ST. VINCENT PALLOTTI COLLEGE OF ENGINEERING & TECHNOLOGY, NAGPUR

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

B. Tech. Scheme of Examination & Syllabus 2024-25

INDUSTRIAL IoT

SEMESTER III

Sr. No	Course Category	Course Code	Course Title	Hours per Week			Credits	Maximum Marks				No. of hours for ESE
				L	T	P		Mid Sem Exam	Continual Assessment	End Sem Examination	Total	
1	PCC	**24II301T**	Object Oriented Programming & Data Structures	**3**	**1**	**-**	**4**	**20**	**20**	**60**	**100**	**03**
2	PCC	**24II301P**	Object Oriented Programming & Data Structures Lab	**-**	**-**	**4**	**2**	**-**	**25**	**25**	**50**	**-**
3	PCC	**24II302T**	Analog & Digital Communication	**3**	**1**	**-**	**4**	**20**	**20**	**60**	**100**	**03**
4	PCC	**24II302P**	Analog & Digital Communication Lab	**-**	**-**	**2**	**1**		**25**	**25**	**50**	**-**
5	PCC	**24II303T**	Mechatronics	**3**	**-**	**-**	**3**	**20**	**20**	**60**	**100**	**03**
6	PCC	**24II303P**	Mechatronics Lab	**-**	**--**	**2**	**1**		**25**	**25**	**50**	**-**
7	AEC	**24ES401T**	Economics & Management	**3**	**-**	**-**	**3**	**20**	**20**	**60**	**100**	**03**
8	SEC	**24II341P**	Career Development - III	**-**	**-**	**2**	**1**	**-**	**50**	**-**	**50**	**-**
9	ELC	**24II304P**	Micro Project I*	**-**	**-**	**2**	**1**	**-**	**50**	**-**	**50**	**-**
10	MDM	**24II331M**	Multidisciplinary Minor	**2**	**-**	**-**	**2**	**10**	**10**	**30**	**50**	**1.5**
			Total	**14**	**2**	**12**	**22**	**90**	**265**	**345**	**700**	**13.5**

***Field Project or Community engagement project in the major discipline**

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B. Tech. Scheme of Examination & Syllabus 2024-25

INDUSTRIAL IoT

THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
23II301T	Object Oriented Programming & Data Structures	3	1	-	4	20	20	60	100

Course Objectives	Course Outcomes
This course is intended ● Understand the principles of Object-Oriented Programming and develop skills in C++ to assess how the choice of data structures and algorithm design methods impacts program performance. ● Choose the appropriate data structure and algorithm design method for various applications, and write programs using C++. ● Design, implement, and analyze efficient solutions to problems using advanced C++ programming techniques, including inheritance, polymorphism, and dynamic data structures.	Student will be able to ● Develop and demonstrate basic programs using Object-Oriented Programming principles, focusing on function overloading and operator overloading. ● Implement various types of inheritance to create reusable and maintainable code, applying runtime polymorphism. ● Apply and analyze fundamental sorting and searching algorithms, and efficiently manage data using arrays. ● Design and implement stack and queue data structures using linked lists for dynamic data storage and processing. ● Implement and manipulate tree data structures, including binary search trees and threaded binary trees, for efficient data retrieval and storage.

Unit I **[10 Hrs]**

Introduction of Object-Oriented Programming and Overloading

Basic concepts of OOP: Encapsulation, Inheritance, Polymorphism, Abstraction Benefits and applications of OOP in IoT, Class members, access control, constructors, and destructors, Parameter passing methods, inline functions, static class members, friend functions Function overloading and generic programming, Function and class templates Operator overloading: Unary and binary operator overloading, rules for operator overloading

Unit II **[9 Hrs]**

Inheritance

Basics of inheritance: Base and derived classes, Types of inheritance: Single, multilevel, multiple, hierarchical, hybrid, virtual base class, Runtime polymorphism: Virtual functions, pure virtual functions, abstract classes

Unit III **[9 Hrs]**

Introduction to Data structure

Arrays: Introduction and linear arrays, representation in memory, Sorting algorithms: Selection sort, insertion sort, bubble sort, quick sort, merge sort, radix sort, searching algorithms: Linear search, binary search, Complexity analysis of sorting and searching algorithms, Multidimensional arrays and sparse matrices

Unit IV **[10 Hrs]**

Introduction of Stack and Queue

Introduction to stack and queue, Dynamic memory allocation, Linked lists: Introduction, representation of singly linked list in memory, Traversing, insertion, and deletion in linked lists, Implementation of stack using linked representation, Implementation of queue using linked representation

Unit V **[10 Hrs]**

Trees and Terminology

Basic terminology of trees, Binary trees: Representation and traversal (in-order, pre-order, post-order), Algebraic expressions and complete binary trees, Array and linked representation of binary trees, Binary search tree (BST) implementation, Operations on, BST: Searching, insertion, deletion, Threaded binary trees and traversal methods, Generalization of trees to graphs: Representation and traversal, Dijkstra's shortest path algorithm

Text Books

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

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Mastering C++	K.R.Venugopal,B. RajKumar, T.RaviShankar	-	Tata McGraw Hill publication.
2	Problem solving with C++ The OOP	W. Savitch	-	Pearson education.
3	C++, the Complete Reference	Herbert Scheldt	-	Tata McGraw Hill Publications.
4	Data Structures and Program Design in C++	Robert L. Kruse, Alexander J. Ryba	-	PHI Publications
5	Object Oriented Programming in Microsoft C++	Robert Lafore	-	Galgotia Publications Pvt. Ltd

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THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24II301P	Object Oriented Programming & Data Structures Lab	---	---	2	1	25	25	50

Course Objectives	Course Outcomes
1) Understand the concept of object-oriented programming and develop skills in C++ Language. 2) To choose the appropriate data structure and algorithm design method for a specified application. Write programs using C++ Language.	• Describe & Illustrate concept of object-Oriented Programming, function overloading, operator overloading • Classify Inheritance and develop program using C++. • Implement searching and sorting techniques using C++. • Implement operation like Searching, Insertion and Deletion, traversing mechanism on various data structure. • Design programs using data structures such as Binary tree and graph.

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

Text Books

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

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Mastering C++	K.R.Venugopal,B.RajKumar,T. RaviShankar	--	Tata McGraw Hill publication.
2	Problem solving with C++ The OOP	W.Savitch	--	Pearson education.
3	C++, the Complete Reference	Herbert Scheldt	--	Tata McGraw Hill Publications.
4	Data Structures and Program Design in C++	Robert L. Kruse, Alexander J. Ryba	--	PHI Publications
5	Object Oriented Programming in Microsoft C++	Robert Lafore	--	Galgotia

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THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
24II302T	Analog & Digital Communication	3	1	-	4	20	20	60	100

Course Objectives	Course Outcomes
This course is intended ● Impart the basic concepts of analog modulation schemes. ● Describe different types of noise and predict its effect on various analog communication systems. ● Know the techniques of analog communication and digital communication.	Student will be able to ● Analyze basics of signals, its properties and application in communication system. ● Compare different modulation techniques. ● Evaluate the performance of pulse modulation and demodulation techniques in various transmission environments. ● Explain digital modulation techniques in communication systems ● Explain digital demodulation techniques in communication systems

Unit I INTRODUCTION TO ELECTRONIC COMMUNICATIONS AND SIGNALS **[6 Hrs]**

Introduction, Digital and Analog Sources and Systems, Deterministic and Random Waveforms Block Diagram of a Communication System (Analog and Digital), Power Measurements (dB, dBm, and Bel), Channel capacity and Ideal Communication Systems, Properties of Signals and Noise, classification of signals and systems, Fourier Series and Fourier Transform, Power Spectral Density, Bandwidth of Signals

Unit II AMPLITUDE MODULATION AND ANGLE MODULATION **[9 Hrs]**

Introduction, Types of communication, Need of modulation, Modulation, Modulation Index, Importance of Modulation Index, Suppressed Carrier Systems, SSB and VSB, Generation of AM waves, Demodulation of AM waves, AM Transmitters and Receivers, Comparison of AM Techniques, Properties of Angle-Modulated Waves, Relationship between PM and FM Waves, Narrowband FM, Wideband FM, Transmission Bandwidth of FM Waves, FM Modulators and Transmitters, FM Demodulator and Receivers.

Unit III PULSE AND DATA COMMUNICATION **[8 Hrs]**

Introduction, Pulse Amplitude Modulation (PAM), Generation and Detection of PAM signals, Sampling Process, Pulse Width Modulation: Generation and Detection of PWM signals, Pusle Position Modulation (PPM): Generation and Detection of PPM Signals, Quantization Process, Pulse Code Modulation: Bandwidth of PCM system

Unit IV DIGITAL MODULATION **[9 Hrs]**

Introduction to Binary Modulation Schemes: ASK, PSK, FSK, QPSK: Mathematical Representation, Signal Space representation or Constellation Diagram, Waveforms, Generation and Reception, Comparison of binary modulation schemes.

Unit V **[8 Hrs]**

Introduction to Digital Demodulation, ASK Demodulation – Coherent and Non-coherent Detection, FSK Demodulation – Detection, Coherent Detection using PLL, PSK Demodulation – Coherent Detection using Carrier QPSK Demodulation – Signal Space Representation, Symbol Detection, Concept of Bit Error Rate Demodulation, Comparison of Digital Demodulation Techniques – Complexity, Noise Tolerance, Bandwidth

Text Books

S.N	Title	Authors	Edition	Publisher
1	Analog and Digital Communication	Simon Haykin and Micheal Moher	2nd	Wiley
2	Digital and Analog Communications System	Leon W. Couch	8th	Pearson Education
3.	Introduction to Communication System	Upmanyu Madhow	1st	Cambridge University Press

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Modern Digital and Analog Communications System	B. P. Lathi & Zhi Ding	Indian	Oxford Publication
2	Fundamentals of Digital Communication	Upmanyu Madhow	South Asian	Cambridge University Press

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Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24II302P	Analog & Digital Communication Lab	---	---	2	2	25	25	50

Course Objectives	Course Outcomes
This course is intended ● Impart the basic concepts of analog modulation schemes. ● Know the techniques of analog communication and digital communication.	**Students will be able to** ● Demonstrate generation and detection of analog and digital modulation techniques. ● Demonstrate generation and detection of keying techniques. ● Compare different modulation techniques. ● Identify the basic elements of mobile communication system

List of Experiments

- Calculation of Modulation Index by Observing AM Wave
- DSB-AM Generation and Reception using AM Transmitter and Receiver
- FM Modulation using Varactor Diode and Reactance Modulator
- PAM Generation using Sample and Hold Circuit
- PWM Generation using Varying Sampling Frequencies
- FSK Modulation and Demodulation
- Study and Simulation of ASK and BPSK Modulation & Demodulation with BER Analysis using MATLAB
- BPSK/DPSK/QPSK Modulation and Demodulation with Spectral Analysis using MATLAB or Equivalent Simulation Tool

Text Books

S.N	Title	Authors	Edition	Publisher
1	Analog and Digital Communication	Simon Haykin and Micheal Moher	2nd	Wiley
2	Digital and Analog Communications System	Leon W. Couch	8th	Pearson Education
3.	Introduction to Analog and Digital Communication	M.A. Bhagyaveni, R Kalidoss, K.S. Vishvaksenan	1st	River Publications

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Modern Digital and Analog Communications System	B. P. Lathi & Zhi Ding	Indian	Oxford Publication
2	Fundamentals of Digital Communication	Upmanyu Madhow	South Asian	Cambridge University Press
3	Introduction to Communication System	Upmanyu Madhow	1st	Cambridge University Press

THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
24II303T	Mechatronics	3	-	-	3	20	20	60	100

Course Objectives	Course Outcomes
This course aims to provide a foundational understanding of Mechatronics by integrating mechanical, electronic, and computer engineering principles. Students will learn about various sensors and advanced sensor technologies, including smart sensors and MEMS, and analyze different actuation systems to design and implement effective Mechatronics solutions.	Student will be able to • Describe the evolution and role of Mechatronics in automation. • Apply principles of various sensors in Mechatronics systems. • Evaluate smart sensor technologies and MEMS applications. • Design pneumatic, hydraulic, mechanical, and electrical actuation systems. • Utilize signal conditioning, microprocessors, microcontrollers, and PLCs.

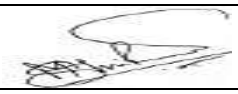
Unit I	**[7Hrs]**
Introduction to Mechatronics: Evolution of Mechatronics, origins, Multidisciplinary scenario, importance of mechatronics in automation, Mechatronics system, products and systems in manufacturing, Advanced manufactruing system, CIM, Industrial robots and automatic quality control and inspection systems.	
Unit II	**[8 Hrs]**
Sensors: Sensors/Transducers, Principles, Classification, Parameters, Static characteristics, Dynamic characteristics, Displacement sensors, Positioning sensor, Proximity sensors, velocity sensors, motion sensors, Force sensors, Accelerometer sensors, temperature sensors, Selection of sensors	
Unit III	**7 Hrs]**
Smart Sensors, Sensor Technologies and Applications: Smart sensor basics: Introduction, mechanical-elecronics transition in sensing, nature of sensors, Micro-electromechanical system (MEMS) sensors, integration of micromachining and microelectronics. **Micromachining techniques:** Bulk micromachining, surface micromachining, LIGA process.	
Unit IV	**[9 Hrs]**
Actuators: Pneumatic & Hydraulic Actuation Systems: Actuation Systems, Pneumatic & Hydraulic Systems, Cylinders/Actuators, Directional Control Valves,Logic gate valves, direct & indirect control of single/double acting cylinder, development of pneumatic circuit for applications, cylinder sequencing. **Mechanical Actuation Systems:** Mechanical Systems, Types of motion, Kinematic chains, Cams, Gear Trains, Ratchet and Pawls, Belt and Chain Drives, Bearings, Mechanical Aspects of Motor Selection, **Electrical Actuation Systems:** Electrical Systems, Mechanical Switches, Solid-State Switches, Solenoid, DC Motors, AC Motors, Stepper Motors	
Unit V	**[9 Hrs]**
Signal Conditioning, Microprocessor, Microcontrollers, and Programmable Logic Controllers **Signal Conditioning:** Signal Conditioning, The Operational Amplifier, Protection, Filtering, Wheatstone Bridge, Digital Signals, Multiplexers, Data Acquisition, Digital Signal Processing, Pulse Modulation, **Microprocessors:** Control, Microprocessors Systems, Microcontrollers, Applications, **Programmable Logic Controllers:** Basic structure, I/O Processing, Data Handling, Analog Input/Output, Selection of PLC	

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Mechatronics	W. Bolton		Pearson Education Ltd
2.	Sensors and Transducers	D. Patranabis		PHI Publication
3.	Mechatronics Integrated Mechanical Electronics Systems	K P Ramchandran, G k Vijayaraghavan, M S Balasundaram		Wiley

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Mechatronics	HMT Ltd	Third Edition (Kindle Edition)	Tata McGraw-Hill
2	Introduction to Mechatronics	Appu kuttan K.K		**Oxford University Press**

		July 2025	3.0	Applicable for 2025-26
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THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation		
						CA	ESE	Total
24II303P	Mechatronics Lab	-	-	2	1	25	25	50

Course Objectives	Course Outcomes
To provide students with practical knowledge of selection of sensors, actuators, signal conditioning, signal processing in design and analysis of Systems for various applications.	● To develop a measurements system by selecting appropriate sensors to measure a physical quantity ● To develop pneumatic / hydraulic circuit for given application using actuators and control valves. ● Implementation of ladder diagram, programming using PLC to develop a new mechatronics application. ● design & develop a measurement system using Data Acquisition System.

- **Minimum eight experiments to be performed from the list**

Expt. No.	Title of the experiment
1	Performance based on the working of Digital-to-analog conversion.
2	Performance based on the working of Analog-to-digital conversion.
3	To design & develop a measurement system using Data Acquisition System & LabVIEW software.
4	Performance based on pneumatic/hydraulic cylinder using single acting & double acting cylinder.
5	Performance based on Temperature measurement sensor
6	Performance based on distance measurement sensor.
7	Performance based on weight measurement sensor
8	Performance based on displacement measurement sensor
9	Performance based on proximity sensor (Inductive & Capacitive)
10	Performance based on water level indication sensor
11	Development of ladder diagram, programming using PLC for Lift / elevator control.
12	Development of ladder diagram, programming using PLC for electro-hydraulic system.

Text Books

S.N	Title	Authors	Edition	Publisher
1.	Mechatronics	W. Bolton		Pearson Education Ltd
2.	Sensors and Transducers	D. Patranabis		PHI Publication
3.	Mechatronics Integrated Mechanical Electronics Systems	K P Ramchandran, G K Vijayaraghavan, m S Balasundaram		Wiley

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Mechatronics	HMT Ltd	Third Edition (Kindle Edition)	Tata McGraw-Hill
2	Introduction to Mechatronics	Appu kuttan K.K		**Oxford University Press**

THIRD SEMESTER

Course Code	Course Name	Th	Tu	Pr	Credits	Evaluation			
						MSE	CA	ESE	Total
24II331M	MDM-I Microcontrollers: Arduino Playground	2		-	2	10	10	30	50

Course Objectives	Course Outcomes
• Understand the fundamentals of microcontrollers, embedded systems, and Arduino platforms. • Learn Arduino programming (C/C++), including data types, loops, functions, and serial communication. • Interface sensors, actuators, display modules, and communication modules with Arduino.	• Explain the fundamental concepts of microcontrollers, embedded systems, and Arduino • Implement Arduino programming concepts using C/C++, and interface LEDs, buzzers, motors, relays, and display modules for embedded applications. • Design and develop real-world embedded systems by interfacing various sensors, wireless communication modules, and implementing mini-projects like home automation and robotics.

Unit I	[8 Hrs]
Overview of Microcontrollers and Embedded Systems, Introduction to Arduino: Arduino board variations (Uno, Mega, Nano, etc.),Features and specifications of Arduino, Understanding Digital and Analog I/O: Pin configuration and functionality, Setting up Arduino IDE & Writing First Program:Installation of Arduino IDE,Writing, compiling, and uploading sketches, Basics of C/C++ Programming for Arduino:Data types, variables, loops, and functions, Using digitalRead(), digitalWrite(), analogRead(), and analogWrite(), Debugging Using the Serial Monitor : Serial Communication using Arduino (Serial Monitor & Serial Plotter)	
Unit II	[8 Hrs]
Let Us (Arduino) C: Arduino C, Data types, Decision making, Loops, Functions, Actuators & Output Devices:Interfacing LEDs & Buzzer,Controlling DC Motors & Servo Motors using Arduino,Relay Module for AC Appliances,Display Modules:LCD 16x2 Interfacing, 7-Segment Display	
Unit III	[8 Hrs]
Interfacing Sensors with Arduino: Temperature Sensor (DHT11, LM35), Light Sensor (LDR), Ultrasonic Sensor (HC-SR04), PIR Motion Sensor, Gas Sensor (MQ Series), Wireless Communication Modules: Bluetooth Module (HC-05, HC-06),IR Remote and Receiver, Application :Smart Home Automation	

Text Books

S.N	Title	Authors	Edition	Publisher
1	Arduino Cookbook	Michael Margolis	1	O'Reilly Media
2	Arduino for Beginners: Essential Skills Every Maker Needs	John Baichtal	1	Pearson

Reference Books

S.N	Title	Authors	Edition	Publisher
1	Microcontroller datasheets and user's manual			https://www.farnell.com/datasheets/1682209.pdf
2	UNO R3 Arduino Documentation			https://docs.arduino.cc/hardware/uno-rev3

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