NOTIFICATION

No.99/2024 Dated : 15 /08/2024

Subject : Implementation of new syllabus of Semester V & VI of B.E. (Industrial IoT) (C.B.C.S.).

It is notified for general information of all concerned that the authorities of the University have accepted to implement the new syllabus **of Semester V & VI of B.E. (Industrial IoT) (C.B.C.S.)** to be implemented from the academic session 2024-2025 onwards as mentioned below.

Sd/-
(Dr.A.M.Asanare)
Registrar
Sant Gadge Baba Amravati University

SYLLABUS of SEMESTER V & VI of B.E. [INDUSTRIAL IOT] [C.B.C.S.]

SEMESTER V

5IIoT01 COMMUNICATION NETWORK

Course Requisite: 1. Communication Systems

Course Objectives:

1. To understand the general principles of network design and compare the different network topologies.
2. To understand the general principles of switching and various routing algorithms.
3. To acquire the knowledge of functions and protocols of OSI and TCP/IP models.
4. To understand security issues in data network.

Course Outcomes:

After successfully completing the course, students will be able to:

1. Identify different types of network devices and their functions within a network.
2. Describe different types of network topologies and protocols.
3. Differentiate the layers of the OSI and TCP/IP model.
4. Understand various types of routing algorithms and concepts of IP addresses.
5. Deal with security issues in data network.

	Subject: Communication Network	**L**
UNIT I	Data Communication Network: A brief history of Internet, Protocols and Standards, Standard Organizations, Need for Protocol Architecture, OSI Reference Model, Overview of TCP/IP architecture, Addresses in TCP/IP. Types of Network: LAN, MAN, WAN. Network connecting Devices: Hubs, Repeater, Bridges, Switches, Routers, Gateways. Network_ Topology: Mesh, Bus, Tree, Ring, Star.	7
UNIT II	Data Link Control Protocols: Need for Flow control, Stop and Wait Flow Control, Sliding Window Flow Control, Stop and wait ARQ, Go-Back-N ARQ, Selective Repeat ARQ, Transmission efficiency of ARQ protocols. Multiple Access Control Protocols: Random Access Techniques: ALOHA, Slotted ALOHA. Contention Techniques: CSMA, CSMA/ CD (IEEE 802.3), CSMA/CA. Controlled Access Techniques: Polling, Token Passing. Medium Access Control Protocols: Token Bus (IEEE 802.4), Token Ring (IEEE802.5).	7
UNIT III	Network Layer Logical Addressing: Network layer Issues, IPV4 addresses, Class full addressing, Classless addressing (Problems expected), IPv4: Datagram, Fragmentation, Checksum, Address Resolution Protocol(ARP), IPv6 addresses, IPv6 Packet format, Comparison between IPv4 and IPv6. Network Layer Routing: Alternate routing in circuit switched network, Fixed Routing, Flooding, and Random Routing in Packet Switched networks	7
UNIT IV	Routing Algorithms and Transport layer: Dijkstra's Algorithm(Problems expected), Bellman FordAlgorithm (Problems expected). Traffic Control: Leaky bucket algorithm, Token bucket algorithm. Transport Layer: User datagram protocol (UDP), Transmission control protocol	7

UNIT V	Application Layer: Name Space, Domain Name System (DNS), Distribution of Name Space, DNS in the Internet, Resolution. Remote Login: TELNET, Electronic Mail: SMTP, POP, FTP, World Wide Web, HTTP	7
UNIT VI	Network Security: Security services, Message confidentiality, Message integrity, Message authentication, Digital Signature, Entity Authentication, Key Management.	7
	Total	42

Text Books:

1. Alberto Leon-Garcia, IndraWidjaja, Communication Networks, McGraw-Hill.
2. B. Forouzan, "Data Communications and Networking", 4th Edition, McGraw-Hill.
3. Andrew S. Tanenbaum and David J. Wetherall, "Computer Networks", 5th Edition, Pearson Educn., Inc.
4. William Stallings, "Data and Computer Communication", 8th Edition, Pearson Education, Inc.

Reference Books:

1. James F. Kuross, Keith W. Ross, "Computer Networking- A Top-Down Approach Featuring the Internet", Third Edition, Addison Wesley, 2004.
2. Nader F. Mir, "Computer and Communication Networks", Pearson Education,2007.
3. Comer, "Computer Networks and Internets with Internet Applications", Fourth Edition, Pearson Education, 2003.

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5IIOT02 MICROCONTROLLERS & APPLICATIONS

Course Pre-requisite: Object Oriented Programming

Course Objectives:

1. To understand microcontroller C Language Programming concepts.
2. To know the importance of different peripheral devices and their interfacing to microcontrollers**.**

Course Outcomes:

After successfully completing the course, students will be able to:

1. Understand architecture, addressing modes and instruction set of Microprocessor 8085.
2. Comprehend the knowledge of architecture of 8051 Microcontroller and understand the functions of each block.
3. Illustrate various addressing modes and instruction set of 8051 Microcontroller and develop basic assembly language programs.
4. Develop assembly language programs for counter/Timers in various modes and understand serial communication along with its operating modes.
5. Develop interfacing mechanism for different peripheral devices with Microcontroller 8051.
6. Understand the architecture of AVR microcontroller along with its internal constituents and demonstrate the knowledge of Memory Paging and Addressing modes of AVR microcontroller

	Subject: Microcontroller and Applications	**L**
UNIT I	**Introduction to Microprocessor 8085:** Architecture and Pin Diagram, Register Structure, Addressing modes, **Interrupts Structure of 8085**.	7
UNIT II	**Introduction to Microcontroller 8051:** Introduction to 8051 microcontroller, Pin diagram, architecture, Ports Structure, memory organization, SFR's, Counters/Timers, Serial port of 8051.	7
UNIT III	**Assembly Language Programming of 8051:** Addressing modes, Instruction set of 8051, Assembly language programming examples.	7
UNIT IV	**Counter/ Timers of 8051:** Counter / timer programming in various modes. Serial communication and its Operating modes.	7
UNIT V	**Interfacing and programming of 8051:** Interfacing and programming of external RAM &ROM, Stepper motor, DC Motor; Architecture, Interfacing and programming of ADC 0808 & DAC 0808.	7
UNIT VI	**Introduction to AVR:** Introduction to AVR, Series of AVR controllers, Architecture of AVR, Types of Memory, Pin Configuration of AVR, Registers of AVR, Memory Paging.	7
	Total	**42**

Text Books:

1. Gaonkar R.S.: Microprocessor Architecture Programming and Applications with the 8085, Penram International Pub.
2. M.A. Mazidi, J.G. Mazidi and R.D. McKinley: "The 8051Microcontroller and Embedded Systems using Assembly and C", Pearson Education (2nd Ed.)
3. Mahummad A. Mazidi, Sarmad Naimi, Sepehr Naimi, "AVR MICROCONTROLLER AND EMBEDDED SYSTEMS: USING ASSEMBLY AND C", Pearson Education (1st Ed.)

Reference: K.J. Ayala: "The 8051 Microcontroller", Penram Int. Pubs., 1996.

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5IIoT03 PYTHON PROGRAMMING

Pre requisite: Programming Language.

Course Objectives:

1. To provide foundational understanding of the Python programming language, including its basic concepts, data types, operators, and control flow structures.
2. To gain proficiency in working with strings, functions, and various data structures such as lists, tuples, and dictionaries.
3. To acquire skills in file handling, Date and Time with its functions, Modules, packages and object-oriented programming principles.

Course Outcomes:

After Successful completion of this course, the student will be able to:

1. Understand the basic concepts of Python, including variables, data types, and operators.
2. Comprehend the knowledge of different string manipulation techniques and functions in python.
3. Comprehend the knowledge of different data structures in python to perform various operations on data.
4. Implement the concepts and procedures of file handling in Python for real-world scenarios.
5. Utilize the Pandas library to manipulate and analyze data effectively.
6. Demonstrate the application of object-oriented programming principles in Python.

	Course: Python Programming	L
Unit-I	**Introduction to Python :** Characteristics of Python, Why Python, Print statement, Comments, Python Variables, Data types, Operators in Python, Global and local variables, Basic Programs.	07
Unit-II	**Data Structures in Python:** Data Structures (List, Tuples, Dictionaries, Sets), Function related to data structure, Basic String Operations in Python (String Manipulation, Accessing Strings, Basic Operations, String slices), Simple Input and Output, Output formatting, Basic Programs..	07
Unit-III	**Python Program Flow:** Indentation, if statement, and its related statements, while loop, for loop, range statement, break and continue, Assert, Examples of Looping.	07
Unit-IV	**Functions and Modules:** Function: Functions, defining a function, Calling a function, Types of functions, Function Arguments, Create a Module, Standard Modules, Exception Handling.	07
Unit-V	**File Handling:** Modes of file handling (Opening and closing file, Reading and writing files), Date and Time with its functions, Introduction to Modules and packages	07
Unit-VI	**Classes and objects** Overview of OOP, Class Definition, Creating Objects, Objects as Arguments, Objects as Return Values, Built-in Class Attributes, Inheritance, Overloading, Overriding, Programs.	07
	Total	**42**

Text Books:

1. Martin C Brown, ―Python: The Complete Reference‖, MCGraw Hill
2. Mueller, J., & Massaron, L. (2019). Python for data science. 2nd edition. Hoboken, NJ, John Wiley & Sons, Inc

Reference Books:

1. Larry Lutz, ―Python for Beginners: Step By Step Guide to Learning Python Programming ‖, Create Space Independent Publishing Platform, First edition, ISBN, 1717410588, 9781717410580, 2018
2. Nicholas Ayden, ―Python Programming‖, Independently Published, First Edition, ISBN, 1707051933,9781707051939, 2019.
3. MichałJaworski, Tarek Ziadé, ―Expert Python Programming‖, Packt Publishing Ltd., Third Edition,ISBN,9781789808896, 2019.

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5IIOT04 PROFESSIONAL ELECTIVE - I: (i) POWER ELECTRONICS

Course Pre-requisite: Basic Electrical Engineering

Course Objectives:

1. To introduce power electronics devices: SCR and its mechanism in detail.
2. To study the TRAIC, IGBT, MOSFET and to learn their characteristics.
3. The ability to analyze the dynamics in power electronic converters/drives systems and study AC-DC converters and effect of freewheeling diode.
4. To study the inverters in different modes of operation.
5. To build choppers and test circuits using power devices such as SCR.
6. To study applications of power converters in DC drives like cycloconverters.

Course Outcomes:

After successfully completing the course, students will be able to:

1. Analyze the characteristics of various power electronics devices.
2. Understand SCR firing circuits, commutation techniques.
3. Analyze and design controlled rectifiers and dual converters
4. Analyze and design DC to DC, AC to AC converters and DC to AC inverters.
5. Design and develop power electronic circuits for various applications.
6. Know various applications of power converters in DC drives.

	Subject: Object Oriented Programming	**L**
UNIT I	SCR-construction, characteristics, two transistor analogy for turning ON-OFF a SCR, different methods of turning ON of a SCR, turn OFF mechanism, Thyristor firing circuit using UJT, Protection of SCR (snubber circuit).	6
UNIT II	Triac, Diac-construction, characteristics. power transistor, power MOSFET, IGBT - their construction & characteristics.	6
UNIT III	Principle of phase control, single phase half wave controlled rectifier, half controlled bridge & fully controlled bridge rectifier for resistive and RL load, effect of freewheeling diode, single phase dual converters.	6
UNIT IV	Series inverter, improved series inverter, parallel inverter, principle of operation for three phase bridge inverter in 120 deg. and 180 deg. Mode.	6
UNIT V	Basic principles of chopper, time ratio control and current limit control techniques, voltage commutated chopper circuit and AC chopper.	6
UNIT VI	Basic principle of cyclo-converter, single phase to single phase cyclo-converter. speed control of DC series motors speed control of DC shunt motor using phase controlled rectifiers.	6

Text Books:

1. M.D.Singh, K.B. Khanchandani, “Power Electronics”, Tata McGraw-Hill.
2. Muhammad H. Rashid, “Power electronics” Prentice Hall of India.

References:

1. Ned Mohan, Robbins, “Power electronics”, edition III, John Wiley and sons.
2. P.C. Sen., “Modern Power Electronics”, edition II, Chand& Co.
3. V.R.Moorthi, “Power Electronics”, Oxford University Press.
4. Cyril W., Lander,” Power Electronics”, edition III, McGraw Hill.
5. G K Dubey, S R Doradla,: Thyristorised Power Controllers”, New Age International 6. Publishers. SCR manual from GE, USA.

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5IIOT04 PROFESSIONAL ELECTIVE - I (PE-I): (ii) PROGRAMMABLE LOGIC CONTROLLER

Course Requisite: 1) Transducer & Data Acquisition
2) Micro-controller & Applications.

Course Objectives:

1. To understand Basic Architecture of PLC.
2. To study Different input peripherals and communication standards used with PLC.
3. To study Different output peripherals used with PLC
4. To study Basic Instructions used for Ladder programming.
5. To develop skills to write basic PLC programs.
6. To know PLC application in industrial automation.

Course Outcomes:

After successfully completing the course, students will be able to:

1. Understand the basic concepts of a Programmable Logic Controller.
2. Understand output peripherals Interface with PLC
3. Understand output peripherals Interface with PLC
4. Understand the use timer, counter, and other programming functions.
5. Develop PLC Ladder programs for various Applications.
6. Application of PLC in industries.

	Subject: Programmable Logic Controller	**L**
UNIT I	**PLC Basic:** Introduction to PLC, Need of PLC, Types of PLC, Block diagram, processor section, solid state memory, Advantages and limitations of Automation.	6
UNIT II	**Input Devices:** Input modules (Analog, Digital, Discrete), Mechanical switches, proximity switches, encoders, Transducer and Sensor- RTD, Thermistors, Thermocouple, Displacement, position, motion sensor, pressure, liquid level detector, fluid flow measurement,	8
UNIT III	**Output Devices:** output module (Analog, Digital, Discrete) optical sensors. Relays, Solenoid, directional control valve, motors, stepper motors.	6
UNIT IV	**PLC Functions:** Symbols of ladder diagram, Symbols of I/O Devices, PLC Timer functions, PLC Counter functions, Comparison functions, data handling functions, Bit functions, data move functions.	6
UNIT V	**PLC Ladder Programming:** Types of programming language, Development of ladder diagrams: Various types for ladder programming, flowchart, ladder programming for logic gets, flip- flop (JK, RS, D, T), Up down counters.	6
UNIT VI	**PLC Programming for industrial Application:** Design and development of ladder logic diagram of DOL starter, star delta converter, forward reverse of motor, temperature control of motor, switching appliance using sensor, on delay timer etc.	6
	TOTAL	38 Hours

Text Books:

1. “Programmable logic controllers’ principle and application”, John W. Webb, PHI publication.
2. “Process Control Instrumentation Technology”, Curtis Johnson PHI publication.
3. “SCADA supervisory control and data acquisition”, Stuart A. Boyer, ISA Publication.

Reference Books:

1. “PLCs & SCADA: Theory and Practice”, Rajesh Mehra and Vikrant Vijay, Laxmi Publications,
2. “Programmable Logic Controllers”, John R Hackworth, Pearson education
3. “Introduction to programmable logic controllers”, Gary A Dunning.
4. “Mitsubishi FX programmable logic controllers Application and programming” by John Ridley.

5IIOT04 PE-I(iii) OPEN SOURCE TECHNOLOGY FOR INDUSTRY 4.0

Course Pre-requisite: Nil

Course Objectives:

1. To provide a basic idea of Open source software and hardware technology
2. Software and Hardware development process to understand the role and future of open source hardware and software in the industry
3. The impact of legal, economic and social issues for such software and hardware.

Course Outcomes:

Upon completing the course, the student will able to:

1. Elaborate the importance and basics of open source Technology.
2. Understand the Principles, Methodologies, Platform and opportunities for Open Source Technology.
3. Study and analyze various open source software.
4. Comprehend the knowledge of Open Source Hardware Foundations and Development.
5. Explore the Open Source Hardware and understand the relationship between Open Source Hardware and software.
6. Understand the moral values of open source Technology.

	Subject: Open Source Technology for Industry 4.0	L
UNIT I	Introduction – Why Open Source – Open Source –Principles, Standards Requirements, Successes – Free Software – FOSS – Internet Application Projects	7
UNIT II	Open source – Initiatives, Principles, Methodologies, Philosophy, Platform, Freedom, OSSD, Licenses – Copy right, Copy left, Patent, Zero Marginal Technologies, Income generation opportunities, Internalization.	7
UNIT III	Case Studies – Apache, BSD, Linux, Mozilla (Firefox), Wikipedia, Joomla, GCC, Open Office.	7
UNIT IV	**Open Source Hardware Development:** OHANDA, Future of Open Hardware, Elements of Open Source Hardware Projects, Open Source Hardware Processes **Open Source Hardware Foundations:** Introduction, Open Source Hardware Statement of Principles (OSHW), Open Source Hardware Definitions, OSHW Community Survey.	7
UNIT V	**Case Studies of Open Source Hardware:** Arduino Boards, Beagle Boards **Relationship between Open Source Hardware and Software:** Benefits of Open Source Software, Use of Open Source Software's in Open Source Hardware's, Repositories of Open Source Hardware	7
UNIT VI	Open Source Ethics, Open Vs Closed Source, Government, Ethics, Impact of Open Source Technology, Shared Software, Shared Source.	7
	Total	**42 hours**

Text Books:

1. Kailash Vadera, Bhavyesh Gandhi, "Open Source Technology", Laxmi Publications Pvt Ltd 2012, 1st Edition.
2. Parthe Pratim Ray and Rebika Rai, "Open Source Hardware-An Introductory Approach", Lap Lambert Academic Publishing, First Edition, 2013.

Reference Book: Fadi P. Deek and James A. M. McHugh, "*Open Source: Technology and Policy*", Cambridge Universities Press 2007.

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5IIOT04 PROFESSIONAL ELECTIVE - I (P.E.-I): (iv) DATA STRUCTURES

Course Pre-requisite: Object Oriented Programming

Course Objectives:

1. To understand the linear and nonlinear data Structures and its memory representations.
2. To perform different operations on data structures such as insertion, deletion, searching and traversing.
3. Comprehend the stacks and queue along with its basic operations.
4. Understand the concept of Trees.
5. To introduce various techniques for representation such as graphs of the data in the real world.
6. To understand various data searching and sorting methods with its complexity.

Course Outcome:

After successfully completing the course, students will be able to:

1. Understand the of basic data structures for storage and retrieval of linear and Non-linear data structure.

2. Apply knowledge of data structures to implement algorithms for the creation, insertion, deletion, searching, and sorting of each data structure.

3. Differentiate between arrays & linked list which is used to implement list of abstract data types.

4. Understand the tradeoffs between stacks and queues which can make appropriate design decisions based on application data requirements.

5. Design and develop the data structures such as tree by using C as the programming language using static or dynamic implementations.
6. Recognize the importance of Graph and its application in real world scenarios.

	Subject: Data Structures	L
UNIT I	Introduction to Algorithms and Data Structures: Introduction, Algorithms, Asymptotic Notation, Introduction to Data Structures, Types of Data Structures, Data Structure Operations.	6
UNIT II	Arrays: Introduction, Types of Arrays, Representation of One-Dimensional Array in Memory, Array Traversal, Insertion and Deletion, Sorting and Searching, Representation of Multi-Dimensional Array in Memory. Linked List: Introduction, Linked Lists - Basic Concept, Types of Linked List.	8
UNIT III	Stacks: Introduction to Stacks, Stack Operations. Queues: Introduction, Queues - Basic Concept, Queue Operations, Basics of Circular Queues and Priority Queues.	6
UNIT IV	Trees: Introduction, Basic Concept, Binary Tree, Binary Tree Representation, Binary Tree Traversal, Binary Search Tree,	6
UNIT V	Graphs: Introduction, Basic Concept, Graph Terminology, Graph Implementation, Shortest Path Algorithm, and Graph Traversal.	6
UNIT VI	Sorting and Searching: Introduction, Sorting Techniques: Selection Sort, Insertion Sort, Bubble Sort, Quick Sort, Merge Sort. Searching Techniques: Linear Search, Binary Search.	6
	TOTAL	38 hours

Text Book:

1. Seymour Lipschutz, "Data Structures with C", Schaum's Outline Series.

Reference Books:

1. E. Balagurusamy, "Data Structures using C", McGraw Hill Education, 2018
2. Forouzan, Gilberg, "Data Structures and Algorithms",
3. CENGAGE Learning.
4. Reema Thareja, "Data Structures using C", Oxford University Press, 2011.
5. Arpita Gopal, "Magnifying Data structures", PHI (EEE), 2010.
6. Ellis Horowitz and Sartaj Sahani, "Fundamentals of Data Structures", CBS Publications.

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5IIOT05 Open Elective -I (i): INTRODUCTION TO IoT

Pre-requisite: Nil

Course Objectives:

1. To understand fundamentals of IoT, including its definitions, characteristics, and architectures, with enabling technologies in IoT and various IoT applications.
2. To explore the predecessors of IoT and understand the emergence of IoT through concepts such as Wireless Sensor Networks, Machine-to-Machine Communications, and Cyber Physical Systems.
3. To provide a foundation in networking basics and network security, focusing on addressing, TCP/IP transport layer, and security measures relevant to IoT.
4. To understand IoT architecture, including state-of-the-art models, reference architectures, and deployment considerations.
5. To introduce students to IoT communication protocols transport protocols, sensor network topologies.
6. To explore real-world IoT applications such as Smart Home automation, Agricultural Systems, and Smart Parking.

Course Outcomes:

After successfully completing the course, students will be able to-

1. Understand the foundational concepts of IoT, including its definitions, characteristics, and architectures and comprehend the knowledge of various IoT applications across different domains.
2. Comprehend the knowledge about the predecessors of IoT and understand the IoT related concepts such as M2M, CPS, and WoT, and appreciate the technological dependencies shaping IoT ecosystems.
3. Acquire skills in networking basics and network security relevant to IoT, including addressing, TCP/IP transport layer, and security protocols.
4. Understand IoT architectures, including state-of-the-art models and reference architectures, and understand deployment considerations.
5. Understand IoT communication protocols such as MQTT, CoAP, and transport protocols like BLE and Li-Fi, sensor network topologies.
6. Demonstrate practical understanding real-world IoT applications such as Smart Home automation, Agricultural Systems, and Smart Parking.

	Course : Introduction to IoT	L
Unit-I	**Introduction to IoT:** Fundamentals of IoT: Introduction, Definitions & Characteristics of IoT, IoT Architectures Enabling Technologies in IoT, Iot Applications, IoT Challenges	07
Unit-II	**Predecessors & Emergence of IoT:** Introduction, Wireless Sensor Networks, Machine-to-Machine Communications, Cyber Physical Systems, Architectural components of CPS, IoT versus M2M, IoT versus CPS, IoT versus WoT, Enabling IoT and the Complex Interdependence of Technologies, IoT Networking Components, Addressing Strategies in IoT	07
Unit-III	**Basics of Networking & Basics of Network Security:** Network Types, Layered Network Models, Addressing , Internet of Things TCP/IP Transport layer, Security ,Network Confidentiality, Cryptography, Message Integrity and Authenticity, Digital signatures, Key Management, Internet Security & Firewall.	07
Unit-IV	**Unit IV: IoT Architecture -State of the Art:** Introduction, State of the art, Architecture Reference Model- Introduction, Reference Model, and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View.	07
Unit-V	**IoT Communication Protocols:** Messaging Protocols: MQTT, CoAP, XMPP; Transport Protocols: Introduction of BLE, Introduction to Li-Fi; Basics of Sensor Network Topologies: Point to Point Topology, Mesh topology, Ring topology, Star Topology.	07
Unit-VI	**Applications of IoT:** Overview, Block Diagram and Working of real world IoT applications : Smart Home automation, Agricultural System and Smart Parking.	07
	Total	**42**

Text Books:

1. David Hanes, Gonzelo Salgueiro, Patrick Grossetete, Robert Barton, and Jerome Hentry, “IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things”, Cisco Pres, 2017.
2. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applicationsand Protocols”, Wiley, 2012.
3. Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press,2012.
4. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet ofThings”, Springer, 2011.

Reference Books:

1. Vijay Madisetti and Arshdeep Bahga, “Internet of Things (A Hands-On-Approach)”,1st Edition, VPT, 2014
2. Cuno Pfister, Getting Started with the Internet of Things, O‟Reily Media, 2011, ISBN: 978-1- 4493-9357-1

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5IIOT05 Open Elective -I (ii): SENSORS AND TRANSDUCERS

Course Pre-requisite: Basic Electrical Engineering

Course Objectives:

1. To provide the the basic concepts of transducers and its specification.
2. Demonstrate comprehensive understanding of various measurement techniques.
3. Investigate the operational principles the operational principles and characteristics of light sensors, gas sensors and their applications in environmental monitoring and safety systems.
4. Examine different types of Analog-to-Digital Converters (ADCs)

Course Outcomes:

After successfully completing the course, students will be able to-

1. Comprehend the knowledge of transducers and its statistical characteristic, errors of system and calibration.
2. Comprehend the knowledge of instrumentation amplifier, AC and DC bridges and techniques for high common mode voltage measurements.
3. Understand the operational principles and characteristics of temperature sensors, light sensors, pressure sensors.
4. Understand the operational principles and characteristics for mearsument of velocity and displacement.
5. Analyze the operational principles and characteristics of advanced sensor and transducer
6. Comprehend the knowledge of different Analog to Digital converters including their resolution and accuracy and demonstrate use of ADC0808 and ADC ADS1115 converters.

	Course: Sensors and Transducers	L
Unit-I	**Transducer :** Definition, Classification, Selection criteria. Errors, loading effects, Transducer specifications, calibration. Generalized Instrumentation diagram.	07
Unit-II	**Electrical measurements :** Basic signal conditioning circuits(Instrumentation Amplifier), DC bridges (Wheatstone bridge, Kelvin Bridge), AC Bridges (Maxwell Bridge , Schering bridge), Techniques for High Common-Mode Voltage Measurements.	07
Unit-III	**Temperature Sensors:** Resistance Vs Temperature characteristics for different materials, Thermistors, Thermocouples - thermoelectric effects for thermocouples, RTD, **Light Sensors:** LDR, Photo-diode, Photo-transistor. **Pressure Transducer:-** Strain Gauge, Piezoelectric	07
Unit-IV	**Velocity Measurement:** Velocity measurement system by encoder, Magnetic Pickup and Photo detector (Linear and Angular Measurement) **Displacement Measurement:** Resistive, Inductive (LVDT), Capacitive Methods	07
Unit-V	**Advance Sensors and Transducer:** IC based temperature sensor (LM35, DS18B20). IC Based light sensor OPT101, Proximity sensors: inductive and capacitive, IR based proximity sensor. Hall effect sensor, Linear encoders, Gas sensors MQ135.	07
Unit-VI	**Analog-to-Digital Converters:** Flash ADCs, Voltage-to-Frequency ADCs, Integrating ADCs: Dual Slope, Sigma-Delta. Accuracy and Resolution of ADCs. Effective Number of Bits. Introduction to ADC0808.	07
	Total	**42**

Text Books:

1. Sawney A K and Puneet Sawney, “A Course in mechanical measurements and instrumentation and control”, 12th edition, DhanpatRai and Co, new delhi,2013.
2. D. Patranabis, Principles of Industrial Instrumentation, Tata McGraw Hill Publishing Ltd., New Delhi, 1999.
3. Electronics instrumentation" by H. S. Kalsi [TMH]

Reference Books:

1. Data Acquisition and Control Handbook by www.keithley.com
2. David A. Bell, Electronic Instrumentation and Measurements, Third Edition, Oxford Higher Education
3. R.K.Jain, Mechanical and Industrial Measurements, Khanna Publishers, New Delhi, 1999.

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5IIOT05 OE-I (III) INDUSTRY 4.0

Course Objectives:

1. To understand the business perspective of Industry 4.0.
2. To study various hardware used in Smart Manufacturing.
3. To study the Hands-on on cloud computing technologies
4. To study the need of machine learning and various IoT Layers with their relative importance.
5. To develop design thinking and problem solving capability using IoT.
6. To understand the implementation of IoT for smart manufacturing for the need of Industry 4.0.

Course Outcome:

After successfully completing the course, students will be able to:

1. Introduce concept of Industry 4.0 for Smart Manufacturing and its scope.
2. Explain Design thinking principles and its usage for problem solution.
3. Comprehend the knowledge of various tools and technologies.
4. Understand the concepts of Augmented Reality and virtual Reality.
5. Understand the design thinking and learned skills to approach problems.
6. Apply the acquired knowledge by Industry case studies that exist in real life.

	Subject: Industry 4.0	L
UNIT I	**Introduction 4.0 Industry:** Introduction to Sensing & Actuation, Industry 4.0: Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected business perspective.	7
UNIT II	**Industry 4.0:** Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Artificial Intelligence, Big Data and Advanced Analysis, Introduction to FDM machine, 3D printing demonstration.	7
UNIT III	**Cloud Computing Technologies:** Introduction to Cloud Technologies, Study of top cloud services providers platforms and their real life use cases exploration (AWS, Azure, GCP), Hands-on using platforms.	7
UNIT IV	**Augmented Reality and Virtual Reality:** Introduction to AR and VR, Hands-on using UNITY, Industry use cases of AR and VR	7
UNIT V	**Design Thinking as a Problem-Solving Process:** Describe the principles of Design Thinking. - Describe the Design Thinking process for problem solution.	7
UNIT VI	**Basics of Industrial Internet of Things(IIOT):** Introduction, Industrial Internet system, Industrial process, Key enablers of IIOT, Cyber Security. **Case Studies:** Agriculture, Health, Manufacturing etc.	7

Total: 42 hrs

Text Books:

1. The Concept Industry 4.0: An Empirical Analysis of Technologies and Applications in Production Logistics, Christoph Jan Bartodziej.
2. Industry 4.0: Entrepreneurship and Structural Change in the New Digital Landscape, Springer.

Reference Books:

1. Virtual and Rapid Manufacturing: Advanced Research in Virtual and Rapid Prototyping, By Bartolo, P J, Taylor and Francis.
2. Rapid Manufacturing: An Industrial Revolution for a Digital Age, Hopkinson, N, Haque, R., and Dickens, P., Wiley.
3. Make: 3D Printing By Anna Kaziunas France.

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5IIOT05- OPEN ELECTIVE - I: (iv) POWER ELECTRONICS

Course Requisite: Basic Electrical Engineering

Course Objectives:

1. To introduce power electronics devices: SCR, TRAIC, IGBT, MOSFET and to learn their characteristics.
2. To develop the ability to analyze the dynamics in power electronic converters/drives systems.
3. To study rectifiers for different types of load.
4. To study applications of power inverters in DC drives.
5. To build choppers and test circuits using power devices such as SCR.
6. To study AC-AC, DC-AC, DC-DC converters.

Course Outcomes:

After successfully completing the course, students will be able to:

1. Analyze the characteristics of various power electronics devices.
2. Understand SCR firing circuits, commutation techniques.
3. Analyze and design controlled rectifiers and dual converters
4. Analyze and design DC to DC, AC to AC converters and DC to AC inverters.
5. Design and develop power electronic circuits for various applications.
6. Know various applications of power converters in DC drives.

	Subject: Object Oriented Programming	L
UNIT I	SCR-construction, characteristics, two transistor analogy for turning ON-OFF a SCR, different methods of turning ON of a SCR, turn OFF mechanism, Protection of SCR (snubber circuit).	7
UNIT II	Triac, Diac-construction, characteristics. power transistor, power MOSFET, IGBT - their construction & characteristics.	7
UNIT III	Principle of phase control, single phase half wave controlled rectifier, half controlled bridge & fully controlled bridge rectifier for resistive and RL load.	7

UNIT IV	Series inverter, improved series inverter, parallel inverter, principle of operation for three phase bridge inverter in 120 deg. and 180 deg. Mode.	7
UNIT V	Basic principles of chopper, time ratio control and current limit control techniques, voltage commutated chopper circuit.	7
UNIT VI	Basic principle of cyclo-converter, single phase to single phase cyclo-converter. speed control of DC series motors speed control of DC shunt motor using phase controlled rectifiers.	7
	Total	42 Hours

Text Books:

1. M.D.Singh, K.B. Khanchandani, "Power Electronics", Tata McGraw-Hill.
2. Muhammad H. Rashid, "Power electronics" Prentice Hall of India.

References:

1. Ned Mohan, Robbins, "Power electronics", edition III, John Wiley and sons.
2. P.C. Sen., "Modern Power Electronics", edition II, Chand& Co.
3. V.R.Moorthi, "Power Electronics", Oxford University Press.
4. Cyril W., Lander," Power Electronics", edition III, McGraw Hill.
5. G K Dubey, S R Doradla,: Thyristorised Power Controllers", New Age International 6. Publishers. SCR manual from GE, USA.

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5IIoT06 COMMUNICATION NETWORK - Lab

Course Pre-requisite: 1.Communication Systems.

Course Objectives:

1. To understand the practical approach to network communication protocols.
2. To learn and understand network layers, structure/format and role of each network layer.
3. To learn the realization and able to design and implement various network application such as data transmission between client and server, file transfer, real-time multimedia transmission.

Course Outcomes:

After successful completion of this course, the students will be able to-

1. Use his/her understanding/knowledge of Communication Networks so as to design /conduct experimentation related to the given aim/objective.
2. Use equipment's/other concerned resources for conduction of experiments.
3. Interpret results, formulate findings, draw suitable conclusion and respond to inquiries, related to given experiment.

List of Experiments: Minimum 08-10 experiments should be conducted based on 5IIoT01 Communication Network syllabus.

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5IIoT07 MICROCONTROLLER – LAB.

Course Requisite*:* 1. Object-Oriented Programming 2. Computer Programming

Course Objectives:

1. Demonstrate the skills in Assembly Language Programming of microprocessors and microcontroller.
2. Interpret the basic knowledge of microprocessor interfacing, delay generation, and waveform generation.
3. Apply the concepts of Interfacing to connect external devices with the microprocessor 8085 and 8051.

Course Outcomes*:*

After successful completion of this course, students will be able to-

1. Use his/her understanding/knowledge of Microcontroller so as to develop Assembly Language Program related to the given aim/objective.
2. Use equipment's/other concerned resources for conduction of experiments.
3. Interpret results, formulate findings, draw suitable conclusion and respond to inquiries, related to given experiment

List of Experiments :

Minimum 08-10 experiments should be conducted based on**5IIoT02 – Microcontrollers and applications** Syllabus.

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5IIoT08 PYTHON PROGRAMMING – Lab.

Course Requisite*:* 1. GNU-Linux Operating System **2.** Object Oriented Programming

Course Objectives*:*

1. To be able to introduce core programming basics and program design with functions using Python programming language.
2. To understand a range of Object-Oriented Programming, as well as in-depth data and information processing techniques.
3. To understand the high-performance programs designed to strengthen the practical expertise.

Course Outcomes:

After successful completion of this course, students will be able to –

1. Use his/her understanding/knowledge of Python Programming so as to develop python programs related to the given aim/objective.
2. Use equipment's/other concerned resources for conduction of experiments.
3. Interpret results, formulate findings, draw suitable conclusion and respond to inquiries, related to given experiment

List of Experiments:

Minimum 08-10 experiments should be conducted based on**5IIoT03- Python Programming** syllabus.

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5IIoT09 SKILL DEVELOPMENT-III – Lab.

Course Requisite: 1**.** C/C++ programming
2**.** Object Oriented Programming
3**.** GNU- Linux Operating system

Course Objectives:

1. To study Aurdino Hardware and IDE platform for Internet of Things Application Development.
2. To help students succeed in learning basic concepts of Aurdino interfacing and programming
3. To create mini-projects by using Aurdino Board and suitable IDE platform.

Course Outcomes:

After successful completion of this course, students will be able to-

1. Use his/her understanding/knowledge of Aurdino hardware and IDE platform so as to design practical applications related to the given aim/objective.
2. Use concerned Aurdino Hardware and IDE platform tool for application development.
3. Interpret results, formulate findings, draw suitable conclusion and respond to inquiries, related to given experiment.

List of Experiments: Minimum 08-10 experiments should be conducted based onAurdino Hardware and IDE platform.

SEMESTER VI

6IIoT01 HUMAN MACHINE INTERFACE DESIGN

Course Objectives:

1. Learn the foundation of human machine interaction.
2. Understand the importance of design & software process in designing good interfaces.
3. Comprehend the knowledge of Graphical User and Web Interface system.
4. Understand various design technologies to meet user requirements.
5. Understand the different Interaction Styles and Communication with the help of windows.
6. Indulge into emerging trends of HMI.

Course Outcomes:

At the end of the course, the students will be able to –

1. Understand the User Interface (UI) Interaction and its design principles.
2. Comprehend the HMI design and software process.
3. Apply Interactive Design process in real world applications i.e. graphical user interface.
4. Understand HMI technologies and different platforms.
5. Study the application for social and technical emerging trends.

	Subject: Human Machine Interface Design	L
UNIT I	**Foundation of HMI:** The Human: Definition and importance of HMI, Evolution and history of User Interface Designing, I/O channels, Hardware, Software and Operating environments, The Psychopathology of everyday Things, Psychology of everyday actions, Reasoning and problem solving. The computer: Devices, Memory, processing and networks. Interaction: Models, frameworks, Ergonomics, styles, elements, interactivity, Paradigms.	7
UNIT II	**Design & Software Process:** Mistakes performed while designing a computer system, Human interaction with computers, Human interaction speeds. Interactive Design basics, process, scenarios, navigation, Iteration and prototyping. HMI in software process: software life cycle, usability engineering, Prototyping in practice, design rationale. Design rules: principles, standards, guidelines, rules. Recognize the goals, Goal directed design process.	8
UNIT III	**Graphical User Interface:** The graphical User Interface: Popularity of graphics, the concept of direct manipulation, graphical systems, Characteristics. Web user Interface: Interface popularity, characteristics, graphical Business systems and the Web Principles of user interface design.	7
UNIT IV	**HMI Technologies and Platforms:** Touchscreens and gesture recognition, Voice user interfaces (VUI), Augmented reality (AR) and virtual reality (VR) interfaces, Wearable and mobile interfaces. Mobile Ecosystem: Platforms, Application frameworks: Types of Mobile Applications: Widgets, Applications, Games, Mobile Information Architecture, Mobile 2.0.	8
UNIT V	**Interaction Styles and Communication:** Windows: Characteristics, Components, Presentation styles, Types of Windows, Management, operations. Text messages: Words, Sentences, messages and text words, Text for web pages. Icons, Multimedia and colors.	7
UNIT VI	**Emerging Trends in HMI:** Natural language processing and conversational interfaces, Biometric interfaces and emotion recognition, Brain-computer interfaces (BCI), Ethical considerations in HMI design and usage.	7

Total: 44 hrs

Text Books:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, ―Human Computer Interaction‖, 3rdEdition, Pearson Education, 2004.
2. Wilbert O. Galitz, ―The Essential Guide to User Interface Design‖, Wiley publication.
3. Alan Cooper, Robert Reimann, David Cronin, ―About Face3: Essentials of Interaction design, Wiley publication.
4. Jeff Johnson, ―Designing with the mind in mind‖, Morgan Kaufmann Publication.
5. Donald A. Normann, ― Design of everyday things‖, Basic Books; Reprint edition 2002.
6. Brian Fling, ―Mobile Design and Development‖, First Edition, O'Reilly Media Inc., 2009.

Reference Books:

1. Rogers Sharp Preece,‖Interaction Design:Beyond Human Computer Interaction‖,,Wiley.
2. Guy A. Boy ―The Handbook of Human Machine Interaction‖, Ashgate publishing Ltd.
3. Kalbande, Kanade, Iyer, ―Galitz's Human Machine Interaction‖, Wiley Publications.

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6IIoT02 CLOUD COMPUTING

Course Objectives:

1. To understand fundamentals of cloud computing and different models.
2. To study cloud deployment and Service model.
3. To study Different types of Operating System and Cloud Computing API's.
4. To study Virtualization and Hypervisors.
5. To develop software skills using cloud.
6. To know security application in Cloud computing.

Course Outcomes:

After completion of the course students will able to-

1. Gain a comprehensive understanding of what cloud computing is, its evolution, key concepts, and its significance in modern IT infrastructure.

2. Explore and understand various different cloud service models and cloud deployment models including public, private, and hybrid, and learn to differentiate between them based on their features and suitability for different organizational needs.
3. Define the requirements and the need of operating system for understanding and use of cloud
4. Learn about virtualization technologies such as hypervisors and containerization platforms like Docker, and understand their role in cloud computing
5. To understand how cloud service providers and cloud service consumers are benefitted from these technological advancements in the cloud scenario
6. Understand security challenges and best practices in cloud computing, including data protection, identity management, encryption, and compliance considerations.

	Subject: Cloud Computing	**L**
UNIT I	**Cloud Computing Fundamentals:** Motivation for Cloud Computing, The Need for Cloud Computing, Defining Cloud Computing, Cloud Computing Is a Service. Cloud Computing Is a Platform, Principles of Cloud computing, Five Essential Characteristics, Four Cloud Deployment Models, Three Service Offering Models, Cloud Ecosystem, Requirements for Cloud Services, Cloud Application, Benefits and Drawbacks.	7
UNIT II	**Cloud Deployment and Service Models** Cloud Deployment Models: Introduction, Private Cloud, Public Cloud, Community Cloud, Hybrid Cloud. Cloud Service Models: Introduction, Infrastructure as a Service, Platform as a Service, Software as a Service, Other Cloud Service Models	7
UNIT III	**Operating System** Types of Operating Systems, Role of OS in Cloud Computing, Features of Cloud OS. Application Environment: Need for Effective ADE, Application Development Methodologies, Power of Cloud Computing in Application, Cloud Application Development Platforms and Cloud Computing API's.	7
UNIT IV	**Virtualization** Introduction, Types of Virtualization, Virtualization Opportunities, Approaches to Virtualization, Hypervisors, Types of Hypervisors, Virtualization to Cloud Computing.	7
UNIT V	**Software Development in Cloud** Introduction, Different Perspectives on SaaS Development, New Challenges, Cloud-Aware Software Development Using PaaS Technology. Networking for Cloud Computing: Introduction, Overview of Data Center Environment, Networking Issues in Data Centers, Transport Layer Issues in DCNs.	7
UNIT VI	**Security in Cloud Computing:** Introduction, Security Aspects: Data, Virtualization and Network Security, Platform-Related Security: Security issues in Cloud Service Models, SaaS, PaaS, IaaS security issues, Audit and Compliance: Disaster Recovery, Privacy and Integrity.	7
	Total	42 Hours

Text Book: K. Chandrasekaran: Essentials of Cloud Computing, Edition, CRC Press Taylor & Francis Group.

Reference Books:

1. Shrinivasan, J. Suresh: Cloud computing a practical approach for learning and implementation, Pearson publication.
2. M. N. Rao: Cloud Computing, PHI Learning Pvt. Ltd, 2015.
3. Dr. Kumar Saurabh: Cloud computing, 2nd Edition, Wiley India 2012.
4. Rajkumar Buyya, James Broberg and Andrzej M. Goscinski: Cloud Computing: Principles and Paradigms, John Wiley & Sons, Inc. 2011.
5. Anthony T. Velte , Toby J. Velte and Robert Elsenpeter, Cloud computing a practical approach, Tata McGraw- Hill , New Delhi – 2010.
6. Judith Hurwitz, Robin Bloor, Marcia Kaufman and Fern Halper, "Cloud computing for dummies" Wiley Publishing, Inc, 2010.

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6IIOT03 EMBEDDED SYSTEMS AND RTOS

Course Requisite: **1.** Object Oriented programming
2. Microcontroller and Applications

Course Objectives:
Students will be expected to demonstrate their understanding of Embedded System by being able to do each of the following:

1. To introduce the fundamental and building blocks of Embedded System.
2. To introduce hardware units, bus communication in processors and input/output interfacing.
3. To impart the knowledge of basic embedded programming in various languages as well as data Structures.
4. To impart the knowledge of programming Models for an embedded system and introduction to IPC.
5. To impart knowledge of real-time operating system.
6. To study process management and inter process communication.

Course Outcomes:
On completion of the course, the students will be able to:
1. Describe the basic structural units of a processor as well as hardware units of embedded system.
2. Explain processor-memory organization for embedded system.
3. Use knowledge of programming to do embedded programming in various languages and use of data structures for programming.
4. Discuss programming models for embedded system and need for Inter Process Communication.
5. Examine the basic concepts of operating systems with real-time operating systems aspects.
6. Comprehend knowledge of process management system in RTOS.

	Subject: Embedded Systems and RTOS	**L**
UNIT I	**Introduction to Embedded Systems:** Embedded systems, Processor embedded into a system, Embedded hardware units and devices in a system, Embedded software in a system, Classification of embedded systems, Examples of embedded systems. Embedded SOC and use of VLSI circuit design technology, Design process in embedded system, Design challenges in embedded-system design, Hardware-software Co-Design in an embedded system.	7
UNIT II	**Processor and Memory Organization**: Processor-Memory Organization, Introduction to advanced processor architecture, Processor Organization, Instruction-Level parallelism, Memory types and memory maps and addresses, Memory Hierarchy and Cache, Selection of Processor and Memory devices. Serial bus communication Protocols, Parallel bus device Protocols.	7
UNIT III	**Embedded Programming:** Programming in assembly language and in high level language 'C', 'C' Program Elements: Header and Source files and Processor Directives, Macros and Functions, Data Types, Data Structures, Modifiers, Statements, Loops and Pointers, Use of Loops, Infinite Loops and Conditions, Use of Function Calls, Function Pointers and Function Queues, Queuing of Functions on Interrupts and ISR Queues. Simple programs	7
UNIT IV	**Embedded System Models** Program Models, DFG models, State machine programming models for event-controlled program flow, FSM Model, Multiprocessor systems, UML modelling.	7
UNIT V	**Basic Function of OS and RTOS:** Introduction to Operating System: Computer Hardware Organization, BIOS and Boot Process, Multi-threading concepts, Processes, Threads, Scheduling, Introduction to RTOS, Basic design using RTOS, RTOS task-scheduling models, OS Security Issues, OS Standards: POSIX.	7
UNIT VI	**Process Management and IPC:** Concepts, scheduling, IPC, RPC, CPU Scheduling, scheduling criteria, scheduling algorithms Threads: Multi-threading models, threading issues, thread libraries, synchronization Mutex: creating, deleting, prioritizing mutex, mutex internals and Introduction to Inter-process communication.	7
	Toal	42 Hours

Text Books:
1. Rajkamal, "Embedded Systems, Architecture, Programming & Design", Third Edition TMH.
2. J. J Labrosse, "MicroC/OS-II: The Real –Time Kernel", Newnes, 2002.
3. Jane W. S. Liu, "Real-time systems", Prentice Hall, 2000.

References:
1. Shibu K V "Introduction to Embedded Systems" McGraw-Hill.
2. Mohammad Ali Mazidi "The 8051 Microcontroller and Embedded System using Assembly and C"Pearson.
3. Frank Vahid and Tony Givargis, "Embedded System Design, A Unified Hardware/Software Introduction", John Wiley & Sons Pvt. Ltd.
4. W. Richard Stevens, "Advanced Programming in the UNIX® Environment", 2nd Edition, Pearson Education India, 2011.
5. Philips A. Laplante, "Real-Time System Design and Analysis", 3rd Edition, John Wley & Sons, 2004.
6. Doug Abbott, "Linux for Embedded and Real-Time Applications", Newnes, 2nd Edition, 2011.

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6IIOT04 – Prof. Elective -II (i) ADVANCE DIGITAL CIRCUIT DESIGN

Course Requisite: Analog & Digital Electronics

Course Objectives:
1. To understand the basics of combinational logic.
2. To study various combinational circuits like Encoder, Decoder, Adder etc.
3. To comprehend the knowledge of shift register, Sequence Generator, and counters.
4. To Study the designing of sequential circuits using Flip Flop and state Diagram.
5. To explore the knowledge of Semiconductor Memories and CCD Memories.
6. To study the applications of Sequential logic designs using converters and counters.

Course Outcomes:

After completing the course, students will be able to-
1. Implement Combinational Logic and perform operations using Minimization techniques.
2. Analyze the working of Comparators, Encoders, Decoders and Adders.
3. Demonstrate knowledge of Sequential logic Design.
4. Design and analyze Sequential Circuits using flip-flops and state Diagrams.
5. Demonstrate the knowledge of Semiconductor Memories.
6. Design Sequential logic circuits converters and counters.

	Subject: Advance Digital Circuit Design	L
Unit-I	Principles of combinational logic: Definition of combinational logic, canonical forms, Karnaugh maps-3,4,5 variables, Don't care Conditions, Min Term, Max term equations, Quine-McClusky Minimization techniques – 3 & 4 variables	07
Unit-II	Analysis of combinational circuits: Comparators, Encoders – priority encoder, Decoders – BCD to Decimal, seven segment displays, Design of adders – Ripple adder, Adder with look-ahead Carry.	07
Unit-III	Sequential logic design: Shift Registers, Sequence Generator, Ripple Counters, Synchronous Counter design	07
Unit-IV	Sequential Circuit Design: Design of a synchronous mod-n counter using clocked JK, D, T and SR flip-flops. Mealy and Moore models, Construction of state diagrams.	07
Unit-V	Semiconductor Memories: Classification & Characteristics of Memories, Static and Dynamic Shift register, Basics and operations of Charge Coupled Device Memory.	07
Unit-VI	Applications of Sequential logic Design: Delay Line, Serial to Parallel Converter, Parallel to Serial Converter, UP/Down Counter, Modulus of the counter.	07
	Total	**42**

Text Books:

1. M.Morris Mano and M.D.Ciletti, "Digital Design", Pearson Education.
2. R P Jain, "Modern Digital Electronics", TMH.

Reference Books:

1. D. P. Kothari and J. S Dhillon, ―Digital Circuits and Design‖, Pearson, 2016,
2. Wakerly, "Digital Design: Principles and Practices", 3rd edition, Pearson Education, 2004.
3. Lee S.C," Digital Circuits and Logic Design", PHI.

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6IIOT05 Prof. Elect.- II(ii): I NDUSTRIAL WIRED COMMUNICATION SYSTEMS

Course Pre-requisite: Communication Network (5IIoT01)

Course Objectives:

1. To introduce the basic principles of networking
2. To learn industrial protocols and the way of data processed and transferred in industrial network
3. To equip the students with the relevant knowledge to understand and solve technical problems in Industrial Automation systems.

Course Outcomes:

Upon completing the course, the student will able to:

1. Identify the need for network protocols during data exchange
2. Demonstrate the knowledge of various wired communication mediums
3. Demonstrate the use of serial standards as required in an industrial plant environment.
4. Compare the different protocols used as industrial standards
5. Comprehend the knowledge of HART communication protocol
6. Compare various Industrial Ethernet standards and comprehend the knowledge of foundation fieldbus

	Subject: Industrial Wired Communication Systems	L
UNIT I	**Fundamental of Industrial Data Communication Systems:** Review of Data Acquisition, Automation System Architecture - Hierarchical Levels, Functional Layered Models **-** OSI reference model, System engineering approach, Input / Output Structures, Control Unit Structure, Protocols, Network topology, Networking Devices: Switches, Hub, Routers	7
UNIT II	**Wired Communication Medium:** **Coaxial Cable:** Construction, Performance, Advantages and Disadvantages; **Twisted Pair:** Construction, Elimination of Noise, Components of Twisted pair, EIA/TIA 568 Cable categories, Advantages and Disadvantages; **Optical Fiber:** Principle of Transmission of light, Fiber Optic Cable components and parameters, Step Index and Graded Index fibres, Fusion Splicing and Mechanical Splicing	8
UNIT III	**Serial communication standards:** Standards organizations, Serial data communication interface standards, Balanced and unbalanced transmission lines, Synchronous and asynchronous communication, RS 232,422,485 standards.	7
UNIT IV	**Industrial protocols:** XON/OFF Signalling, Binary Synchronous Protocol (BSC), HDLC/SDLC protocol, CSMA/CA protocol, OSI implementation for Industrial communications, **Industrial control applications:** ASCCII-based protocol – ANSI –X 3.28 -2.5.	7
UNIT V	**HART Communication Protocol Architecture**: Physical, data link, application layer, communication technique, normal and burst mode of communication, benefits of HART	6
UNIT VI	**Industrial Ethernet and Foundation Fieldbus:** 10Mbps, 100Mbps Ethernet, Gigabit Ethernet, Industrial Ethernet; Fieldbus requirement, features, advantages, fieldbus components, types, architecture–physical, data link, application layer, system and network management, wiring, segment functionality checking, function block application process.	7
	Total	42

Text Books:

[1]. John Park, Steve Mackay, Edwin Wright, *Practical Data Communications for Instrumentation and Control*, 1st Edition ELSEVIER, 2003.
[2]. Deon Reynders, Steve Mackay, Edwin Wright, *Practical Industrial Data Communications*, 1st Edition, Newnes, Imprint of ELSEVIER, 2005.

Reference Books:

[1]. William C. Dunn, *Fundamental of industrial instrumentation and process control*, Mc Graw-Hill, 2005.

[2]. Behrouz A. Forouzan, *Data Communications and Networking*, 2nd Edition, Mc Grow – Hill, 2001.

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6IIOT04 PE-II (iii) PYTHON FOR EMBEDDED SYSTEMS

Course Objectives:

1. To provide a comprehensive understanding of embedded systems, including their structure, architecture, software frameworks, and constraints.
2. To introduce the basic syntax and constructs of Python programming, including variables, data types, operators, control flow, functions, modules, and OOP terminologies.
3. To understand the origin, features, and limitations of MicroPython, and learn to use its REPL Console along with built-in and standard libraries.
4. To introduce different Micro Python-ready boards, their specific libraries, and the necessary programming tools and assembly required for these boards.
5. To understand communication protocols such as I2C and SPI, and learn to interface hardware components like LEDs, pushbuttons, LDRs, potentiometers, and thermistors with MicroPython.
6. To apply the knowledge gained to develop real-world embedded Python projects, exploring case studies on weather monitoring, plant monitoring, and stoplight simulators.

Course Outcomes:

After Successful completion of this course, the student will be able to:

1. Understand the fundamental concepts, components, and classifications of embedded systems.
2. Comprehend the knowledge of basic Python programs, effectively using variables, control flow mechanisms, functions, and basic OOP concepts.
3. Understand REPL Console for Micro-Python programming and implement various built-in and standard libraries in Micro-Python projects.
4. Comprehend the knowledge of programming tools for different Micro-Python boards, implement board-specific libraries, and deploy applications on these boards.
5. Implement communication protocols and interface various hardware components with Micro-Python, developing practical applications.
6. Design and implement real-world embedded systems projects using Python.

	Course: Python for Embedded System	L
Unit-I	**Fundamentals of Embedded Systems:** An Overview of Embedded Systems, Embedded Systems Structure, Embedded Software Architecture, Software Framework, Platform Embedded Systems Constraints, Embedded Systems Classification.	07
Unit-II	**Python Essentials:** Variables, Data Types, and Operators, Basic Data Structures, Control Flow (Conditionals and Loops), Functions and Modules, OOP terminologies	07
Unit-III	**Micro-Python Essentials:** Micro-Python Origin, Features, Limitations. Micro-Python execution: The Run, Evaluate, Print Loop (REPL Console), Micro-Python Libraries Built-In and Standard Libraries: Common Standard Libraries, Built-In Functions and Classes, Micro-Python Libraries : Commons Micro-Python Libraries, Custom Libraries	08
Unit-IV	**Micro-Python Hardware (Boards) and its Specific Libraries:** Programming Tools, Assembly Required, Micro-Python-Ready Boards: Pyboard, WiPy, Micro-Python-Ready Boards: BBC micro-bit, Circuit Playground Express (Developer Edition), Adafruit Feather Huzzah , Other Boards. Board-Specific Libraries, Pyboard, WiPy.	08
Unit-V	**Communication Protocol and Hardware Interfacing with Micro-Python:** Communication Protocol: Inter-Integrated Circuit (I2C), Serial Peripheral Interface (SPI). Interfacing of LED, pushbutton, LDR, Potentiometer and thermistor with Arduino IDE and python.	06
Unit-VI	**Case Studies of Embedded Python Projects for** 1. Weather Monitoring 2. Plant Monitoring 3. Stoplight Simulator	06
	Total	**42**

Text Books:

1. C. A. Bell, Micro-Python for the Internet of Things: A Beginner's Guide to Programming with Python on M icrocontrollers. Berkeley, CA, Apress, 2017.
2. A. Subero, Programming Microcontrollers with Python, S.L, Apress, 2021.
3. Sudhakar Kumar, Manas Ranjan Das,Rajesh Kushalkar, Nirmala Venkat, Chandrashekhar
4. Gourshete Kannan M. Moudgaly, Microcontroller Programming with Arduino and Python, 2021

Reference Books:

1. N. H. Tollervey, Programming with Micro-Python. O'Reilly Media, Inc., 2017.
2. D. Norris, Python for microcontrollers: getting started with Micro-Python. New York: McGraw Hill Education, 2017.

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6IIOT04 PE-II (iv): ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

Course Pre-requisite: Nil

Course Objectives:

1. To acquire the basic concepts of Artificial Intelligence.
2. To formulate Problems and Evaluation of Uniformed Search Strategies
3. To understand the various searching techniques, constraint satisfaction problem and example problems - game playing techniques.
4. To imbibe the concepts, techniques and building blocks of machine learning.
5. To understand mathematics for modelling and evaluation.
6. To Learn various algorithms of classification & regression for supervised machine learning.

Course Outcomes:

On completion of the course, the students will be able to:

1. Explain concepts of Artificial Intelligence and different types of intelligent agents and their architecture.
2. Evaluate different uninformed search algorithms on well formulate problems along with stating valid conclusions that the evaluation supports.
3. Can design and analyze informed search algorithms on well formulated problems.
4. Understand the concept of Machine Learning
5. Understand how to evaluate models generated from data.
6. Implement the variety of algorithms for Supervised Learning

	Subject: Artificial Intelligence & Machine Learning	**L**
UNIT I	Introduction to Artificial Intelligence What Is AI? The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art, Risks and Benefits of AI, Intelligent Agents: Agents and Environments, Good Behaviour: The Concept of Rationality, The Nature of Environments, The Structure of Agents.	7
UNIT II	Basic Problem Solving & Search Strategies Problems, Problem Space and Search: Production Systems, Problem Characteristics, Production System Characteristics, Issues in the Design of Search Programs. Problem trees and graphs. Uninformed Search Strategies: Breadth First Search, Depth First Search, Depth Limited Search, Iterative Deepening Depth First Search, Bidirectional Search.	7
UNIT III	Informed Search Strategies Generate-and-Test, Hill Climbing, Best-first Search, A* Algorithm, Problem Reduction, AND-OR Graphs, The AO* Algorithm, Minmax Algorithm. Constraint Satisfaction, Means ends Analysis.	7
UNIT IV	Machine Learning: The three different types of machine learning, Introduction to the basic terminology and notations, A roadmap for building machine learning systems, Using Python for machine learning.	7
UNIT V	Classification: Training Simple Machine Learning Algorithms for Classification, Artificial neurons – a brief glimpse into the early history of machine learning, implementing a perception learning algorithm in Python, Adaptive linear neurons and the convergence of learning.	7
UNIT VI	Regression: Machine Learning Classifiers Using scikit-learn, choosing a classification algorithm, First steps with scikit-learn – training a perceptron, Modeling class probabilities via logistic regression, Maximum margin classification with support vector machines, Solving nonlinear problems using a kernel SVM, Decision tree learning, K-nearest neighbors – a lazy learning algorithm.	7
	Total	42 Hours

Text Books:

1. Artificial Intelligence – Elaine Rich, Kevin Knight, Nair (Third Edition) [Mc Graw Hill]
2. Sebastian Raschka, and Vahid Mirjalili ―Python Machine Learning: Machine Learning and Deep Learning with Python, scikit-learn, and Tensor Flow.

References:

1. Introduction to Artificial Intelligence and expert system – Dan W. Patterson
2. Introduction to Artificial Intelligence – Rajendra Akerkar
3. Nils Nilson: "Principles of Artificial Intelligence". (Addison-Wesley)
4. Andriy Burkov ― The Hundred - Page 'Machine Learning Book'.
5. Aurélien Géron ―'Hands-on Machine Learning' with Scikit-Learn, Keras, and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems.

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6IIOT05 OPEN ELECTIVE - II (i): INTRODUCTION TO CLOUD COMPUTING

Course Objectives:

1. To understand fundamentals of cloud computing and Ecosystem.
2. To study cloud computing Architecture and its management using applications.
3. To study Different types of Operating System and Cloud Computing API's.
4. To study technological drivers using different technologies.
5. To understand Virtualization.
6. To develop software skills using cloud.

Course Outcomes:

After completion of the course students will able to

1. Gain a comprehensive understanding of what cloud computing is, its evolution, key concepts, and its significance in modern infrastructure.
2. Comprehend the knowledge of cloud computing architecture by understanding its management.
3. Explore and understand various different cloud service models and cloud deployment models including public, private, and hybrid, and learn to differentiate between them based on their features and suitability for different organizational needs.
4. Define the requirements and the need of operating system as well as technological drivers for understanding and use of cloud.
5. Learn about virtualization technologies such as hypervisors and containerization platforms like Docker, and understand their role in cloud computing
6. To understand how cloud service providers and cloud service consumers are benefitted from these technological advancements in the cloud scenario.

	Subject: Introduction to Cloud Computing	**L**
UNIT I	Cloud Computing Fundamentals: The Need for Cloud Computing, Defining Cloud Computing, 5-4-3 Principles of Cloud computing, Cloud Ecosystem,	7
UNIT II	Cloud Computing Architecture and Management. Introduction, Cloud Architecture, Anatomy of the Cloud, Applications on the Cloud, Managing the Cloud, Migrating Application to Cloud.	7
UNIT III	Cloud Deployment Models Introduction, Private Cloud, Public Cloud, Community Cloud, Hybrid Cloud, Cloud Service Models, Infrastructure as a Service, Platform as a Service, Software as a Service, Other Cloud Service Models	7
UNIT IV	Technological Drivers for Cloud Computing Introduction, SOA and Cloud, Virtualization, Multicore Technology, Memory and Storage Technologies, Networking Technologies, Web 2.0	7
UNIT V	Virtualization Introduction, Virtualization Opportunities, Approaches to Virtualization, Hypervisors, From Virtualization to Cloud Computing	7
UNIT VI	Software Development in Cloud Introduction, Different Perspectives on SaaS Development, New Challenges, Cloud-Aware Software Development Using PaaS Technology.	7

Total : 42 hrs

Text Book: K. Chandrasekaran: Essentials of Cloud Computing, Edition, CRC Press Taylor & Francis Group.

Reference Books:

1. A. Shrinivasan, J. Suresh: Cloud computing a practical approach for learning and implementation, Pearson publication.
2. M. N. Rao: Cloud Computing, PHI Learning Pvt. Ltd, 2015.
3. Dr. Kumar Saurabh: Cloud computing, 2nd Edition, Wiley India 2012.
4. Rajkumar Buyya, James Broberg and Andrzej M. Goscinski: Cloud Computing: Principles and Paradigms, John Wiley & Sons, Inc. 2011.
5. Anthony T. Velte , Toby J. Velte and Robert Elsenpeter, Cloud computing a practical approach, Tata McGraw- Hill , New Delhi – 2010.
6. Judith Hurwitz, Robin Bloor, Marcia Kaufman and Fern Halper, "Cloud computing for dummies" Wiley Publishing, Inc, 2010.

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6IIOT05 O.E.-II (ii) INTRODUCTION TO PYTHON PROGRAMMING

Course Objectives:

1. To provide foundational understanding of the Python programming language, including its basic concepts, data types, operators, and control flow structures.
2. To gain proficiency in working with strings, functions, and various data structures such as lists, tuples, and dictionaries.
3. To acquire skills in file handling, Date and Time with its functions, Modules, packages and object-oriented programming principles.

Course Outcomes:

After Successful completion of this course, the student will be able to:

1. Understand the basic concepts of Python, including variables, data types, and operators.
2. Comprehend the knowledge of different string manipulation techniques and functions in python.
3. Comprehend the knowledge of different data structures in python to perform various operations on data.
4. Implement the concepts and procedures of file handling in Python for real-world scenarios.
5. Utilize the Pandas library to manipulate and analyze data effectively.
6. Demonstrate the application of object-oriented programming principles in Python.

	Subject: Introduction to Python Programming	L
Unit-I	**Introduction to Python :** Characteristics of Python, Why Python, Print statement, Comments, Python Variables, Data types, Operators in Python, Global and local variables, Basic Programs.	07
Unit-II	**Data Structures in Python:** Data Structures (List, Tuples, Dictionaries, Sets), Function related to data structure, Basic String Operations in Python (String Manipulation, Accessing Strings, Basic Operations, String slices), Simple Input and Output, Output formatting, Basic Programs..	07
Unit-III	**Python Program Flow:** Indentation, if statement, and its related statements, while loop, for loop, range statement, break and continue, Assert, Examples of Looping.	07
Unit-IV	**Functions and Modules:** Function: Functions, defining a function, Calling a function, Types of functions, Function Arguments, Create a Module, Standard Modules, Exception Handling.	07
Unit-V	**File Handling:** Modes of file handling (Opening and closing file, Reading and writing files), Date and Time with its functions, Introduction to Modules and packages	07
Unit-VI	**Classes and objects:** Overview of OOP, Class Definition, Creating Objects, Objects as Arguments, Objects as Return Values, Built-in Class Attributes, Inheritance, Overloading, Overriding, Programs.	07
	Total	**42**

Text Books:

1. Martin C Brown, ―Python: The Complete Reference‖, MCGraw Hill
2. Mueller, J., & Massaron, L. (2019). Python for data science. 2nd edition. Hoboken, NJ, John Wiley & Sons, Inc.

Reference Books:

1. Larry Lutz, ―Python for Beginners: Step By Step Guide to Learning Python Programming, Create Space Independent Publishing Platform, First edition, ISBN, 1717410588, 9781717410580, 2018
2. Nicholas Ayden, ―Python Programming, Independently Published, First Edition, ISBN, 1707051933,9781707051939, 2019.
3. MichałJaworski, Tarek Ziadé, ―Expert Python Programming, Packt Publishing Ltd., Third Edition,ISBN,9781789808896, 2019.

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6IIOT04 – O.E-II (iii) DIGITAL SYSTEM DESIGN

Course Requisite: Analog & Digital Circuits.

Course Objectives:

1. To study basic concepts of Binary Arithmetic, number systems and codes.
2. To study basics of logic gates, Boolean algebra and techniques of minimization of Boolean expression.
3. To understand digital logic families, their characteristics and Semiconductor Memories.
4. To understand the construction and working of Multivibrators and Flip Flops.
5. To study the formal procedures for the analysis and design of sequential circuits.
6. To learn the concept of a Combinational logic circuit.

Course Outcomes:

After completing the course, students will be able to-

1. Perform Binary Arithmetic operations, number systems and their conversion.
2. Elaborate logic gates and use Boolean algebra to solve logic functions.
3. Use the knowledge of digital logic families, their characteristics, and Semiconductor Memories.
4. Demonstrate construction & working of Multivibrators and Flip Flops
5. Identify, and analyze the sequential circuits.
6. Identify, and analyze the Combinational logic circuit.

	Subject: Digital System Design	L
Unit-I	Binary Arithmetic and Number System: Binary Arithmetic, Number systems and their conversions, BCD code, Octal Code, Hexadecimal code, Excess-3 code, Gray code.	07
Unit-II	Logic gates & Boolean Algebra: NOT, OR, AND, NAND, NOR, EXNOR & EXOR gates. (Definition and truth table). Boolean laws, De-Morgan's theorem, Simplification of Boolean equations using Boolean Algebra, Fundamental products & sum terms, K-map (K-map up to 4 variables).	07
Unit-III	Logic Families & Semiconductor Memories: Introduction of logic families, and characteristics (Fan-in, Fan-out, Noise immunity, Propagation delay, Power dissipation). Introduction to semiconductor memory: RAM ROM, PROM, EPROM, EEPROM, flash memory.	07
Unit-IV	Multi-vibrators and Flip Flops: Construction & working of Astable, monostable, and Bistable multi-vibrators, RS, CK-RS, D, JK and T Flip Flops (Logic diagram, Truth table).	07
Unit-V	Sequential Circuits:(Counters and Shift registers) Asynchronous & synchronous Counter, Up-down counters (up to 4-bits).Types of shift registers, SISO, SIPO, PISO & PIPO, Ring counter, Johnson's counter.	07
Unit-VI	Combinational logic circuit: Encoder: Binary to BCD, Decimal to BCD, Decoder: BCD to decimal, BCD to 7 segments, Multiplexer: 4X1, 8X1, De multiplexer: 1X4, 1X8, (Definition, construction)	07
	Total	**42**

Text Books:

1. M.Morris Mano and M.D.Ciletti, "Digital Design", Pearson Education.
2. R P Jain, "Modern Digital Electronics", TMH.

Reference Books:

1. Wakerly, "Digital Design: Principles and Practices", 3rdedition, Pearson Education, 2004.
2. Charles H. Roth, "Fundamentals of Logic Design", 4th Edition, Jaico Publication
3. Lee S.C," Digital Circuits and Logic Design", PHI.

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6IIOT05 – O.E-II (iv) Introduction to Wireless Communication

Course Requisite: 3IIOT04 Communication System

Course Objectives:

1. To understand the evolution of wireless communication systems.
2. To understand the fundamentals of cellular mobile communication systems design and coverageimprovement techniques.
3. To study the basics of Mobile Radio Propagation, fading and Multipath propagation.
4. To understand basic concepts of Multiple Access techniques.
5. To understand the operation of GSM in detail.
6. To study various wireless data communication networks and the basics of Wireless Adhoc Networks.

Course Outcomes:

After completing the course, students will be able to-

1. Illustrate the evolution of wireless communication systems and types of wireless communication systems.
2. Understand the fundamentals of cellular radio systems along with parameters affecting their performance and techniques to improve them.
3. Understand fading and its impact on the performance of cellular radio communication systems.
4. Comprehend the knowledge of basic Multiple Access Techniques, OFDM and CSMA protocol
5. Understand the working of GSM and CDMA systems in terms of their architecture, frame structure, channels and security.
6. Demonstrate the basic concepts of wireless data communication networks.

	Subject: Introduction to Wireless Communication	L
Unit-I	**Introduction to Wireless Communication System:** Need and development of Wireless communication systems, the introduction of Mobile Radio Systems, Types of Wireless Communication Systems, and Comparison of Common wireless communication systems.	07
Unit-II	**Basic Cellular System:** Introduction to Cellular Systems, Basic cell fundamentals in cellular systems. Frequency Reuse, Adjacent Channel & co-channel interference, S/I ratio consideration for Co-channel and adjacent Channel interference, Handoffs and their types, and Cell capacity improvement techniques.	07
Unit-III	**Mobile Radio Propagation Mechanism:** Basic Propagation Mechanism: Reflection, Diffraction and Scattering. Small Scale Fading and Multipath: Factors Influencing Small Scale Fading. Types of Small-Scale Fading.	07
Unit-IV	**Multiple Access Techniques:** Basic concepts of TDMA, FDMA & CDMA and their Comparisons, Fundamentals of OFDM and CSMA.	07
Unit-V	**Global System for Mobile Communication:** GSM Systems: GSM architecture, GSM Channels, Frame Structure, Authentication and security in GSM. Introduction to CDMA Systems, Forward and reversechannel of CDMA.	07
Unit-VI	**Wireless Communication Network:** Introduction to WLAN, Wi-Fi, WiMAX, ZigBee Networks and Wireless Adhoc Network (Architecture not expected), Security issues and challenges in a Wireless network.	07
	Total	**42**

Text Books:

1. Theodore S. Rappaport, “Wireless Communications: Principles &Practice”, Second edition, Pearson Education (2002).
2. K. Pahlavan and P. Krishnamurthy, “Principles of Wireless Networks”, Pearson Education Asia Publication (2002).
3. T. L. Singal, “Wireless Communication”. McGraw Hill Education.
4. A. F. Molisch, “Wireless Communications”, Second Edition, Wiley Publication.

Reference Books:

1. Upena Dalal, "Wireless communication", Oxford University Press.
2. Wireless Communications-T.L.Singh-TMH
3. Adhoc Mobile Wireless network, C.K.Toh Pearson.

Course Code	Course Title	L	T	P	C
6IIoT06	**HUMAN MACHINE INTERFACE DESIGN Lab.**	00	00	02	01

Course Objectives:

1. To understand the importance of human psychology in designing good interfaces by using HMI fundamentals and Win CC software.
2. To motivate students to apply HMI in their day to day activities.
3. To apply HMI best practices and troubleshoot issues.

Course Outcomes:

After successful completion of this course, students will be able to-

1. Use his/her understanding/knowledge of Human Machine Interface Design so as to develop mobile applications related to the given aim/objective.
2. Use concerned Android application development tools for application development.
3. Interpret results, formulate findings, draw suitable conclusion and respond to inquiries, related to given experiment

List of Experiments:

Minimum 08-10 experiments should be conducted based on **6IIoT01 Human Machine Interface Design** Syllabus.

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Course Code	Course Title	L	T	P	C
6IIoT07	**Cloud Computing Lab**	00	00	02	01

Course Pre-requisite: 1. Programming Languages
2. Communication Network

Course Objectives:

1. To inculcate the concepts of distributed computing.
2. To familiarize the concepts of cloud computing and services.
3. To explain cloud platform and types of cloud and to explain resource management in cloud.

Course Outcomes:

After successful completion of this course, students will be able to-

1. Use his/her understanding/knowledge of Cloud Computing to design /conduct experimentation related to the given aim/objective.
2. Use equipment's/other concerned resources for conduction of experiments.
3. Interpret results, formulate findings, draw suitable conclusion and respond to inquiries, related to given experiment.

List of Experiments:

Minimum 08-10 experiments should be conducted based on **6IIoT02 Cloud Computing** Syllabus.

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6IIoT08 EMBEDDED SYSTEMS Lab.

Course Requisite**:** Microcontrollers and Applications.

Course Objectives:

1. To Learn how to develop basic applications in Various Embedded Development Strategies.
2. To impart knowledge in various processor scheduling algorithms.
3. To Develop programming skills in embedded systems for various applications.

Course Outcomes:

After successful completion of this course, students will be able to-

1. Use his/her understanding/knowledge of Embedded System so as to develop computer program related to the given aim/objective.
2. Use equipment's/other concerned resources for conduction of experiments.
3. Interpret results, formulate findings, draw suitable conclusion and respond to inquiries, related to given experiment.

List of Experiments:

Minimum 08-10 experiments should be conducted based on **6IIoT03 Embedded Systems and RTOS** Syllabus.

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Course Code	Course Title	L	T	P	C
6IIoT08	**Embedded Systems Lab.**	00	00	02	01

Course Requisite: Microcontroller.

Course Objectives:

1. To Learn how to develop basic applications in the LabView graphical programming environment.
2. To Create applications using a state machine design pattern, read and write data to file.

Course Outcomes:

After successful completion of this course, students will be able to –

1. Use his/her understanding/knowledge of
2. Embedded System so as to develop computer program related to the given aim/objective.
3. Use equipment's/other concerned resources for conduction of experiments.
4. Interpret results, formulate findings, draw suitable conclusion and respond to inquiries, related to given experiment

List of Experiments:

Minimum 08-10 experiments should be conducted based on**6IIoT03 Embedded Systems and RTOS** Syllabus.

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6IIoT09 SKILL DEVELOPMENT-IV Lab.

Course Pre-requisite: Skill Development-III

Course Objectives:

1. To study Raspberry pi platform, that is widely used in IoT applications.
2. To implement the Hands On Experience with Raspberry pi and development of Internet of Things (IoT) prototypes including devices for sensing, actuation, processing, and communication.
3. To help students to develop skills and experiences.

Course Outcomes:

After successful completion of this course, students will be able to-

1. Use his/her understanding/knowledge of Raspberry pi platform so as to develop suitable practical applications related to the given aim/objective using Raspberry pi.
2. Use equipment's/other concerned resources for development of applications.
3. Interpret results, formulate findings, draw suitable conclusion and respond to inquiries, related to given experiment

List of Experiments:

Minimum 08-10 experiments should be conducted based on **Raspberry Pi Platform.**

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