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	: 15MAT31	IA Marks	: 20
Number of Lecture Hours/Week	: 04	Exam Marks	: 80
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:

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	: 15 EI/BM/ML 32		IA Marks	: 20
Number of Lecture Hours/Week	: 04		Exam Marks	: 80
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:** **Digital storage oscilloscopes**: Basic DSO operation only. **Analog storage oscilloscopes**: Need for trace storage, bistable storage CRT, Variable persistence storage CRT. **Delayed time-base oscilloscopes**: Need for a time delay & delayed-time-base system.	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, Whetstone'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 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. "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, 3rdEdition, 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	: 15 EI/BM/ML 33		IA Marks	: 20
Number of Lecture Hours/Week	: 04		Exam Marks	: 80
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 Designof BJT Amplifier, Hybrid Equivalent and Hybridπ 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. **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 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. 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)			
Choice Based Credit System (CBCS)			
Semester - III			
DIGITAL DESIGN AND HDL			
(Common to EI, BM & ML)			
Subject Code	: 15 EI/BM/ML 34	IA Marks	: 20
Number of Lecture Hours/Week	: 04	Exam Marks	: 80
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 Kmap 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 - 2bit and four 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.	10 Hours	L1,L2

Verilog behavioral description of Encoders (8 to 3 with priority and without 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 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 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

B.E. Electronics and Instrumentation Engineering (EI)			
Choice Based Credit System (CBCS)			
Semester - III			
TRANSDUCERS AND INSTRUMENTATION			
Subject Code	: 15EI35	IA Marks	: 20
Number of Lecture Hours/Week	: 04	Exam Marks	: 80
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 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 5 full questions, selecting one full question fromeachmodule.

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

B.E. Electronics and Instrumentation Engineering (EI)			
Choice Based Credit System (CBCS)			
Semester – III (Elective-I)			
NETWORK ANALYSIS			
(Common to EI, BM & ML)			
Subject Code	: 15 EI/BM/ML 361	IA Marks	: 20
Number of Lecture Hours/Week	: 03	Exam Marks	: 80
Total Number of Lecture Hours	: 40	Exam Hours	: 03
Credits - 3			

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 – Analysing, L5 – Evaluating, and L6 - Creating

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
Module -1 **Basic concepts**: Sources of electrical energy, Source transformation & Source shifting, Network reduction using star-delta 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.	8 Hours	L_1=Remembering, L_2=Understanding, L_3=Applying, L_4=Analysis.
Module -2 **Network theorems**: Super position, reciprocity, Millman's theorem (for DC networks), Thevinin's & Norton's theorem (for DC networks), and Maximum power transfer theorems (for AC & DC networks)	8 Hours	L_1=Remembering L_2=Understanding L_3=Applying L_4=Analysis
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. **Laplace transformation & Applications**: Solution of network problems, Wave form synthesis.	8 Hours	L_1= Understanding L_2= Analyzing L_3=Applying L_4=Synthesis
Module -4 **Resonant Circuits**: Series resonance: Variation of current and voltage with frequency, Selectivity & Bandwidth, Q-factor Parallel resonance: Selectivity & Bandwidth, Maximum impedance conditions with Capacitor, Inductor & frequency variable, general case-resistance present in both branches. **Two port network parameters**: Definitions and modeling of Z, Y, H & transmission parameters.	8 Hours	L_1= Understanding L_2= Analyzing L_3=Applying L_4=Realizing
Module -5 **Network topology**: Graph of a network, concepts of: tree & co-tree, incidence matrix, tie-set & cut-set schedules, Solution of resistive	8 Hours	L_1= Understanding L_2= Analyzing L_3=Applying

networks using equilibrium equations in matrix form, Principle of duality.		L_4=Evaluation

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
- 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. Networks And Systems, D Roy Choudhury, New Age International Publishers, Third edition.
2. Network Analysis, M.E. Van Valkenburg, Prentice-Hall, Third edition.

Reference Books:
1. Engineering Circuit Analysis, William H Hayt et al, McGraw Hill, 8th edition.
2. Introduction to Electric circuits, Richard C Dorf & James A Svoboda, Wiley, 9th edition.
3. Electric Circuits, Mahmood Nahvi, McGraw Hill, 9th edition

B.E. Electronics and Instrumentation Engineering (EI)				
Choice Based Credit System (CBCS)				
Semester – III (Elective-I)				
MATERIAL SCIENCE				
Subject Code	: 15EI362		IA Marks	: 20
NumberofLectureHours/Week	: 03		Exam Marks	: 80
Total Number ofLecture Hours	: 40		Exam Hours	: 03
Credits - 3				

Course Objectives:
- To impart the knowledge of crystal structure of various types of materials
- To understand the principle, construction and working of various types of instruments used to study the structure of materials
- To understand the mechanical behavior & characteristics of metals
- It will expose students to failure mechanisms due to fatigue, creep and dislocations
- To impart the fundamental knowledge of nanotechnology and nanomaterials

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 **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.	**8 Hours**	**L1, L2, L3**
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.	**8 Hours**	**L1, L2, L3, L4**
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	**8 Hours**	**L1, L2, L3, L4**

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.	**8 Hours**	**L1, L2, L3, L4**
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.	**8 Hours**	**L1, L2, L4**

Course Outcomes: After studying this course, students will able to:
- Recognize basic nomenclature, basic microstructure, associate terms with the appropriate structure / phenomena and be able to differentiate between related structure / phenomena.
- Use the instruments for testing and characterization of various types of materials, and perform simple calculations to qualify materials properties and microstructural characteristics.
- Demonstrate the ability to identify engineering problem in using plastic deformation, fatigue, creep and dislocations.
- Explain the concepts of nanotechnology, identify the nanomaterials and able to use them based on the engineering design and applications.

Graduate Attributes (as per NBA)
- Engineering knowledge
- Problem analysis
- Modern tool usage
- Environment & sustainability
- Lifelong 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 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. 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. Rakesh Rathi, Nanotechnology: Technology Revolution of 21st Century, S. Chand, 2009.

B.E. Electronics and Instrumentation Engineering (EI) Choice Based Credit System (CBCS) Semester – III (Elective-I)			
COMPUTER ORGANIZATION			
Subject Code	: 15EI363	IA Marks	: 20
Number of Lecture Hours/Week	: 03	Exam Marks	: 80
Total Number of Lecture Hours	: 40	Exam Hours	: 03
Credits - 3			

Course Objectives: This course will enable the students
- Recall and Describe basic structure of computers, machine instructions and programs.
- Recall and Describe different addressing modes, output operations, Stacks and Queues, Subroutines and Additional Instructions, IEEE standard for Floating point Numbers.
- Write and Describe accessing I/O Devices, Interrupts, Direct Memory Access, Busses, Interface Circuits, and Standard I/O Devices.
- Describe Semiconductor RAM Memories, Read Only Memories, Cache Memories, Performance Considerations and Virtual Memories.
- Recall and Describe execution of a Complete Instruction, Multiple Bus Organization, Microprogrammed Control and Hardwired Control.

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 Structure of Computers:** Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Software, Performance – Processor Clock, Basic Performance Equation. **Machine Instructions and Programs:** Numbers, Arithmetic Operations and Characters, Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing.	**8 Hours**	**L1, L2**
Module -2 **Machine Instructions and Programs (Continued):** Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions. IEEE standard for Floating point Numbers (6.7.1 of Chapter 6)	**8 Hours**	**L1, L2**
Module -3 **Input/output Organization:** Accessing I/O Devices, Interrupts, Direct Memory Access, Busses, Interface Circuits, Standard I/O Devices	**8 Hours**	**L1, L2**
Module -4 **Memory System:** Some Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Cache Memories, Performance Considerations, Virtual Memories.	**8 Hours**	**L1, L2**

Module -5		
Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Microprogrammed Control, Hardwired Control.	**8 Hours**	**L1, L2**

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

- Acquire knowledge of
  - o The basic structure of computers & machine instructions and programs.
  - o Addressing Modes, Assembly Language,
  - o Stacks, Queues and Subroutines.
  - o Input/output Organization such as accessing I/O Devices, Interrupts.
  - o Memory system basic Concepts, Semiconductor RAM Memories, Static memories, Asynchronous DRAMS, Read Only Memories, Cache Memories and Virtual Memories.
  - o Some Fundamental Concepts of Basic Processing Unit, Execution of a Complete Instruction, Multiple Bus Organization, Hardwired Control and Microprogrammed Control.
- Apply the knowledge gained in the design of Computer.
- Acquire competency in understanding computer organization.
- Understand the importance of life-long learning in the field of computer organization.

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 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. Carl Hamacher, ZvonkoVranesic, SafwatZaky, "Computer Organization", McGraw Hill, 5th Edition, 2015, ISBN:9781259005275.

Reference Books:
1. David A. Patterson, John L. Hennessy, "Computer Organization and Design – The Hardware / Software Interface ARM", Elsevier.
2. William Stallings, "Computer Organization & Architecture", PHI.
3. Vincent P. Heuring & Harry F. Jordan, "Computer Systems Design and Architecture", Pearson.

B.E. Electronics and Instrumentation Engineering (EI)			
Choice Based Credit System (CBCS)			
Semester – III (Elective-I)			
STATISTICS AND NUMERICAL METHODS			
(Common to EI, BM & ML)			
Subject Code	: 15 EI/BM/ML 364	IA Marks	: 20
Number of Lecture Hours/Week	: 03	Exam Marks	: 80
Total Number of Lecture Hours	: 40	Exam Hours	: 03
Credits - 3			

Course Objectives:

- This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology

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 **Testing of Hypothesis:** Large sample test based on Normal distribution for single mean and difference of means – Tests based on t, and F distributions for testing means and variances – Contingency table (Test for Independency) – Goodness of fit	8 Hours	L1, L2, L3, L4
Module -2 **Design of Experiments**: One way and two way classifications - Completely randomized design – Randomized block design –Latin square design - factorial design	8 Hours	L2, L3, L5, L6
Module -3 **Solution of Equations and Eigen value 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	8 Hours	L2, L3, L4, L5
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 derivates using interpolation polynomials – Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules	8 Hours	L2, L3, L4, L5
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	8 Hours	L2, L3, L4, L5

methods for solving first order equations – Finite difference methods for solving second order equations		

Course Outcomes:
- It helps the students to have a clear perception of the power of statistical and numerical techniques, ideas and would be able to demonstrate the applications of these techniques to problems drawn from industry, management and other engineering fields

Graduate Attributes (as per NBA)
- Engineering knowledge
- Problem analysis
- Design & Development of Solutions
- Investigation of Complex Problems
- Lifelong 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 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. Johnson. R.A. and Gupta. C.B., "Miller and Freund's "Probability and Statistics for Engineers", 11th Edition, Pearson Education, Asia, 2011.
2. 2. Grewal. B.S. and Grewal. J.S., "Numerical Methods in Engineering and Science", 9th Edition, Khanna Publishers, New Delhi, 2007

Reference Books:
1. Walpole. R.E., Myers. R.H., Myers.S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", 8th Edition, Pearson Education, Asia, 2007.
2. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outlines on 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" Pearson Education, Asia, New Delhi, 2006

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	: 15 EI/BM/ML L37	IA Marks	: 20
Number of Practical Hours/Week	: 03	Exam Marks	: 80
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 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 15% 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, 2015, 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	: 15 EI/BM/ML L38		IA Marks	: 20
Number of Practical Hours/Week	: 03		Exam Marks	: 80
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	L2, L3, L4

a) JK type b) SR type c) T type and d) D type	
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 15% Marks allotted to the procedure part to be made zero

Text Books:
1. Digital Principals and Design – Donald D Givone,12th reprint, TMH,2008
2. HDL Programming VHDL And Verilog ByNazeih M. Botros, 2009 reprint, Dreamtech press.

Reference Books:
1. Digital Logic Applications and Design by John M Yarbrough, Thomson Learning,2001
2. Fundamentals of HDL- Cyril P R Pearson/Sanguin 2010

IV SEMESTER

<table>
<tr><td colspan="4" align="center">B.E. Electronics and Instrumentation Engineering (EI)
Choice Based Credit System (CBCS)
Semester - IV</td></tr>
<tr><td colspan="4" align="center">ENGINEERING MATHEMATICS-IV
(Common to All Branches)</td></tr>
<tr><td>Subject Code</td><td>: 15MAT41</td><td>IA Marks</td><td>: 20</td></tr>
<tr><td>Number of Lecture Hours/Week</td><td>: 04</td><td>Exam Marks</td><td>: 80</td></tr>
<tr><td>Total Number of Lecture Hours</td><td>: 50</td><td>Exam Hours</td><td>: 03</td></tr>
<tr><td colspan="4" align="center">Credits - 4</td></tr>
</table>

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>
</table>

Subject Code	: 15 EI/BM/ML42		IA Marks	: 20
Number of Lecture Hours/Week	: 04		Exam Marks	: 80
Total Number of Lecture Hours	: 50		Exam Hours	: 03
		Credits – 4		

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, Log and Antilog Amplifier, Multiplier and Divider, Differentiator and Integrator. Comparator, Schmitt circuit, Astable mutivibrator, Monostable multivibrator and Triangular waveform generator. (Relevant problems)	10 Hours	L1,L2, L3,L4
Module -3 **Voltage Regulators:** Series Op-amp regulator, IC voltage regulators, 723 General purpose regulators. **Active filters:** First and Second order LPF, First and Second orders HPF, Band Pass filters, Band Reject filters. (Filter design). Phase shift oscillator, Wien bridge oscillator.	10 Hours	L1,L2, L3,L4
Module -4	10 Hours	L2,L3,L4, L5,

555 Timer: Description of Functional Diagram, Monostable operation, Astable operation, Applications in Monostable and Astable mode. **Phase Locked Loops:** Basic Principles, Phase Detector/Comparator, and Voltage controlled oscillator.		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**: **DACs:** Weighted Resistor DAC, R – 2R Ladder DAC, Inverted R – 2R Ladder DAC, DAC 0800 (from Data sheet). **ADCs:** Flash ADC, Counter type ADC, Successive approximation ADC, Dual slope ADC, DAC 0804 (from Data sheet) 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 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. "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	: 15 EI/BM/ML 43	IA Marks	: 20
Number of Lecture Hours/Week	: 04	Exam Marks	: 80
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 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. "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 Mallikarjuna Swamy ,TMH., 2009.

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

CONTROL SYSTEMS
(Common to EI & BM)

Subject Code	: 15 EI/BM 44		IA Marks	: 20
Number of Lecture Hours/Week	: 04		Exam Marks	: 80
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,	10 Hours	L2, L3, L4, L5

Correlation between time & frequency response, Bode plots. **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 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 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	: 15EI45	IA Marks	: 20
Number ofLectureHours/Week	: 04	Exam Marks	: 80
Total Number ofLecture 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), Votex 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 gravity, Liquid density measurement – Ball type, capacitance type,	10 Hours	L1, L2, L3, L4

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 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 5 full questions, selecting one full question from each module.

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, 5[th]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	: 15 EI/BM/ML 461		IA Marks	: 20
Number of Lecture Hours/ Week	: 03		Exam Marks	: 80
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	**8 Hours**	**L1, L2**
Module -2 UV and visible Spectrometers –instrumentation : Radiation Sources, Wavelength selection, Detector, Readout modules, Instruments for absorption photometry	**8 Hours**	**L1, L2**
Module -3 Flame emission and atomic absorption spectroscopy: Introduction, Instrumentation for flame spectrometric methods, Flame emission spectrometry, atomic absorption spectrometry, Atomic fluoresce spectrometry, Interferences associated with Flames & furnaces, applications, comparison of FES and AAS	**8 Hours**	**L1, L2**
Module -4 Gas Chromatography : Chromatography , Basics parts of a chromatography, Methods of measurements of peak areas, HPLC : HPLC Instrumentation, Mobile –phase delivery system sample introduction, separation of columns, Detectors – Ultraviolet Photometers & Spectrophotometers, electro chemicals detector (amperometric detector), Differential refractometers	**8 Hours**	**L1, L2, L3**

Module -5		
Blood analyzer : Introduction, Blood P_H measurements, measurement of blood P_{CO_2}, P_{O_2}, A Complete blood gas analyzer. Air pollution monitoring instruments Carbon monoxide, Sulphur di-oxide, Nitrogen oxides, Hydrocarbons Ozone, automated wet chemical air analysis, water pollution monitoring instruments.	**8 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 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. Instrumental Methods of Analysis, 7th edition. – 2. 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 (Elective-II)			
PRODUCT DESIGN TECHNOLOGY AND ERGONOMICS			
Subject Code	: 15EI462	IA Marks	: 20
Number of Lecture Hours/Week	: 03	Exam Marks	: 80
Total Number of Lecture Hours	: 40	Exam Hours	: 03
Credits - 3			

Course Objectives:
- The course aims at providing the basic concepts of product design, product features and its architecture so that student can have a basic knowledge in the common features a product has and how to incorporate them suitably in product

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:** Need for IPPD – Strategic importance of Product development – integration of customer, designer, material supplier and process planner, Competitor and customer – Behaviour analysis. Understanding customer – prompting customer understanding – involve customer in development and managing requirements – Organization – process management and improvement – Plan and establish product specifications.	**8 Hours**	L1, L2, L3, L4
Module -2 **Concept Generation And Selection:** Task – Structured approaches – clarification – search – externally and internally – explore systematically – reflect on the solutions and processes – concept selection – methodology – benefits.	**8 Hours**	L1, L2, L3
Module -3 **Product Architecture:** Implications – Product change – variety – component standardization – product performance – manufacturability – product development management – establishing the architecture – creation – clustering – geometric layout development – fundamental and incidental interactions – related system level design issues – secondary systems – architecture of the chunks – creating detailed interface specifications.	**8 Hours**	L1, L2, L3, L4
Module -4 **Industrial Design:** Integrate process design – Managing costs – Robust design – Integrating CAE, CAD, CAM tools – Simulating product performance and manufacturing processes electronically – Need for industrial design – impact – design process – investigation of for industrial design – impact – design process – investigation of customer needs –	**8 Hours**	L1, L2, L3, L4, L5

conceptualization – refinement – management of the industrial design process – technology driven products – user – driven products – assessing the quality of industrial design.		
Module -5 **Design For Manufacturing And Product Development:** Definition – Estimation of Manufacturing cost – reducing the component costs and assembly costs – Minimize system complexity – Prototype basics – principles of prototyping – planning for prototypes – Economic Analysis – Understanding and representing tasks – baseline project planning – accelerating the project – project execution	**8 Hours**	L1, L2, L3, L4, L5

Course Outcomes: After studying this course, students will able to:
- The student will be able to design some products for the given set of applications; also the knowledge gained through prototyping technology will help the student to make a prototype of a problem and hence product design and development can be achieved

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

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 FOUR 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. Kari T.Ulrich and Steven D.Eppinger, ”Product Design and Development”, McGraw-Hill International Edn, 1999

Reference Books:
1. Kemnneth Crow, "Concurrent Engg./Integrated Product Development”, DRM Associates,26/3, Via Olivera, Palos Verdes, CA 90274(310) 377-569, Workshop Book.
2. Stephen Rosenthal, “Effective Product Design and Development”, Business One Orwin, Homewood, 1992, ISBN 1-55623-603-4.
3. Staurt Pugh, “Tool Design –Integrated Methods for Successful Product Engineering”, Addison Wesley Publishing, New York.

B.E. Electronics and Instrumentation Engineering (EI)				
Choice Based Credit System (CBCS)				
Semester – IV (Elective-II)				
FIELD THEORY				
Subject Code	: 15EI463		IA Marks	: 20
Number of Lecture Hours/Week	: 03		Exam Marks	: 80
Total Number of Lecture Hours	: 40		Exam Hours	: 03
Credits - 3				

Course Objectives: This course will enable the students to
- Define and Describe Coulomb's law and electric field intensity.
- Define and explain electric flux density, Gauss's law and divergence.
- Describe energy and potential along with concepts of current and conductors.
- Describe Poisson's and Laplace's Equations, and Uniqueness Theorem.
- Define and Describe basic concepts of Magnetostatics by studying the various laws, Stoke's Theorem and scalar and vector magnetic flux density.
- Explain Magnetic Forces, Materials and Inductance.
- Describe the concepts of time varying fields and Develop Maxwell's equations in Point and Integral Forms.
- Describe and Compare different Types of Wave Propagation.

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 **Coulomb's Law and Electric Field Intensity** Experimental law of Coulomb, Electric field intensity, Field due to continuous volume charge distribution, Field of a line charge. Relevant Problems. **Electric flux density, Gauss's law and divergence** Electric flux density, Gauss' law, Divergence. Maxwell's First equation (Electrostatics), Vector Operator ▼ and divergence theorem. Relevant Problems.	**8 Hours**	**L1, L2**
Module -2 **Energy and Potential** Energy expended in moving a point charge in an electric field, The line integral, Definition of potential difference and potential, The potential field of point charge, Energy density in the electrostatic field. Relevant Problems. **Conductors, dielectrics and capacitance** Current and current density, Continuity of current, Metallic conductors, Conductor properties and boundary conditions, boundary conditions for perfect Dielectrics, Capacitance and examples. Relevant Problems	**8 Hours**	**L1, L2**
Module -3 **Poisson's and Laplace's Equations** Derivation of Poisson's and Laplace's Equations, Uniqueness theorem,	**8 Hours**	**L1,L2**

Examples of the solution of Laplace's equation, Examples of the solution of Poisson's equation, Relevant Problems. **The Steady Magnetic Field** Biot-Savart Law, Ampere's circuital law, Curl, Stokes' theorem, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic Potentials. Relevant Problems.		
Module -4 **Magnetic Forces** Force on a moving charge, differential current elements, Force between differential current elements. Force and Torque on a closed circuit. Relevant Problems. **Magnetic Materials and Inductance** Magnetization and permeability, Magnetic boundary conditions, Magnetic circuit, Potential Energy and forces on magnetic materials, Inductance and mutual inductance. Relevant Problems.	**8 Hours**	**L1, L2, L3**
Module -5 **Time-varying fields and Maxwell's equations** Faraday's law, displacement current, Maxwell's equations in point-form Maxwell's equations in integral-form, the retarded potential. Relevant Problems. **Uniform Plane Wave:** Wave propagation in free space, Wave propagation in dielectrics, Poynting's theorem and wave power, Propagation in good conductors: Skin Effect. Relevant Problems.	**8 Hours**	**L1, L2, L5**

Course Outcomes: After studying this course, students will able to:
 	
Acquire knowledge of
 o Concepts of Electric Fields, Magnetic Fields and Electromagnetic Waves.
 o Basic Concepts to Solve Problems in Electric Fields, Magnetic Fields.
 o Time-varying fields and Maxwell's equations.
 o Wave propagation in free space and dielectrics.
Analyse
 o Different Charge and Current Configurations to derive Electromagnetic Field Equations.
 o Poisson's and Laplace's Equations, Uniqueness theorem, and solution of Laplace's equation.
 o Time-varying fields, Maxwell's equations, wave propagation in free space and dielectrics.
Interpretation of
   o Gradient, Divergence and Curl Operators.
   o Maxwell's Equations in differential and integral forms.
   o Wave propagation in free space and dielectrics.
Apply the knowledge gained in the design of electric and Electronic Circuits, Biomedical equipment's, Antenna's and Communication Systems.		

Graduate Attributes (as per NBA) • Engineering Knowledge • Problem Analysis. • Design / development of solutions (partly)		
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 FOUR 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. W.H. Hayt, J.A. Buck and M. Jaleel Akhtar, "Engineering Electromagnetics", 8th Edition, McGraw-Hill, 2015, 9789339203276.
2. Mathew N.O. Sadiku and S.V. Kulkarni, "Principles of Electromagnetics", 6th Edition, Oxford University Press, 2015, 9780199461851.

Reference Books:
1. John Krauss and Daniel A Fleisch, "Electromagnetics with applications", McGraw Hill.
2. N. Narayana Rao, "Fundamentals of Electromagnetics for Engineering", Pearson

B.E. Electronics and Instrumentation Engineering (EI) Choice Based Credit System (CBCS) Semester – IV (Elective-II)				
ELECTRICAL MACHINES AND DRIVES				
Subject Code	: 15EI464		IA Marks	: 20
Number of Lecture Hours/ Week	: 03		Exam Marks	: 80
Total Number of Lecture Hours	: 40		Exam Hours	: 03
Credits - 3				

Course Objectives:
- The students will learn basic principle, A.C, D.C Circuits, Transformers, Characteristics, starting methods, of D.C. and A.C. motors, induction motor. and controlling the speed of D.C. and A.C. motors using solid state devices

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 ELECTRICAL CIRCUITS AND TRANSFORMERS: D.C. Voltage, current, power – Ohms law – series, parallel circuits – Kirchhoff's laws – mesh analysis – A.C. voltage – sinusoidal waves, – power factor – complex power – basic operation of transformers – simple problems	**8 Hours**	**L1, L2, L4**
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	**8 Hours**	**L1, L2**
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	**8 Hours**	**L1, L2, L3, L4**
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	**8 Hours**	**L1, L2, L3, L4**
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	**8 Hours**	**L1, L2, L3, L4**

Course Outcomes:

• Upon Completion of this subject, the students can able to explain different types of electrical machines and their performance

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

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 FOUR 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. Vukosavic, "Digital Control of Electrical Drives", Springer, Indian Reprint, 2010.
2. Vedam Subramaniam. "Electric Drives", Tata McGraw Hill, New Delhi, 2007.
3. De. N.K. & Sen. P.K "Electric Drives", Prentice Hall India Pvt Limited 2002.

Reference Books:
1. Crowder, "Electric Drives and Electromechanical Systems", Elsevier, Indian Reprint, 2009
2. Metha. V.K. &Rohit Metha, "Principle of Electrical Engineering", S.Chand & Co .2006.
3. Dubey.G.K. "Fundamental Electrical Drives" 2nd Edition, Narosa Publications, 2002
4. 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 - IV			
EMBEDDED CONTROLLERS LAB			
(Common to EI, BM & ML)			
Subject Code	: 15 EI/BM/ML L47	IA Marks	: 20
Number of Practical Hours/Week	: 03	Exam Marks	: 80
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 sin wave, square wave, Triangular wave, Ramp wave   to 8051 Microcontroller with C Program.
      12. Keyboard Interfacing for pressing any key function with 8051 Microcontroller with C Program.
	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: <ol start="5"> - 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 15% Marks allotted to the procedure part to be made zero.
Reference Books: "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   "MSP430 Microcontroller Basics" John H. Davis, Elsevier 2010.   "Embedded Systems Design using the TI MSP430 series", Cris Nagy, Newnes, Elsevier.   "The 8051 Microcontroller architecture. Programming and applications", Kenneth J Alyala Thomson learning 2005.

B.E. Electronics and Instrumentation Engineering (EI)

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

INSTRUMENTATION AND MEASUREMENT- LAB

Subject Code	: 15EIL48		IA Marks	: 20
Number of practical Hours/Week	: 03		Exam Marks	: 50
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 15% 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