III SEMESTER

B.E. Electronics and Instrumentation Engineering (EI)				
Choice Based Credit System (CBCS)				
Semester - III				
ENGINEERING MATHEMATICS-III				
(Common to All Branches)				
Subject Code	: 17MAT31		CIE Marks	: 40
Number of Lecture Hours/Week	: 04		SEE Marks	: 60
Total Number of Lecture Hours	: 50		Exam Hours	: 03
Credits - 4				
Course Objectives: This course will enable the students to				
Revised Bloom's Taxonomy Levels: L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analyzing, L5 – Evaluating, and L6 - Creating				

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT)Level**
Module -1	10 Hours	
Module -2	10 Hours	
Module -3	10 Hours	
Module -4	10 Hours	

Module -5	10 Hours	

Course Outcomes: After studying this course, students will able to:

Graduate Attributes (as per NBA)

Question Paper Pattern:
- The question paper will have TEN questions.
- Each full question carry16 marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

Reference Books:

B.E. Electronics and Instrumentation Engineering (EI)			
Choice Based Credit System (CBCS)			
Semester - III			
ELECTRONIC INSTRUMENTATION AND MEASUREMENTS			
(Common to EI, BM & ML)			
Subject Code	: 17 EI/BM/ML 32	CIE Marks	: 40
Number of Lecture Hours/Week	: 04	SEE Marks	: 60
Total Number of Lecture Hours	: 50	Exam Hours	: 03
Credits - 4			

Course Objectives: This course will enable the students to
- Impart with the knowledge of generalized measurement systems.
- Learn the characteristics of various types of measurement systems and errors in measuring instruments.
- Analyze the circuits for the measurement of Resistance, Capacitance, Inductance, and Frequency.
- Impart with the basic concepts of CRO and its usage for the measurement of various parameters.
- Understand the concepts of Ammeters, Voltmeter and Multimeters
- Understand the importance of Display Devices and Recorders in practical fields

Revised Bloom's Taxonomy Levels: L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analyzing, L5 – Evaluating, and L6 - Creating

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT)Level
Module -1 **A).Measurements:** introduction, Significance of measurements, methods of measurements, instruments and measurement systems, Functions of instruments and measurement systems, Applications of measurement systems. **Measurement Errors:** Introduction Gross errors and systematic errors, Absolute and relative errors, basic concepts of accuracy, Precision, Resolution and Significant figures, Measurement error combinations. (relevant problems)	10 Hours	L1,L2
Module -2 **A). Ammeters, Voltmeter and Multimeters:** Introduction, DC ammeter principle only, DC voltmeter, Multi-range voltmeter, Extending voltmeter ranges, Loading, Peak responding and True RMS voltmeters. (relevant problems) **B). Digital Voltmeters:** Introduction, Ramp type, Dual slope integrating type (V–T), integrating type (V–F) and Successive approximation type (relevant problems). **Digital Instruments**: Introduction, Block diagram of a Basic Digital Multi-meter. Digital frequency meters: Basic circuit of a Digital frequency meter, Basic circuit for frequency measurement.	10 Hours	L1,L2,L3, L5

Module -3 **A). Oscilloscopes :** Introduction, Basic principles, CRT features, Block diagram and working of each block, Typical CRT connections, Dual beam and dual trace CROs, Electronic switch. **B).Special Oscilloscopes:** **Delayed time-base oscilloscopes**: Need for a time delay & delayed-time-base system. **Analog storage oscilloscopes**: Need for trace storage, bistable storage CRT, Variable persistence storage CRT. **Digital storage oscilloscopes**: Basic DSO operation only.	10 Hours	L1,L2,L3, L4
Module -4 **A). Signal Generators :** Introduction, Fixed and variable AF oscillator, Standard signal generator, Modern laboratory signal generator, AF sine and Square wave generator, Function generator, Square and Pulse generator. **B). Bridge Circuits for Measurement of R, L & C:** **DC bridges**: Introduction, Wheatstone's bridge, Kelvin Bridge **AC bridges**: Capacitance Comparison Bridge, inductance Comparison Bridge, Maxwell's bridge, Schering Bridge. (relevant problems)	10 Hours	L1,L2,L3,L5 ,L6
Module -5 **Display Devices and Recorders:** Introduction, electrical indicating instruments, digital instruments, digital display methods, digital display unit. Segmental Displays: Seven segmental display, dot matrices, LED, LCD, decade counting assemblies, display systems. Recorders: Recording requirements, analog recorders- Graphic recorders, strip chart recorders & its types, X-Y recorder, Magnetic & Digital tape recorders.	10 Hours	L1,L2,L3,L5

Course Outcomes: After studying this course, students will able to:
- Analyze instrument characteristics, errors and generalized measurement system.
- Analyze and use the circuit for the measurement of R, L, C, F, I, V etc
- Use of Ammeters, Voltmeter and Multimeters and CRO for measurement
- Analyze and interpret different signal generator circuits for the generation of various waveforms
- Understand and use different display devices and recorders

Graduate Attributes (as per NBA)
- Engineering knowledge
- Problem analysis
- Design & Development of Solutions
- Modern tool usage

Question Paper Pattern:
- The question paper will have TEN questions.
- Each full question carry16 marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. "Electronic Instrumentation", H. S. Kalsi, TMH, 2004 (Module- 2,3 & 4)

2. "Electronic Instrumentation and Measurements", David A Bell, PHI / Pearson Education2006/ Oxford Higher Education, 2013. (Module 1 & 3)
3. Electrical and Electronic Measurements and Instrumentation – A. K. Sawhney, 17th Edition (Reprint 2004), Dhanpat Rai & Co. Pvt. Ltd., 2004.(Module- 1 & 5)

Reference Books:
1. "Principles of Measurement Systems", John P. Beately, 3rd Edition, Pearson Education, 2000
2. "Modern Electronic Instrumentation and Measuring Techniques", Cooper D & A D Helfrick, PHI, 1998.

B.E. Electronics and Instrumentation Engineering (EI) Choice Based Credit System (CBCS) Semester - III				
ANALOG ELECTRONIC CIRCUITS **(Common to EI, BM & ML)**				
Subject Code	: 17 EI/BM/ML 33		CIE Marks	: 40
Number of Lecture Hours/Week	: 04		SEE Marks	: 60
Total Number of Lecture Hours	: 50		Exam Hours	: 03
Credits - 4				

Course Objectives: This course will enable the students
- With the knowledge of Electronic devices.
- To know modeling of BJT and FET for analysis and to Design of BJT Amplifier, Hybrid Equivalent and Hybrid π Models.
- To know construction and characteristics of JFETs and MOSFETs.
- Describe various types of FET biasing, and Demonstrate use of FET amplifiers.
- Demonstrate and Generalize Frequency response of BJT and FET amplifiers at various frequencies.
- Analyze Power amplifier circuits in different modes of operation.
- To know the concept of Feedback and its effect on amplifier circuits and Oscillator circuits-operation and generation of low and high frequency signal using BJT/FET/Op-amp.

Revised Bloom's Taxonomy Levels: L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analysing, L5 – Evaluating, and L6 - Creating

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT)Level
Module -1 BJT AC Analysis BJT modeling, re transistor model: Common Emitter Configuration, Voltage-Divider Bias, CE Emitter-Bias Configuration (Excluding P-spice Analysis),Emitter Follower Configuration, Determining Current Gain, Effect of R_L and R_S, Cascaded Systems, RC- Coupled BJT Amplifier, Cascade Connection, Darlington Connection. The Hybrid Equivalent model, Approximate Hybrid Equivalent Circuit, Fixed bias configuration, Voltage-Divider configuration. (Relevant problems on above topics) Complete Hybrid Equivalent Model and Hybrid π Model.	**10 Hours**	**L1 L2**
Module -2 **Field Effect Transistors** Introduction, Construction and Characteristics of JFETs, Transfer Characteristics, Applying Shockley's Equation. **Depletion Type MOSFET:** Basic Construction, Basic Operation and Characteristics, P-Channel Depletion Type MOSFET and Symbols, **Enhancement Type MOSFET**: Basic Construction, Basic Operation and Characteristics, P-Channel Enhancement Type MOSFETs and Symbols. Relevant problems on above topics, **CMOS-Basics.** **FET Biasing** Introduction, Fixed-Bias Configuration, Self-Bias Configuration, Voltage-Divider Biasing. Relevant problems on above topics	**10 Hours**	**L1 L2**

Module -3 **FET Amplifiers** Introduction, JFET Small Signal Model, JFET AC equivalent Circuit, Fixed-Bias Configuration, Self-Bias Configuration, Voltage-Divider Configuration, Source Follower Configuration. Relevant problems on above topics. **BJT and JFET Frequency Response:** Introduction, General Frequency Considerations, Low Frequency Response of BJT Amplifier, Low Frequency Response of FET Amplifier, Miller Effect Capacitance, High Frequency Response of FET Amplifier, Multistage frequency effects. Relevant problems on above topics. (Excluding P-spice Analysis)	**10 Hours**	**L1, L2, L3**
Module -4 **Power Amplifiers** Introduction: Definitions and Amplifier Types, Series Fed Class A Amplifier, Transformer Coupled Class A Amplifier, Class B Amplifier operation. **Class B amplifier circuits**: Transformer-Coupled Push-Pull Circuits, Complementary –Symmetry Circuits only, Amplifier Distortion, Class C and Class D Amplifier. Relevant Problems on above topics.	**10 Hours**	**L1,L2, L3,L4**
Module -5 **Feedback and Oscillator Circuits** Feedback Concepts, Feedback Connection Types, Effects of negative feedback, Oscillator operation, Phase Shift Oscillator: FET Phase Shift Oscillator, Transistor Phase Shift Oscillator, Wien Bridge Oscillator, Tuned oscillator Circuit: FET and Transistor Colpitts Oscillator, FET and Transistor Hartley Oscillator, Crystal oscillator. Relevant Problems on above topics Unijunction transistor oscillator.	**10 Hours**	**L2, L3**

Course Outcomes: After studying this course, students will able to: • Explain the Working principles, characteristics and basic applications of BJT and FET. • Modeling of BJT/FET for analysis • Design Single stage, Multistage amplifier, with and without feedback • Analyze Frequency response of BJT and FET. • Acquire the knowledge of classifications of Power amplifier, operation, and able to design power amplifier. • Apply the knowledge gained in the design of BJT/FET circuits in Oscillators to generate different frequency signals.
Graduate Attributes (as per NBA) • Engineering Knowledge • Problem Analysis • Design / development of solutions (partly) • Interpretation of data
Question Paper Pattern: • The question paper will have TEN questions. • Each full question carry 16 marks • There will be TWO full questions (with maximum of THREE sub questions) from each module. • Each full question will have sub questions covering all the topics under a module.

• The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. Robert L. Boylestad and Louis Nashelsky, "Electronics devices and Circuit theory", Pearson, 10th Edition, 2009, ISBN:9788131727003

Reference Books:
1. David A. Bell, "Electronic Devices and Circuits", Oxford University Press.
2. I. J. Nagrath, "Electronics: Analog and Digital", PHI

B.E. Electronics and Instrumentation Engineering (EI)

B.E. Electronics and Instrumentation Engineering (EI)
Choice Based Credit System (CBCS)
Semester - III

DIGITAL DESIGN AND HDL
(Common to EI, BM & ML)

Subject Code	: 17 EI/BM/ML 34		CIE Marks	: 40
Number of Lecture Hours/Week	: 04		SEE Marks	: 60
Total Number of Lecture Hours	: 50		Exam Hours	: 03
Credits - 4				

Course Objectives: This course will enable the students to
- To impart the concepts of simplifying Boolean expression using K-map techniques and provide an understanding of logic families
- To impart the concepts of designing and analyzing combinational logic circuits
- To provide an understanding for the concepts of HDL-Verilog, data flow and behavioral models for the design of digital systems.
- To impart design methods and analysis of sequential logic circuits

Revised Bloom's Taxonomy Levels: L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analysing, L5 – Evaluating, and L6 - Creating

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT)Level
Module -1 **Principles of combinational logic:** Definition of combinational logic, Canonical forms, Generation of switching equations from truth tables, Karnaugh maps- up to 4 variables, Quine-McCluskey minimization technique **Introduction to Verilog:** Structure of Verilog module, Operators, data types, Styles of description- Data flow description, Behavioral description, Implement logic gates, half adder and full adder using Verilog data flow description.	10 Hours	L2,L3,L4
Module -2 **Combinational Functions:** Arithmetic Operations: Adders and subtractors-cascading full adders, Look ahead carry, Binary Comparators – 2 bit and 4 bit, two bit Multiplier, Verilog Description of for above circuits. **Multiplexers-** Realization of 2:1, 4:1 and 8:1 using gates & Applications. **Demultiplexers**: - Realization of 1:2 1:4 and 1:8 using basic gates & Applications **Verilog Behavioral description:** Structure, variable assignment statement, sequential statements, loop statements, Verilog behavioral description of Multiplexers (2:1,4:1,8:1) and De-multiplexers (1:2,1:4,1:8)	10 Hours	L1,L2,L3
Module -3 **Analysis and design of combinational logic:** Encoders: Binary coded decimal codes, Binary – Gray vice versa, BCD – Excess 3 Encoders: Realization and Priority Encoders, Decoders: BCD – Decimal, BCD – Seven segment, Seven segment display. **Verilog behavioral description** of Encoders (8 to 3 with priority and without	10 Hours	L1,L2

priority), Decoders (2 to 4).		
Module -4 **Sequential Logic Circuits-1:**Latches and Flip-Flops: SR-latch, D-latch, D flip-flop, JK flip-flop, T flip- flop Master slave FF, Edge trigger and Pulse trigger FF , Registers and Shift Registers: PISO, PIPO, SISO,SIPO, Right shift and left shift, Universal Shift register. **Verilog behavioral description** of latches (D-latch, SR latch) and flip-flops (D, T, JK, SR flip-flops).	10 Hours	L2,L3,L6
Module -5 **Counters, design and their applications**: Counters-Binary ripple counters, Synchronous binary counters, Modulo N counters – Synchronous and Asynchronous counters. **Verilog behavioral description** of Synchronous and Asynchronous counters, sequential counters. **Synthesis of Verilog:** Mapping process in the hardware domain- Mapping of signal assignment, variable assignment, if statements, else-if statements, loop statements	10 Hours	L2,L3,L4, L6

Course Outcomes: After studying this course, students will able to:
- Simplify Boolean functions using K-map and Quine-McCluskey minimization technique
- Analyze, design and write verilog code for combinational logic circuits. (MUX, De-MUX, adder and subtractor, and comparator circuits)
- Analyze and design code converters, encoders and decoders.
- Analyze and design of synchronous sequential circuits
- Analyze sequential circuits, Moore/Mealy machines

Graduate Attributes (as per NBA)
- Engineering knowledge
- Problem analysis
- Design & Development of Solutions
- Modern tool usage

Question Paper Pattern:
- The question paper will have TEN questions.
- Each full question consists of 16 marks.
- There will be 2 full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:
1. Digital Logic Applications and Design by John M Yarbrough, Thomson Learning,2001 (Modules 1,2,3,4,5 –Logic design)
2. HDL Programming VHDL and Verilog by Nazeih M. Botros, 2009 reprint, Dreamtech press.(Modules 1,2,3,4,5 Verilog description)

Reference Books:
1. Charles H Roth, Jr., "Fundamentals of logic design", Cengage Learning
2. Digital Principals and Design – Donald D Givone,12th reprint, TMH,2008
3. Logic Design, Sudhakar Samuel, Pearson/ Saguine, 2007
4. Fundamentals of HDL- Cyril P R Pearson/Sanguin 2010

E. Electronics and Instrumentation Engineering (EI) Choice Based Credit System (CBCS) Semester - III				
TRANSDUCERS AND INSTRUMENTATION				
Subject Code	: 17EI35		CIE Marks	: 40
Number of Lecture Hours/Week	: 04		SEE Marks	: 60
Total Number of Lecture Hours	: 50		Exam Hours	: 03
Credits - 4				

Course Objectives:
- To provide the fundamental knowledge of transducers, instrumentation and measurement systems.
- To understand the functional elements of instrumentation/measurement systems.
- To impart the knowledge of static and dynamic characteristics of instruments, and understand the factors in selection of instruments for measurement.
- To discuss the principle, design and working of transducers for the measurement of displacement, level, strain, force, torque, pressure, sound and speed.

Revised Bloom's Taxonomy Levels: L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analysing, L5 – Evaluating, and L6 - Creating

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT)Level
Module -1 **Classification and Functional Elements of Instrument/ measurement system:** Measurement, significance of measurement, instruments and measurement systems, mechanical, electrical and electronic instruments, Deflection & Null type instruments and their comparison, Analog and digital modes of operation, functions of instruments and measurement systems, applications of measurement systems, Elements of generalized measurement system, Input-output configuration of measuring instruments and measurement systems, methods of correction for interfering and modifying inputs. Transducers, Classifications of transducers-primary & secondary, active & passive, analog and digital transducers.	10 Hours	L1, L2
Module -2 **Static and Dynamic Characteristics:** Static calibration and error calibration curve, accuracy and precision, indications of precision, static error, scale range and scale span, reproducibility and drift, repeatability, signal to noise ratio, sensitivity, linearity, hysteresis, threshold, dead zone and dead time, resolution, signal to noise ratio, factors influencing the choice of transducers/instruments. Dynamic response – dynamic characteristics, time domain analysis & different types of inputs, frequency domain analysis. Time domain response – zero order system, first order electrical system, response of a first order system to step & ramp input, Second order system, response of a second order system to step input, time domain specifications, frequency response of first and second order system.	10 Hours	L1, L2, L3, L4

Module -3 **Measurement of Displacement:** Introduction, Principles of Transduction, Variable resistance devices, variable Inductance Transducer, Variable Capacitance Transducer, Hall Effect Devices, Proximity Devices, Digital Transducer **Measurement of Level:** Capacitance probes, conductivity probes, differential pressure level detector, float level devices, optical level switches, radiation level sensor, ultrasonic level detector, thermal level sensors	10 Hours	L1, L2, L3, L4
Module -4 **Measurement of Strain:** Introduction, Factors affecting strain measurements, Types of Strain Gauges, Theory of operation of resistance strain gauges, Types of Electrical Strain Gauges – Wire gauges, unbounded strain gauges, foil gauges, semiconductor strain gauges (principle, types & list of characteristics only), Materials for Strain Gauges, Strain gauge Circuits – Wheatstone bride circuit, Applications. **Measurement of Force & Torque**: Introduction, Force measuring sensor – Load cells – column types devices, proving rings, cantilever beam, pressductor. Hydraulic load cell, Electronic weighing system. Torque measurement: Absorption type, transmission type, stress type & deflection type.	10 Hours	L1, L2, L3, L4
Module -5 **Measurement of Pressure**: Introduction, Diaphragms, Other elastic elements, Transduction methods – potentiometric device, strain gauge transducer, variable reluctance, LVDT type, variable capacitance device (principle & working, no derivation), force balance transducer with analysis, thin-film pressure transducers, piezoelectric pressure transducer, pressure multiplexer, pressure calibration. **Miscellaneous Sensors**: Noise (sound) Sensors, Speed Sensors, Thickness Measurement, Weather stations	10 Hours	L1, L2, L3, L4

Course Outcomes: After studying this course, students will able to:
- Define the transducer, instrument, measurement and classify different types of transducers
- Explain the functional elements of instrumentation / measurement systems
- Discuss the input-output configuration of measurement systems
- Define, interpret and analyze the static and dynamic characteristics of instruments
- Explain the principle, design and analyze the transducers for the measurement of displacement, level, strain, force, torque, pressure, sound and speed

Graduate Attributes (as per NBA)
- Engineering knowledge
- Problem analysis
- Design & Development of Solutions
- Engineer and society
- Environment & sustainability
- Lifelong learning

Question Paper Pattern:
- The question paper will have TEN questions.

- Each full question consists of 16 marks.
- There will be 2 full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:
1. Electrical and Electronic Measurements and Instrumentation – A. K. Sawhney, 17th Edition (Reprint 2004), Dhanpat Rai& Co. Pvt. Ltd., 2004. (Module 1 & 2)
2. Instrumentation: Devices and Systems- C. S. Rangan, G. R. Sarma, V. S. V. Mani, 2nd Edition (32nd Reprint), McGraw Hill Education (India), 2014. (Module 3-Displacement measurement, Module 4, Module 5 – Measurement of pressure)
3. Process Measurement Instrument Engineers Handbook- Bela G. Liptak, Revised Edition, Chilton Book Company, 1982. (Module 3 – Level measurement, Module 5- Miscellaneous Sensors)

Reference Books:
1. Transducers and Instrumentation – D.V.S.Murty, 2nd Edition, PHI, 2009.
2. Introduction to Measurements and Instrumentation - A. K. Ghosh, 2nd Edition, PHI, 2007.
3. Instrumentation Measurement and Analysis- B.C.Nakra and K.K.Choudhry, 3rd Edition, McGraw Hill Education (India) Pvt.Ltd. 2009.
4. Measurement Systems Application and Design- Ernest O.Doeblin and Dhanesh N Manik, 5th Edition, McGraw Hill, 2007

<table>
<tr><td colspan="4">B.E. Electronics and Instrumentation Engineering (EI)
Choice Based Credit System (CBCS)
Semester – III (Elective-I)</td></tr>
<tr><td colspan="4">NETWORK ANALYSIS (Revised)
(Common to EI, BM & ML)</td></tr>
<tr><td>Subject Code</td><td>: 17 EI/BM/ML 36</td><td>CIE Marks</td><td>: 40</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>: 03</td><td>SEE Marks</td><td>: 60</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>: 40</td><td>Exam Hours</td><td>: 03</td></tr>
<tr><td colspan="4">Credits - 3</td></tr>
</table>

Course Objectives: This course will enable the students to
- To introduce the Basic circuit laws, Network theorems and analyze the networks.
- To analyze the networks by using optimized methods
- To analyze the network behavior during switching states.
- To realize the network parameters.

Revised Bloom's Taxonomy Levels: L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analyzing, L5 – Evaluating, and L6 - Creating

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1 **Basic concepts**: Sources of electrical energy, Source transformation, Loop and node analysis with dependent & independent sources for DC networks, concept of super node and super mesh analysis for only independent sources for DC networks. Numerical on all Topics	08 Hours	L1, L2, L3, L4
Module -2 **Network theorems**: Super position, reciprocity, Millman's theorem Thevinin's & Norton's theorem (for DC networks only), Maximum power transfer theorem (for AC & DC networks) Numerical on all Topics	08 Hours	L1, L2, L3, L4
Module -3 **Transient behavior and initial conditions**: Behavior of circuit elements under switching condition and their representation, evaluation of initial & final conditions in RL, RC & RLC circuits for DC excitations. **Two port network parameters**: Definitions and modeling of Z, Y, H & transmission parameters Numerical on all Topics	08 Hours	L1, L2, L3, L4
Module -4 **Resonant Circuits**: Series resonance: Variation of current and voltage with frequency, Selectivity & Bandwidth, Q-factor Parallel resonance: General case-resistance present in both branches, Selectivity & Bandwidth. Numerical on all Topics	08 Hours	L1, L2, L3, L4
Module -5	08 Hours	L1, L2, L3, L4

Network topology: Graph of a network, concepts of: tree & co-tree, incidence matrix, tie-set & cut-set schedules, Solution of resistive networks using equilibrium equations in matrix form, Principle of duality. Numerical on all Topics		

Course Outcomes: After studying this course, students will able to:
- Apply the basic concepts (Laws, theorems) of networks to obtain solution.
- Choose the Appropriate/specific technique to analyze the networks.
- Realize and Analyze the network behavior

Graduate Attributes (as per NBA)
- Applying the Engineering concepts to analyze the networks
- Realizing and solving the complex circuits

Question Paper Pattern:
- The question paper will have TEN questions.
- Each full question carry16 marks
- In each full question, preferably 40% should be related to theoretical concepts/derivations and 60% should be related problems/solutions.
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. Engineering Circuit Analysis, William H Hayt et al, McGraw Hill, 8th Edition.
2. Networks and Systems, D Roy Choudhury, New Age International Publishers, 3rd Edition.
3. Network Analysis, M.E. Van Valkenburg, Prentice-Hall, 3rd Edition.

Reference Books:
1. Introduction to Electric circuits, Richard C Dorf & James A Svoboda, Wiley, 9th Edition.
2. Electric Circuits, Mahmood Nahvi, McGraw Hill, 9th Edition

B.E. Electronics and Instrumentation Engineering (EI)			
Choice Based Credit System (CBCS)			
Semester - III			
ANALOG ELECTRONIC CIRCUITS LAB			
(Common to EI, BM & ML)			
Subject Code	: 17 EI/BM/ML L37	CIE Marks	: 40
Number of Practical Hours/Week	: 03	SEE Marks	: 60
Total Number of Practical Hours	: 42	Exam Hours	: 03
Credits - 2			

Course Objectives:

 This laboratory course enables students to get practical knowledge & experience in design, assembly and evaluation/testing of

- Rectifier circuits without and with filter
- BJT as Amplifier without and with feedback
- JFET Characteristics and as Amplifier.
- MOSFET Characteristics
- BJT as Power Amplifiers
- Oscillators using BJT and FET for frequency generation
- UJT characteristics
- Verification of Theorems and applications in practical fields

Revised Bloom's Taxonomy Levels: L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analyzing, L5 – Evaluating, and L6 - Creating

Laboratory Experiments NOTE: The experiments are to be carried using discrete components only	Revised Bloom's Taxonomy (RBT)Level
1. To design and testing of the following rectifiers with and without filters: (a) Full Wave Rectifier (center tap) (b) Bridge Rectifier.	L3, l4, L5, L6
2. To plot characteristics of UJT and to determine its intrinsic stand-off ratio.	L1, L2, L3, L4
3. To design and test the common emitter amplifier (voltage divider bias) without feedback and determine input, output impedance, gain and bandwidth.	L3, l4, L5, L6
4. To design and test the Emitter follower amplifier (BJT) using voltage divider bias and determine input, output impedance, gain and bandwidth.	L3, l4, L5, L6
5. To plot the Drain and Transfer characteristic for the given FET and to find the Drain Resistance and Trans-conductance.	L1, L2, L3, L4
6. To design, test and to plot the frequency response of Common Source JFET/MOSFET amplifier, and to determine its bandwidth.	L3, l4, L5, L6
7. To plot the input and output characteristics of n-channel MOSFET and calculate its parameters, namely; drain resistance, mutual conductance and amplification factor.	L1, L2, L3, L4
8. Wiring and testing of Complimentary symmetry class B push pull power amplifier and calculation of efficiency.	L1, L2, L3, L4

9. To design and test the RC-Phase shift Oscillator using BJT for the given frequency.	L3, L4, L5, L6
10. To design and test the following tuned oscillator circuits for the given frequency. (a) Hartley Oscillator using BJT (b) Colpitts Oscillator using FET.	L3, L4, L5, L6
11. Testing of crystal oscillator and to determine its frequency of oscillation.	L1, L2, L3, L4
12. Verification of Thevenin's theorem and Maximum Power Transform theorem for the given DC circuits.	L1, L2, L3, L4

Course Outcomes: After studying this course, students will able to:
- Acquire the Working principles, characteristics and basic applications of BJT and FET.
- Modeling of BJT/FET for analysis
- Able to design Single stage, Multistage amplifier, with and without feedback
- Able to analyze Frequency response of BJT and FET.
- Acquire the knowledge of Power amplifiers, operation, and able to design power amplifier.
- Apply the knowledge gained in the design of BJT/FET circuits in Oscillators to generate different frequencies and their applications.
- Knowledge of UJT characteristics and its application.
- Applications of theorems in various practical fields.

Graduate Attributes (as per NBA)
- Engineering Knowledge.
- Problem Analysis.
- Design / development of solutions (partly)

Conduct of Practical Examination:
1. All laboratory experiments are to be included for practical examination.
2. Students are allowed to pick one experiment from the lot.
3. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
4. Change of experiment is allowed only once and 17% Marks allotted to the procedure part to be made zero.

Reference Books:
1. Electronics Lab Manual by K. A. Navas, Volume I, PHI, 5th Edition, 2017, ISBN:9788120351424.
2. Electronics Laboratory Primer - A Design Approach by S.Poorna Chandra, B.Sasikala, S Chand Pub.

B.E. Electronics and Instrumentation Engineering (EI)				
Choice Based Credit System (CBCS)				
Semester - III				
DIGITAL DESIGN AND HDL LAB				
(Common to EI, BM & ML)				
Subject Code	: 17 EI/BM/ML L38		CIE Marks	: 40
Number of Practical Hours/Week	: 03		SEE Marks	: 60
Total Number of Practical Hours	: 42		Exam Hours	: 03
Credits - 2				

Course Objectives: This course will enable the students to
- The operation of various logic gates and digital circuits and write the Verilog code.
- Design of logic circuits for combinational and sequential circuits and write Verilog code.
- Synthesis of digital circuits, FFs, shift registers and counters using ICs.
- To use FPGA/CPLD kits for downloading the Verilog code and test the output.

Revised Bloom's Taxonomy Levels: L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analyzing, L5 – Evaluating, and L6 - Creating

Laboratory Experiments: **Note:** **(1)** Use discrete components to test and verify the logic gates. (2) Use FPGA/CPLD kits for down loading the Verilog code and test the output.	**Revised Bloom's Taxonomy (RBT) Level**
1. Simplification, realization of Boolean expressions using logic gates/Universal gates	L1,L2,L3
2. To design and implement a) Adder/Subtractor – Full/half using logic gates. b) 4-bit Parallel Adder/ subtractor using IC 7483.	L3, L4, L5,L6
3. To realize a) BCD to Excess-3 code conversion and vice versa b) Binary to Gray code conversion and vice versa	L2,L3, L4
4. To realize a) 4:1 Multiplexer using gates b) 1:8 Demux c) Priority encoder and 3:8 Decoder using IC74138 d) One / Two bit comparator	L2, L3, L4
5. To realize the following flip-flops using NAND Gates (a) T type (b) JK Master slave (c) D type	L2, L3, L4
6. To realize the 3-bit counters as a sequential circuit and Mod-N Counter design (7476, 7490, 74192, 74193)	L2, L3, L4
7. Adder/Subtractor – Full/half using Verilog data flow description	L2, L3, L4
8. Code converters using Verilog Behavioral description a) Gray to binary and vice versa b) Binary to excess3 and vice versa	L2, L3, L4
9. Multiplexers/decoders/encoder using Verilog Behavioral description - 8:1 mux, 3:8 decoder, 8:3 encoder, Priority encoder - 1:8 Demux and verify using test bench - 2-bit Comparator using behavioral description	L2, L3, L4
10. Flip-flops using Verilog Behavioral description a) JK type b) SR type c) T type and d) D type	L2, L3, L4

11. Counter up/down (BCD and binary) , sequential counters using Verilog Behavioral description	L2,L3, L4
12. Interface experiments: (a) Stepper motor (b) Relay (c) Waveform generation using DAC	L2,L3, L4

Course Outcomes: After studying this course, students will able to:
- Realize Boolean expression using Universal gates / basic gates using ICs and Verilog
- Demonstrate the function of adder/subtractor circuits using gates/ICs & Verilog.
- Design and analyze the Comparator, Multiplexers Decoders, Encoders circuits using ICs and Verilog.
- Design and analysis of different Flip-flops and counters using gates and FFs
- Able to use FPGA/CPLD kits for down loading Verilog codes for shift registers and counters and check output.

Graduate Attributes (as per NBA)
- Engineering Knowledge.
- Problem Analysis.
- Design/Development of solutions

Conduct of Practical Examination:
1. All laboratory experiments are to be included for practical examination.
2. Students are allowed to pick one experiment from the lot.
3. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
4. Change of experiment is allowed only once and 17% Marks allotted to the procedure part to be made zero

Reference Books:
1. Digital Principles and Design – Donald D Givone,12th reprint, TMH,2008
2. HDL Programming VHDL and Verilog By Nazeih M. Botros, 2009 reprint, Dreamtech press.
3. Digital Logic Applications and Design by John M Yarbrough, Thomson Learning,2001
4. Fundamentals of HDL- Cyril P R Pearson/Sanguin 2010

IV SEMESTER

B.E. Electronics and Instrumentation Engineering (EI)				
Choice Based Credit System (CBCS)				
Semester - IV				
ENGINEERING MATHEMATICS-IV				
(Common to All Branches)				
Subject Code	: 17MAT41		CIE Marks	: 40
Number of Lecture Hours/Week	: 04		SEE Marks	: 60
Total Number of Lecture Hours	: 50		Exam Hours	: 03
Credits - 4				
Course Objectives: This course will enable the students to				
Revised Bloom's Taxonomy Levels: L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analyzing, L5 – Evaluating, and L6 - Creating				

Modules	**Teaching Hours**	**Revised Bloom's Taxonomy (RBT)Level**
Module -1	10 Hours	
Module -2	10 Hours	
Module -3	10 Hours	
Module -4	10 Hours	

Module -5	10 Hours	

Course Outcomes: After studying this course, students will able to:

Graduate Attributes (as per NBA)

Question Paper Pattern:
- The question paper will have TEN questions.
- Each full question carry16 marks
- There will be TWO full questions (with maximum of FOUR sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

Reference Books:

<table>
<tr><td colspan="5" align="center">**B.E. Electronics and Instrumentation Engineering (EI)**
Choice Based Credit System (CBCS)
Semester – IV</td></tr>
<tr><td colspan="5" align="center">**SIGNAL CONDITIONING AND DATA ACQUISITION CIRCUITS**
(Common to EI, BM & ML)</td></tr>
<tr><td>Subject Code</td><td>: 17 EI/BM/ML42</td><td></td><td>CIE Marks</td><td>: 40</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>: 04</td><td></td><td>SEE Marks</td><td>: 60</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>: 50</td><td></td><td>Exam Hours</td><td>: 03</td></tr>
<tr><td colspan="5" align="center">Credits – 4</td></tr>
</table>

Course Objectives: This course will enable the students to
- Define and describe Op Amp, basic concepts, characteristics and specifications
- Gain knowledge about Linear and nonlinear applications op-amp.
- Design and develop circuits like, amplifiers, filters, Timers to meet industrial requirements.
- Get a firm grasp of basic principles of op-amp.

Revised Bloom's Taxonomy Levels: L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analyzing, L5 – Evaluating, and L6 – Creating

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT)Level
Module -1 **Introduction to Operational Amplifiers:** Introduction, Block schematic of an Op-amp, Power supply connections, Characteristics of an Ideal OP-AMP, Inverting Amplifier, Non-inverting Amplifier, Voltage follower, Differential Amplifier, CMRR. (Relevant problems). **Operational Amplifier Characteristics**: DC characteristics – Input bias current, Input offset current, Input offset voltage, Total output offset voltage, Thermal drift. AC characteristics – Frequency response, Slew rate, PSRR. **Basic op-amp applications** – Scale changer/Inverter. Summing amplifier: Inverting summing amplifier, Non-inverting Summing amplifier, Subtractor, Instrumentation Amplifier. (Relevant problems).	10 Hours	L1,L2, L3,L4
Module -2 **Operational Amplifier Applications:** V – I and I – V converter, Op-amp circuit using diodes, sample and hold circuit, Differentiator and Integrator. **Comparator and waveforms generator:** Comparator, Regenerative comparator (Schmitt Trigger), Astable mutivibrator, Monostable multivibrator and Triangular waveform generator. Phase shift oscillator, Wien bridge oscillator. (Relevant problems).	10 Hours	L1,L2, L3,L4
Module -3 **Voltage Regulators:** Introduction, Series Op-amp regulator, IC voltage regulators, 723 general purpose regulators, switching regulator. **Active filters:** First and Second order LPF, First and Second orders HPF,	10 Hours	L1,L2, L3,L4

Band Pass Filters, Band Reject filters. (Design examples).		
Module -4 **555 Timer:** Description of Functional Diagram, Monostable operation, Applications of Monostable Multivibrator: Frequency Divider & Pulse Width Modulation. Astable operation, Applications of Astable Multivibrator: FSK Generator and Pulse Position Modulation. **Phase Locked Loops:** Basic Principles, Analog phase Detector/comparator, Voltage controlled oscillator. PLL applications: Frequency Multiplication/Division, Frequency translation, FM demodulation.	10 Hours	L2,L3,L4, L5, L6
Module -5 **Data Acquisition Systems:** Types of instrumentation systems, Components of analog data acquisition system, Digital data acquisition system, Use of recorders in digital systems, Digital recording systems. **Data Converters:** **Digital to Analog Converters:** Basic DAC techniques, Weighted Resistor DAC, R – 2R Ladder DAC, DAC 0800 (Data sheet: Features and description only). **Analog to Digital Converters:** Functional diagram of ADC, Flash ADC, Counter type ADC, Successive approximation ADC, Dual slope ADC. ADC 0809 (Data sheet: Features, specifications and description only), DAC/ADC specifications.	10 Hours	L2, L3,L4, L5, L6

Course Outcomes: After studying this course, students will able to:
1. Understand the basic principles and operation of op-amp.
2. Design and develop circuits to meet the practical applications
3. Implement and integrate the op-amp circuits in electronic gadgets.

Graduate Attributes (as per NBA)
- Engineering knowledge
- Problem analysis
- Design & development of solutions
- Investigation of Complex Problem

Question Paper Pattern:
- The question paper will have TEN questions.
- Each full question carry 16 marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. "Linear Integrated Circuits", D. Roy Choudhury and Shail B. Jain, 4th edition, Reprint 2010, New Age International. (Module -1,2,3,4 & 5)
2. "Op - Amps and Linear Integrated Circuits", Ramakant A. Gayakwad, 4th edition, PHI (Module-3)
3. "A course in Electrical & Electronic Measurements & Instrumentation", A K Sawhney, Dhanpat Rai Publications, 19th edition, 2011.(Module-5)

Reference Books:
1. "Operational Amplifiers and Linear Integrated Circuits", Robert. F. Coughlin & Fred. F. Driscoll, PHI/Pearson, 2006
2. "Op - Amps and Linear Integrated Circuits", James M. Fiore, Thomson Learning, 2001

3. "Design with Operational Amplifiers and Analog Integrated Circuits", Sergio Franco, TMH, 3e, 2005

B.E. Electronics and Instrumentation Engineering (EI)				
Choice Based Credit System (CBCS)				
Semester - IV				
EMBEDDED CONTROLLERS				
(Common to EI, BM & ML)				
Subject Code	: 17 EI/BM/ML 43		CIE Marks	: 40
Number of Lecture Hours/Week	: 04		SEE Marks	: 60
total number of lecture hours	: 50		exam hours	: 03
Credits - 4				

Course Objectives: This course enables students to understand:
- Basics of Microprocessor and Microcontroller
- 8051 Microcontroller architecture and Pin description
- 8051 Addressing modes and instruction set
- Programming of on-chip peripherals in 8051
- Design and develop applications using 8051 Assembly language and C program.
- MSP 430 Microcontroller architecture
- On-chip peripherals and program using Assembly language and C.

Revised Bloom's Taxonomy Levels: L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analyzing, L5 – Evaluating, and L6 - Creating

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT)Level
Module -1 **Microprocessor and Microcontrollers:** **Introduction: Microprocessor and Microcontroller**, Microprocessor survey, RISC and CISC, CPU Architecture, Harvard and Von-Neumann, CPU Architecture. 8051 Microcontroller Architecture. Pin functions organizations Input/ Output pins, ports and circuits. Internal and External memory Architecture. 8051 Reg. banks and stack, 8051 flag bits and PSW Register. Special function Registers. Timer /Counter, Serial data input/ output, Interrupts, program counter and ROM space in the 8051.	**10 Hours**	**L1,L2**
Module -2 **Addressing modes directives instruction set of 8051 Microcontroller.** Immediate and Register addressing modes. Accessing memory using various addressing modes. Bit addressing for I/o and RAM 8051 data types and directives. Jump Loop and CALL Instructions Arithmetic and Logic Instructions and programming I/o port programming. Assembly Language programs using various Instructions.	**10 Hours**	**L1,L2**
Module -3 **8051 programming in C and interfacing.** Data types and time delay in 8051 C, I/o programming, Logic operation, data conversion programs, accessing Code ROM Space, data serialization. **8051 interfacing** to LCD and key board, DAC, stepper motor, DC Motor, Parallel and serial ADC. Elevator.	**10 Hours**	**L2,L3,L4**

Module -4 **Timer/ Counter, Serial communication and Interrupts in 8051**. Programming 8051 timer/ counter, programming timer 0 and 1 in 8051 C, Basics of serial communication, 8051 connections to **RS-232.** 8051 serial port programming in assembly and C. 8051 Interrupts, Programming Timer Interrupts, External hardware Interrupts and serial communication Interrupts. Interrupts priority & Interrupt programming in C.	**10 Hours**	**L2,L3,L4,L5**
Module -5 **Introduction to Advanced Microcontrollers**. Salient Features of Advanced Microcontrollers. **MSP430F2013** Architecture and pin functions, Memory, Clock Generator, CPU Registers, Addressing modes, Instruction set and emulated Instruction set. Development Environment. Aspects of C for embedded system, Introduction to MSP 430 starter kit, parallel ports.	**10 Hours**	**L1,L2,L3**

Course Outcomes: After studying this course , Student will be able to:
- Learn architecture of 8051 and MSP 430.
- Learn programming skills using Assembly language and C
- Design and interfacing of microcontroller based embedded systems.
- Build projects

Graduate Attributes (as per NBA)
- Engineering Knowledge
- Problem Analysis
- Design and Development of solutions
- Modern Tool usage

Question Paper Pattern:
- The question paper will have TEN questions.
- Each full question carry 16 marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. "The 8051 Microcontroller and Embedded systems-using assembly and C", Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinaly,PHI,2006/pearson,2006
2. "MSP430 Microcontroller Basics" John H. Davis, Elsevier 2010.
3. "Embedded Systems Design using the TI MSP430 series", Cris Nagy, Newnes, Elsevier.

Reference Books:
1. "The 8051 Microcontroller architecture. Programming and applications", Kenneth J Alyala Thomson learning 2005.
2. "The 8051 Microcontroller: Hardware, Software and Applications" V. Udhayashankara and MallikarjunaSwamy ,TMH., 2009.

B.E. Electronics and Instrumentation Engineering (EI)				
Choice Based Credit System (CBCS)				
Semester - IV				
CONTROL SYSTEMS				
(Common to EI & BM)				
Subject Code	: 17 EI/BM 44		CIE Marks	: 40
Number of Lecture Hours/Week	: 04		SEE Marks	: 60
Total Number of Lecture Hours	: 50		Exam Hours	: 03
Credits - 4				

Course Objectives: This course will enable the students to
- Understand the basic concepts & mathematical modeling of systems
- Draw block diagram & reduction for a given system
- Obtain Transfer functions by reduction and Signal Flow graph techniques.
- Analyze the system response in time and frequency domain
- Understand and Design of control systems using state space analysis

Revised Bloom's Taxonomy Levels: L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analyzing, L5 – Evaluating, and L6 - Creating

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1 **Modeling of Systems and Block diagram**: Introduction to Control Systems, Types of Control Systems, with examples. Concept of mathematical modeling of physical systems- Mechanical, Translational (Mechanical accelerometer, systems excluded), and Rotational systems, Analogous systems based on force voltage analogy and force current analogy. Introduction to Block diagram algebra. Numerical problems on all topics.	10 Hours	L_1, L_2, L_3, L_4
Module -2 **Signal Flow graph**: Introduction to Signal Flow graph, Mason's gain formula. Obtaining Transfer functions for the given SFG using Mason's gain formula. **Time response analysis**: Introduction. Standard test signals, response of first order & second order systems for unit step input. Steady state errors & Error constants. Numerical problems on all topics.	10 Hours	L_1, L_2, L_3, L_4
Module -3 **Concepts of stability**: The Concept of stability. Necessary conditions for stability. Hurwitz stability criterion. Routh stability criterion. Relative stability analysis using RH Criterion. **The Root Locus Technique**: Introduction. Root locus concepts. Construction of root loci. Stability analysis using Root locus Technique Numerical problems on all topics.	10 Hours	L2, L3, L4, L5
Module -4 **Frequency domain Analysis**: Introduction to frequency domain analysis, Correlation between time & frequency response, Bode plots. Numerical	10 Hours	L2, L3, L4, L5

problems on all topics. **Polar Plot**: Introduction to Polar plot and Nyquist plots, Nyquist stability criterion. Stability analysis using Polar plot. Numerical problems on all topics.		
Module -5 **State space Analysis:** Concept of state, state variables and state model. State diagrams and State models for Linear continuous-time systems (Electrical systems): State space representation using Physical and Phase variables. Derivation of transfer functions from the state model. Numerical problems on all topics. **Solution of state equations**: Solutions of homogeneous and Non-homogeneous state equations. Properties of state transition matrix, computation of state transition matrix by matrix exponential and Laplace transform method. Numerical problems	10 Hours	L2, L3, L4, L5

Course Outcomes: After studying this course, students will able to:
- Apply modeling knowledge in implementation physical systems.
- Understand the reduction of block diagram & analyze using Signal flow graph.
- Comment on performance of a system by evaluating various parameters.
- Model a system by applying the concept of State Space analysis
- Design and develop portable control systems

Graduate Attributes (as per NBA)
- Engineering knowledge
- Problem analysis
- Design & Development of Solutions
- Investigation of Complex Problem

Question Paper Pattern:
- The question paper will have TEN questions.
- Each full question consists of 16 marks.
- There will be 2 full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:
1. "Control Systems Engineering", I.J. Nagarath and M. Gopal ,New Age International (P) Limited, Publishers, Fifth edition – 2012.
2. "Modern Control Engineering ", K. Ogata, Pearson Education Asia/ PHI, 4th Edition, 2002.

Reference Books:
1. "Automatic Control Systems", Benjamin C. Kuo, John Wiley India Pvt. Ltd., 8th Edition, 2008.
2. "Feedback and Control System", Joseph J Distefano III et al., Schaum's Outlines, TMH, 2nd Edition 2007.

B.E. Electronics and Instrumentation Engineering (EI)				
Choice Based Credit System (CBCS)				
Semester - IV				
PROCESS INSTRUMENTATION				
Subject Code	: 17EI45		CIE Marks	: 40
Number of Lecture Hours/Week	: 04		SEE Marks	: 60
Total Number of Lecture Hours	: 50		Exam Hours	: 03
Credits - 4				

Course Objectives:
- To discuss the principle, design and working of transducers/sensors for the measurement of temperature, flow, vibration, density, viscosity, humidity and moisture.
- To provide the basic knowledge in selection of appropriate transducers/sensors for the measurement of above parameters based on their specifications, advantages and limitations.

Revised Bloom's Taxonomy Levels: L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analyzing, L5 – Evaluating, and L6 - Creating

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT)Level
Module -1 **Measurement of Temperature**: Introduction, temperature scales, mechanical temperature sensors, resistance type temperature sensors, platinum resistance thermometer, thermistors (principle, types & characteristics), thermocouples, solid state sensors – principle and working, brief discussion on AD590, LM35. Quartz thermometer, Calibration of thermometers. **Radiation Methods of Temperature Measurement**: Introduction, Radiation detectors-Thermal & photon (principle & working in brief), Automatic Null balance Radiation thermometer, Disappearing filament optical pyrometer, Two-colour radiation thermometer, Blackbody-Tipped Fiber-Optic Radiation thermometer, Fluoroptic Temperature Measurement	10 Hours	L1, L2, L3, L4
Module -2 **Flow Measurement**: Introduction, Classification of Flow Meters, Head type flow meters, Rotameter, Electromagnetic Flow Meter, Mechanical Flow Meters, Anemometers, Ultrasonic flow meters – Doppler shift type (principle, working & derivation of Δf), Transit time ((principle, working & derivation of ΔT), Vortex flow meters, Thermal flow meter, Laser anemometer, Rotor torque mass flow meter.	10 Hours	L1, L2, L3, L4
Module -3 **Vibration Measurement:** Introduction, Characteristics of vibration, Vibration sensing devices, Signal conditioners for vibration sensors, Shock measurements, System characteristics, Vibration exciters& Calibration. **Measurement of Density:** Definition & units of density and specific	10 Hours	L1, L2, L3, L4

gravity, Liquid density measurement – Ball type, capacitance type, displacement type, hydrometers, oscillating coriolis, radiation type, sound velocity type. Gas density measurement – displacement type, electromagnetic suspension type.		
Module -4 **Viscosity Measurement:** Definition and units, selection of viscometer, viscometer applications. Laboratory Viscometers – Capillary, capillary extrusion, Saybolt viscometer, Falling ball, Rotational viscometer, Cone & plate viscometer. Industrial Viscometers - differential pressure continuous capillary viscometer, falling piston viscometer, single and two float viscometer, cone and plate plastometer, rotational viscometer, vibrating reed viscometer. **Turbidity**: Definition, transmission type turbidity meter, light scattering turbidity meter.	10 Hours	L1, L2, L3, L4
Module -5 **Humidity Measurement:** Definition and terminologies, dry and wet bulb psychrometers (Sling psychrometer), hair hygrometers, thin film capacitance humidity sensor, dew-point hygrometers, electrolytic hygrometers. **Moisture Measurement:** Definition and terminologies. Measurement of moisture in gases and liquids – Electrolytic hygrometer, capacitance hygrometer, impendence hygrometer, piezoelectric hygrometer, infrared absorption hygrometer. Measurement of moisture in solids – Nuclear moisture gauge, infrared absorption moisture gauge, capacitance moisture gauge, conductance moisture gauge.	10 Hours	L1, L2, L3, L4

Course Outcomes: After studying this course, students will able to:
- Explain the principle, construction/design and analyze the transducers/sensors for the measurement of temperature, flow, vibration, density, viscosity, humidity and moisture.
- Select the appropriate transducers/sensors based on the needs of the process.
- Install and analyze the transducers/sensors for the measurement of above parameters.

Graduate Attributes (as per NBA)
- Engineering knowledge
- Problem analysis
- Design & Development of Solutions
- Engineer and society
- Environment & sustainability
- Lifelong learning

Question Paper Pattern:
- The question paper will have TEN questions.
- Each full question consists of 16 marks.
- There will be 2 full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer 5 full questions, selecting one full question fromeachmodule.

Text Books:
1. Instrumentation: Devices and Systems- C. S. Rangan, G. R. Sarma, V. S. V. Mani, 2nd Edition (32nd Reprint), McGraw Hill Education (India), 2014. [Module1- Measurement of temperature,

Module 2, Module3- Measurement of vibration].
2. Measurement Systems Application and Design- Ernest O.Doeblin and Dhanesh N Manik, 5th Edition, McGraw Hill, 2007 [Module1- Radiation Methods of Temperature Measurement].
3. Process Measurement Instrument Engineers Handbook- Bela G.Liptak, Revised Edition, Chilton Book Company, 1982. [Module 3 – Measurement of Density, Module 4]
4. Industrial Instrumentation – K. Krishnaswamy and S. Vijayachitra, New Age International Pub., 2005. [Module 5]

Reference Books:
1. Transducers and Instrumentation – D.V.S.Murty, 2nd Edition, PHI, 2009.
2. Introduction to Measurements and Instrumentation-A. K. Ghosh, 2nd Edition, PHI, 2007
3. Instrumentation Measurement and Analysis- B.C.Nakra and K.K.Choudhry, 3rd Edition, McGraw Hill Education (India) Pvt.Ltd. 2009.

B.E. Electronics and Instrumentation Engineering (EI)			
Choice Based Credit System (CBCS)			
Semester – IV (Elective-II)			
SCIENTIFIC AND ANALYTICAL INSTRUMENTATION			
(Common to EI, BM & ML)			
Subject Code	: 17 EI/BM/ML 46	CIE Marks	: 40
Number of Lecture Hours/ Week	: 03	SEE Marks	: 60
Total Number of Lecture Hours	: 40	Exam Hours	: 03
Credits - 3			

Course Objectives:
- To introduce the basic concept of qualitative and quantitative analysis of a given sample.
- To impart various spectroscopic techniques and its instrumentation.
- To impart the concept of separation science and its application.
- To impart methods of Industrial analyzers and its application.

Revised Bloom's Taxonomy Levels: L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analyzing, L5 – Evaluating, and L6 - Creating

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT)Level
Module -1 **An introduction to instrumental methods:** Terms associated with Chemical analysis, Classification of instrumental techniques, A review of important consideration in analytical methods, Basic functions of instrumentation, Nature of EM radiation, EM spectrum. Atomic energy levels, Molecular electronic energy levels, vibrational energy levels, Fundamental Levels of photometry, IR Spectroscopy: Basic Components of IR Spectrophotometers, Fourier Transform IR Spectroscopy	**08 Hours**	**L1, L2**
Module -2 **UV and visible Spectrometers** –instrumentation : Radiation Sources, Wavelength selection, Detector, Readout modules, Instruments for absorption photometry	**08 Hours**	**L1, L2**
Module -3 **Flame emission and atomic absorption spectroscopy**: Introduction, Instrumentation for flame spectrometric methods, Flame emission spectrometry, atomic absorption spectrometry, Atomic fluorescence spectrometry, Interferences associated with Flames & furnaces, applications, comparison of FES and AAS	**08 Hours**	**L1, L2**
Module -4 **Gas Chromatography:** Chromatograph, Basics parts of a chromatograph, Methods of measurements of peak areas, HPLC : HPLC Instrumentation, Mobile –phase delivery system sample introduction, separation of columns, Detectors – Ultraviolet Photometers & Spectrophotometers, electro chemicals	**08 Hours**	**L1, L2, L3**

detector (amperometric detector), Differential refractometers		
Module -5 **Blood analyzer:** Introduction, Blood pH measurements, measurement of blood P_{co_2}, P_{o_2} , A Complete blood gas analyzer. Air pollution monitoring instruments Carbon monoxide, Sulphur dioxide, Nitrogen oxides, Hydrocarbons Ozone, automated wet chemical air analysis, water pollution monitoring instruments.	**08 Hours**	**L1, L2, L3, L4**

Course Outcomes:
   1. The students get well versed with the principle, construction and working of various analytical instrumentation.
   2. Students get detailed information about the application of analytical techniques in medicine, Industry, etc.

Graduate Attributes (as per NBA)
   • Engineering Knowledge
   • Problem Analysis
   • Life-long Learning

Question Paper Pattern: • The question paper will have TEN questions. • Each full question carry16 marks • There will be TWO full questions (with maximum of THREE sub questions) from each module. • Each full question will have sub questions covering all the topics under a module. • The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
   1. Instrumental Methods of Analysis, 7th edition. H.H. Willard, L.L. Merritt, J.A. Dean, F.A. Settle, CBS Publishing & Distribution (Module 1, Module 2, Module 3, Module 4 HPLC)
   2. Handbook of Instruments – R.S. Khandpur, Tata McGraw Hill (Module 1-IR Spectroscopy, Module 4, Module 5)

Reference Books:
   1. Braun R.D., Introduction to Instrumental Analysis, Mc Graw –Hill Singapore, 2006.
   2. Frank G. Kerry Industrial Gas Handbook: Gas Separation and Purification, Taylor and francis group, 2007.
   3. Principles of Instrumental Analysis 5th Edition – Douglas A. Skoog, F. James Holler, Timothy A. Niemen, Thomason Brooks/ Cole

B.E. Electronics and Instrumentation Engineering (EI)				
Choice Based Credit System (CBCS)				
Semester - IV				
EMBEDDED CONTROLLERS LAB				
(Common to EI, BM & ML)				
Subject Code	: 17 EI/BM/ML L47		CIE Marks	: 40
Number of Practical Hours/Week	: 03		SEE Marks	: 60
Total Number of Practical Hours	: 42		Exam Hours	: 03
Credits - 2				

Course Objectives:
This laboratory course enables students to :
- Write 8051 Assembly language and C programs for 8051 and MSP430.
- Interface hardware modules to Microcontroller board.
- Develop applications based on Microcontroller 8051 and MSP430.

Revised Bloom's Taxonomy Levels:L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analyzing, L5 – Evaluating, and L6 - Creating

Laboratory Experiments Note: Software and Hardware program using KEIL software and MSP 430 IDE.	Revised Bloom's Taxonomy (RBT)Level
Software program using 8051 µc Simple Assembly Language; 1. Program using 8051 in Block, Move, Exchange. 2. Program in sorting, finding largest and smallest element in an array. 3. Counters ---> For Hex and BCD up/ down count. 4. Boolean and Logical Instructions. (Bit Manipulation). 5. Subroutines using CALL and RETURN instructions. 6. Code Conversions ---> ASCII to Decimal, Decimal to ASCII, BCD to ASCII 7. Programs to generate delay, programs using serial port and on chip timer/ counter.	**L2, L3, L4**
Software program using MSP 430 IDE 8. Assembly program using MSP 430 for data transfer, Block Move in an array.	**L2, L3, L4**
Hardware programming (using 8051) 9. Stepper motor Interface to 8051 Microcontroller with C Program. 10. DC Motor Interface to 8051 Microcontroller with C Program 11. DAC Interface for to generate sine wave, square wave, triangular wave, Ramp wave through 8051Microcontroller with C Program. 12. Keyboard Interfacing. 13. **ADC Interfacing**	**L3, L4, L5**

Course Outcomes: After the completion of this Laboratory course, students will be able to:
- Get hands-on exposure in 8051 and MSB 430 platform.
- Enhance programming skills using Assembly language and C.
- Design and interfacing of microcontroller based embedded systems.

• Build projects

Graduate Attributes (as per NBA)
• Engineering Knowledge
• Problem Analysis
• Design and Development of solutions
• Modern Tool usage
• Individual and Team work
Conduct of Practical Examination:
1. All laboratory experiments are to be included for practical examination.
2. Students are allowed to pick one experiment from the lot.
3. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
4. Change of experiment is allowed only once and 17% Marks allotted to the procedure part to be made zero.
Reference Books:
1. "The 8051 Microcontroller and Embedded systems-using assembly and C", Muhammad AliMazidi and Janice Gillespie Mazidi and Rollin D. McKinaly,PHI,2006/pearson,2006
2. "MSP430 Microcontroller Basics" John H. Davis, Elsevier 2010.
3. "Embedded Systems Design using the TI MSP430 series", Cris Nagy, Newnes, Elsevier.
4. "The 8051 Microcontroller architecture. Programming and applications", Kenneth J Alyala Thomson learning 2005.

B.E. Electronics and Instrumentation Engineering (EI)				
Choice Based Credit System (CBCS)				
Semester - IV				
INSTRUMENTATION AND MEASUREMENT LAB				
Subject Code	: 17EIL48		CIE Marks	: 40
Number of practical Hours/Week	: 03		SEE Marks	: 60
Total Number of practical Hours	:42		Exam Hours	: 03
Credits - 2				

Course Objectives: This Lab course will enable the students to
- Impart the working principle of sensors and transducer
- Testing the response and plot the characteristics of different transducers
- Interpret and analyze experimental results with theoretical concepts.
- Calibrate the sensors/transducers
- Design the signal conditioning circuits and to make the transducer output compatible to interface with other devices
- Study and interpret data sheets of different transducers to select the suitable transducer for particular application and safe operation.

Revised Bloom's Taxonomy Levels: L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analyzing, L5 – Evaluating, and L6 - Creating

LIST OF EXPERIMENTS	Revised Bloom's Taxonomy (RBT) Level
1. Displacement measurement using LVDT	L1, L2, L3, L4
2. Temperature measurement using RTD, Thermistor and Thermocouple, and finding their sensitivity.	L1, L2, L3, L4
3. Temperature measurement using AD590 / LM34.	L1, L2, L3, L4
4. Characteristics of LDR, Photodiode & Phototransistor by variable illumination & variable distance.	L1, L2, L3, L4
5. Measurement of unknown resistance by Wheatstone bridge & finding the sensitivity of the bridge.	L1, L2, L3, L4
6. Measurement of low resistance using Kelvin double bridge.	L1, L2, L3, L4
7. Measurement of self-inductance using Maxwell's bridge.	L1, L2, L3, L4
8. Measurement of inductance and internal resistance of a choke by three voltmeter method.	L1, L2, L3, L4
9. Measurement of unknown capacitance using Schering's bridge.	L1, L2, L3, L4
10. Characteristics of pressure transducer.	L1, L2, L3, L4
11. Characteristics of Load cell and Cantilever beam using Strain gauge (Quarter, Half and Full bridge)	L1, L2, L3, L4
12. Characteristics of potentiometric transducer	L1, L2, L3, L4

Course Outcomes: After studying this course, students will able to:
- Analyze the response and plot the characteristics of temperature measurement transducers such as RTD, Thermistor, and Thermocouple & AD590.
- Analyze the response and plot the characteristics of displacement measuring transducers such

as LVDT and Potentiometric transducer.
- Analyze the response and plot the characteristics of strain gauge type load cell.
- Analyze the response and plot the characteristics of pressure transducer.
- Measure unknown values of resistance, capacitance and Inductance using different bridges.
- Design , build and test the circuits for practical applications

Graduate Attributes (as per NBA)
- Engineering Knowledge.
- Problem Analysis.
- Design / development of solutions (partly)
- Interpretation of data

Conduct of Practical Examination:
1. All laboratory experiments are to be included for practical examination.
2. Students are allowed to pick one experiment from the lot.
3. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
4. Change of experiment is allowed only once and 17% Marks allotted to the procedure part to be made zero.

Reference Books:
1. Measurement systems application and design by E.O. Doebline 4th Edition, TMH.
2. Instrumentation for Process Measurement by Norman. A. Anderson, 3rd Edition, CRC
3. Principle of Measurement System by John. P. Bentley, 3rd Edition, Pearson, 2007
4. Process Measurement by Bela G. Liptak

5th Semester

B.E. Electronics and Instrumentation Engineering (EI)	
Choice Based Credit System (CBCS)	
Semester - V	

Management and Entrepreneurship Development
(Common to EC/TC/EI/BM/ML)

Subject Code	: **17ES51**		CIE Marks	: 40
Number of Lecture Hours /Week	: 04		SEE Marks	: 60
Total Number of Lecture Hours	: 50		Exam Hours	: 03
Credits – 4 (Each module – 10 Hours)				

Module -1

Management: Nature and Functions of Management – Importance, Definition, Management Functions, Levels of Management, Roles of Manager, Managerial Skills, Management & Administration, Management as a Science, Art & Profession (Selected topics of Chapter 1, Text 1).
Planning: Planning-Nature, Importance, Types, Steps and Limitations of Planning; Decision Making – Meaning, Types and Steps in Decision Making.
(Selected topics from Chapters 4 & 5, Text 1).

Module -2

Organizing and Staffing: Organization-Meaning, Characteristics, Process of Organizing, Principles of Organizing, Span of Management (meaning and importance only), Departmentalisation, Committees– Meaning, Types of Committees; Centralization Vs Decentralization of Authority and Responsibility; **Staffing**-Need and Importance**,** Recruitment and Selection Process
(Selected topics from Chapters 7, 8 & 11, Text 1).
Directing and Controlling: Meaning and Requirements of Effective Direction, Giving Orders; Motivation-Nature of Motivation, Motivation Theories (Maslow's Need-Hierarchy Theory and Herzberg's Two Factor Theory); Communication – Meaning, Importance and Purposes of Communication; Leadership-Meaning, Characteristics, Behavioural Approach of Leadership; Coordination-Meaning, Types, Techniques of Coordination; Controlling – Meaning, Need for Control System, Benefits of Control, Essentials of Effective Control System, Steps in Control Process
(Selected topics from Chapters 17 to 18 and 9, Text 1).

Module -3

Social Responsibilities of Business: Meaning of Social Responsibility, Social Responsibilities of Business towards Different Groups, Social Audit, Business Ethics and Corporate Governance (Selected topics from Chapter 3, Text 1).
Entrepreneurship: Definition of Entrepreneur, Importance of Entrepreneurship, concepts of Entrepreneurship, Characteristics of successful Entrepreneur, Classification of Entrepreneurs, Myths of Entrepreneurship, Entrepreneurial Development models, Entrepreneurial development cycle, Problems faced by Entrepreneurs and capacity building for Entrepreneurship
(Selected topics from Chapter 2, Text 2).

Module -4
Modern Small Business Enterprises: Role of Small Scale Industries, Impact of Globalization and WTO on SSIs, Concepts and definitions of SSI Enterprises, Government policy and development of the Small Scale sector in India, Growth and Performance of Small Scale Industries in India, Sickness in SSI sector, Problems for Small Scale Industries, Ancillary Industry and Tiny Industry (Definition only)(Selected topics from Chapter1, Text 2).
Institutional Support for Business Enterprises: Introduction, Policies & Schemes of Central Level Institutions, State Level Institutions.**(Selected topics from Chapter 4, Text 2).**

Module -5
Projects Management: AProject. Search for a Business idea**:** Introduction, Choosing an Idea, Selection of product, The Adoption process, Product Innovation, Product Planning and Development Strategy, Product Planning and Development Process. Concepts of Projects and Classification**:** Introduction, Meaning of Projects, Characteristics of a Project, Project Levels, Project Classification, Aspects of a Project, The project Cycle, Features and Phases of Project management, Project Management Processes. Project Identification**:** Feasibility Report, Project Feasibility Analysis. Project Formulation**:** Meaning, Steps in Project formulation, Sequential Stages of Project Formulation, Project Evaluation.
Project Design and Network Analysis: Introduction, Importance of Network Analysis, Origin of PERT and CPM, Network, Network Techniques, Need for Network Techniques, Steps in PERT, CPM, Advantages, Limitations and Differences.
(Selected topics from Chapters 16 to 20 of Unit 3, Text 3).

Course Outcomes: After studying this course, students will be able to:
1. Learn and explain basics of management and acquire basic managerial skills.
2. Analyze the nature, purpose & objectives of Planning, Organizing & Staffing.
3. Develop the factual leadership qualities for development of organizations
4. Learn and build the qualities and characteristics of business ethics and entrepreneurs.
5. Describe the importance of small scale industries in economic development and institutional support to start a small scale industry and implement.
6. Demonstrate the project management, product planning, project design and network analysis.

Question paper pattern
- The question paper will have TEN questions
- Each full question carries 16 marks
- There will be two full questions (with a maximum of THREE sub questions) from each module
- Each full question will have sub questions covering all topics under a module.
- The students will have to answer 5 full questions, selecting one full question from each module.

Text Books:
1. Principles of Management – P.C.Tripathi, P.N Reddy, McGraw Hill Education, 6th Edition, 2017. ISBN-13:978-93-5260-535-4.
2. Entrepreneurship Development Small Business Enterprises- Poornima M Charantimath, Pearson Education 2008, ISBN 978-81-7758-260-4.
3. Dynamics of Entrepreneurial Development and Management by Vasant Desai. HPH 2007, ISBN: 978-81-8488-801-2.

Reference Book:
1. Essentials of Management: An International, Innovation and Leadership perspective by Harold Koontz, Heinz Weihrich McGraw Hill Education, 10th Edition 2016. ISBN- 978-93-392-2286-4.

B.E. Electronics and Instrumentation Engineering (EI)			
Choice Based Credit System (CBCS)			
Semester - V			
Fundamentals of Signals and DSP			
(Common to EI & BM)			
Subject Code	: 17EI/BM52	CIE Marks	: 40
Number of Lecture Hours /Week	: 04	SEE Marks	: 60
Total Number of Lecture Hours	: 50	Exam Hours	: 03
Credits – 4 (Each module – 10 Hours)			

Module -1
Introduction to Signals and Systems:
Basic elements of a DSP System, Classification of Signals, Sampling Theorem (statement and problems on Nyquist rate), Discrete Time Signals (Representation, Standard Signals, Classification, and Operations), Discrete Time Systems, Convolution Sum, Cross correlation and Auto correlation of sequences.
Text 1: 1.1.1, 1.2, 1.4.2, 2.1, 2.2, 2.3.3, 2.3.7, 2.6.1.

Module -2
Z- Transform and its Application to analysis of LTI Systems:
Direct Z-Transform, Properties of the Z-Transform, Examples, Inverse Z- Transform by Partial- Fraction Expansion method only, System Function of a LTI System, Causality and Stability (from H (z)).
Realization of Digital System: Direct Form I, Direct form II, cascade form and parallel form
Text 1: 3.1.1, 3.2, 3.4.3, 3.3.3, 3.5.3.
Text 2: 9.2,9.3

Module -3
DFT: Properties and Applications:
Definition and Problems on DFT & IDFT, DFT Properties – Periodicity, Linearity, Time Reversal, Circular Time Shift, Circular Frequency Shift, Circular Convolution, Multiplication of two DFTs & Circular Convolution, Parseval's Theorem, DFT in linear filtering. Introduction to FFT, 8-point DFT Computation using Radix-2 DIT-FFT & DIF-FFT methods only, relevant examples.
Text 1: 7.1.3, 7.2, 7.3.1, 8.1.3.

Module -4
IIR& FIR Filters:
IIR Filters: Low-pass filter specifications, IIR filter Design by Impulse Invariance & Bilinear Techniques, Design of Digital IIR filter by Butterworth approach, Examples. Magnitude response of lowpassChebyshev Type I, II filter (Theoretical concept only)
FIR Filters: Design of FIR filters – Symmetric and Antisymmetric FIR filters, Design of Linear phase FIR filters by Rectangular Hamming &Hanning windows. Summary of window function characteristics (window shape, transition bandwidth, stop band attenuation, etc.). Implementation of FIR filters by direct form and Single-stage lattice structure only.
Text 1: 10.3.2, 10.3.3, 10.3.4, 9.3.1, 9.3.3, 9.3.4, 10.2.1,10.2.2, 10.2.7, 9.2.1, 9.2.4

Module -5
Multirate Digital Signal Processing & Adaptive Filters:
Introduction, Decimation Process, Interpolation Process, Digital Filter Bank, Adaptive Filters, LMS

adaptive algorithm, Applications, Features & Architectural of TMS320C54XX processor.
Text 2: 17.1, 17.2, 17.3, 17.4, 16.2, 16.3, 16.5, 19.2, 19.3.

Course Outcomes: After studying this course, students will able to:
1. Visualize, Classify and perform computation on discrete time signals, systems and properties
2. Perform the transformation techniques from time domain to other and vice versa, and analyze the system and properties (Z-Transform, DFT etc.)
3. Realize / implement the Direct/ cascade/ parallel/ lattice forms of the given digital system (IIR/ FIR)
4. ComputeDFT by FFT algorithms
5. Develop transformation from analog system to digital systemand design and implementIIR and FIR filters
6. Demonstrate the advanced concepts of signal processing (Multirate and Adaptive filtering) and architecture of DSP processor

Question Paper Pattern:
- The question paper will have TEN questions.
- Each full question carry 16 marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. Dimitris G Manolakis, John G. Proakis, "Digital Signal Processing: Principles, Algorithms, and Applications", 4th Edition, Pearson India, 2007.
2. V.Udayashankara, "Modern Digital Signal Processing", Third Edition, PHI 2016

Reference Books:
1. Simon Haykin and Barry Van Veen "Signals and Systems", John Wiley & Sons, 2nd edition
2. S K Mitra, "Digital Signal Processing", 4th Edition, McGraw-Hill, Year
3. Avtar Singh, "Digital Signal Processing Implementation", Brooks Cole

B.E. Electronics and Instrumentation Engineering (EI) Choice Based Credit System (CBCS) Semester - V			
Process Control Systems			
Subject Code	: 17EI53	CIE Marks	: 40
Number of Lecture Hours/Week	: 04	SEE Marks	: 60
Total Number of Lecture Hours	: 50	Exam Hours	: 03
Credits – 4 (Each module – 10 Hours)			

Module -1

Introduction to Process Control and Final Control Operations:
Introduction, Process control principles, Process control block diagram, Control system evaluation, Analog and Digital Processing, Analog data representation.
Final Control: Introduction, Final control operation, Signal conversions, Actuators, Control elements. (Numerical problems on all topics)

Module -2

Controller Principles: Introduction, Process characteristics, Control system parameters, Discontinuous controller modes: Two position, multiposition, floating control modes. Continuous controller modes: Proportional (P), Integral (I), Derivative (D) control modes, Composite controller modes: PI, PD, PID modes. (Problems on all types of controller modes)**.**

Module -3

Analog Controllers: Introduction, General features, Electronic controllers**,** Error detector, Single mode, Composite controller modes, Pneumatic controllers, Design considerations. (Numerical problems on all topics).

Digital Controllers: Digital electronic methods, Simple alarms, Two position control, Multivariable alarms, Data logging, Supervisory computer control (SDC) and Direct digital control. Sampled data systems, Input data operations. Controller Modes Software-Error, P, I, D, &PID control mode software.

Module -4

Control-Loop Characteristics: Introduction, Control system configurations: single variable and cascade control, Multivariable control system. Control system quality: Definition and measure of quality. Stability: Transfer function and frequency dependence, stability criteria. Process loop tuning: Open-loop transient response method, Ziegler-Nichols method, Frequency response methods. (Numerical problems on all topics).
Basic Instrumentation symbols, Process instrumentation & drawing (P&ID) symbols.

Module - 5

Modeling and Simulation for Plant Automation: Introduction, definition of terms, Need of system modeling, Uses of system simulation, how to build the mathematical model of a plant, Model evaluation and improvement, modern tools for modeling and simulation of systems, application examples, future perspectives.
Multivariable & Intelligent Controllers:
Ratio control, Feed-forward control. Adaptive controller, Optimal control, Predictive control, Artificial intelligent based systems, Expert controller.

 Course Outcomes: After studying this course, students will able to:

1. Discuss the principles of process control, evaluation, data representation andthe elements of final control operation.
2. Analyze the principle and working of continuous and discontinuous controller modes.
3. Design analog controllers based on op-amps and pneumatic systems.
4. Discuss the principle and working digital controllers and implementation of controller mode software, concepts and applications of modelling and simulation of process plant
5. Analyze control loop characteristics, control system quality and process loop tuning, and sketch the basic process instrumentation symbols.
6. Describe the fundamental concepts of multivariable and intelligent controllers.

Question Paper Pattern:
- The question paper will have TEN questions.
- Each full question carry16 marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. Process Control Instrumentation Technology by C. D. Johnson, 7th Edition, Pearson Education Private Limited, New Delhi 2002. (Modules 1, 2 3 & 4).
2. Computer Based Industrial Control by Krishna Kant, PHI, New Delhi 1997. (Module 5)

Reference Books:
1. Chemical Process Control – George Stephanopoulos, 4th Indian reprint, PHI Ltd., 1997.
2. Process/ Industrial Instruments and Control Handbook by D.M. Considine, 4th Edition, McGraw Hill International Edition, 1993.
3. Process dynamics and control by S.S.Bhagade and G.D.Nageshwar PHI publications New Delhi, 2011.
4. Lessons in Industrial Instrumentation by Tony R. Kuphaldt, Creative Commons Attribution License (open source textbook), Sept. 2008. (for basic instrumentation symbols, 6.5.1, 6.5.2, 6.5.3, 6.5.4, 6.5.9).
5. Instrument Engineers Handbook-Process Control Volume2 by Bela G. Liptak, Chilton Book Company/ Radnor, 3rd Edition, Pennsylyania, 1969.

B.E. Electronics and Instrumentation Engineering (EI)				
Choice Based Credit System (CBCS)				
Semester - V				
Biomedical Instrumentation				
Subject Code	: 17EI54		CIE Marks	: 40
Number of Lecture Hours/ Week	: 04		SEE Marks	: 60
Total Number of Lecture Hours	: 50		Exam Hours	: 03
Credits – 4 (Each module – 10 Hours)				

Module -1

Fundamentals of Biomedical Instrumentation: Sources of biomedical signals, Basic Medical Instrumentation system, Performance requirements of medical instrumentation systems. PC based medical instruments, General constraints in design of biomedical instrumentation systems.

Bioelectric Signals and Electrodes : Origin of Bioelectric signals, Types of bioelectric signals-ECG, EEG, EMG, Recording electrodes: Electrode – Tissue interface, polarization, skin contact- impedance, Silver-silver chloride
electrodes, Electrodes for ECG, EEG, EMG, Microelectrodes.

Module -2

Electrocardiograph: Physiology of the heart, Electrical activity of the heart and Electrocardiogram (ECG), Normal & Abnormal cardiac Rhythms, Block diagram-description of an Electrocardiograph, ECG leads, Effects of artifacts on ECG Recordings, Multi- channel ECG machine.

Electroencephalograph: Block diagram description of an Electroencephalograph, 10-20 electrode systems, computerized analysis of EEG.

Electromyograph, Biofeedback instrumentation.

Module -3

Patient Monitoring System: Bedside patient monitoring systems, Central monitors, Measurement of heart rate – Average heart rate meter, Instantaneous heart rate meter, Measurement of pulse rate, Definition of oximeter & Pulse oximeter.

Blood Pressure Measurement: Introduction, Indirect methods of blood pressure measurement: Korotkoff's method, Rheographic method, differential auscultatory technique, Oscillometric technique.

Measurement of Respiration Rate: Impedance pneumography, CO_2 method of respiration rate measurement, Apnoea detectors.

Module -4

Blood Flow Measurement: Electromagnetic blood flow meter- Principle and Square wave electromagnetic flowmeter. Doppler shift blood flow velocity meter, Blood flow measurement by Doppler imaging.

Cardiac Output Measurement: Measurement of continuous cardiac output derived from the aortic pressure waveform, ultrasound method.

Cardiac Pacemakers and Defibrillators: Need for cardiac pacemaker, External pacemaker, Implantable pacemaker, Types of Implantable pacemakers, Programmable pacemakers, Power sources for Implantable pacemaker.

Cardiac Defibrillator: Need for a Defibrillator, DC defibrillator, Pacer-Cardioverter-Defibrillator.

Module -5
Therapeutic Instruments:

Cardiac-assist devices, Pump oxygenators, Total artificial heart, Hemodialysis, Lithotripsy, Ventilators, Infant incubators, Drug infusion pumps, Ambulatory and Implantable Infusion systems, Anesthesia Machines, Electrosurgical unit.

Patient Safety: Electric shock hazards, Leakage currents, Electrical safety analyzer, Testing of Biomedical equipment

Course Outcome: After studying this course, students will able to:
1. Acquire knowledgebout origin of bio-potential, bio-signals and their measurement
2. Describe the problem, identify and formulate solution in the field of Bio-Medical Engineering for current and future issues
3. Describe the cardiac, brain and muscular physiological systems with the related diagnostic measurement methods.
4. Recognize the therapeutic methods of treatment and the associated instrumentation.
5. Identify and judge patient safety issues related to biomedical instrumentation.
6. Describe the principle and working of cardiac pacemakers, defibrillators, BP measurement, blood flow meters, CO measurement, respiration measurements and their implementation.

Question Paper Pattern:
- The question paper will have TEN questions
- Each full question carry16 marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. Handbook of Biomedical Instrumentation - R.S.Khandpur, 2nd Edition, Tata McGraw- Hill, 2003 (Module 1, 2, 3, 4 & Module 5- Patient Safety)
2. Medical Instrumentation: Application and Design – John G Webster, 3rd Edition, John Wiley & Sons, 2006. (Module 5- Therapeutic Instruments)

Reference Book:
1. Biomedical Instrumentation & Measurement - Leslie Cromwell, Fred J Weibell& Erich A Pfeiffer, 2nd Edition, Prentice Hall of India, 2001.

B.E. Electronics and Instrumentation Engineering (EI) **Choice Based Credit System (CBCS)** **Semester - V**			
VLSI Design **(Common to EI, BM & ML)**			
Subject Code	: 17EI/BM/ML551	CIE Marks	: 40
Number of Lecture Hours/Week	: 03	SEE Marks	: 60
Total Number of Lecture Hours	: 40	Exam Hours	: 03
Credits – 3 (Each module – 8 Hours)			

Module -1

Moore's law, speed power performance, nMOS fabrication, CMOS fabrication: n-well, p-well processes, BiCMOS, Comparison of bipolar and CMOS.
Basic Electrical Properties of MOS And BiCMOS Circuits: Drain to source current versus voltage characteristics, threshold voltage, transconductance.

Module -2

Basic Electrical Properties of MOS And BiCMOS Circuits: nMOS inverter, Determination of pull up to pull down ratio, nMOS inverter driven through one or more pass transistors, alternative forms of pull up, CMOS inverter, BiCMOS inverters, latch up.
Basic Circuit Concepts: Sheet resistance, area capacitance calculation, Delay unit, inverter delay, estimation of CMOS inverter delay, driving of large capacitance loads, super buffers, BiCMOS drivers.

Module -3

MOS and BiCMOS Circuit Design Processes: MOS layers, stick diagrams, nMOS design style, CMOS design style, design rules and layout, λ - based design.
Scaling of MOS Circuits: scaling factors for device parameters, limitations of scaling.

Module -4

Subsystem Design and Layout-1 : Switch logic pass transistor, Gate logic inverter, NAND gates, NOR gates, pseudo nMOS, Dynamic CMOS, example of structured design, Parity generator, Bus arbitration, multiplexers, logic function block, code converter.
Subsystem Design and Layout-2 : Clocked sequential circuits, dynamic shift registers, bus lines, subsystem design processes, General considerations, 4-bit arithmetic processes, 4-bit shifter.

Module -5

Design Process-Computational Elements: Regularity, design of ALU subsystem, ALU using adders, carry look ahead adders, Multipliers, serial parallel multipliers, Braun array, Bough – Wooley multiplier.
Memory, Register and Aspects of Timing: Three Transistor Dynamic RAM cell, Dynamic memory cell, Pseudo- Static RAM, JK Flip-flop, D Flip-flop circuits, RAM arrays, practical aspects and testability: Some thoughts of performance, optimization and CAD tools for design and simulation.

Course Outcomes: After studying this course, students will able to;
1. Identify the CMOS layout levels, and the design layers used in the process sequence.
2. Describe the general steps required for processing of CMOS integrated circuits.
3. Design static CMOS combinational and sequential logic at the transistor level.

4. Demonstrate different logic styles such as complementary CMOS logic, pass-transistorLogic, dynamic logic, etc.
5. Interpret the need for testability and testing methods in VLSI.

Question Paper Pattern:
- The question paper will have TEN questions.
- Each full question carry16marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. Basic VLSI Design -3rd Edition Douglas A Pucknell, Kamaran Eshraghian, Prentice Hall of India publication, 2005.

Reference Books:
1. CMOS Digital Integrated Circuits, Analysis And Design, 3rd Edition, Sung – Mo (Steve) Kang, Yusuf Leblbici, Tata McGraw Hill, 2002.
2. VLSI Technology - S.M. Sze, 2nd edition Tata McGraw Hill, 2003.

B.E. Electronics and Instrumentation Engineering (EI) Choice Based Credit System (CBCS) Semester - V			
Aeronautical Instrumentation			
Subject Code	: 17EI552	CIE Marks	: 40
Number of Lecture Hours/Week	: 03	SEE Marks	: 60
Total Number of Lecture Hours	: 40	Exam Hours	: 03
Credits – 3 (Each module – 8 Hours)			

Module -1
Aircraft Instruments: Introduction-Qualitative and quantitative displays, basic T grouping of instruments, basics of Altitude Director Indicator (ADI) &Horizontal Situation Indicator.
Air Data Instruments: Pneumatic type and air data computers, International Standard Atmosphere (ISA), combined pitot-static probe, separate static probe, air speed indicator, instantaneous vertical speed indicator.

Module -2
Altimeters, **Air Data Warning System:** Mach warning system, altitude alerts system, airspeed warning system.

Module -3
Directional Systems: Earth's total magnetic field, horizontal and vertical components of total field direct reading compass and its limitations, fluxgate detector units. gyro stabilized direction indicating systems.

Module -4
Gyroscopic Flight Instruments: types of gyros-mechanical, ring laser gyros, fiber optic gyros and their limitations, basic mechanical gyro and its properties namely rigidity and precision, gyro horizon, direction indicator, turn and bank indicator.

Module -5
Engine Instruments: pressure measurement (EPR), Temperature measurement (EGT), capacitance type volumetric fuel quantity indicator, densitometer, fuel quantity indicator by weight. Engine speed measurement, torque measurement, integrated impellor type flow meter.

Course Outcomes: After studying this course, students will able to
1. Outline the scope and extent of avionics and identify the types of flight instruments and display panels.
2. Describe the fundaments of flight, basics of aircraft structures, propulsion and materials used in the development of an aircraft.
3. Comprehend the complexities involved during development of flight vehicles.
4. Recognize the fundamental applications of gyroscopic flight instruments in aircraft and analyses the performance of aircraft control system and interpret the results.
5. Evaluate the performance characteristics of engine instruments of aircraft and give better view and ways to improve efficiency.

Question Paper Pattern:
- The question paper will have TEN questions.
- Each full question carry16marks

• There will be TWO full questions (with maximum of THREE sub questions) from each module.   • Each full question will have sub questions covering all the topics under a module.   • The students will have to answer FIVE full questions, selecting ONE full question from each module.
Text Books: **1.** Aircraft Instruments and Integrated Systems- EHJ Pallet, Longman Scientific & Technical, 1992.

Reference Books:
   1. Aircraft Instrumentation and Systems -S. Nagabhushana & L.K. Sudha, IK International
   2. Aircraft Systems: Mechanical, electrical, and avionics subsystems integration - Ian Moir and Allan Seabridge, Third Edition, John Wiley & Sons, Ltd., 2008.

B.E. Electronics and Instrumentation Engineering (EI) Choice Based Credit System (CBCS) Semester - V			
Remote Sensing and Telemetry			
Subject Code	: 17EI553	CIE Marks	: 40
Number of Lecture Hours/Week	: 03	SEE Marks	: 60
Total Number of Lecture Hours	: 40	Exam Hours	: 03
Credits – 3 (Each module – 8 Hours)			

Module -1
Introduction: Sun and Atmosphere, concept of signatures, remote sensing system, why observe earth from space? remote sensing – A Historic perspective, Indian remote sensing programme , the earth observation evolution – the paradigm shift legal and ethical aspects, electromagnetic radiation, velocity of EM radiation polarization coherent radiation, propagation of EM waves from one medium to another, attenuation, quantum of EM radiation ,thermal radiation, source of EM Radiation for remote sensing.

Module -2
Remote Sensors – Classification of remote sensors, optical – infrared sensors, photographic camera, television cameras, opto - mechanical scanners, opto-mechanical scanners operated from satellites, pushbroom cameras, hyper-spectral imager, measuring the third dimension, image quality aspects.
Microwave Sensors: Antenna, passive microwave sensors, active microwave sensors, side looking radar, scatterometer , platforms, principles of satellite motion, locating a satellite in space, types of Orbit, Orbital perturbations, the spacecraft, global positioning system(GPS).

Module -3
Data Reception and Data Products: Data formats, ground segment organization, data product generation, referencing scheme, data products output medium, IRS data products, special processing, data analysis, visual image analysis, digital classification, classification accuracy.

Module -4
Telemetry System: Introduction, fundamental of RF telemetry, basic telemetry, system components of coding resolution, pulse code modulation, PCM multiplexing and conversion, PCM data transmission, PCMPSD system. Theoretical comparison of telemetry systems.

Module -5
Applications of Remote Sensing for Earth Resources Management: Agriculture, forestry application, land cover/land use mapping water resources, snow and glacier, wetland management, marine fisheries, remote sensing for earth system science studies, geographical information system(GIS), date model, data entry data analysis example – urban land use suitability, spatial data infrastructure.

Course Outcomes: After studying this course, students will able to;
1. Acquire the different concepts associated with EM radiation.
2. Identify and classify the different remote and microwave sensors.
3. Illustrate the concepts of data acquisition for remote sensing.
4. Describe the telemetry system employed in remote sensing.
5. Discuss the Applications of Remote Sensing for Earth Resources Management.

Question Paper Pattern:

- The question paper will have TEN questions.
- Each full question carry16marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
   1. **Fundamentals of Remote Sensing** – by George Joseph, second Edition, Universities press, 2005.

Reference Books:
   1. **Advanced Remote Sensing** - Liang, Shunlin, Academic Press (an imprint of Elsevier), 2012.

B.E. Electronics and Instrumentation Engineering (EI)			
Choice Based Credit System (CBCS)			
Semester - V			
Product Design Technology and Ergonomics			
Subject Code	: 17EI554	CIE Marks	: 40
Teaching Lecture Hours/ Week	: 03	SEE Marks	: 60
Total Number of Lecture Hours	: 40	Exam Hours	: 03
Credits – 3 (Each module – 8 Hours)			

Module -1

Introduction to Product Design: Asimow's Model : Definition of product design, Design by Evaluation, Design by Innovation, Essential Factors of Product Design, Flow and Value Addition in the Production-Consumption Cycle. The Morphology of Design (The seven Phase), Primary Design phase and flowcharting, role of Allowance, Process Capability.

Module -2

Product Design Practice and Industry: Introduction, Product Strategies, Time to Market, Analysis of the Product, The three S's, Standardization, Renard Series (Preferred Numbers), Simplification,
The Designer: The designer and His Role, Myth and Reality, The Industrial Design Organization, Basic Design Consideration, Problems faced by Industrial Designer, Procedure adopted by Industrial Designers,

Module -3

Productivity: Definition of productivity, individual enterprises, task of management Productivity of materials, land, building, machine and power.
Measurement of productivity, factors affecting the productivity, productivity improvement programs.

Module -4

Work Study: Definition, objective and scope of work study. Human factor in work study, Work study and management, work study and supervision, work study and worker.
Introduction to Work Measurement: Definition, objective and benefit of work measurement, Work measurement techniques

Module -5

Ergonomics: Introduction, Areas of study under Ergonomics, System approach to Ergonomics model, Man-Machine System. Components of Man-Machine System, Work capabilities of Industrial Worker.
Study of Development of Stress in Human body and their consequences, Computer based ergonomics.

Course Outcomes: After studying this course, students will able to;
1. Define product design and describe process of product design.
2. Analyze the strategies in the development of product from industry perspective.
3. Identify the role and responsibility of designer and the challenges in industrial design.
4. Evaluate the work study and work measurement.
5. Apply the concepts of ergonomics in product design and development.
6. Develop engineering, scientific and mathematical skills to execute a design from concept to finished product.

Question Paper Pattern:
- The question paper will have TEN questions.

- Each full question carry16marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. Product Design and Manufacturing - A.C. Chitale and R.C. Gupta - PHI.
2. Introduction to work study, ILO - III Revised Edition, 1981
3. Work Study and Ergonomics - S Dalela and Sourabh, – Chand Publishers - 3rd edition.

References Books:
1. Product Design & Development – Karl T. Ulrich & Steven D., Epinger, TataMcGraw Hill - 3rd Edition, 2003.
2. Human Factors in Engineering Design - S Sanders and E J McCormick, McGraw Hill - 6th Edition.

B.E. Electronics and Instrumentation Engineering (EI) **Choice Based Credit System (CBCS)** **Semester - V**				
Computer Organization **(Common to EI, BM & ML)**				
Subject Code	: 17EI/BM/ML561		CIE Marks	: 40
Number of Lecture Hours/Week	: 03		SEE Marks	: 60
Total Number of Lecture Hours	: 40		Exam Hours	: 03
Credits – 3 (Each module – 8 Hours)				

Module -1
Basic Structure of Computers: Basic Operational Concepts, Bus Structures, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. Machine Instructions and Programs: Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines.

Module -2
Input / Output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Exceptions, Direct Memory Access, Buses, Interface Circuits, Standard I/O Interfaces – PCI Bus, SCSI Bus, USB.

Module -3
Memory System: Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories – Mapping Functions, Replacement Algorithms, Performance Considerations, Virtual Memories, Secondary Storage.

Module -4
Arithmetic: Numbers, Arithmetic Operations and Characters, Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed Operand Multiplication, Fast Multiplication, Integer Division, Floating-point Numbers and Operations.

Module -5
Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control, Micro programmed Control. Embedded Systems and Large Computer Systems: Examples of Embedded Systems, Processor chips for embedded applications, Simple Microcontroller. The structure of General-Purpose Multiprocessors.

Course Outcomes: After studying this course, students will able to
1. Describe basic structure of computers, machine instructions and programs
2. Describe different addressing modes, output operations, Stacks and Queues, Subroutines and Additional Instructions, IEEE standard for Floating point Numbers
3. Apply the techniques accessing of I/O Devices, Interrupts, Direct Memory Access, Busses, Interface Circuits, and Standard I/O Devices.
4. Evaluate the concepts of Semiconductor RAM Memories, Read Only Memories, Cache, Memories, Performance Considerations and Virtual Memories.
5. Execute a Complete Instruction, Multiple Bus Organization, and Microprogrammed Control and Hardwired Control.

Question Paper Pattern:
- The question paper will have TEN questions.
- Each full question carry16marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
  1. Carl Hamacher, Zvonko Vranesic, SafwatZaky: Computer Organization, 5th Edition, Tata McGraw Hill, 2002.

Reference Books:
  1. William Stallings: Computer Organization & Architecture, 9th Edition, Pearson, 2017.

B.E. Electronics and Instrumentation Engineering (EI) **Choice Based Credit System (CBCS)** **Semester – V**				
Material Science				
Subject Code	: 17EI562		CIE Marks	: 40
Number of Lecture Hours/Week	: 03		SEE Marks	: 60
Total Number of Lecture Hours	: 40		Exam Hours	: 03
Credits – 3 (Each module – 8 Hours)				

Module -1

Crystallography: Forces between atoms, bonding in solids, ionic, covalent and metallic bonding; Fundamental concepts of crystals, lattice points and space lattice, crystal systems, Bravais lattices, directions, planes and Miller indices, atomic packing fraction, structure of simple cubic, body centered cubic (CsCl), face centered cubic (NaCl), hexagonal closed packed (HCP), diamond structure; X-ray diffraction, Bragg's law.

Module -2

Characterization Techniques: X-ray diffraction, powder X – ray diffractometer, construction and working, crystalline phase analysis, fundamentals of transmission electron microscopy and scanning electron microscopy(SEM), study of crystal structure using TEM, study of microstructure using SEM, scanning electron microscopy with EDS, construction and working, grain size and chemical analysis atomic force microscopy, construction and working, scanning tunneling microscope, construction and working.

Module -3

Crystal Imperfections: Point defects, vacancies and self-interstitials, impurities in solids, dislocations, linear defects, interfacial defects, bulk or volume defects edge and screw dislocation.
Mechanical Behaviour: Elastic behaviour of metals, stress-strain relation, Hooke's law, atomic model of elastic behaviour, plasticity, ductile and brittle materials, tensile strength, hardness, fatigue, creep, fracture, types of fracture.

Module -4

Diffusion and Phase Transformation in Solids: Fick's laws of diffusion, experimental determination of diffusion coefficient, Kirkendall effect, atomic model of diffusion. Time scale of phase changes, nucleation and growth, nucleation kinetics, applications, solidification and crystallization, glass transition.

Module -5

Nanoscience: Overview of nanotechnology, quantum effect, nanotechnology in nature, energy levels in nano-films, nano-wires and nano-dots. Growth techniques, physical vapor deposition, ball milling, lithography techniques, properties at nanoscale, size dependence, structural, chemical, optical, mechanical, electrical and magnetic properties. Applications of Nanomaterials: Sensors and actuators, catalysis, biomedical, advanced electronic materials, current challenges and future trends, safety and societal implications.

Course Outcomes: After studying this course, students will able to;
1. Explain fundamental concepts of crystal and crystal structure with examples.
2. Describe the principle and working of different instrumentation techniques for the characterization of crystals and materials.

3. Analyze the crystal Imperfections and mechanical behaviour of materials.
4. Discuss the concepts and experimentations in the areas of diffusion and phase transformation in solids
5. Discuss the basic concepts of Nanoscience and nano-materials with emphasis on applications in different fields, challenges, safety and societal implications

Question Paper Pattern:
- The question paper will have TEN questions.
- Each full question carry16marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. V. Raghavan, Materials Science and Engineering: A First Course, Prentice Hall of India, 2007.
2. Charles P. Poole, Frank J. Owens, Introduction to Nanotechnology, John Wiley and Sons, 2007.

Reference Books:
1. S. O. Pillai, Solid State Physics, New Age International, 2008.
2. M. Arumugam, Materials Science, Anuradha Agencies, Kumbhakonam, 2007.
3. RakeshRathi, Nanotechnology: Technology Revolution of 21st Century, S. Chand, 2009.

B.E. Electronics and Instrumentation Engineering (EI) Choice Based Credit System (CBCS) Semester - V				
Operating Systems (Common to EI & BM)				
Subject Code	**: 17EI/BM563**		CIE Marks	: 40
Number of Lecture Hours/Week	: 03		SEE Marks	: 60
Total Number of Lecture Hours	: 40		Exam Hours	: 03
Credits – 3 (Each module – 8 Hours)				

Module -1

Introduction to Operating Systems: What operating systems do, Computer System Organization, Architecture and Operations, Process Management, memory management, Storage Management, Protection and Security, Computing Environments.

Operating system structures: OS Services, User-OS Interface, System calls, System programs, OS structure, System Boot.

Text: 1.1, 1.2, 1.3, 1.5, 1.6, 1.7, 1.8, 1.9, 1.11, 2.1, 2.2, 2.3, 2.5, 2.7, 2.10.

Module -2

Process Management

Processes: Process concept, Process scheduling, Operation on processes, Inter process communication.

Threads – Overview, Multithreading models, Threading issues.

CPU scheduling – Basic concepts, Scheduling criteria, Scheduling algorithms, real time scheduling.

Text: 3.1, 3.2, 3.3, 3.4, 4.1, 4.3, 4.6, 6.1, 6.2, 6.3, 6.6

Module -3

Process Synchronization: Background, The critical section problem, Peterson's Solution, Synchronization hardware, Mutex Locks, Semaphores, Classical problems of synchronization, Monitors.

Deadlock – System model, Deadlock characterization, Methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection and recovery from deadlock.

Text: 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7, 5.8, 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.7.

Module -4

Memory management:

Main Memory: Background, Swapping, Contiguous, allocation, Paging.

Virtual memory: Background, Demand paging, Copy-on-write, Page replacement.

Text: 8.1, 8.2, 8.3, 8.5, 9.1, 9.2, 9.3, 9.4.

Module -5

Storage Management:

Mass storage structure: Overview of mass storage structure, Disk structure, Disk scheduling, Disk management, Swap space management.

File System Interface: File concept, Access methods, Directory and Disk structure, File system mounting, Protection.

File System Structure: File system structure, File system implementation, Directory implementation, Allocation methods, and free space management.

Text: 10.1, 10.2, 10.4, 10.5, 10.6, 11.1, 11.2, 11.3, 11.4, 11.6, 12.1, 12.2, 12.3, 12.4, 12.5

Course Outcomes: After studying this course, students will able to;
1. Define OS and explain organization of computer system, and components, computing environments, & typical structure of OS.
2. Analyze the process management, process scheduling and threads.
3. Describe the concepts of process synchronization and analyze the problems of synchronization
4. Evaluate, prevent and avoid the deadlocks
5. Develop the techniques of memory allocation and paging
6. Apply appropriate disk scheduling algorithms.
7. Describe the interfaces to file systems, file structure and implement file systems and directory structure.

Question Paper Pattern:
- The question paper will have TEN questions.
- Each full question carry16marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. Operating System Concepts-by Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, **9th Edition**, John Wiley &Sons 2016 (India Edition).

Reference Books:
1. Operating system concepts and design- Milan Milankovic, 2nd Edition, McGraw Hill 1992.
2. Operating systems- Harvey M Deital Addison Wesley 1990.
3. Operating Systems concepts based approach, D.M. Dhamdhere, Tata McGraw Hill 2002.

B.E. Electronics and Instrumentation Engineering (EI) Choice Based Credit System (CBCS) Semester - V			
Fundamentals of Nanotechnology			
Subject Code	: 17EI564	CIE Marks	: 40
Number of Lecture Hours/Week	: 03	SEE Marks	: 60
Total Number of Lecture Hours	: 40	Exam Hours	: 03
Credits – 3 (Each module – 8 Hours)			

Module -1

Foundations in Nanosciences: Introduction, Scientific Revolutions, Basic Science behind Nanotechnology, Nanometer: How Big or Small, Nanotechnology, Materials at Nano scale, Quantum Confinement in Nanomaterial, Rationale behind the Downsizing of the Materials, Size and Shape Matter.

Module -2

The Rising Carbon in the Nanoworld: Introduction, Carbon: The Versatile Element in the Nanoworld, Graphite, Diamon, Fullerenes, Graphene, Carbon Nanotubes.

Module -3

Prime Materials in Nanotechnology: Introduction, Nanomaterial: Natural and Man Made, Semiconductor Nanomaterial, Ceramic Nanomaterial, Polymers and Composites, Metal Nanoparticles, Biomaterials.

Module -4

Nano scale Characterization: Introduction, Scanning Electron Microscope, Transmission Electron Microscope, Scanning Tunneling Microscope , Atomic Force Microscope , X-Ray Diffraction , Raman Spectroscopy.

Module -5

Nanotech Applications and Recent Breakthroughs: Introduction, Significant Impact of Nanotechnology and Nanomaterial, Medicine and Healthcare Applications, Biological and Biochemical Applications (Nano biotechnology), Energy Applications, Electronic Applications (Nano electronics), Computing Applications (Nano computers), Chemical Applications (Nano chemistry), Optical Applications (Nano photonics), Agriculture and Food Applications, Recent Major Breakthroughs in Nanotechnology.

Course Outcomes: After studying this course, students will able to;
1. Explain the fundamental concepts Nanotechnology.
2. Discuss different classes of carbon nano-materials and their characteristics
3. Describe different types of nano-materials and their characteristics.
4. Analyze and characterize nanomaterial using scientific and analytical instrumentation
5. Apply nanotechnology for multidisciplinary fields for the real life problems for better solutions.

Question Paper Pattern:
- The question paper will have TEN questions.
- Each full question carry16marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.

- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. M.A. Shah, K.A. Shah, "Nanotechnology: The Science of Small", Wiley India, ISBN 13: 9788126538683

Reference Books:
1. Charles Poole, Frank Owens, "Introduction to Nanotechnology", Wiley India, Student Edition
2. Mark A. Ratner, Daniel Ratner, "Nanotechnology: A Gentle Introduction to the Next Big Idea", 2003, Prentice Hall.

B.E. Electronics and Instrumentation Engineering (EI) Choice Based Credit System (CBCS) Semester - V				
Signal Conditioning Circuits and Data Acquisition Lab **(Common to EI, BM & ML)**				
Subject Code	: 17 EI/BM/ML L57		CIE Marks	: 40
Number of Practical Hours/Week	: 03		SEE Marks	: 60
Total Number of Practical Hours	: 42		Exam Hours	: 03
Credits - 2				
Revised Bloom's Taxonomy Levels: L1 – Remembering, L2 – Understanding, L3 – Applying, L4 –Analyzing, L5 – Evaluating, and L6 - Creating				

Laboratory Experiments: Note: Standard design procedure to be adopted Students should build the circuit using discrete components and ICs (models are not to be used)	Revised Bloom's Taxonomy (RBT)Level
1. To design and implement • Inverting Amplifier and Inverting Attenuator • Non-Inverting Amplifier and Voltage Follower	L3, L4
2. To realize • Full wave Precision rectifier	L3, L4
3. To design and implement • Butterworth I order Low-pass filter • Butterworth II order High-pass filter	L3, L4
4. To design and implement • RC Phase shift oscillator • Wein Bridge oscillator	L3, L4
5. To realize • ZCD • Positive and Negative Voltage level detectors	L3, L4
6. To design and implement • Astable Multivibrator using 555 timer • Mono-stable Multivibrator using 555 timer	L3, L4
7. To realize • Sample and Hold circuit using discrete components	L3, L4
8. To realize • Programmable Gain Amplifier using Analog Mux	L3, L4
9. To design and implement • 4 bit R-2R DAC using discrete components	L3, L4
10. To design and implement • 8-bit DAC using IC (DAC 0800)	L3, L4
11. To design and implement • 8-bit ADC using IC (ADC 0809)	L3, L4
12. To design and implement • 3 bit Flash ADC using ICs	L3, L4

Course Outcomes: After studying this course, students will able to;
1. Sketch/draw circuit schematics, construct circuits on breadboards, analyze and troubleshoot circuits containing Op-amps, resistors, diodes, capacitors and independent sources.
2. Memorizeand reproduce the manufacturer's data sheets of IC 555 timer, IC μa741 op-amp and data converters like IC ADC 0800 and IC DAC 0809.
3. Design and evaluate analog integrated circuits like Amplifiers, Oscillators, Active filters, Precision Rectifiers and Voltage level detectors, and compare the experimental results with theoretical values.
4. Demonstrate and analyze the working of Sample-Hold, Programmable gain amplifier and Analog Multiplexer circuits in data acquisition system.
5. Design and evaluate different resolution data converters using discrete components and ICs.

Conduct of Practical Examination:
5. All laboratory experiments are to be included for practical examination.
6. Students are allowed to pick one experiment from the lot.
7. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
8. Change of experiment is allowed only once and 17% Marks allotted to the procedure part to be made zero.

Reference Books:
4. "Linear Integrated Circuits", D. Roy Choudhury and Shail B. Jain, 4th edition, Reprint 2010, New Age International.
5. "Op - Amps and Linear Integrated Circuits", Ramakant A. Gayakwad, 4th edition, PHI.
6. "A course in Electrical & Electronic Measurements & Instrumentation", A K Sawhney, Dhanpat Rai Publications, 19th edition, 2011.
7. "Operational Amplifiers and Linear Integrated Circuits", Robert. F. Coughlin &Fred. F. Driscoll, PHI/Pearson, 2006
8. "Op - Amps and Linear Integrated Circuits", James M. Fiore, Thomson Learning, 2001
9. "Design with Operational Amplifiers and Analog Integrated Circuits", Sergio Franco, TMH, 3e, 2005

	B.E. Electronics and Instrumentation Engineering (EI) **Choice Based Credit System (CBCS)** **Semester - V**			
	Digital Signal Processing Lab			
Subject Code	: 17EIL58		CIE Marks	: 40
Number of Hours/Week	: 03		SEE Marks	: 60
Total Number of Lecture Hours	: 42		Exam Hours	: 03
	Credits -2			

USING ONLY MATLAB / SCILAB/OCTAVE

1	Verify the Sampling theorem.
2	Determine linear convolution, Circular convolution and Correlation of two given sequences. Verify the result using theoretical computations.
3	Determine the linear convolution of two given point sequences using FFT algorithm.
4	Determine the correlation using FFT algorithm.
5	Determine the spectrum of the given sequence using FFT.
6	Design and test FIR filter using Windowing method (Hamming Hanning and Rectangular window) for the given order and cut-off frequency.
7	Design and test Butterworth 1st and 2nd order low & high pass filter.
8	Design and test Chebyshev 1st and 2nd order low & high pass filter.

USING DSP KIT / EMULATORS FROM TI/ ADSPSHARC/ MOTOROLA

9	Linear convolution of two given sequences.
10	Circular convolution of two given sequences
11	Computation of N-point FFT of a given sequence.
12	Implementation of an FIR filters to meet given specifications.
13	Implementation of an IIR filters to meet given specifications.

Course Outcomes: After studying this course, students will able to;
1. Write programs using Matlab / Scilab/Octave to demonstrate the DSP concepts on sampling, convolution and correlation, and implementation of the same using DSP kit.
2. Write programs using Matlab / Scilab/Octavefor generation and computation of discrete signals.
3. Write program using Matlab / Scilab/Octave to apply FFT/DFT algorithm to determine spectrum of a given signal, and implementation of the same using DSP kit.
4. Write programs using Matlab / Scilab/Octave to design and evaluate different types of low and high pass filters.
5. Designand demonstrate IIR and FIR filters using Matlab / Scilab/Octaveprograms and DSP Kit.
6. Design and demonstrate DSP system applications in noise cancellation, communication, biomedical signal processing.

Reference Books:
1. Roberto Cristi, "Modern Digital Signal Processing", 2003, Nelson Engineering
2. Vinay K. Ingle (Author), John G. Proakis, "Digital Signal Processing Using MATLAB", 3rd Edition, CL Engineering.
3. V.Udayashankara, "Modern Digital Signal Processing", Third Edition, PHI 2016
4. John Proakis, Dimitris G Manolakis, "Digital Signal Processing Principles", Algorithms and

Application", PHI, 3rd Edition (2000).
5. S K MITRA, "Digital Signal Processing", 4th Edition, McGraw-Hill.
6. Avtar Singh, S. Srinivasan, "Digital Signal Processing Implementation", Brooks Cole.
7. S. Salivahana, A.Vallavaraj, Gnanapriya, "Digital Signal Processing", McGraw-Hill, 2nd Edition (2000).

6thSEMESTER

B.E. Electronics and Instrumentation Engineering (EI)			
Choice Based Credit System (CBCS)			
Semester - VI			

Analog and Digital Communication Systems
(Common to EI, BM &ML)

Subject Code	: 17EI/BM/ML61		CIE Marks	: 40
Number of Lecture Hours / Week	: 04		SEE Marks	: 60
Total Number of Lecture Hours	: 50		Exam Hours	: 03
Credits – 4 (Each module – 10 Hours)				

Module -1
Introduction to analog and Digital Communication, Historical Background and Applications.
Amplitude Modulation: Amplitude Modulation,Virtues, Limitations, and Modifications of AM,DSBSC Modulation, Costas Receiver, Single Side band Modulation, Vestigial Sideband Modulation, Theme Examples.(Text 1:1.1,1.2,3.1, 3.2, 3.3, 3.4, 3.6, 3.7, 3.9)

Module -2
Angle Modulation: Basic Definitions, Properties of Angle-Modulated Waves, Relationship between PM and FM Waves, NBFM, WBFM, Transmission Bandwidth of FM Waves, Generation of FM waves, Demodulation of FM Signals, Theme Example.(Text 1:Chapter 4)

Module -3
Pulse Modulation: Transition from Analog to Digital Communications: Sampling Process, PAM, Completing the Transition from Analog to Digital, Quantization Process, PCM, Delta Modulation, Theme Examples.(Text 1: 5.1, 5.2, 5.4, 5.5, 5.6, 5.7, 5.10)

Module -4
Digital Band-Pass Modulation Techniques: Binary Amplitude Shift Keying (BASK): Generation and Detection, Binary Phase Shift-Keying (BPSK): Generation and Detection, Quadriphase Shift Keying (QPSK): Generation and Detection, Binary Frequency Shift Keying (BFSK), Minimum-Shift Keying (MSK), Differential Phase Shift Keying (DPSK): Generation and Detection, Theme Examples.
(Text 1: 7.2, 7.3, 7.4, 7.6, 7.9)
[Note: Excluding Computer Experiments in all the above Modules]

Module -5
Wireless Personal Area Networks (WPAN): Network Architecture, WPAN Components, WPAN Technologies and protocols (Bluetooth &Zigbee), WPAN Applications.(Text2: 4.1, 4.2, 4.3, 4.4, 4.5)
Wireless Wide Area Networks: Cellular Networks: Principles, GSM, CDMA, Handover in Cellular Networks.(Text 2: 7.1 (Excluding GPRS and CDPD)).

Course Outcomes: After studying this course, students will be able to:
1. Explain the basics concepts of analog modulation techniques.
2. Discuss the basic concepts of digital modulation techniques.
3. Describe the basic concepts of digital data and pulse communication.
4. Explain and analyze different digital modulation techniques.
5. Describe different wireless area networks and their applications.

Question Paper Pattern
- The question paper will have TEN questions.
- Each full question carry 16 marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Book:
1. Simon Haykin, John Wiley & sons, "Introduction to Analog and Digital Communications"-Second Edition, 2012, ISBN 978-81-265-3653-5.
2. Dr. Sunil Kumar S.Manvi, Mahabaleshwar S. Kakkasageri, "Wireless and Mobile Networks Concepts and Protocols", John Wiley & sons, 2014 Edition, ISBN 978-81-265-2069-5.

Reference Books:
1. John G Proakis and MasoudSalehi, "Fundamentals of Communication Systems", 2014 Edition, Pearson Education, ISBN 978-8-131-70573-5.
2. Ian A Glover and Peter M Grant, "Digital Communications", Pearson Education, Third Edition, 2010, ISBN 978-0-273-71830-7.
3. B. P. Lathi and Zhi Ding, "Modern Digital and Analog communication Systems", Oxford University Press, 4th Edition, 2010, ISBN: 978-0-198-07380-2.

B.E. Electronics and Instrumentation Engineering (EI)			
Choice Based Credit System (CBCS)			
Semester - VI			
Power and Industrial Electronics			
Subject Code	**: 17EI62**	CIE Marks	: 40
Number of Lecture Hours / Week	: 04	SEE Marks	: 60
Total Number of Lecture Hours	:50	Exam Hours	: 03
Credits – 4 (Each module – 10 Hours)			

Module -1
Introduction: Applications of power electronics, power semiconductor devices, control characteristics, types of power electronic circuits, peripheral effects.
Power BJTs, switching characteristics, switching limits, base-drive control, introduction to IGBT, and MOSFET, isolation of gate and base drives.

Module -2
Thyristors: Introduction, static characteristics of SCR, two transistor model, turn-on and turn off methods, di/dt and dv/dt protection of SCR, series and parallel operation of thyristors, thyristor firing circuit usingUJT.
Commutation Techniques: Introduction, natural commutation, forced commutation: self-commutation, impulse commutation.

Module -3
Controlled Rectifiers: Introduction, principle of phase controlled converter operation, single-phase semi converters, full converters and dual converters.
AC Voltage Controllers: Introduction, principle of ON-OFF and phase control, single-phase bidirectional controllers with resistive and inductive loads.

Module -4
DC Choppers: Introduction, principle of step-down operation, step-down chopper with R- L loads, Principle of step-up operation, Classification of DC Choppers.
DC Drives: Introduction, basic characteristics of DC Motors, operating modes single phase Full-converter drives, Introduction to stepper motor

Module -5
Inverters: Introduction, principle of operation, single phase bridge inverters, three phase inverters, voltage control of single phase inverters, current source inverter
Applications of Power electronics: Power supplies, switched- mode DC power supplies and configurations, AC power supplies (UPS only), Industrial applications.

Course Outcomes: After studying the course, students will be able to:
1. Explain static and dynamic characteristics of power semiconductor devices.
2. Analyze operation, model, characteristics, and turn-on and turn-off methods of devices.
3. Describe the converter circuits and their operation using Thyristors, BJT, MOSFET etc.
4. Analyze, evaluate and apply the power converter circuits in Industry
5. Apply the knowledge in the Domestic/Industrial control system applications.

Question Paper Pattern
- The question paper will have TEN questions.
- Each full question carry 16 marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Book:
1. Power Electronics - M. H. Rashid, Prentice Hall of India Pvt. Ltd., 2nd edition New Delhi, 2002.
2. Power Electronics: Converters, Applications and Design - Ned Mohan, Tore M. Undeland and William P. Robbins, 3rd Edition, John Wiley and Sons, 2003.

Reference Books:
1. Power Electronics- M. D. Sing and Khanchandani K. B., Tata McGraw Hill Publishing Company Limited, Reprint 2001.
2. Power Electronics - Cyril W. Lander, 3rd Edition, McGraw Hill, 1993.

B.E. Electronics and Instrumentation Engineering (EI)				
Choice Based Credit System (CBCS)				
Semester – VI				
OOPS with C++				
(Common to EI, BM & ML)				
Subject Code	: 17EI/BM/ML63		CIE Marks	: 40
Number of Lecture Hours /Week	: 04		SEE Marks	: 60
Total Number of Lecture Hours	: 50		Exam Hours	: 03
Credits – 4 (Each module – 10 Hours)				

Module -1

C++ Programming Basic: Need for object oriented programming, Characteristics of OOPS, Preprocessor directives, Data types, Manipulators, Boolean types, Functions : Functions Declaration, Calling the function, function definition, Passing Arguments to functions, Returning values from functions, Reference arguments, Overloaded functions, inline functions. (Text Book 1)

Module -2

Classes and Objects: Classes & Objects, Specifying the class, Defining objects, calling members functions, objects as data types, constructors, Destructors, overloaded constructors. Arrays: arrays as class member data types, passing arrays, arrays as objects, friend function & friend classes. (Text Book 1)

Module -3

Strings and Pointers: Strings: String variable & string constants, coping a string, array of a string, string as class members, user defined string type. **Pointers :** Pointers and arrays, pointers & functions, pointers & strings, pointers to objects,'this' pointer, Array of pointers to objects, memory management using keywords new & delete (Text Book 1)

Module -4

Operator Overloading andInheritance: Unary operators, binary operators.
INHERITANCE: Derived class and base class, overriding member functions, scope resolution, Public & private inheritance, Public & private inheritance, levels of inheritance, multiple inheritance.(Text Book 1)

Module -5

Virtual Functions and Polymorphism: Virtual function, calling a virtual function through a base class reference, virtual attribute is inherited, virtual functions are hierarchical, Pure virtual functions, Abstract classes, using virtual function, early Vs late binding. (Text Book 2)
Templates: Generic functions, A function with two generic types, explicitly overloading a generic functions, generic classes. Applying template classes, A generic classes using default arguments with template classes. Exception handling: Exception handling fundamentals, catching class types, using multiple catch statement. (Text Book 2)

Course Outcomes: After studying this course, students will able to:
1. Explain the basic concepts of OOPS.
2. Apply the concept of OOPS to realize the existing algorithms.
3. Analyse the given program for debugging to obtain correct output
4. Create suitable application programs to solve real world problems.

Question Paper Pattern

- The question paper will have TEN questions
- Each full question carries 16 marks
- There will be TWO full questions (with maximum of FOUR sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. Object oriented programming in TURBO C++ - Robert Lafore, Galgotia Publications, 2002 (Module 1,2,3,4)
2. Herbert Schildt: The Complete Reference C++, 4th Edition, Tata McGraw Hill, 2003. (Module 5)

Reference Books:
1. Object Oriented Programming with C++, E Balaguruswamy, 4th Edition, Tata McGraw Hill, 2006.
2. K R Venugopal, RajkumarBuyya, T Ravi Shankar: Mastering C++, Tata McGraw Hill, 1999

B.E. Electronics and Instrumentation Engineering (EI) Choice Based Credit System (CBCS) Semester - VI				
Robotics and Automation				
Subject Code	**: 17EI64**		CIE Marks	: 40
Number of Lecture Hours /Week	: 04		SEE Marks	: 60
Total Number of Lecture Hours	: 50		Exam Hours	: 03
Credits – 4 (Each module – 10 Hours)				

Module -1

Fundamentals of Robotics & Automation: Automation and robotics, history of robotics, robotics market and future prospects, robot anatomy, work volume, robot drive systems, control systems, precision of movement, end effectors, robotic sensors, robot programming and work cell control, robot applications, problems.[Textbook-1]

Automation Concepts: SCADA, introduction and brief history of SCADA, SCADA systems software, distributed control system (DCS), introduction to the PLC, considerations and benefits of SCADA system. [Textbook-2]

Module -2

Robot Motion Analysis, Sensors and Control: Introduction to manipulator kinematics, homogeneous transformations and robot kinematics, manipulator path control, robot dynamics, configuration of a robot controller, types of end effecters, mechanical grippers, other types of grippers, tools as end effectors, robot/end effector interface, consideration in gripper selection and design, problems.

Sensors in Robotics: Transducers and sensors, sensors in robotics, tactile sensors, proximity and range sensors, uses of sensors in robotics, problems. [Textbook-1]

Module -3

Machine Vision, Robot Programming & Artificial Intelligence: Introduction to machine vision, sensing and digitizing function in machine vision, image processing and analysis, training the vision system, robotic applications, problems. Robot Programming: Methods of robot programming, lead - through programming methods, a robot program as a path in space, motion interpolation, wait, signal and delay commands, branching, capabilities and limitations of lead-through methods, problems.

Artificial Intelligence (AI): Introduction & goals of AI in research, AI techniques, LISP programming, AI & robotics, LISP in factory, robotic paradigms, and problems. [Textbook-1]

Module -4

Robotics in Manufacturing/Automation , Material Transfer, Machine Loading/Unloading:

Robot cell layouts, multiple robots and machine interference, considerations in work -cell design, work-cell control, interlocks, error detection and recovery, work -cell controller, robot cycle time analysis, graphic simulation of robotic work-cells, problems.

Material Transfer, Machine Loading/Unloading: General considerations in robot material handling, material transfer applications, machine loading and unloading. [Textbook-1]

Module -5

Robots in Automatic Processing Operations, Assembly & Inspection: Introduction, spot welding, continuous arc welding, spray coating, other processing operations. Assembly and robotic assembly automation, parts presentation methods, assembly operations, compliance and remote center compliance

(RCC) device, assembly system configurations, adaptable programmable assembly system, designing for robotic assembly, inspection automation. [Textbook-1]

Autonomous Mobile Robots: Introduction, Planning & Navigation: Introduction, basic control scheme for mobile robots (only basic understanding of perception, localization, path planning & motion control). [Textbook-3]

Course Outcomes: After studying this course, students will able to:

1. Identify basic components of robot system and its functionality
2. Identify DH representation of robot and homogenous transformation for various arm configurations.
3. Analyze the functions of sensors in the robot.
4. Solve forward and inverse kinematic problems.
5. Evaluate and compare the use Robots in different applications.
6. Recognize material-handling applications, processing operations, assembly and inspection operations to increase product quality and uniformity in minimize cycle times and effort.

Question Paper Pattern

- The question paper will have TEN questions.
- Each full question carry 16 marks.
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:

1. Mikell P. Groover, Mitchel Weiss, Roger N. Nagel, Nicholas G. Odrey and AshishDutta, "Industrial Robotics: Technology, Programming and Applications", 2nd Edition, Tata McGraw Hill, 2012.
2. SrinivasMedida, Pocket Guide on Industrial Automation: For Engineers and Technicians, 1st Edition, IDC Technologies, 2007. (http://www.pacontrol.com/download/Industri al-Automation-Pocket-Guide.pdf)
3. Roland Siegwart, Illah R. Nourbakhsh, and DavideScaramuzza, "Introduction to Autonomous Mobile Robots", 2ndEdition, PHI, 2011.

Reference Books:

1. Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers, Chennai, 1998.
2. Asfahl C.R., Robots and manufacturing Automation, John Wiley, USA 1992.

B.E. Electronics and Instrumentation Engineering (EI)				
Choice Based Credit System (CBCS)				
Semester - VI				
Mechatronics				
Subject Code	: 17EI651		CIE Marks	: 40
Number of Teaching Hours/Week	: 03		SEE Marks	: 60
Total Number of Lecture Hours	:40		Exam Hours	: 03
Credits – 3 (Each module – 8 Hours)				

Module 1

Introduction: What is Mechatronics?, Design process, Systems, Measurement systems, Control systems, Examples of mechatronic systems: Digital camera with autofocus, Engine management system.
Sensors and Transducers (only selected topics): Smart sensors, Pneumatic sensors, Proximity switches, Pyroelectric sensors, Piezoelectric sensors, Tactile sensor. [Textbook-1]

Module -2

Pneumatic And Hydraulic Actuation Systems: Actuation systems, Pneumatic and hydraulic systems, Directional control valves, Pressure control valves, Servo and proportional control valves, Process control valves, Rotary actuators.
Mechanical Actuation Systems: Mechanical systems, Types of motion, Kinematic chains, Cams, Gears, Belt and chain drives, Bearings.[Textbook-1]

Module -3

Electrical Actuation Systems: Electrical systems, Mechanical switches, Solenoids, D.C. motors, A.C. motors, Stepper motors.
Fault Finding: Fault-detection techniques, Watchdog timer, Parity and error coding checks, Common hardware faults, Microprocessor systems, Emulation and simulation. [Textbook-1]

Module -4

Interfacing Microcontrollers with Actuators: Introduction, Interfacing with general purpose three state transistors, Interfacing relays, Interfacing solenoids, Interfacing stepper motors, interfacing permanent magnet motors, Interfacing sensors, Interfacing with DAC, interfacing power supplies, Compatibility at an interface.
Reliability: Meaning of reliability**,** The life curve, Repairable and non-repairable systems, Failure or hazard rate models, Reliability systems, Response surface modeling. [Textbook-2]

Module -5

Components Based Modular Design and System Validation: Introduction, Components based modular design view, System validation, Validation methodology, Validation scheme, Fusion technique-An example with vision system.
Integration: Introduction, Background, Advanced actuators, Industrial robot, Autonomous guided vehicle (AGV), Drilling machine for PCB board. [Textbook-3]

Course Outcomes: After studying this course, students will be able to:
1. Describe and analyze the mechatronic systems and their associated systems
2. Describe and select sensors and transducers for different mechatronic applications.
3. Discuss and illustrate different types of actuation systems that can be employed in a mechatronic

system.
4. Demonstrate the integration of mechatronic systems.
5. Identify and solve the faults in mechatronic systems and assess the reliability.
6. Designand develop microcontroller and actuator based mechatronic system.
7. Design modular system and perform validation.

Question Paper Pattern
- The question paper will have TEN questions.
- Each full question carry 16 marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering– W. Bolton, Pearson Education Asia, 4th Edition, 2013.
2. Mechatronics: Principles and Applications – Godfrey C. Onwubolu, Elsevier (BH) Publications, India Reprint 2013.
3. Mechatronics: Principles, Concepts and applications – Nitaigour Premchand Mahailik, TMH, 2003.

Reference Books:
1. Introduction to mechatronics and measurement systems –David G. Alciatore& Michel BiHistand, Tata McGraw Hill –2000.
2. Mechatronics H.D. Ramachandra, Sudha Publication 2003 Mechatronics by HMT Ltd. Tata McGraw-Hill, 2000.
3. Mechatronics System design by DevadasShetty and Richard A. Kark, Thomas Learning, 1997.
4. Mechatronics an Introduction by Robert H Bishop, CR, 2005.
5. Mechatronics Systems Fundamentals by Rolf Isermann, Springer, 2005

B.E. Electronics and Instrumentation Engineering (EI) Choice Based Credit System (CBCS) Semester - VI				
Power Plant Instrumentation				
Subject Code	**:17EI652**		CIE Marks	: 40
Number of Lecture Hours /Week	: 03		SEE Marks	: 60
Total Number of Lecture Hours	: 40		Exam Hours	: 03
Credits – 3 (Each module – 08Hours)				

Module -1
Coal Based Thermal Power Plants: Rankine cycle - improvisations, Layout of modern coal power plant, Super Critical Boilers, FBC Boilers, Turbines, Condensers, Steam & Heat rate, Subsystems of thermal power plants – Fuel and ash handling, Draught system, Feed water treatment. Binary Cycles and Cogeneration systems.

Module -2
Diesel, Gas Turbine And Combined Cycle Power Plants: Otto, Diesel, Dual & Brayton Cycle - Analysis & Optimization. Components of Diesel and Gas Turbine power plants. Combined Cycle Power Plants. Integrated Gasifier based Combined Cycle systems.

Module -3
Nuclear Power Plants: Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANada Deuterium- Uranium reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.

Module -4
Power From Renewable Energy: Hydro Electric Power Plants – Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, Solar Photo Voltaic (SPV), Solar Thermal, Geo Thermal, Biogas and Fuel Cell power systems.

Module -5
Energy, Economic And Environmental Issues Of Power Plants: Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants.

Course Outcomes: After studying this course, students will be able to:
1. Identify the resources of power generation and implementation
2. Describe the installation, operation, maintenance and control of coal based power plant
3. Recognize various analyzer for monitoring impurity, feed water and flue gas etc.
4. Evaluate the safety and boiler control system in power plants
5. Apply the knowledge to design, install, control and monitor the power plants as per the natural resources.

Question Paper Pattern

- The question paper will have TEN questions.
- Each full question carry 16 marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. Power Plant Engineering, P.K. Nag, McGraw-Hill Education.3rd edition 2008.

Reference Books:
1. Power Plant Technology, M.M. El-Wakil, McGraw-Hill Education .2010
2. Thermal Engineering, R. K. Rajput, Laxmi Publication

B.E. Electronics and Instrumentation Engineering (EI)			
Choice Based Credit System (CBCS)			
Semester - VI			
Advanced Control Systems			
Subject Code	: **17EI653**	CIE Marks	: 40
Number of Teaching Hours/Week	: 03	SEE Marks	: 60
Total Number of Lecture Hours	:40	Exam Hours	: 03
Credits – 3 (Each module – 8 Hours)			

Module -1
Design of Lag/Lead/Lag-lead compensators using Frequency domain (Bode plot) technique: Lead, lag, lead lag network and compensator design using Bode techniques.   Numerical problems
Text 1:9.1, 9.2, 9.3, 9.4.

Module-2
Design of Lag/Lead/Lag-lead compensators using Root Locus technique: Lead, lag, lead lag network and compensator design using Root locus techniques. Numerical problems
Text 1: 7.1, 7.2, 7.3, 7.4, 7.5.

Module -3
Nonlinear Systems: Introduction, Common physical nonlinearities, phase-plane Method: Basic concepts, singular points, Stability of non –linear system, Construction of phase trajectories (by analytical method only).
Describing function Method: Basic Concepts, Derivation of describing functions, Stability Analysis by Describing function Method,
Text 3:17.1, 17.2, 17.7, 17.8, 17.9

Module -4
Introduction to Discrete Time Control Systems: Introduction, Digital Control Systems, Impulse sampling and Data Hold, Reconstructing original signals from Sampled signals, The Pulse Transfer Function, Stability analysis of closed loop systems in the Z-plane.
Text 2: 1.1, 1.2, 3.2, 3.4, 3.5, 4.3.

Module -5
State space Analysis: State-Space representations of discrete-Time systems, Solving Discrete-time state space equations, Controllability, Observability. Numerical problems
Text 2: 5.1, 5.2, 5.3, 6.2, 6.3.

Course Outcomes: After studying this course, students will be able to:
1. Explain concepts of Lag, Lead and lag-Lead networks and their design and implementation in controls systems
2. Design of control system for given time domain and frequency domain specifications
3. Describe the concept of nonlinearity and linearity of systems and stability analysis
4. Describe the concept of discrete control system, transform function and solutions and stability analysis
5. Develop model of physical process in state space form and solve state space equations.
6. Test the controllability and observability of a system.

Question Paper Pattern
- The question paper will have TEN questions.
- Each full question carry 16 marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. Modern Control Engineering – K. Ogata, 3rd Edition, Prentice Hall of India, 1997.
2. Discrete Time Control Systems – K. Ogata, 2nd Edition, Prentice Hall of India, 1995.
3. Control Systems Engineering – J. Nagarath& M. Gopal, New Age Int. Pvt. Ltd. Publishers, 5th Edn. 2008.

Reference Books:
1. Digital control and state variable methods, Madan Gopal, PHI, 2nd Edition, 2005.
2. Advanced control theory- A NagoorKani, 2nd edition, RBA Publications.

B.E. Electronics and Instrumentation Engineering (EI)				
Choice Based Credit System (CBCS)				
Semester – VI				
Electrical Machines and Drives				
Subject Code	: **17EI654**		CIE Marks	: 40
Number of Lecture Hours/ Week	: 03		SEE Marks	: 60
Total Number of Lecture Hours	: 40		Exam Hours	: 03
Credits – 3 (Each module – 08Hours)				

Module -1
Electrical Circuits and Transformers: Ohms law, series and parallel circuits Kirchhoff's law mesh analysis, A.C. voltage – sinusoidal waves, power factor complex power Basic operation of transformers, EMF equation, Turns ratio, Losses and efficiency– simple problems

Module -2
Electrical Motors: Constructional details, principle of operation and performance characteristics of D.C. motors, single phase induction motor, three phase induction motor, synchronous motors, universal motors, stepper motors and reluctance motor

Module -3
Speed Control and Starting: Speed control of D.C. motors – three phase induction motors – starting methods of D.C. motor and three phase induction motor – electrical braking – simple problems

Module -4
Electrical Drives: Type of Electrical Drives – Selection & factors influencing the selection – heating and cooling curves –loading condition and classes of duty – determination of power rating – simple problems

Module -5
Solid State Drives (Qualitative Treatment Only): Advantages of solid state drives – D.C. motor control using rectifiers and choppers – control of induction motor by V, V/f and slip power recovery scheme using inverters and A.C. power regulators

Course Outcomes: After studying this course, students will be able to:
1. Formulate and analyze the basic construction, working principle and characteristics of various electrical machines.
2. Evaluate the performance characteristics of motor drives for mechanical load requirements to design torque, speed and position controller in an energy efficient manner
3. Describe the various electrical drives with basic structure, operation and characteristics.
4. Analyze the structure of electric drive systems and their role in various applications and requirements placed by mechanical systems on electric drives.
5. Illustrate the basic concepts of solid-state drives in controlling of DC motor and induction motors.
6. Design and install electrical machines and drives in an industrial environment.

Question Paper Pattern
- The question paper will have TEN questions.
- Each full question carry 16 marks

- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. Vukosavic, "Digital Control of Electrical Drives", Springer, Indian Reprint, 2010.
2. Vedam Subrahmanyam. "Electric Drives: Concepts and Applications", Tata McGraw Hill, New Delhi, 2007.
3. N.K.De and P. K. Sen, "Electric Drives", Prentice Hall India Pvt. Limited 2002.

Reference Books:
1. Crowder, "Electric Drives and Electromechanical Systems", Elsevier, Indian Reprint, 2009
2. Dubey G.K. "Fundamental Electrical Drives" 2nd Edition, Narosa Publications, 2002
3. Bhattacharya S.K. & Brinjinder Singh , "Control of Electrical Machines", New Age International Publishers, 2002

B.E. Electronics and Instrumentation Engineering (EI)			
Choice Based Credit System (CBCS)			
Semester - VI			
Mobile Communication			
(Common to EI, BM &ML)			
Subject Code	: **17EI/BM/ML661**	CIE Marks	: 40
Number of Lecture Hours /Week	: 03	SEE Marks	: 60
Total Number of Lecture Hours	: 40	Exam Hours	: 03
Credits – 3 (Each module – 8 Hours)			

Module -1
Wireless Transmission: Frequencies for radio transmission, signals, antennas, signal propagation, multiplexing, spread spectrum.
Medium Access Control: Motivation for a specialized MAC, SDMA, FDMA, TDMA, fixed TDM, Reservation TDMA, multiple access with collision avoidance, polling, inhibit sense multiple access, CDMA.

Module -2
Telecommunications Systems: GSM, mobile services, system architecture, radio interface, protocols, localization and calling, handover, security, new data services, DECT, system architecture TETRA, UMTS system architecture, UTRAN, core network.

Module -3
Satellite Systems: Basics GEO, LEO, MEO, Routing, localization, handover.
Broadcast Systems: Cyclic repetition of data, digital audio broadcasting, digital video broadcasting, convergence of broadcasting and mobile communications.

Module -4
Wireless LAN: Infrared Vs radio transmission, infrastructure and ad-hoc Network, IEEE802.11-, system architecture, protocol architecture, HiperLAN2, Blue tooth. Dynamic host configuration, protocol, mobile ad-hoc networks Routing, destination sequence distance vector, Dynamic source routing, alternative metrics.

Module -5
Mobile Network Layer: Mobile IP, Goals, assumptions and requirements, entities and terminology, IP packet delivery, agent discovery, registration, tunneling and encapsulation, optimizations, reverse tunneling,PIV6 343, IP micro- mobility support.
Mobile Transport Layer: Traditional TCP, Congestion control, slow start, fast retransmit/ fast recovery, implications of mobility, Classical TCP in improvements, indirect TCP, Snooping, mobile, Fast retransmit/ fast recovery, Transmission/time-out freezing, selective retransmission, Transaction-oriented TCP, TCP over 2.5/3G wireless networks.

Course Outcomes: After studying this course, students will be able to:
1. Explain the basics of radio frequencies and their transmission, and distinguish the process of accessing the medium for wireless communication
2. Recognize and analyze various telecommunication systems such as DECT, 2G and 3G technologies.

3. Describe the working of satellites and broadcasting system.
4. Discuss the issues involved in different ad-hoc routing and networking.
5. Explain wireless communication standards, network devices and their functions within a network.
6. Apply the techniques for transmitting the data packet through Network/TCP layer of ISO/OSI model.
7. Demonstrate the implementation of simple mobile communication system.

Question Paper Pattern
- The question paper will have TEN questions.
- Each full question carry 16 marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. Mobile Communications-Jochen Schiler, 2nd Edition, Addison-Wesley Publications, Imprint Pearson Education, 2003.

Reference Books:
1. Mobile Communications engineering, Theory and applications- 2nd Edition, WILLIM C Y. LEE, McGraw-Hill, 1997, Singapore.
2. Introduction to Wireless and Mobile Systems-Second edition, Dharma Prakash Agarwal, Qing An Zeng, 2nd Edition, Thomson,2007.
3. Electronic Communications systems Fundamentals through Advanced-5th Edition, Wayne Tomasi, Pearson education 2007.

B.E. Electronics and Instrumentation Engineering (EI)			
Choice Based Credit System (CBCS)			
Semester - VI			
MEMS and NEMS			
Subject Code	:**17EI662**	CIE Marks	: 40
Number of Lecture Hours /Week	: 03	SEE Marks	: 60
Total Number of Lecture Hours	: 40	Exam Hours	: 03
Credits – 3 (Each module – 08Hours)			

Module -1
Introduction: Design of MEMS & NEMS, Biological & Biosystems analogies, overview & applications of nano & micro electromechanical systems, systems, devices & structures definition, micro-fabrication, synergetic paradigms in MEMS, architectures of MEMS & NEMS.

Module -2
Fundamentals of MEMS Fabrication: Basic processes, microfabrication & micromachining of ICs, microstructures & microdevices, MEMS Fabrication Technologies – bulk, surface, LIGA.

Module -3
Devising andSynthesis of MEMS & NEMS: MEMS Motion microdevices classifier & synthesis, nano-electromechanical systems.

Module -4
Modeling of MEMS & NEMS: Introduction to modeling, analysis & simulation, electromagnetic and its application for MEMS & NEMS, Induction micromachines.

Module -5
Modeling of MEMS & NEMS (continued): Synchronous microtransducers, microscale permanent-magnet Stepper Micromotors, Piezotransducers.

Course Outcomes: After studying this course, students will be able to:
1. Explain the operation of micro devices, micro systems and their applications
2. Discuss in-depth the MEMS and NEMS architectures.
3. Apply the knowledge in micro-fabrication processes
4. Recognize the basic approaches involved in the various sensor and actuator designs
5. Model, simulate and analyze micro-transducers and micro-motors of a typical MEMS/NEMS.

Question Paper Pattern
- The question paper will have TEN questions.
- Each full question carry 16 marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. Sergey Edward Lyshevski, "MEMS and NEMS: Systems, Devices, and Structures (Nano- and

Microscience, Engineering, Technology and Medicine)" CRC Press; 1st Edition, 2002
Reference Books: 1. Tai-Ran Hsu, "MEMS And Microsystems: Design And Manufacture", McGraw Hill Education; 1 edition (1 July 2017)   2. James J. Allen, "Micro Electro Mechanical System Design", CRC Press; 1 edition (8 July 2005)

B.E. Electronics and Instrumentation Engineering (EI)				
Choice Based Credit System (CBCS)				
Semester - VI				
Embedded System Design and Programming				
(Common to EI, BM & ML)				
Subject Code	**:17EI/BM/ML663**		CIE Marks	: 40
Number of Lecture Hours /Week	: 03		SEE Marks	: 60
Total Number of Lecture Hours	: 40		Exam Hours	: 03
Credits – 3 (Each module – 08Hours)				

Module -1
Introduction: An Embedded System, Characteristics and Constraints of an Embedded system, Processor embedded into a system, Embedded Hardware units and devices in a system, Software embedded in a system, Design metrics, examples of embedded system.

Module -2
Embedded Microcontroller Core and Architecture: 6051 micro controller; Architecture; Instruction sets; Assembly language programming. Timer / counter programming, Serial Communication; Interrupts.

Module -3
Processor and Memory Organization: Structural Units in a Processor; Memory Devices, Memory selection for an embedded system, Processor selection, Direct Memory Access, DMA controllers.

Module -4
Interrupt Servicing (Handling) Mechanism: Context and the periods for context switching; Deadline and interrupt latency. Language Features: Parameter passing, Recursion, Dynamic allocation, Typing, exception handling, abstract data typing, modularity.

Module -5
Real Time Kernels: Real Time and Embedded Operating Systems; Interrupt Routines in RTOS environment; co routines, Interrupt driven systems, Foreground/background systems, Full-featured Real Time Operating Systems.
Real Time Specifications and Design Technique: Mathematical specifications, flow charts, structure charts, Finite state automata, data flow diagrams, Petri Nets, WarnierQrr Notation.

Course Outcomes: After studying this course, students will be able to:
1. Explain different embedded systems and their design metrics.
2. Discuss the 8051 microcontroller architecture and instruction set
3. Write ALP for implementation of mathematical and logical operations.
4. Illustrate accessing I/O devices, direct memory access, buses, and interface circuits.
5. Evaluate interrupt latency, context switching and different interrupt handling mechanisms.
6. Design an embedded system based on real-time specifications.

Question Paper Pattern
- The question paper will have TEN questions.
- Each full question carry 16 marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.

- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. Embedded Systems: Architecture, Programming and Design-Rajkamal; Tata McGraw Hill Publications, 2003.
2. Real–Time Systems Design and Analysis-Phillip A. Laplante, 3rd Edition, Apr 2004. Wiley-IEEE Press.

Reference Books:
1. Real Time Systems- C.M. Krishna, Kang G.Shin McGraw-Hill, 1997.
2. An Embedded software primer-David E Simon; Addison Wesley; 2000.
3. Embedded Real Time system-Concepts, Design and Programming, Dr. K. V. K. K. Prasad Dream Tech Pres, New Delhi 2003.

B.E. Electronics and Instrumentation Engineering (EI) Choice Based Credit System (CBCS) Semester - VI
Statistics and Numerical Methods **(Common to EI&BM)**
Subject Code	: **17EI/BM664**		CIE Marks	: 40
Number of Lecture Hours /Week	: 03		SEE Marks	: 60
Total Number of Lecture Hours	: 40		Exam Hours	: 03
Credits – 3 (Each module – 08 Hours)

Module -1 :
Testing of Hypothesis- Large sample test based on Normal distribution for single mean and difference of means - Tests based on t, Students t-test, statistical significance '*p*' value, lamba^2 and F distributions for testing means and variances – Contingency table (Test for Independency) – Goodness of fit.

Module -2:
Design of Experiments- One way and two way classifications - Completely randomized design – Randomized block design – Latin square design - 22 factorial design.

Module -3:
Solution of Equations and Eigenvalue Problems- Newton Raphson method – Gauss elimination method – pivoting – Gauss Jordan methods – Iterative methods of Gauss Jacobi and Gauss Seidel – Matrix inversion by Gauss Jordan method – Eigen values of a matrix by power method.

Module -4:
Interpolation, Numerical Differentiation and Numerical Integration- Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Approximation of derivatives using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules.

Module -5:
Numerical Solution of Ordinary Differential Equations- Taylor's series method – Euler's method – Modified Euler's method – Fourth order Runge-Kutta method for solving first order equations – Milne's predictor corrector methods for solving first order equations – Finite difference methods for solving second order equations.

Course Outcomes: After studying this course, students will be able to:
1. Perform hypothesis testing.
2. Apply completely randomized design for the experimental data classification.
3. Develop and implement iterative methods to solve algebraic and transcendental equations, simultaneous linear equations, and ordinary differential equations.
4. Apply the knowledge of finite differences, interpolation, numerical differentiation and numerical integration to different area.
5. Apply statistical and numerical methods for the analysis of simple and complex signals/data related to projects, research and real world problems.

Question Paper Pattern

- The question paper will have TEN questions.
- Each full question carry 16 marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. R.A. Johnson and C.B. Gupta, "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 7th Edition, 2007.
2. Grewal B. S. and Grewal J. S., "Numerical methods in Engineering and Science", 6th Edition, Khanna Publishers, New Delhi, 2004.

Reference Books:
1. R.E. Walpole, R.H. Myers, S.L. Myers, and K Ye, "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia , 8th Edition, 2007.
2. M.R. Spiegel, J. Schiller and R.A. Srinivasan, "Schaum's Outlines Probability and Statistics", Tata McGraw Hill edition, 2004.
3. Chapra S. C and Canale, R. P, "Numerical Methods for Engineers", 5th Edition, Tata McGraw-Hill, New Delhi, 2007.
4. Gerald, C. F. and Wheatley, P. O., "Applied Numerical Analysis", 6th Edition, Pearson Education Asia, New Delhi, 2006.

B.E. Electronics and Instrumentation Engineering (EI)			
Choice Based Credit System (CBCS)			
Semester - VI			
Power Electronics, Controls and Communication Lab			
Subject Code	: **17EIL67**	CIE Marks	: 40
Teaching Hours/Week	: 03	SEE Marks	: 60
Total No. of Practical Hours	: 42	Exam Hours	: 03
Credits:02			

1. Static VI characteristics of SCR.

2. Static VI characteristics of Triac. (First and Third mode only).

3. Controlled half wave rectifier using R & RC triggering.

4. AC voltage controller using Triac & Diac.

5. Full wave controlled rectifier using one SCR and four diodes.

6. To determine the step response of 1st order system using RC circuit and to measure time constant.

7. To determine the step response of 2nd order system using RLC circuit and to determine Time domain specifications for under damped and critically damped conditions. Verification using theoretically calculated values.

8. To study the frequency response of Lag, Lead and Lag-lead Network.

9. To determine the response of P, PI and PID controller for step input.

10. Stability analysis of a given Transfer Function based on Bode plot / Root locus / Nyquist plots using Matlab / LabVIEW codes.

11. To design and test tuned amplifier using BJT/FET/ MOSFET.

12. Amplitude modulation using transistor/FET/ MOSFET(Generation and detection).

13. Frequency modulation using IC 8038/2206 and demodulation.

14. ASK &FSK: Generation and Detection.

Course Outcomes: After the completion of this Laboratory course, students will be able to:
1. Recognize and demonstrate functioning of semiconductor power devices.
2. Evaluate the characteristics,switching, power conversion and control by semiconductor power devices.
3. Design and analyze 1st and 2nd order control system, compensators and controllers, and evaluate stability of a system.
4. Design and verify the frequency tuning, AM and FM circuits used in communication systems.
5. Apply the concepts to build power electronic circuits, control and communication systems

Conduct of Practical Examination:
- All laboratory experiments are to be included for practical examination.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and 17% Marks allotted to the procedure part to be made zero.

B.E. Electronics and Instrumentation Engineering (EI)			
Choice Based Credit System (CBCS)			
Semester - VI			
OOPs with C++ Lab			
(Common to EI, BM & ML)			
Subject Code	: **17EI/BM/MLL68**	CIE Marks	: 40
Teaching Hours/Week	:03	SEE Marks	: 60
Total No. of Practical hours	:42	Exam Hours	: 03
Credit-2			

1) Write a C++ program to swap two Variables or Numbers by both call by value & call by reference.

2) Write a program to find largest, smallest & second largest of three numbers using inline functions MAX & Min.

3) Write a C++ program to calculate the volume of different geometric shapes like cube, cylinder and sphere using function overloading concept.

4) Design, develop and execute a program in C++ based on the following requirements: An EMPLOYEE class containing data members & members functions:
   i) Data members: employee number (an integer), Employee_ Name (a string of characters), Basic_ Salary (in integer), All_ Allowances (an integer), Net_Salary (an integer).
   (ii) Member functions: To read the data of an employee, to calculate Net_Salary& to print the values of all the data members. (All_Allowances = 123% of Basic, Income Tax (IT) =30% of gross salary (=basic_ Salary_All_Allowances_IT).

5) Define a STUDENT class with USN, Name & Marks in 3 tests of a subject. Declare an array of 10 STUDENT objects. Using appropriate functions, find the average of the two better marks for each student. Print the USN, Name & the average marks of all the students.

6) Create a class for counting the numbers of objects created and destroyed within various block using constructors & destructors.

7) Write a C++ program to create class called MATRIX using two-dimensional array of integers, by overloading the operator == which checks the compatibility of two matrices to be added and subtracted. Perform the addition and subtraction by overloading + and − operators respectively. Display the results by overloading the operator <<. If (m1 == m2) then m3=m1 + m2 and m4 = m1 −m2 else display error.

8) Demonstrate simple inheritance concept by creating a base class FATHER with data members: First Name, Sur name, DOB & bank Balance & creating a derived class SON, which inherits: Surname & Bank Balance feature from base class but provides its own feature: First Name & DOB. Create& initialize F1 & S1 objects with appropriate constructors & display the Father & Son details.

9) Write a C++ program with different class related through multiple inheritance& demonstrate the use of different access specified by means of members variables & members functions.

10) Write a C++ program to create three objects for a class named count object with data members such as roll_no& Name. Create a members function set_data ( ) for setting the data values & display ( ) member function to display which object has invoked it using 'this' pointer.

11) Write a C++ program to explain virtual function (Polymorphism) by creating a base class polygon which has virtual function areas Two classes rectangle & triangle derived from polygon & they have area to calculate & return the area of rectangle & Triangle respectively.

12) Write a program to define class name FATHER& SON that holds the income respectively calculate & display total income of a family using Friend function.

13) Write a program to accept the student detail such as name & 3 different marks by get_data ( ) method & display the name & average of marks using display ( ) method. Define a friend function for calculating the average marks using the method mark_avg ( ).
14) Write a programme to implement exception handling with minimum 5 exceptions classes including two built in exceptions.

Note: Additional C++ programs depicting / demonstrating high-end concepts and applications may be given as assignments.

Course Outcome: After the completion of this Laboratory course, students will be able to:
1. Write C++ program to solve simple and complex problems
2. Apply and implement major object oriented concepts like message passing, function overloading, operator overloading and inheritance to solve real-world problems
3. Use major C++ features such as Templates for data type independent designs and File I/O to deal with large data set.
4. Analyze, design and develop solutions to real-world problems applying OOP concepts of C++

Conduct of Practical Examination:
- All laboratory experiments are to be included for practical examination.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
- Change of experiment is allowed only once and 17% Marks allotted to the procedure part to be made zero.

7th SEMESTER

B.E. Electronics and Instrumentation Engineering (EI)				
Choice Based Credit System (CBCS)				
Semester - VII				

Automation in Process Control

Subject Code	: 17EI71		CIE Marks	: 40
Number of Lecture Hours /Week	: 04		SEE Marks	: 60
Total Number of Lecture Hours	: 50		Exam Hours	: 03

Credits – 4 (Each module – 10 Hours)

Module -1
Introduction to Programmable Logic Controllers (PLC): The digital concept, Analog signals, The input status file, the output status file, input and output status file, sixteen point I/O modules, PLC addressing, PLC memory.
Input modules: Discrete input modules, Discrete AC and DC input modules
Output modules : Discrete output modules, solid-state output module switching, relay output modules

Module-2
PLC Instructions: What is logic?, PLC programming languages, ladder programming- Conventional ladder Vs PLC ladder, the basic relay instructions: Normally open and normally closed, output and latching instructions, series and parallel function of AND, OR, NOT, XOR logic, Analysis of rung. Understanding relay instructions and the PLC input modules, interfacing start stop pushbutton and motor to PLC, developing ladder diagrams with analytical problems.

Module -3
Timers and Counter Instructions: Timer addressing, On delay, off delay and retentive timer instructions and associated status bits. Counter addressing, PLC counter up and down instructions and associated status bits.
Data Handling Instructions: Data handling instructions-MOVE, Masked Move, COPY. Sequencer instructions: Programming sequence output instructions, developing ladder diagram with analytical.

Module -4
Distributed Digital Control: Introduction, History, Functional requirements of Distributed Process Control System, System Architecture, Distributed Control Systems, Configuration, Some popular Distributed Control Systems, Fieldbus System
Text 2: **Ch.7; 7.1 To 7.8**

Module -5
Supervisory Control and data Acquisition System: Basic Functions: Channel Scanning, conversion to Engineering units, Data Processing, Distributed SCADA System, Remote Terminal Unit, Reliable System Development Strategy.
Modeling and Simulation for Plant Automation: Introduction, Overview of Process Models, Model Based Automatic Control, System Modeling, uses of systems simulation, How to build the mathematical model of a plant, Model evaluation & improvement, Modern tools for modeling and simulation of systems.
Text 2: **Ch.3**; 3.6,3.7, 3.8 (3.8.1- 3.8.7), and **Ch.11;** 11.1,11.2,11.3,11.5,11.6,11.7,11.8,11.9

Course Outcomes: After studying this course, students will be able to:
   1. Describe architecture, functioning and applications of PLC in automation.

2. Recognize various I/O modules of PLC and apply programming concepts to interface peripherals.
3. Write ladder diagram program using different PLC instruction sets
4. Develop an automation system based on PLC ladder diagram program.
5. Analyze the basics of distributed control system and communication protocols used in automation industries.
6. Develop process automation system using SCADA and DSC.
7. Develop models of process automation using modern tools.

Question Paper Pattern
- The question paper will have TEN questions.
- Each full question carry 16 marks.
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. Introduction to Programmable Logic Controllers, Garry Dunning, 3nd edition, Centage Learning. (Modules: 1, 2 & 3).
2. Computer based Industrial Control, Krishna Kant, 2nd edition, PHI, 2017 (Modules: 4&5)

Reference Books:
1. F.D. Petruzella, Programmable Logic Controllers, Tata Mc-Graw Hill, Third edition, 2010
2. T.A. Hughes, Programmable Controllers, Fourth edition, ISA press, 2005
3. Clarke, G., Reynders, D. and Wright, E., "Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems", Newnes, 1st Edition, 2004

B.E. Electronics and Instrumentation Engineering (EI)				
Choice Based Credit System (CBCS)				
Semester - VII				
Digital Image Processing				
Subject Code	: **17EI72**		CIE Marks	: 40
Number of Lecture Hours /Week	:04		SEE Marks	: 60
Total Number of Lecture Hours	: 50		Exam Hours	: 03
Credits – 4 (Each module – 10 Hours)				

Module -1
Introduction: Background, Examples of fields that use DIP, Fundamental steps in Digital Image Processing (DIP), Components of DIP system, Image sensing and acquisition, A simple image formation model, Image sampling and quantization. Basic relationship between pixels, Color image processing fundamentals and models.
Text: Chapter 1, 2.3, 2.4, .2.5

Module -2
Image Enhancement in Spatial Domain: Background, Point processing – Image negatives, Log transformations, Power law transformations, Contrast stretching, Intensity level slicing, Bit plane slicing, Histogram processing – Histogram equalization, Histogram matching (specification), Arithmetic/Logic operations. Fundamentals of spatial filtering, Smoothing spatial filters, Sharpening spatial filters
Text: 3.1, 3.2, 3.3, 2.6.1, 2.6.2, 2.6.3, 2.6.4, 3.4, 3.5, 3.6

Module -3
Image Enhancement In Frequency Domain: Background, 2D-Discrete Fourier Transform and its inverse, Basic properties of the 2D-Discrete Fourier Transform, Basics of filtering in the frequency domain.
Image smoothing using frequency domain filters: Ideal low pass filters, Butterworth low-pass filters, Gaussian low-pass filters; Image sharpening using frequency domain filters, Ideal high-pass filters, Butterworth high-pass filters, Gaussian high-pass filters, Homomorphic filtering.
Text: 4.1, 4.2, 4.5.5, 4.6, 4.7,4.8, 4.9

Module -4
Image Restoration: Model of the Image degradation/restoration process, Noise models, Restoration using spatial filtering: Mean filters, Order statistic filters - Median filter, Min and Max filters, Midpoint filter.
Image Compression: Fundamentals, Image compression models, Basic compression methods – Huffman coding, Arithmetic coding, LZW coding, Run-length coding.
Text: 5.1, 5.2, 5.3.1, 5.3.2, 8.1, 8.2.1, 8.2.3, 8.2.4, 8.2.5

Module -5
Image Segmentation: Fundamentals, Point detection, Line detection, Edge models, Edge detection, Canny edge detector.
Thresholding, Region based segmentation.
Text: 10.1, 10.2.1 – 10.2.6, 10.3, 10.4

Course Outcomes: After studying this course, students will be able to:
    1. Describe the fundamentals of Image Processing and Image transform techniques.

2. Apply image enhancement technique in frequency and spatial domain
3. Analyze and implement restoration and color models.
4. Develop and analyze image compression techniques.
5. Apply segmentation algorithms for general image.
6. Develop image processing algorithms for real-world problems.

Question Paper Pattern
- The question paper will have TEN questions
- Each full question carry 16 marks.
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. Digital Image Processing - Rafael. C. Gonzalez and Richard. E. Woods, Third Edition, Pearson Education, 2008.

Reference Books:
1. Fundamentals of Digital Image Processing - Anil K. Jain, 5th Indian Print, PHI, 2002.
2. Digital Image Processing and Computer Vision - Milan Sonka, India Edition, Cengage Learning.

B.E. Electronics and Instrumentation Engineering (EI) Choice Based Credit System (CBCS) Semester - VII				
ARM Processor (Common to EI, BM & ML)				
Subject Code	: **17EI/BM/ML73**		CIE Marks	: 40
Number of Lecture Hours /Week	: 04		SEE Marks	: 60
Total Number of Lecture Hours	: 50		Exam Hours	: 03
Credits – 4 (Each module – 10 Hours)				

Module -1

ARM Embedded Systems

Introduction, RISC design philosophy, ARM design philosophy, Embedded system hardware - AMBA bus protocol, ARM bus technology, Memory, Peripherals, Embedded system software – Initialization (BOOT) code, Operating System, Applications.

ARM Processor Fundamentals

ARM core dataflow model, registers, current program status register, Pipeline, Exceptions, Interrupts and Vector Table, Core extensions.

Module -2

Introduction to the ARM Instruction set:

Introduction, Data processing instructions, Load - Store instruction, Software interrupt instructions, Program status register instructions, Loading constants, ARMv5E extensions, Conditional Execution.

Module -3

Introduction to the THUMB instruction set:

Introduction, THUMB register usage, ARM – THUMB interworking, Other branch instructions, Data processing instructions, Stack instructions, Software interrupt instructions.

Efficient C Programming:

Overview of C Compilers and optimization, Basic C Data types, C looping structures.

Module -4

Exception and Interrupt Handling:

Exception Handling-ARM Processor Exceptions and Modes, Vector Table, Exception Priorities, Link Register Offset, Interrupts- Interrupt Latency, Basic Interrupt Stack design and implementation, Interrupt Handling Scheme- Non nested Interrupt Handler, Nested Interrupt Handler, Reentrant Interrupt Handler, Prioritized Simple Interrupt Handler, Prioritized Standard Interrupt Handler, Prioritized Direct Interrupt Handler, Prioritized Grouped Interrupt Handler.

Embedded Operating Systems:

Fundamental Components, SLOS Directory Layout, Memory Interrupts and Exceptions handling, scheduler, Context Switch, Device Driver Framework.

Module -5

CACHES:

The memory Hierarchy and caches memory-caches and memory management units, Cache Architecture-basic architecture of caches memory, basic operation of cache controller, the relationship between cache and main memory.

Memory Management Units:

Moving from an MPU to an MMU, Virtual memory Working-Defining regions using pagers,

multitasking and the MMU, Memory organization in a virtual memory system, page tables Translational look aside buffer.

Note: Two or four tutorial classes need to be conducted (in a semester) to discuss the Embedded ARM Applications, such as GSM Chip and Bluetooth controller & assignment should be based on applications only.

Course Outcomes: After studying this course, students will be able to:
1. Depict the organization, architecture, bus technology, memory and operation of the ARM microprocessors
2. Employ the knowledge of Instruction set of ARM processors to develop basic Assembly Language Programs
3. Recognize the importance of the Thumb mode of operation of ARM processors and develop C programs for ARM processors
4. Describe the techniques involved in Exception and Interrupt handling in ARM Processors and understand the fundamental concepts of Embedded Operating Systems
5. Develop embedded C programs to interact with Built in Peripherals
6. Design, analyze and write programs using RTOS (MicroC/OS) on ARM based development boards.

Question Paper Pattern
- The Question paper will have TEN questions
- Each full question carry 16 marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. Andrew N Sloss, Dominic System and Chris Wright," ARM System Developers Guide", Elsevier, Morgan Kaufman publisher, 1st Edition, 2008/,ISBN:1758608745.

Reference Books:
1. David Seal, "ARM Architecture Reference Manual", Addison- Wesley, 2nd Edition, 2009, ISBN:978-0201737196.
2. Furber S, "ARM System on chip Architecture", Addison Wiley, 2nd Edition 2008, ISBN:978-0201675191
3. Rajkam, "Embedded System", Tata McGraw-Hill Publishers, 2nd Edition, 2008, ISBN: 0070494703.

B.E. Electronics and Instrumentation Engineering (EI) Choice Based Credit System (CBCS) **Semester - VII**				
Smart Sensors and Intelligent Instrumentation				
Subject Code	: **17EI741**		CIE Marks	: 40
Number of Lecture Hours /Week	: 03		SEE Marks	: 60
Total Number of Lecture Hours	: 40		Exam Hours	: 03
Credits – 3 (Each module – 08 Hours)				

Module -1

Basics of smart sensors and micromachining: Introduction, Mechanical-Electronic transitions in sensing, nature of sensors, overview of smart sensing and control systems, integration of micromachining and microelectronics, introduction to micromachining, bulk micromachining, wafer bonding, surface micromachining, other micromachining techniques.

Module -2

MCUs and DSPs for sensor: Introduction, MCU control, MCUs for sensor interface, DSP control, Software, tools and support, sensor integration.

Module -3

Sensor Communication and MEMS: Wireless zone sensing, surface acoustical wave devices, intelligent transportation system, RF-ID, Micro optics, micro-grippers, micro-probes, micro- mirrors, FEDs, communications for smart sensors - sources and standards, automotive protocols, industrial networks, office and building automation, home automation, protocols in silicon, other aspects of network communications.

Module -4

Packaging, Testing and Reliability of Smart Sensors: Introduction, Semiconductor packaging applied to sensors, hybrid packaging, packaging for monolithic sensors, reliability implications, testing smart sensors. Unit Standards for Smart Sensors: Introduction, setting the standards for smart sensors and systems, IEEE 1451.1, IEEE 1451.2, IEEE P1451.3, IEEE 1451.4, extending the systems to network.

Module -5

Implications of Smart Sensor Standards and Recent Trends: Introduction, sensor plug-and-play, communicating sensor data via existing wiring, automated/remote sensing and web, process control over the internet, alternative standards, HVAC sensor chip, MCU with integrated pressure sensors, alternative views of smart sensing, smart loop.

Course Outcomes: After studying this course, students will be able to:
1. Describe the principle of smart sensors and process of micromachining in development of smart sensors.
2. Develop intelligent systems by interfacing the smart sensors to MCUs and DSPs.
3. Analyze the use of smart sensors in communication, MEMS and automation.
4. Evaluate the standards of smart sensors by the assessment of reliability testing and packaging.
5. Discuss the applications of smart sensors in different fields and recent development.
6. Develop/sketch the simple models of intelligent instrumentation.

Question Paper Pattern
- The question paper will have TEN questions.
- Each full question carry 16 marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. Understanding Smart Sensors- Randy Frank, 2nd Edition. Artech House Publications, 2013.

Reference Books:
1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalakrishnan, K. N. Bhat, V. K. Aatre, Micro and Smart Systems: Technology and modeling, Willey Publications,2012.

B.E. Electronics and Instrumentation Engineering (EI) Choice Based Credit System (CBCS) **Semester - VII**
Biomedical Signal Processing
Subject Code	: **17EI742**		CIE Marks	: 40
Number of Lecture Hours /Week	: 03		SEE Marks	: 60
Total Number of Lecture Hours	: 40		Exam Hours	: 03
Credits – 3 (Each module – 08 Hours)

Module -1

Introduction: The nature of biomedical signals, objectives of biomedical signal analysis, difficulties encountered in biomedical signal analysis, Computer aided diagnosis. **Text-1: 1.1, 1.3, 1.4, 1.5**
Neurological Signal processing: Brain and its potentials, Electrophysiological origin of Brain waves, EEG signal and its characteristics, EEG analysis, Linear prediction theory, Autoregressive (AR) method, Recursive Estimation of AR parameters, Spectral error measure, Adaptive segmentation.
Text-2: 4.1 to 4.9

Module -2

Filtering for Artifacts Removal : Random noise, structured noise and physiological interference, stationary versus non-stationary processes, typical case study, time domain filters with application: Synchronized averaging, moving-average filters.
Frequency domain filters with examples, removal of high frequency noise by Butterworth low pass filters, removal of low frequency noise by Butterworth high pass filter, removal of periodic artifacts by notch and comb filters. Weiner filter
Text-1: 3.1, 3.1.1, 3.1.2, 3.3, 3.3.1, 3.3.2, 3.3.3, 3.4, 3.4.1, 3.4.2, 3.4.3, 3.5.

Module-3

Basics of signal averaging, Signal averaging as a digital filter, A typical average, Software for signal averaging, Limitations of signal averaging.
Text-3: 9.1 to 9.5
Data Acquisition and classification of sleep stages, The Markov model and Markov chains, Dynamics of Sleep-wave Transitions, Hypnogram Model Parameters.
Text-2: 5.1 to 5.4

Module -4

ECG Parameters and their estimation, A review of wiener filtering problem, Principle of an adaptive filter, the steepest descent algorithm, Adoptive noise canceller, Cancellation 60Hz Interference in ECG, Cancelling Donor heart Interference in Heart-transplant ECG, Cancellation of Electrocardiographic signals from the electrical activity of chest muscles, Cancelling of maternal ECG in Fetal ECG, Cancellation of higher frequency noise in electro-surgery.
Text-2: 7.4, 6.1, 6.2, 6.3, 6.5, 6.6.

Module -5

Direct data compression techniques, Direct ECG data compression techniques, Transformation compression techniques, Other data compression techniques, Data compression techniques comparison.
Text-2: 8.1 to 8.5

Course Outcomes: After studying this course, students will be able to:

1. Discuss the origin, nature and characteristics of biomedical signals.
2. Identify the noise and artifacts in biomedical signals and apply suitable filters remove.
3. Apply the signal averaging technique.
4. Evaluate various event detection techniques for the analysis of the EEG and ECG.
5. Apply differentdata compression techniques on biomedical Signals.
6. Develop algorithms to process and analyze biomedical signals for better diagnosis.

Question Paper Pattern
- The question paper will have TEN questions.
- Each full question carry 16 marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. Biomedical signal analysis- A case study approach, RangayyanRangaraj, Wiley Interscience (IEEE Press)-2005
2. Biomedical Signal Processing- principles and techniques, Tata McGraw-Hill, D.C.Reddy, 2005
3. Biomedical Digital Signal Processing-Willis J.Tompkins, PHI,

Reference Books:
1. Biomedical Signal Processing -Akay M, , Academic: Press 1994.
2. Biomedical Signal Processing -Cohen.A, -Vol. I Time & Frequency Analysis, CRC Press, 1986.

B.E. Electronics and Instrumentation Engineering (EI)				
Choice Based Credit System (CBCS)				
Semester - VII				
Computer Communication Networks				
Subject Code	: **17EI743**		CIE Marks	: 40
Number of Lecture Hours /Week	: 03		SEE Marks	: 60
Total Number of Lecture Hours	: 40		Exam Hours	: 03
Credits – 3 (Each module – 08 Hours)				

Module -1
Introduction: Uses of Computer Networks, Network Hardware, Network Software, Reference Models, Example Networks, Network Standardization
The Physical Layer: The Theoretical Basis for Data Communication, Guided Transmission Media, Wireless Transmission, Communication Satellites, The Public Switched Telephone Network,

Module -2
The Data Link Layer: Data Link Layer Design Issues, Error Detection and Correction,
Elementary Data Link Protocols, Sliding Window Protocols, Protocol Verification, Data Link Protocols

Module -3
The Medium Access Control Sub Layer: The Channel Allocation Problem,
Multiple Access Protocols, Ethernet, Wireless LANS Broadband Wireless, Bluetooth

Module -4
The Network Layer: Network Layer Design Issues,
Routing Algorithms, Congestion Control Algorithms and quality of service.

Module -5
The Transport Layer: The Transport Service. A Simple Transport Protocol, The Internet Transport Protocols (TCP and UDP), Performance Issues.
The Application Layer: Domain Name System (DNS), electronic mail, worldwide web.

Course Outcomes: After completion of this course the student is able to:
1. Describe the basic computer network technology.
2. Identify and analyze the different network topologies and protocols.
3. Analyze the different network devices and their functions within a network\
4. Apply the knowledge in the establishing computer based networks in real world problems.

Question Paper Pattern
- The question paper will have TEN questions.
- Each full question carry 16 marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
   1. Computer Networks: Andrews S. Tanenbaum, 4th Edition, Pearson Education, 2010.

Reference Books:
   1. ATM Networks concepts and Protocols – SumitKasera, Tata McGraw Hill 2nd edition, 2008
   2. Data and computer networks- W STALLINGS 5th Edition, Prentice Hall of India 1998.

B.E. Electronics and Instrumentation Engineering (EI)			
Choice Based Credit System (CBCS)			
Semester - VII			
Real Time Operating Systems			
Subject Code	: **17EI744**	CIE Marks	: 40
Number of Lecture Hours /Week	: 03	SEE Marks	: 60
Total Number of Lecture Hours	: 40	Exam Hours	: 03
Credits – 3 (Each module – 08 Hours)			

Module -1

Basic Real Time Concepts- Basic computer architecture: Bus transfer Mechanism, input and output, memory, CPU operation, software concepts, system concepts, real time definition, Event and Determinism, Synchronous and asynchronous events, real time design issues, Examples of real time systems.

Computer Hardware: CPU, addressing modes: implied mode, immediate mode, Direct mode, Indirect mode, register indirect mode, Pipelining.

Module -2

Real- Time Specification and Design Techniques: Flowcharts, Structure charts, Finite state automata, Data flow diagrams, Demarco's rules, Petri nets, Warnier-ORR Notation, State charts, sanity in using graphical techniques.

Module -3

Real -Time Kernels: Introduction, Polled loop with interrupts, Coroutines, Interrupt Driven systems, context switching, Round-Robin system, preemptive priority systems, Major and minor cycles, hybrid systems, foreground /background systems, Real time operation, Full-Featured real- Time operating systems, Task control block model, task management, posix.

Module -4

Inter-task Communication and Synchronization: Buffering Data ring buffers, Mailboxes, mailbox implementation, Queues, critical regions, semaphores, mailboxes and semaphores, counting semaphores, binary semaphores deadlock, avoidance, detect and recover.

Module -5

Real-time Memory management: process stack management, task control block model, managing the stack, multiple stack arrangements, Dynamic allocation, swapping, overlay, MFT, MVT.

System performance analysis and optimization: Response time calculation, polled loops, co routines / phase driven code, interrupt systems, interrupt latency.

CourseOutcome: After completion of this course the student is able to:
1. Describe theoretical and practical concepts, and functioning of operating system.
2. Distinguish a real-time system from other systems
3. Discuss the specifications, design requirements and kernel techniques in development of RTOS.
4. Evaluate real time operating systems based on real time applications with different models.
5. Implement the real-time operating system principles.

Question Paper Pattern

- The question paper will have TEN questions
- Each full question carry 16 marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. Real–Time Systems Design and Analysis–-3rd Edition, Phillip A. Laplante. Apr 2004.
2. Embedded systems architecture, Programming and design-3rdEdition,Raj Kamal. 2017

Reference Books:
1. Real Time Systems- C.M. Krishna, Kang G.Shin McGraw-Hill, 1997.
2. Embedded Real Time system-Concepts, Design and Programming, Dr. K. V. K. K. Prasad, Dream Tech Pres, New Delhi 2003.

B.E. Electronics and Instrumentation Engineering (EI)			
Choice Based Credit System (CBCS)			
Semester - VII			
Distributed Sensor Networks			
Subject Code	: **17EI751**	CIE Marks	: 40
Number of Lecture Hours /Week	: 03	SEE Marks	: 60
Total Number of Lecture Hours	:40	Exam Hours	: 03
Credits – 3 (Each module – 08 Hours)			

Module -1
Introduction: Challenges, Sensor Network Architectures, Sensor Node Deployment**,** Energy-Efficient Information Processing, Data Dissemination, Self-Configuration Methods.

Module -2
Sensor Node Deployment: Sensor Node Detection Models, Virtual Force Algorithm, Virtual Forces, Overlapped Sensor Detection Areas, Energy Constraint on the VFA Algorithm, Procedural Description. VFA Simulation Results. Uncertainty Modeling, Modeling of Non-Deterministic Placement, Uncertainty-Aware Placement Algorithms, Procedural Description, Simulation Results.

Module -3
Energy-Aware Target Localization: Detection, Probability Table, Score-Based Ranking Selection of Sensors to Query, 3Energy Evaluation Model, Primitive Energy Evaluation Model, Refined Energy Evaluation Model, Procedural Description, Simulation Results, Case Study.

Module -4
Energy-Efficient Self-Organization: Introduction, Relevant Prior Outline of SCARE Basic Scheme, Network Partitioning Problem, Details of SCARE.
Energy-Aware Information Dissemination: Introduction, Related Prior Work Location-Aided Flooding, Modified Flooding, Location Information, Virtual Grids, Packet Header Format, LAF Node Types.

Module -5
Optimal Energy Equivalence Routing In Wireless Sensor Networks: Related Work, Networking Characteristics of WSN, WSN Protocol.
Data-Centric Routing and Directed Diffusion: Energy Equivalence Approach, Basics, Neighbor Switching Path, Rerouting EER Algorithms, and Assumptions. Procedures and Functions Formats of Packets.

Course Outcomes: After studying this course, students will be able to:
1. Describe sensor network technologies from three different perspectives: sensing, communication, and computing.
2. Evaluate the concepts on sensor deployment, energy consumption, dissemination and optimization.
3. Analyze the wireless sensor networks (WSN) based on structure, energy and routing techniques.
4. Apply different strategies to choose best packet routing methodology.
5. Formulate and solve problems creatively in the area of WSN

Question Paper Pattern

- The question paper will have TEN questions.
- Each full question carry 16 marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. Scalable Infrastructure for Distributed Sensor Networks-KrishnenduChakrabarty and S. S. Iyengar, Springer 2005, ISBN-10: 1852339519.

Reference Books:
1. Distributed sensor Networks- a Multi-agent perspective, Victorlesser, Charles Oritiz, Tambe, Kluwer Academic Publishing, 2003.
2. Distributed Sensor N/W- By Sundararaja S. Iyengar, Richard R. Brooks, CRC Press.
3. Wireless Sensor networks- Freng Zhao, Leonidas Guibas, Morgan Kaufmann Publishers, New Delhi.

B.E. Electronics and Instrumentation Engineering (EI)			
Choice Based Credit System (CBCS)			
Semester - VII			
Medical Imaging Techniques			
Subject Code	**: 17EI752**	CIE Marks	: 40
Number of Lecture Hours/ Week	: 03	SEE Marks	: 60
Total Number of Lecture Hours	: 40	Exam Hours	: 03
Credits – 3 (Each module – 08 Hours)			

Module-1

X-Ray Imaging: Definition of x-ray, Interactions between X-rays and matter, Intensity of X-ray beam, Attenuation, Generation and Detection of X-rays – X-ray generation, X-ray generators, Filters, Beam restrictors and grids, Intensifying screens, fluorescent screens, and image intensifiers, X-ray detectors.

X-Ray Diagnostic Methods: Conventional X-ray radiography, Fluoroscopy, Angiography, Mammography.

Computed Tomography: Conventional tomography, Computed tomography – Projection function, CT number. Recent developments – Digital radiography, Digital subtraction angiography (DSA). Biological effects of ionizing radiation.

Module-2

Ultrasound Imaging: Definition of ultrasound**,** Fundamentals of acoustic propagation (only theoretical concepts, no derivations) - Reflection and refraction, Attenuation, absorption & scattering, Doppler effect, Generation and detection of Ultrasound-Piezoelectric effect, Ultrasonic transducers, Axial and Lateral resolution.

Ultrasonic Diagnostic Methods: Pulse echo systems- Amplitude mode (A-mode), Brightness mode (B-mode), Motion mode (M-mode). Doppler methods, Duplex imaging, Colour Doppler flow imaging, Biological effects of ultrasound.

Module-3

Radionuclide Imaging: Introduction**,** Fundamentals of Radioactivity: Nuclear particles, Nuclear activity and half-life, Units of measuring nuclear activity, Specific activity, Interaction of nuclear particles and matter, Attenuation of Gamma radiation, Radionuclides, Generation & Detection of Nuclear Emission – Nuclear sources, Radionuclide generators, nuclear radiation detectors, Collimators,

Diagnostic Methods using Radiation Detector Probes: Thyroid function test, Renal function test, Blood volume measurement, Radionuclide imaging systems- Rectilinear scanner, Scintillation camera, SPECT: Principle and working. PET: Principle and working.

Module-4

Basics of Magnetic Resonance Imaging: Fundamentals of nuclear magnetic resonance- Angular momentum, magnetic dipole moment, magnetization, Larmor frequency, Free induction decay (FID), Fourier spectrum of the NMR signal, Relaxation times, Pulse sequences.

Generation and Detection of NMR Signal: Introduction (block diagram and working), Magnet, Imaging Methods- Introduction, slice selection, frequency encoding, phase encoding, Spin-Echo imaging- Gradient echo imaging. Biological effects of magnetic fields-Brief summary of all types of effects.

Module -5

Thermal Imaging & Advances in Medical Imaging

Thermal Imaging: Medical thermography, Physics of thermography, Infrared detectors, Thermographic equipment, Quantitative medical thermography, Pyroelectricvidicon camera. Applications of thermal imaging medicine.

Image Guided Intervention: Introduction, Stereotactic neurosurgery, Stereotactic neurosurgery based on digital image volumes- image acquisition, planning and transfer, Intraoperative Imaging- Intraoperative diagnostic imaging.

Course Outcomes: After studying this course, students will be able to:
1. Describe the fundamentals of x-ray radiography and computed tomography, and analyze the system requirements.
2. Explain principles of ultrasound imaging and diagnostic methods and analyze the system requirements.
3. Discuss the fundamentals of radionuclide imaging, MRI, thermal imaging and analyze the system requirements.
4. Describe the concepts of image Guided Intervention and image guided surgery.
5. Design and develop prototype of simple medical imaging system.

Question Paper Pattern:
- The question paper will have TEN questions
- Each full question carry 16 marks
- TWO full questions will be set (with maximum of THREE sub questions) from each module
- Covering all the topics under that module.
- The students will have to answer FIVE full questions, selecting one full question from each module.

Text Books:
1. Principles of Medical Imaging - by Kirk Shung, Michael B. Smith and BanjaminTsui, Academic Press, 1992.
2. Handbook of Biomedical Instrumentation – by R.S.Khandpur, 2nd Edition, Tata McGraw Hill, 2003.
3. Fundamentals of Medical Imaging - by Paul Suetens, Cambridge University Press, 2002.

B.E. Electronics and Instrumentation Engineering (EI)				
Choice Based Credit System (CBCS)				
Semester - VII				
Virtual Instrumentation				
Subject Code	: **17EI753**		CIE Marks	: 40
Number of Lecture Hours /Week	: 03		SEE Marks	: 60
Total Number of Lecture Hours	:40		Exam Hours	: 03
Credits – 3 (Each module – 08 Hours)				

Module -1

Graphical System Design :Introduction, Graphical system design model, Design flow with GSD , Virtual Instrumentation, Virtual instrument and traditional instrument, Hardware in virtual instrumentation, Virtual instrumentation for Test, control & design, virtual instrumentation in Engineering process, virtual instruments beyond personal computer , Graphical system design using LABVIEW, Graphical programming & textual programming.

Module -2

Introduction To LabView: Introduction, advantages of LABVIEW software environment, palettes, front panel controls & indicators, Block diagram, Data flow program, arranging objects, colour coding, creating sub –VI's.

Repetition And Loops: For loops, while loops, structure tunnels, terminals inside or outside loops, shift registers, feed-back nodes, control timing, communicating among multiple-loops, local variables, Global variables,case structure, formula node.

Module -3

Arrays: Introduction, arrays in LABVIEW, creating one - dimensional array controls, indicators and constants, creating two dimensional arrays, creating multidimensional arrays, initializing array, deleting, inserting, and replacing elements, rows, columns, and pages with in arrays, arrays functions, auto indexing, creating 2-dimensional array using loops.

Module -4

Plotting Data: Types of waveforms, waveform graphs, waveform charts, XY graphs, Intensity graphs & charts, Digital waveform graphs, 3D graphs, customizing graphs & charts, configuring a graph or chart, Displaying special planners on the XY graph.

Module -5

File Input/ Output: File formats, fill I/O functions, path function sample VI's to demonstrate file write &read, generating filenames automatically, String handling: string functions, LABVIEW string formats, examples, parsing of strings.

Instrument Control: Introduction, GPIB communication, Hardware specification, software architecture, Instrument I/O assistant, VISA, Instrument drivers, serial port communications, using other interfaces.

Course Outcomes: After studying this course, students will be able to:
1. Recognize the Graphical system design model and develop programs using the modern tools of Graphical programming & textual programming
2. Develop a virtual instrumentation model using the front panel controls & indicators, block diagram, data flow programs.
3. Analyze, design, create, and delete different array controls, indicators constants with various

functions
4. Evaluate and Design Digital waveform graphs, 3 D graphs, customizing graphs & charts
5. Demonstrate file write & read, generating filenames automatically, String handling: string functions, LABVIEW string formats, examples, parsing of strings
6. Demonstrate Instrument Control, GPIB communication, Hardware specification, software architecture, Instrument I/O assistant, VISA, Instrument drivers, serial port communications, using other interfaces.

Question Paper Pattern
- The question paper will have TEN questions.
- Each full question carry 16 marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. Virtual Instrumentation using LABVIEW- Jovitha Jerome, PHI , 2011
2. Virtual Instrumentation using LABVIEW – Sanjay Gupta, Joseph John, TMH , McGraw Hill Second Edition, 2011.

Reference Books:
1. S. Gupta and J P Gupta, ''PC Interfacing for Data Acquisition and Process Control'', Instrument Society of America, 1994.
2. Robert H. Bishop ''Learning with Lab –View" Prentice Hall, 2009.

B.E. Electronics and Instrumentation Engineering (EI)				
Choice Based Credit System (CBCS)				
Semester - VII				
Big Data and Cloud Computing				
(Common to EI, BM & ML)				
Subject Code	: **17EI/BM/ML754**		CIE Marks	: 40
Number of Lecture Hours /Week	: 03		SEE Marks	: 60
Total Number of Lecture Hours	: 40		Exam Hours	: 03
Credits – 3 (Each module – 08 Hours				

Module -1

Introduction To Big Data:
Characteristics of Data, Evolution of Big Data, Definition of Big Data, Challenges with Big Data, What is Big Data?, Other Characteristics of Data, Why Big Data?, Information?, Traditional Business Intelligence (BI) versus Big Data, A Typical Data Warehouse Environment, A Typical Hadoop Environment, What is New Today?, What is changing in the Realms of Big Data?

Big Data Analytics: What is Big Data Analytics? What Big Data Analytics Isn't? Classification of Analytics, Top Challenges Facing Big Data, Why is Big Data Analytics Important? Data Science, Few Top Analytics Tools.

Module -2

Technologies and Tools For Big Data Analytics:
NoSQL (Not Only SQL), Hadoop.

Module -3

Introduction: Cloud Computing at a Glance, Historical Developments, Building Cloud Computing Environments,
Computing Platforms and Technologies,
Virtualization: Introduction, Characteristics of Virtualized, Environments Taxonomy of Virtualization Techniques, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples.

Module -4

Cloud Computing Architecture: Introduction, Cloud Reference Model, Architecture, Types of Clouds, Economics of the Cloud, Open Challenges,
Aneka: Cloud Application Platform: Framework Overview, Anatomy of the Aneka Container, Building Aneka Clouds,
Cloud Programming and Management.

Module -5

Cloud Platforms In Industry: Amazon Web Services, Google App Engine, Microsoft Azure.
Cloud Applications: ECG Analysis in the Cloud, Satellite Image Processing, Social Networking, Media Applications, Multiplayer Online Gaming.

Course Outcomes: After studying this course, students will be able to:
1. Describe the concepts and technologies of big data analytics.
2. Apply the techniques in handing and analysis of big data.

3. Discuss the concepts and terminologies of cloud computing.
4. Demonstrate cloud frameworks and technologies
5. Describe and apply fine data intensive computing.
6. Demonstrate cloud applications.

Question Paper Pattern
- The question paper will have TEN questions.
- Each full question carry 16 marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. Big Data and Analytics – SeemaAcharya, SubhashiniChellappan Willey India, 2017,ISBN 13 9788126554782
2. Mastering Cloud Computing – RajkumarBuyya, Christian Vecchiola, and ThamaraiSelvi McGraw Hill Education, 2013.

Reference Books:
1. Big Data Analytics with R and Hadoop – VigneshPrajapati, 2013 Packt Publishing.
2. Cloud Computing Bible - Barrie Sosinsky, Wiley-India, 2010.
3. Cloud Computing: A Practical Approach - Toby Velte, Anthony Velte, Robert Elsenpeter, McGraw Hill Professional Publications, 2009. [ISBN: 0071626956].

B.E. Electronics and Instrumentation Engineering (EI)			
Choice Based Credit System (CBCS)			
Semester - VII			
Process Control and Virtual Instrumentation Lab			
Subject Code	**: 17EIL76**	CIE Marks	: 40
Teaching Hours/Week	: 03 (1I+2P)	SEE Marks	: 60
Total No. of Practical hours	: 42	Exam Hours	: 03
Credits – 2			

1. Rig up and test the circuit to display the temperature using RTD/Thermistor with suitable signal conditioning circuit.
2. Rig up and test the circuit to display the temperature using IC AD590 / LM35 with suitable signal conditioning circuit.
3. Rig up and test the circuit to display the load/ strain using load cell/ strain gauge with suitable signal conditioning circuits.
4. Realize Op-amp based Proportional (P), Derivative (D) and Integral (I) analog controller modes.
5. Realize Op-amp based PI and PD composite analog controller modes.
6. Conduct an experiment to perform and analyze PC based temperature/pressure controller. Plot the optimum response of different controller modes for different set-points.
7. Conduct an experiment to perform and analyze PC based level/flow controller. Plot the optimum response of different controller modes for different set-points.
8. Realization of basic gate functions using PLC. The logic should be solved using ladder diagram.
   (i) AND   (ii)OR (iii)NAND(iv) XOR(v)NOR   (vi)Latch and Unlatch of output
9. Study and demonstration of working of different types of Timers and Counters of PLC. The logic should be solved using ladder diagram.
10. Study and demonstration of Bottle Filling Process using PLC. The logic should be solved using ladder diagram.
11. Study and demonstration of Lift/Elevator System using PLC. The logic should be solved using ladder diagram.
12. Conduct an experiment to plot the characteristics of different types process control valves.
13. Basic operations, simple programming structure using LabVIEW.
    (i) Basic arithmetic operations   (ii) Boolean operations
(iii) Sum of 'n' numbers using 'for' loop   (iv) Sorting even numbers using 'while' loop in an array
14. Creation of a CRO using LabVIEW and measurement of frequency and amplitude.
15. Data acquisition using LabVIEW for temperature measurement with thermocouple and AD590.

Course Outcomes: After studying this course, students will able to:
1. Design and evaluate signal conditioning circuits for given transducer/sensor.
2. Design and evaluate the controllers to obtain the optimal response.
3. Write ladder logic programs for specific applications using PLC.
4. Develop LabVIEW programs for specific applications.
5. Design and develop complete process control system for specific application.

Conduct of Practical Examination:
- All laboratory experiments are to be included for practical examination.
- Students are allowed to pick one experiment from the lot.
- Strictly follow the instructions as printed on the cover page of answer script for breakup of

marks.
- Change of experiment is allowed only once and 17% Marks allotted to the procedure part to be made zero.

B.E. Electronics and Instrumentation Engineering (EI) Choice Based Credit System (CBCS) Semester - VII				
ARM Processor Lab **(Common to EI, BM & ML)**				
Subject Code	**: 17EI/BM/MLL77**		CIE Marks	: 40
Teaching Hours/Week	: 03 (1I+2P)		SEE Marks	: 60
Total No. of Practical hours	: 42		Exam Hours	: 03
Credits – 2				

PART-A: Conduct the following experiments by writing Assembly Language Program (ALP) using ARM Cortex M3 Registers using an evaluation board/simulator and the required software tool.

1. Write an ALP to multiply two 16 bit binary numbers.
2. Write an ALP to find the sum of first 10 integer numbers.
3. Write an ALP to find factorial of a number.
4. Write an ALP to add an array of 16 bit numbers and store the 32 bit result in internal RAM
5. Write an ALP to add two 64 bit numbers.
6. Write an ALP to find the square of a number(1 to 10) using look-up table.
7. Write an ALP to find the largest/smallest number in an array of 32 numbers .
8. Write an ALP to arrange a series of 32 bit numbers in ascending/descending order.
9. Write an ALP to count the number of ones and zeros in two consecutive memory locations.
10. Write an ALP to Scan a series of 32 bit numbers to find how many are negative.

PART-B: Conduct the following experiments on an ARM CORTEX M3 evaluation board using evaluation version of Embedded 'C' &Keil Uvision-4 tool/compiler.

1. Display "Hello World" message using Internal UART.
2. Interface and Control a DC Motor.
3. Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.
4. Determine Digital output for a given Analog input using Internal ADC of ARM controller.
5. Interface a DAC and generate Triangular and Square waveforms.
6. Interface a 4x4 keyboard and display the key code on an LCD.
7. Using the Internal PWM module of ARM controller generate PWM and vary its duty cycle.
8. Demonstrate the use of an external interrupt to toggle an LED On/Off.
9. Display the Hex digits 0 to F on a 7-segment LED interface, with an appropriate delay in between.
10. Interface a simple Switch and display its status through Relay, Buzzer and LED.

Note: More weightage should be given for PART-B experiments in the evaluation of Internal Assessment and Laboratory Examinations.

Conduction of Practical Examination:

1. All laboratory experiments (Part-A + Part-B) are to be included for practical examination.
2. Students are allowed to pick & execute one experiment from each part.
3. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
4. Change of experiment is allowed only once and 17% of Marks allotted to the procedure part to be made zero.

Course Outcomes: After studying this course, students will able to;
1. Write ALP for implementation of specific arithmetic or logical operations.
2. Write programs to demonstrate functioning of various devices interfaced to ARM processor.
3. Develop programs for ARM processors to implement real world problems.
4. Design and develop mini projects.

B.E. Electronics and Instrumentation Engineering (EI)				
Choice Based Credit System (CBCS)				
Semester - VII				
Project Work Phase- I + Project Work Seminar				
Subject Code	**: 17EIP78**		CIE Marks	: 100
Teaching Hours/Week	: 03		SEE Marks	: --
Total No. of Practical hours	: 42		Exam Hours	: --
Credits – 2				

During Project Work Phase – I , students are expected to do the followings;

1. Identify the project domain and topic.
2. Carryout necessary literature survey.
3. Define the problem and objectives of the proposed project work.
4. Finalize the methodology to carry out the project work in Phase- II and submit the Synopsis.
5. Present a Seminar on topic selected for the project.

Evaluation Procedure:

- As per the University guidelines.
- The Internal Assessment marks shall be awarded based on the relevance of the proposed Project Domain & Topic, Quality of the Synopsis and timely submission, Seminar presentation on the proposed project work, participation in the question and answer session, and attendance in the seminar presentations.

Course Outcomes: After studying this course, students will able to;

1. Collect the literature and materials in the proposed project work.
2. Analyze the current state of art work in the proposed project work
3. Prepare synopsis with objectives and methodology
4. Justify the proposed project and its probable outcome in the seminar presentation.
5. Communicate the concepts by effective presentation
6. Participate effectively as an individual and member of project team.

8th SEMESTER

B.E. Electronics and Instrumentation Engineering (EI)				
Choice Based Credit System (CBCS)				
Semester - VIII				
Neural Network and Fuzzy Logic Systems				
Subject Code	: **17EI81**		CIE Marks	: 40
Number of Lecture Hours /Week	: 04		SEE Marks	: 60
Total Number of Lecture Hours	: 50		Exam Hours	: 03
Credits – 4 (Each module – 10 Hours)				

Module -1
Introduction. - Neural Networks, Application Scope of Neural Networks, Fuzzy Logic, Generic Algorithm, Hybrid Systems, Soft Computing.
Artificial Neural Network: An Introduction. - Fundamental Concept, Evolution of Neural Networks, Basic models of Artificial Neural Networks (ANN), Important Technologies of ANNs, McCulloch-Pitts Neuron, Linear Separability.

Module -2
Hebb Network and simple problems,
Supervised Learning Network – Introduction –Perceptron Networks, Adaptive Linear Neuron (Adaline), Multiple Adaptive Linear Neurons.

Module -3
Back –Propagation Network. - Theory, Architecture, Flowchart for training process, Training Algorithm, Learning Factors of Back-Propagation Network, Testing Algorithm of Back-Propagation Network. Radial Basis Function Network, Time Delay Neural Network, Functional Link Networks, Tree Neural Networks, wavelet neural network.

Module -4
Introduction to Fuzzy Logic, Classical sets and Fuzzy sets.
Introduction to Fuzzy Logic, Classical sets (crisp sets) - Operations on Classical sets, Properties of Classical sets, Function of Mapping of Classical sets. Fuzzy sets – Fuzzy set operations, Properties of fuzzy sets. Simple Problems
Classical Relations and Fuzzy Relations – Introduction, Cartesian Product of Relation, Classical Relation, Fuzzy Relation, Tolerance and Equivalence Relations, Non-interactive Fuzzy sets, Simple Problems.

Module -5
Membership Functions – Introduction, Features of the Membership functions, Fuzzication, Methods of Membership Value Assignments, Simple Problems
Defuzzification- Introduction, Lamba-cuts for Fuzzy sets (Alpha-Cuts), Lamba-Cuts for Fuzzy Relation, Defuzzification Methods.
Fuzzy Logic Control Systems – Introduction, Control System Design, Architecture and Operation of FLC system, FLC system Models, Application of FLC systems.

Course Outcomes: After studying this course, students will be able to:
1. Compare and contrast the biological neural network and ANN.
2. Discuss the ANN for pattern classification.
3. Develop and configure ANN's with different types of functions and learning algorithms.

4. Apply ANN for real world problems.
5. Discuss the fundamentals of fuzzy logic, implementation and their functions
6. Apply fuzzy logic concepts in building automated control systems.

Question Paper Pattern
- The question paper will have TEN questions.
- Each full question carry 16 marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. S. N. Sivanandam and S.N. Deepa, "Principles of Soft Computing", 2nd Edition, Wiley India Pvt. Ltd.-2014.
2. Timothy J. Ross, "Fuzzy logic with engineering applications", McGraw Hill International Edition, 1997

Reference Books:
1. Simon Haykin, "Neural Networks: A comprehensive foundation", 2nd Edition, PHI, 1998.

B.E. Electronics and Instrumentation Engineering (EI)			
Choice Based Credit System (CBCS)			
Semester - VIII			
LASERs and Optical Instrumentation			
Subject Code	: **17EI82**	CIE Marks	: 40
Number of Lecture Hours /Week	: 04	SEE Marks	: 60
Total Number of Lecture Hours	: 50	Exam Hours	: 03
Credits – 4 (Each module – 10 Hours)			

Module -1

Lasers -I: Introduction, Emission and absorption of radiation, Einstein relation, population inversion, threshold conditions, Line shape function, population inversion and pumping threshold conditions**.**

Lasers -II: LASER modes: Axial & Transverse modes; Classes of LASER: Doped insulator LASERs, semiconductor LASERs, Gas LASERs, Liquid dye LASERs.

Module -2

Generation of Lasers: Single mode operation, frequency stabilization. Q-switching, mode locking, lasing threshold.

Applications of Laser: Measurement of distance: Interferometric methods, Beam modulation telemetry, Pulse echo techniques; Holography & its Applications.

Module -3

Overview of Optical Fiber Communications: Motivations for light wave communications, optical spectral bands, Decibel units, Network information rates, WDM concepts, Key elements of optical fiber systems, standards for optical fiber communications.

Structures, Wave guiding, and Fabrication I: The nature of light, basic optical laws and definitions, optical fiber modes and configurations, Mode theory for circular waveguides, Single mode fibers.

Module -4

Structures, Wave guiding, and Fabrication II: Graded index fiber structure, Fiber materials, Photonic crystal fibers, Fiber fabrication, Mechanical properties of fibers, Fiber optic cables.

Optical Amplifiers: Types of optical amplifiers and its applications, Semiconductor optical amplifiers, Erbium-doped fiber amplifiers, Amplifier noise, Optical SNR, System Applications, Raman amplifiers, wideband optical amplifiers.

Module -5

Applications of Fiber Optic Laser Systems in Medicine: Introduction, Fiberoptic laser systems in cardiovascular disease-Endoscopic laser systems in cardiology, Fiber-optic laser therapy-angioplasty, Endoscopic Nd:YAG Laser therapy in gastroenterology, Laproscopic laser surgery, photodynamic therapy inoncology, ophthalmological applications of laser-fiber systems, arthroscopic surgery in orthopedics, laser lithotripsy, flowchart diagrams for clinical applications of laser-fiber systems-advances.

Textbook 3: Unit 9.1, 9.2, 9.2.1, 9.2.2, 9.2.5, 9.3.4, 9.5.2.3, 9.7.3, 9.8.2, 9.9.2, 9.11.4.3

Course Outcomes: After studying this course, students will be able to:
1. Explain the principle and working of Laser system.
2. Discuss the engineering applications of laser systems.
3. Discuss the fundamentals of optical fiber communications.
4. Evaluate the design of optical fibers.

5.	Apply fiber optic laser systems in medical field.

Question Paper Pattern
- The question paper will have TEN questions.
- Each full question carry 16 marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. Optoelectronics- An Introduction-Wilson & Hawkes, Prentice Hall of India.
2. Optical fiber communications-GeirdKeser, McGraw Hill education (India) private limited, Fifth edition.
3. Lasers and Optical Fibers in Medicine - by Abraham Katzir, Academic Press, 1998.

Reference Books:
1. LASER Fundamentals- William T. Silfvast, Cambridge University Press.
2. Essentials of Opto Electronics with Applications - A.J. Rogers, CRC press 1997.

B.E. Electronics and Instrumentation Engineering (EI)			
Choice Based Credit System (CBCS)			
Semester – VIII			
Instrumentation Buses and Industrial Data Networks			
Subject Code	: 17**EI831**	CIE Marks	: 40
Number of Lecture Hours /Week	: 03	SEE Marks	: 60
Total Number of Lecture Hours	: 40	Exam Hours	: 03
Credits – 3 (Each module – 08 Hours)			

Module -1
Data Network Fundamentals: Network hierarchy and switching – Open System Interconnection model of ISO– Data link control protocol: - HDLC – Media access protocol – Command/response – Token passing – CSMA/CD, TCP/IP.

Module-2
Inter Networking: Bridges – Routers – Gateways –Standard ETHERNET and ARCNET configuration- special requirement for networks used for control.

Module -3
HART and Fieldbus: Introduction- Evolution of signal standard – HART communication protocol – Communication modes– HART networks – HART commands – HART applications.
Fieldbus: – Introduction – General Fieldbus architecture – Basic requirements of Field bus standard – Fieldbus topology – Interoperability – Interchangeability – Introduction to OLE for process control (OPC).

Module -4
Modbus and Profibus PA/DP/FMS: MODBUS protocol structure, function codes troubleshooting Profibus; Introduction – Profibus protocol stack –Profibus communication model communication objects – system operation – troubleshooting – review of foundation field bus.

Module -5
Industrial Ethernet and Wireless Communication: Industrial Ethernet: Introduction – 10Mbps Ethernet, 100Mbps Ethernet. Radio and wireless communication: Introduction – components of radio link the radio spectrum and frequency allocation – radio modems.

Course Outcomes: After studying this course, students will be able to:
1. Explain basic concepts of network hierarchy and switching.
2. Apply network data communication protocols.
3. Describe routers and gateways Standards followed in inter-networking.
4. Evaluate appropriateness of different industrial data networks.
5. Develop the various communication networks for industries.

Question Paper Pattern
- The question paper will have TEN questions.
- Each full question carry 16 marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. Steve Mackay, Edwin Wrijut, Deon Reynders, John Park, 'Practical Industrial Data networks Design, Installation and Troubleshooting', Newnes publication, Elsevier First edition, 2004
2. Buchanan, W., "Computer Buses", CRC Press, 2000,

Reference Books:
1. Andrew S. Tanenbaum, Modern Operating Systems, Prentice Hall of India Pvt. LTD, 2003
2. Stallings,W., "wireless Communication and networks", 2nd Edition, Prentice Hall of India, 2005
3. Process Software and Digital Networks", B.G. Liptak, CRC Press ISA- The Instrumentation, Systems, and Automation Society.
4. Theodore S. Rappaport, 'Wireless communication: Principles & Practice', 2nd Edition, 2001, Prentice Hall of India.

B.E. Electronics and Instrumentation Engineering (EI) Choice Based Credit System (CBCS) Semester - VIII				
Industrial Process Instrumentation				
Subject Code	: **17EI832**		CIE Marks	: 40
Number of Lecture Hours /Week	: 03		SEE Marks	: 60
Total Number of Lecture Hours	: 40		Exam Hours	: 03
Credits – 3 (Each module – 08 Hours)				

Module -1
Food Industry Instrumentation: Instrumentation in canning, baking, dairy industries.

Module-2
Paper and Pulp Instrumentation: Different types of pulping, pulp bleaching, pulp blending, wet end and drier instrumentation.

Module -5
Cement Plants: Objectives of automation system, automation strategy, Distributed Control System for Cement Plant- A case study.

Module -3
Thermal power plant Instrumentation: Automation strategy, distributed system structure, Man-machine interface, software system, communication, advanced control systems.

Module -4
Steel Plant: Automation strategy, production planning and area supervision, iron zone, steel zone, mill zone, utility zone.

Course Outcomes: After studying this course, students will be able to:
1. Sketch the typical instrumentation and control strategy in the process industries like paper, pulp, cement, power and steel plants.
2. List the variable to be monitored and controlled in the above said process industries.
3. Describe the instrumentation, control requirements and complete functioning of the above said industries.
4. Analyze the hardware and software tools required for the above said process industries.
5. Design and develop instrumentation and control strategy for simple process industry.

Question Paper Pattern
- The question paper will have TEN questions.
- Each full question carry 16 marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. Handbook of Applied Instrumentation by Considine and Ross, , McGraw Hill Pub. (Modules 1 & 2)

2. Computer Based Industrial Control by Krishna Kant, 2nd Edition, PHI, 2017 (Modules: 3, 4 &5).

Reference Books:
   1. Donald P Eckman, " Industrial Instrumentation", J.Wiley
   2. S K Singh, "Industrial Instrumentation & Control", 3rd edition, TMH 2009
   3. J S Smith, "Food Processing Principles & Applications", University press (US) 2004.

B.E. Electronics and Instrumentation Engineering (EI)			
Choice Based Credit System (CBCS)			
Semester – VIII			
Biosensors and Bioinstrumentation			
Subject Code	: **17EI833**	CIE Marks	: 40
Number of Lecture Hours/ Week	: 03	SEE Marks	: 60
Total Number of Lecture Hours	: 40	Exam Hours	: 03
Credits – 3 (Each module – 08 Hours)			

Module - 1

Introduction: A historical perspective, Bio-analytical sensors & systems, Transduction modes & classifications, Approaches to Immobilization, Basic designs of discrete sensors, calibration & figures of merit

Chemical Measurement: Objectives of chemical Measurement, Requirements & limitations in chemical measurement. Chemical transducer – Electro-chemical transducer, electrical potential & reference electrodes, potentiometric sensors, Amperometric sensors, electrochemical gas sensors

Module - 2

Biosensors – Enzyme based biosensors, immunosensors, Microbial sensors, continuous measurement of chemical quantities – intravascular measurements, tissue measurements, Measurement - by blood drainage, Measurements by Microdialysis, Measurements by effluent fluid analysis. Transcutaneous Measurements of pO_2, pCO_2. Transcutaneous arterial oxygen saturation monitoring – basics of oximetry, pulse oximeter. PCR: Principle, procedure and instrumentation.

Module - 3

Optically based Energy Transduction: Fiber optic devices, Guided waves, Evanescent wave, Fiber optic sensor designs, planar wave guides, near field optical sensing. Surface Plasmon resonance, Thermal sensor.

Surface Characterization in Biomaterials and Tissue Engineering- Molecules and Biomaterials, Molecules & Tissue Engineering, surface analysis- Transmission electron Microscope, Scanning electron Microscope, scanning Tunneling Microscope, Scanning Force Microscope.

Module - 4

Blood Cell Counters: Blood components & processing, calculation of size of cells, methods of cell counting – microscopic method, automatic optical method, electrical conductivity method. Coulter counters – multiparameter coulter counter, picoscale. automatic recognitions and differential counting of cells

Cellular Measurements in Biomaterials and Tissue Engineering: Cell Measurement overview, Light Microscopy, Cell orientation, Cell-rolling velocity, Cell Deformation, Cell proliferation, Cell Differentiation, Cell Signaling & Regulation

Module -5

Body Temperature, Fat and Movement Measurement: Regulation of Body Temperature, Infrared Thermometer, Measurement of Body fat, Direct & Indirect Measurement of body fat, Measurements of body Movement.

Force Measurement: Muscle contraction measurements, Measurement of stresses in the bone, Ground force measurement.

Course Outcomes: After studying this course, students will be able to:
1. Explain the principle and working of chemical transducers and biosensors.
2. Apply biosensors in the measurement of many physiological and biomechanics parameters.
3. Demonstrate the functioning of simple biosensors.
4. Evaluate the characteristics of biomaterials and tissues using bioinstrumentation techniques.
5. Develop and demonstrate the simple biosensors for physiological measurements.

Question Paper Pattern
- The question paper will have TEN questions.
- Each full question carry 16 marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. Introduction to Bioanalytical Sensor by Alice Cunningham, John Wiley and Sons, 1998.
2. Biomedical Transducers and Instruments by Tatsuo Togawa, Toshiyo Tamura, P. AKE Oberg, CRC Press 1997.
3. Bio-Instrumentation, John G. Webster, John Wiley India, 2003.

Reference Books:
1. Biosensors and their Applications by Victor Yang and That Ngo, Kluwer Academic/ Plenum Publisher, 2000.
2. Handbook of Biomedical Instrumentation by R.S. Khandpur, Second Edition, TMH Publication, 2007.

B.E. Electronics and Instrumentation Engineering (EI)				
Choice Based Credit System (CBCS)				
Semester - VIII				
Programmable System on Chip (PSoC)				
(Common to EI & ML)				
Subject Code	: **17EI/ML834**		CIE Marks	: 40
Number of Lecture Hours /Week	: 03		SEE Marks	: 60
Total Number of Lecture Hours	: 40		Exam Hours	: 03
Credits – 3 (Each module – 08 Hours)				

Module -1
Introduction to PSoC: PSoC Technology, Programmable Routing and Interconnect, Configurable Analog and Digital Blocks, CPU Sub system , Families of PSoC (PSoC 1, PSoC 3, PSoC 5), Difference between PSoC and conventional MCU**.**

Module -2
Introduction to PSoC 3/5: PSoC 3/5 Architecture – Block Diagram, System Wide Resources, I/O Interfaces, CPU Subsystem, Memory Organization, Digital Subsystems, Analog Subsystems.

Module -3
PSoC Design Modules: Why Cypress PSoC, Structure of PSoC, PSoC Designer Suit, Limitations of PSoC, PSoC Subsystem Design, PSoC Memory Management.

Module -4
Mixed – Signal Embedded Design: Overview of Mixed Signal Embedded Systems Design, Hardware and Software subsystems of mixed signal architectures, PSoC Hardware Components, PSoC Software Components, PSoC Interrupt Subsystem, Introduction to PSoC Express, System Design using PSoC Express.

Module -5
PSoC Components: Universal Digital Blocks (UDB), UDB arrays and Digital System Interconnect (DSI), Timer, Counter and PWM, Digital Filter Blocks (DFB), Delta Sigma ADC Topologies and Circuits, Programmable Gain Amplifiers, Switched Capacitor / Continuous Time, Analog Routing, Flash Temperature Sensors, DTMF Dialers, Sleep Timers, UART, I2C, SPI, USB, CAN Buses.
System Design Using PSoC
Interfacing of Temperature Sensor and Tachometer, SPI and UART based Communication, Low Noise Continuous Time Signal Processing with PSoC, Data Acquisition and control system with PSoC, Ultra-wide band RADAR, and Serial Bit Receiver with Hardware Manchester Decoder, DTMF Detector, Ultrasonic Vehicle Parking Assistant, and Universal Wide Range Signal Generator.

Course Outcomes: After studying this course, students will be able to:
1. Explain the basic concepts and families of PSoC.
2. Recognize the various features of PSoC architecture and programmable blocks.
3. Analyze the various features of PSoC Designer for configuring the digital and analog modules
4. Design the hardware and software components for mixed signal components.
5. Develop the programming skills for interfacing various I/O modules to PSoC.

Question Paper Pattern
- The question paper will have TEN questions.
- Each full question carry 16 marks
- There will be TWO full questions (with maximum of THREE sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.
- The students will have to answer FIVE full questions, selecting ONE full question from each module.

Text Books:
1. Designer's Guide to the Cypress PSoC™ by Robert Ashby, ISBN-13: 978-0-7506-7780-6, Elsevier 2005.
http://www.kelm.ftn.uns.ac.rs/literatura/mms/pdf/Designers%20Guide%20to%20the%20Cypress%20PSoC.pdf

Reference Books:
1. System Investigation of Programmable Systems on Chip (PSoC) Publisher: VDMVerlag Dr. Mueller E.K. (20 July 2008)

B.E. Electronics and Instrumentation Engineering (EI)			
Choice Based Credit System (CBCS)			
Semester - VIII			
Internship / Professional Practice			
Subject Code	: **17EI84**	CIE Marks	: 50
Number of Lecture Hours /Week	: --	SEE Marks	: 50
Total Number of Lecture Hours	: --	Exam Hours	: 03
Credits – 2			

Course objectives:
Internship/Professional practice provide students the opportunity of hands-on experience that include personal training, time and stress management, interactive skills, presentations, budgeting, marketing, liability and risk management, paperwork, equipment ordering, maintenance, responding to emergencies etc. The objective are further,

- To put theory into practice
- To relate to, interact with, and learn from current professionals in the field.
- To gain a greater understanding of the duties and responsibilities of a professional
- To understand and adhere to professional standards in the field.
- To gain insight to professional communication including meetings, memos, reading, writing, public speaking, research, client interaction, input of ideas, and confidentiality.
- To identify personal strengths and weaknesses.
- To develop the initiative and motivation to be a self-starter and work independently.

Internship/Professional practice: Students under the guidance of internal guide/s and external guide shall take part in all the activities regularly to acquire as much knowledge as possible without causing any inconvenience at the place of internship.

Seminar: Each student, is required to

- Present the seminar on the internship orally and/or through power point slides.
- Answer the queries and involve in debate/discussion.
- Submit the report duly certified by the external guide.

Course outcomes: At the end of the course the student will be able to:

- Acquire practical experience within industry in which the internship is done.
- Apply knowledge and skills learned to classroom work.
- Experience the activities and functions of professionals.
- Develop and refine oral and written communication skills.
- Recognizethe areas for future knowledge and skill development.
- Acquire the basic knowledge of administration, marketing, finance and economics.
- Develop the skills to enable lifelong learning.

Evaluation Procedure:

- **As per University guidelines.**
- **Evaluation of CIE Marks:** The Internal Assessment marks shall be awarded based on the Internship/Professional Practice Report and Seminar Presentation.
- **Semester End Examination**: The marks shall be awarded based on the Internship/Professional Practice Report and Seminar Presentationas per the University norms by the examiners appointed VTU.

B.E. Electronics and Instrumentation Engineering (EI)				
Choice Based Credit System (CBCS)				
Semester - VIII				
Project Work Phase-II				
Subject Code	: **17EIP85**		CIE Marks	: 100
Number of Lecture Hours /Week	: --		SEE Marks	: 100
Total Number of Lecture Hours	: --		Exam Hours	: 03
Credits – 6				

Course objectives:
- To support independent learning.
- To develop interactive, communication, organization, time management, and presentation skills.
- To impart flexibility and adaptability.
- To inspire independent and team working.
- To expand intellectual capacity, credibility, judgment, intuition.
- To adhere to punctuality, setting and meeting deadlines.
- To instill responsibilities to oneself and others.
- To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.

Project Work Phase - II: Each student of the project batch shall involve in carrying out the project work jointly in constant consultation with internal guide, co-guide, and external guide and prepare the project report as per the norms avoiding plagiarism.

Course outcomes: At the end of the course the student will be able to:
- Describe the project and be able to defend it.
- Develop critical thinking and problem solving skills.
- Learn to use modern tools and techniques.
- Communicate effectively and to present ideas clearly and coherently both in written and oral forms.
- Develop skills to work in a team to achieve common goal.
- Develop skills of project management and finance.
- Develop skills of self learning, evaluate their learning and take appropriate actions to improve it.
- Prepare themselves for life-long learning to face the challenges and support the technological changes to meet the societal needs.

Evaluation Procedure:
- **As per University guidelines**
- **Internal Marks:** The Internal marks (100 marks) evaluation shall be based on Phase wise completion of the project work, Project report, Presentation and Demonstration of the actual/model/prototype of the project.
- **Semester End Examination:** SEE marks for the project (100 marks) shall be based on Project report, Presentation and Demonstration of the actual/model/prototype of the project, as per the University norms by the examiners appointed VTU.

B.E. Electronics and Instrumentation Engineering (EI) Choice Based Credit System (CBCS) Semester - VIII				
Seminar				
Subject Code	: **17EIS86**		CIE Marks	: 100
Number of Lecture Hours /Week	: --		SEE Marks	: --
Total Number of Lecture Hours	: --		Exam Hours	: --
Credits – 1				

Course objectives:

The objective of the seminar is to inculcate self-learning, face audience confidently, enhance communication skill, involve in group discussion and present and exchange ideas. Each student, under the guidance of a Faculty, is required to choose, preferably, a recent topic of his/her interest relevant to the course of specialization. Carryout literature survey, organize the Course topics in a systematic order.

- Conduct literature survey in the domain area to find appropriate topic.
- Prepare the synopsis report with own sentences in a standard format.
- Learn to use MS word, MS power point, MS equation and Drawing tools or any such facilities in the preparation of report and presentation.
- Present the seminar topic orally and/or through power point slides.
- Communicate effectively to answer the queries and involve in debate/discussion.

The participants shall take part in discussion to foster friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

Course outcomes:

At the end of the course the student will be able to:

- Develop knowledge in the field of Electronics &Instrumentation Engineering and other disciplines through independent learning and collaborative study.
- Identify and discuss the current, real-time issues and challenges in engineering & technology.
- Develop written and oral communication skills.
- Explore concepts in larger diverse social and academic contexts.
- Apply principles of ethics and respect in interaction with others.
- Develop the skills to enable life-long learning.

Evaluation Procedure:

- As per University guidelines.
- The Internal Assessment marks for the seminar shall be awarded based on the relevance of the seminar topic, quality of the report, presentation skills, participation in the question and answer, and attendance in the seminar classes/sessions.