UEI741C: PROCESS AUTOMATION
4 Credits (4-0-0)

Course Objectives:

1. To convey the importance and benefits of industrial automation.
2. To develop PLC programming skills.
3. To discuss SCADA and DCS for process automation.

UNIT-I

Introduction: Expectations from automation, Basic functions, Historical development of control systems, Current trends in computer of process plants. **Intelligent Controllers:** Model based controllers, Predictive control, Artificial intelligence based systems. **Introduction to Programmable Logic Controllers (PLC):** Introduction to PLC operation-The digital concept, Analog signals, The input status file, The output status file, Input and output status files, Sixteen point I/O modules, PLC memory, Input modules - Discrete type, Discrete AC and DC type. Output Modules - Discrete type, Solid-state type, Switching relay type.

13 Hrs.

UNIT-II

Introduction to Logic: The logic, Conventional ladder v/s LPLC ladder, Series and parallel function of OR, AND, NOT, XOR logic, Analysis of rung. **PLC Instructions:** The basic relay instructions normally open and normally closed instructions, Output latching instructions, Understanding relay instructions and the programmable controller input modules, Interfacing start stop push-button and motor to PLC, Developing ladder diagram with analytical problems.

13 Hrs.

UNIT-III

Timer and Counter Instructions: On delay and off delay and retentive timer instructions, PLC counter up and down instructions, Combining counters and timers, Developing ladder diagram with analytical problems. **Comparison and Data Handling Instructions:** Data handling instructions, Sequencer instructions - Programming sequence output instructions, Developing ladder diagram with analytical problems.

13 Hrs.

UNIT-IV

Supervisory Control And Data Acquisition (SCADA): Introduction. Channel scanning, Conversion to engineering units, Data processing, Distributed SCADA system. **Distributed Control System (DCS):** Introduction, Distributed versus Centralized control, Advantages of Distributed Control System, Functional requirements of distributed control system, System architecture, Distributed Control Systems.

13 Hrs.

Total Hrs.: 52

Course Outcomes:
Student will be able to:

CO1: a. Elucidate the role of automation in industry and comprehend the various controllers used in industries
b. Illustrate typical elements of PLC and its memory organization

CO2: a. Compare electrical relay logic and PLC ladder logic illustrate the working of PLC instructions
b. Develop program using basic PLC instructions

CO3: a. Illustrate the working of advanced PLC instructions
b. Develop program for PLC applications

CO4: a. Interpret the role of SCADA in process control
b. Analyze the role of Distributed Control System (DCS)

Text Books:

1. Garry Dunning, "Introduction to Programmable Logic Controllers," 2nd Edition. Thomson Publishing, ISBN: 981-240-625-5.
2. Krishna Kant, "Computer based Industrial Control," 6th Edition, 2004, PHI, ISBN: 1-203-11237

Reference Books:

1. Curtis Johnson, "Process Control Instrumentation Technology", Prentice Hall of India.
2. Bela G. Liptak, "Instrumentation Engineers Hand Book – Process Control", Chilton Book Company, Pennsylvania.
3. W.Bolton, "Industrial Control and Instrumentation", Universities Press.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	1	--	--	--	--	--	1	--	1	3	2
CO2	2	3	3	1	2	--	--	--	--	1	--	1	2	3
CO3	3	3	3	3	2	--	--	--	--	1	--	1	2	3
CO4	2	2	2	1	--	--	--	--	--	1	2	1	3	2

UEI742C: LASERS AND OPTICAL INSTRUMENTATION
4 Credits (4-0-0)

Course Objectives:

1. To discuss various laser devices.
2. To know the application of lasers in different fields.
3. To discuss the fundamentals of optical fibers and optical sensors.

UNIT-I

Fundamentals of Lasers: Emission and absorption of radiation, Einstein relations, population inversion with 2 level, 3 level and 4 level energy systems, optical feedback, line shape function, laser losses, threshold conditions, laser modes, properties of laser light, classification of lasers, **Doped and Semiconductor Lasers:** Doped insulator lasers –Nd:YAG laser, Ruby laser, Semiconductor lasers – basics, threshold current density for semiconductor lasers, power output of semiconductor lasers, hetero junction lasers.

13 Hrs.

UNIT-II

Gas, ion and molecular Lasers: Gas lasers: Atomic lasers- He-Ne laser, Ion laser- Argon laser, Molecular laser-CO_2 laser, Liquid dye lasers, Single mode operation, Mode locking technique- Introduction, active & passive mode locking, Q-switching technique: Introduction, methods of Q-switching- Rotating mirror method, Electro-optic method, Passive method. **Laser applications:** Measurement of distance - Interferometric methods, beam modulation telemetry, pulse echo techniques. Holography-Principle, holographic computer memory system.

13 Hrs.

UNIT-III

Optical Fibers: Introduction, fiber benefits, areas of application, structure of fiber, propagation of light in fibers, Principles of fiber optics: Ray theory transmission, total internal reflection, numerical aperture, mode theory of optical propagation, fiber specification, types of fiber: Step index fiber, graded index fiber, multi-mode and single mode fiber, fiber materials, and optical fiber cables. **Optical source**: LED- Principle, characteristics, construction, working.

13 Hrs.

UNIT-IV

Optical Detectors: Characteristics, Photo detectors- photo multiplier tube, photo diode, PIN diode, avalanche diode, photo transistor, CMOS, CCD image sensors(Working principles only), **Optical fiber sensors:** Phase and polarization fiber sensors, ring with multi turn fiber coil, optical fluid level detector, optical fiber flow sensors, current measurement by single mode optical fiber sensors, fluro-optic temperature sensors, photo elastic pressure sensors, laser Doppler velocimeter using optical fiber, fiber Bragg grating sensor .

13 Hrs.

Total Hrs.: 52

Course Outcomes:

Student will be able to:

CO1 Describe the fundamental concepts of laser and optical instruments.

CO2 Define various principles of laser and optical instruments.

CO3 Describe techniques employed in laser and optical instruments.

CO4 Depict the applications of laser and optical instruments.

Text Books:

1. Wilson, Hawkes, "Optoelectronics: An Introduction," 2nd Edition, Prentice-Hall of India, 2001.
2. K.Sarkar, D.C. Sarkar, "Optoelectronics and Fiber Optics Communication," New Age Int. Pub., 2004.
3. P. Sarah, I.K.," Lasers and Optical Fiber Communications," International Publishung House Pvt. Ltd., 2008.

Reference Books:

1. Wilson, Hawkes, "Laser Principles and Applications," 7th Edition, 1987, PHI, ISBN: 978-0135237052.
2. Orazio Svelto, "Principles of Lasers," 5th Edition, Springer, 2010.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	--	--	--	--	--	--	--	--	--	--	3	2
CO2	3	3	--	--	--	--	--	--	--	--	--	--	3	3
CO3	3	2	--	--	--	--	--	--	--	--	--	--	3	2
CO4	3	2	--	--	--	--	--	--	--	--	--	--	3	2

UEI743L: VIRTUAL INSTRUMENTATION LABORATORY
2 Credits (0-0-4)

Course Objectives:

1. To learn the components of virtual instrumentation and develop programs for given application
2. To interface DAQ card to measure and control a parameter
3. To implement small projects in VI

List of Experiments:

1. Creating controls and indicators of different data types
2. Creating basic components of a VI
3. Creating Virtual Instrumentation for simple applications
4. Programming exercises for loops and charts
5. Programming exercises for arrays and matrices
6. Programming exercises for subVIs
7. Programming exercises for clusters and graphs
8. Programming exercises on case and sequence structures, file Input/Output.
9. Data acquisition through Virtual Instrumentation.
10. Developing voltmeter using DAQ cards.
11. Developing signal generator using DAQ cards.
12. Simulating reactor control using Virtual Instrumentation.
13. Real time temperature control using Virtual Instrumentation
14. Real time sequential control of any batch process.

Course Outcomes:
Students will be able to:

CO1	Apply the concepts of VI for the given logic
CO2	Analyze the software and hardware components of VI
CO3	Develop LabVIEW program for the given application

Text Books:

1. Jerome, Jovitha, "Virtual instrumentation using LABVIEW", PHI, 1st Edition,2010

Reference Books:

1. Bitter, R., Mohiuddin, T. and Nawrocki, M., "Labview Advanced Programming Techniques", CRC Press, 2nd Edition, 2007.
2. Jamal, R. and Picklik, H., "Labview – Applications and Solutions", National Instruments Release.
3. Johnson, G., "Labview Graphical programming", McGraw-Hill, Newyork, 1997.

Wells, L.K. and Travis, J., "Labview for Everyone", Prentice Hall, New Jersey, 1997.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	--	--	3	--	--	--	--	--	--	--	2	1
CO2	1	1	--	--	3	--	--	--	--	--	--	--	1	2
CO3	2	2	--	--	3	--	--	--	--	--	--	--	2	1

UEI744L: PROCESS AUTOMATION LABORATORY
1 Credits (0-0-2)

Course Objectives:

1. To give hands on experience of PLC programming and interfacing.
2. To make use of computers for process control.

List of Experiments:

Part A (PLC):

1. Implementation of Boolean functions using PLC.
2. Sequential control experiments using PLC. Logic should be solved using ladder diagram technique.
3. Experiments on timers and counter instructions of PLC.
4. Interfacing external devices to PLC.
5. Implementation of level control process using PLC
6. Implementation of automatic bottle filling process using PLC.
7. Implementation of control of conveyer belt using PLC.
8. Implementation of elevator control using PLC.

Part B (Computerized Process Control):

1. Interfacing the level process station to the computer using available arrangement and controlling it through PID controller.
2. Interfacing the flow process station to the computer using available arrangement and controlling it through PID controller.

Course Outcomes:

Students will be able to:

CO1 Design and develop a system/write program for the given objective.
CO2 Conduct the experiment/ execute the program and demonstrate the theoretical concepts.
CO3 Analyze and interpret the results.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3	--	--	--	--	--	--	2	3	3
CO2	3	3	3	2	3	--	--	--	--	--	--	2	2	3
CO3	3	3	3	2	2	--	--	--	--	--	--	2	3	3

UEI711E: DATA BASE MANAGEMENT SYSTEM
3 Credits (3-0-0)

Course Objectives:

1. Provide a strong foundation in database concepts, technology.
2. Practice SQL programming through a variety of database problems**.**
3. Design and build database applications for real world problems.

UNIT-I

Introduction to Databases: Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications. Overview of Database Languages and Architectures: Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment. **Conceptual Data Modelling using Entities and Relationships:** Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, examples, Specialization and Generalization.

10 Hrs.

UNIT-II

Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations. Relational Algebra: Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra. Mapping Conceptual Design into a Logical Design: Relational Database Design using ER-to-Relational mapping. SQL: SQL data definition and data types, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL.

10 Hrs.

UNIT-III

SQL : Advances Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL. Database Application Development: Accessing databases from applications, An introduction to JDBC, JDBC classes and interfaces, SQLJ, Stored procedures, Case study: The internet Bookshop. Internet Applications: The three-Tier application architecture, The presentation layer, The Middle Tier.

10 Hrs.

UNIT-IV

Normalization: Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on

Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. Normalization Algorithms: Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design, Nulls, Dangling tuples, and alternate Relational Designs, Further discussion of Multivalued dependencies and 4NF, Other dependencies and Normal Forms.

10 Hrs.

Total Hrs.: 40

Course Outcomes:

Student will be able to:

- **CO1** Effectively explains the basic concepts of databases and data models
- **CO2** Develops an Entity-Relationship model based on user requirements. Use Structured Query Language (SQL) for database manipulation.
- **CO3** Effectively designs basic and advanced SQL queries to retrieve data from the database.
- **CO4** Applies various Normalization techniques for database design improvement.

Text Books:

1. Ramez Elmasri and Shamkant B. Navathe, "Fundamentals of Database Systems", 7th Edition, 2017, Pearson.

Reference Books:

1. Ramakrishnan, and Gehrke, "Database management systems" 3rd Edition, 2014, McGraw Hill.
2. Silberschatz Korth and Sudharshan, "Database System Concepts", 6th Edition, McGrawHill, 2013.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3	--	--	--	--	--	--	1	3	2
CO2	3	3	3	2	3	--	--	--	--	--	--	1	3	2
CO3	3	3	3	2	3	--	--	--	--	--	--	1	3	2
CO4	3	3	3	2	3	--	--	--	--	--	--	1	3	2

UEI712E: VLSI DESIGN
3 Credits (3-0-0)

Course Objectives:

1. To build upon the theoretical, mathematical and physical analysis of digital VLSI circuits.
2. To understand the fabrication process of MOS technology
3. Understand the concept of parasitic resistance, capacitance and thus propagation delay of gate level circuit.
4. To learn the concepts of designing VLSI Subsystems.

UNIT-I

Introduction to MOS Technology: Introduction to integrated circuit technology, Metal oxide semiconductor and related VLSI technology, Basic MOS transistors, enhancement mode transistor action, depletion mode transistor, nMOS fabrication, CMOS fabrication, BiCMOS technology.Basic Electrical Properties of MOS and BiCMOS Circuits: Drain to source current verses Voltage characteristics, threshold voltage, trans-conductance, nMOS inverter, termination of pull up to pull down ratio, nMOS inverter driven through one or more pass transistors, alternative forms of pull up, CMOS inverter, MOS transistor circuit model, BiCMOS inverters**.**

10 Hrs.

UNIT-II

MOS and BiCMOS Circuit Design Process: MOS layers stick diagrams, nMOS design style,CMOS design style, designs rules and layout, and lambda based design rules. Basic Circuit Concept: sheet resistance, area capacitance calculation, delay unit, inverter delay, driving large capacitive loads, super buffers, wiring capacitance.

10 Hrs.

UNIT-III

Subsystem Design and Layout: architectural issues, gate (restoring) logic, examples of structured design (combinational logic)- a parity generator, Bus arbitration logic for n-line bus, multiplexers. Subsystem Design Process: General consideration, design process- 4 bit arithmetic processor.

10 Hrs.

UNIT-IV

Semiconductor memories: Introduction, Dynamic random-access memory, static random-access memory, nonvolatile memory, flash memory, Ferro electric random-access memory.

10 Hrs.

Total Hrs.: 40

Course Outcomes:
Student will be able to:

- **CO1** Understand the fabrication process of IC technology and analysis of the operation of MOS transistor.
- **CO2** Draw the stick diagrams of various logic circuits.
  Estimate the various delay encountered in logic circuits.
- **CO3** Implement and design of building blocks of data path and sub systems.
- **CO4** Demonstrate an understanding of working principle of operation of different types of memories.

Text Books:

1. Douglas A. Pucknell, Kamran Eshraghian, "Basic VLSI Design", 3rd Edition, PHI
2. Sung Mo Kang, Yusuf Leblebici, "CMOS Digital Integrated Circuits, Analysis and Design", 3rd Edition, Tata McGraw Hill

Reference Books:

1. S. M. Sze, "VLSI Technology", 2nd Edition, Tata McGraw Hill.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	--	--	--	--	--	--	--	--	--	--	3	2
CO2	3	3	--	--	--	--	--	--	--	--	--	--	3	3
CO3	3	2	2	--	--	--	--	--	--	--	--	--	3	2
CO4	3	2	2	--	--	--	--	--	--	--	--	--	3	2

UEI713E: INTERNET OF THINGS
3 Credits (3-0-0)

Course Objectives:

1. To explain the characteristics, functional units of IoT
2. To understand the design concepts of IoT
3. To understand the applications and data analytics of IoT

UNIT-I

Introduction & Concepts: Definition and Characteristics of IoT, Things in IoT, IoT Protocols, IoT Functional Blocks, IoT Communication Models, IoT Communication APIs, IoT Enabling Technologies, IoT Levels and Deployment Templates. **IoT and M2M:** SDN and NFV for IoT.

10 Hrs.

UNIT-II

Developing Internet of Things: IoT Platform Design Methodology, Specifications: Requirements, Process, Domain, Information, Services, Level, Functional, Operational, Integration, **Application Development Python Language:** Data Types and Data Structures, Control Flow, Functions, Modules, Packages, File Handling, Date and Time Operations, Classes, Python Packages of Interest for IoT. **IoT Physical Devices and End Points:** Basic Building Blocks of an IoT Device, Raspberry Pi, Linux on Raspberry Pi, Raspberry Pi Interfaces: Serial, SPI, I2C.

10 Hrs.

UNIT-III

Programming Raspberry Pi with Python: Controlling LED, Interfacing Switch, Other IoT Devices: Arduino, Beagle Bone Black. **Cloud and Data Analytics:** Introduction to cloud storage Models and Communication APIs, Python Web Application Framework – Django, Web Services for IoT, SkyNet Messaging Platform, **Data Analytics for IoT**: Apache Hadoop, spark.

10 Hrs.

UNIT-IV

IoT Case Studies: Home Automation: Smart Lighting, Cities: Smart Parking, Environment: Weather Reporting Bot, Forest Fire Detection; Agriculture – Smart Irrigation, IoT Printer.

10 Hrs.

Total Hrs.: 40

Course Outcomes:
Student will be able to:

- **CO1** Describe fundamentals of IoT
- **CO2** Describe the characteristics of protocols with IoT
- **CO3** Analyze the design steps associated with IoT
- **CO4** Design systems using IoT and data analytics

Text Books:

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A Hands-on Approach," Universities Press, 1st Edition, 2014

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	--	--	--	--	--	--	--	--	--	--	--	2	1
CO2	2	--	--	--	3	--	--	--	--	--	--	--	2	1
CO3	1	--	--	--	3	--	--	--	--	--	--	2	1	2
CO4	1	--	--	--	3	--	--	--	--	--	--	2	2	1

UEI714E: ADVANCED CONTROL SYSTEMS
3 Credits (3-0-0)

Course Objectives:

1. To impart the concept of compensation techniques in control system.
2. To obtain a state space model of a system.
3. To design and analyze a system in state space.
4. To design feedback controller and observer.

UNIT-I

Design of Feedback Control Systems: Concepts of design and compensation, cascade compensation networks, phase-lead and phase-lag control design approaches using both root locus plots and Bode diagrams. Usage of MATLAB command-line functions to verify the solution.

10 Hrs.

UNIT-II

Control System Analysis in State-space: State variable representation, state variables of a dynamic system, the state differential equation, block diagram and signal-flow graph state models, conversion of state equations and transfer functions, conversion of transfer functions to canonical state variable models. Usage of MATLAB command-line functions to verify the solution.

10 Hrs.

UNIT-III

State transition matrix: The time response and the state transition matrix, properties of state transition matrix, solving state equations via Laplace transform and directly in time domain. Usage of MATLAB command-line functions to verify the solution.

10 Hrs.

UNIT-IV

Control System Design in State-space: Concepts of controllability and observability, methods of testing controllability and observability, pole-placement design using feedback, stability improvement by state feedback, necessary condition for arbitrary pole placement, design of state observers, state feedback with integral control. Usage of MATLAB command-line functions to verify the solution.

10 Hrs.

Total Hrs.: 40

Course Outcomes:

Student will be able to:

- **CO1** Design and compensate a system.
- **CO2** Model and analyse a system in state space.
- **CO3** Determine state transition matrix and solve state equations.
- **CO4** Test linear system for controllability and observability and design state feedback controller and observer.
- **CO5** Use MATLAB command-line functions to verify solutions.

Text Books:

1. M.Gopal, "Control Systems", 3rd Edition, Tata McGraw Hill, 2011.
2. Katsuhiko Ogata, "Modern Control Engineering", 4th Edition. Pearson Education, 2002.

Reference Books:

1. Richard C. Dorf and Robert H, Bishop, "Modern Control Systems", Addison Wesley Longman Inc., 1999.
2. M.Gopal, "Digital Control and State Variable Methods", 3rd Edition, Tata McGraw Hill, 2000.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	--	--	--	--	--	--	--	--	--	3	3	3
CO2	3	3	3	--	--	--	--	--	--	--	--	--	3	3
CO3	3	3	3	--	--	--	--	--	--	--	--	--	3	3
CO4	3	3	3	--	--	--	--	--	--	--	--	--	3	3
CO5	--	--	--	--	3	--	--	--	--	--	--	--	--	--

UEI811E: INDUSTRIAL DRIVES AND MACHINES
3 Credits (3-0-0)

Course Objectives:

1. To explain dynamics and modes of operation of electric drives, selection of motor power ratings and control of dc motor using rectifiers.
2. To analyze the performance of induction motor drives under different conditions.
3. To explain the control of induction motor, synchronous motor and stepper motor drives.
4. To discuss typical applications electrical drives in the industry.

UNIT-I

Electrical Drives: Electrical Drives, Advantages of Electrical Drives. Parts of Electrical Drives, Choice of Electrical Drives, Status of dc and ac Drives. **Dynamics of Electrical Drives:** Fundamental Torque Equations, Speed Torque Conventions and Multiquadrant Operation. Equivalent Values of Drive Parameters, Components of Load Torques, Nature and Classification of Load Torques, Calculation of Time and Energy Loss in Transient Operations, Steady State Stability, Load Equalization. **Control Electrical Drives:** Modes of Operation, Speed Control and Drive Classifications, Closed loop Control of Drives. **Selection of Motor Power Ratings:** Thermal Model of Motor for Heating and Cooling, Classes of Motor Duty, Determination of Motor Rating.

10 Hrs.

UNIT-II

Direct Current Motor Drives: Controlled Rectifier Fed dc Drives, Single Phase Fully Controlled Rectifier Control of dc Separately Excited Motor,Single Phase Half Controlled Rectifier Control of dc Separately Excited Motor, Three Phase Fully Controlled Rectifier Control of dc Separately Excited Motor,Three Phase Half Controlled Rectifier Control of dc Separately Excited Motor, Multiquadrant Operation of dc Separately Excited Motor Fed Form Fully Controlled Rectifier,Rectifier Control of DC Series Motor. **Induction Motor Drives:** Analysis and Performance of Three Phase Induction Motors, Operation with Unbalanced Source Voltage and Single Phasing,Operation with Unbalanced Rotor Impedance, Analysis of Induction Motor Fed From Non-Sinusoidal Voltage Supply,Starting, Braking, Transient Analysis.Speed Control Techniques - Stator Voltage Control, Variable Voltage Frequency Control from Voltage Sources.

10 Hrs.

UNIT-III

Induction Motor Drives (continued): Voltage Source Inverter (VSI) Control, Cycloconverter Control, Closed Loop Speed Control and Converter Rating for VSI and Cycloconverter Induction Motor Drives, Variable Frequency Control from a Current Source, Current Source (CSI) Control,current regulated voltage

source inverter control, speed control of single phase induction motors. **Synchronous Motor Drives:** Operation from fixed frequency supply-starting, synchronous motor variable speed drives, variable frequency control of multiple synchronous motors. Self-controlled synchronous motor drive employing load commutated thyrister inverter.

10 Hrs.

UNIT-IV

Synchronous Motor Drives (continued): Self-controlled synchronous motor drive employing load commutated thruster inverter, Starting Large Synchronous Machines, Permanent Magnet ac (PMAC) Motor Drives, Sinusoidal PMAC Motor Drives, Brushless DC Motor Drives. **Stepper Motor Drives**: Variable Reluctance, Permanent Magnet, Important Features of Stepper Motors, Torque Versus Stepping rate Characteristics, Drive Circuits for Stepper Motor. **Industrial Drives:** Textile Mills, Steel Rolling Mills, Cranes and Hoists, Machine Tools.

10 Hrs.

Total Hrs.: 40

Course Outcomes:

Student will be able to:

- **CO1** Explain dynamics and different modes of operation of electric drives.
- **CO2** Suggest a motor for a drive and control of dc motor using controlled rectifiers.
- **CO3** Analyze the performance of induction motor drives under different conditions.
- **CO4** Suggest a suitable electrical drive for specific application in the industry.

Text Books:

1. Gopal K. Dubey**,** "Fundamentals of Electrical Drives", Narosa Publishing House, 2nd Edition, 2001.
2. Vedum Subramanyam, "Electrical Drives: Concepts and Applications," McGrawHill, 2nd Edition, 2011.

Reference Books:

1. N.K De, P.K. Sen, "Electric Drives,"PHI Learning, 1st Edition, 2009.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	--	--	--	--	--	--	--	--	1	3	2
CO2	3	3	3	--	--	--	--	--	--	--	--	1	3	2
CO3	3	3	3	--	--	--	--	--	--	--	--	1	3	2
CO4	3	3	3	--	--	--	--	--	--	--	--	2	3	3

UEI812E: JAVA
3 Credits: (3-0-0)

Course Objectives:

1. Gain knowledge about basic Java language syntax and semantics to write Java programs
2. Understand the fundamentals of object-oriented programming in Java
3. Understand the principles of inheritance, packages and interfaces
4. Understand the concept of exception handling and AWT

UNIT-I

Evolution of Java: Java's Lineage, the creation of Java, Java changed the internet, byte code, Java buzzwords, an overview of Java, data types, variables and arrays, operators, control statements.

10 Hrs.

UNIT-II

Introducing classes: Class fundamental, declaring objects, assigning object reference variables, introducing methods, constructors, this keyword, garbage collection. **Methods and classes:** Overloading methods, using object as parameters, argument passing, returning objects, recursion, access control, static, introducing final, the finalize method (), stack class.

10 Hrs.

UNIT-III

Inheritance: Inheritance, using super, creating a multilevel hierarchy, when constructors are called, method overriding, dynamic method dispatch, using abstract classes, using final with Inheritance, the object class. **Packages and Interfaces**: packages, access protection, importing packages, interfaces.

10 Hrs.

UNIT-IV

Exception handling: Fundamentals, exception types, uncaught exception, using try and catch, Multiple catch clauses, Nested try Statements, throw and finally statements. **AWT**: AWT classes, window fundamentals, working with frame windows, creating window programs, displaying information within a window

10 Hrs.

Total Hrs.: 40

Course Outcomes:
Student will be able to:

- **CO1** Set up Java JDK environment to create, debug and run Java programs.
- **CO2** Implement object-oriented concepts using programming examples
- **CO3** Demonstrate concepts of inheritance and importing of packages
- **CO4** To implement the exception handling mechanism and AWT concepts

Text Books:

1. Herbert Schildt, "Java The Complete Reference", 7th Edition, Tata McGraw Hill, 2007.

Reference Books:

1. E Balagurusamy, "Programming with Java", 6th Edition, MGH.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3	--	--	--	--	--	--	2	3	2
CO2	3	3	3	2	3	--	--	--	--	--	--	2	3	2
CO3	3	3	3	2	--	--	--	--	--	--	--	2	3	2
CO4	3	3	3	2	--	--	--	--	--	--	--	2	3	2

UEI813E: CLOUD COMPUTING
3 Credits (3-0-0)

Course Objectives:

1. To impart the knowledge of cloud computing, its advantages, characteristics, challenges and platforms.
2. To provide the knowledge of cloud computing architecture, reference model, types of cloud, service models with respect to all service models.

UNIT-I

Introduction: Cloud Computing at a Glance, Historical Development, Characteristics of Cloud Computing, Building Cloud Computing Environments, Computing Platforms and Technologies. **Cloud Computing Architecture:** Introduction, Cloud Reference Model, Types of Clouds, Economics of Cloud, Open Challenges.

10 Hrs.

UNIT-II

Aneka: Cloud Application Platform: Framework Overview, Anatomy of the Aneka Container, Building Aneka Clouds, Cloud Computing and Management. **Concurrent Computing:** Thread Programming: Introducing Parallelism for Single Machine Computation, Programming Application with Threads, Multi Applications with Threads, Multithreading with Aneka, Programming Applications with Aneka Threads.

10 Hrs.

UNIT-III

Virtualization: Introduction and Characteristics of Virtualized Environments, Taxonomy of Virtualization Techniques, Virtualization and Cloud Computing. Pros and Cons of Virtualization, Technology Examples. **Cloud Platforms in Industry:** Amazon Web Services, Google AppEngine, Microsoft Azure**. Cloud Applications:** Scientific Applications, Business and Consumer Applications.

10 Hrs.

UNIT-IV

High Throughput Computing: Task Programming: Task Computing, Task-based Application Models, Aneka Task-Based Programming. **Data Intensive Computing:** Map- Reduce Programming, Data-Intensive Computing, Technologies for Data-Intensive Computing, Aneka Map Reduce Programming.

10 Hrs.

Total Hrs.: 40

Course Outcomes:
Student will be able to:

- **CO1** Understand the definition of cloud computing, its advantages, characteristics, challenges and platforms.
- **CO2** Describe cloud computing architecture, reference model, types of cloud, service models with respect to all service models etc.
- **CO3** Deploy cloud instances in Aneka cloud computing platform and threading programming of Aneka
- **CO4** Analyze virtualization technology, Cloud Platforms in Industry and High Throughput and Data Intensive Computing, etc.

Text Books:

1. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, "Mastering Cloud Computing", McGraw Hill Education (India) Private Limited.

Reference Books:

1. Barrie Sosinsky, "Cloud Computing Bible", Wiley Publication, India 2010.
2. Kumar Saurabh, "Cloud Computing" Second Edition, Wiley Publication, India.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	-	-	-	-	-	-	-	-	-	3	1
CO2	2	2	2	-	-	-	-	-	-	-	-	-	3	1
CO3	2	2	2	-	2	-	-	-	-	-	-	-	3	2
CO4	2	2	2	-	-	-	-	-	-	-	-	-	3	2

UEI814E: INDUSTRIAL ELECTRONIC EQUIPMENT DESIGN
3 Credits (3-0-0)

Course Objectives:

1. To understand the various processes and systems to address human needs
2. To develop competence to create tangible electronic products
3. To follow comprehensive process of design for the production of equipment/systems

UNIT-I

Introduction to Industrial Design: General introduction in the course, role of industrial design in the domain of industry, product innovation, designer's philosophy and role in product design. Product development tools and methods. **Product Design Methodology:** Electronic product design and development, methodology, creativity techniques, brain storming, documentation.

10 Hrs.

UNIT-II

Product Planning: Defining the task, scheduling the task, estimation of labor cost and amount of documentation. **Ergonomics:** Ergonomics of electronics electronic use of ergonomics at work placesand plat layouts, ergonomics of panel design, case study.

10 Hrs.

UNIT-III

Aesthetics: Elements of aesthetics, aesthetics of control design. **Visual Communication Techniques:** Perspective, band sketching and rendering technique, elements of engineering drawing, assembly drawing part drawing, exploded views. **Product Anatomy:** Layout design, structure design, standard and non standard structures, Industrial standards.

10 Hrs.

UNIT-IV

Product Detailing: Product detailing in sheet metal and plastics for ease of assembly, maintenance and aesthetics. **Product Manufacturing:** Different manufacturing processes in sheet metal and plastics, product finishing, finishing methods like platting, anodization, spray painting, powder coating. **Value Engineering:** Introduction to marketing, graphics and packing.

10 Hrs.

Total Hrs.: 40

Course Outcomes:
Student will be able to:

- **CO1** Understand user centered design process.
- **CO2** Develop sketches, virtual/physical appearance models for electronic products and refine existing product designs.
- **CO3** Make mock-up model and working prototype along with design documentation.
- **CO4** Design some laboratory level/ household electronic equipment.

Text Books:

1. Peter Z., "German Design Standard," Volume2, Reddot, 2006.
2. Clarkson P. J, Coleman R. and Keates, S., "Inclusive Design, Design for the whole population,"Springer Verlag Gmbh, 2003.

Reference Books:

1. Jordan P. W., "Designing Pleasurable Products: An Introduction to the New Human Factors," Taylorand Francis, 2002.
2. Otto K. and Wood K., "Product design: Techniques in Reverse Engineering and New ProductDevelopment," Prentice Hall, 2001.
3. Cross N. "Engineering Design Methods: Strategies for Product Design", Willey, 2000.
4. Cagan J., Vogel C. M., "Creating Breakthrough Products -Innovation from Product Planning toProgram Approval," Pearson Education, 2007.
5. Norman D. A., "The design of everyday things, Basic Books," 2002.
6. Chakrabarty D., "Indian Anthropometric Dimensions for Ergonomic Design Practice," NID, Ahmedabad, 1999.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	--	--	--	--	--	--	--	--	--	1	3	3
CO2	3	3	3	--	--	--	--	--	--	--	--	1	3	2
CO3	3	3	3	--	--	--	--	--	--	--	--	1	3	2
CO4	3	3	3	--	--	--	--	--	--	--	--	1	2	3

UEI821E: INDUSTRIAL SAFETY
3 Credits (3-0-0)

Course Objectives:

1. To understand the need and importance of safety measures in industries
2. To stress upon the safety measures in chemical, petrochemical, cement and construction industries
3. To understand the need and importance of health and hygiene in industries

UNIT-I

Safety in Oil, Gas, Chemical, Petrochemical Industries; Need of safety in chemical industries, Types of chemical industries, Indian Standards. Overview of hazards and controls: Chemical, Storage, Material (Property) , Process, Pollution. Safe transfer and transportation of chemicals, Instrumentation for safe plant Operation, Inspection, Testing and Maintenance. **Safety in Petroleum Refinery, Mining and Petrochemical Industry:** OISD norms for petroleum industry, Petroleum classification and hazards due to petroleum product. Hazards of bulk storages, and their control measures.

10 Hrs.

UNIT-II

Safety in Petroleum Refinery, Mining and Petrochemical Industry: OISD norms for petroleum industry, Petroleum classification and hazards due to petroleum product. Hazards of bulk storages, and their control measures. **Safety in Construction and Cement Industry :** Basic Parameters governing the safety in construction such as site planning and layout, safe access, safety work permit and checklist, good housekeeping. Safety in the use of construction machinery and equipment. Health and welfare of construction workers: Dust, noise, vibration, heat, humidity, and other hazard. First aid, medical examinations and health records.

10 Hrs.

UNIT-III

Safety Integrity Level (SIL): SIL in industries, SIL1, 2, 3, and 4 in industries, TUV, Functional Safety Level (IEC Standards), Safety Instrumented System (SIS), **Risk Management and Selecting a SIS or SIL Level.**

10 Hrs.

UNIT-IV

Industrial Health and Hygiene: Occupational health hazard, Introduction & classification of health hazards. Dangerous properties of chemicals, dust, gases, fume, mists, vapors, smoke and aerosols and their health effects. Routes of human entry system, recognition, evolution and control basic hazards, and bio chemical action of toxic substance and toxicity, type and degrees of toxic effects, threshold limits of exposure (TLV), Physiology of work and occupational diseases.

10 Hrs.

Total Hrs.: 40

Course Outcomes:
Student will be able to:

- **CO1** Understand the need and rationale of safety in industries
- **CO2** Describe certain methods of safety measures in core/manufacturing industries
- **CO3** Understand the concept of health and hygiene in industries
- **CO4** Inculcate the practices of safety measures while working in industries

Text Books:

1. John Ridley, "Safety at Work", Butterworth & Co., London, 1983.
2. Roland P. Blake , "Industrial Safety" Prentice Hall, Inc., New Jersey, 1973.
3. L M Deshmukh, "Industrial safety management", TATA McGraw Hill, 2010.

Reference Books:

1. Krishnan N.V. "Safety Management in Industry" Jaico Publishing House, Bombay, 1997.
2. Industrial Safety -National Safety Council of India.
3. Grimaldi and Simonds , "Safety Management", AITBS Publishers , New Delhi (2001).
4. Industrial Safety National Safety Council of India.
5. Safety, health and working condition in the transfer of technology, Inter National Labor Office.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	--	--	--	--	--	--	--	--	--	1	3	3
CO2	3	3	3	--	--	--	--	--	--	--	--	1	3	2
CO3	3	3	3	--	--	--	--	--	--	--	--	1	3	2
CO4	3	3	3	--	--	--	--	--	--	--	--	1	2	3

UEI822E: WIRELESS COMMUNICATION
3 Credits (3-0-0)

Course Objectives:

1. To impart cellular network systems and their generation.
2. To describe the wireless network architecture and operation.
3. To discuss cellular network modulation techniques.

UNIT-I

Evolution and deployment of cellular telephone systems: Different generations of wireless cellular networks,1G, 2G, 2.5G, 3G and 4G cellular systems. **Common cellular system components:** Common cellular network components, Hardware and software views of cellular networks, 3G cellular system components, Cellular component identification, Call establishment.

10 Hrs.

UNIT-II

Wireless network architecture and operation: Cellular concept, Cell fundamentals, Capacity expansion techniques, Cellular backbone networks, Mobility management, Radio resources and power management Wireless network security, **CDMA technology:** CDMA overview, CDMA network and system architecture.

10 Hrs.

UNIT-III

GSM and TDMA techniques: GSM system overview, GSM network and system architecture, GSM channel concept.**GSM system operation:** GSM identities, GSM system operations (traffic cases), Call handoff, GSM infrastructure communications (Um interfaces), other TDMA systems.

10 Hrs.

UNIT-IV

Wireless modulation techniques and hardware: Transmission characteristics of wire line and fiber system, Characteristics of air interface, Path loss models, Wireless coding techniques, Digital modulation techniques, Spread spectrum modulation techniques, UWB radio techniques, Diversity techniques. Introduction to wireless LAN 802.11X technologies, Evolution of Wireless LAN, IEEE 802.11design issues.

10 Hrs.

Total Hrs.: 40

Course Outcomes:
Student will be able to:

- **CO1** Define the characteristics of different generations of cellular networks and identify the basic functions of common cellular system components.
- **CO2** Comprehend the Architecture and operation of wireless mobile network and capacity expansion techniques.
- **CO3** Describe the operation of GSM system, GSM protocol architecture, TDMA and CDMA systems.
- **CO4** Discuss different wireless modulation techniques and working of different wireless technologies.

Text Books:

1. Gary J. Mullet, "Wireless Telecom Systems and Networks", Thomson Learning, 2006.

Reference Books:

1. Lee W.C.Y., "Mobile Cellular Telecommunication", McGraw Hill, 2002.
2. P. Agrawal, "Wireless Communication", Thomson Learning, 2007.
3. David Tse, Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge, 2005.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	3	1
CO2	2	1	-	-	-	-	-	-	-	-	-	-	3	1
CO3	2	-	-	-	-	-	-	-	-	-	-	-	3	2
CO4	2	-	-	-	-	-	-	-	-	-	-	-	3	2

UEI823E: AERONAUTICAL INSTRUMENTATION
3 Credits (3-0-0)

Course Objectives:

1. To describe the basics of Aircraft and instrumentation involved in aircraft systems.
2. To discuss about the measurement of various aircraft parameters.
3. To explain the techniques for measurement of fuel quantity and engine control instrument.

UNIT-I

Introduction: Aircraft types, Components of airplane, Introduction to the aircraft instruments, Classification of aircraft instruments, Basic "T" grouping of instruments, Instrument displays, Cockpit layout. **Theory of Air Data Instruments:** Pneumatic type and air data computers, International standard atmosphere (ISA), Basic pneumatic air data system, Combined Pitot-static probe.

10 Hrs.

UNIT-II

Air Data Instruments: Air speed indicator, Mach-meters, Altimeters, Instantaneous vertical speed indicator. **Directional Systems**: Earth's total magnetic field, Horizontal and vertical components of total field direct reading compass and its limitations, Total magnetic effect. **Air Data Warning System:** Mach warning system, Altitude alerts system, Airspeed warning system.

10 Hrs.

UNIT-III

Gyroscopic Flight Instruments: Basic mechanical gyro and its properties: Rigidity and Precision, limitations of a free gyroscope, Methods of operating gyroscopic flight instruments, Gyro horizon principle, Erection systems for gyro horizons, Direction indicator, Turn and bank indicator, Turn coordinator.

10 Hrs.

UNIT-IV

Engine Instruments: Pressure measurement,Temperature measurement, Capacitance type volumetric fuel quantity indicator, Densitometer, Fuel quantity indicator by weight, EPR, EGT, Integrated impeller type flow meter.

10 Hrs.

Total Hrs.: 40

Course Outcomes:
Student will be able to:

- **CO1** Identify and list various engineering components of aircraft.
- **CO2** Describe general instrumentation of aircraft.
- **CO3** Compare and interpret the working of air data, engine and power plant instruments of an aircraft.
- **CO4** Distinguish the functionality of air data instruments from other instrumentation.

Text Books:

1. EHJ Pallet**,** "Aircraft Instruments and Integrated Systems", Longman Scientific & Technical, 1992.

Reference Books:

1. C A Williams, "Aircraft Instruments", Galgotia Publications, New Delhi.
2. Bhaskar Roy, "Aircraft Propulsion", Elsevier Publications, New Delhi.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	--	--	--	--	--	--	--	--	--	--	3	2
CO2	3	3	--	--	--	--	--	--	--	--	--	--	3	3
CO3	3	2	2	--	--	--	--	--	--	--	--	--	3	2
CO4	3	2	2	--	--	--	--	--	--	--	--	--	3	2

UEI824E: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
3 Credits (3-0-0)

Course Objectives:

1. To describe the AI concepts and algorithms
2. To analyse simple knowledge-based systems
3. To explain the concepts of machine learning, linear regression, classification
4. To solve the problems of decision tree, linear and logistic regression

UNIT-I

Introduction to Artificial Intelligence: Definition, foundations, history, Introduction to Agents and environment; Rationality; the nature of environment; the structure of agents. **Problem solving:** Problem-solving agents; Example problems; Searching for solution; uninformed search strategies. Informed Search and **Exploration:** Informed search strategies; Heuristic functions.

10 Hrs.

UNIT-II

Constraint Satisfaction: Backtracking search for CSPs, Knowledge and Reasoning: Logical Agents: Knowledge-based agents; Logic; propositional logic: A very Simple Logic: Reasoning patterns in propositional logic; Effective propositional inference; Agents based on propositional logic. First-Order Logic, Inference in First-Order Logic – 1: Representation revisited; Syntax and semantics of first-order logic; Using first-order logic; Knowledge engineering in first-order logic.

10 Hrs.

UNIT-III

Introduction to Machine Learning: Definition of Machine Learning, Examples of Machine Learning applications, Well posed learning problems, Designing learning system, perspectives and issues in Machine Learning, **Decision Tree Learning:** Introduction, Decision tree representation, Problems, Basic algorithm, Hypothesis space search, Inductive bias, Issues. Hands on with Python programming.

10 Hrs.

UNIT-IV

Linear Regression: Model representation for single variable, Single variable Cost Function, Gradient Decent for Linear Regression, **Logistic Regression:** Classification, Hypothesis Representation, Decision Boundary, Cost function, Advanced Optimization, Multi-classification (One vs All), Problem of Over fitting, Regularization. Hands on with Python programming.

10 Hrs.

Total Hrs.: 40

Course Outcomes:
Student will be able to:

- **CO1** Illustrate the fundamentals of knowledge representation, inference and theorem proving.
- **CO2** Analyse simple knowledge-based system.
- **CO3** Explain the concepts of Machine Learning.
- **CO4** Solve the problems of Machine learning.

Text Books:

1. Stuart Russel and Peter Norvig, "Artificial Intelligence a Modern Approach", 3rd Edition, Pearson Education, 2015.
2. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education, 2017.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	--	--	--	--	--	--	--	--	--	--	2	1
CO2	2	2	--	--	--	--	--	--	--	--	--	--	2	1
CO3	1	3	--	--	--	--	--	--	--	--	--	2	1	2
CO4	1	3	--	--	--	--	--	--	--	--	--	2	2	1

UEI831E: INDUSTRIAL BUSES AND DATA NETWORKS
3 Credits (3-0-0)

Course Objectives:

1. To understand industrial communication standards.
2. To analyze industrial communication problems.
3. To troubleshoot industrial communication problems.

UNIT-I

Introduction: Modern instrumentation and control system, Open System Interconnection (OSI) model, Protocols, Standards. **Overview of** EIA-232, EIA-485 and Fiber Optics.

10 Hrs.

UNIT-II

Modbus Protocol: General overview, Modbus protocol structure, Function codes, Troubleshooting, Modbus plus overview. **HART Protocol:** Introduction to HART and smart instrumentation, HART protocol, Physical layer, Datalink layer, Application layer, Troubleshooting. **AS Interface overview:** Introduction, Layer-1, Layer-2, Operating characteristics, Troubleshooting.

10 Hrs.

UNIT-III

DeviceNet overview: Physical layer, Connectors, Device taps, Cable description, network power, datalink layer, Application layer, Troubleshooting. **Profibus**: Introduction, ProfiBus protocol stack, The ProfiBus communication model, Relationship between application process and communication, Communication objects, Performance, System operation, Troubleshooting.

10 Hrs.

UNIT-IV

Foundation Field Bus Overview: physical layer, Data link layer, Application layer, User layer, Error detection and diagnostic, Troubleshooting. **Industrial Ethernet Overview**: 10Mbps ethernet, 100 Mbps ethernet, Gigabit ethernet, Industrial ethernet, Troubleshooting. **TCP/IP Overview:** Internet layer protocol, Host-to-Host layer, Troubleshooting. **Radio and wireless communication overview:** Components of radio link, The radio spectrum and frequency allocation, Radio modems.

10 Hrs.

Total Hrs.: 40

Course Outcomes:
Student will be able to:

- **CO1** Describe the essential components of Industrial communication system.
- **CO2** Understand the structure of various buses.
- **CO3** Identify the problems in industrial communication networks.
- **CO4** Troubleshoot the problems in industrial communication.

Text Books:

1. Steve Mackay, Edwin Wright, Deon Reynders, John Park, "Practical Industrial Data Networks: Design Installation and troubleshooting," Newnes Publication, 2004.
2. Sunit Kumar Sen, "Fieldbus and Networking in Process Automation," CRC Press, 2021.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	1	--	--	--	--	--	--	--	2	3	2
CO2	3	1	1	1	--	--	--	--	--	--	--	2	3	2
CO3	3	3	1	1	--	--	--	--	--	--	--	2	3	2
CO4	3	3	1	2	--	--	--	--	--	--	--	2	2	3

UEI832E: OPERATING SYSTEM
3 Credits (3-0-0)

Course Objectives:

1. Recognize the concepts and principles of operating systems.
2. To study the process management and scheduling.
3. To understand the working of an OS as a resource manager, file system manager.

UNIT-I

Introduction to operating systems, System structures: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Special-purpose systems; Computing environments. Operating System Services;User - Operating System interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating System structure; Virtual machines; Operating System generation; System boot. Process Management Process concept; Process scheduling; Operations on processes; Inter process communication,

10 Hrs.

UNIT-II

Multi-threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues. Process Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Multiple-processor scheduling; Thread scheduling. Process Synchronization: Synchronization: The critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors.

10 Hrs.

UNIT-III

Deadlocks: Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock. Memory Management: Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.

10 Hrs.

UNIT-IV

Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing. **File System, Implementation of File System**: File system: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection: Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.

10 Hrs.
Total Hrs.: 40

Course Outcomes:
Student will be able to:

- **CO1** Describe the basic concepts of operating systems and identify the mechanism to handle processes.
- **CO2** Identify mechanism to handle processes scheduling and synchronization.
- **CO3** Understands the use of synchronization techniques to avoid deadlock.
- **CO4** Describe Memory management and file system management in operating System.

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Principles" 7 th edition, Wiley-India.

Reference Books:

1. Milan Milankovic, "Operating System Concepts and Design", 2nd Edition, McGraw Hill.
2. Ann McHoes Ida M Fylnn, Understanding Operating System, Cengage Learning, 6th Edition.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3	--	--	--	--	--	--	1	3	2
CO2	3	3	3	2	3	--	--	--	--	--	--	1	3	2
CO3	3	3	3	2	3	--	--	--	--	--	--	1	3	2
CO4	3	3	3	2	3	--	--	--	--	--	--	1	3	2

UEI833E: PROCESS MODELING
3 Credits (3-0-0)

Course Objectives:

1. To define and classify process modelling.
2. To describe the approaches of process modelling.
3. To give insight of various techniques in lumped and distributed process modeling.

UNIT-I

Introduction to Modeling: A systematic approach to model building, classification of models. **Principles of Process Systems and Models:** Conservation principles, thermodynamic principles. Development models of steady state and dynamic lumped and distributed parameter models based on first principles. **Analysis of Ill-conditioned Systems:** Meaning and methods.

10 Hrs.

UNIT-II

Process Modeling: Development of Grey box models. Empirical model building, Statistical model calibration and validation. Population balance models. Examples.

10 Hrs.

UNIT-III

Solutions to Lumped Process Models: Solution strategies for lumped parameter models. Stiff differential equations. Solution methods for initial value and boundary value problems. Euler's method, R-K method, shooting method, finite difference methods.

10 Hrs.

UNIT-IV

Solutions to Distributed Process Models: Solution strategies for distributed parameter models. Solving parabolic, elliptic and hyperbolic partial differential equations. Finite element and finite volume methods.

10 Hrs.

Total Hrs.: 40

Course Outcomes:

Student will be able to:

CO1	Identify and classify models.
CO2	Develop process modeling.
CO3	Find solution for lumped parameter models.
CO4	Find solution for distributed parameter models.

Text Books:

1. M. Hangos, I. T. Cameron, "Process Modeling and Model Analysis", Academic Press, 2001.
2. W.L. Luyben, "Process Modeling, Simulation and Control for Chemical Engineers", 2nd Edition, McGraw Hill Book Co., New York, 1990.
3. W. F. Ramirez, "Computational Methods for Process Simulation", Butterworths, 1995.

Reference Books:

1. Park E. Davis, "Numerical Methods and Modeling for Chemical Engineers", John Wiley & Sons, 1984.
2. Singiresu S. Rao, "Applied Numerical Methods for Engineers and Scientists" Prentice Hall, Upper Saddle River, NJ, 2001.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	--	--	--	--	--	--	--	--	--	3	3	3
CO2	3	3	3	--	--	--	--	--	--	--	--	--	3	3
CO3	3	3	3	--	--	--	--	--	--	--	--	--	3	3
CO4	3	3	3	--	--	--	--	--	--	--	--	--	3	3

UEI834E: BIOMEDICAL SIGNAL PROCESSING
3 Credits (3-0-0)

Course Objectives:

1. To discuss the fundamentals and dynamic characteristics of biomedical signals.
2. To illustrate the methods of data reduction and spectral estimation.
3. To impart the skills of biomedical data handling and analysis.

UNIT-I

Introduction to Biomedical Signals: Nature of biomedical signals, Classification of biomedical signals, Objectives of biomedical signal analysis, Difficulties encountered during acquisition and processing of biomedical signals, Computer aided diagnosis. **DSP of Biomedical Signals**: Sampling, spectral estimation, **Random Processing**: Introduction, Elements of probability theory, Random signal characterization, Correlation analysis, The Gaussian process.

10 Hrs.

UNIT-II

Dynamic Biomedical Signals: Characteristics of ENG, ERG, EOG, EEG, EP, EMG, ECG/EKG, EGG, GSR, and EDR. **ECG QRS Detection**: Power spectrum, Differentiation method, Template matching method, QRS detection algorithm, ST segment analyzer, Portable arrhythmia monitors, Arrhythmia analysis, Signal averaging.

10 Hrs.

UNIT-III

Data Reduction: Turning point algorithm, Fan algorithm, AZTEC algorithm, Huffman and modified Huffman coding, Run length coding, Residual differencing. **Time Series Analysis**: Introduction, AR models, MA models, ARMA models, **Adaptive Segmentation**: Introduction, ACM method, SEM method.

10 Hrs.

UNIT-IV

Spectral Estimation: The BT method, Periodogram, Maximum entropy method, AR method, Moving average method, ARMA method, Maximum likelihood method, **Adaptive Filter** : Introduction, General structure, LMS adaptive filter, Adaptive noise canceling - Cancellation of mains interferences, Commercial DSP systems.

10 Hrs.

Total Hrs.: 40

Course Outcomes:
Student will be able to:

- **CO1** Identify the need of biomedical signal analysis and describe the fundamental concepts of Biomedical signal processing.
- **CO2** Classify and Characterize various vital biomedical signals.
- **CO3** Describe various data reduction algorithms used in Biomedical Signal Processing and analysis.
- **CO4** Depict the application of Spectral Estimation, DSP techniques for biomedical data handling and analysis.

Text Books:

1. Arnon Cohen, "Biomedical Signal Processing," Volume I and II, CRC press, 1986.
2. Willis J. Tomkin, "Biomedical Digital Signal Processing," PHI,1993.

Reference Books:

1. D. C. Reddy, "Biomedical Signal Processing," TMH,2005.
2. Rangaraj M, Rangayyan, "Biomedical Signal Analysis," John Wiley & Sons, 2nd edition, 2015.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	--	--	--	--	--	--	--	--	--	--	3	1
CO2	3	2	--	--	--	--	--	--	--	--	--	--	3	1
CO3	3	3	3	--	--	--	--	--	--	--	--	--	3	2
CO4	3	3	3	--	--	--	--	--	--	--	--	--	3	2