Problems, coins Problems, Playing Cards Problem, Miscellaneous Imax:- Lean Start-up, True Entrepreneurship,	

Unit II	[5Hrs]
Aptitude:- Mensuration: - 2-Dimension Problems, 3-Dimension Problems, Area, Volume, Surface Area, Total Surface Area. Geometry:- Lines, Circle, Triangles Etc. Imax:- Personal Accountability, Innovation Lessons from our Ancestors	

Unit III	[4Hrs]
Aptitude:- Data Interpretation:- Tabular DI Bar Graph Line graph Pie Chart	

Unit IV	[5Hrs]
Aptitude:- Logical Thinking (Syllogism) and Venn Diagram problem:- Some, No, All, Some Not, Very Few, Few, Possibility Problem Imax:- Interview Practice 1, Interview Practice 2, Interview Practice 3	

Unit V	[5Hrs]
Aptitude:- Non Verbal Reasoning:- Mirror Images, Water Images, Paper Cutting, Paper Folding, Fig Embedded Imax:- Interview Practice 4, Interview Practice 5, Interview Practice 6	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Quantitative Aptitude By R. S. Aggarwal	R.S. Aggarwal		
2	Quantitative Aptitude	Shripad Deo		Allied Publication
3	A Modern Approach to Verbal & Non-Verbal Reasoning	R.S. Aggarwal		

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Quantitative Aptitude for CAT by Arun Sharma	Arun Sharma		

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ELECTRONICS AND TELECOMMUNICATION ENGINEERING

VI SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23ET631M	MDM – IV Wireless Communication	3	-	0	3	15	15	70	100

Course Objectives	Course Outcomes
<ol style="list-style-type: none">To introduce the fundamentals of wireless communication using simple, application-based concepts.To explain how wireless signals travel and the factors affecting performance in real environments.To familiarize students with common wireless technologies such as Wi-Fi, Bluetooth, GPS, and mobile networks.To expose students to IoT applications where wireless communication and AI are used together.To introduce basic wireless security concepts and simple AI-based enhancements.	<p>After completion of this unit, the student will be able to:</p> <ol style="list-style-type: none">Describe the basic concepts of wireless communication with real-life examples.Explain how wireless signals propagate and identify factors affecting signal quality.Compare commonly used wireless technologies and their applications across disciplines.Illustrate simple IoT and smart system applications using wireless technologies and AI support.Identify basic wireless security issues and explain simple AI-assisted protection methods.

UNIT-I: Basics of Wireless Communication	[10 Hrs]
Introduction to wireless communication, Wired vs Wireless communication (simple comparison), Basic terms: signal, transmitter, receiver, antenna, Everyday wireless examples: mobile, Wi-Fi, Bluetooth, remote control, Use of wireless communication across engineering domains, Introduction to Artificial Intelligence (AI) – simple meaning, AI applications in wireless: pattern detection, noise identification.	
UNIT-II: Wireless Signal Propagation	[10 Hrs]
How wireless signals travel in air, Propagation effects: reflection, absorption, diffraction, scattering, Interference and noise (simple explanation), Range, coverage, and speed – basic concepts, Spectrum as a shared resource (simple analogy), AI in wireless propagation: noise reduction, coverage prediction, signal-strength mapping.	
UNIT-III: Common Wireless Technologies	[9 Hrs]
Wi-Fi basics: access points, hotspots, Bluetooth & BLE, NFC & RFID (contactless systems), GPS & Navigation, Mobile Networks: overview of 2G, 3G, 4G, and 5G (concept only), Applications across Mechanical, Civil, Electrical, Computer, AI, Data Science, IIoT streams, AI for wireless network optimization: selecting channels, predicting congestion.	
UNIT-IV: Wireless Communication in IoT & Smart Systems	[8 Hrs]
Introduction to IoT: simple explanation and components, Sensors, connectivity, and cloud (concept only), Wireless technologies used in IoT: Wi-Fi, BLE, ZigBee, LoRa, IoT use cases: smart homes, smart parking, agriculture monitoring, wearables, industrial automation, AI in IoT: prediction, automation, anomaly detection, Case studies: smart classroom, smart building, smart factory.	
UNIT-V: Basic Wireless Security & AI-Assisted Protection	[8 Hrs]
Need for wireless security, Issues: weak passwords, unauthorized access, eavesdropping, jamming, Basic safe practices: strong passwords, secure Wi-Fi, authentication, Introduction to encryption (concept-level), AI-assisted wireless security: intrusion detection, anomaly behavior identification, spam call detection, Future trends: AI + 5G, 6G basics.	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Mobile Communications	Jochen Schiller	2nd Edition	Pearson
2	Wireless Communications	Andreas F. Molisch	2nd Edition	Wiley India
3	Wireless Communication Technologies for IoT	Various Authors	1st Edition (2023)	Cambridge Scholars Publishing

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Fundamentals of Wireless Communication	David Tse, Pramod Viswanath	1st Edition	Cambridge University Press
2	Wireless Communications: Principles & Practice	Theodore S. Rappaport	2nd Edition	Pearson

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