DEPARTMENT OF
ELECTRONICS & TELECOMMUNICATION ENGINEERING

Structure &Syllabus for

B. Tech(E & Tc) Sem– V (2023 COURSE)

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B. Tech(E & Tc) Sem – VI (2023 COURSE)

BHARATI VIDYAPEETH (DEEMED TO BE UNIVERSITY)
COLLEGE OFENGINEERING, PUNE
B. Tech. (E & Tc): Semester – V (NEP 2023COURSE)

Sr. No.	Subject	Teaching Scheme			Examination Scheme-Marks						Credits			
		L	P	T	ESE	Internal Assessment	TW	PR	OR	Total	Th	PR/OR	Tut	Total
1.	Digital Communication	3	2	-	60	40	25	-	25	150	3	1	0	4
2.	Embedded Systems	3	2	-	60	40	25	25	-	150	3	1	0	4
3.	Power Electronics	3	2	-	60	40	25	-	25	150	3	1	0	4
4.	Data Communication andNetworking	3	0	-	60	40	-	-	-	100	3	0	0	3
5.	Microwave Theory and Antenna	3	-	1	60	40	-	-	-	100	3	0	1	4
6.	Skill-based Course –V Hardware Description Language	-	2	-	-	-	25	-	25	50	0	1	0	1
7.	Environmental Studies	4	-	-	60	40	-	-	-	100	4	-	-	4
	Total	**19**	**08**	**01**	**360**	**240**	**100**	**25**	**75**	**800**	**19**	**04**	**01**	**24**

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COLLEGE OFENGINEERING, PUNE
B. Tech. (E & Tc): Semester – VI (NEP 2023COURSE)

Sr. No	Subject	Teaching Scheme			Examination Scheme-Marks						Credits			
		L	P	T	ESE	Internal Assessment	TW	PR	OR	Total	Th	PR/OR	Tut	Total
1.	Digital Signal Processing	3	2	-	60	40	25	-	25	150	3	1	0	4
2.	Information Theory and Coding	3	-	-	60	40	-	-	-	100	3	0	0	3
3.	Digital CMOS Design	3	2	-	60	40	25	25	-	150	3	1	0	4
4.	Fiber Optic Communication	3	2	-	60	40	25	-	-	125	3	1	0	**4**
5.	PEC-I	3	-	-	60	40	-	-	-	100	3	0	0	3
6.	Professional Skills	-	2	-	-	-	25	-	-	25	-	1	-	**1**
7.	Skill-based Course –VI- Mini Project	-	2	-	-	-	25	-	25	50	0	1	0	1
	Total	**15**	**10**	**-**	**300**	**200**	**125**	**25**	**50**	**700**	**15**	**05**	**0**	**20**
8.	**Value Added Course- II	2	-	-	-	100	-	-	-	100	02	-	-	2
9.	**MOOC – II	-	-	-	-	-	-	-	-	-	-	-	-	2

Program Elective Course (PEC) List

Sr. No	PEC-I
1	Sensors & Instrumentation
2	Internet of Things
3	Operating Systems
4	Digital Control System

****indicate this is mandatory but the credits will not be considered in SGPA/CGPA**

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College of Engineering, Pune

B. Tech Sem V: Electronics & Telecommunication Engineering **Subject: Digital Communication**		
Teaching Scheme:	**Examination Scheme:**	**Credits Allotted:**
Theory: 03	End Semester Examination: 60 Marks	Credits: 03
Practical: 02	Continuous Assessment: 40 Marks	Credit: 01
Tutorial: 00	TW: 25 Marks	Credit: 00
	Oral: 25 Marks	
	Practical: 00	Total Credit: 04

Course Pre-requisites: Analog Communication, Signals & System

Course Outcomes: After learning this course students will be able to

1	Identify key components and performance criteria in digital communication
2	Apply various waveform coding techniques in digital communication systems.
3	Implement line coding and digital multiplexing techniques to optimize signal transmission.
4	Apply digital carrier modulation techniques for efficient signal transmission.
5	Analyze and evaluate multiple access techniques for reliable communication.
6	Evaluate and utilize information theory principles to enhance the performance of communication systems.

UNIT – I	**Fundamentals of Digital Communication System**	**(06 Hours)**
	Introduction to Digital Communication and Analog Communication, Evolution of Communication Systems, Components of a Digital Communication System, Basic Digital Communication Nomenclature, Signal Representation in Digital Communication, Noise and Distortion in Digital and Analog Systems, Bandwidth and Spectrum Efficiency Considerations, Sampling Process, Types of Sampling, Nyquist Theorem & Aliasing, Anti-Aliasing Filters and Their Role	
UNIT –II	**Waveform Coding Techniques**	**(06 Hours)**
	PCM Generation and Reconstruction, Quantization Noise, Non-uniform Quantization and Compounding, PCM with noise: Decoding noise, Error threshold, Delta Modulation, Adaptive Delta Modulation, Delta Sigma Modulation, Differential Pulse Code Modulation, LPC speech synthesis.	

UNIT – III	**Line Coding and Digital Multiplexing**	**(06 Hours)**
	Block diagram of baseband transmitter-receiver system, Line Coding & its properties. NRZ & RZ types, signaling format for unipolar, Polar, bipolar (AMI) & Manchester coding and their power spectra. Digital Multiplexing: Multiplexers and hierarchies, Data Multiplexers, synchronization, Inter Symbol Interference (ISI), Eye Patterns	
UNIT -IV	**Digital Carrier Modulation & Demodulation Techniques**	**(06 Hours)**
	Generation, Detection and applications of the following modulations: Binary ASK, Binary FSK, Binary PSK, Quadrature PSK, QASK, M-ary PSK, M-ary FSK and MSK. Baseband Signal Receivers, Matched Filter	
UNIT -V	**Spread Spectrum and Multiple Access Technologies**	**(06 Hours)**
	Pseudo-noise sequences, A Notion of spread Spectrum, Direct-Sequence Spread Spectrum with Coherent Binary Phase-shift Keying, Frequency Hop Spread Spectrum, TDMA, FDMA, CDMA, OFDM	
UNIT -VI	**Random Signal Theory**	**(06 Hours)**
	Probability, Joint & conditional Probability, Probability mass function, statistical averages, continuous random variables- PDF & Statistical averages, Random Processes, Time Average, Ergodicity, Power Spectral density of Stationary random processes.	

List of experiments:

1. To perform Sampling and reconstruction of a signal
2. To perform Pulse Code Modulation (PCM).
3. To observe Delta modulated signal with staircase approximation.
4. Comparing the Delta Modulation (DM) system and the Adaptive Delta Modulation (ADM) system
5. To perform Differential Pulse Code Modulation (DPCM).
6. To draw and observe practically Different Data Formats
7. To perform Amplitude Shift Keying (ASK) modulation and demodulation.
8. To perform Binary Phase Shift Keying (BPSK) modulation and demodulation.
9. To perform Binary Frequency Shift Keying (BFSK) modulation and demodulation
10. To perform Quadrature Phase Shift Keying (QPSK) modulation and demodulation.

11. MATLAB simulation of digital modulation techniques and Information Theory
Text Books/ Reference Books:
1. Simon Haykin, “Digital Communication Systems”, John Wiley & Sons, Fourth Edition.
2. A.B Carlson, P B Crully, J C Rutledge, “Communication Systems”, Fourth Edition, McGraw Hill Publication.
3. K. Sam Shanmugam, “Digital and analogue communication systems”, John Wiley.
4. Roberto Togneri, Christopher J.S deSilva “Fundamentals of Information Theory and Coding Design”, CRC Press.
5.Ranjan Bose, “Information Theory Coding and Cryptography” Tata McGraw-Hill

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B. Tech Sem V: Electronics & Telecommunication Engineering
Subject: Embedded Systems

Teaching Scheme:	Examination Scheme:	Credits Allotted:
Theory: 03	End Semester Examination: 60 Marks	Credits: 03
Practical: 02	Continuous Assessment: 40 Marks	Credit: 01
Tutorial: 00	TW: 25 Marks	
	Practical: 25 Marks	
	Total: 150 Marks	Total Credit: 04

Course Pre-requisites: Digital Electronics

Course Outcomes: After learning this course students will be able to

1	Apply fundamental concepts, architectures, and core components of embedded systems in real World application.
2	Analyze and apply design methodologies using modeling techniques and Embedded C programming.
3	Analyze the architecture and peripheral features of the ARM7-based LPC2148.
4	Implement and demonstrate effective peripheral interfacing on the LPC2148 using Embedded C.
5	Apply the fundamental principles of real-time operating systems, including kernel architecture and task scheduling.
6	Design and develop advanced RTOS applications incorporating multitasking, inter-process communication, and priority management.

UNIT – I	**Introduction to Embedded Systems**	**(06 Hours)**
	Embedded System Definition & Applications: Characteristics, real-world use cases (automotive, healthcare, robotics-industrial), Embedded vs. General-Purpose Computing: Differences and key architectural considerations. Core Components: Hardware: Microcontrollers, microprocessors, memory (RAM, ROM, and Flash), sensors, actuators, and communication interfaces. Software: Embedded firmware, Application software, Editor, Emulator, Assembler, Compiler, Architectural Classifications: Harvard vs. Von Neumann architectures. Embedded System Design Life Cycle: Development process and challenges.	
UNIT – II	**Embedded System Design Methodologies & Programming**	**(06 Hours)**
	Modeling Techniques: Flow graphs, FSM, UML for embedded design, requirement analysis, and use case modeling. Building Process for Embedded Systems: Compilation process (preprocessing, compiling, linking, locating), cross-	

	compilers, linker scripts, embedded file systems. Embedded Programming Fundamentals: Differences between C and Embedded C. Programming structure, data types, constants, variables, bitwise operations. Functions, control structures (if-else, loops) and their role in embedded systems.	
UNIT – III	**ARM7 Processor**	**(06 Hours)**
	Introduction to ARM Processors and Its Versions: ARM7, ARM9 & ARM11 Features, ARM7 Data Flow Model, Programmer's Model, Modes of Operations, Overview of Instruction Set. ARM7 Based LPC2148: Features, Architecture (Block Diagram and Its Description), ADC, DAC, System Control Block -PLL, VPB Divider, Memory Map, GPIO, Pin Connect Block, Timers	
UNIT -IV	**Interfacing with ARM7**	**(06 Hours)**
	Interfacing the peripherals with LPC2148: LED, LCD, GLCD, KEYPAD, GSM and GPS using UART, on-chip ADC using interrupt (VIC), EEPROM using I2C, SDCARD using SPI, on-chip. DAC for waveform generation. Programming in Embedded C.	
UNIT -V	**Real-Time Operating Systems (RTOS) – Fundamentals**	**(06 Hours)**
	Introduction to Operating Systems: Features, functions, kernel architecture. Types of Embedded OS Models: Polled loop systems, interrupt-driven systems, multi-rate systems. Processes & Task Management: Task states, Process/Task Control Block (PCB/TCB), threads. Schedulers & Scheduling Algorithms: Concepts of scheduling, dispatcher, preemptive and non-preemptive scheduling. RTOS Features & Implementations: µC/OS-II, Free RTOS fundamentals.	
UNIT -VI	**RTOS Advanced Concepts & Multitasking**	**(06 Hours)**
	Context Switching & Task Synchronization: Mutex, semaphore, deadlocks. Inter-Process Communication (IPC): Shared memory, mailbox, and message queue. Priority Management & Inversion Handling: Priority ceiling protocol, priority inheritance protocol. RTOS-Based System Design: Case studies in automotive, healthcare, and industrial automation. Practical RTOS Applications: Implementing scheduling, task management, and resource sharing in real-time embedded systems.	

List of Experiments :

1. To implement a basic LED blinking program using LPC2148.
2. To develop a buzzer control application that triggers sound alerts based on input conditions using LPC2148.

3. To design and simulate an LCD/GLCD interfacing application that displays alphanumeric data on LPC2148.
4. To configure and simulate the internal ADC of LPC2148 for reading analog sensor data using interrupt-driven programming.
5. To establish UART-based serial communication between LPC2148 and a GSM/GPS module for data exchange.
6. To simulate SD card interfacing using the SPI protocol on LPC2148 for data storage operations.
7. To implement I2C communication for reading from and writing to an EEPROM connected to LPC2148.
8. To develop a seven-segment display application that shows numeric values using LPC2148.
9. To generate PWM signals on LPC2148 for controlling the speed and direction of a DC motor.
10. To implement a simple RTOS-based application on LPC2148 demonstrating task scheduling and inter-task communication using μC/OS-II.
Text Books/ Reference Books:
1. Andrew Sloss, Dominic Symes, Chris Wright, "ARM System Developer's Guide Designing and Optimizing System Software", ELSEVIER
2. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M", Newness, ELSEVIER
3. Rajkamal, "Embedded System-Architecture, Programming and Design", TMH Publications, Edition 2003

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B. Tech Sem V: Electronics & Telecommunication Engineering
Subject: Power Electronics

Teaching Scheme:	Examination Scheme:	Credits Allotted:
Theory: 03	End Semester Examination: 60 Marks	Credits: 03
Practical: 02	Continuous Assessment: 40 Marks	
Tutorial: 00	TW: 25 Marks	Credit: 00
	Oral: 25 Marks	Credit: 01
	Practical: 00	Total Credit: 04

Course Pre-requisites: Elementary Electronics, Electrical Technology, Signals & Systems, Semiconductor Devices & Circuits

Course Outcomes: After learning this course students will be able to

1	Evaluate the constructions, switching characteristics and selection of power devices and thyristors.
2	Design and analyze controlled rectifiers (AC-DC) and voltage controllers (AC-AC)
3	Design and analyze different types of inverters (DC-AC)
4	Identify and differentiate between different types of Choppers (DC-DC)
5	Design and analyze different types of motors
6	Evaluate the applications of power electronics devices in industry.

UNIT – I	**Introduction to Power Devices**	**(06 Hours)**
	Introduction to Power Electronics, Introduction to Uncontrolled Device: Power diode, Power Transistor, Power MOSFET, IGBT. Introduction to Controlled Device: SCR: Construction, Operation, VI characteristics, Two transistor analogy, Turn on methods, Gate Characteristics, Ratings. TRIAC: Construction, Operation. GTO: Construction, Operation, Turn off mechanism, Applications.	
UNIT – II	**Rectifiers and AC voltage controller**	**(06 Hours)**
	Controlled Rectifiers: line, load & forced commutation, Single phase (half and	

	full) with R & RL and Three phase (half and full) Controlled rectifiers. Voltage Controller: Single phase AC voltage controller for R & R-L loads, three phase AC voltage controller for R load	
UNIT -III	**Inverters**	**(06 Hours)**
	Classification, Series Inverter, Parallel Inverter, Bridge Inverter, Three phase bridge inverter, PWM Techniques, Harmonic reduction	
UNIT -IV	**Choppers**	**(06 Hours)**
	Introduction, Classification, step-down Chopper, Step-up Chopper, Types of Choppers (class A, B, C, D, E), Chopper control techniques, Thyristor chopper Circuits (Voltage commutated, current commutated & Load commutated)	
UNIT -V	**Introduction to Motors**	**(06 Hours)**
	DC motors, AC Motors, Special Purpose Motors, Induction Motor, Universal Motor, Stepper Motor, Servomotors, BLDC Motors etc. (Qualitative analysis only)	
UNIT -VI	**Applications and Emerging Trends**	**(06 Hours)**
	Power electronics in telecommunication systems: Power supplies for base stations, RF amplifiers. Role in renewable energy systems: Solar inverters, wind energy conversion. Introduction to advanced topics: Resonant converters, multilevel inverters. Protection circuits: Overvoltage, overcurrent, and thermal protection in power electronic systems	

List of experiments:

1. To study the SCR V-I characteristics and find latching current, holding current
2. To study the characteristics of IGBT.
3. To study the characteristics of MOSFET.
4. To draw V-I characteristics of TRIAC for different values of gate current.
5. To Study triggering circuits.
6. To study single phase AC voltage regulator
7. To study Single Phase Half controlled bridge converter with R and RL and active (RLE) load.
8. To study Single Phase full controlled bridge converter with R and RL and active (RLE) load.
9. To study the chopper using MOSFET

10. To Study Series, Parallel and Bedford inverter
11. Simulation of Converter / Chopper using MATLAB/ Lab View/ Multisim.
12. Simulation of PWM Inverter using MATLAB/ Lab View/ Multisim.
Text Books / Reference Books:
1. M. H. Rashid, “Power Electronics circuits devices and applications”, PHI 3rd edition, 2004 edition, New Delhi.
2. M. D. Singh & K B Khanchandani, “Power Electronics”, TMH, New Delhi.
3. Deodatta Shingare “Industrial and Power Electronics”, EP Publication, Maharashtra.
4. P.C. Sen, “Modern Power Electronics”, S Chand & Co New Delhi.
5. Ned Mohan, T. Undeland & W. Robbins, “Power Electronics Converters applications and design” 2nd edition, John Willey & sons
6. B. L. Thareja& A. K. Tahreja, “Electrical Technology” Volume 1 & 2, S.Chand Publications
7. H. Cotton, “Electrical Technology”, CBS.
8. Nagrath Kothari, “Electrical Machines”, TMH.

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B. Tech Sem V: Electronics & Telecommunication Engineering **Course: Data Communication and Networking**		
Teaching Scheme:	**Examination Scheme:**	**Credits Allotted:**
Theory: 03	End Semester Examination: 60 Marks	Credits: 03
Practical: 00	Continuous Assessment: 40 Marks	
Tutorial: 00	TW: 00	
	Oral: 00	
	Practical: 00	Total Credit: 03

Course Pre-requisites: Analog Communications

Course Outcomes: After learning this course students will be able to

1	Identify different types of network topologies, addressing schemes and the protocol stacks
2	Compare various transmission media and broadband technologies
3	Implement and evaluate flow control, error control, and medium access control techniques for efficient data transmission.
4	Identify network layer addressing and routing schemes.
5	Compare and distinguish between connection-oriented and connectionless transport protocols.
6	Implement application layer protocols in networking.

UNIT – I	**Fundamentals of Data Communication**	**(06 Hours)**
	Components of data communication: Transmitter, Receiver, Medium, Message, Protocol. Standards, Standard organizations, Basic block diagram of data communication system. Need of computer networks, Network criteria, advantages of networking Network types, Network topologies, ISO-OSI model, TCP/IP protocol, Comparison of OSI and TCP/IP.	
UNIT – II	**Physical Layer**	**(06 Hours)**
	Transmission medium: classification based on electromagnetic wave spectrum. Guided Media -Twisted pair (UTP, STP) cable -connector, Coaxial cable, Fiber-optic cable, twisted pair. Unguided Media-Radio waves, microwaves, Infrared and their applications Multiplexing: Basic concept, Time - Division Multiplexing, Frequency- Division Multiplexing, Wavelength- Division Multiplexing, types of Time - Division	

	Multiplexing, Code Division Multiple Access (CDMA), Orthogonal Frequency Division Multiplexing (OFDM). Switching: Circuit-switched networks, Packet switched networks -Datagram approach, virtual circuit approach. Modems: classifications: Broadband modem, DSL-ADSL.	
UNIT - III	**Data Link Layer**	**(06 Hours)**
	Design issues, Data link services: Flow control, Error control. Flow control: Framing, Flow and Error control, Noiseless and Noisy Channels – Stop and wait Protocol. Sliding window Protocol: One bit window protocol, Go Back N ARQ Protocol, Selective ARQ, Piggybacking. High Level Data Link Control (HDLC), Medium Access Control Protocols, Random Access- ALOHA, Slotted ALOHA, CSMA, CSMA/CD. CSMA/CA, Controlled Access- Reservation Polling, token passing, Wired LANs: Ethernet: Ethernet Protocol: IEEE802, Ethernet Evolution, Standard Ethernet, Fast Ethernet, Gigabit Ethernet, 10 Gigabit Ethernet. Characteristics, Addressing, Access Method, Efficiency, Implementation.	
UNIT -IV	**Network Layer**	**(06 Hours)**
	Design issues, Packet Switching, Network devices: Repeater, Hub, Bridge, Switches, Router, Gateway. Network layer Logical addressing: Principles of Internetworking, requirements, IPv4 packet, IPv4 Addresses: addressing, classful and classless addressing. Need for IPv6, IPv6 Datagram format, comparison with IPv4, IPv6 addresses, DHCP, Network address translation (NAT). Network layer-Multicast Routing Protocols: Unicast, Multicast and Broadcast routing and applications. Routing protocols: Distance Vector routing and link state routing, DSARIP, OSPF, BGP and EIGRP. Subnetting, super netting, VLSM. Overview of ICMP, ARP, RARP.	
UNIT -V	**Transport Layer**	**(06 Hours)**
	Connectionless and Connection–oriented services at transport layer. Congestion Control and Quality of Service. Congestion control in TCP. Transport Layer Services: Process to process delivery, UDP,RTP and SCTP- ports, Packet format, operation, Advantages and Application. TCP and UDP checksum calculation. TCP Segment, TCP three-way handshake, User datagram Protocol (UDP), Datagram.	

UNIT -VI	Application Layer	(06 Hours)
	Introduction to Application layer Protocols: HTTP, FTP, DNS, SMTP, TELNET, SSH, DHCP and SNMP, Remote Logging, Electronic Mail, and File Transfer. Network Security: Cryptography, Block diagram of symmetric and asymmetric Cryptography. Symmetric key Algorithms (DES, AES), Public key Algorithms-RSA, Digital Signatures, IPSec, Firewall.	

Reference Books:

1. Data Communications and Networking – Behrouz A. Forouzan, Fifth Edition TMH.
2. Computer Networks - Andrew S Tanenbaum, 5th Edition, Pearson Education, 2013.
3. J J. F. Kurose and K. W. Ross," Computer Networking: A Top-Down Approach", Addison
4. Wesley, 5th Edition, 2010
5. Alberto Leon Garcia, "Communication Networks", McGraw Hill Education, Second Edition,
6. Fourth Edition, 2008.
7. An Engineering Approach to Computer Networks- S.Keshav, 2nd Edition, Pearson Education, 2015.
8. Understanding communications and Networks, 3rd Edition, W.A.Shay, Cengage Learning

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B. Tech Sem V: Electronics & Telecommunication Engineering
Subject: Microwave Theory and Antenna

Teaching Scheme:	Examination Scheme:	Credits Allotted:
Theory: 03	End Semester Examination: 60 Marks	Credits: 03
Practical: 00	Internal Assessment: 40 Marks	
Tutorial: 01		Credits: 01
		Total Credit: 04

Course Pre-requisites: Engineering Mathematics-I and II, Engineering Physics, Electromagnetics and Transmission Lines

Course Outcomes: After learning this course students will be able to

1	Analyze different modes in a waveguide.
2	Identify the passive devices based on microwave system requirements.
3	Identify the operations of Microwave sources and active devices.
4	Classify the antennas and calculate fundamental parameters of antenna.
5	Identify the radiation pattern of wire antennas.
6	Apply modern antenna technologies for real-world applications.

UNIT I	**MICROWAVE WAVEGUIDES**	**(06 Hours)**
	Concept of Modes in Waveguide (TE, TM), Analysis of TE and TM Modes in Rectangular Waveguide, Modes in Co-axial cable, Excitation of modes in Rectangular Waveguide, Power Transmission and losses in Waveguide, Microwave cavity resonator: Rectangular, circular and semicircular.	
UNIT II	**MICROWAVE PASSIVE DEVICES**	**(06 Hours)**
	Structure, S-matrix and Working of Microwave Passive Devices: **Waveguide Tees**: E-Plane tee and H-plane tee, Magic Tees (Hybrid Tees); Hybrid Rings (Rat-Race Circuits), Two-Hole Directional Couplers, Circulators and Isolators.	
UNIT III	**MICROWAVE SOURCES AND ACTIVE DEVICES**	**(06 Hours)**
	Construction and operation of Microwave Tubes: Two cavity Klystron, Reflex Klystron, Travelling Wave Tube (TWT), Magnetron. **Construction and Operation of Active Microwave Devices:** Gunn Diode, Tunnel Diodes, Schottky Diode, PIN Diode, Microwave Transistors.	

UNIT IV	**ANTENNA FUNDAMENTALS**	**(06Hours)**
	Definition and need of Antenna, General classification of antennas, **Definition and significance of antenna parameters:** Radiation Pattern, Radiation Power Density, Radiation Intensity, Beam width, Directivity, Antenna Efficiency, Gain, Beam Efficiency, Bandwidth, Polarization, Input Impedance, Antenna Radiation Efficiency, Antenna Vector Effective Length and Equivalent Areas, Antenna Temperature, Near field & Far-Field. **Friis' Transmission Equation.**	
UNIT -V	**WIRE ANTENNAS**	**(06 Hours)**
	Study of Radiation pattern: Half wave Dipole Antenna, Short Dipole, Monopole, Loop Antenna, Helical Antenna, Slot Antenna, Yagi-Uda Antenna.	
UNIT VI	**MODERN ANTENNA APPLICATIONS AND CASE STUDIES**	**(06 Hours)**
	Applications of Antennas in Modern Technology: IoT and Wireless Sensor Networks: Low-power, miniaturized antennas, Satellite Communications: Phased array and high-gain antennas, Biomedical Applications: Body-worn and implantable antennas. **Case Studies on Antenna Implementations:** Case Study 1: Automotive Radar Antennas – Self-driving Cars and Collision Avoidance, Case Study 2: Patch Antennas for Wearable Healthcare Monitoring. Case study 3: Antenna for wireless LAN 802.11	

List of suggested tutorials:

1. Study of the Klystron Tube.
2. Study of Gunn Diode
3. Numerical problems based on TE modes.
4. Numerical problems based on TM modes.
5. Study of passive microwave devices such as Waveguide Tees, Directional coupler,Circulator, Isolator and derive S-matrix.
6. Study of active microwave devices
7. Numerical problems based on Antenna parameters
8. Design of Simple Dipole Antenna
9. Design of Simple Monopole Antenna
10. Plot Radiation Pattern of simple Antenna structures

Text Books/Reference Books:

1. Samuel Y Liao, "Microwave Devices & Circuits", Prentice Hall of India,3rd Edition, 2006.
2. D.M.Pozar, "Microwave Engineering", John Wiley & sons, Inc, 3rd Edition, 2006.
3. Robert. E.Collin, "Foundation of Microwave Engg", Willey India. 2nd Edition
4. Annapurna Das and Sisir K Das, "Microwave Engineering", Tata Mc Graw3. Hill Inc., 1st Edition ,2004.
5. C.A Balanis , “Antenna theory and Design”, John willy & sons.
6. K.D.Prasad, “Antenna and Wave Propagation”, Satya Prakashan, New Delhi.
7. R. E. Collin, "Antennas and Radio Wave Propagation", McGraw-Hill.,
8. F. B. Gross, "Smart Antennas for Wireless Communications", McGraw-Hill., 2005
9. W. L. Stutzman, and G. A. Thiele, "Antenna Theory and Design", 2nd Ed., John Wiley & Sons. 1998.
10. Phased Array Antenna Handbook" – Robert J. Mailloux
11. RF and Microwave Wireless Systems" – Kai Chang
12. "5G NR: The Next Generation Wireless Access Technology" – Erik Dahlman, Stefan Parkvall, Johan Sköld
13. "Wearable Antennas and Body-Centric Communication" – Albert Sabban
14. "Automotive Radar Sensors in Autonomous Vehicles" – Gregory L. Charvat

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B. Tech Sem V: Electronics & Telecommunication Engineering
Subject: Skill-based Course V Hardware Description Language

Teaching Scheme:	Examination Scheme:	Credits Allotted:
Theory: 00	End Semester Examination: 00	Credits: 00
Practical: 02	Continuous Assessment: 00	
Tutorial: 00	TW: 25 Marks	Credit: 00
	Oral: 25 Marks	Credit: 01
	Practical: 00	Total Credit: 01

Course Pre-requisites: Digital circuit, Basic Electronics.

Course Outcomes: After learning this course students will be able to

1	Demonstrate knowledge of the syntax, semantics, and features of HDL.
2	Design circuits using logic gates and implement them with HDL program.
3	Design and implement combinational and sequential circuits using HDL
4	Create and use testbenches to verify the functionality and timing simulations of digital designs through simulation
5	Use synthesis tools to convert HDL models into gate-level implementations and prepare them for FPGA or ASIC deployment.
6	Apply skills for careers in digital design, embedded systems and VLSI design.

List of experiments:

1. Introduction to HDL tools and design of various Gates.
2. Write HDL program for Half adder, Full adder, half subtractor, Full subtractor using Data flow and Behavioral style.
3. Write HDL program for Full adder using half adder using Structure modeling style.
4. Write HDL program for 4-bit parallel adder using Component Instantiation statement (Structure modeling style).
5. Write HDL program for 4:1 Mux, 8:1 Mux and 16:1 Multiplexer.

6. Write HDL program for 1:4 Demux and 1: 8 Demultiplexer.
7. Write HDL program for 4:2 and 8: 3 Encoder and 2:4 and 3:8 Decoder.
8. Write HDL program for D-FF, T-FF, SR-FF and JK-Flip flop with Behavioral modeling Style using Process and Wait Statement.
9. Implementation all logic gates using FPGA kit
Text Books/ Reference Books:
1. Merrick, Russell. Getting Started with FPGAs: Digital Circuit Design, Verilog, and VHDL for Beginners. No Starch Press, 2023.
2. LaMeres, Brock J. Introduction to logic circuits & logic design with VHDL. Springer Nature, 2023.
3. Zwoliński, Mark. Digital system design with VHDL. Pearson education, 2004.
4. Palnitkar, Samir. Verilog HDL: a guide to digital design and synthesis. Prentice Hall Professional, 2003.
5. Cavanagh, Joseph. Digital design and Verilog HDL fundamentals. CRC press, 2017.
6. Roy, Shirshendu. Advanced Digital System Design: A Practical Guide to Verilog Based FPGA and ASIC Implementation. Springer Nature, 2023.

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B. Tech Sem V: Electronics & Telecommunication Engineering **Subject: Environmental Studies**		
Teaching Scheme:	**Examination Scheme:**	**Credits Allotted:**
Theory: 04	End Semester Examination: 40	Credits: 04
Practical: 00	Continuous Assessment: 10	
Tutorial: 00	TW: 00 Marks	Credit: 00
	Oral: 00 Marks	Credit: 04

Course Pre-requisites: Environmental Studies

Course Outcomes: After learning this course students will be able to

1	Get acquainted with the scope and multidisciplinary nature of environmental science with the overall aim of sustainable development.
2	Understand the importance of ecosystems in the view of its conservation.
3	Know the values of natural resources with associated problems for sustainable lifestyles.
4	Familiarize the basics of Biodiversity and concerned issues in the context of Western Ghats.
5	Make aware of the pollution issues with its mitigation measures.

UNIT I	**NATURE OF ENVIRONMENTAL SCIENCE, ECOSYSTEM, NATURAL RESOURCES AND BIODIVERSITY CONSERVATION**	**(15 Hours)**
	a) Nature of Environmental Science: • Definition, scope, and importance • Multidisciplinary nature of environmental studies • Sustainable Development Goals (SDGs) , Concept of sustainable development **b) Ecosystem:** • Structure and function of an ecosystem, • Energy flow in the ecosystem, Food chains, food webs , ecological pyramids • Ecological succession. Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems Degradation of ecosystems and its impacts. **c) Natural Resources:** • Classification of natural resources • Forest resources: Use and over-exploitation, deforestation, forests and tribal people. • Water resources: Use of surface and groundwater, Water scarcity and	

	stress • Water conservation: rainwater harvesting, watershed management • Soil and Mineral resources: Soil as a resource and its degradation, Environmental effects of extracting and using mineral resources. • Energy resources: Growing energy needs, Energy crisis, use of alternate energy sources, Role of Indian traditions and culture in conservation of the environment **d) Biodiversity and its conservation:** • Types: genetic, species, and ecosystem diversity, • Bio-geographical classification of India, • Value of biodiversity: • India as a mega- diversity nation. Hot-spots of biodiversity, Western Ghats as a biodiversity region. • Threats to biodiversity habitat loss, poaching of wildlife, man- wildlife, Conflicts, Endangered and endemic species of India. • Conservation of biodiversity: In-situ and Ex-situ conservation	
UNIT II	**ENVIRONMENTAL POLLUTION, CLIMATE CHANGE AND ENVIRONMENTAL LEGISLATION**	**(10 Hours)**
	a) Environmental Pollution: • Air pollution: Causes, effects and control measures • Water pollution: Causes, effects and control measures, Marine pollution, • Soil pollution: Causes, effects and control measures, • Noise pollution: Causes, effects and control measures • Solid waste Management: Causes, effects and control **b) Climate change: Causes, effects and mitigation** • Greenhouse gases, phenomenon of greenhouse effect and climate change, • Impacts of climate change: on life, on ocean and land systems; Sea level rise, On forests and natural ecosystems; On agriculture, on Human health • Mitigation of climate change: IPCC, Carbon foot print, Green House Gas (GHG) reduction, net zero targets for the future • Energy efficiency measures; Renewable energy sources for carbon reduction **c) Environmental legislation:** Constitutional provisions- Article 48A, Article 51A (g), Environmental Protection Act.,	

	Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act,	
	NATURE VISITS / FIELD WORK /FIELD TOUR/ INDUSTRIAL VISITS / CAMPUS ENVIRONMENTAL MANAGEMENT ACTIVITIES	**(05 Hours)**

Text Books/Reference Books:

1. Environmental Studies E-Text Book (Marathi and English Medium) Shivaji University, Kolhapur
2. Environmental Studies – UGC- Text Book for Undergraduate Courses for all Branches of Higher Education – Erach Bharucha, Bharti Vidyapeeth Institute of Environment Education and Research, Pune
3. A Textbook of Environmental Studies, January 2006 Ahmed Khan ABD Publishers
4. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. Science, 339: 36-37.
5. McNeill, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.
6. Odum, E.P., Odum, H.T. & Andrews, J. 1971. Fundamentals of Ecology. Philadelphia: Saunders.
7. Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2011. Environmental and Pollution Science. Academic Press.
8. Raven, P.H., Hassenzahl, D.M. & Berg, L.R. 2012. Environment. 8th edition. John Wiley & Sons.
9. Rosencranz, A., Divan, S., & Noble, M. L. 2001. Environmental law and policy in India. Tripathi 1992.
10. Sengupta, R. 2003. Ecology and economics: An approach to sustainable development. OUP.
11. Singh, J.S., Singh, S.P. and Gupta, S.R. 2014.Ecology, Environmental Science and Conservation. S. Chand Publishing, New Delhi.
12. Sodhi, N.S., Gibson, L. & Raven, P.H. (eds). 2013. Conservation Biology: Voices from the Tropics. John Wiley & Sons.
13. World Commission on Environment and Development. 1987. Our Common Future. Oxford University Press.

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B. Tech Sem VI: Electronics & Telecommunication Engineering **Subject: Digital Signal Processing**		
Teaching Scheme:	**Examination Scheme:**	**Credits Allotted:**
Theory: 03	End Semester Examination: 60 Marks	Credits: 03
Practical: 02	Continuous Assessment: 40 Marks	
Tutorial: 00	TW: 25 Marks	Credit: 00
	Oral: 25 Marks	Credit: 01
	Practical: 00	Total Credit: 04

Course Pre-requisites: Signal and System

Course Outcomes: After learning this course students will be able to

1	Highlightening the advantages of digital signal processing over analog signal processing.
2	Analyse the digital signals using various digital transforms signal.
3	Design a Finite Impulse Response (FIR) Filter given the specifications.
4	Design a Infinite Impulse Response (IIR) Filter given the specifications.
5	Apply the role of DSP in algorithms in different areas
6	Exploring the key features & functionalities of a DSP Processor.

UNIT – I	**Introduction to DSP**	**(06 Hours)**
	Basic elements of DSP and its requirement, Advantages of digital over analog signal processing, Discrete systems: attributes, Frequency analysis, Inverse Systems, Relation between DFT and Z-Transform, DFT and Fourier –Transform, Introduction to DFT, IDFT and FFT system.	
UNIT – II	**Introduction to The Discrete Fourier Transform**	**(06Hours)**
	Overview of Frequency Analysis of signals, DFT, IDFT, Properties of DFT- Circular convolution, overlap save & overlap-add algorithm, DIT -FFT & DIF -FFT algorithm and implementation.	
UNIT -III	**FIR Filter Design**	**(06 Hours)**

	Introduction of FIR filter, Characteristics of FIR filter, properties of FIR filter, frequency sampling, Linear phase filter – Windowing techniques – rectangular, triangular, Blackman, Hamming, Hanning and Kaiser windows, Realization of FIR by direct form structures, cascade, parallel form.	
UNIT -IV	**IIR Filter Design**	**(06 Hours)**
	Introduction of IIR filter, Design of Discrete-Time IIR filters from continuous-time filters approximation by Impulse invariant technique, Bilinear transformation and Derivative approximation methods. Realization of IIR by direct form structures, cascade & parallel form.	
UNIT -V	**Adaptive Filter and algorithms**	**(06 Hours)**
	Introduction of adaptive signal processing, Introduction of multirate signal processing. Least Mean Square (LMS) algorithm, Introduction Particle Swarm Optimization (PSO) algorithm, Hybrid algorithm.	
UNIT -VI	**Architecture of DSP Processors & applications**	**(06 Hours)**
	Need for special purpose DSP Processors, Features of DSP Processors: Harvard and Modified Harvard Architectures, pipelining, Multiplier-accumulator (MAC) hardware and architectures of fixed and floating point (TMSC6000) DSP processors. Applications of DSP: DTMF, Spectral Analysis, Musical Sound Processing, Case study on applications of DSP.	

List of experiments:

1. Study of signal processing in MATLAB.
2. Study of discrete time signal processing.
3. Write a program to perform circular convolution of two sequences using DFT.
4. To plot magnitude and phase Spectra of DFT of a given sequence.
5. To plot magnitude and phase Spectra of IDFT of a given sequence.
6. To implement filter using overlap add and overlap save method

7. To design FIR Filter for given specifications using hamming and Gaussian window and plot them in the same filter design tool.
8. Design of FIR filters using Kaiser Window method.
9. Design low pass butter worth digital filter with given specification using impulse invariance method.
10. To do Spectral Analysis of a real signal.
11. To implement an FIR Filter on a DSP Processor
Text Books/ Reference Books:
1. "Digital Signal Processing: Principles, Algorithm & Application", 4th edition, Proakis, Manolakis, Pearson
2. Digital Signal Processing – A computer based Approach, S.K.Mitra, Tata McGraw Hill,6th edition
3. E. C. Ifleachor and B. W. Jervis, "Digital Signal Processing- A Practical Approach", Second Edition, Pearson education.
4. A.V. Oppenheins and R.W. Schalfer , "Discrete Time Signal Processing", PHI

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B. Tech Sem V: Electronics & Telecommunication Engineering
Subject: Information Theory and Coding

Teaching Scheme:	Examination Scheme:	Credits Allotted:
Theory: 03	End Semester Examination: 60 Marks	Credits: 03
Practical: 00	Continuous Assessment: 40 Marks	
Tutorial: 00	TW: - 00	Credit: 00
	Oral: - 00	Credit: 00
	Practical: - 00	Total Credit: 03

Course Pre-requisites: Digital Communication, Analog Communication, Signals and Systems

Course Outcomes: After learning this course students will be able to

1	Evaluate the performance of source coding techniques in terms of average code length and efficiency.
2	Compute mutual information and entropy functions to quantify the information transfer through a communication channel.
3	Classify error-correcting codes and analyze their error detection and correction capabilities.
4	Construct and decode cyclic codes using generator polynomials and syndrome-based methods
5	Design convolutional coding schemes and represent them using code trees, state diagrams, and trellis diagrams.
6	Assess information-theoretic security methods for secure communication applications in modern networks.

UNIT – I	**Source Coding**	**(06 Hours)**
	Introduction, Historical Perspective of Information Theory, Information: Definition and physical significance, Properties of Information, Entropy, Properties of Entropy, Some Source Coding Algorithms: Huffman Coding, Shannon-Fano Coding. Average Code length, Efficiency, Source Coding Theorem, Lempel-Ziv Coding.	
UNIT – II	**Mutual Information And Channel Capacity**	**(06 Hours)**
	Discrete Memoryless Channel, Channel Matrix, Mutual information, Conditional Entropy, Joint Entropy. Physical Significance of Mutual Information, Properties of Mutual Information, Differential entropy and mutual information. Channel Capacity Theorem, Channel Coding Theorem, Muroga's Method for channel capacity.	

UNIT - III	**Linear Block Codes**	**(06 Hours)**
	Introduction: Need of Error Control Coding, Classification of Error Correcting Codes, Error Detection and Error Correction Techniques, Systematic and nonsystematic Codes, Code rate. Linear Block Codes, Generator and Parity Check Matrices, Syndrome: definition and properties, Syndrome decoding	
UNIT -IV	**Cyclic Codes**	**(06 Hours)**
	Cyclic Codes: Properties and significance, Generator Polynomial and its properties, Parity Check Polynomial, Syndrome Polynomial and its properties, Encoding and Decoding of Cyclic Codes using shift register.	
UNIT -V	**Convolutional Codes**	**(06 Hours)**
	Introduction, Encoding of Convolutional Codes, Code Tree, State diagram and Trellis Diagram, Transform Domain Approach, Maximum Likelihood Decoding-Viterbi Algorithm, Sequential Decoding.	
UNIT -VI	**Applications of Information Theory and Coding in Modern Communication Systems**	**(06 Hours)**
	Basics of cryptographic security using information theory, Rate-Distortion Theory for Lossy Compression, One-time pad and Shannon's perfect secrecy theorem, Error control coding in secure communications, Case study: LDPC and Turbo codes in wireless networks, Applications in multimedia compression (JPEG, MP3, H.264)	

Text Books/ Reference Books:

1. Simon Haykin, ' Communication Systems' 4th edition, John Wiley & Sons
2. David J.C. MacKay, "Information Theory, Inference, and Learning Algorithms", Cambridge University Press.
3. T. M. Cover and J. A. Thomas, Elements of Information Theory, 2nd Ed., Wiley.
4. D. J. C. MacKay, Information Theory, Inference, and Learning Algorithms, Cambridge University Press
5. R. E. Blahut, Algebraic Codes for Data Transmission, Cambridge University Press.
6. Andrea Goldsmith, "Wireless Communications", Cambridge University Press.
7. Ranjan Bose, "Information Theory Coding and Cryptography" Tata McGraw-Hill.
8. K. Sam Shanmugam, "Digital and analog communication systems", John Wiley.
9. Thomas M. Cover, Joy A. Thomas," Elements of Information Theory, 2nd Edition", Wiley Publication.
10. Roberto Togneri, Christopher J.S deSilva "Fundamentals of Information Theory and Coding Design", CRC Press
11. Steven Roman," Introduction to Coding and Information Theory", Springer New York.

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B. Tech Sem VI: Electronics & Telecommunication Engineering **Subject: Digital CMOS Design**		
Teaching Scheme:	**Examination Scheme:**	**Credits Allotted:**
Theory: 03	End Semester Examination: 60 Marks	Credits: 03
Practical: 02	Internal Assessment: 40 Marks	
Tutorial: 00	TW: 25 Marks	Credits: 01
	Practical: 25 Marks	
		Total Credit: 04

Course Pre-requisites: Elementary Electronics, Digital Electronics, Semiconductor Devices and Circuits

Course Outcomes: After learning this course students will be able to

1	Identify the characteristics of CMOS transistors.
2	Use CMOS Fabrication Process.
3	Design Inverter with delay constraints.
4	Design combinational logic circuits using CMOS technology.
5	Design sequential logic circuits using CMOS technology.
6	Apply the knowledge of advanced techniques in CMOS Design

UNIT – I	**Introduction to CMOS Technology**	**(06 Hours)**
	Introduction to CMOS (Complementary Metal-Oxide-Semiconductor) Technology, Electrical characteristics of MOSFETs (threshold voltage, subthreshold behavior, ON/OFF states), Comparison of CMOS with Bipolar Junction Transistor (BJT), CMOS inverter: operation and voltage transfer characteristics	
UNIT – II	**CMOS Fabrication**	**(06 Hours)**
	Overview of fabrication processing, MOSFET fabrication steps, CMOS fabrication techniques, n-Well CMOS fabrication process, Twin-Tub (Twin-Well) CMOS Fabrication, CMOS Fabrication Practical Aspects	
UNIT - III	**MOS INVERTERS: Switching Characteristics and Interconnect Effects**	**(06 Hours)**
	Introduction, Delay-Time Definitions Calculation of Delay times, Inverter design with delay constraints, Estimation of Interconnect parasitics, Calculation of	

	Interconnect Delay	
UNIT -IV	**Combinational CMOS Logic Design**	**(06 Hours)**
	Combinational Logic Design Using CMOS: CMOS logic gates: AND, OR, NAND, NOR XOR, XNOR gates**, Complex CMOS Gates:** Design of complex logic functions with multiple inputs, Use of transmission gates for logic design.	
UNIT-V	**Sequential CMOS Logic Design**	**(06 Hours)**
	Introduction to flip-flops and latches, SR latch, D flip-flop, T flip-flop, JK flip-flop design in CMOS, Timing diagrams and setup/hold time considerations.	
UNIT -VI	**Advanced CMOS Technologies**	**(06 Hours)**
	Introduction to FinFETs and their advantages over traditional CMOS, Scaling challenges in CMOS and the role of FinFET in advanced nodes, Silicon-on-insulator (SOI) technology, Carbon nanotubes and graphene in future CMOS circuits, Quantum-dot-based logic devices.	

List of Experiments

1. To Study about Microwind tool and λ (Lambda) Rules for Layout Generation
2. To generate layout for CMOS Inverter and simulate it.
3. To generate layout for CMOS NAND and simulate it.
4. To generate layout for CMOS NOR and simulate it.
5. To generate layout for CMOS TG and simulate it.
6. To implement layout for Boolean function F= (A.B +C.D)'
7. Design and implementation of half adder
8. Design and implementation of D latch
9. Design and implementation of SRAM Cell
10. Design and implementation of Counter
11. Design and implementation of Ring Oscillator

Text Books/Reference Books

1. Sung-Mo Kang & Yusuf Leblebici, "CMOS Digital Integrated Circuits – Analysis and Design", 3rd Edition, Tata McGraw-Hill, New Delhi, 2003.
2. Neil Weste and David Harris, "CMOS VLSI Design: A Circuits and Systems Perspective", 4th Edition, Addison-Wesley, 2010
3. John P.Uyemura, "CMOS Logic Circuit Design", Springer International Edition.2005.Logic Circuit Design", Springer International Edition.2005
4. W.Wolf, Modern VLSI Design: System on Chip, Third Edition, Pearson, 2002
5. J. P. Uyemura, "Introduction to VLSI circuits and Systems," John Wiley, New Delhi, 2002.
6. Jan M. Rabaey et al, "Digital Integrated Circuits: A Design Perspective," Second Edition, PHI, 2003
7. Donald A. Neamen et al, "Semiconductor Physics and Devices," 4th edition, McGraw Hill, 2017

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B. Tech Sem VI: Electronics & Telecommunication Engineering **Subject: Fiber Optic Communication**		
Teaching Scheme:	**Examination Scheme:**	**Credits Allotted:**
Theory: 03	End Semester Examination: 60 Marks	Credits: 03
Practical: 02	Continuous Assessment: 40 Marks	
Tutorial: 00	TW: 25 Marks	Credit: 01
	Oral: 00	Credit: 00
	Practical: 00	Total Credit: 04

Course Pre-requisites: Digital communication, Electromagnetic and Transmission Lines

Course Outcomes: After learning this course students will be able to

1	Design the components and measurement equipment in optical fiber networks.
2	Calculate the important parameters associated with optical components used in fiber optic telecommunication systems
3	Compare and contrast the performance of major components in optical link
4	Evaluate the performance viability of optical links using the power and rise time budget analysis
5	Design digital optical links by proper selection of components and check its viability using simulation tools
6	Compile technical information related to state of art components, standards, simulation tools and current technological trends by accessing the online resources to update their domain knowledge

UNIT – I	**Basics of Optical Fiber Communication System**	**(06 Hours)**
	Introduction to fiber optic communication system, Ray theory of Transmission: Total internal reflection, acceptance angle, numerical aperture, Electromagnetic mode theory for optical propagation: Phase and group velocity, propagation modes and modes on fiber, Types of fiber, cables used on optical fiber communication	
UNIT – II	**Optical Fiber for Telecommunication**	**(06 Hours)**

	Attenuation in optical fiber: Absorption, scattering, radiative losses, attenuation characteristics, Signal distortion in optical Fiber: intermodal dispersion, intramodal dispersion, Special Fibers, Fiber non-linearities	
UNIT -III	**Optical Sources and Transmitters**	**(06 Hours)**
	Introduction, LED Structures: PN junction LED, surface emitting LED, Edge emitting LED, LASER: Types of LASERs, Modulation of optical source, splicing of fibers, Optical fiber connectors, power launching and coupling	
UNIT -IV	**Optical Detectors and Receivers**	**(06 Hours)**
	Introduction of optical detectors: optical communication bands, characteristics, Semiconductor photodetectors: PIN diode, avalanche photodiode, Optical Receiver: block diagram, structures, noise in optical receiver, Photo Transistors: structure, characteristics	
UNIT -V	**Optical Link Design and Optical measurements**	**(06 Hours)**
	Introduction of point-to-point optical fiber communication links: Power loss, Optical link power budget, Analog links: CNR, photodetector noise, intensity noise, Optical Fiber Measurement: Attenuation measurement, Optical Time Domain Reflectometer (OTDR), Optical Fiber Transducer	
UNIT -VI	**Advanced Optical Communication System**	**(06 Hours)**
	Introduction, Wavelength Division Multiplexing: Operation, types of WDM, Fiber Optic Couplers: Characteristics, classification, Isolators, Splitter, multiplexing methods, Introduction of optical amplifiers, Switches and modulators	

List of Experiments:

1. To determine the refractive index of a thin glass plate.
2. To find Newton's Rings-Refractive index of liquid
3. To determine the wavelength of a laser using the Michelson interferometer
4. To calculate the beam divergence and spot size of the given laser beam
5. To calculate Newton's Rings-Wavelength of light
6. To verify the Brewster's law and to find the Brewster's angle
7. To find the numerical aperture of a given optic fiber and hence to find its acceptance angle

8. To measure Numerical aperture and attenuation constant of optical fiber
Text Books/ Reference Books:
1. Optical Fiber Communication – John M. Senior – Pearson Education – Second Edition. 2007
2. Optical Fiber Communication – Gerd Keiser – Mc Graw Hill – Third Edition. 2000
3. R.P. Khare, “Fiber Optics and Optoelectronics”, Oxford University Press, 2007.
4. J.Gower, “Optical Communication System”, Prentice Hall of India, 2001
5. Rajiv Ramaswami, “Optical Networks “, Second Edition, Elsevier, 2004.
6. Govind P. Agrawal, “Fiber-optic communication systems”, third edition, John Wiley & sons, 2004

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B. Tech Sem VI: Electronics & Telecommunication Engineering (2023) **Course: Sensors And Instrumentation (PEC-1)**		
Teaching Scheme:	**Examination Scheme:**	**Credits Allotted:**
Theory: 03	End Semester Examination: 60 Marks	Credits: 03
Practical:00	Continuous Assessment: 40 Marks	
Tutorial: 00	TW: 00	Credit: 00
	Oral: 00	
	Practical: 00	Total Credit: 03

Course Pre-requisites: Elementary Electronics, Integrated Circuits and Applications, Signals and Systems

Course Outcomes: After learning this course students will be able to

1	Identify key components and performance criteria in digital communication
2	Apply various waveform coding techniques in digital communication systems.
3	Implement line coding and digital multiplexing techniques to optimize signal transmission.
4	Apply digital carrier modulation techniques for efficient signal transmission.
5	Analyze and evaluate multiple access techniques for reliable communication.
6	Evaluate and utilize information theory principles to enhance the performance of communication systems.

UNIT – I	**Fundamentals of Sensors**	**(06 Hours)**
	Measurement Systems Overview • Definition of measurement and instrumentation • Generalized measurement system: sensor, signal conditioning, display/data processing • Calibration basics and uncertainty **Basic Sensor Principles** • Terminology: accuracy, precision, resolution, sensitivity, repeatability • Classification of sensors: active vs. passive, contact vs. non-contact **Mathematical Representation of Sensor Characteristics** • Transfer function of a sensor • Static and dynamic sensor characteristics Equation for sensitivity	
UNIT – II	**Sensor Characteristics and Errors**	**(06 Hours)**
	Static Characteristics	

	• Sensitivity, linearity, range, offset, hysteresis • Methods of measuring linearity and hysteresis **Dynamic Characteristics** • Time constant, response time, frequency response • First-order and second-order system behaviour in sensors **Error Analysis** • Sources of error (systematic vs. random) • Error minimization techniques (shielding, grounding, filtering) **Calibration and Standardization** • Calibration methods and instruments Traceability to standards (NIST, ISO, etc.)	
UNIT – III	**Sensor Technologies**	**(06 Hours)**
	Resistive Sensors • Potentiometers, strain gauges, RTDs (Resistance Temperature Detectors) • Working principles and typical applications **Capacitive and Inductive Sensors** • Capacitive humidity and proximity sensors • Inductive displacement sensors (LVDT, RVDT) **Thermal Sensors** • Thermocouples, thermistors, IR sensors • Signal conditioning for temperature measurement **Optical and Magnetic Sensors** • Photodiodes, phototransistors, fiber-optic sensors Hall-effect sensors, magnetoresistance sensors	
UNIT -IV	**Signal Conditioning for Sensors**	**(06 Hours)**
	Signal Amplification and Filtering • Instrumentation amplifiers, differential amplifiers • Active and passive filters (low-pass, high-pass, band-pass) **Bridge Circuits** • Wheatstone bridge for strain gauges and RTDs • Balancing, offset compensation, and sensitivity enhancement **Analog-to-Digital Conversion (ADC)** • Sampling, quantization, resolution • Types of ADC (Successive Approximation, Flash, Sigma-Delta) **Noise Reduction and Shielding** • Ground loops, electromagnetic interference (EMI) Proper grounding, shielding techniques	
UNIT -V	**Data Acquisition and Interfacing**	**(06 Hours)**

	Data Acquisition Systems (DAQ) • Components: sensors, DAQ hardware, software interface • Key specifications: sampling rate, resolution, channel count **Communication Protocols** • Serial (UART, RS-232/485) and parallel interfaces • I^2C, SPI, CAN for sensor interfacing **Computer-Based Instrumentation** • LabVIEW and/or MATLAB data acquisition toolboxes • Virtual instrumentation concepts **Microcontroller/Embedded System Interfaces** • Analog input pins, digital input/outputs Interfacing techniques and example code snippets	
UNIT -VI	**Case Studies and Emerging Trends**	**(06 Hours)**
	Industrial Applications • Process control, automation, predictive maintenance • Smart sensors in Industry 4.0 **Healthcare and Biomedical Instrumentation** • Biomedical sensors (ECG, SpO_2, blood pressure sensors) • Wearable technology and IoT in healthcare **Automotive Sensors** • Engine management (temperature, pressure, O_2 sensors) • Safety systems (airbag accelerometers, ABS speed sensors) **Advanced and Emerging Technologies** • MEMS sensors, nano-sensors • Wireless sensor networks, IoT-based sensors	

Reference Books:

1. D. Patranabis, *Sensors and Transducers*, PHI Learning.2003, 2nd Edition, ISBN : 9788120321984
2. Ernest O. Doebelin and Dhanesh N. Manik, *Measurement Systems: Application and Design*, McGraw Hill, 6th Edition ,2017, ISBN-10:9780070699687
3. John Turner and Martyn Hill, *Instrumentation for Engineers and Scientists*, Oxford University Press,1999, ISBN-10: 0198565178
4. R.K. Rajput, *Sensors and Instrumentation*, S. Chand Publishing, 2009, Revised Edition, ISBN: 9788121929172
5. A.K. Sawhney, *A Course in Electrical and Electronic Measurements and Instrumentation*, Dhanpat Rai & Co., 2021, ISBN: 9788177001006

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B. Tech Sem VI: Electronics & Telecommunication Engineering **Subject: Internet Of Things (PEC 1)**		
Teaching Scheme:	**Examination Scheme:**	**Credits Allotted:**
Theory: 03	End Semester Examination: 60 Marks	Credits: 03
Practical: 00	Internal Assessment: 40 Marks	
Tutorial: 00		
		Total Credit: 03

Course Pre-requisites: Control System and Applications, Embedded systems

Course Outcomes:

1	Design IoT systems' fundamental concepts, architecture, and components
2	Analyze the functionality and suitability of IoT hardware components
3	Evaluate various IoT communication protocols and networking technologies to determine their applicability.
4	Assess the role of data management, cloud integration, and analytics in designing efficient IoT ecosystems.
5	Identify security vulnerabilities and privacy challenges in IoT systems and propose strategies to mitigate them
6	Identify emerging trends in IoT, such as 5G, AI integration, and Industry 4.0, and their impact on future technological advancements.

UNIT – I	**Introduction to IoT**	**(06 Hours)**
	Definition, history, and evolution of IoT Characteristics and key components of IoT systems IoT reference architecture: Physical, Network, and Application layers Applications in E&TC: Smart homes, wearable devices, industrial automation, telemedicine Benefits, challenges, and societal impact of IoT Case studies: IoT in smart cities and healthcare	
UNIT – II	**IoT Hardware Components**	**(06 Hours)**

	Overview of IoT hardware platforms: Microcontrollers (Arduino, Raspberry Pi, ESP32) Types of sensors: Temperature, humidity, pressure, motion, light, and gas sensors Actuators: Relays, motors, solenoids, and their applications Power management techniques for IoT devices Embedded systems design considerations for IoT Comparison of hardware platforms for different use cases	
UNIT - III	**IoT Communication Protocols and Networking**	**(06 Hours)**
	Wired protocols: UART, SPI, I2C Wireless protocols: Wi-Fi, Bluetooth, Zigbee, LoRa, NB-IoT IoT-specific protocols: MQTT, CoAP, HTTP/REST, AMQP Comparison of protocols based on bandwidth, range, and power efficiency Network topologies: Star, Mesh, and Hybrid Role of IPv6 and 6LoWPAN in IoT networking Challenges in IoT connectivity and scalability	
UNIT -IV	**IoT Data Management and Cloud Integration**	**(06 Hours)**
	Data lifecycle in IoT: Acquisition, processing, storage, and analysis Edge computing vs. cloud computing: Concepts and trade-offs IoT cloud platforms: AWS IoT, Google Cloud IoT, Microsoft Azure IoT Data visualization and real-time analytics in IoT Role of APIs and web services in IoT ecosystems Case studies: IoT data management in industrial and consumer applications	
UNIT -V	**IoT Security and Privacy**	**(06 Hours)**
	Security vulnerabilities in IoT systems Encryption and secure communication: TLS/SSL, DTLS Authentication mechanisms and access control Privacy issues and ethical considerations in IoT Case studies: IoT security breaches and lessons learned Standards and regulations for IoT security (e.g., GDPR, NIST)	
UNIT -VI	**Emerging Trends and Future of IoT**	**(06 Hours)**

	IoT and Industry 4.0: Automation and smart manufacturing Integration of IoT with AI, Machine Learning, and Blockchain Impact of 5G on IoT: Low latency and massive connectivity Future trends: Quantum IoT, Green IoT, and autonomous systems Socio-economic implications of widespread IoT adoption	

Text Books/Reference Books

1. Enabling the Internet of Things: Fundamentals, Design, and Applications, Muhammad Azhar Iqbal et al., IEEE Press Wiley 2021
2. Vijay Madisetti and Arshdeep Bahga, Internet of Things: A Hands-on Approach, Universities Press, 2014.
3. Internet of Things, Architectures, Protocols and Standards, Simone Cirani, Wiley 2019
4. Internet of Things with ESP8266, Marco Schwartz, Packt Publishing, 2016
5. Raj Kamal, Internet of Things: Architecture and Design Principles, McGraw Hill Education, 2017.

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B. Tech Sem VI: Electronics & Telecommunication (NEP 2020 COURSE)

Subject: Operating System PEC-1

Teaching Scheme:	**Examination Scheme:**	**Credits Allotted:**
Theory: 03	End Semester Examination: 60 Marks	Credits: 03
Practical: 00	Continuous Assessment: 40 Marks	
Tutorial: 00	TW: 00	Credit: 00
	Oral: 00	Credit: 00
	Practical: 00	Total Credit: 03

Course Pre-requisites: Computer Programming

Course Outcomes: After learning this course students will be able to

1	Demonstrate a thorough understanding of different types of operating systems and their structures
2	Apply various process management techniques such as scheduling algorithms
3	Apply synchronization techniques to solve classical synchronization problems and demonstrate how modern operating systems handle concurrency using synchronization primitives.
4	Analyze deadlock conditions and apply suitable techniques for deadlock prevention, avoidance, detection, and recovery in operating systems.
5	Evaluate and implement different memory management techniques
6	Analyze functioning of I/O management and file system organization.

UNIT – I	**Introduction to Operating Systems**	**(06 Hours)**
	Basics and Evolution of Operating Systems. Operating System Structures: Layered, Monolithic, Microkernel, Hybrid Models. System Calls: Definition, Types (Process Control, File Management, Device Management, etc.) Types of Operating Systems: Batch SystemsMultiprogramming and Multitasking Systems, Time-sharing, Distributed and Clustered Systems,Real-Time and Embedded Systems. Virtualization in Operating Systems: Virtual Machines	
UNIT – II	**Process Management**	**(06 Hours)**
	Processes and Threads: Process Concept, Process Life Cycle, Process Control Block (PCB), Types of Schedulers (Long-term, Short-term, Medium-term), Context Switching. Scheduling Algorithms: FCFS, SJF, Priority Scheduling,	

	Round Robin, and Multilevel Queue Scheduling with comparison. Process Synchronization: Critical Section Problem and its Solutions using Mutex and Semaphore. Inter-process Communication (IPC): Shared Memory and Message Passing. Introduction to Threads: User-level vs Kernel-level Threads, Multithreading Models.	
UNIT - III	**Concurrency and Synchronization**	**(06 Hours)**
	Introduction to Concurrency: Concept of Concurrency, Need for Concurrency in Modern Operating Systems. Process Synchronization: Critical Section Problem. Classical Synchronization Problems: Producer-Consumer Problem, Readers-Writers Problem, and Dining Philosophers Problem. Synchronization Techniques: Hardware-based solutions (Test and Set Lock, Disable Interrupts), Software Solutions (Peterson's Algorithm), and Operating System-provided Synchronization Tools (Semaphores, Mutexes, Monitors, Condition Variables). Case Study: Synchronization in Linux (brief overview of Linux Synchronization Primitives such as Spinlocks, Mutexes, and Semaphores).	
UNIT -IV	**Deadlocks**	**(06 Hours)**
	Deadlock Concept: Definition, Examples, and Real-life Scenarios of Deadlock. Necessary Conditions for Deadlock: Mutual Exclusion, Hold and Wait, No Preemption, and Circular Wait. Resource Allocation Graph: Representation and Analysis of Deadlock Situations. Methods for Handling Deadlocks: Deadlock Prevention Techniques, Deadlock Avoidance using Banker's Algorithm, Deadlock Detection, and Recovery from Deadlock. Case Study: Deadlock Handling in Modern Operating Systems (Brief overview of how Linux/Windows deals with deadlocks).	
UNIT -V	**Memory Management**	**(06 Hours)**
	Basics of Memory Management: Concept of Logical and Physical Address Space, Address Binding, and Memory Allocation Techniques. Contiguous Memory Allocation: Fixed and Variable Partitioning. Paging, Segmentation. Virtual Memory, Demand Paging, Page Fault Handling, and Performance Considerations. Page Replacement Algorithms: Optimal, FIFO, LRU, and LRU Approximation. Case Study: Memory Management in Linux and Windows, including concepts like Cache Memory, Translation Lookaside Buffer (TLB), and Memory Protection.	
UNIT -VI	**Input and Output, File System**	**(06 Hours)**
	I/O management & Disk scheduling: I/O Devices, Organization of I/O functions, Operating System Design issues, I/O Buffering, DiskScheduling (FCFS), RAID, Disk Cache.File Management: Concepts, File Organization, File Directories, File Sharing, Record Blocking, Allocation methods,Free Space management	

Text Books/ Reference Books:

1. Dhamdhere D., "Systems Programming and Operating Systems", 2nd Edition, 'TMH
2. Operating System Concepts" (10th Edition, 2018) by Abraham Silberschatz, Peter B. Galvin, Greg Gagne, Wiley Publication.
3. Modern Operating Systems" (4th Edition, 2014) by Andrew S. Tanenbaum, Pearson Publication
4. Operating Systems: Internals and Design Principles" (9th Edition, 2017) by William Stallings, Pearson Publication
5. Linux Operating System" (1st Edition, 2019) by Kaiwan N. Billimoria, Packt Publishing
6. **Real-Time Systems"** (2nd Edition, 2000) by Jane W. S. Liu, Prentice Hall Publication
7. **VxWorks Real-Time Operating System"** by William Stallings, Pearson Publication
8. **File Systems: Design and Implementation"** (1st Edition, 2001) by S. V. Subrahmanya , Pearson Publication
9. **Understanding the Linux Kernel"** (3rd Edition, 2005) by Daniel P. Bovet and Marco Cesati, O'Reilly Media Publication.

Bharati Vidyapeeth
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B. Tech Sem VI: Electronics & Telecommunication Engineering **Subject: Digital Control System (PEC 1)**		
Teaching Scheme:	**Examination Scheme:**	**Credits Allotted:**
Theory: 03	End Semester Examination: 60 Marks	Credits: 3
Practical: 00	Continuous Assessment: 40 Marks	
Tutorial: 00	TW: 00	Credit: 0
	Oral: 00	Credit: 0
	Practical: 00	Total Credit: 03

Course Pre-requisites: Signals & Systems, Control Systems

Course Outcomes: After learning this course students will be able to

1	Describe z-domain description of digital control systems
2	Model the digital control devices and systems
3	Design the digital control algorithms with root locus and frequency plots
4	Analyze the state variables of digital control systems
5	Introduce neural networks for control
6	Describe fuzzy control concepts and design fuzzy logic controller

UNIT – I	**Introduction to digital controls systems**	**(06 Hours)**
	Review of digital control system, sampling as impulse modulation, sampled spectra, aliasing, filtering, choice of sampling rate, discretization. Stability on the z-plane and the Jury stability, z-domain description of sampled continuous- time plants, z-domain description of systems with dead time	
UNIT – II	**Models of Digital Control Devices and Systems**	**(06 Hours)**
	Implementation of digital controllers, tunable PID controller, digital temperature control systems, digital position control system, digital position control system, stepping motors and their control, PLC	
UNIT – III	**Design of Digital Control Algorithms**	**(06 Hours)**

	Introduction, z-plane specifications of control system design, digital compensator design using frequency plots, digital compensator design using root locus, z-plane synthesis	
UNIT -IV	**State variable Analysis of Digital Control System**	**(06 Hours)**
	Introduction, state descriptions of digital processors, state descriptions of sampled continuous time plants, state descriptions of systems with dead time, solution of state difference equations, controllability and observability, multivariable systems	
UNIT -V	**Fundamentals of fuzzy**	**(06 Hours)**
	Introduction, fuzzy quantification of knowledge fuzzy logic, fuzzy operations, fuzzy relations	
UNIT -VI	**Fuzzy Control**	**(06 Hours)**
	Introduction, Fuzzy inference, Mamdani rules, Design of fuzzy logic controller, examples, introduction to genetic algorithm	

Text Books/ Reference Books:

1. 'Digital Control and State Variable Methods' by M Gopal, 2nd Edition, TMH publication
2. 'Neural Networks for Control' by W. Thomas Miller, Richard S. Sutton, Paul J. Werbos, MIT press

Programme: B. Tech. (Common for All) Sem –VI (2023 course)

COURSE: PROFESSIONAL SKILLS		
Teaching Scheme:	**Examination Scheme:**	**Credits:**
Practical:- 2 Hours/ Week	Semester End Examination: 00 Term work Internal Assessment: 25 Marks	Credits:1

Course Pre-requisites: The students should have knowledge of	
1	Basic mathematical concepts, reasoning skills, and comprehension abilities.
2	Fundamentals of communication processes and soft skills.
3	Basic understanding of leadership qualities, ethics, etiquettes, and values.
Course Objective:	
	This course is structured to provide students with a well-rounded foundation in quantitative aptitude, logical and verbal reasoning, professional communication, employment skills, leadership development, and business ethics. By integrating these components, students will be better equipped to excel in recruitment processes and succeed in their professional careers.
Course Outcomes: The student will be able to	
1	Apply shortcut techniques to solve quantitative aptitude questions efficiently in recruitment and competitive exams.
2	Utilize logical reasoning methods and mnemonics to enhance problem-solving skills in placement tests.
3	Improve verbal communication skills, including vocabulary, sentence patterns, and reading comprehension, for effective professional interactions.
4	Develop proficiency in job application writing, resume building, and interview skills to enhance employability..
5	Understand and apply soft skills, leadership qualities, and professional ethics in the workplace.
6	Demonstrate appropriate corporate etiquette, business ethics, and values in professional settings.

Course Content:

Unit-I	• **QUANTITATIVE APTITUDE** : • Number System, Percentage, Profit and Loss, Simple & Compound Interest • Ratio, Proportion, and Average • Mixture and Allegation • Time, Speed & Distance, Time & Work • Permutation & Combination, Probability • Pipes and Cisterns	**(4 Hours)**

Unit-II	**LOGICAL REASONING :** • Coding-Decoding, Number Series, Blood Relation, Directions • Cubes & Dices, Data Interpretation, Data Sufficiency • Set Theory & Syllogisms, Matching, Selection & Arrangement • Clocks & Calendars, Visual Reasoning • Input-Output & Flow Charts	**(4 Hours)**
Unit-III	**VERBAL REASONING:** • Sentence Patterns, Sentence Correction, Spotting Errors • Vocabulary, Antonyms & Synonyms, Analogy • Phrasal Verbs, Idiomatic Expressions • Reading Comprehension, Cloze Test • Sentence Rearrangement and Theme Detection	**(4 Hours)**
Unit-IV	**HONING EMPLOYBILITY AND PRESENTATION SKILLS:** • Job Application Letters: Layout, Structure, Covering Letter • Resume & CV Building: Structure, Effective Writing Tips • Group Discussion: Skills, Strategies, and Evaluation • Interview Skills: Telephonic & Face-to-Face Interviews • Body Language, Grooming & Etiquette for GD & PI • Extempore Speaking Techniques • Presentation Skills: Structure, Layout, Flow, and PPT Creation	**(4 Hours)**
Unit-V	**SOFT SKILLS AND LEADERSHIP DEVELOPMENT:** • Soft Skills: Definition, Importance, and Differences from Hard Skills • Life Skills & Personal Development • Team Building & Conflict Resolution • Problem-Solving, Time & Stress Management • Pareto Principle (80/20 Rule), Time Management Matrix • Leadership Skills: Importance, Types, Attributes of a Good Leader • Motivational Theories and Emotional Intelligence in Professional Life	**(4 Hours)**
Unit-VI	**BUSINESS ETHICS ,ETIQUETTES AND VALUES:** • Ethics & Values in the Business World • Respect for Individuality and Workplace Diversity • Key Features of Corporate Etiquette • Corporate Grooming & Dressing • Social & Office Etiquette • Importance of Professional Behavior in the Workplace • Corporate Social Responsibility (CSR): Need and Importance .	**(4 Hours)**
Reference Books:		

1	Quantitative Aptitude by R. S. Agarwal published by S. Chand
2	The Book of Numbers by Shakuntala Devi
3	A Modern Approach To Logical Reasoning by R. S. Agarwal published by S. Chand
4	A New Approach to Reasoning Verbal & Non-Verbal by Indu Sijwali
5	Business Communication by Meenakshi Raman, Prakash Singh published by Oxford University press, second edition
6	Communication Skills by Sanjay Kumar, Pushp Lata, published by Oxford University press, second edition
7	Technical Communication by Meenakshi Raman, Sangeeta Sharma published by Oxford University press
8	Developing Communication Skills by Krishna Mohan, Meera Banerji published by Macmillan India Pvt Ltd
9	Soft Skills by Meenkashi Raman, published by Cengage publishers
10	Soft Skills by Dr. K Alex published by Oxford University press
11	Soft skills for Managers by Dr. T. Kalyana Chakravarthi and Dr. T. Latha Chakravarthi published by biztantra

Term Work Assignments

Unit-I: QUANTITATIVE APTITUDE

1. Solve 20 practice problems on Number System, Percentage, and Profit & Loss.
2. Create a comparative analysis of Simple Interest vs. Compound Interest with real-world examples.

Unit-II: LOGICAL REASONING

1. Solve a set of logical reasoning problems covering Coding-Decoding, Blood Relations, and Directions.
2. Prepare a case study on how logical reasoning skills are used in competitive exams and corporate assessments.

Unit-III: VERBAL REASONING

1. Identify and correct errors in 10 sentences focusing on sentence structure and grammatical mistakes.
2. Develop a vocabulary list with antonyms, synonyms, and phrasal verbs commonly used in professional settings.

Unit-IV: HONING EMPLOYABILITY AND PRESENTATION SKILLS

1. Draft a job application letter along with a structured resume tailored for a technical position.
2. Participate in a mock group discussion and receive peer and instructor feedback.
3. Conduct a mock interview (telephonic & face-to-face) and submit an evaluation report

Unit-V: SOFT SKILLS AND LEADERSHIP DEVELOPMENT (Term Work Assignments)

1. Conduct a self-assessment on personal soft skills and identify areas for improvement.
2. Develop a time management plan using the Pareto Principle (80/20 Rule) and Time Management Matrix.
3. Prepare a report on different leadership styles and their impact in the corporate world.

Unit-VI: BUSINESS ETHICS, ETIQUETTES, AND VALUES

1. Write a report on corporate ethics and how companies implement ethical policies.
2. Conduct a role-play activity demonstrating appropriate corporate etiquette in business interactions.
3. Prepare a presentation on the significance of Corporate Social Responsibility (CSR).

Bharati Vidyapeeth
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B. Tech Sem VI: Electronics & Telecommunication Engineering
COURSE: MINI-PROJECT

Teaching Scheme:	**Examination Scheme:**	**Credits Allotted:**
Theory: 00	End Semester Examination:	Credits: 00
Practical: 02	Continuous Assessment:	
Tutorial: 00	TW: 25 Marks	Credit: 00
	Oral: 25 Marks	Credit: 01
	Practical: 00	Total Credit: 01

Course Pre-requisites: EDATP, PCB Workshop, Integrated Circuits and Applications, Microcontroller Programming, Embedded Systems

Course Outcomes: After learning this course students will be able to

1	Design PCB artwork
2	Implement electronic hardware
3	Test and trouble-shoot the implemented hardware
4	Design the enclosure and front panel for the implemented hardware
5	Plan the budget for the project
6	Plan and execute an electronic project as a teamwork

Syllabus

Domains for projects may be from among the following, but **not** limited to:

- Instrumentation and Control Systems
- Electronic Communication systems
- Biomedical Electronics
- Power Electronics
- Audio , Video Systems
- Embedded systems
- Mechatronic systems
- FPGA based system

Guidelines

- Project group shall consist of not more than three students per group

- Project design ideas can be adapted from authentic sources like electronic design magazines (Everyday Electronics/Elektor Electronics/Electronics for you/Circuit cellar/ Nuts &Volts)
- Application notes from component manufacturers may also be consulted.
- Hardware component is mandatory.
- Layout versus schematic verification is mandatory.

Project Report

A project report with following contents shall be prepared:

1. Title
2. Specifications
3. Block diagram
4. Circuit diagram
5. Component selection
6. Simulation results
7. PCB artwork
8. Layout versus schematic verification report
9. Testing procedures
10. Enclosure design
11. Test results
12. Conclusion

Assessment:

Assessed via rubrics

Rubrics for Mini-Project:

Criterion	A	B	C	D	E
1. Understanding of Concepts & Needs	Demonstrates minimal grasp of electronics fundamentals and project requirements; unclear problem definition.	Shows partial understanding of concepts, but analysis is superficial; problem definition is incomplete.	Applies fundamental principles with reasonable clarity; identifies most requirements with minor omissions.	Exhibits strong grasp of theory, thorough analysis of requirements; minor gaps in depth or detail.	Displays comprehensive understanding of electronics/engineering fundamentals and systematically addresses all requirements.
2. Design & Implementation	Provides rudimentary or incomplete designs; no coherent PCB or enclosure approach; major deficiencies in implementation.	Develops basic design with some functionality; schematic or PCB is partially correct; limited enclosure or front-panel work.	Shows clear design approach; PCB and enclosure are functional with a few improvements needed; overall solution workable.	Produces an efficient, well-organized PCB and enclosure design; implements hardware effectively with only minor refinements.	Delivers a robust, optimized design solution (PCB, enclosure, etc.) with professional-grade implementation and attention to detail.
3. Testing & Analysis	Little to no testing performed; troubleshooting relies on guesswork.	Conducts minimal or ad-hoc testing; identifies some issues, but diagnosis is not systematic.	Performs structured testing with standard instruments/software; resolves most issues reasonably.	Deploys thorough testing plans, uses appropriate instruments; solves complex issues with systematic	Demonstrates advanced testing protocols, systematically documents results; interprets data meticulously to refine final solution.

				troubleshooting.	
4. Budget & Project Management	No clear budget planning; project milestones or deliverables not tracked.	Basic budgeting done but lacks detail; project management is sporadic or reactive.	Budgeting is reasonably accurate; basic schedule and milestones are managed; occasional delays or shortfalls.	Presents a detailed, realistic budget with documented trade-offs; effective scheduling, mostly meets deadlines.	Optimizes budget allocation with professional cost–benefit insight; demonstrates exemplary project planning and on-time deliverables.
5. Communication & Teamwork	Little collaboration or coordination; minimal documentation; ineffective or unclear communication.	Limited team interaction; documentation is incomplete or unclear in places; communication partially effective.	Acceptable teamwork, with shared responsibilities; documentation covers main points; communication generally clear.	Strong team synergy; well-structured documentation and consistent communication; timely resolution of conflicts.	Exceptional collaboration; comprehensive documentation; professional presentations; all team members contribute significantly and coherently.

Name of candidate:							
PRN:			**A× 2**	**B× 2**	**C× 2**	**D× 2**	**E× 2**
Exam Seat No:							
Day & Date:		**Total Score:**					
Examiner 1 (Name & Signature)		**Examiner 2 (Name & Signature)**					

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B. Tech. (E & Tc)
Value Added Course - Introduction to MATLAB

Teaching Scheme:	**Examination Scheme:**	**Credits Allotted:**
Theory: 02	End Semester Examination:	Credits: 02
Practical: 00	Internal Assessment: 100 Marks	
Tutorial: 00		
		Total Credit: 02

Course Outcomes: After learning this course students will be able to

1	Apply the basic concept of MATLAB programming.
2	Use basic commands, variables and operators in programming.
3	Use vectors, arrays and strings in programming.
4	Apply knowledge of conditional statements, loops, and functions in programming.
5	Use different operations of Matrices in programming.
6	Design different models using MATLAB Simulink.

UNIT – I	**Introduction to MATLAB**	**(04 Hours)**
	- Introduction to MATLAB software. - MATLAB windows. - Types of program files- scripts and function files. - MATLAB toolbox.	
UNIT –II	**Commands, Variables and Operators**	**(04 Hours)**
	- Basic commands: for managing a session, input and output commands, plotting commands. - Variables: assigning variables, special variables, constants, use of semicolon. - Operators: arithmetic operators, relational operators, logical operators, bitwise operations and set operations on scalar data.	
UNIT -III	**Vectors, Arrays and Strings**	**(04 Hours)**
	- Vectors: row vectors, column vectors, referencing the elements of a vector, vector operations-addition, subtraction, transpose, dot product, appending and magnitude of a vector. - Arrays-array functions, special arrays, accessing data in cell	

	arrays. - Strings.	
UNIT -IV	**Conditional Statements, Loops and Functions**	**(04 Hours)**
	- Decision making within a program: if statement, if-else statement, nested if statement, switch statement, break statement and continue statement. - Loops: while loop, for loop, nested loop. - Function: local functions, nested functions and anonymous functions.	
UNIT -V	**Operations on Matrix**	**(04 Hours)**
	- Matrix Operations: Creating rows and columns of matrix, referencing the elements of a matrix, deleting a row or a column in a matrix, addition and subtraction of matrices, division of matrices. - Transpose of a matrix, concatenating matrices, matrix multiplication, determinant of a matrix, inverse of a matrix.	
UNIT -VI	**MATLAB Simulink**	**(04 Hours)**
	- Introduction of Simulink, Simulink environment & interface. - Study of Simulink library. - Building models- circuit oriented design and equation oriented design. - Applications.	

Reference Books:

1. MATLAB for Beginners-A Gentle Approach, Peter I. Kattan, 2010, Research Gate publication
2. Getting started with MATLAB, Rudra Pratap, 2010, Oxford university press.
3. Introduction to MATLAB for Engineers, William J.Palm, 3rd Edition, McGraw-Hill Education.

Assessment method :

The internal assess ent worth 100 marks is distributed as follows:

(a) three assignments, each worth 20 marks, and

(b) two case studies, presentations, or quizzes, each worth 20 marks. *

* The subject teachers have the flexibility to choose between conducting two case studies, two presentations, two quizzes, or any combination thereof.