

IV SEMESTER

B.E. Electronics and Instrumentation Engineering (EI) Choice Based Credit System (CBCS) Semester - IV			
ENGINEERING MATHEMATICS-IV (Common to All Branches)			
Subject Code	: 15MAT41		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: <ul style="list-style-type: none"> • 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:		
Reference Books:		

IV SEMESTER

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

SIGNAL CONDITIONING AND DATA ACQUISITION CIRCUITS (Common to EI, BM & ML) [Revised]

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				
<p>Course Objectives: This course will enable the students to</p> <ul style="list-style-type: none"> • 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. 				
<p>Revised Bloom's Taxonomy Levels: L1 – Remembering, L2 – Understanding, L3 – Applying, L4 – Analyzing, L5 – Evaluating, and L6 – Creating</p>				
Modules			Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
<p>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).</p> <p>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.</p> <p>Basic op-amp applications – Scale changer/Inverter. Summing amplifier: Inverting summing amplifier, Non-inverting Summing amplifier, Subtractor, Instrumentation Amplifier. (Relevant problems).</p>			10 Hours	L1,L2, L3,L4
<p>Module -2 Operational Amplifier Applications: V – I and I – V converter, Op-amp circuit using diodes, sample and hold circuit, Differentiator and Integrator.</p> <p>Comparator and waveforms generator: Comparator, Regenerative comparator (Schmitt Trigger), Astable mutivibrator, Monostable</p>			10 Hours	L1,L2, L3,L4

multivibrator and Triangular waveform generator. Phase shift oscillator, Wien bridge oscillator. (Relevant problems).		
Module -3 Voltage Regulators: Introduction, Series Op-amp regulator, IC voltage regulators, 723 general purpose regulators, switching regulator. Active filters: First and Second order LPF, First and Second orders HPF, Band Pass Filters, Band Reject filters. (Design examples).	10 Hours	L1,L2, L3,L4
Module -4 555 Timer: Description of Functional Diagram, Monostable operation, Applications of Monostable Multivibrator: Frequency Divider & Pulse Width Modulation. Astable operation, Applications of Astable Multivibrator: FSK Generator and Pulse Position Modulation. Phase Locked Loops: Basic Principles, Analog phase Detector/comparator, Voltage controlled oscillator. PLL applications: Frequency Multiplication/Division, Frequency translation, FM demodulation.	10 Hours	L2,L3,L4, L5, L6
Module -5 Data Acquisition Systems: Types of instrumentation systems, Components of analog data acquisition system, Digital data acquisition system, Use of recorders in digital systems, Digital recording systems. Data Converters: Digital to Analog Converters: Basic DAC techniques, Weighted Resistor DAC, R – 2R Ladder DAC, DAC 0800 (Data sheet: Features and description only). Analog to Digital Converters: Functional diagram of ADC, Flash ADC, Counter type ADC, Successive approximation ADC, Dual slope ADC. ADC 0809 (Data sheet: Features, specifications and description only), DAC/ADC specifications.	10 Hours	L2, L3,L4, L5, L6
Course Outcomes: After studying this course, students will able to: <ol style="list-style-type: none"> 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) <ul style="list-style-type: none"> • Engineering knowledge • Problem analysis • Design & development of solutions • Investigation of Complex Problem 		
Question Paper Pattern: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • 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	

<p>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.</p>	<p>10 Hours</p>	<p>L2,L3,L4</p>
<p>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.</p>	<p>10 Hours</p>	<p>L2,L3,L4,L5</p>
<p>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.</p>	<p>10 Hours</p>	<p>L1,L2,L3</p>
<p>Course Outcomes:After studying this course , Student will be able to:</p> <ul style="list-style-type: none"> • 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 		
<p>Graduate Attributes (as per NBA)</p> <ul style="list-style-type: none"> • Engineering Knowledge • Problem Analysis • Design and Development of solutions • Modern Tool usage 		
<p>Question Paper Pattern:</p> <ul style="list-style-type: none"> • 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. 		
<p>Text Books:</p> <ol style="list-style-type: none"> 1. “The 8051 Microcontroller and Embedded systems-using assembly and C”, Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinaly,PHI,2006/pearson,2006 2. “MSP430 Microcontroller Basics” John H. Davis, , Elsevier 2010. 3. “Embedded Systems Design using the TI MSP430 series”, Cris Nagy, Newnes, Elsevier. 		

Reference Books:

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

B.E. Electronics and Instrumentation Engineering (EI) Choice Based Credit System (CBCS) Semester - IV				
CONTROL SYSTEMS (Common to EI & BM)				
Subject Code	: 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 <ul style="list-style-type: none"> • 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.		10 Hours	L ₂ , L ₃ , L ₄ , L ₅	

Construction of root loci. Stability analysis using Root locus Technique Numerical problems on all topics.		
Module -4 Frequency domain Analysis: Introduction to frequency domain analysis, 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	10 Hours	L2, L3, L4, L5
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: <ul style="list-style-type: none"> • 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) <ul style="list-style-type: none"> • Engineering knowledge • Problem analysis • Design & Development of Solutions • Investigation of Complex Problem 		
Question Paper Pattern: <ul style="list-style-type: none"> • 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: <ol style="list-style-type: none"> 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, 4thEdition, 2002. 		
Reference Books: <ol style="list-style-type: none"> 1. “Automatic Control Systems”, Benjamin C. Kuo, John Wiley India Pvt. Ltd., 8thEdition, 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 of Lecture Hours/Week	: 04		Exam Marks	: 80
Total Number of Lecture Hours	: 50		Exam Hours	: 03

Credits - 4

Course Objectives:

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

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

Modules	Teaching Hours	Revised Bloom's Taxonomy (RBT) Level
<p>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</p>	10 Hours	L1, L2, L3, L4
<p>Module -2 Flow Measurement: Introduction, Classification of Flow Meters, Head type flow meters, Rotameter, Electromagnetic Flow Meter, Mechanical Flow Meters, Anemometers, Ultrasonic flow meters – Doppler shift type (principle, working & derivation of Δf), Transit time ((principle, working & derivation of ΔT), Vortex flow meters, Thermal flow meter, Laser anemometer, Rotor torque mass flow meter.</p>	10 Hours	L1, L2, L3, L4
<p>Module -3 Vibration Measurement: Introduction, Characteristics of vibration,</p>	10 Hours	L1, L2, L3, L4

<p>Vibration sensing devices, Signal conditioners for vibration sensors, Shock measurements, System characteristics, Vibration exciters & Calibration.</p> <p>Measurement of Density: Definition & units of density and specific gravity, Liquid density measurement – Ball type, capacitance type, displacement type, hydrometers, oscillating coriolis, radiation type, sound velocity type. Gas density measurement – displacement type, electromagnetic suspension type.</p>		
<p>Module -4</p> <p>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.</p> <p>Turbidity: Definition, transmission type turbidity meter, light scattering turbidity meter.</p>	10 Hours	L1, L2, L3, L4
<p>Module -5</p> <p>Humidity Measurement: Definition and terminologies, dry and wet bulb psychrometers (Sling psychrometer), hair hygrometers, thin film capacitance humidity sensor, dew-point hygrometers, electrolytic hygrometers.</p> <p>Moisture Measurement: Definition and terminologies. Measurement of moisture in gases and liquids – Electrolytic hygrometer, capacitance hygrometer, impedance hygrometer, piezoelectric hygrometer, infrared absorption hygrometer. Measurement of moisture in solids – Nuclear moisture gauge, infrared absorption moisture gauge, capacitance moisture gauge, conductance moisture gauge.</p>	10 Hours	L1, L2, L3, L4
<p>Course Outcomes: After studying this course, students will able to:</p> <ul style="list-style-type: none"> • 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. 		
<p>Graduate Attributes (as per NBA)</p> <ul style="list-style-type: none"> • Engineering knowledge • Problem analysis • Design & Development of Solutions • Engineer and society • Environment & sustainability • Lifelong learning 		
<p>Question Paper Pattern:</p>		

- 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, 5th Edition, McGraw Hill, 2007 [Module1- Radiation Methods of Temperature Measurement].
3. Process Measurement Instrument Engineers Handbook- BelaG.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 46		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 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
<p>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</p>	10 Hours	L1, L2
<p>Module -2 UV and visible Spectrometers –instrumentation : Radiation Sources, Wavelength selection, Detector, Readout modules, Instruments for absorption photometry</p>	10 Hours	L1, L2
<p>Module -3 Flame emission and atomic absorption spectroscopy: Introduction, Instrumentation for flame spectrometric methods, Flame emission spectrometry, atomic absorption spectrometry, Atomic fluorescence spectrometry, Interferences associated with Flames & furnaces, applications, comparison of FES and AAS</p>	10 Hours	L1, L2

<p>Module -4 Gas Chromatography : Chromatograph , Basics parts of a chromatograph, Methods of measurements of peak areas, HPLC : HPLC Instrumentation, Mobile –phase delivery system sample introduction, separation of columns, Detectors – Ultraviolet Photometers & Spectrophotometers, electro chemicals detector (amperometric detector), Differential refractometers</p>	<p>10 Hours</p>	<p>L1, L2, L3</p>
<p>Module -5 Blood analyzer : Introduction, Blood pH measurements, measurement of blood Pco₂, Po₂ , A Complete blood gas analyzer. Air pollution monitoring instruments Carbon monoxide, Sulphur dioxide, Nitrogen oxides, Hydrocarbons Ozone, automated wet chemical air analysis, water pollution monitoring instruments.</p>	<p>10 Hours</p>	<p>L1, L2, L3, L4</p>
<p>Course Outcomes:</p> <ol style="list-style-type: none"> 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. 		
<p>Graduate Attributes (as per NBA)</p> <ul style="list-style-type: none"> • Engineering Knowledge • Problem Analysis • Life-long Learning 		
<p>Question Paper Pattern:</p> <ul style="list-style-type: none"> • 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. 		
<p>Text Books:</p> <ol style="list-style-type: none"> 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) 		
<p>Reference Books:</p> <ol style="list-style-type: none"> 1. Braun R.D., Introduction to Instrumental Analysis, Mc Graw –Hill Singapore, 2006. 2. Frank G. Kerry Industrial Gas Handbook: Gas Separation and Purification, Taylor and francis group, 2007. 3. Principles of Instrumental Analysis 5th Edition – Douglas A. Skoog, F. James Holler, Timothy A. Niemen, Thomason Brooks/ Cole 		

B.E. Electronics and Instrumentation Engineering (EI) Choice Based Credit System (CBCS) Semester - IV				
EMBEDDED CONTROLLERS LAB (Common to EI, BM & ML)				
Subject Code	: 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 : <ul style="list-style-type: none"> • 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; <ol style="list-style-type: none"> 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 <ol style="list-style-type: none"> 8. Assembly program using MSP 430 for data transfer, Block Move in an array. 			L2, L3, L4	
Hardware programming (using 8051) <ol style="list-style-type: none"> 9. Stepper motor Interface to 8051 Microcontroller with C Program. 10. DC Motor Interface to 8051 Microcontroller with C Program 11. DAC Interface for to generate sine wave, square wave, triangular wave, Ramp wave through 8051Microcontroller with C Program. 12. Keyboard Interfacing. 13. ADC Interfacing 			L3, L4, L5	
Course Outcomes: After the completion of this Laboratory course, students will be able to: <ul style="list-style-type: none"> • Get hands-on exposure in 8051 and MSB 430 platform. • Enhance programming skills using Assembly language and C. 				

- Design and interfacing of microcontroller based embedded systems.
- Build projects

Graduate Attributes (as per NBA)

- Engineering Knowledge
- Problem Analysis
- Design and Development of solutions
- Modern Tool usage
- Individual and Team work

Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Students are allowed to pick one experiment from the lot.
3. Strictly follow the instructions as printed on the cover page of answer script for breakup of marks.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

Reference 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.
4. "The 8051 Microcontroller architecture. Programming and applications", Kenneth J Alyala Thomson learning 2005.

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

INSTRUMENTATION AND MEASUREMENT- LAB

Subject Code	: 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