Department: Electronics and Computer Engineering
Class: : Final Year B. Tech

Rev: Course Structure/01/NEP/2023-24
Semester: VII

Course Code	Cours Type	Course	Teaching Scheme				Evaluation Scheme					Credits
			L	T	P	Total Hrs	CA1	CA2	MSE	ESE	Total	
23EC4701	PCC	VLSI Design	3	-	-	3	10	10	30	50	100	3
23EC4702	PCC	Computer Network and Security	3	-	-	3	10	10	30	50	100	3
23EC4703	PEC	Program Elective Course -III	3	-	-	3	10	10	30	50	100	3
23EC4704	PEC	Program Elective Course -IV	3	-	-	3	10	10	30	50	100	3
23ECMDXX	MDM	Multidisciplinary Minor –V	3	-	-	3	10	10	30	50	100	3
23EC4705	PCC	VLSI Design Laboratory	-	-	2	2	15	15	-	20	50	1
23EC4706	PCC	Computer Network and Security Laboratory	-	-	2	2	15	15	-	20	50	1
23EC4707	RM	Research Methodology	3	-	-	3	10	10	30	50	100	3
23EC4708	RM	Seminar	-	-	2	2	-		-	50	50	1
23EC4709	PROJ	Capstone Project - II	-	-	4	4	25	25	-	50	100	2
23EC4710	VEC	Values and Ethics	1	-	-	1	25	25	-	-	50	Audit
Total			**19**	**-**	**10**	**29**	**140**	**140**	**180**	**440**	**900**	**23**

Biomedical Engineering (Basket A)	Data Science (Basket B)	Industrial Automation (Basket C)
Medical Image Processing (23ECMDA5)	Advanced Data Visualization (23ECMDB5)	Industrial Automation and Control (23ECMDC5)

Program Elective Course -III	Program Elective Course -IV
Digital Image Processing	Real Time Operating System
Cloud Computing	Microwave Engineering
Satellite Communication	Block Chain Management

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VLSI Design

23EC4701	PCC	VLSI Design	3-0-0	3 Credits

Teaching Scheme:	**Evaluation Scheme:**
Lectures: 3Hrs/Week	CA-I:10Marks CA-II:10Marks Mid Semester Exam: 30Marks End Semester Exam: 50Marks

Pre-requisites: Fundamentals of Digital circuits

Course Outcomes: At the end of the course, students will be able to:

CO1	Explain VLSI Design flow, VHDL features, attributes, operators.
CO2	Design combinational logic circuits using VHDL.
CO3	Design sequential circuits like counter, serial adder, sequence detector
CO4	Make use of verilog features to design adder, decode, encoder, mux
CO5	Explain basics of MOS transistor theory
CO6	Explain basics of PLD architecture, testing and fault-finding methods

Course Contents:

Unit 1: Introduction to VHDL Need of HDL, VLSI Design flow, Levels of abstraction Features and capabilities of VHDL, Elements of VHDL, data objects, data types, operators, attributes	[6]
Unit 2: Combinational logic design using VHDL Concurrent statements, Adder, Subtractor, decoder, encoder, tri state buffer, multiplexer, parity generator, parity checker, comparator, barallel shifter	[6]
Unit 3: FSM Design Using VHDL Impediments to synchronous design, clock jitter, skew, gating the clock, asynchronous inputs, meta-stability and synchronizer failure. VHDL implementation of counter, shift register, LFSR, Serial adder. Bus arbiter, sequence detector	[6]
Unit 4: Introduction to Verilog Basic verilog naming conventions, verilog operators, data types, assignment statements, control statements, behavioral modeling in verilog HDL, combinational logic design using verilog.	[6]
Unit 5: MOS Transistor theory Physical structure of MOS transistor, MOS transistor under static conditions, Introduction to CMOS inverter and its V-I characteristics.	[6]
Unit 6: PLD Architectures and Testing Basic architecture of Xillnx 9500 series CPLD (XC9572), Spartan II FPGA (XC3s400) Testing: Fault models, path sensitizing, random test, design for testability, Built-in self test and Boundary scan.	[6]

Text Books:

1. Volnei A. Pedroni,"Circuit Design with VHDL",thirdedition,MIT press
2. Douglas Perry, "VHDL", Tata MC-Graw Hill
3. Verilog HDL A Guide To Digital Design And Synthesis, Edition: 2 by Samir Palnitkar
4. J. Bhasker, "A VHDL Primmer", Prentice Hall PTR, 1999
5. A. AnandKumar,"Fundamentals of Digital Circuits",secondedition,PHI

Reference Books:

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1. Stephen Brown and ZvonkoVranesic "Fundamentals of Digital Logic with VHDL design", Tata- McGraw Hill
2. D. A. Pucknell and K. Eshraghian, "Basic VLSI Design", Prentice Hall India, 3rd Edition,2003

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Computer Network and Security

23EC4702	PCC	Computer Network and Security	3-0-0	3 Credits

Teaching Scheme:	**Evaluation Scheme:**
Lectures: 3Hrs/Week	CA-I:10Marks CA-II:10Marks Mid Semester Exam: 30Marks End Semester Exam: 50Marks

Pre-requisites: Basic Communication System.

Course Outcomes: At the end of the course, students will be able to:

CO1	Summarize fundamentals of computer communication network.
CO2	Explain the Data link layer with Multiple access concept.
CO3	Explain the network layer with routing technique and IPv6 address.
CO4	Illustrate the Transport layer concepts in computer Network.
CO5	Explain the application layer with its concept and technique used in computer network.
CO6	Outline the various network security techniques used in computer networking.

Course Contents:

Unit 1: Introduction to Local Area Networks Data Communication, Networks, OSI Model, TCP/IP Protocol Suit, Wired LAN: Standard Ethernet, Fast Ethernet (100 MBPS), Gigabit Ethernet, 10 Gigabit Ethernet. Wireless LAN: Introduction, IEEE 802.11.	[6]
Unit 2: Data link Layer Error detection and correction- Types of Errors, detection versus correction, Forward error correction versus retransmission Block coding, Error detection, Error correction, Multiple Access:- Aloha, CSMA, CSMA/CD, CSMA/CA.	[6]
Unit 3: Network Layer Introduction, Network-Layer Services, Packet Switching, IPv4 Addresses, Network Layer Protocols: Internet Protocol (IP), Routing Algorithms, Next Generation IP:-IPv6 Addressing.	[6]
Unit 4: Transport Layer Introduction to Transport Layer, Process to Process Delivery, User Datagram Protocol, Transmission Control Protocol, SCTP.	[6]
Unit 5: Application Layer Introduction to Application Layer, Standard Client Server Protocols: World Wide Web and HTTP, FTP, Electronic Mail, DNS. Network Management: Introduction, SNMP.	[6]
Unit 6: Network Security Cryptography: Introduction, Symmetric Cryptography, Asymmetric Cryptography, Network Security: Introduction, Message Confidentiality. Message Integrity, Message Authentication, IPSec, Firewalls.	[6]

Text Books:

1. Behrouz A. Forouzan, "Data Communications and Networkingl MacGraw Hill, 5th edition
2. James F. Kurouse & W. Rouse, —Computer Networking: A Topdown Approachl, 6thEdition, Pearson Education.

Reference Books:

1. Andrew S. Tannenbaum, —Computer Networksl, Pearson Education, Fourth Edition,2003
2. Wayne Tomasi, —Introduction to Data Communication and Networkingl, 1/e, Pearson Education

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3. Natalia Olifer, Victor Olifer, —Computer Networksl Wiley Student Edition.

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Program Elective Course -III
Digital Image Processing

23EC4703A	PEC	Digital Image Processing	3-0-0	3 Credits

Teaching Scheme:	Evaluation Scheme:
Lectures: 3Hrs/Week	CA-I:10Marks CA-II:10Marks Mid Semester Exam: 30Marks End Semester Exam: 50Marks

Pre-requisites: Introduction to Digital Signal Processing

Course Outcomes: At the end of the course, students will be able to:

CO1	List fundamental steps involved in Digital Image Processing & Perform operations on color image processing.
CO2	Apply different image transforms for image enhancement.
CO3	Apply different filtering techniques on an image.
CO4	Identify and design image processing techniques for object segmentation and recognition.
CO5	Apply 2-D data compression techniques for digital images
CO6	Analyze and solve image restoration problems.

Course Contents:

Unit 1: Digital Image Fundamentals Fundamentals steps in DIP, components of image processing system, Elements of visual perception, image sensing and acquisition, Image sampling and quantization, basic relations between pixels, Color fundamentals, color models, Full color image processing, color transformations.	[6]
Unit 2: Image Transform Basic intensity transformation: image negation, Log transformation, power law transformation, Piecewise linear transformation functions, arithmetic and Logic operation, Histogram processing (equalization and matching).	[6]
Unit 3: Image filtering Fundamentals of spatial filtering, Smoothening in spatial domain, sharpening in spatial domain, Smoothening in frequency domain, Sharpening in frequency domain.	[6]
Unit 4: Image segmentation **Detection of discontinuities:** Point detection, line detection, edge detection, Global and adaptive Thresholding, Region based segmentation (region growing, region splitting and merging), **Morphology:** Dilation & erosion, Opening and closing operation, Hit- or –miss transformation Basic morphological algorithms: Boundary extraction, region filling, Thinning and thickening, skeletons.	[6]
Unit 5: Image Compression Fundamentals, Coding redundancy, fidelity criteria. Image compression model, lossless predictive coding, Lossy predictive coding, Image compression standards JPEG and JPEG 2000.	[6]
Unit 6: Image Restoration A model of the Image Degradation / Restoration process, Noise Models, Restoration in the Presence of Noise only-spatial filtering, Minimum Mean square Error (Wiener) filtering, Geometric Mean Filter, Geometric Transformations	[6]

Text Books:

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1.Digital image processing: Rafael C Gonzalez, Richard E. Woods: Pearson Publication Image
2.Iain E. G. Richardson, —H.264 and MPEG
3.Digital image processing and Analysis- B. Chanda, D. Datta, majnudar.
4.Fundamentals of digital Image Processing- Anil K.Jain.

Reference Books:
1.A. K. Jain, Fundamentals of digital image processing, Prentice Hall of India, 1989.
2.Pratt William K. "Digital Image Processing", John Wiley & sons
3.Digital image processing- S. Jayraman, S Esakkiarajan ,Veerakumar:MGH

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Cloud Computing

23EC4703B	PEC	Cloud Computing	3-0-0	3 Credits

Teaching Scheme:	**Evaluation Scheme:**
Lectures: 3Hrs/Week	CA-I:10Marks CA-II:10Marks Mid Semester Exam: 30Marks End Semester Exam: 50Marks

Pre-requisites: Basics of networking and different Types of cloud.

Course Outcomes: At the end of the course, students will be able to:

CO1	Explain Cloud Services.
CO2	Illustrate the Architecture of cloud computing.
CO3	Classify cloud services use and its storage.
CO4	Explain cloud Security
CO5	Explain the administration and risk factor of cloud computing.
CO6	Identify cloud Adoption services

Course Contents:

Unit 1: Introduction to Cloud Computing Introduction, Evolution of cloud computing, Components of cloud computing, computing services delivery models, Parallel v/s distributed computing, Cloud Characteristics Virtualization Introduction and benefits, Implementation levels of Virtualization, Virtualization structure, Virtualization of CPU	[6]
Unit 2: Cloud Computing Architecture Cloud Architecture, NIST Cloud Computing Reference Architecture, Public Private and Hybrid Clouds-IOT Services, Architectural Design Challenges, private versus hybrid cloud.	[6]
Unit 3: Cloud services and storage Services mechanism–Iaas , Paas ,SaaS, Database as a service (DBaas), benefits to Cloud adoption among users and providers, Cloud Storage, Storage-as-a-Service, Advantages of Cloud Storage	[6]
Unit 4: Cloud development and security Factors for cloud implementation, Cloud network topologies, automation in cloud development, Cloud security framework, cloud performance and Monitoring, host security for Saas, host security IaaS, data security threats, cloud data challenges and security. Single sign- on for clouds, SAML	[6]
Unit 5: Administration for cloud and Risk factor The AAA model, risk in cloud computing, risk assessment and management, Risk of failure and inadequate SLA, risk in physical infrastructure, risk with Software and application licensing. IAM Budget , subscription.	[6]
Unit 6: Adoption of cloud Cloud migration services –Database server application, Cloud adoption framework- Adoption journey, strategy, plan, ready, adopt, manage, sequence, organize, case study, examples.	[6]

Text Books:

1. Kailash Jayaswal, Jagannath kallakurchi, Donald j. houde, Dr. deven shah- DT Editorial services "Cloud Computing "2015
2. Rajkumar Buyya, Christian Vecchiola , S .ThamaraiSelvi,—Mastering Cloud Computingl, Tata Mcgraw Hill, 2013.

Reference Books:

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1. Toby Velte, Anthony Velte, Robert Elsenpeter,"Cloud Computing-A Practical Approachl, Tata Mc graw Hill, 2009.
2. GeorgeReese,"Cloud Application Architectures:Building Applications and Infrastructure in the Cloud: TransactionalSystemsforEC2and Beyond (TheoryinPractice), O'Reilly, 2009.

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Satellite Communication

23EC4703C	PEC	Satellite Communication	3-0-0	3 Credits

Teaching Scheme:	**Evaluation Scheme:**
Lectures: 3Hrs/Week	CA-I:10Marks CA-II:10Marks Mid Semester Exam: 30Marks End Semester Exam: 50Marks

Pre-requisites: Analog Communication & Digital Communication.

Course Outcomes: At the end of the course, students will be able to:

CO1	Explain Orbital aspects involved in satellite communication.
CO2	Illustrate various satellite subsystems.
CO3	Explain and Analyze Link budget calculation.
CO4	Compare Satellite Network System.
CO5	Explain NonGeostationary Satellite Systems.
CO6	Summarize modern applications of Satellite.

Course Contents:

Unit 1: Introduction of satellite communication Introduction, basic concept of satellite communication, Orbital Mechanics, Lookangle determination, Orbital perturbation, Orbital determination Launchers and Launch vehicles, Orbital effects in communication system performance.	[6]
Unit 2: Satellite Subsystem Introduction, Attitude and control system (AOCS),Telemetry, Tracking, Command and Monitoring, Power systems, Communication subsystem, Satellite antennas, Equipment reliability and space qualification.	[6]
Unit 3: Satellite Link Design Introduction, Basic transmission Theory, System Noise Temperature and G/T Ration, Design of Downlinks, Uplink Design, Design of specified C/N: Combining C/N and C/I values in Satellite Links.	[6]
Unit 4: Satellite Networks Reference architecture for satellite networks, basic characteristics of satellite networks, On-board connectivity with transparent processing, analogue transparent switching, On board connectivity with beam scanning.	[6]
Unit 5: Low Earth Orbit and Non -Geo-Stationary Satellite System Introduction, Orbit considerations, Coverage and Frequency Consideration, Delay and Throughput Consideration, Operational NGSO constellation design: Iridium, Teledesic.	[6]
Unit 6: Satellite Application Communication Satellite-Digital DBS TV, Satellite Radio Broadcasting, Navigation Satellite, GPS Position Location Principles, GPS Receivers and codes.	[6]

Text Books:

1. Satellite Communications-Timothy Pratt, Charles Bostian, Jeremy Allnut John Wiley &Sons (II Edition).
2. Satellite Communications-Anil k. Maine and Varsha Agaraval, Wiley Publications.
3. Satellite Technology Principles and Applications Anil K. Maini and Varsha Agarawal, Wiley Publications, Third Edition.

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4. Satellite Communication Engineering- Wilbur L. Pritchand, Robert A Nelson and Henri G.Suyderhoud, 2nd Edition, Pearson Publications.

Reference Books:

1. Satellite Communications- Dennis Roody McGraw Hill Fourth Edition.
2. Satellite Communications- Gerard Maral and Michel Bousquet, Wiley Publication (5th Edition).
3. Satellite Communications systems Engineering, 2nd edition- Wilbur L. Pritchard, Henri G. Suyderhoud and Robert A. Nelson.

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Program Elective Course -IV

23EC4704A	PEC	Real Time Operating System	3-0-0	3 Credits

Teaching Scheme:	**Evaluation Scheme:**
Lectures: 3Hrs/Week	CA-I:10Marks CA-II:10Marks Mid Semester Exam: 30Marks End Semester Exam: 50Marks

Pre-requisites: Digital Electronics.

Course Outcomes: At the end of the course, students will be able to:

CO1	Explain the key components and structure of RTOS.
CO2	Design task scheduling and synchronization mechanisms.
CO3	Develop embedded applications using RTOS APIs
CO4	Demonstrate proficiency in debugging and resource optimization in real-time systems.

Course Contents:

Unit 1: Introduction Introduction to UNIX/LINUX, Overview of Commands, File I/O,(open, create, close, lseek, read,write), Process Control (fork, vfork, exit, wait, waitpid, exec.	[6]
Unit 2: Real Time Operating Systems Brief History of OS, Defining RTOS, The Scheduler, Objects, Services, Characteristics of RTOS, Defining a Task, asks States and Scheduling, Task Operations, Structure, Synchronization, Communication and Concurrency. Defining Semaphores, Operations and Use, Defining Message Queue, States, Content, Storage, Operations and Use.	[6]
Unit 3: Objects, Services and I/O Pipes, Event Registers, Signals, Other Building Blocks, Component Configuration, Basic I/O Concepts, I/O Subsystem.	[6]
Unit 4: Exceptions, Interrupts and Timers Exceptions, Interrupts, Applications, Processing of Exceptions and Spurious Interrupts, Real Time Clocks, Programmable Timers, Timer Interrupt Service Routines (ISR), Soft Timers, Operations.	[6]
Unit 5: Memory & Resource Management Static vs dynamic memory allocation, Memory fragmentation and heap management, Resource locking and deadlock resolution, Device drivers and I/O in RTOS.	[6]
Unit 6: RTOS-Based Application Development Case study: Real-time embedded application using FreeRTOS / VxWorks / RTX Porting RTOS to ARM Cortex-M, RTOS in IoT/Edge systems, Debugging and performance monitoring tools.	[6]

Text Books:

1. Real Time Concepts for Embedded Systems – Qing Li, Elsevier, 2011.

Reference Books:

1. Embedded Systems- Architecture, Programming and Design by Rajkamal, 2007, TMH.
2. Advanced UNIX Programming, Richard Stevens
3. Embedded Linux: Hardware, Software and Interfacing – Dr. Craig Hollabaugh

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Microwave Engineering

23EC4704B	PEC	Microwave Engineering	3-0-0	3 Credits

Teaching Scheme:	**Evaluation Scheme:**
Lectures: 3Hrs/Week	CA-I:10Marks CA-II:10Marks Mid Semester Exam: 30Marks End Semester Exam: 50Marks

Pre-requisites: Good knowledge of Engineering Fundamentals of Physics and Electromagnetic.

Course Outcomes: At the end of the course, students will be able to:

CO1	Explain the working of the waveguide.
CO2	Select a suitable microwave measurement instrument and perform the necessary measurements.
CO3	Identify the use of microwave components and devices in microwave applications.
CO4	Explain the working principles of all the microwave tubes.
CO5	Illustrate the microwave network analysis.

Course Contents:

Unit 1: Microwave Wave Guides Introduction to Microwave Engineering: History of Microwaves, Microwave Frequency bands. Applications of Microwave, General solution for TEM, TE and TM waves, Parallel plate waveguide, and rectangular waveguide, Wave guide parameters, Introduction to the coaxial line, rectangular waveguide cavity resonators, Circular waveguide cavity resonators.	[6]
Unit 2: Microwave Components Multi-port junctions: Construction and operation of E-plane, H-plane, Magic Tee, and Directional couplers. Ferrites components: - Ferrite Composition and characteristics, Faraday rotation, Construction and operation of Gyrator, Isolator, and Circulator. Striplines: Structural details and applications of strip lines, Microstrip lines, Parallel Strip lines, Coplanar Strip lines, and Shielded Strip Lines.	[6]
Unit 3: Microwave Measurements Measurement devices: Slotted line, Tunable detector, VSWR meter, Power Meter, S-parameter measurement, frequency measurements, Power measurement, Attenuation measurement, Phase shift measurement, VSWR measurement, Impedance measurement, Q of cavity resonator measurement.	[6]
Unit 4: Microwave Tubes: Two cavity Klystron: Construction and principle of operation, velocity modulation, and bunching process, Applegate diagram. Reflex Klystron: Construction and principle of operation, velocity modulation, and bunching process, Applegate diagram, Oscillating modes, o/p characteristics. M-type tubes Magnetron: Construction and Principle of operation of 8 cavity cylindrical traveling wave magnetron, o/p characteristics, Applications. Slow wave devices: Advantages of slow wave devices, Helix TWT: Construction and principle of operation, Applications.	[6]
Unit 5 Microwave Solid State Devices: Varactor Diode, PIN Diode, Schottky Barrier Diode, Tunnel Diode, Gunn Diodes, IMPATT diode, and TRAPATT diode. Structural details, Principles of operation, various modes, specifications, and applications of all these devices.	[6]
Unit 6 Microwave Network Analysis Introduction and applications of Impedance and Equivalent voltages and currents, Impedance and Admittance matrices, The Transmission (ABCD) matrix Scattering Matrix:- Significance,	[6]

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formulation, and properties. S-Matrix calculations for-2 port network junction	

Text Books:

1. Microwave Engineering – Annapurna Das, Sisir K Das TMH Publication, 2nd, 2010
2. Microwave Devices and circuits- Liao / Pearson Education
3. Antennas and Wave Propagation, John D. Krauss, Ronald J Marhefka, and Ahmad S Khan, 4thSpecial Indian Edition, McGraw- Hill Education Pvt. Ltd., 2010.

Reference Books:

1. Microwave Engineering – David M Pozar, John Wiley India Pvt. Ltd., 3rdEdn, 2008
2. Microwave Engineering – Sushrut Das, Oxford Higher Education, 2ndEdn, 2015
3. Antennas and Wave Propagation – Harish and Sachidananda: Oxford University Press, 2007.

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Block Chain Management

23EC4704C	PEC	Block Chain Management	3-0-0	3 Credits

Teaching Scheme:	**Evaluation Scheme:**
Lectures: 3Hrs/Week	CA-I:10Marks CA-II:10Marks Mid Semester Exam: 30Marks End Semester Exam: 50Marks

Pre-requisites: .

Course Outcomes: At the end of the course, students will be able to:

CO1	Explain structure of Blockchain.
CO2	Illustrate Bitcoin Blockchain.
CO3	Explain Ethereum Blockchain.
CO4	Explain Enterprises Blockchain.
CO5	Make use of Ethereum Smart Contracts.
CO6	Summarize Hyperledger Fabric Chaincode.

Course Contents:

Unit 1: Introduction to Blockchain What is Blockchain? The structure of Blockchains, Blockchain applications, The Blockchain life cycle, Consensus: The driving force of blockchains, blockchain in use: current blockchain in uses, future blockchain applications, Blockchain decision tree, Diving into Blockchain Technology.	[6]
Unit 2: Bitcoin Blockchain Introduction to Bitcoin, Creation of coins, payments and double spending, Bitcoin cash, The limitations of Bitcoin, Bitcoin Wallets, Bitcoin Scripts, Bitcoin Attacks, Bitcoin Network, Mining for bitcoins, proof of work, making your first paper wallet	[6]
Unit 3: Ethereum Blockchain Introduction to Ethereum, Swarm and whisper, Remix IDE, Truffle Framework, Ethereum Networks, Ethereum Wallets, Ethereum Clients, Web3.js, NFT, Exploring the Ethereum Mainnet	[6]
Unit 4: Enterprises Blockchain Enterprise Blockchain, cross border payments, know your customer (KYC), dfood security, mortage over blockchain, blockchain enabled trade, we trade-n trade finance network, supply chain financing, identity on blockchain.	[6]
Unit 5: Ethereum Smart Contracts Introduction, Smart Contract Lifecycle, Solidity, Solidit Variables, Solidity Compilation and Deployment Solidity Functions Truffle Security Consideration.	[6]
Unit 6: Hyper ledger Fabric Chaincode Hyperledger fabric- architecture, identities and policies, membership and access control, channels, transaction validation, writing smart contracts using hyperledger fabric, overview of ripple and corda.	[6]

Text Books:

1. Draft version of "S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, 'Blockchain Technology: Cryptocurrency and Applications', Oxford University Press, 2019.
2. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform, 2017.
3. Melanie Swan, "Blockchain: Blueprint for a New Economy", O'Reilly, 2015.

Reference Books:

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1. Daniel Drescher, "Blockchain Basics", Apress; 1st Edition, 2017.
2. Anshul Kaushik, "Blockchain and Crypto Currencies", Khanna Publishing House, Delhi.
3. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O'Dowd, Venkatraman Ramakrishna, "Hands-On Block Chain with Hyperledger: Building Decentralized Applications with Hyperledger Fabric and Composer", Import, 2018.
4. Ritesh Modi, "Solidity Programming Essentials: A Beginner's Guide to Build Smart Contracts for Ethereum and Blockchain", Packt Publishing.

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Multidisciplinary Minor-V

23ECMDA5	MDM	Medical Image Processing	3-0-0	3 Credits

Teaching Scheme:	**Evaluation Scheme:**
Lectures: 3Hrs/Week	CA-I:10Marks CA-II:10Marks Mid Semester Exam: 30Marks End Semester Exam: 50Marks

Pre-requisites: Digital Image Processing, Signal Processing Basics

Course Outcomes: At the end of the course, students will be able to:

CO1	Understand various medical imaging modalities and their digital representation.
CO2	Explain the characteristics and challenges in processing medical images.
CO3	Apply various image enhancement techniques to improve the quality of medical images.
CO4	Implement and evaluate segmentation techniques for isolating regions of interest in medical images.
CO5	Examine meaningful features from medical images for classification and diagnosis.
CO6	Apply image registration and fusion to align and combine medical images from different modalities.

Course Contents:

Unit 1: Introduction to Medical Imaging Introduction to medical image processing, Imaging modalities: X-ray, CT, MRI, PET, Ultrasound, Nuclear imaging, Characteristics of medical images, Digital image representation and formats (DICOM), challenges in medical image analysis.	[6]
Unit 2: Medical Image Enhancement Techniques Noise in medical images, Histogram equalization, Contrast stretching, Filtering: Spatial and frequency domain, Edge enhancement, Adaptive filtering techniques.	[6]
Unit 3: Medical Image Segmentation Thresholding and region-based segmentation, Edge-based segmentation, Clustering-based segmentation (K-means, Fuzzy C-means),active contours and level sets, Evaluation metrics: Dice coefficient, Jaccard index.	[6]
Unit 4: Feature Extraction and Description Texture, shape, intensity, and morphological features, Feature descriptors: SIFT, HOG, LBP, Feature selection and dimensionality reduction (PCA, LDA).	[6]
Unit 5: Image Registration and Fusion Need for image registration, Rigid and non-rigid registration techniques, Intensity-based and feature-based registration, Multi-modal image fusion techniques.	[6]
Unit 6: Classification and AI in Medical Imaging Supervised and unsupervised learning for image classification, Deep learning in medical imaging (CNNs, U-Nets, Applications: Tumor detection, Organ segmentation, Disease diagnosis, Ethical issues and regulatory considerations in medical imaging AI.	[6]

Text Books:

1. J.M. Boone and J.A. Seibert, The Essential Physics of Medical Imaging, Lippincott Williams & Wilkins.
2. Isaac Bankman, Handbook of Medical Image Processing and Analysis, Academic Press.
3. Rafael C. Gonzalez and Richard E. Woods: Digital Image Processing, Pearson (for foundational concepts).

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Reference Books:

1. K. Doi, Computer-Aided Diagnosis in Medical Imaging, World Scientific.
2. Suri et al., Advanced Algorithms for Medical Image Analysis, Wiley.
3. Research papers from IEEE Transactions on Medical Imaging, Medical Image Analysis Journal, etc.

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SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING
Yadrav (Ichalkaranji) Dist.Kolhapur

Advanced Data Visualization

23ECMDB5	MDM	Advanced Data Visualization	3-0-0	3 Credits

Teaching Scheme:	Evaluation Scheme:
Lectures: 3Hrs/Week	CA-I:10Marks CA-II:10Marks Mid Semester Exam: 30Marks End Semester Exam: 50Marks

Pre-requisites: Data Sciences.

Course Outcomes: At the end of the course, students will be able to:

CO1	Extend different types of data sources and create effective charts using data.
CO2	Make use of Data transform techniques for converting unstructured to structured formatted data.
CO3	Build reports using advanced Power BI techniques for effective navigation.
CO4	Demonstrate sharing report on Cloud and access the report by end user easily.

Course Contents:

Unit 1: Introduction to Power BI Fundamentals of visualization with Power BI, Data visualization, and its importance, getting to know extract the data and visualize the chart using data (Line chart, bar chart).	[6]
Unit 2: Data visualizations Data transform techniques for converting unstructured to structured formatted data. Introduction to visualizations and format of each chart for example:- Line chart, Area chart, Column charts, Bar chart, Pie chart, Donut chart, table and matrix visual	[6]
Unit 3: Advanced Power BI Filters (Visual, Page and Report level), Drill through filter, Slicers, Drill up-down, Bookmark.	[6]
Unit 4: Power BI Data model (Relationship between two tables) Cardinalities (One to many, many to one, one to one, Many to Many), Fact and Dim table, Star and snowflake schema.	[6]
Unit 5: DAX formulas Row context and Filter context and their uses, DAX formulas :- SUM, SUMX, Time Intelligent Dax function, USERELATIONSHIP Dax function.	[6]
Unit 6: Power BI service (cloud) Dashboard, Report, Dataset, Workspace and there settings, Roles Admin, Member, Contributor, Viewer), Provide report access to user.	[6]

Text Books:

1. "Tableau Public for Data Visualization" by Ryan Sleeper.
2. "Business Intelligence Analytics and Data Science" by Sharda and Ramesh.

Reference Books:

1. Data Science Fundamentals and Practical Approaches, Nandi, Gypsy.
2. "Programming Skill Data Science", by Freeman and Michael.
3. Mastering Power Query in Power BI and Excel: Learning real-world Power Query and M Techniques for a better data analysis.
4. Data Visualization: Using Power BI, Orange and Excel, by Dr. Shirshendu Roy.

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Industrial Automation and Control

23ECMDC5	MDM	Industrial Automation and Control	3-0-0	3 Credits

Teaching Scheme:	**Evaluation Scheme:**
Lectures: 3Hrs/Week	CA-I:10Marks CA-II:10Marks Mid Semester Exam: 30Marks End Semester Exam: 50Marks

Pre-requisites: PLC

Course Outcomes: At the end of the course, students will be able to:

CO1	Explain the basic concepts and importance of industrial automation systems.
CO2	Identify and apply appropriate sensors and transducers for industrial applications
CO3	Develop ladder logic programs and interface components with PLCs.
CO4	Explain the operation of SCADA and HMI systems for process monitoring and control.
CO5	Implement control strategies and communication protocols for automated systems.
CO6	Describe various industrial actuators, drives, and safety systems used in automation.

Course Contents:

Unit 1: Introduction to Industrial Automation Definition, benefits, and scope of automation, Types of automation: fixed, programmable, flexible, Components of automation systems, Overview of control system hierarchy Introduction to SCADA, DCS, and PLC.	[6]
Unit 2: Sensors and Transducers Introduction to sensors and transducers, Classification: active/passive, analog /digital Industrial sensors: temperature, pressure, proximity, level, flow, etc. Signal conditioning and data acquisition systems, Interfacing sensors with control systems.	[6]
Unit 3: Programmable Logic Controllers (PLCs) Basics of PLCs: architecture and working,I/O modules, memory organization, scan cycle, Ladder logic fundamentals, Timers, counters, and arithmetic operations, Programming and troubleshooting	[6]
Unit 4: Human Machine Interface (HMI) and Supervisory Control Role and architecture of HMI, HMI design considerations, SCADA systems: architecture, functions, applications, Communication protocols: Modbus, Profibus, OPC, Ethernet, Data logging and remote monitoring	[6]
Unit 5: Control Strategies and Industrial Communication ON-OFF, PID control systems in automation, Tuning of PID controllers, Industrial networks: Fieldbus, Device Net, CAN, Wireless automation and IIoT (Industrial Internet of Things), Introduction to Industry 4.0	[6]
Unit 6: Drives, Actuators and Safety Systems Electric drives: AC, DC drives, and servo systems, Pneumatic and hydraulic actuators Safety in automation: emergency stops, interlocks, Introduction to Safety PLCs and safety standards (ISO/IEC), Case studies and applications in industries.	[6]

Text Books:

1. "Industrial Automation and Control" by S.K. Singh – McGraw Hill
2. "Programmable Logic Controllers" by Frank D. Petruzella – McGraw Hill
3. "Automation, Production Systems, and Computer-Integrated Manufacturing" by Mikell P. Groover

Reference Books:

Department of Electronics & Computer Engineering SIT YADRAV

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1."Mechatronics and Measurement Systems" by David G. Alciatore, Michael B. Histand
2."Process Control Instrumentation Technology" by Curtis D. Johnson
3."Industrial Instrumentation and Control" by S.K. Singh

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VLSI Design Laboratory

23EC4705	PCC	VLSI Design Laboratory	0-0-2	1 Credit

Teaching Scheme:	Evaluation Scheme:
Practical: 2Hrs/Week	CA-I:15Marks CA-II:15Marks End Semester Exam: 20Marks

Pre-requisites: Digital logic Design

Course Outcomes: At the end of the course, students will be able to:

CO1	Develop VHDL code for Adder, mux, decoder, encoder, comparator.
CO2	Make use of VHDL statements and operators and FSM design basics to build code for sequential circuits (sequence detector, serial adder, counter)
CO3	Build verilog code for mux, decoder, counter.

Experiment List: Minimum 8 Experiment should be Conducted.

Sr. no.	Experiment Name.
1	Make use of appropriate modelling style and Write VHDL code to verify truth table of Half Adder, Full Adder, Half Subtractor, Full subtractor.
2	Develop VHDL code for decoder, encoder.
3	Build VHDL code to verify truth table of 4:1 ,2:1,8:1 MUX Design 16: 1 mux using 4:1 mux develop VHDL code using structural modeling
4	Develop code for comparator, parity generator, parity checker.
5	Make use of VHDL shift and rotate operators to Develop code for barallel shifter
6	Develop FSM to detect sequence 1010 and write VHDL code
7	Design FSM for serial adder and show simulation using VHDL code
8	Build VHDL code for LFSR, bus arbiter
9	Design Universal Shift Register use load and shift line to control operation to Simulate (SISO, SIPO, PIPO, PISO) modes of operation make use of VHDL structural modelling
10	Design FSM for even and odd counter simulation in VHDL.
11	Develop verilog code to demonstrate behavior of Decoder, encoder, mux
12	Build verilog code to demonstrate counter operation.

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