UEI541C: MICROCONTROLLER AND PERIPHERALS
3 Credits (3-0-0)

UNIT-I

8051 Architecture: Features of 8051 microcontroller, Internal block diagram, Oscillator and clock, Accumulator, Data pointer, Program counter, Program status word, Stack pointer, Special function registers, Timer/ counter, I/O ports, Memory organization, **Addressing modes:** Immediate, register, direct and indirect addressing modes,.

10Hrs.

UNIT-II

Instruction Set and Programming: Data transfer, Arithmetic, Logic and compare instructions, Control transfer instructions, Miscellaneous instructions of 8051 microcontroller and assembly programs. **8051 Programming in C:** Data types and time delay in 8051 C, I/O programming in C, Logical operations in C.

10 Hrs.

UNIT-III

8051 Timer Programming in Assembly: Programming 8051 timers, Counter programming, **Interrupts Programming in Assembly:** 8051 interrupts, Programming timer interrupts, Programming external hardware interrupts, Programming serial communication interrupt, Interrupt priority in 8051, **8051 Serial Port Programming in Assembly:** Basics of serial communication, 8051 connection to RS232, 8051 serial port programming in assembly.

10 Hrs.

UNIT-IV

Interfacing Peripherals with 8051 Microcontroller: Keyboard interfacing, LED interfacing, Seven segment LED interfacing, LCD interfacing, Stepper motor interfacing, DC motor interfacing (programs for interfacing peripherals in assembly). Introduction to Arduino.

10Hrs.

Total Hrs.: 40

Course Outcomes:

Students will be able to:

- **CO1:** Describe the internal architecture and instruction set of 8051 microcontroller
- **CO2:** Develop assembly and C programs using 8051 instructions and embedded C
- **CO3:** Analyze the given 8051 assembly programs
- **CO4:** Develop software and hardware for interfacing peripherals with 8051 microcontroller

TEXT BOOKS:

1. Kenneth J. Ayala, "8051 Microcontroller: Architecture, Programming and Applications", 3rd Edition, Thomson publication

2. Muhammad Ali Mazidi, Janice Gillespie Mazidi, Rolin D McKinlay, "The 8051 Microcontroller and Embedded Systems: using Assembly & C", 2nd Edition, Pearson, 2006

REFERENCE BOOKS:

1. Dr. D.S. Suresh Kumar, "8051 Microcontroller", 1stEdition, SK Publishers

CO-PO Mapping:

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

UEI542C: PROCESS CONTROL
4 Credits (4-0-0)

UNIT-I

I**ntroduction to Process Control:** Introduction, control systems, process control block diagram, control system evaluation. Introduction to final control: Final Control operation, signal conversions, actuators, control elements.

13 Hrs.

UNIT-II

Controller Principles: Introduction, process characteristics, control system parameters, discontinuous controller modes, continuous controller modes, composite control modes. **Analog Controllers:** Introduction, general features, electronic controllers, pneumatic controllers

13 Hrs.

UNIT-III

Computer Based Control: Introduction, digital applications, computer based controller, other computer applications, control system networks. Distributed Digital Control System: Advantages of digital computer control, process control requirements of computers.

13 Hrs.

UNIT-IV

Control Loop Characteristics: Introduction, control system configuration, multi variable control systems, control system quality, stability, and process loop tuning. **P & ID Symbols and Diagrams:** Flow sheet symbols, inter logic symbols, graphic symbol

13 Hrs.

Total Hrs.: 52

Course Outcomes:

Students will be able to:

- **CO1:(a)** Identify the various process control elements and describe their basic principles
- **CO2:(a)** Define and describe various controller modes (proportional, Integral, Derivative)
- **(b)** Analyze and design the analog controllers
- **CO3:(a)** Describe the computer based control system
- **CO4: (a)** Describe the behavior and characteristics of a process control loop and tune it

TEXT BOOKS:

1. C. D. Johnson, “Processes Control Instrumentation”, 8 th Edition, PHI.
2. Myke King, “Processes Control: A Practical Approach ”, Wiley Publication
3. M. Chidambaram, “Computer Control of Process”, Narosa, Publication
4. B G Liptak, “Instrument Engineers Handbook”, (Vol. 1 & 2), Chilton publication

REFERENCE BOOKS:

1. S. K. Singh, “Computer Aided Process Control”, Prentice Hall of India.

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

UEI543C: DIGITAL SIGNAL PROCESSING
4 Credits (4-0-0)

UNIT-I

Introduction: Digital signal processing and its benefits, sampling, aliasing, sampling theorem, frequency-domain representation of sampling, reconstruction of a band limited signal from its samples, correlation. **The Discrete Fourier Transform (DFT):** DFT, IDFT, DFT as a linear transformation, relationship of the DFT to other transforms, properties of DFT, circular convolution, use of DFT in linear filtering, overlap-add and overlap-save method. Usage of MATLAB command-line functions to verify the solution.

13 Hrs.

UNIT-II

Efficient Computation of the DFT: Introduction, radix-2 FFT algorithm, Radix-2 inverse FFT, decimation-in-time FFT algorithm, decimation-in-frequency FFT algorithm, general computational considerations in FFT algorithms. Usage of MATLAB command-line functions to verify the solution.

13 Hrs.

UNIT-III

Design of Infinite Impulse-response (IIR) Digital Filters: Characteristics of commonly used analog filters-Butterworth and Chebyshev-I filters, design of digital IIR filters from analog Butterworth and Chebyshev-I filters, impulse-invariant transformation method, and bilinear transformation method. Usage of MATLAB command-line functions to verify the solution.

13 Hrs.

UNIT-IV

Design of Finite Impulse-Response (FIR) Digital Filters: Some common window functions (Rectangular, Hamming and Hanning), the Gibbs phenomenon, design of FIR filters using windows and frequency sampling method. **Realization of IIR and FIR systems:** Structure for IIR systems: direct-form, cascade-form, and parallel-form. Structure for FIR and linear phase FIR systems: direct-form, cascade-form. Usage of MATLAB command-line functions to verify the solution.

13 Hrs.

Total Hrs.: 52

Course Outcomes:

Students will be able to:

- **CO1:** **(a)** Describe sampling, aliasing, reconstruction of signals, and relationship of DFT with other transforms
  (b) Compute DFT, IDFT, sectional convolution and state and prove properties of DFT
- **CO2:** **(a)** Develop radix 2-FFT algorithms
  (b) Compute DFT using FFT
- **CO3:** Design IIR filters
- **CO4:** **(a)** Design FIR filters
  (b) Realize IIR and FIR systems
- **CO5:** Use MATLAB command-line functions in the design and analysis of DSP

TEXT BOOK:

1. John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing", 4th Edition, Pearson Education, 2007.
2. Johnny R. Johnson, "Introduction to Digital Signal Processing", PHI Pvt. Ltd., 2000.

REFERENCE BOOKS:

1. Alan V. Oppenheim, Ronald W. Schafer, and John R. Buck, "Discrete-Time Signal Processing", 2nd Edition, Pearson Education, 2008.
2. Ashok Ambardar, "Digital Signal Processing: A Modern Introduction", Indian Edition, Thomson Learning, 2007

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
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	3
CO4	3	3	3	-	-	-	-	-	-	-	-	-	3	3
CO5	-	-	-	-	3	-	-	-	-	-	-	-	-	-

UEI544L: DSP LABORATORY
1.5 Credit (0-0-3)

List of experiments:

1. Illustrate aliasing effect in the time-domain and frequency domain.
2. Determine the linear convolution and correlation of the given two sequences.
3. Determine the linear convolution of the given two sequences using FFT.
4. Determine the spectrum of the given sequence using FFT.
5. Realize IIR transfer functions in cascade and parallel form.
6. Realize FIR transfer functions in cascade form.
7. Design IIR filter using bilinear transformation method with
    a. Butterworth characteristic
    b. Chebshev type I characteristic
    c. Chebshev type II characteristic
8. Design IIR filter using impulse invariance method with
    a. Butterworth characteristic
    b. Chebshev type I characteristic
    c. Chebshev type II characteristic
9. Design FIR filter using windowing method.
10. Design FIR filter using frequency-sampling method.

Course Outcomes:

Students will be able to:

CO1: Work in a team
CO2: Program and analyze DSP algorithms in MATLAB.
CO3: Design IIR filters to suit specific requirements using MATLAB.
CO4: Design FIR filters to suit specific requirements using MATLAB.

REFERENCE BOOK:

1. Sanjit K. Mitra, "Digital Signal Processing Laboratory", International Edition , WCB/McGraw-Hill, 2000.

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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	3
CO3	3	3	3	-	3	-	-	-	-	-	-	-	3	3
CO4	3	3	3	-	3	-	-	-	-	-	-	-	3	3

UEI545L: MICROCONTROLLER LABORATORY
1.5 Credit (0-0-3)

List of experiments:

I. Software Programming:

1. Data Transfer instructions: Block move, Exchange, Sorting, Finding largest element in an array.
2. Arithmetic instructions: Addition, subtraction, multiplication and division.
3. Counters: Binary / BCD /Hexadecimal (up / down).
4. Boolean & Logical instructions: To check whether 0th bit and 5th bit of data is 0 or 1. If the bit is 0 then set the bit (Bit manipulations).
5. Conditional CALL and RETURN: Multiplication of every element of an array with constant.
6. Code conversion: BCD to ASCII; ASCII to Decimal; Decimal to ASCII.
7. Generate a square wave using timer to generate delay.

II. Interfacing Programs:

8. Generate different waveforms: Sine, square, triangular, ramp using DAC interface to 8051.
9. Stepper motor control interface to 8051.
10. DC motor control interface to 8051.

Course Outcomes:

Students will be able to:

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

REFERENCE BOOKS:

1. Kenneth J. Ayala, "8051 Microcontroller: Architecture, Programming and Applications", 3rd Edition, Thomson publication
2. Muhammad Ali Mazidi, Janice Gillespie Mazidi, Rolin D McKinlay, "The 8051 Microcontroller and Embedded Systems: using Assembly & C", 2nd Edition, Pearson, 2006

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Design and develop a system/program for the given objective	3	2	2	-	-	-	-	-	-	-	-	-	3	3
CO2	Conduct the experiment and demonstrate the theoretical concepts	3	2	2	-	-	-	-	-	-	-	-	-	2	2
CO3	Analyze and interpret the experimental results	3	2	2	-	-	-	-	-	-	-	-	-	3	3

UEI546L: PROCESS CONTROL LABORATORY

1 Credit (0-0-2)

List of Experiments:

1. Design and implementation of signal conditioning circuit for given RTD to display the physical parameter in the given range using DPM/DVM as display.
2. Design and implementation of signal conditioning circuit for given thermocouple to display the physical parameter in the given range using DPM/DVM as display.
3. Design and implementation of signal conditioning circuit for given thermistor to display the physical parameter in the given range using DPM/DVM as display.
4. Design and implementation of signal conditioning circuit for given AD590 to display the physical parameter in the given range using DPM/DVM as display.
5. Design and implementation of signal conditioning circuit for given load cell arrangement to display the physical parameter in the given range using DPM/DVM as display.
6. Design and implementation of analog controllers using OPAMPS and other passive components.
7. Experiment on synchros and resolvers.
8. Experiment on relay driving circuit to control dc motor.
9. Experiment on current to pressure converter.
10. Experiment on pressure to current converter.

Course Outcomes:

Students will:

CO1: Design and develop a circuit/system for the given objective.

CO2: Conduct the experiment and demonstrate the theoretical concepts.

CO3: Analyze and interpret the experimental results.

REFERENCE BOOK:

1. C. D. Johnson, "Processes Control Instrumentation", 8 th Edition, PHI.

CO-PO Mapping

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Design and develop a system/program for the given objective	3	2	2	-	-	-	-	-	-	-	-	-	3	3
CO2	Conduct the experiment and demonstrate the theoretical concepts	3	2	2	-	-	-	-	-	-	-	-	-	2	2
CO3	Analyze and interpret the experimental results	3	2	2	-	-	-	-	-	-	-	-	-	3	3

UEI511E: ANALYTICAL INSTRUMENTATION

3 Credits (3-0-0)

UNIT-I

Introduction: Analytical methods, **Electromagnetic Spectrum**: Properties of electromagnetic radiation and interaction with matter. **Molecular Spectroscopy**: Measurement of transmittance and absorbance, Beer Lambert's law and its limitations, Components of analytical instruments: Sources of radiation, Wavelength selectors, Sample containers, Detectors. **UV-Visible Absorption Spectrometry**: Single and double beam absorption instruments, Application for qualitative and quantitative analysis.

10 Hrs.

UNIT-II

IR Absorption Spectrometry: Basic components of IR instruments, Non-dispersive spectrometers: Filter photometers, Photometers without filters, Filter correlation analyzers. **Mass Spectrometry**: Features of mass spectroscopy, Components of spectrometers: Sample inlet systems, Electron impact ion source, Mass analyzers- Single focus and double focus magnetic sector analyzer, Quadrupole analyzer and time of flight (TOF) analyzer, Applications.

10 Hrs.

UNIT-III

Atomic Spectroscopy: Principles of AAS, AES and AFS, Sample atomization techniques, Atomic absorption instrumentation, Applications. **X-ray Techniques:** Introduction, Principles, Sources, Detectors, Instrumentation, X-ray absorption method - Absorptiometer, X-ray fluorescence method-Energy dispersive type, X-ray diffraction-powder diffraction method and applications.

10 Hrs.

UNIT-IV

Chromatography: Introduction, Classification, Gas chromatography: Principle, GLC instrumentation, Liquid chromatography: Scope and HPLC instrumentation, Applications. **NMR Spectroscopy:** Principles of NMR spectroscopy, Different types of NMR instruments: FT – NMR, Carbon-13 NMR, Applications.

10 Hrs.

Total Hrs.: 40

Course Outcomes:

Students will be able to:

- **CO1:** Describe the importance and basic concepts of qualitative and quantitative analysis.
- **CO2:** Identify components and analytical methods for qualitative and quantitative analysis.
- **CO3:** Describe various principles and techniques employed for instrumental analysis using UV, visible and other EM sources.
- **CO4:** List the applications and usage of analytical instruments.

TEXT BOOKS:

1. Douglas A. Skoog, James Holler, Stanley R.Crounch, “Instrumental Analysis”, Cengage Learning Publication, 2007.
2. H.H. Willard, L.L.Merritt, J.A.Dean, F.A. Settle“, Instrumental Methods of Analysis”, 7thEdition, CBS Publishing and Distribution, 1986.

REFERENCE BOOK:

1. R.S. Khandpur, “Hand Book of Analytical Instrumentation”, TMH, 1989.

CO-PO Mapping:

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

UEI512E : COMMUNICATION SYSTEMS

3 Credits (3-0-0)

UNIT-I

Amplitude modulation: Time-domain description, Frequency domain description, Generation of AM waves, Detection of AM waves, AM/DSB, Time-domain description, Frequency domain description, Generation of DSBSC waves, Coherent detection of DSBSC modulated waves. Costas loop, Quadrature carrier multiplexing, AM-SSB/SC generation, Frequency-domain description, Frequency discrimination method for generation an SSB Modulated wave, Time domain description, Phase discrimination method for generating an SSB modulated wave, Demodulation of SSB waves, Comparison of amplitude modulation techniques.

10 Hrs.

UNIT-II

Angle modulation: Basic concepts, Frequency modulation, Spectrum analysis of sinusoidal FM wave, NBFM, WBFM, Constant average power, Transmission bandwidth of FM waves, Generation of FM waves, Direct FM, demodulation of FM waves, Frequency discriminator, ZCD. **Noise in analog modulation systems:** Signal-to-noise ratios, AM receiver model, Signal-to -noise ratios for coherent reception, DSBSC receiver, SSB receiver, noise in AM receivers using envelope detection.

10 Hrs.

UNIT-III

Pulse modulation: Sampling theorem for low-pass and band-pass signal, Statement and proof, PAM, Channel bandwidth for a PAM signal, Natural sampling, Flat-top sampling, Signal recovery though holding, Quantization of signals, Quantization error, PCM, Electrical representations of binary digits, PCM systems.

10 Hrs.

UNIT-IV

Digital modulation: Introduction, Binary Shift Keying, DPSK, QPSK, QPSK transmitter, non-offset QPSK, QPSK receiver, Signal - space representation, BFSK, Spectrum, Receiver for BFSK, Geometrical representation of orthogonal BFSK.

10 Hrs.

Total Hrs.: 40

Course Outcomes:

Students will be able to:

- **CO1:** Describe the concepts of Analog modulation and demodulation techniques
- **CO2:** Explain the concepts of digital modulation and demodulation techniques
- **CO3:** Calculate the various parameters of modulated signals
- **CO4:** Analyze the performance of noise in analog communication

TEXT BOOK:

1 Simon Haykin, “Analog and Digital Communication”, John Willey

2 Taub, Schilling, “Principles of Communication Systems”, Tata McGraw Hill.

REFERENCE BOOKS:

1. Roy Blake, “Electronic Communication Systems”, 2nd Edition, Thomson publishers, 2002.
2. George Kennedy, “Electronic Communication Systems”, TMG, 4th Edition.

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

UEI513E: PYTHON PROGRAMMING

3 Credits (2-2-0)

UNIT-I

Variables: Values and types, variables, variable names and keywords, **Statements:** Operators and operands, Expressions: Order of operations, Modular operator, String operations, Asking the user for input, Comments, Choosing mnemonic variable name, Debugging, **Conditional execution:** Boolean expression, Logical operators **07 Hrs.**

Tutorials: 06 Hrs

UNIT-II

Functions: Function calls, Built-in functions, Type conversion functions, Math functions, Random numbers, Adding new functions, Definitions and uses, Flow of execution, Parameters and arguments, Fruitful functions and void functions **07 Hrs.**

Tutorials: 06 Hrs.

UNIT-III

Iterations: Updating variables, The while statement, Infinite loops, Finishing iterations with continue, Definite loops using for, Loop patterns, **Strings:** Definition, Getting the length of a string using len, Traversal through a string with a loop, String slices, Strings are immutable, Looping and counting, The in operator, String comparison, String methods, Parsing strings, Format operator

07 Hrs.

Tutorials: 06 Hrs.

UNIT-IV

Files: Persistence, Opening files, Text files and lines, Reading files, searching through a file, Letting the user choose a file name, Using a try, except and open, Writing files. **Lists:** Definition, Lists are mutable, Traversing a list, List operations, List slices, List methods, Deleting elements, Lists and functions, Lists and strings, Parsing lines, Objects and values, Aliasing, List arguments.

07 Hrs.

Tutorials: 06 Hrs.

Course Outcomes:

Students will be able to:

- **CO1:** Explain syntax and semantics of different statements and functions in Python.
- **CO2:** Demonstrate the use of strings, files, lists, dictionaries and tuples in simple applications.
- **CO3:** Write simple applications using regular expressions, different data types.
- **CO4:** Analyze the given Python program

TEXT BOOK:

1 Charles R. Severance, "Python for Everybody: Exploring Data in Python 3", 1st Edition, Create Space Independent Publishing Platform, 2016.

REFERENCE BOOKS:

1. Timothy A. Budd, "Exploring Python", MGH(India), 10th reprint, 2017
2. B. Nagesh Rao, "Learning Python", 2nd Indian Edition, CyBERPLUS, 2018

CO-PO Mapping:

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

UEI514E: ROBOTICS

3 Credits (3-0-0)

UNIT-I

Introduction to Robotics: Robot definitions, robotics systems and robot anatomy, specifications of robots, safety measures in robotics. **Robot Kinematics and Dynamics:** Introduction, forward and reverse kinematics of three degrees of freedom robot arm, forward and reverse kinematics of a four degree of freedom manipulator in 3D.

10 Hrs.

UNIT-II

Robot Drives, Actuators and Control: Functions of drive system, general types of fluids, pump classification, introduction to pneumatics systems, electrical drives, DC motors and transfer functions, AC motors, piezoelectric actuators, stepper motor, drive mechanisms.

10 Hrs.

UNIT-III

Robot End-effectors: Introduction, classification of end effectors, drive systems for grippers, mechanical grippers, magnetic grippers, vacuum grippers, adhesive grippers, hooks, scoops and other miscellaneous devices. **Sensors and Intelligent Robots:** Artificial Intelligence (AI) and automated manufacturing, AI and robotics, need for sensing systems, sensory devices, types of sensors, robot vision systems.

10 Hrs.

UNIT-IV

Applications of Robots: Introduction, capabilities of robot, robotics applications, obstacle avoidance, other uses of robots, robotic application under CIM environment, future of robotics.

10 Hrs.

Total Hrs.: 40

Course Outcomes:

Students will be able to:

- **CO1:** Identify the basic elements of robots, its specifications and interpret the robot kinematics and dynamics
- **CO2:** Infer the functionality of robot drives actuators, end effectors and control mechanism
- **CO3:** Analyze the role of Artificial Intelligence in automated manufacturing
- **CO4:** Identify the potential applications of robots

TEXT BOOK:

1. S. R. Deb and S. Deb, "Robotics Technology and Flexible Automation", Tata McGraw Hill Education Pvt. Ltd, 2010.

REFERENCE BOOKS:

1. Mikell P. Groover, "Automation, Production Systems, and Computer Integrated Manufacturing", Prentice Hall, 2001
2. S. Fu, R.C. Gonzalez, C.S.G. Lee, "Robotics Control Sensing Vision and Intelligence", McGraw Hill, 1987

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

UEI521E: PNEUMATICS AND HYDRAULICS INSTRUMENTATION

3 Credits (3-0-0)

UNIT-I

Introduction to Hydraulic Power: Pascal's law and problems on Pascal's Law, continuity equations, introduction to conversion of units. Structure of Hydraulic Control System. **The Source of Hydraulic Power:** Pumps Pumping theory, pump classification, gear pumps, vane pumps, piston pumps, pump performance, pump selection. Variable displacement pumps. **Hydraulic Actuators and Motors:** Linear Hydraulic Actuators [cylinders], Mechanics of Hydraulic Cylinder loading, Hydraulic Rotary Actuators, Gear motors, vane motors, piston motors, Hydraulic motor theoretical torque, power and flow rate, hydraulic motor performance

10 Hrs.

UNIT-II

Control Components in Hydraulic Systems: Directional Control Valves – Symbolic representation, Constructional features, pressure control valves – direct and pilot operated types, flow control valves. **Hydraulic Circuit Design and Analysis:** Control of single and Double – acting Hydraulic cylinder, regenerative circuit, pump unloading circuit, Double pump Hydraulic system, Counter Balance Valve application, Hydraulic cylinder sequencing circuits. Locked cylinder using pilot check valve, cylinder synchronizing circuits, speed control of hydraulic cylinder, speed control of hydraulic motors, accumulators and accumulator circuits**.**

10 Hrs.

UNIT-III

Maintenance of Hydraulic systems: Hydraulic oils – Desirable properties, general type of fluids, sealing devices, reservoir system, filters and strainers, problem caused by gases in hydraulic fluids, wear of moving parts due to solid particle contamination, temperature control, trouble shooting. **Introduction to Pneumatic control:** Choice of working medium, characteristics of compressed air. Structure of Pneumatic control system. **Pneumatic Actuators:** Linear cylinders – Types, conventional type of cylinder working, end position cushioning, seals, mounting arrangements applications. Rod-less cylinders – types, working advantages. Rotary cylinder types construction and application. Design parameters – selection**.**

10 Hrs.

UNIT-IV

Directional Control Valves: Symbolic representation as per ISO 1219 and ISO 5599. Design and constructional aspects, poppet valves, slide valves spool valve, suspended seat type slide valve. **Simple Pneumatic Control:** Direct and indirect actuation pneumatic cylinders, use of memory valve. **Signal processing elements:** Use of Logic gates – OR and AND gates pneumatic applications. Practical examples involving the use of logic gates **Multi-cylinder applications:** Coordinated and sequential motion control. Motion and control diagrams – Signal elimination methods. (using reversing valves). **Electro-Pneumatic control:** Principles-signal input and output pilot assisted solenoid control of directional control valves, use of relay and contactors. **Compressed air:** Production of compressed air – compressors, preparation of compressed air- Driers, Filters, Regulators, Lubricators, Distribution of compressed air- Piping layout. **10 Hrs.**

Total Hrs.: 40

Course Outcomes:

Students will be able to:

CO1:	**(a)**	Analyze the laws associated with hydraulic systems
	(b)	Interpret the functionality of hydraulic actuators
	(a)	Infer the working of hydraulic components
CO2:	**(b)**	Design and analyze hydraulic circuits
	(a)	Understand the maintenance of hydraulic systems
CO3:	**(b)**	Interpret the functionality of pneumatic actuators
	(a)	Infer the working of hydraulic components
CO4:	**(b)**	Design and analyze pneumatic circuits

TEXT BOOK:

1. Anthony Esposito, "Fluid Power with applications", Fifth edition, Pearson Education, Inc. 2000
2. Andrew Parr, "Pneumatics and Hydraulics", Jaico Publishing Co. 2000

REFERENCE BOOKS:

1. S.R. Majumdar "Oil Hydraulic Systems – Principles and Maintenance", Tata Mc Graw Hill Publishing Company Ltd. 2001
2. S.R.Majumdar, "Pneumatic Systems" , Tata Mc Graw Hill Publishing Company, 1995
3. Pippenger, Hicks, "Industrial Hydraulics", McGraw Hill, New York

CO-PO Mapping

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

UEI522E: AUTOMOTIVE ELECTRONICS

3 Credits (3-0-0)

UNIT-I

Starting System: Condition at starting, Behavior of starter during starting and its characteristics, Principle and construction of starter motor, Working of different starter drive units, Care and maintenance of starter motor, Starter switches, Three point starter-basic constructions and working principle. **Generator:** Main construction features, Armature winding, Commutator, Basic principle of a D.C. generator, Slip-ring commutation, Operating characteristic and application of D.C. generators, Armature reaction, Total loss in D.C. generator, Working principle of D.C. motor, Types of D.C. motor and it's characteristics, Speed control of D.C motor.

10 Hrs.

UNIT-II

Lighting System &Accessories: Insulated & earth return systems, Positive and negative earth systems, Details of head light and side light, Headlight dazzling and preventive methods, Electrical fuel-pump, Speedometer, Fuel, oil and temperature gauges, Horn, Wiper system, Trafficator. **Automotive Electronics:** Current trends in modern automobiles, Open and close loop systems, Components for electronic engine management, Electronic management of chassis system, Vehicle motion control. **Sensors and Actuators for Automobiles:** Basic sensor arrangement, Types of sensors such as-Oxygen sensors, Crank angle position sensors-Fuel metering/vehicle speed sensor and detonation sensor- Altitude sensor, Flow sensor, Throttle position sensors.

10 Hrs.

UNIT-III

Electronic Fuel Injection and Ignition Systems: Introduction, Feedback carburettor systems, Throttle body injection and multi port or point fuel injection, Fuel injection systems, Injection system controls, Advantages of electronic ignition systems, Types of solid-state ignition systems and their principle of operation, Contactless electronic ignition system, Electronic spark timing control. **Electronic Dashboard Instruments:** Onboard diagnosis system, Security and warning system.

10 Hrs.

UNIT-IV

Digital Engine Control System: Open loop and closed loop control systems, Engine cranking and warm up control, Acceleration enrichment, Deceleration leaning and idle speed control, Distributorless ignition, Integrated engine control systems, exhaust emission control engineering. **Chassis and Safety Systems:** Traction control system, Cruise control system, Electronic control of automatic transmission, Antilock braking system, Electronic suspension system, Working of airbag and role of MEMS in airbag systems, Centralized door locking system, Climate control of cars.

10 Hrs.

Total Hrs.: 40

Course Outcomes:

Students will be able to:

- **CO1:** Describe the use of various electronics and sensors in automobiles
- **CO2:** Describe the working of different electronic systems used in automobile vehicles
- **CO3:** Demonstrate the knowledge of electronics and sensors involved in automobile systems
- **CO4:** Use sensors and electronic hardware for a specific application in an automobile vehicle

TEXT BOOK:

1. Judge A.W, "Modern Electrical Equipment of Automobiles", Chapman & Hall, London, 1992.

REFERENCE BOOKS:

1. Tom Denton, "Automobile Electrical and Electronics Systems", Edward Arnold Publishers, 2000.
2. William B. Ribbens, "Understanding Automotive Electronics", 5th Edition, Newness Publishing, 2000.
3. Barry Hollembeak, "Automotive Electricity, Electronics &Computer Controls", Delmar Publishers, 2001.
4. Ronald. K. Jurgon, "Automotive Electronics Handbook", McGraw-Hill, 1999.

CO-PO Mapping:

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

UEI523E: OBJECT ORIENTED PROGRAMMING WITH C++

3 Credits (3-0-0)

UNIT-I

Introduction: Object oriented programming, characteristics of object oriented languages, C++ and C. C++ Programming Basics: Basic programming construction, Cin and Cout statements, per-processor directives, comments, integer variables, character variables, floating point types, type Bool, the setw manipulator, type conversion, arithmetic operators. **Loops and Decisions:** Relational operators, for- loop, while loop, do-while loop, if statement, if-else statement, else-if statement, switch statement, conditional operator, logical operators, precedence.

10 Hrs.

UNIT-II

Structures: A simple structure, defining a structure, defining structure variables, accessing structure members, other structure features, enumerated data type. **Function**s: Simple functions, passing arguments to functions, returning values from functions, overloaded functions.

10 Hrs.

UNIT-III

Objects and Classes: A simple class, C++ objects as physical objects, C++ objects as data types, constructors, destructor's, objects as function arguments, the defaults copy constructor, returning objects from functions.

10 Hrs.

UNIT-IV

Arrays: Array fundamentals, arrays as class member data, arrays of objects. **Operator Overloading**: Creating a member operator function, overloading unary operators, overloading binary operators

10 Hrs.

Total Hrs.: 40

Course Outcomes:

Students will be able to:

- **CO1: (a)** Demonstrate the basic concept of programming
- **CO2: (a)** Analyze and design the programs using the concept of structure
  (b) Implement the code that includes the reusability
- **CO3: (a)** Apply the concepts of object-oriented programming
- **CO4: (a)** Understand the concept of arrays.
  (b) Analyze and design the concept of operator overloading

TEXT BOOK:

1. Robert Lafore, “Object Oriented Programming in Turbo C++”, Galgotia Publishing..
2. E.Balaguruswamy, “Object Oriented Programming with C++”, Tata McGraw Hill

REFERENCE BOOKS:

1 **.** Herbert Schildt, “C++ The Complete Reference”, Tata McGraw Hill

CO-PO Mapping:

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

UEI524E: RENEWABLE ENERGY

3 Credits (3-0-0)

UNIT-I

Introduction to Energy Sources: Importance of energy consumption as measure of prosperity, per capita energy consumption, classification of energy resources; conventional energy resources – availability and their limitations; non-conventional energy resources: Classification, advantages, limitations; comparison of conventional and non-conventional energy resources. **Solar Energy Basics:** Introduction, solar constant, basic sun-earth angles – definitions and their representation, solar radiation geometry (only theory); Measurement of solar radiation data: Pyranometer and pyro-heliometer. **Solar Thermal Systems:** Principle of conversion of solar radiation into heat, solar water heaters (Flat plate collectors), Solar cookers: box type, concentrating dish type; solar driers, solar still.

10 Hrs.

UNIT-II

Solar Electric Systems: Solar thermal electric power generation: Solar pond and concentrating solar collector (parabolic trough, parabolic dish, central tower collector). Advantages and disadvantages; Solar photovoltaic: Solar cell fundamentals, module, panel and array. Solar PV systems: Street lighting, domestic lighting and solar water pumping systems. **Wind energy:** Wind and its properties, history of wind energy, wind energy scenario – world and India. Basic principles of wind energy conversion systems (WECS), classification of WECS, parts of a WECS, derivation for power in the wind, advantages and disadvantages of WECS.

10 Hrs.

UNIT-III

Biomass Energy: Introduction, photosynthesis process, biomass conversion technologies; Biomass gasification: Principle and working of gasifies; Biogas: production of biogas, factors affecting biogas generation, types of biogas plants – KVIC and Janata model. **Geothermal Energy:** Introduction, geothermal resources (brief description), advantages and disadvantages, applications of geothermal energy.

10 Hrs.

UNIT-IV

Energy from Ocean: Tidal energy: Principle of tidal power, components of tidal power plant (TPP), classification of tidal power plants, advantages and limitation of TPP. Ocean thermal energy conversion (OTEC): Principle of OTEC system, methods of OTEC power generation: Open cycle (Claude cycle), closed cycle (Anderson cycle) and hybrid cycle (block diagram description of OTEC), advantages & limitation of OTEC. **Emerging Technologies:** Fuel cell, hydrogen energy, and wave energy. (Principle of energy generation using block diagrams, advantages and limitations).

10 Hrs.

Total Hrs.: 40

Course Outcomes:

Students will be able to:

- **CO1:** List the types and advantages of renewable energy sources and distinguish them
- **CO2:** Describe the technology for generation of different renewable energies
- **CO3:** Identify and assess the strength and weakness of various renewable energy sources and design a method of harnessing these energy sources
- **CO4:** Use renewable energy for a particular system/ application

TEXT BOOK:

1. Rai G. D., "Non-Conventional Sources of Energy," 4th Edition, Khanna Publishers, 2007.
2. Khan B. H., "Non-Conventional Energy Resources", TMH, New Delhi, 2006.

REFERENCE BOOKS:

1 Mukherjee D., Chakrabarti, S., "Fundamentals of Renewable Energy Systems", New Age International Publishers, 2005.

2 Tiwari, G. N., Ghosal M. K., "Renewable Energy Sources: Basic Principles and Applications", Alpha Science International Ltd., New Delhi, 2006.

CO-PO Mapping:

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

UHS002N: ADVANCED QUANTITATIVE APTITUDE AND SOFT SKILLS

1 Credits (2-0-0)

Course Objectives:

1. To develop and augment the written communication skills
2. To develop a deep sense of analysis towards solving a problem
3. To fine-tune the quantitative, data analysis and interpretation skills

UNIT-I

Professional Communication: Discussions and Debates, Written Communication

08 Hrs.

UNIT-II

Professional Communication: Written Communication

Written English: Synonyms and Antonyms, Error Detection and Correction, Para Jumbles and Miscellaneous Questions

07 Hrs.

UNIT-III

Mathematical Thinking: Ratio, Proportion and Variation, Percentages, Profit and Loss, Simple and Compound Interest, Averages and Allegations, Time and Work

08 Hrs.

UNIT-IV

Analytical Thinking: Analytical Puzzles, Data Analysis

07 Hrs.

Total Hrs.: 30

Course Outcomes:

Students will be able to:

- **CO1:** Demonstrate speaking in public or to an audience
- **CO2:** Demonstrate verbal ability
- **CO3:** Demonstrate written communication
- **CO4:** Analyze the given problem and develop a method for solving it
- **CO5:** Solve quantitative aptitude

REFERENCE BOOKS:

1. R. S. Aggarwal, "A Modern Approach to Verbal and Non – Verbal Reasoning", Sultan Chand and Sons, New Delhi, 2018
2. R. S. Aggarwal, "Quantitative Aptitude", Sultan Chand and Sons, New Delhi, 2018
3. Chopra, "Verbal and Non – Verbal Reasoning", MacMillan India
4. M Tyra, "Magical Book on Quicker Maths", BSC Publications, 2018
5. Edward De Bono, "Lateral Thinking", Penguin Books, New Delhi, 2016

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1										3		2		
CO2										3		2		
CO3										3		1		
CO4		3										2		
CO5		3										2		

Evaluation Methodology:

Continuous Internal Evaluation: 3 CIEs with 30 Objective Questions in 60 minutes

Semester Ending Examination: 50 Objective Questions in 90 minutes covering entire syllabus

UEI641C: MEDICAL INSTRUMENTATION

3 Credits (3-0-0)

UNIT-I

Fundamentals of Bio-signals: Sources, Basic instrumentation system, General constraints in design of biomedical instrumentation systems, Origin of bioelectric signals, Types of bioelectric signals– ECG,EEG, EMG, EOG, ERG. **Electrocardiograph**: Characteristics of Electrocardiogram (ECG), Electrocardiograph block diagram, Transformer coupled isolation ECG preamplifier circuit**,** RL driven circuit, ECG lead system and multi-channel ECG machine.

10 Hrs.

UNIT-II

Electroencephalograph: Electroencephalograph block diagram, 10-20 electrode systems, Unipolar, bipolar and average electrode configurations, Computerized analysis of EEG. **Patient Monitoring System**: Bedside patient monitoring system. **Measurement of Heart Rate:** Average heart rate meter, Instantaneous heart rate meter (cardio tachometer). **Measurement of Pulse Rate:** Reflectance and transmittance photoelectric method, Processing of plythysmographic signals.

10 Hrs.

UNIT-III

Blood Pressure Measurement: Direct and indirect method, Korotkoff's method, Rheographic method, Ultrasonic Doppler shift method. **Blood Flow Meters:** Ultrasonic blood flow meters: Continuous wave flow meter, Doppler imaging flow meter, NMR blood flow meters. **Measurement of Respiration Rate:** Mechanics of respiration**, T**hermistor method, Impedance pnuemography, CO_2 method, Apnoea detectors. **Ventilators**: Artificial ventilation, Positive and negative pressure ventilators.

10 Hrs.

UNIT-IV

Cardiac Pacemakers: Need for cardiac pacemaker, Implantable pacemaker, Programmable pacemaker, Rate responsive pacemakers. **Defibrillators**: AC and DC defibrillators. **Pulmonary Function Analyzer**: Pulmonary function measurement, Measurement of flow-volume by nitrogen washout technique. **Patient Safety:** Electric shock hazards, Precautions to minimize electric shock hazards, Safety codes for electro medical equipment, Introduction to digital health system.

10 Hrs.

Total Hrs.: 40

Course Outcomes:

Students will be able to:

- **CO1:** Characterize the various physiological signals.
- **CO2:** Describe various principles and techniques employed in measurement of vital physiological parameters.
- **CO3:** Categorize and interpret various medical instruments.
- **CO4:** Identify and judge patient safety issues related to medical instrumentation.

TEXT BOOKS:

1 R. S. Khandpur, "Hand book of Biomedical Instrumentation", 2nd Edition, TMH, 2003.

2 J. G. Webster, "Medical Instrumentation, Application & Design", 3rd Edition, John Wiley, 1998.

REFERENCE BOOK:

1. Lesely Cromwell, “Principles of Applied Biomedical Instrumentation”, John Wiley, 2004.

CO-PO Mapping:

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

UEI642C: CONTROL SYSTEMS

4 Credits (4-0-0)

UNIT-I

Introduction: Objective of control system, Importance of control system, Examples of control system, Types of control systems, Open-loop and closed loop control systems, Feed-back and its effects on system performance characteristics. **Modeling of Physical Systems:** Models of mechanical systems, Electrical systems, and Electromechanical systems, Analogous systems: Force-voltage analogy, Force-current analogy. Usage of MATLAB command-line functions to verify the solution.

13 Hrs.

UNIT-II

Block Diagrams and Signal Flow Graphs: Transfer function; Block diagram reduction, Signal flow graphs, Mason's gain formula, and Application of Mason's gain formula to block diagrams. **Time Response of Feedback Control Systems:** Standard test signals, Type and order of system, Steady state error and error constants, Unit-step response of first and second order systems, Time domain specifications. Usage of MATLAB command-line functions to verify the solution.

13 Hrs.

UNIT-III

Stability Analysis: The concept of stability, BIBO stability, Zero-input and asymptotic stability, Routh-Hurwitz (R-H) stability criterion, Application. **Root-Locus Analysis:** The concept of root locus and Complementary root locus, Basic properties of root locus, Construction of root locus. Usage of MATLAB command-line functions to verify the solution.

13 Hrs.

UNIT-IV

Frequency Domain Analysis: The concept of frequency response, Polar plots, Procedure for constructing polar plots, Bode plots, procedure for constructing Bode plots, Gain margin, Phase margin, Frequency domain specifications, Nyquist stability criterion and examples. Usage of MATLAB command-line functions to verify the solution.

13 Hrs.

Total Hrs.: 52

Course Outcomes:

Students will be able to:

- **CO1:** **(a)** Identify and classify types of control systems
  (b) Model a physical system
- **CO2:** **(a)** Reduce and simplify block diagrams and signal flow graphs
  (b) Analyse and determine time-domain responses of first and second systems for step and ramp input
- **CO3:** **(a)** Analyse and determine stability of control systems using R-H criterion
  (b) Analyse and construct root locus
- **CO4:** **(a)** Analyse and construct polar plot and Bode plot
  (b) State and describe Nyquist stability criterion
- **CO5:** Use MATLAB command-line functions for modeling and analysis of LTI systems.

TEXT BOOK:

1. I. J. Nagarath and M Gopal, "Control Systems Engineering", New Age International (P) Ltd., 1999

REFERENCE BOOKS:

1. B. C. Kuo, "Automatic Control Systems", 7th Edition, PHI, 2002.
2. R. S. Allurkar, "Control Systems", EBPB, 2004

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	-	-	-	-	-	-	-	-	-

UEI643C: ARM PROCESSOR

3 Credits (3-0-0)

UNIT-I

An Introduction to Processor Design: Processor architecture and organization, Abstraction in Hardware design, MU0- A Simple processor, Instruction set design, Processor design trade-offs, The reduced instruction set computer, Design for low power consumption, Architectural inheritance.

10 Hrs.

UNIT-II

Features of Processor Architectures: Von-Neumann and Harvard, ARM7TDMI Features, Programmer's Model and 3-stage pipelined Architecture, Memory Formats and Instruction Length, Features of LPC2148 Microcontroller, Architecture of LPC2148, Memory Mapping and control Operation.

10 Hrs.

UNIT-III

Addressing modes of Data Transfer, Data processing and Controller Transfer instructions in ARM state, Stack operation in ARM, **System Control:** Reset condition, Brown out reset, Clocking and Power control. **Exceptions in ARM7TDMI processor:** Exception handling, Interrupt Latency.

10 Hrs.

UNIT-IV

LPC2148 Peripherals: High level Programming using GPIO, External Interrupt Inputs, Timers, ADC and DAC. Theory on PWM operation, Theory on serial communication: UART, SPI, I2C and CAN protocols, RS232 standards

10 Hrs.

Total Hrs.: 40

Course Outcomes:

Students will be able to:

- **CO1:** Identify the various digital components in ARM Processor architecture
- **CO2:** Select suitable instructions and addressing modes to implement code for specific application
- **CO3:** Interface and write C - Program to access Memory and Peripheral devices
- **CO4:** Develop Program to handle exceptions

TEXT BOOK:

1. Steve Furber, "ARM System On Chip Architecture" , 2nd Edition, Pearson Publication, 2016
2. William Hohl, Christopher Hinds, "ARM Assembly Language: Fundamentals and Techniques", 2nd Edition, CRC Press, 2015

REFERENCE BOOKS:

1. ARM Architecture reference manual DDI 0100E
2. ARM7TDMI Revision: r4p1 Technical Reference Manual
3. LPC2141/42/44/46/48 Single-chip 16-bit/32-bit microcontrollers; up to 512 kB flash with ISP/IAP, USB 2.0 full-speed device, 10-bit ADC and DAC Rev. 5 — 12 August 2011 Product data sheet

CO-PO Mapping:

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

UEI644L: ARM PROCESSOR LABORATORY
1 Credit (0-0-2)

List of experiments:

1. Write a C program to interface the LEDs
2. Write a C program to implement counter by interfacing 7 Segment display
3. Write a C program to interface buzzer
4. Write a C program to interface relay
5. Write a C program to interface keys and keyboard
6. Write a C program to interface stepper motor
7. Write a C program to interface DC motor
8. Write a C program to read the digital data from internal ADC
9. Write a C program to generate various waveforms using internal DAC
10. Write a C program to interface external interrupt source
11. Write a C program to interface the LCD and display the given text in given fashion.
12. Write a C program to transmit the data serially using UART.

Minimum 10 experiments to be completed from the above list

Course Outcomes:

Students will be able to:

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

CO-PO Mapping:

CO	Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	Design and develop a circuit/program for the given objective	3	3	-	-	-	-	-	-	-	-	-	-	2	2
CO2	Conduct the experiment and demonstrate the theoretical concepts	-	3	2	-	-	-	-	-	-	-	-	-	2	2
CO3	Analyze and interpret the experimental results	-	-	3	-	-	-	-	-	-	-	-	-	2	2

UCS659L: Advanced C Programming Lab
2 Credits (0-2-2)

The objective of the course is to:

1. Imbibe thorough knowledge in advanced C programming concepts.
2. Have proficiency in applying advanced C programming concepts to solve any real world problem.

UNIT -I

Multidimensional arrays. Self-referential structures and Unions. **Pointers:** Introduction, Pointers for inter function communication, Pointers to pointers, Compatibility, Lvalue and Rvalue, Examples. **Pointer Applications:** Arrays and pointers, pointer arithmetic and arrays, passing an array to a function, memory allocation functions, array of pointers, Examples. 06 Hrs

UNIT- II

Data Structures, Classifications (Primitive & Non Primitive), Data structure Operations, Stacks: Definition, Stack Operations, Array Representation of Stacks, Stacks using Dynamic Arrays, Stack Applications: Queues: Definition, Array Representation, Queue Operations. Programming Examples.
06 Hrs

UNIT- III

Linked Lists: Definition, Representation of linked lists in Memory, Linked list operations: Traversing, Searching, Insertion, and Deletion. Applications of Linked lists.
06 Hrs

UNIT- IV

Trees: Terminology, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals
06 Hrs

Course outcomes:

The student will be able to:

1. Define advanced C programming concepts like pointers, data structures.
2. Apply the knowledge of advanced C programming concepts to implement given requirement specification or to solve real world problem.
3. Analyze different data structures and use suitable data structure to implement requirement specification.
4. Implement, interpret, debug and test any given advanced C program.
5. Develop software product using advanced C programming concepts to solve real world problem.

Text Books:

1. Gilberg & Forouzan, "Data Structures: A Pseudo-code approach with C," 2nd Edition, 2014
2. Yashwant Kanetkar, "Data Structures through C," BPB Publication, 2017

Reference Book:

1. Reema Thareja, "Data Structures using C," Oxford press, 3rd Edition 2012
2. Jean-Paul Tremblay & Paul G., "An Introduction to Data Structures with Applications," McGraw-Hill, 2nd Edition, 2013

UEI611E: INTELLIGENT INSTRUMENTATION

3 Credits (3-0-0)

UNIT-I

Introduction: Intelligent instrumentation, Definition, Historical Perspective, Current status, software based instruments. **Intelligent Sensors**: Classification, Smart sensors, Monolithic Integrated Smart Sensors, Hybrid Integrated Smart Sensors, Cogent Sensors, Soft or Virtual sensors, Self-adaptive, Self-validating sensors, Soft Sensor Secondary Variable Selection, Rough Set Theory, Model Structures. Self-Adaptive Sensors, Self-Validating Sensors, VLSI Sensors, Temperature Compensating Intelligent Sensors, Pressure Sensor

10 Hrs.

UNIT-II

Sensor Characterization and Linearization: Analog Linearization of Positive and Negative Coefficient Resistive Sensors. Higher-Order Linearization, Quadratic Linearization, Third-Order Linearization Circuit, Nonlinear ADC- and Amplifier-Based Linearization, Interpolation, Piecewise Linearization, Microcontroller-Based Linearization, Lookup Table Method, Artificial Neural Network– Based Linearization, Nonlinear Adaptive Filter–Based Linearization.

10 Hrs.

UNIT-III

Sensor Calibration and Compensation: Sensor Calibration, Conventional Calibration Circuits, Offset Compensation, Error and Drift Compensation, Lead Wire Compensation. **Sensors with Artificial Intelligence:** Artificial Intelligence, Sensors with Artificial Intelligence, Multidimensional Intelligent Sensors, AI for Prognostic Instrumentation, ANN-Based Intelligent Sensors, Fuzzy Logic–Based Intelligent Sensors.

10 Hrs.

UNIT-IV

Intelligent Sensor Standards and Protocols: IEEE 1451 Standard: STIM, TEDS, NCAP. Network Technologies, LonTalk, CEBUS, J1850 Bus: Signal Logic and Format, MI Bus, Plug-n-Play Smart Sensor Protocol.

10 Hrs.

Total Hrs.: 40

Course Outcomes:

Students will be able to:

- **CO1:** To study the concepts of intelligent sensor devices, their performance characteristics and signal and system dynamics.
- **CO2:** To address the issues in dealing signal conditioning operations such as calibration, linearization and compensation.
- **CO3:** To develop the design methodologies for measurement and instrumentation of real world problems.
- **CO4:** To use artificial intelligence in sensor signal processing to solve real world problems.
- **CO5:** To deal with interfacing protocols in wireless networking platform

TEXT BOOK:

1. Manabendra Bhuyan, “Intelligent Instrumentation: Principles and Applications,” CRC Press, Taylor and Francis Group, 2011.

REFERENCE BOOKS:

1 G. C. Barney, “Intelligent Instrumentation,” Prentice Hall, 1995.

2 J.B Dixit, Amit Yadav, “Intelligent Instrumentation for Engineers,” Laxmi Publications Ltd., 2011.

CO-PO Mapping:

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

UEI612E: MICRO ELECTRO MECHANICAL SYSTEM

3 Credits (3-0-0)

UNIT-I

Overview of Micro Electro Mechanical System and Microsystems: MEMS and Microsystems, typical MEMS and microsystem products, evolution of microfabrication, microsystems and microfabrication, microsystem and microelectronics, microsystem and miniaturization, applications of microsystems in various industries. **Working Principles of MEMS:** Introduction, Microsensors.

10 Hrs.

UNIT-II

Working Principles of MEMS: Microactuation, MEMS and microactuators, Microaccelerometers, microfluidics**. Scaling Laws in Miniaturization:** Introduction to scaling, scaling in geometry, scaling in rigid body dynamics, scaling in electrostatic forces, scaling in electromagnetic forces, scaling in electricity, scaling in fluid mechanics, scaling in heat transfer.

10 Hrs.

UNIT-III

Materials for MEMS and Microsystems: Substrates and wafers**,** active substrate materials, silicon as a substrate material, silicon compounds, silicon piezoresistors, Gallium Arsenide, Quartz, Piezoelectric crystals, polymers packaging materials. **Microsystem Fabrication Processes:** Introduction to microfabrication, Photolithography, Ion implantation, diffusion, oxidation, chemical vapor deposition, physical vapor deposition, deposition by epitaxy, etching.

10 Hrs.

UNIT-IV

Micromanufacturing: Bulk micromachining, Surface micromachining, LIGA process. **Microsystem Design:** Introduction**,** Design considerations, Process design, Computer aided design.

10 Hrs.

Total Hrs.: 40

Course Outcomes:

Students will be able to:

- **CO1:** Interpret the benefits of miniaturization and identify the various applications of microsystems
- **CO2:** Elucidate the effect of scaling and illustrate the working principle of microsensors and microactuators
- **CO3:** Analyze the characteristics of various materials and their significance in micro manufacturing
- **CO4:** Infer the microsystem fabrication processes and elucidate the micro manufacturing design and process

TEXT BOOKS:

1. Tai, Ran Hsu, “MEMS and Microsystems: Design and Manufacture”, TMH, 2002.
2. G.K. Ananthsuresh, K.J. Vinoy, S. Gopalkrishna, K.N. Bhat, V.K. Aatre “Micro and Smart Systems", Wiley Publisher, 2010, ISBN:9788126527151.

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

UEI613E: COMPUTER NETWORKS AND SECURITY

3 Credits (3-0-0)

UNIT-I

Introduction: Uses of computer networks, Network hardware, Network software, Reference models. **The physical layer**: The theoretical basis for data communication, Guided transmission media, Wireless transmission.

10 Hrs.

UNIT-II

The data link layer: Data link layer design issues, Error detection and correction, Elementary data link protocols, Sliding window protocols. **The medium access control sub-layer**: The channel allocation problem, Multiple access protocols: Aloha, Carrier Sense Multiple Access protocols.

10 Hrs.

UNIT-III

The Network layer: Network layer design issues, Routing algorithms, Congestion control algorithm.
The Transport layer: The transport services, Elements of transport protocol.

10 Hrs.

UNIT-IV

Network security: Cryptography, Symmetric key algorithms, Public key algorithms. **The Application laye**r: Domain name system (DNS), The DNS name space, resource records. Electronic mail, Architecture, World Wide Web (WWW). Architectural overview.

10 Hrs.

Total Hrs.: 40

Course Outcomes:

Students will be able to:

- **CO1:** List the applications of computer networks and Identify different types of networks.
- **CO2:** Explain function and role of physical, data link, network, transport and application layer of OSI reference model.
- **CO3:** Comprehend the design issues of different layers of OSI reference model.
- **CO4:** Discuss the concept of cryptography

TEXT BOOK:

1 Andrews S. Tanenbaum, “Computer Networks”, 4th Edition, Pearson Education

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

UEI614E: DIGITAL IMAGE PROCESSING

3 Credits (3-0-0)

UNIT-I

Digital Image Fundamentals: Introduction, Fundamental steps in digital image processing (DIP), Components of DIP system, Simple image formation model, Image sampling and quantization, Basic relationship between pixels, Color image processing fundamentals and models. Two-dimensional mathematical preliminaries, 2D transforms: DFT, DCT, KLT, SVD.

10 Hrs.

UNIT-II

Image Enhancement: Histogram equalization and specification techniques, Noise distributions, Spatial averaging, Directional smoothing, median, Geometric mean. **Image Restoration:** Image restoration - degradation model. Unconstrained restoration: Lagrange multiplier. Constrained restoration, Inverse filtering-removal of blur caused by uniform linear motion, Wiener filtering.

10 Hrs.

UNIT-III

Image Segmentation: Edge detection, Edge linking via Hough transform, Thresholding, Region based segmentation, Region growing, Region splitting and merging, Segmentation by morphological watersheds, Basic concepts, Dam construction, Watershed.

10 Hrs.

UNIT-IV

Image Compression: Need for data compression, Huffman, Run length encoding, Shift codes, arithmetic coding, Vector quantization, Transform coding, JPEG standard, MPEG.

10 Hrs.

Total Hrs.: 40

Course Outcomes:

Students will be able to:

- **CO1:** Analyze general terminology of digital image processing.
- **CO2:** Examine various types of images, intensity transformations and spatial filtering.
- **CO3:** Apply image enhancement and restoration techniques in practical applications.
- **CO4:** Apply image segmentation and compression techniques in practical applications.

TEXT BOOK:

1. Rafael C. Gonzalez, Richard E. Woods, "Digital Image Processing", Pearson, 2nd Edition, 2004.
2. Anil K. Jain, "Fundamentals of Digital Image Processing", 2nd Edition Pearson.

REFERENCE BOOKS:

1. Kenneth R. Castleman, "Digital Image Processing", Pearson, 2006.
2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, "Digital Image Processing using MATLAB", Pearson Education Inc., 2004.
3. D. E. Dudgeon, R. M. Mersereau, "Multidimensional Digital Signal Processing", Prentice Hall.

CO-PO Mapping:

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

UHS003N: CAREER PLANNING AND PROFESSIONAL SKILLS

1 Credits (2-0-0)

Course Objectives:

1. To enhance the ability to think and reason critically
2. To augment the student's attention to detail and problem-solving skills in basic computations
3. To successfully handle personal interviews and enhance public speaking skills

UNIT-I
Professional Communication: Mock Group Discussions, Interview Handling Skills

08 Hrs.

UNIT-II
Professional Communication: Résumé Writing, Leadership Skills and Team Workmanship, Spoken English
Written English: Reading Comprehension

07 Hrs.

UNIT-III
Written English: Sentence Completion, Critical Reasoning
Analytical Thinking: Boolean Logic and Cryptarithms

08 Hrs.

UNIT-IV
Mathematical Thinking: Time, Speed and Distance, Permutations and Combinations, Probability

07 Hrs.
Total Hrs.: 30

Course Outcomes:

Students will be able to:

- **CO1:** Interact with confidence in personal interviews successfully
- **CO2:** Demonstrate leadership and team workmanship skills
- **CO3:** Analyze the given problem and develop a method for solving it
- **CO4:** Solve quantitative aptitude

REFERENCE BOOKS:

1. R. S. Aggarwal, "A Modern Approach to Verbal and Non – Verbal Reasoning", Sultan Chand and Sons, New Delhi, 2018
2. R. S. Aggarwal, "Quantitative Aptitude", Sultan Chand and Sons, New Delhi, 2018
3. Chopra, "Verbal and Non – Verbal Reasoning", MacMillan India
4. M Tyra, "Magical Book on Quicker Maths", BSC Publications, 2018

6. Edward De Bono, “Lateral Thinking”, Penguin Books, New Delhi, 2016

CO-PO Mapping:

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

Evaluation Methodology:

Continuous Internal Evaluation: 3 CIEs with 30 Objective Questions in 60 minutes

Semester Ending Examination: 50 Objective Questions in 90 minutes covering entire syllabus