Dr Ambedkar Institute of Technology, Bangalore-560056

(An Autonomous Institutions Affiliated to Visvesvaraya Technological University, Belgaum)

Department of Electronics and Instrumentation Engineering

Third and fourth semester syllabus

(2020-2021 Regulation)

2021-2022

.Dr. Ambedkar Institute of Technology, Bengaluru-560 056

SCHEME OF TEACHING AND EXAMINATION from Academic Year 2018-19

B.E Electronics and Instrumentation Engineering

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

III SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	BC	18MA31	Transforms & Applications	Mathematics	2	2	--	03	50	50	100	3
2	PC	18EI31	Analog Electronic Circuits	EI	3	0	--	03	50	50	100	3
3	PC	18EI32	Digital System Design	EI	4	0	--	03	50	50	100	4
4	PC	18EI33	Network Analysis	EI	3	2	--	03	50	50	100	4
5	PC	18EI34	Measurements and Instrumentation	EI	3	0	--	03	50	50	100	3
6	PC	18EI35	Sensors & Applications	EI	4	0	--	03	50	50	100	4
7	PC	18EIL36	Analog Electronic Circuits Lab	EI	--	0	2	03	50	50	100	1
8	PC	18EIL37	Digital System Design Lab	EI	--	0	2	03	50	50	100	1
9	HS	18HS31	Constitution of India Professional Ethics and Human Rights/ / Env. Studies	Hu/Civ	1	--	--	02	50	50	100	1
10	MC	18HS33	Soft skills (MC)	Humanities	04		--	03	50	-	50	0
				TOTAL	**24**	**04**	**04**	**29**	**500**	**450**	**950**	**24**

Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs

11	MC	18MAD31	Advance Mathematics - I	Mathematics	02	01	--	03	50		50	0

Note: HODs are informed to accommodate one more laboratory in addition to the above courses if needed, without altering the total number of credits (TOTAL: 24).

(a)**The mandatory non – credit courses** Advance Mathematics I and II prescribed at III and IV semesters respectively, to lateral entry Diploma holders admitted to III semester of BE programs shall compulsorily be registered during respective semesters to complete all the formalities of the course and appear for SEE examination.

(b) **The mandatory non – credit courses** Advance Mathematics I and II, prescribed to lateral entrant Diploma holders admitted to III semester of BE programs, are to be completed to secure eligibility to VII semester. However, they are not considered for vertical progression from II year to III year of the programme but considered as head of passing along with credit courses of the programme to eligibility to VII semester.

Note: BC: Science Course, PC: Professional Core. Hu: Humanities, MC: Mandatory Course.

Dr. Ambedkar Institute of Technology, Bengaluru-56

SCHEME OF TEACHING AND EXAMINATION from Academic Year 2018-19

B.E Electronics and Instrumentation Engineering

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

IV SEMESTER

Sl. No	Course and Course code		Course Title	Teaching Department	Teaching Hours /Week			Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P					
1	BC	18MA41	Probability, Numerical & Optimization Techniques	Mathematics	2	2	--	03	50	50	100	3
2	PC	18EI41	Process Instrumentation	EI	3	0	--	03	50	50	100	3
3	PC	18EI42	Control Systems	EI	4	0	--	03	50	50	100	4
4	PC	18EI43	Microcontroller and Applications	EI	4	0	--	03	50	50	100	4
5	PC	18EI44	Signals and Systems	EI	3	2	--	03	50	50	100	4
6	PC	18EI45	Linear IC's & Applications	EI	3	0	--	03	50	50	100	3
7	PC	18EIL46	Sensors and Signal Conditioning Circuits Lab	EI	--	0	2	03	50	50	100	1
8	PC	18EIL47	Microcontroller Lab	EI	--	0	2	03	50	50	100	1
9	HS	18HS41/42	Constitution of India Professional Ethics and Human Rights/ Env. Studies	Hum/Civ	1	--	--	02	50	50	100	1
10	MC	18HS43	Employability skills (MC)	Humanities	04		--	03	50	-	50	0
				TOTAL	**24**	**04**	**04**	**29**	**500**	**450**	**950**	**24**
Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs												
11	MC	18MAD41	Advance Mathematics - II	Mathematics	02	01	--	03	50		50	0

Note: HODs are informed to accommodate one more laboratory in addition to the above courses if needed, without altering the total number of credits (TOTAL: 24).

(a) The mandatory non – credit courses Advance Mathematics I and II prescribed at III and IV semesters respectively, to lateral entrant Diploma holders admitted to III semester of BE programs shall compulsorily be registered during respective semesters to complete all the formalities of the course and appear for SEE examination.

(b) The mandatory non – credit courses Advance Mathematics I and II, prescribed to lateral entrant Diploma holders admitted to III semester of BE programs, are to be completed to secure eligibility to VII semester. However, they are not considered for vertical progression from II year to III year of the programme but considered as head of passing along with credit courses of the programme to eligibility to VII semester.

Note: BC: Science Course, PC: Professional Core. Hu: Humanities, MC: Mandatory Course.
ENV: Environmental Studies, CIP: Constitution of India Professional Ethics and Human Rights

Subject Title : **Analog Electronic Circuits**		
Sub Code : **18EI31**	No of credits : 3=3:0:0(L:T:P)	No of Lecture hours/week:3
Exam Duration: 3 hrs		Total no. of contact hours: 39

Course Objectives: This course introduces the student to

1. Understand the design and working of diode, clipping, clamping circuits,
2. Impart knowledge on the structure, V-I characteristics, working of MOSFETs
3. Design amplifiers using BJTs and MOSFETs, power amplifiers, feedback amplifiers

Unit No	Syllabus	No of Teaching hours
1	**Diode:** Diode Clippers and clampers circuit. **BJT:** Operating point, Fixed bias circuits, voltage biased circuits. **Transistor at Low Frequencies:** BJT transistor modeling, Hybrid equivalent model, CE Fixed bias configuration, Voltage divider bias configuration **Frequency Response of the CE amplifier:** General frequency consideration, The low frequency response, The high frequency response	**08**
2	**MOS Field-Effect Transistors:** Device Structure and Physical operation, Current Voltage Characteristics, MOSFET circuits at DC	**08**
3	**MOSFET Amplifier:** The MOSFET as an amplifier and as a switch, biasing in MOS amplifier circuits, Small-Signal Operation and Models, Frequency Response of The CS Amplifier.	**08**
4	**Feedback Amplifier and Oscillators:** Feedback concept, Feedback connections type, Practical feedback circuits using BJT, Condition for oscillations, phase shift Oscillator.	**08**
5	**Power Amplifiers**: Definitions and amplifier types, series fed class A amplifier, Transformer coupled Class A amplifiers, Class B amplifier operations, Class B amplifier circuits, Amplifier distortions**.**	**07**

TEXT BOOKs:

1. Microelectronic Circuits-Theory and applications by Adel S. Sedra and Kenneth C.Smith, Fifth Edition , (Oxford International Student Edition)
2. **"Electronic Devices and Circuit Theory",** Robert L. Boylestad and Louis Nashelsky, PHI/Pearson Education. 12th Edition 2012.

REFERENCE BOOKS:

1. **'Integrated Electronics',** Jacob Millman & Christos C. Halkias, Tata - McGraw Hill, 2nd Edition 2007
2. **"Electronic Devices and Circuits",** David A. Bell, PHI, 4th Edition, 2007

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

CO1: Define, understand and explain the structure, V-I characteristics, working of analog electronic devices like diodes, Bipolar Junction Transistors (BJTs) and MOSFETs

CO2: Apply the knowledge of Kirchhoff's voltage and current laws to obtain voltage or current waveform at different points in analog electronic circuits such as diode clippers, clampers, amplifiers using BJTs and MOSFETs, power amplifiers, feedback amplifiers

CO3: Analyze analog electronic circuits such as diode clippers, clampers, amplifiers using BJTs and MOSFETs, Power amplifiers, feedback amplifiers.

CO4: Design analog electronic circuits such as diode clippers, clampers, amplifiers using BJTs and MOSFETs, power amplifiers, feedback amplifiers for given specifications.

CO-PO MAPPING												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**2**
CO2	**3**	**2**	**2**	**1**	**3**	**-**	**-**	**-**	**1**	**1**	**-**	**2**
CO3	**2**	**2**	**3**	**1**	**3**	**-**	**-**	**-**	**1**	**1**	**-**	**2**
CO4	**3**	**2**	**2**	**2**	**3**	**-**	**-**	**-**	**1**	**1**	**-**	**2**

Subject Title : **Digital System Design**		
Sub Code : **18EI32**	No of credits : 4=4:0:0 (L:T:P)	No of Lecture hours/week: 4
Exam Duration: 3 hrs		Total no. of contact hours: 52

Course Objectives:

This course introduces the student to

1. Make the students to understand the principles of Boolean algebra and simplification using K-maps and Quine- McCluskey techniques.
2. Analyze and design the digital systems like decoders, Multiplexers, Encoders, and Comparators etc.
3. Understand the operation of flip-flops, counters, registers, and register transfers and to design and analyze the operation of sequential circuits using various flip-flops
4. Understand the concepts of HDL-Verilog dataflow, behavioral and structural description
5. Design and develop the verilog code for both combinational and Sequential circuits using procedure, task and function

Unit No	Syllabus	No of hours
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**
2	**Combinational Functions:** Arithmetic Operations: Adders and subtractors cascading full adders, Look ahead carry, Binary Comparators -2bit and 4 bit, two bit Multiplier, Verilog Description of for above circuits. Multiplexers, Demultiplexers & its 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)	**12**
3	**Analysis and design of combinational logic:** Decoders: Binary – Gray vice versa, BCD – Excess 3, BCD – Decimal, BCD – Seven segment, Seven segment display. Encoders: Realization of Priority Encoders, **Verilog behavioral description of Encoders (**8 to 3 with priority and without priority), Decoders (2 to 4).	**10**
4	**Sequential Logic Circuits:** Latches and Flip-Flops: SR-latch, D-latch, D flip-flop, JK flip-flop, T flip- flop Master slave 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**
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.	**10**

TEXT BOOKS:

1. "Digital Logic Applications and Design", John M Yarbrough, Thomson Learning, 2001.(units 1,2,3,4,5-logic design)
2. "HDL Programming VHDL and Verilog"- Nazeih M.Botros, 2009 reprint, Dreamtech press(units 1,2,3,4,5-verilog description)

REFERENCE BOOKS:

1. Fundamentals of logic Design", Charles H Roth, Jr Cengage learning
2. "VHDL: Programming Examples"-Douglas perry-Tata McGraw-Hill 4th edition 2004
3. "Fundamentals of HDL" by Cyril P R Pearson/Sanguin 2010

Course Outcomes:

Upon completion of the course, student should able to

CO1: Simplify Boolean functions using k-map and Quine-Mc.Cuskey minimization technique.

CO2: Utilize the Verilog code to analyze, design and write Verilog code for combinational circuits (MUX, De-MUX, adder, subtractor and comparator circuits)

CO3: Design and analyze code converters, encoders and decoders.

CO4: Analyze and design synchronous sequential circuits.

CO-PO MAPPING												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**1**	**3**	**2**	**2**	-	-	-	**1**	**1**	-	**2**
CO2	**3**	**2**	**3**	**1**	**3**	-	-	-	**1**	**1**	-	**2**
CO3	**3**	**2**	**3**	**1**	**3**	-	-	-	**1**	**1**	-	**2**
CO4	**3**	**2**	**3**	**2**	**3**	-	-	-	**1**	**1**	-	**2**

Low-1 Medium-2 High-3

Subject Title : **Network Analysis**		
Sub Code : **18EI 33**	No of credits : 4=3:2:0 (L:T:P)	No of Lecture hours/week: 5
Exam Duration: 3 hrs		Total no. of contact hours: 65

Course Objectives:

1. To give fundamental idea to solve electrical networks
2. To make use of network theorems to solve complex network
3. To understand concept of resonance and applying initial conditions in electric circuits.
4. To study theorems and applications of Laplace transform for RLC circuits
5. To understand fundamental knowledge about two port network parameters

Unit No	Syllabus	No of Teaching hours	Tutorial
1	**Basic Concepts**: Practical sources, Source shifting, Source transformations, Network reduction using Star – Delta transformation. **Advanced loop and node analysis:** Loop and node analysis with linearly dependent and independent sources for DC and AC networks, Concepts of super node and super mesh.	**08 Hours**	**06 Hours**
2	**Network Theorems: (**applied to DC and AC circuits with independent and dependent source**s)** Superposition theorem , Thevinin's and Norton's theorems, Maximum Power transfer and Millman's theorem	**08 Hours**	**06 Hours**
3	**Resonant Circuits:** Series and parallel resonance, frequency-response of series and Parallel circuits, Q –factor, Bandwidth. **Transient behavior and initial conditions**: Behavior of circuit elements under switching condition and their Representation, evaluation of initial and final conditions in RL, RC and RLC circuits for AC and DC excitations.	**08 Hours**	**04 Hours**
4	**Laplace Transformation & Applications**: Solution of networks, step, ramp and impulse responses, waveform Synthesis. Solving RC, RL and RLC Networks with initial conditions using Laplace transform analysis	**08 Hours**	**05 Hours**
5	**Two port network parameters:** Definition of z, y, h and transmission parameters, modeling with these parameters, relationship between parameters sets. Problems to solve for each parameters and problems on relationship.	**07 Hours**	**05 Hours**

Course Outcomes:

After completion of the course the students is able to

1. Apply basic technique and network theorems to solve for network parameters with AC & DC source.
2. Analyze the behavior of resonance in electrical networks.
3. Evaluate transient behavior and initial conditions in electrical circuits.
4. Apply Laplace transformation to determine the response of electrical networks
5. Determine the two port parameters and evaluate relationships between them

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

TEXT BOOKS:

1.**"**Network Analysis", M. E. Van Valkenburg, PHI / Pearson Education, 3rd Edition. 2002.

2." Network Analysis and Synthesis", Ravish R Singh, Mc Graw Hill, 2nd Edition, 2019.

REFERENCE BOOKS:

1. *"***Networks and systems**", Roy Choudhury, 2nd edition, 2006, New Age International Publications.

2. **"Engineering Circuit Analysis",** Hayt, Kemmerly and Durbin TMH 6th Edition, 2002

Subject Title : **Measurements and Instrumentation**		
Sub Code : **18EI34**	No of credits : 3=3:0:0(L:T:P)	No of Lecture hours/week:3
Exam Duration: 3 hrs		Total no. of contact hours: 39

Course Objectives: The students will be able to

1. Understand the use of various electrical & electronic instruments, principles of operation, analysis, and calibration of instruments.
2. Apply DC/AC bridges for unknown parameters measurement.
3. Analyze and evaluate the performance of various electrical and electronic Instruments
4. Develop mathematical models, analyze and design various instrument systems.

Unit No	Syllabus	No of Teaching hours
1	**Measurement:** Introduction, definition of measurements, units of electrical measurements, selecting measurement and control devices, safety, performance, electrical supply, air supply, installation and maintenance, Accuracy and repeatability **Identification and Symbols**: identification, Line symbols, device and function symbols **Calibration of measuring Instruments**: comparison methods, Digital multimeters as standard instruments, calibration instruments, potentiometers, potentiometer calibration methods.	**08**
2	**Analyzers:** Location, tagging, implementation, safety: Introduction, electrocution, risk, earthing(grounding), bonding, flammable atmospheres, other safety aspects, code compliance, selection, documentation, Sampling systems, testing and startup, maintenance **EMC:** Introduction, interference, coupling mechanisms, circuits, layout & grounding, interfaces, filtering and scheduling	**08**
3	**Measurement of electrical parameters:** Method of measuring voltage using PTs, Method of measuring current using CTs, Interposing CTs, Shunt and Hall effect sensor. Advantages/Disadvantages of CTs over shunts, simple methods of measurement of power in DC and AC systems. Method of electrical isolation. Voltage and current transducers **Data Acquisition System (DAS):** Introduction, Single channel, Multi channel DAS, Computer based DAS.	**08**
4	**Ammeter:** Introduction, DC Ammeter, Multirange Ammeters, RF Ammeter, Effect of frequency on calibration. **Voltmeter:** Introduction, DC voltmeter, Multirange voltmeter, Extending voltmeter ranges, Average Responding voltmeter, Peak responding voltmeter, True RMS voltmeter.	**07**
5	**Measurement of Resistance, Inductance and capacitance:** Wheatstone bridge-sensitivity analysis, limitations, kelvin's double bridge, Maxwells bridge, desauties bridge, schering Bridge, source and detectors, minimization of AC bridge errors, problems., hay's bridge , Anderson's bridge	**08**

TEXT BOOKS

1. Electronic Instrumentation and Measurements, David A Bell, PHI/ Pearson Education, 2nd Edition, 2012, ISBN: 978-81-203-2360.
2. Electronic Instrumentation, H S Kalsi, TMH, 2nd Edition, 2010, ISBN: 978-00-707-2066
3. Electrical and Electronic Measurements and Instrumentation, A.K.Sawhney, Dhanpat Rai & sons, 18th Edition, ISBN: 81-7700-016-0
4. The condensed Handbook of Measurement and Control, N E Battikha, ISA copy right 2018

Course Outcomes: After completing the course, the students will be able to

CO1: Understand the basic concepts of measurement and identification of various symbols

CO2: Apply the concepts of DC/AC bridge circuits, analog and digital instruments, DAS.

CO3: Analyze and evaluate the performance of various electrical and electronic Instruments

CO4: Develop mathematical models, analyze and design various instrument systems and their calibration, through course activities.

Subject Title : **Sensors & Applications**		
Sub Code : **18EI35**	No of credits : 4=4:0:0(L:T:P)	No of Lecture hours/week:4
Exam Duration: 3 hrs		Total no. of contact hours: 52

Course Objectives:
In this course students will be able to:

1. To impart the principles and working modes of various types of Inductive, Capacitive, Laser, Ultrasonic, Radar sensors.
2. To give an idea about the applications of various transducers and selection criteria of a transducer
3. To develop a knowledge on the principles and applications of self generating sensors.

Unit No	Syllabus	No of Teaching hours
1	Definition of a sensor and transducer, sensor classification, block diagram, Active and Passive Transducers, Primary and secondary Transducers, Advantages of Electrical Transducers, Selection of Transducers **Static characteristics of measurement system:** Definition, static calibration, true value, types of error- Gross error, systematic error, random error, static error, static correction, scale range and span, Reproducibility, drift, repeatability, accuracy & precision, linearity, Hysteresis, threshold, Dead time & dead zone, Resolution & discrimination, problems **Dynamic characteristics:** Definition, Speed of response, measuring lag, fidelity, Dynamic error, dead time, zero order measurement systems, first order measurement systems, second order measurement systems	**10**
2	**Inductive, capacitive, optical, Sensors and limit switches:** Inductive proximity sensors and its working principle. Different types like flush, non flush, ring type. Various industry applications (like end travel sensing, metal sensing). Capacitive type proximity sensors and its working principle, various industry applications (like bottle filling etc.,) Limit switches and its industry applications (like Conveyor Belts). Photo sensors (diffused beam, through beam, slotted sensor) working principle and industry application.	**12**
3	**Laser, Ultrasonic, Radar type Sensors:** Ultrasonic sensor working principle and its Applications involving ultra sonic detection, Laser and Radar sensor working principle and its Applications, Advantage and disadvantages. Conventional conductive sensor used in water tanks for level measurement. Touch sensors and its working principles, Types of Touch sensors and its application.	**10**
4	**Linear variable Differential transformer(LVDT)**: Advantages, disadvantages, uses of lvdt's, Rotary variable differential transformer **Piezo-electric Transducers**- modes of operation od piezo-electric crystals, properties, equivalent circuit of Piezo-electric Transducers, loading effects and frequency response, impulse response of Piezo-electric crystals, uses of Piezo-electric materials and transducers Optical transducers, photo emissive cells, photo conductive cells, photo diodes, photo transducers, photo voltaic cells **Digital Encoding transducers**: classification of encoders, construction of	**10**

	encoders-brush type, optical displacement transducers, shaft encoder, coding limitations, brush type encoders.	
5	**Self-generating sensors:** Thermo electric sensors, piezo electric sensors, pyro electric sensors, photovoltaic sensors, Intelligent sensors **Other sensing methods:** sensors based on semiconductor junctions, sensors based on MOSFET transistors, charge coupled and CMOS image sensors, fiber optic sensors, ultrasonic based sensors, biosensors **Applications:** weather monitoring systems, water monitoring systems, Battery monitoring systems	**10 Hours**

Text books:

1. Electrical & Electronic Measurements & Instrumentation, A.K.Sawhney. Dhanphat Rai 11th edition, PHI 2014
2. Electronic Instrumentation & Measurements, H S. Kalsi, II edition, 2010

Reference Books:

1. Doebelin, E.O., Measurement Systems, McGraw-Hill Book Co., 1998.
2. Neubert, H.K.P. Instrument Transducers, Clarenden Press, Oxford, 1988.
3. Patranabis, D, Sensors and Transducers, Wheeler Publishing Co., Ltd. New Delhi, 1997.
4. Murthy, D.V.s., Transducers and Instrumentation, Prentice Hall of India Pvt. Ltd., New Delhi, 1995.
5. Ranganathan, S., Transducer Engineering, Allied Publishers, Chennai, 1999.

Course Outcomes:

After completion of the course the students is able to

CO1: Remember and understand the basic principles of sensors and transducers.
CO2: Apply the knowledge of transducers and sensors in selecting the proper instrumentation systems.
CO3: Analyze and evaluate the performance of different sensors, transducers and converters for various applications.
CO4: Design and create a system using appropriate sensors for a particular application.

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

Low-1 Medium-2 High

Subject Title : **Analog Electronic Circuits Lab**		
Sub Code :**18EI L36**	No of credits : 1.0=0:0:1.0 (L:T:P)	No of Lecture hours/week: 2
Exam Duration: 3 hrs		Total no. of contact hours: 13

Course objectives:

1. To familiarize the function of Electronic equipments like CROs, Signal generators ,Power supplies, , Multimeters
2. To impart the knowledge of using simulation software tool
3. Apply the biasing techniques to design and construct transistor amplifiers and FET amplifiers

Expt No	Syllabus
1	Study the characteristics of Diode, BJT, FET, MOSFET
2	Design and Testing of Diode clipping and clamping circuits
3	Testing of Half wave, Full wave and Bridge Rectifier circuits with and without Capacitor filter. Determination of ripple factor, regulation and efficiency
4	Design and testing of RC coupled Single stage BJT amplifier
5	Design and testing the frequency response of CS FET/ MOSFET
6	Design and Testing for the performance of BJT/FET RC Phase shift Oscillators for range of $f_0 \geq$100KHz.
7	Design and Testing for the performance of FET Hartley & Colpitts Oscillators for range of $f_0 \geq$100KHz.
8	Design a Series Voltage Regulator using Zener diode and power transistor.
9	Design a switching circuit using BJT,MOSFET/IGBT
10	Testing of a transformer less Class – B push pull power amplifier and Determination of its conversion efficiency.
11	Design an experiment to analyze the Darlington amplifier of BJT/FET using software simulator
12	Design and testing of current and voltage series amplifier (BJT) using software simulator tool
13	Demonstration of open ended project using the concept of Experiments 1- 12

Course Outcome:

On completion of this course the students will be able to:

CO1: Compute the parameters from the characteristics of Diode, BJT, FET, MOSFET devices

CO2: Test the performance of Rectifiers, Oscillator Circuits, Amplifiers

CO3: Design and construct basic electronic circuits using diodes, transistors and FETs

CO4: Demonstrate basic skills on using electronic simulation software

CO-PO MAPPING												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**1**	**1**	**-**	**2**
CO2	**3**	**2**	**2**	**1**	**3**	**-**	**-**	**-**	**1**	**1**	**-**	**2**
CO3	**3**	**2**	**2**	**1**	**3**	**-**	**-**	**-**	**1**	**1**	**-**	**2**
CO4	**3**	**2**	**2**	**2**	**3**	**-**	**-**	**-**	**1**	**1**	**-**	**2**

Subject Title : **Digital System Design Lab**		
Sub Code :**18EI L37**	No of credits : 1.0=0:0:1.0(L:T:P)	No of Lecture hours/week: 2
Exam Duration: 3 hrs		Total no. of contact hours: 13

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**.**

Expt No	Syllabus
1	Simplification, realization of Boolean expressions using logic gates/Universal gates
2	To design and implement a. Adder/Subtractor – Full/half using logic gates. b. 4-bit Parallel Adder/ subtractor using IC 7483.
3	To realize using IC 7483 a. BCD to Excess-3 code conversion and vice versa b. Binary to Gray code conversion and vice versa
4	To realize a. 4:1 Multiplexer ,8x1 Mux b. 1:8 Demux c. Priority encoder and 3:8 Decoder using IC74138 d. Two bit comparator
5	To verify the truth table of following flip-flops using IC (a) T type (b) JK Master slave (c) D type
6	To realize the 3-bit counters as a sequential circuit and Mod-N Counter design (7476, 7490, 74192, 74193)
7	Adder/Subtractor – Full/half using Verilog data flow description
8	Code converters using Verilog Behavioral description a. Gray to binary and vice versa b. Binary to excess3 and vice versa
9	Combinational designs using Verilog Behavioral description a. 8:1 mux, 3:8 decoder, 8:3 encoder, Priority encoder b. 1:8 Demux and verify using test bench c. 2-bit Comparator using behavioral description
10	Flip-flops using Verilog Behavioral description a) JK type b) SR type c) T type and d) D type
11	Binary any-sequence UP/Down 4-bit counter using Verilog behavioral description
12	Interface experiments: (a) Stepper motor (b) Waveform generation using DAC

CO-PO MAPPING												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**1**	**3**	**2**	**2**	-	-	-	**1**	**1**	-	**2**
CO2	**3**	**2**	**3**	**1**	**3**	-	-	-	**1**	**1**	-	**2**
CO3	**3**	**2**	**3**	**1**	**3**	-	-	-	**1**	**1**	-	**2**
CO4	**3**	**2**	**3**	**2**	**3**	-	-	-	**1**	**1**	-	**2**
CO5	**3**	**2**	**3**	**2**	**2**				**1**	**1**	-	**2**

Subject Title : **Process Instrumentation**		
Sub Code : **18EI41**	No of credits : 3=3:0:0 (L:T:P)	No of Lecture hours/week: 3
Exam Duration: 3 hrs		Total no. of contact hours: 39

Course Objectives:

The objectives of the course are to make the students to:

1. Understand the basic concepts Functional elements of an instrument.
2. Understand the concepts of measurements of Force, Torque and Shaft power.
3. Understand and explain the concept of Temperature measurements, Flow measurements, Radiation measurements, Pressure measurements and Level measurements techniques

Unit No	Syllabus	No of Teaching hours
1	**Generalized Configuration, Functional Description & Performance Characteristics of Measuring Instruments:** Functional elements of an instrument: analog & digital modes of operation: null & deflection methods: I/O configuration of measuring instruments & instrument system- methods of correction for interfering & modifying inputs. **Measurement of Displacement:** Principle of measurement of displacement, variable inductance & variable reluctance pickups, capacitance pickup.	8
2	**Measurement of Force, Torque & Accelerometer**: Principle of measurement of Force, Torque, Shaft power standards and calibration, basic methods of force measurement, characteristics of elastic force transducer Bonded strain gauge, differential transformer, piezo electric transducer, variable reluctance/ FM-Oscillator digital systems, loading effects; torque measurement on rotating shafts, accelerometers.	8
3	**Temperature Measurement:** Standards & calibration, thermal expansion methods, bimetallic thermometers, liquid-in-glass thermometers, thermoelectric sensor (thermocouple), common thermocouples, reference junction consideration, special materials, configuration & techniques, electrical resistance sensors, conductive sensor (resistance thermometers), bulk semiconductor sensors (thermistors), junction's semiconductor sensors (AD590, LM335); **Radiation Methods:** radiation fundamentals, radiation detectors, unchopped (DC) broadband radiation thermometers, Chopped (AC) selective band (photon) radiation thermometers, optical pyrometers.	8
4	**Flow Measurement**: Local flow velocity, magnitude and direction. Flow visualization. Velocity magnitude from pitot static tube. Velocity direction from yaw tube, pivoted vane, servoed sphere, dynamic wind vector indicator. Hot wire and hot film anemometer. **Laser Doppler Velocimeter:** Gross volume flow rate; calibration and standards. Constant-area, variable-pressure-drop meters (obstruction meters). Averaging pitot tubes. Constant pressure-drop, variable area meters (Rotameters),	8
5	**Pressure Measurement**: Standards & calibration, basic methods of pressure measurement, dead weight gauges & manometer, manometer dynamics, elastic transducers, high pressure measurement, low pressure (vacuum) measurement, McLeod gauge, Knudsen gauge, momentum transfer (viscosity) gauges. **Level Measurement:** radiation level sensors, ultrasonic level detector.	7

TEXT BOOKS:

1. "Measurement Systems Application and Design", Ernest O Doebelin, Tata McGraw Hill. 6th Edition, 2007

REFERENCE BOOKS:

1. Instrumentation Devices & Systems- Rangan, Mani and Sharma, Tata McGraw Hill. 2nd Edition, 1997
2. Process Instruments & Controls Hand Book Considine- D.M. Mc Graw Hill, 2nd edition 1985
3. Transducers & Instrumentation, DVS Murthy, Prentice Hall of India. 2nd Edition, 2008
4. Instrument Engineers Hand book-(process measurement) B G LIPTAK, Chilton book Company, 4th edition, 2011.

Course Outcomes:

On Successful completion of the course the student is equipped with the knowledge on an:

CO1: Ability to understand the basic concepts of Functional elements of an instrument.

CO2: Ability to understand the concepts of Measurements of Force, Torque, Shaft power

CO3: Ability to explain the techniques of Flow measurements and Pressure measurements and Level measurements.

CO-PO MAPPING												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**2**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**2**	**1**	**2**
CO2	**2**	**2**	**2**	**2**	**3**	**-**	**-**	**-**	**1**	**1**	**-**	**2**
CO3	**2**	**2**	**2**	**1**	**3**	**-**	**-**	**-**	**1**	**1**	**-**	**2**

Low-1 Medium-2 High-3

Subject Title : **Control Systems**		
Sub Code :**18EI42**	No of credits : 4=4:0:0 (L:T:P)	No of Lecture hours/week: 4
Exam Duration: 3 hrs		Total no. of contact hours: 52

Course Objective:

1. To introduce the concept of feedback control system.
2. To impart knowledge in mathematical modeling of physical systems.
3. To impart knowledge in characteristics and performance of feedback control system.
4. To teach a variety of classical methods and techniques for analysis and design of control systems.
5. To understand and analyze the stability of control systems in time domain using Roth- Hurwitz method and root locus technique.
6. To understand and analyze the stability of control systems in frequency domain using Nyquist and Bode Plots

Unit No	Syllabus	No of Teaching hours
1	**System Modelling:** Introduction, Review of Systems, Mathematical Models, Differential equation of Physical Systems, Electrical systems, Mechanical Translational systems and Rotational systems, Transfer Functions, Analogous systems, Block Diagrams and Signal Flow Graphs.	**11 Hours**
2	**Time Response of feedback control systems**: Standard test signals, Unit step response of First and second order systems, Time response specifications, Time response specifications of second order systems, steady state errors. **Stability analysis:** Concepts of stability, Necessary conditions for Stability, Routh- Hurwirtz stability criterion, Relative stability analysis.	**10 Hours**
3	**The Root Locus Method:** Introduction, The root locus concepts, Construction of root loci, Feedback Control System Analysis & Performance Specifications in Time Domain	**10 Hours**
4	**Frequency Domain Analysis:**Frequency Response Methods, Performance Specifications in Frequency-Domain, Nyquist's Stability Criterion, Bode Plots, Stability Margins.	**10 Hours**
5	**Compensation Techniques:** Lead, lag, lead lag network and compensator design using Bode/Root locus techniques.	**11 Hours**

Course Outcome:

After the successful completion of the course, the student is able to:

CO1:generate mathematical models of linear time invariant control system by applying differential equations, transfer function, block diagram and signal flow diagram techniques.

CO2: Transform from electrical to mechanical and vice versa by applying suitable analogy

CO3: Analyze and characterize the behavior of a control system in terms of time domain and frequency domain performance parameters.

CO4: Compute and assess the system stability by applying Routh Hurwitz and root locus techniques

CO5: Assess the stability of the system in the frequency domain by applying Nyquist stability criterion and bode Plots

CO6: Design lead, lag and lead lag compensators for the given specifications by drawing root locus and bode plots

CO-PO MAPPING												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	2	2	-	-	1	1	1	1	1
CO2	1	2	2	3	2	-	-	1	1	1	1	1
CO3	2	2	2	3	2	-	-	1	1	1	1	1
CO4	1	2	2	3	2	-	-	1	1	1	1	1
CO5	1	2	2	3	2	-	-	1	1	1	1	1
CO6	2	2	2	3	2		-	1	1	1	1	1

TEXT BOOK:

1. J. Nagarath and M.Gopal, "Control Systems Engineering", New Age International (P) Limited, Publishers, 5th edition – 2007
2. "Modern Control Engineering **",** K. Ogata, Pearson Education Asia/ PHI, 5th Edition, 2010.

REFERENCE BOOKS:

1. "Automatic Control Systems", Benjamin C. Kuo and FaridGolnaagi, Wiley Studnt 8th Edition, 2009

2."Feedback and Control System", Joseph J Distefano III et al., Schaum's Outlines, TMH, 2nd Edition 2007.

3. "Design and Analysis of Control Systems**"** Arthur G.O. Mutambara CRC Publication 2nd Indian Reprint 2015

4. Control Systems Engineering Norman S. Nise, California State Polytechnic University, 7th Edition, Pomona, Wiley Publications

Subject Title : **Microcontroller and Applications**		
Sub Code : **18EI43**	No of credits : 4=4:0:0 (L:T:P)	No of Lecture hours/week: 4
Exam Duration: 3 hrs		Total no. of contact hours: 52

Course objectives:

1. To understand the basic concepts of embedded systems.
2. To understand the architecture of 8051 microcontrollers
3. To understand the architectural features and application capabilities of MSP430.

Unit No	Syllabus	No of Teaching hours
1	**Introduction:** Microcontrollers and Embedded systems, Overview of the 8051, Architecture of the 8051, Addressing modes, assembly programming, Programming the 8051.	**10**
2	MSP430x5x series block diagram, address space, on-chip peripherals (analog and digital), and Register sets. Instruction set, instruction formats, and various addressing modes of 16-bit microcontroller; Sample embedded system on MSP430 microcontroller. Memory Mapped Peripherals, programming System registers, I/O pin multiplexing, pull up/down registers, GPIO control. Interrupts and interrupt programming.	**11**
3	Watch dog timer, system clocks, Timer & Real Time Clock (RTC), PWM control, timing generation and measurements. Analog interfacing and data acquisition: ADC and Comparator in MSP430, data transfer using DMA.	**11**
4	Serial communication basics, Synchronous/Asynchronous interfaces (like UART, USB, SPI, and I2C). UART protocol, I2C protocol, SPI protocol. Implementing and programming UART, I2C, SPI interface using MSP430, Interfacing external devices.	**10**
5	Parallel Ports, Lighting LEDs, Flashing LEDs, Read Input from a Switch, Toggle the LED state by pressing the push button, 7-segment Display Interfacing, LCD interfacing. Stepper motor, DC motor Interfacing., IR Sensor, LDR Sensor Interfacing.	**10**

Text Books:

1. Mazidi Ali Muhammad, Mazidi Gillispie Janice, and Mc Kinlay Rolin D "The 8051 Microcontroller and Embedded Systems using Assembly and C", Pearson Publication.
2. John H Davies, MSP430 Microcontroller Basics, Newnes Publications, Elsevier,2008.

References:

1. Chris Nagy, Embedded Systems Design using TI MSP430 Series, Newnes Publications, Elsevier, 2003.
2. User Guide from Texas Instruments

Course Outcomes: On completion of the course, students will be able to

CO1: Explain the concept and applications of Embedded Systems and 8051 microcontroller architecture and simple programming
CO2: Apply the architecture, addressing modes and Analyze instruction set of MSP430 and develop programs for control applications using assembly language and embedded C.
CO3: Use RTC, Timers, ADC and comparator for simple applications.
CO4: Demonstrate Serial communication protocols and programming.
CO5: Interface devices and peripherals to microcontroller and write program

CO-PO MAPPING												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	2	**3**	-	**3**	-	-	-	**1**	**1**	**1**	**2**
CO2	**3**	**2**	**3**	**1**	**3**	-	-	-	**1**	**1**	-	**2**
CO3	**3**	**2**	**3**	**1**	**3**	-	-	-	**1**	**1**	-	**2**
CO4	**3**	**2**	**3**	**2**	**3**	-	-	-	**1**	**1**	-	**2**
CO5	**3**	**2**	**3**	**1**	**3**	-	-	-	**1**	**1**		**2**

Low-1 Medium-2 High-3

Subject Title : **Signals & Systems**		
Sub Code : **18EI44**	No of credits : 4=3:2:0 (L:T:P)	No of Lecture hours/week: 5
Exam Duration: 3 hrs		Total no. of contact hours: 65

Course Objectives:

The objectives of the course is to:

1. Explain the types of signals and systems along with its properties.
2. To understand the concepts of various operations to be performed on signals.
3. Represent the Linear time invariant systems (both analog and discrete-time systems) using the time-domain concepts.
4. Provide the student with the capability to represent the signals in frequency domain. E.g. Fourier representation of the signals and Z- Transformation
5. Introduce students to the applications of Z –transformation for the analysis of systems represented in discrete domain.

Unit No	Syllabus	No. of hours	
		Theory	Tutorial
1	**Introduction**: Definitions of a signal and a system, classification of signals, basic Operations on signals, elementary signals, Systems viewed as Interconnections of operations, properties of systems.	**8**	**5**
2	**Time-domain representations for LTI systems 1 -** Convolution, impulse response representation, Convolution Sum and Convolution Integral	**8**	**6**
3	**Time-domain representations for LTI systems 2:** properties of impulse response representation, Differential and difference equation Representations, Block diagram representations Direct form I, Direct form II, Cascade (Series), Parallel representations.	**8**	**5**
4	**Fourier representation for signals** Introduction, Discrete time and continuous time Fourier series (derivation of series excluded) and their properties, Example problems Discrete and continuous Fourier transforms (derivations of transforms are excluded) and their properties, Example problems**.**	**7**	**5**
5	**Z-Transforms:** Introduction, Z transform, properties of ROC, properties of Z transforms inversion of Z – transforms, problems, unilateral Z- Transform and its application to solve difference equations.	**8**	**5**

TEXT BOOK

1. "Signals and Systems", Simon Haykin and Barry Van Veen John Wiley & Sons, 2nd 2003

REFERENCE BOOKS:

1. "Signals and Systems" Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab, Pearson Education Asia / PHI, 4th edition, Indian Reprint 2007
2. H. P Hsu, R. Ranjan, "Signals and Systems", Scham's outlines, TMH, 2006

3. Fundamentals of Signals and Systems, Michael J Roberts, Tata McGraw Hill Publications,2007

Course Outcomes

Successful completion of the course objectives will contribute to the following outcomes:

CO1: To classify the types of signals and systems and determine its properties.

CO2: To apply the defined modifications on the signals

CO3: To analyze Linear time invariant systems (both analog and discrete-time systems) using the time-domain concepts.

CO4: To represent the signals in frequency domain using Fourier representation and Z-Transformation of signals

CO5: To apply Z –transformation for the analysis of systems represented in discrete domain.

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

Subject Title : **Linear IC's & Applications**		
Sub Code : **18EI45**	No of credits : 3=3:0:0 (L:T:P)	No of Lecture hours/week: 3
Exam Duration: 3 hrs		Total no. of contact hours: 39

Course Objectives:

The main objectives of the course is to equip the students with the knowledge on

1. The fundamentals of Operational Amplifiers (OPAMP)
2. The principles and functioning of signal conditioning circuits using OPAMP
3. The Design of various signal generation circuits using OPAMP
4. The Linear and non-linear applications of operational amplifiers.

Unit No	Syllabus	No of Teaching Hours
1	**Operational Amplifier Fundamentals**: Basic Op-Amp circuit, Op-Amp parameters, Input and output voltage, CMRR and PSRR, offset voltages and currents, Input and output impedances, Slew rate and Frequency limitations Op-Amps as DC Amplifiers, Biasing Op-Amps, Voltage Follower, Direct coupled Non-inverting Amplifiers, Inverting amplifiers.	**8**
2	**Characteristics of OPAMP:** Ideal OP-AMP characteristics **Frequency response of OP-AMP**- Circuit stability, Frequency and phase response, Frequency compensating methods, Band width, Slew rate effects, Z_{in} Mod compensation, and circuit stability precautions	**7**
3	**OP-AMP Applications I:** Inverting, Non-inverting Amplifier, summer, differentiator, integrator, comparators, Differential amplifier, Instrumentation amplifier, V/I & I/V converters. Voltage sources, current sources and current sinks, first and second order active filters, Clippers, Clampers, Peak detector.	**8**
4	**OP-AMP Applications II:** Schmitt trigger, waveform generators- square wave generator, triangular wave generator, S/H circuit, D/A converter (R- 2R ladder and weighted resistor types), A/D converters using OPAMPs, Oscillators- phase shift oscillator, Wein bridge oscillator.	**8**
5	**Specialized IC Applications: Voltage** Regulators - Fixed voltage regulators , Adjustable voltage regulators , Switching regulators, 555 as manostable, Astable multivibrater Phase locked loops - operating principles, monolithic phase looked loops, 565 PLL Applications, VCO.	**8**

TEXT BOOKS:

1. "Op-amps and Linear Integrated Circuits" Ramakant A. Gayakward, 4th Edition, Pearson Education, 2003 / PHI. 2000.
2. "Operational Amplifiers and Linear IC's", David A. Bell, 6th edition, PHI/Pearson, 2004

Reference Books:

1. "Linear Integrated Circuits", D. Roy Choudhury and Shail B. Jain**,** 2nd edition, Reprint 2006
2. "Op-amps & Linear Integrated Circuits Concepts & Applications "Fiore,Cengage,2010.

3. “Fundamentals of Analog Circuits”, Floyd , Buchla,” Pearson, 2013.

Course Outcome:

On successful completion of the course the student is able to:
CO1: Understand the fundamental principles of operational amplifiers
CO2: Design and analyze the signal conditioner circuits like Amplifiers, filters, ADC, DAC using operational amplifiers for various applications.
CO3: Design and analyze the signal generator circuits for the given specification
CO4: Use OPAMP for various applications like waveform generation, PLL, Voltage regulator etc
CO5: An ability to identify, formulate, and solve engineering problems related to analog and digital system design using project-based learning approach
CO6: An ability to use the techniques and skills, necessary for engineering practices

Subject Title : **Sensors and Signal Conditioning Circuits Lab**		
Sub Code :18**EIL46**	No of credits : 1.0=0:0:1.0	No of hrs/week : 2
Exam duration : 3hrs	Exam Marks : 100	

OBJECTIVE:

- Developing adequate knowledge on various Transducers and sensors, To Emphasis Knowledge on filtering techniques
- To Emphasis Knowledge on amplifiers and waveform generators
- Learn to identify and simulate the analog circuits using software tools.

Expt No	**Syllabus**
1	To measure the resistance using wheat stone bridge and kelvin double bridge
2	To measure the characteristics of LVDT and Capacitance transducer.
3	To study the characteristics of LDR and Optocoupler.
4	Temperature measurement using thermistor
5	Study the following Op amp parameters a. Input offset current b. Input bias current c. Slew rate d. CMRR
6	Design the following circuits using Op-amp (μA741) for the given specification Inverting amplifier, non- inverting amplifier & Schmitt trigger circuit
7	Design the following circuits using Op-amp (μA741) for the given specification a. Adder b. Subtractor, c. Comparator
8	Design the following circuits using Op-amp (μA741) for the given specification a. Integrator, b. Differentiator
9	Design a low-pass and High pass filters (Butterworth I & II order) for different cutoff frequency
10	Design an Instrumentation amplifier for different gains using Opamp and verify using Use any software tool.
11	Design of Astable and Monostable multivibrator using 555 timer
12	Design a suitable signal conditioning circuit to display temperature using RTD
13.	**Add on Experiment:** Demonstrate the working of Proximity Sensor, Limit Switch, Optical Sensor.
14	Demonstration of open ended project using the concept of Experiments 1- 12

Course Outcomes

At the end of the course students will be able to

CO1: Determine the performance characteristics of transducers and sensors.

CO2: Identify the tools for analysis and simulation.

CO3: Design analog circuits using OP Amp and Timer

CO4: Apply statistical procedure to verify the experimental results.

CO-PO MAPPING												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**1**	**3**	**2**	**2**	**-**	**-**	**-**	**1**	**1**	**-**	**2**
CO2	**3**	**2**	**3**	**1**	**3**	**-**	**-**	**-**	**1**	**1**	**-**	**2**
CO3	**3**	**2**	**3**	**1**	**3**	**-**	**-**	**-**	**1**	**1**	**-**	**2**
CO4	**3**	**2**	**3**	**2**	**3**	**-**	**-**	**-**	**1**	**1**	**-**	**2**

Subject Title : **Microcontroller Lab**		
Sub Code : **18EIL47**	No of credits : 1.0=0:0:1.0	No of hrs/week : 2
Exam duration : 3hrs	Exam Marks : 100	

Course objectives:

1. To Understand the assembly level programming and understand the use of instructions to implement the various logics
2. To understand the higher level programming and learn the interfacing of various devices

Expt No	**Syllabus**
1	Data Transfer - Block move, Exchange, Sorting, Finding largest element in an array.
2	Assembly language program to add n 1-byte numbers and store 16 bit sum.
3	Arithmetic Instructions - Addition/subtraction, multiplication and division, square, Cube –(16 bits Arithmetic operations – bit addressable).
4	Code conversion: HEX - Decimal and Decimal - HEX.
5	Assembly language program to convert BCD to ASCII using logical instructions and arithmetic instructions and verify whether same answer is obtained.
6	Programs using CALL and RETURN instructions
7	Assembly language program to implement 16 bit Counters using delay subroutine.

II. INTERFACING:

1	Interface LED and Switches, implement 4 : 1 multiplexer circuits
2	Interface 7-segment Display, LCD Display
3	Internal ADC and Temperature control interface to MSP430.
2	Generate different waveforms Sine, Square, Triangular, Ramp etc. using DAC interface to MSP430; change the frequency and amplitude.
3	Stepper and DC motor control interface to MSP430.
4	Use internal Timer to generate the required timing
5	Use internal PWM module to vary the Speed of DC motor
6	Use the internal comparator module to compare the magnitude of voltages
7	Use internal USCI to communicate the data Asynchronously

Course Outcomes: On completion of the course, students will be able to

CO1: Write the Assembly level programming and explain implementation of various logics

CO2: Demonstrate execution of Arithmetic and logical operation

CO3: Explain Instruction set and addressing modes of microcontroller

CO4: Interface peripherals to the microcontroller to implement its application

CO5: Apply the knowledge of microcontroller architecture to implement application

CO-PO MAPPING												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**1**	**3**	**2**	**2**	-	-	-	**1**	**1**	-	**2**
CO2	**3**	**2**	**3**	**1**	**3**	-	-	-	**1**	**1**	-	**2**
CO3	**3**	**2**	**3**	**1**	**3**	-	-	-	**1**	**1**	-	**2**
CO4	**3**	**2**	**3**	**2**	**3**	-	-	-	**1**	**1**	-	**2**
CO5	**3**	**2**	**3**	**2**	**2**				**1**	**1**	-	**2**