Dr Ambedkar Institute of Technology, Bengaluru-56

Department of Electronics and Instrumentation Engineering

Third and Fourth Semester

Scheme and Syllabus - CBCS – 2022 -2023 Regulation

Academic Year 2023-24

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Outcome Based Education(OBE) and Choice Based Credit System
B.E. Name of the programme: Electronics and Instrumentation Engineering
Tentative Scheme of Teaching and Examination effective from the Academic Year 2023-24

III SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	BSC	22MAT301EI	Mathematics	Mathematics	3	0	0		03	50	50	100	4
2	IPCC	22EIU302	Analog Electronic circuits	EIE	3	0	2		03	50	50	100	4
3	IPCC	22EIU303	Digital System Design using Verilog	EIE	3	0	2		03	50	50	100	4
4	PCC	22EIT304	Sensors and Industrial Instrumentation	EIE	3	0	0		03	50	50	100	3
5	PCCL	22EIL305	Transducers & Signal conditioning circuits Lab	EIE	0	0	2		03	50	50	100	1
6	ESC	22EIT306x	Engineering Science Course	EIE	3	0	0		03	50	50	100	3
7	UHV	22HST307	Social Connect and Responsibility	EIE	0	0	2		01	100	---	100	1
8	AEC/ SEC	22EIT308x or 22EIL308x	Ability Enhancement Course/Skill Enhancement Course – III	EIE	If the course is a Theory: 1	0	0		01	50	50	100	1
					If a course is a laboratory: 0	0	2		02				
9	HS	22CDN309	Aptitude and Verbal Ability Skill-I	Placement Cell	2	0	0		--	50	--	50	PP/NP
10	MC	22NSN310	National Service Scheme (NSS)	NSS coordinator	0	0	2		--	100	---	100	PP/NP
		22PEN310	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		22YON310	Yoga	Yoga Teacher									
									Total	550	350	900	21

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical, S= Self-Study, **CIE**: Continuous Internal Evaluation, **SEE**:Semester End Evaluation. K: This letter in the course code indicates common to all the streams of Engineering. ESC: Engineering Science Course, ETC: Emerging Technology Course, PLC: Programming Language Course

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Engineering Science Course (ESC/ETC/PLC) 22EIT306x			
22EIT306A	**Communication Systems**	**22EIT306C**	
22EIT306B		**22EIT306D**	
Ability Enhancement Course – III 22EIT308x **OR** 22EIL308x			
22EIL308A	**Programming in MATLAB**	**22EIT308C**	**Electrical and Electronic Measurements**
22EIT308B	**Sensors and Actuators**	**22EIL308D**	**Concepts of C Programming Lab**

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first Week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the Degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of Degree.

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Outcome Based Education(OBE) and Choice Based Credit System
B.E. Name of the programme: Electronics and Instrumentation Engineering
Tentative Scheme of Teaching and Examination effective from the Academic Year 2023-24

IV SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory	Tutorial	Practical/ Drawing	Self - Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC	22EIT401	Control Systems	EIE	3	0	0		03	50	50	100	3
2	IPCC	22EIU402	Microcontroller & Applications	EIE	3	0	2		03	50	50	100	4
3	IPCC	22EIU403	Process Control systems	EIE	3	0	2		03	50	50	100	4
4	PCCL	22EIL404	Control System and Simulation Lab	EIE	0	0	2		03	50	50	100	1
5	ESC	22EIT405x	Signals and Systems	EIE	3	0	0		03	50	50	100	3
6	AEC/ SEC	22EIT406x or 22EIL406x	Ability Enhancement Course/ Skill Enhancement Course- IV	TD and PSB: Concerned department	If the course is Theory				01	50	50	100	1
					1	0	0						
					If the course is a lab				02				
					0	0	2						
7	BSC	22BIT407	Biology For Engineers	TD / PSB: BT, CHE,	3	0	0		03	50	50	100	2
8	UHV	22HST408	Universal human values course	Any Department	1	0	0		01	50	50	100	1
9	HS	22CDN409	Aptitude and Verbal Ability Skill-II	Placement Cell	2	0	0		--	50	--	50	PP/ NP
10	MC	22NSN410	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	PP/ NP
		22PEN410	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		22YON410	Yoga	Yoga Teacher									

Total	**500**	**400**	**900**	**19**

PCC: Professional Core Course, PCCL: Professional Core Course laboratory, UHV: Universal Human Value Course, MC: Mandatory Course (Non-credit), AEC: Ability Enhancement Course, SEC: Skill Enhancement Course, L: Lecture, T: Tutorial, P: Practical, S= Self-Study, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation. K : This letter in the course code indicates common to all the stream of engineering.

Engineering Science Course (ESC/ETC/PLC) 22EIT405x OR 22EIL405x			
22EIT405A	**Signals and Systems**	**22EIT405C**	
22EIT405B		**22EIT405D**	
Ability Enhancement Course / Skill Enhancement Course – IV 22XXT405x OR 22XXL406x			
22EIL406A	**Arduino and Raspberry Pi Lab**	**22EIL406C**	**C++ Programming Lab**
22EIL406B	**Java Programming Lab**	**22EIL406D**	**Verilog Programming Lab**

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first Week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the Degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses is mandatory for the award of Degree.

Course Title	**Analog Electronic Circuits**						
Course Code	**22EIU302**						
Category	Integrated Professional Core Course **(IPCC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	00	02	00	05	40+12	04
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

COURSE OBJECTIVE:

1. To study and understand the transistor characteristics, biasing methods, ac models of transistor.
2. To study and understand the parameters, Circuit Theorems basic circuits of op-amps.
3. To analyse the frequency response of transistors and Op-amps.
4. To design different amplifier, Oscillators, waveform generation circuits using op-amps
5. To use modeling/simulation parameters with standard equivalent circuit models to predict correctly the expected performance of various general-purpose electronic circuits.

Unit No	Syllabus	No of Teaching hours
1	**MOS Field-Effect Transistors**: Device Structure and Physical operation, Current Voltage Characteristics, MOSFET circuits at DC.	**08**
2	**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**
3	**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, summer, differentiator, integrator, comparators, Differential amplifier.	**08**
4	**Frequency response of OP-AMP:** Circuit stability, Frequency and phase response, Band width, Slew rate effects, circuit stability precautions. **OP-AMP Applications I:** Instrumentation amplifier, V/I & I/V converters, Voltage sources, current sources and current sinks, first and second order active filters, Clippers, Clampers, Peak detector.	**08**
5	**Specialized IC Applications:** D/A converter (R- 2R ladder and weighted resistor types), A/D converters using OPAMPs, 555 as manostable, Astable multivibrater Phase locked loops - operating principles, monolithic phase looked loops, 565 PLL Applications, VCO.	**08**

TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos

COURSE OUTCOMES:

CO1: Illustrate working principle of different electronic circuit and their application in real life

CO2: Analyze the equivalent model and performance of transistors and op-amp as an amplifiers.

CO3: Apply the working principal of op-amps to build simple circuits.

CO4: Design and implementing the analog electronic circuits using op-amp and analog IC's for various applications.

CO5: Use modeling/simulation parameters with standard equivalent circuit models to predict correctly the expected performance of various general-purpose electronic circuits.

Text Books:

1. **Microelectronics circuits**, Sedra & Smith, 7th Edition, 20017, Publisher: Oxford University Press, *ISBN*-13: 978-0195338836
2. **Op-amps and Linear Integrated Circuits'** Ramakant A. Gayakward, 4th Edition, Pearson Education, 20015.

Reference Books

1. **"Electronic Devices and Circuit Theory",** Robert L. Boylestad and Louis Nashelsky, PHI/Pearson Education. 12th Edition 2021.
2. "Linear Integrated Circuits", D. Roy Choudhury and Shail B. Jain**, 4th** edition, Reprint 2017
3. "Op-amps & Linear Integrated Circuits Concepts & Applications "Fiore, Cengage, 2018.
4. Electronic Devices and circuits by David A Bell, 5th Edition 2008, OXFORD

EBOOKS/ONLINE RESOURCES

1. https://nptel.ac.in/courses/108102112
2. https://nptel.ac.in/courses/108105158

Practical Component

Sl.No	Experiments
1	Design and test the frequency response of CS FET amplifier
2	Design a switching circuit using MOSFET
3	Design a two stage amplifiers using FET : - Plot of frequency Vs gain, Estimation of Q factor, bandwidth of an amplifier and verify using Use any software tool.
4	Design the following circuits using Op-amp (μA741) for the given specification a. Voltage Follower b. Inverting amplifier, c. non- inverting amplifier
5	Design the following circuits using Op-amp (μA741) for the given specification a. Adder b. Subtractor c. Comparator
6	Design the following circuits using Op-amp (μA741) for the given specification a. Integrator b. Differentiator
7	Design the following circuits using Op-amp (μA741) for the given specification a. Half wave and full wave precision rectifier b. Schmitt trigger circuit

8	Design a low-pass and High pass filters (Butterworth I & II order) for different cutoff frequency
9	Design and Testing for the performance of FET/Op-Amp RC Phase shift Oscillators for range of $f_0 \geq 100KHz$.
10	Design the Wein bridge oscillator using Op-Amp
11	Design an Instrumentation amplifier to improve CMRR using Op-amp and verify using any software tool.
12	Design of Astable and Monostable multivibrator using 555 timer
13	Demonstration of open ended project using the concept of Experiments 1- 12

MAPPING of COs with POs

	Po1	Po2	Po3	Po4	Po5	Po6	Po7	Po8	Po9	Po10	Po11	Po12	Pso1	Pso2	Pso3
Co1	3	2	2		1				1			1	2	1	
Co2	2	2	2		1				1			1	2	1	
Co3	3	1	2		1				1			1	2	1	
Co4	1	2	2		1				1			1	2	1	
Co5	1	2	2		1				1			1	2	1	
Strength of correlation: Low-1, Medium- 2, High-3															

Course Title	**Digital System Design using Verilog**						
Course Code	**22 EIU303**						
Category	Integrated Professional Core Course **(IPCC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	00	02	00	05	40+12	04
CIE Marks: 50	**SEE Marks: 50**		**CIE Marks: 50**		**SEE Marks: 50**		

Course Objectives:

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 Adders, Subtractor, 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 Teaching 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.	08 Hours
2	**Combinational Functions:** Arithmetic Operations: Adders and subtractor cascading full adders, Look ahead carry, Binary Comparators -2bit and 4 bit, 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)	08 Hours
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).	08 Hours
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 behavioural description** of latches (D-latch, SR latch) and flip-flops (D, T, JK, SR flip-flops).	08Hours
5	**Counters, design and their applications:** Counters, Binary ripple counters, Synchronous binary counters, Modulo N counters, Synchronous and Asynchronous counters.	08 Hours

	Verilog behavioural description of Synchronous and Asynchronous counters, sequential counters.	

TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos

Course outcomes:

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

CO2: Design combinational circuits, write Verilog code for combinational circuits (MUX, De-MUX, adder, subtractor and comparator circuits)

CO3: Design code converters, encoders and decoders and write Verilog code for the same.

CO4: Analyze sequential circuits and write Verilog code for the same.

CO5: Analyze synchronous and asynchronous circuits and write Verilog code for the same.

TEXT BOOKS:

1. "Digital Logic Applications and Design", John M Yarbrough, Thomson Learning, 2006.(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 2012

3. "Fundamentals of HDL" by Cyril P R Pearson/Sanguin 2010

Web links and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/108105132
2. https://nptel.ac.in/courses/117105080
3. https://nptel.ac.in/courses/108103179

Practical Component:

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.

Sl.No	Experiments
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 study a. Multiplexer IC74153 and application b. Priority encoder and 3:8 Decoder using IC74138 c. Two bit comparator using gates
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

MAPPING of COs with POs

	Po1	Po2	Po3	Po4	Po5	Po6	Po7	Po8	Po9	P10	Po11	Po12	Pso1	Pso2	Pso3
Co1	3	2	2		1				1			1	2	1	
Co2	2	2	2		1				1			1	2	1	
Co3	3	1	2		1				1			1	2	1	
Co4	1	2	2		1				1			1	2	1	
Co5	1	2	2		1				1			1	2	1	
Strength of correlation: Low-1, Medium- 2, High-3															

Course Title	**Sensors and Industrial Instrumentation**						
Course Code	**22EIT304**						
Category	Professional Core Course **(PCC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	00	00	00	03	40	03
CIE Marks: 50	**SEE Marks: 50**		**CIE Marks: 50**			**SEE Marks: 50**	

Course Objectives:

In this course students will be able to:

1. Explain the fundamentals of transducers and sensors
2. Demonstrate the operation of different sensors
3. Apply the principles of different type of sensors and transducers for various measurements.
4. Develop a signal conditioning circuits for resistive sensors.
5. Illustrate the importance, characteristics and advantages of suitable sensors and transducers for various applications.

Unit No	Syllabus	No of Teaching hours
1	**Introduction:** Measurement, Instrument, Instrumentation, Classification of transducers, Calibration and standards **Resistive transducers:** Resistance thermometer, Hotwire resistance transducers, Displacement transducers, stain transducer, pressure transducer, Moisture transducer, magnetic flex transducer, optical radiation transducer	**08**
2	**Inductive transducer:** Thickness transducers, Displacement transducers, Movable core type, eddy current type **Capacitive transducer:** Thickness transducers, Displacement transducers, moisture **Signal conditioning for Resistive sensors**: measurement of resistance, voltage dividers: potentiometers, dynamic measurements, amplifiers for voltage dividers, Wheatstone bridge balance measurements.	**08**
3	Thermoelctric transducers, piezoelectric transducers, magnetostrictive transducers, hall effect transducers, photo electric transducers, Smart sensors, micro sensors, ultrasonic sensors, Fiber optic sensors, bio sensors, MEMS & Nano Sensors	**08**
4	**Temperature Measurement:** Resistance Vs Temperature characteristics for different materials, Thermistors, Thermocouples - thermoelectric effects for thermocouples, thermocouple tables, RTD, **Flow measurement:** turbine meters, electromagnetic flow meters. **Liquid level measurement:** Resistive method, inductive methods, capacitive methods. **Pressure Measurement:** Monometers, Membranes, High pressure measurement, Mcleod Gage, Knudsen gage	**08**
5	**Motion, Proximity And Ranging Sensors:** Motion Sensors – Potentiometers, Resolver, Encoders – Optical, LVDT – RVDT, Accelerometer, Proximity Sensors - Magnetic, Inductive, Capacitive, Optical, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR **Radiation sensors:** radiation pyrometer, infra-red and optical pyrometer, Thermocouple.	**08**

	Applications: weather monitoring systems, water monitoring systems, Battery monitoring systems.	

TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos

Course Outcome

CO1: Illustrate the characteristics of transducers.

CO2: Demonstrate the operation of Ultrasonic, Laser and Radar sensors

CO3: Demonstrate the operation of encoders, flow meters, pressure measurement, level and radiation sensors.

CO4: Analyze and develop signal conditioning circuits for resistive sensors.

CO5: Analyze the performance of various sensors, transducers for different applications.

Text books:

1. A.K.Sawhney. Dhanphat Rai "Electrical & Electronic Measurements & Instrumentation, 19th edition, PHI 2019
2. D.V.S. Murty, "Transducers and Instrumentation", Prentice Hall India.
3. E.O.Doebline, Measurement systems application and Design, 5th Edition, TMH 2004

Reference Books:

1. Rangan & Mani "Instrumentation: Devices and Systems", McGraw Hil
2. B.C.Nakra and K.K. Choudhury, Instrumentation Measurement and Analysis, Tata McGraw-Hill Education, 2nd Edition, 2003
3. Ramon Pallas-Areny and John G Webster Sensors and signal Conditioning John Wiley New York , A Wiley-Interscience Publication, 2nd edition
4. Patranabis, D, Sensors and Transducers, Wheeler Publishing Co., Ltd. New Delhi, 2018.

Web links and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/108105153
2. https://nptel.ac.in/courses/108105064
3. https://nptel.ac.in/courses/108105064
4. https://nptel.ac.in/courses/103105130

MAPPING of COs with POs

	Po1	Po2	Po3	Po4	Po5	Po6	Po7	Po8	Po9	P10	Po11	Po12	Pso1	Pso2	Pso3
CO1	2	1	0		1							1	3	1	
CO2	2	1	0		1							1	3	1	
CO3	2	1	0		1							1	3	1	
CO4	2	1	2	1	1							1	3	1	
CO5	2	1	2	1	1							1	3	1	
Strength of correlation: Low-1, Medium- 2, High-3															

Course Title	**Transducers & Signal Conditioning circuits Lab**						
Course Code	**22EIL305**						
Category	Professional Core Course **(PCC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	00	00	02	00	02	13	01
CIE Marks: 50	**SEE Marks: 50**		**CIE Marks: 50**		**SEE Marks: 50**		

Course Objective

1. Understand the characteristics of different sensors
2. Familiarize with signal conditioning circuits
3. Understand the calibration of different sensors
4. understand the Operation of Digital and analog conversion

Sl.No	**Experiments**
1	Study the characteristics of LVDT with signal conditioning circuit
2	Study the characteristics of Strain Gauge/ Load cell using Wheatstone bridge and signal conditioning circuit
3	Study the characteristics of RTD with signal conditioning circuit
4	Study the characteristics of Thermister with signal conditioning circuit
5	Study the characteristics of thermocouple with signal conditioning circuit and cold junction compensation
6	Temperature measurement using AD590
7	Study the characteristics of capacitor transducer with signal conditioning circuit
8	Study the characteristics of Inductive transducer with signal conditioning circuit
9	Design and implement 4 bit R-2R DAC using discrete components
10	Design and implement Weighted Resister DAC
11	Design and Implement 3 bit Flash ADC using ICs
12	Implement 3 bit Successive Approximation ADC

Course Outcomes:

CO1: Recognize the Different Sensors for various parameter Measurement.
CO2: Design signal conditioning circuits for different sensors.
CO3: Calibrate different sensors to display the parameters appropriately

MAPPING of COs with POs															
	Po1	Po2	Po3	Po4	Po5	Po6	Po7	Po8	Po9	P10	Po11	Po12	Pso1	Pso2	Pso3
Co1	3		1		2							1	2	2	
Co2	1	2	1		2							1	2	2	
Co3	3	1	2	1	2							1	2	2	

Course Title	**Communication Systems**						
Course Code	**22EIT306A**						
Category	Engineering Science Course **(ESC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	00	00	00	03	40	03
CIE Marks: 50	**SEE Marks: 50**		**CIE Marks: 50**			**SEE Marks: 50**	

Course Objectives

1. To discuss the principles and working of Analog and Digital Communication techniques.
2. To know the various multiple access techniques.
3. To understand the Wireless communication.
4. To discuss fundamentals of optical fibre communication and its importance.

Unit		**No. of Hrs**
1	**Analog Communication:** AM, DSBSC, SSBSC: Time domain description, frequency domain description, generation, and detection. Comparison of AM techniques, AM transmitter, AM receiver model: Signal to noise rations for coherent reception,	**8**
2	**Angle modulation**: Basic concept, frequency modulation, NBFM, WBFM, power & bandwidth of FM wave, generation of FM wave, Phase lock loop of FM. FM receiver model, noise in FM reception, pre-emphasis and de-emphasis in FM systems	**8**
3	**Pulse modulation:** sampling theorem, Sample and hold circuit, natural sampling, flat top sampling, quantization of signals, quantization error, PCM system, DPCM, Delta modulation, adaptive delta modulation. **Digital modulation techniques:** ASK, BPSK, BFSK, QPSK, **Multiple access technique**: FDMA, TDMA, CDMA.	**8**
4	**Introduction to Wireless Communication Systems**: Generations: 2G, 3G, 4G, 5G. Wireless Local Area Networks: IEEE 802.11 WLANs, MAC and PHY layer variants; Wireless Personal Area Networks: Bluetooth (IEEE 802.15.1), ZigBee (IEEE 802.15.4); Bluetooth and Personal Area networks, Broadband Wireless Access- WiMAX Technology. Wireless Spectrum allocation, Standards.	**8**
5	**Overview of optical fiber communication:** The general system, advantages of optical fiber communications. Optical fiber wave guides- Introduction, Ray theory transmission, Optical fiber Modes and configuration, Mode theory for circular Waveguides, Step Index fibers, Graded Index fibers. Single mode fibers- Cut off wavelength, Mode Field Diameter, Effective Refractive Index. Fiber Material and its Fabrication Techniques	**8**

Course outcome:

1. Understand the basic theories, principles of analog and digital modulation techniques.
2. Analyse the performance of a Digital Communication techniques
3. Illustrate wireless access technologies for various applications.
4. Explain the theory of optical communication techniques.

	Po1	Po2	Po3	Po4	Po5	Po6	Po7	Po8	Po9	Po10	Po11	Po12	Pso1	Pso2	Pso3
Co1	3	2	1										1	2	1
Co2	2	3	2	2									1	2	2
Co3	2	2	1	1								2	1	3	3
Co4	2	1	1	2	1							2	1	2	2

Text Book:

1. Analog and Digital communication- Simon Haykin, John Willey. 2nd Edition Jan 2012
2. Andrea Goldsmith, Wireless Communications, Cambridge University Press, 2005
3. John M. Senior, “Optical Fiber Communications”, PEARSON, 3rd Edition, 2010.

Online sources:

1. NPTEL Couse: https://archive.nptel.ac.in/courses/117/102/117102062/#
2. https://www.youtube.com/watch?v=qhjj6WG7Rgc&list=PLwjK_iyK4LLArUHRm3SvPLT0XWlVhpl4h

Reference Book:

1. “Principles of Electronics Communication Systems- Louis E. Frenzel Jr., fourth edition, McGrawHill Education 2016.
2. David Tse and Pramod Viswanath, Fundamentals of Wireless Communication, Cambridge University Press, 2005.
3. Govind P. Agrawal, “Fiber Optic Communication Systems”, John Wiley, 3rd Edition, 2004

Course Title	**Programming in MATLAB**						
Course Code	**22EIL308A**						
Category	Ability Enhancement Course – III (AEC)						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	00	00	02	00	02	13	01
CIE Marks: 50	**SEE Marks: 50**		**CIE Marks: 50**		**SEE Marks: 50**		

1. To know about fundamentals of MATLAB tool.
2. To provide an overview to program curve fitting & solve Linear and Nonlinear Equations.
3. To understand the concept and importance of Fourier transforms.
4. To gain knowledge about MATLAB Simulink & solve Electrical engineering problems.

Sl. No	**Experiments**
1	Introduction to MATLAB Programming: Basics of MATLAB Programming, array operations in MATLAB, loops 2 and execution of control, working with files: Scripts and functions, plotting and programming output, examples.
2	
3	Numerical Methods and their applications: Curve Fitting: Straight line fit, Polynomial fit.
4	
5	Numerical Integration and Differentiation: Trapezoidal method, Simpson method.
6	
7	Linear and Nonlinear Equations: Eigen values, Eigen vectors, Solution of linear algebraic equations using Gauss Elimination and LU decomposition, Solution of nonlinear equation in single variable using Gauss-Siedal and Newton-Raphson method.
8	
9	Ordinary Differential Equations: Introduction to ODE's, Euler's method, second order RungaKutta method, 10 MATLAB ode45 algorithm in single variable and multivariables. Transforms: Discrete Fourier Transforms,
10	
11	Application of MATLAB to analyse problems in basic engineering mechanics, mechanical vibrations, control system, statistics and dynamics of different circuits. MATLAB Simulink: Introduction to MATLAB Simulink, Simulink libraries, development of basic models in Simscape Power Systems
12	
13	

TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos

Course Outcome:

CO1: Able to implement loops, branching, control instruction and functions in MATLAB programming environment.

CO2: Able to program curve fitting, numerical differentiation and integration, solution of linear equations in MATLAB and solve electrical engineering problems.

CO3: Able to understand implementation of ODE using ode 45 and execute Solutions of nonlinear equations and DFT in MATLAB.

CO4: Able to simulate MATLAB Simulink examples

Text Books:

1. Agam Kumar Tyagi, "MATLAB and Simulink for Engineers", OXFORD Higher Education.

2. Dr. Shailendra Jain, "Modeling& Simulation using MATLAB – Simulink", Wiley – India.

Reference Books:

1. Won Y.Tang, Wemun Cao, Tae-Sang Ching and John Morris, "Applied Numerical Methods Using MATLAB", A John Wiley & Sons.

2. Steven T. Karris, "Introduction to Simulink with Engineering pplications", Orchard Publications. "Signals and Systems" Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab, PearsonEducation Asia / PHI, 4th edition, Indian Reprint 2007

MAPPING of COs with POs

	Po1	Po2	Po3	Po4	Po5	Po6	Po7	Po8	Po9	P10	Po11	Po12	Pso1	Pso2	Pso3
CO1	1	1	2	1						1		1	1	3	
CO2	1	2	2	3	3				1	1		1	1	3	
CO3	2	2	2	2	3				1	2		2	1	3	
CO4	1	2	3	2	3				1	2		2	1	3	
Strength of correlation: Low-1, Medium- 2, High-3															

Course Title	**Sensors and Actuators**						
Course Code	**22EIT308B**						
Category	Ability Enhancement Course – III (AEC)						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	02	00	00	00	02	15	01
CIE Marks: 50	**SEE Marks: 50**		**CIE Marks: 50**		**SEE Marks: 50**		

Course Objectives:

In this course students will be able to:

1. Explain the fundamentals of sensors
2. Demonstrate the operation of different sensors, actuators, micro sensors, micro actuators
3. Demonstrate the operations of sensors materials and processing techniques.
4. To study the advantages, disadvantages, limitations of suitable sensors and actuators for various applications.

UNIT No	Syllabus	No. of Teaching Hours
1	SENSORS: Difference between sensor, transmitter and transducer. Signal transmission - Types of signal: Pneumatic signal; Hydraulic signal; Electronic Signal. Principle of operation, construction details, characteristics and applications of potentiometer, Strain Gauges, Resistance thermometer, Thermistor, Hot-wire anemometer, Resistance Hygrometer, Photo-resistive sensor.	3
2	ACTUATORS: Definition, types and selection of Actuators; linear; rotary; Logical and Continuous Actuators, Pneumatic actuator- Electro-Pneumatic actuator; cylinder, rotary actuators, Mechanical actuating system: Hydraulic actuator - Control valves; Construction, Characteristics and Types, Selection criteria.	3
3	Micro Sensors : Principles and examples, Force and pressure micro sensors, position and speed micro sensors, acceleration micro sensors, chemical sensors, biosensors, temperature micro sensors and flow micro sensors.	3
4	Micro Actuators: Actuation principle, shape memory effects-one way, two way and pseudo elasticity. Types of micro actuators- Electrostatic, Magnetic, Fluidic, Inverse piezo effect.	3
5	Sensor Materials and Processing Techniques: Materials for sensors: Silicon, Plastics, metals, ceramics, glasses, nano materials. Processing techniques: Vacuum deposition, sputtering, chemical vapour deposition, electro plating, photolithography, silicon micro machining, Bulk silicon micro machining and surface silicon micro machining	3

Text books:

1. Patranabis.D, “Sensors and Transducers”, Wheeler Publishing Co., Ltd. New Delhi, 2018.
2. Sergej Fatikow and Ulrich Rembold, “ Microsystem Technology and Microbotics”, First edition, Springer –Verlag NEwyork, Inc, 1997.

Reference Books:

Massood Tabib and Azar, “Microactuators Electrical, Magnetic, thermal, optical, mechanical, chemical and smart structures”, First edition, Kluwer academic publishers, Springer, 1997.

CO1: Describe the fundamentals of different sensors.
CO2: Demonstrate the working operation of different sensors, actuators, micro sensors, micro actuators.
CO3: Determine the operations of sensors materials and its processing techniques.
CO4: Illustrate the advantages, disadvantages, limitations of suitable sensors and actuators for various applications.

Course Title	**Electrical and Electronic Measurements**						
Course Code	**22EIT308C**						
Category	Ability Enhancement Course – III (AEC)						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	02	00	00	00	02	15	01
CIE Marks: 50	**SEE Marks: 50**		**CIE Marks: 50**		**SEE Marks: 50**		

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. Analyse and evaluate the performance of various electrical and electronic Instruments

4. Develop mathematical models, analyse and design various instrument systems.

Unit No	**Syllabus**	**No of Teaching hours**
1	Measurement System: instrumentation – definition, classification and characteristics of transducer- static and dynamic- errors in measurements- calibration, primary and secondary standards..	03 Hours
2	Measurement of Resistance, Inductance and capacitance: Wheatstone bridge-sensitivity analysis, kelvin's double bridge, Maxwells bridge, schering Bridge, source and detectors, problems., hay's bridge , Anderson's bridge	03 Hours
3	Digital Instruments: Digital Voltmeters – Introduction, DVM's based on V – T, V – F and Successive approximation principles, Resolution and sensitivity, General specifications, Digital Multi-meters, Digital frequency meters.	03 Hours
4	Waveform Generators: Square wave and pulse generators, Triangular wave-shape generator, Signal and function generators	03Hours

5	Cathode Ray Oscilloscope Signal Analyzers General purpose cathode ray oscilloscope – Dual trace, dual beam and sampling oscilloscopes.	03Hours

Text Books

1. Electrical and Electronic Measurements and Instrumentation, A.K.Sawhney, Dhanpat Rai sons, 18th Edition, ISBN:81-7700-016-0

2. Electronic Instrumentation, H S Kalsi, TMH, 2nd Edition, 2010, ISBN: 978-00-707-2066

Reference books:

1. Electronic Instrumentation and Measurements, David A Bell, PHI/Pearson Education, 2nd Edition, 2012, ISBN: 978-81-203-2360.

2. The condensed Handbook of Measurement and Control, N E Battikha, ISA copy right2018

Course Title	**Concepts of C programming Lab**						
Course Code	**22EIL308D**						
Category	Ability Enhancement Course – III (AEC)						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	00	00	02	00	02	13	01
CIE Marks: 50	**SEE Marks: 50**		**CIE Marks: 50**		**SEE Marks: 50**		

Course objectives:

The objectives of this course are:

1) Provide a comprehensive study of the C programming language.
2) To learn and acquire art of computer programming.
3) Understand the syntax of data types, decision making, looping constructs, arrays, functions, structures and unions.

1. Write A Program For Electricity Bill Tracking Different Categories Of Users, Different Slabs In Each Category**. (Using Nested If Else Statement)**

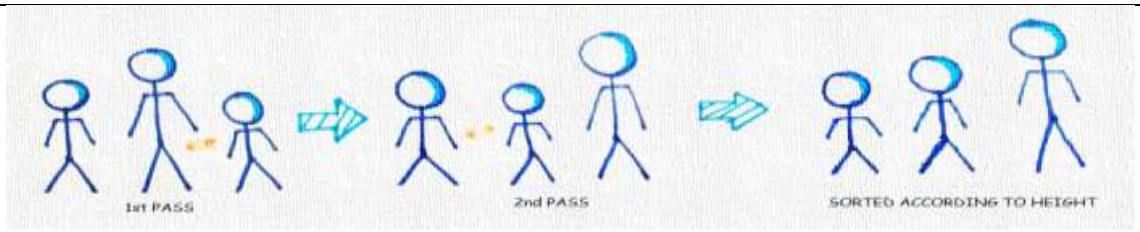
Domestic		Non-Domestic	
Range	Unit per charge	Range	Unit per charge
0 - 200	0.5	0 - 100	0.5
201 - 400	100 + 0.65	101 - 200	50 + 0.60
401 -600	230 + 0.80	201 - 300	100 + 0.70
601 and Above	390 + 1.00	301 and Above	200 + 1.00

2. Write a C program to compute the value for sine series

$$\sin x = \sum_{n=0}^{\infty} \frac{(-1)^n}{(2n+1)!} x^{2n+1} = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \cdots \text{ for all } x$$

3. Write a C program to construct a pyramid of numbers. **(Using FOR LOOP)**

4. Consider physical education classes or sports classes back in school. Students Lined up in a random order in front of the teacher, who's put to the task of lining up all students in an ascending order of height. In this case every person's height is an element of the list.

	 Input : Total Number of students 'n', Height of each the student.(h1,h2,h3 upto hn) Output : Sorted list **(BUBBLE SORT : With every pass that the teacher goes over the students, they slowly start standing in a more orderly fashion till all of them stand according to height.)** Print both the given array and the sorted array with suitable headings.
5.	The total distance travelled by vehicle in 't' seconds is given by distance = ut+1/2at2 where 'u' and 'a' are the initial velocity (m/sec.) and acceleration (m/sec2). Write C program to find the distance travelled at regular intervals of time given the values of 'u' and 'a'. The program should provide the flexibility to the user to select his own time intervals and repeat the calculations for different values of 'u' and 'a'. [Total distance→s=(u*i)+(0.5*a*i*i)] **(Using for loop)**
6.	Searching for a book in the library. Sorted list is the well-arranged books in an alphabetical order. Our target element is the book we prefer to read. Instead of hopelessly running around in circles and ruffling through every rack to find our book we can apply this algorithm to find that book without breaking a sweat. All we need to do is determining the total number of racks, and then find the middle rack. If we don't find the book, then we accordingly determine whether to omit the first half of the racks or the second half. We repeat this process till we finally find our book or run out of racks to look in. Input: Total Number of books 'n', Books b1, b2, upto bn sorted in alphabetical order, book to be searched. Output: Book found or not. **(Using Binary Search)**
7.	Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +,- ,*, /, % and use (**Switch Statement**)
8.	Consider you have a pile of electricity bills for the past year, and you want to arrange them in ascending order from staring from January. One approach might be to look through the pile until you find the bill for January and pull that out. Then look through the remaining pile until you find the bill for February and add that behind January. Proceed through the ever-shrinking pile of bills to select next one until you are done. **(Using Selection Sort)** Input: Total Number of bills 'n', Each month bill arranged in random order upto n. Output : Sorted list print both the given array and the sorted array with suitable headings.
9.	Write a program in C to evaluate the given polynomial f(x) = a4 x4 + a3 x3 + a2 x2 + a1 x1 + a0 for given value of x and the coefficients using Horner's method.
10.	Write A Menu Driven Program To Read 2 matrices A,B. Find the Trace and Norm of a matrix using **Functions.** i) To find trace of matrix ii) To find norm of a matrix

11.	Write a C program to generate Fibonacci series for a given value of N. Display the result with suitable messages.
12.	Write A Menu Driven Program To Read List Of Student Names with the following attributes Name,Branch,Section And Perform The Following Operations Using **structures**. i) To Print List Of Names ii) To Sort Them In Ascending Order
13.	Write a program for reading 'n'elements using pointer to an array and display the values using array. **(POINTERS)**
14.	Three people denoted by P1, P2, P3 intend to buy some rolls, buns, cakes and bread. Each of them needs these commodities in differing amounts and can buy them in two shops S1, S2. Which shop is the best for every person P1, P2, P3 to pay as little as possible? The individual prices and desired quantities of the commodities are given in the following tables: Demanded quantity of foodstuff: roll | bun | cake | bread P_1 | 6 | 5 | 3 | 1 P_2 | 3 | 6 | 2 | 2 P_3 | 3 | 4 | 3 | 1 Prices in shops S_1 and S_2: | S_1 | S_2 roll | 1.50 | 1.00 bun | 2.00 | 2.50 cake | 5.00 | 4.50 bread | 16.00 | 17.00 **MATRIX MULTIPLICATION** Write a C program by considering 2 matrices A (M x N) and B (P x Q) that uses functions to perform the following: i. Reading data to p1, p2, p3 (Matrix A)ii. Reading data to s1, s2 (Matrix B) iii. Multiplication of Two Matrices(C=AXB)
	Note: In the practical examination the student has to select one question and both a, b should be executed. All the questions listed in the syllabus have to be included in the lots. The change of question has to be considered by deducting marks, provided the request is made for the same, within half an hour from the start of the examination.

Course Outcomes:

At the end of this lab session, the student will

1. Understand the basic terminology used in computer programming.
2. Write, compile and debug programs in C language.
3. Design programs involving decision structures, loops and functions. Identify the type of looping constructs to be used and use one and two dimensional arrays for solving problems.
4. Recognize different types of functions and string handling functions.

CO-PO MAPPING															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	-	1	-	-	-	-	-	-	1	-	-	-
CO2	2	2	-	1	2	-	-	-	-	-	-	1	-	2	1
CO3	2	2	2	2	-	-	-	-	1	-	-	2	1	2	-
CO4	2	2	2	2	-	-	-	-	-	-	-	1	-	2	2

Course Title	**Control Systems**						
Course Code	**22EIT401**						
Category	Professional Core Course **(PCC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	00	00	00	03	40	03
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

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, Mechanical Translational systems and Rotational systems, Electrical systems, Analogous systems, Block Diagrams and Signal Flow Graphs.	8
2	**Time Response of feedback control systems:** Standard test signals, Unit step response of First and second order systems, under damped second order system I & II, steady state errors, Static error constants.	8
3	**Stability analysis:** Concepts of stability, Necessary conditions for Stability, Routh- Hurwirtz stability criterion, Routh- Hurwirtz stability criterion-special cases **The Root Locus Method:** Introduction, The root locus concepts, Construction of root locus I and root locus II.	8
4	**Frequency Domain Analysis:** Introduction to Bode plots, numerical problems on Bode plots, Stability Margins, Nyquist's Stability Criterion.	8
5	**Compensation Techniques:** Lead, lag, lead lag network and compensator design using Root locus techniques.	8

TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos

Course Outcome:

1. Generate mathematical models of linear time invariant control system by applying differential equations, transfer function, block diagram and signal flow diagram techniques.
2. Transform from electrical to mechanical and vice versa by applying suitable analogy
3. Analyse and characterize the behaviour of a control system in terms of time domain and frequency domain performance parameters.
4. Compute and assess the system stability by applying Routh Hurwitz and root locus techniques
5. Assess the stability of the system in the frequency domain by applying Nyquist stability criterion and bode Plots
6. Design lead, lag and lead lag compensators for the given specifications by drawing root locus and bode plots

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

Web links and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/107106081

CO-PO MAPPING															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	-	-	1	1	1	1	1	2	1	3
CO2	1	2	2	3	2	-	-	1	1	1	1	1	2	1	3
CO3	2	2	2	3	2			1	1	1	1	1	2	1	3
CO4	1	2	2	3	2			1	1	1	1	1	2	1	3
CO5	1	2	2	3	2			1	1	1	1	1	2	1	3
CO6	1	2	2	3	2			1	1	1	1	1	2	1	3

Course Title	**Micro Controller & Applications**						
Course Code	**22EIU402**						
Category	**Integrated Professional Core Course (IPCC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	00	02	00	05	40+12	04
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Objectives:

This course introduces the student to

1. To understand the basic concepts of microcontroller and embedded systems.
2. To understand the architecture of MSP430F55xx microcontroller, Addressing modes, instruction format and Register set
3. To understand the parallel ports, interfacing of various modules like switch, led, display, stepper motor DC motor, and sensors.
4. To understand the peripherals modules like timer, pwm, ADC and DMA
5. To understand the serial communication modules of MSP430

Unit No	**Syllabus**	**No of Teaching hours**
1	**Introduction:** Microprocessor, Microcontrollers and Embedded systems, MSP430F55xx 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;	08 Hours
2	MSP430F55xx assembly programming, 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.	08 Hours
3	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.	08 Hours
4	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.	08Hours
5	Serial communication basics, Synchronous/Asynchronous interfaces (like UART, USB, SPI, and I2C). UART protocol, I2C protocol, SPI protocol. Implementing and	08Hours

	programming UART, I2C, SPI interface using MSP430, Interfacing external devices.	

TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos

Practical Component

Sl.No	Experiments
1	Data Transfer - Block move, Exchange data in an array.
2	Sorting, Finding largest element in an array.
3	Assembly language program to add n 1-byte numbers and store 16 bit sum.
4	Arithmetic Instructions - Addition/subtraction, multiplication and division, square, Cube –(16 bits Arithmetic operations – bit addressable).
5	Code conversion: HEX - Decimal and Decimal - HEX.
6	Assembly language program to convert BCD to ASCII using logical instructions and Arithmetic instructions and verify whether same answer is obtained.
7	Programs using CALL and RETURN instructions
Interfacing Experiments	
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.
4	Stepper and DC motor control interface to MSP430.
5	Use internal Timer to generate the required timing
6	Use internal PWM module to vary the Speed of DC motor
7	Use internal USCI to communicate the data Asynchronously

Course Outcome

1. Understand the architecture of, instruction format, Instruction set, and Addressing modes of MSP430 microcontroller.
2. Able to write assembly program and understand the IO pins, GPIO control, interrupt and interrupt programming
3. Able to interface the I/O devices to MSP 430 microcontroller and write the C-program for working the peripherals
4. Able to understand the peripherals modules like ADC, Timer, PWM, comparator and write program for the modules
5. Able to understand the serial communication peripherals module and write program for the module.

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

Web links and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/106105193
2. https://nptel.ac.in/courses/108105102

MAPPING of COs with POs

	Po1	Po2	Po3	Po4	Po5	Po6	Po7	Po8	Po9	P10	Po11	Po12	Pso1	Pso2	Pso3
Co1	3	2	2		1				1			1	2	1	
Co2	2	2	2		1				1			1	2	1	
Co3	3	1	2		1				1			1	2	1	
Co4	1	2	2		1				1			1	2	1	
Co5	1	2	2		1				1			1	2	1	
Strength of correlation: Low-1, Medium- 2, High-3															

Course Title	**Process Control Systems**						
Course Code	**22EIU403**						
Category	Integrated Professional Core Course **(IPCC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	00	02	00	05	40+12	04
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Objectives:

1. To introduce the terminology, concepts and practices in process modeling and automatic process control.
2. To impart knowledge in the design of control systems and PID controller tuning for processes.
3. In addition, the subject also introduces about discrete state process control and Batch process.
4. To know the concept about safety Instrumented Systems.
5. Understand the practical implementation of various control strategies

Unit No	Syllabus	No. of Teaching Hours
1	**Introduction To Process Control:** Line diagrams-Definition of P & I diagrams- Use of letter code of identification of Instruments-Introduction to standards that are widely used in instrumentation Viz.- ISI ANSI, BIS, ISA Introduction, Process control systems, Process-Control Block Diagram, control system evaluation, Stability. **Final control:** introduction to final control operation, signal conversions, actuators, control elements.	07
2	**Controller principles and modes**: Introduction, Process Characteristics, Process Equation, Process Load, Process Lag, Process Regulation, Control System Parameters. Continuous Controller Modes, Composite Controllers with Applications & Problems. **Discrete-State** Process Control: Introduction, definition and characteristics of discrete state process control.	09
3	**Analog controller Design**: Introduction, Electronic controllers, Error Detector, Design of an On/Off Controller, Design of Single-Mode, 2-Position and 3-Position continuous Controller Modes. **Control-loop characteristics**: Introduction, control system configuration. control system quality, stability, and process loop tuning	09
4	**Process control Applications:** Building conditioning control: Fan control and temperature control, batch control description and terminology: Batch Automation, Product Management, safety interlocking, Boiler control: role of sensors, safety interlocking, and wastewater treatment control: two reagent control system, steam turbine controls: controls and optimization.	07
5	**Introduction to Safety Instrumented systems** - Safety Lifecycle , Introduction to Functional Safety, Difference between BPCS and SIS, Functions of different personnel's, Major fire hazards–Acronyms-Overview of Standards and Regulations	07

Practical Component

Sl.No	Experiments
1	Study the various types of control valve Characteristics
2	Experimental study of PID controller on level process loop
	Experimental study of PID controller on flow process loop
3	Experimental study of ON-OFF and PID controller on temperature process
4	Experimental study of cascade / ratio control for a level-flow process
5	PID controller tuning methods using MATLAB
6	Design and implementation of dead time compensator using MATLAB
7	Design and implementation of velocity and position form of PID Control algorithms using MATLAB
8	Study of Complex Control System Using MATLAB
9	Response of Process with and without Transportation Lag
10	Simulation of nonlinear processes using MATLAB
11	Motor Control using PID controller
12	PID controller tuning

Course outcomes:

On successful completion of the course the student is able to

1. Able to understand technical terms and nomenclature associated with Process control domain.
2. Design the suitable controllers for process control systems
3. Analyze the controller tuning techniques for process control system
4. Choose the proper control system for the automatic control system
5. Apply proper safety norms in process industry

Text Books:

1. **Process Control Instrumentation Technology**-C D Johnson, PHI Publication. 8th Edition, 2009

2. **Safety Instrumented Systems Verification**- Practical Probalistic Calculation, William M Goble

3. **Instrument Engineers Handbook-(Vol 1 & 2)-**B G Liptak,Chilton Book Company, 4th edition 1995

Reference Books:

1. **Chemical Process Control an Introduction to theory and practice,** George Stephanopoulos, PHI, sixth reprint.1998,

2. **Computer Aided Process Control-** S K Singh, Prentice Hall of India, 2008

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

Course Title	**Control System and Simulation Lab**						
Course Code	**22EIL404**						
Category	**Professional Core Course laboratory (PCCL)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	00	00	02	00	02	13	01
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Objectives:

The objective of the lab is to design a system and calculate the transfer function, analyzing the stability of the system (both open and closed loop, with positive and negative feedback) with time domain approach and frequency response analysis, using MATLAB/ Modelica

Sl.No	Experiments
1	Study the operation of Sample and Hold circuits using discrete components and IC.
2	Transfer Function of DC Motor
3	Time Domain Analysis of Second Order System using discrete components
4	Verify the function of programmable gain amplifier using analog multiplexer.
5	Design relay driving circuits using photo devices (LDR & Optocouplers).
6	To study the unipolar and Bipolar analog Multiplexer
7	Frequency Response Analysis of Lead Compensating network
8	Frequency Response Analysis of Lag Compensating Network
9	Mathematical Modeling of Physical Systems
10	Root Locus Plot Using Matlab
11	Bode Plot And Nyquist Plot
12	Study the PID controller and its effects on the feedback loop response

Upon the completion of Control Systems practical course, the student will be able to attain the following:

1. Model a mechanical (masses, dampers and springs) and electrical system (inductors, resistors, capacitors) in the form of a transfer function.

2. Analyze the effect of P, PI, PD and PID controllers on a control system

3. Perform time response analysis of a second order control system using MATLAB

4. Analyse and interpret stability of the system through Root Locus, Bode plot and NYQuist plot.

5. Design Lag, Lead, Lead-Lag compensators and verify experimental results using MATLAB.

MAPPING of COs with POs

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

Course Title	**Signals and systems**						
Course Code	**22EIT405A**						
Category	**Engineering Science Course (ESC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	00	00	00	03	40	03
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Objectives:

1. To Express a signal and a system in time and frequency domains and develop a mathematical process to migrate between the two representations of the same entity.
2. Represent the Linear time invariant systems using the time-domain concepts and its properties.
3. Introduce students to the applications of Z –transformation for the analysis of systemsrepresented in discrete domain.
4. Understand the computation of DFT and properties
5. Understand the concepts of efficient computations of DFT using FFT algorithm.

Unit No	**Syllabus**	No. of Teaching Hours
1	**Introduction to Signals and System**: Definition of Signals, Classification of Signals, Basic Operations on Signals: Operations Performed on the Independent and Dependent Variable, Precedence Rule, Elementary Signals. Definition of Systems, System Viewed as Interconnection of Operations, Properties of Systems.	8
2	**Time domain representations of Linear Time Invariant Systems** : Convolution Sum, Convolution Sum Evaluation Procedure, Convolution Integrals, Convolution Integrals Evaluation Procedure, Interconnections of LTI System, Relations between LTI System Properties and the Impulse Response , step response, Difference Equation Representation of LTI System and Solving Difference Equations	8
3	**Applications of Z Transform**: Introduction to bilateral and unilateral Z-transforms, Properties (proof excluded), Analysis of LTI Systems: Transfer function and structures for implementing LTI system, Causality and stability, frequency response, and solution of difference equations.	8
4	**The Discrete Fourier transforms - Its properties and Applications:** Frequency domain Sampling and Reconstruction of Discrete time signals, DFT, DFT as a linear Transformation, and Relationship of DFT to other transforms. Properties of DFT: Periodicity, Linearity and Symmetry properties, Multiplication of two DFTs and circular convolution, additional DFT properties. Linear filtering methods based on the DFT: Use of DFT in linear filtering, Filtering of long data sequences.	8
5	**Efficient computation of DFT - FFT Algorithms**: Direct computation of DFT, Radix-2 FFT Algorithms and Implementation of FFT Algorithms, Applications of FFT algorithms, Efficient computation of DFT of two real sequences, Efficient computation of DFT of a 2N – point real sequence.	8

TEACHING LEARNING PROCESS: Chalk and Talk, power point presentation, animations, videos

Course Outcome:

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

CO2: To analyze Linear time invariant systems using the time-domain concepts.

CO3: To apply Z –transformation for the analysis of systems represented in discrete domain.

CO4: Analyze the digital signals using various digital transforms DFT,

CO5: To analyze a various FTT algorithms for efficient computations of DFT

Text Books:

1. "Signals and Systems", Simon Haykin and Barry Van Veen John Wiley & Sons, 2nd 2007
2. Digital Signal Processing Principles, Algorithms and Applications, John G Proakis and Manolakis,Pearson, Fourth Edition, 2014.
3. Digital Signal Processing- S K MITRA, Mc Graw-Hill. Publication 4th Edition, 2013

Reference Books:

1. "Signals and Systems" Alan V Oppenheim, Alan S, Willsky and A zamid Nawab, PearsonEducation Asia / PHI, 4th edition, Indian Reprint 2007
2. Digital Signal Processing with Matlab Examples volume1, Jose Maria Giron-Sierra, ©Springer Science+Business Media Singapore 2017
3. Digital Signal Processing Fundamentals and Applications, Li Tan Purdue, Jean JiangSecond edition, Elsevier publication, 2013.

Web links and Video Lectures (e-Resources):

1. https://nptel.ac.in/courses/117102060
2. https://nptel.ac.in/courses/108104100
3. NPTEL lecture video on Signals and Systems by Roy, https://www.satishkashyap.com/2012/04/iit-video-lectures-onsignals-andhtml.
4. NPTEL lecture video on Signals and Systems by Prof TK Basu, IIT, Kharaghpur, https://www.nptel.ac.in/courses/108105065
5. NPTEL online course modules-IIT Bombay-Signals and Systems

http://www.cdeep.iitb.ac.in/nptel/Electrical%20&%20Comm%20Engg/Signalsand%20System/TOC- M1.html

MAPPING of COs with POs

	Po1	Po2	Po3	Po4	Po5	Po6	Po7	Po8	Po9	P10	Po11	Po12	Pso1	Pso2	Pso3
CO1	1	1	2	1						1		1	1	3	
CO2	1	2	2	3	3				1	1		1	1	3	
CO3	2	2	2	2	3				1	2		2	1	3	
CO4	1	2	3	2	3				1	2		2	1	3	
CO5	1	2	3	2	3				1	2		2	1	3	
Strength of correlation: Low-1, Medium- 2, High-3															

ourse Title	**Arduino and Raspberry Pi Lab**						
Course Code	**22EIL406A**						
Category	Ability Enhancement Course **(AEC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	00	00	02	00	02	13	01
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Objective:

To study the use of Arduino and Raspberry Pi's and investigate the practicality of integrating them into the laboratory classes

Expt. No.	**Experiments**
1	Implement digital output from the Arduino board
2	Implement digital input using the Arduino board.
3	Implement an Arduino based simple digital I/O system
4	Implement serial I/O between the Arduino board and the PC using the serial monitor graphical user interface (GUI)
5	Controlling relay state based on input from IR sensors
6	Using the Arduino board/ Rapberry pi board read data from a sensor. Experiment with both analog and digital sensors
7	Implement Blinking LED using Arduino board
8	Controlling relay state based on ambient light levels using LDR sensor
9	Basic Burglar alarm security system with the help of PIR sensor and buzzer.
10	Interfacing stepper motor with R-Pi
11	Interface a 2x16 LCD in 4-bit mode to the Arduino board
12	Upload humidity & temperature data to Thing Speak
13	Controlling LEDs, relay & buzzer using Blynk app

Course Outcome:

1. Understand the uses of App like Think speak and Blynk
2. Design a system using Arduino board and Raspberry Pi
3. Implement various functions using Arduino board and Raspberry Pi

Text Book:

1. Programming Arduino: Getting Started with Sketches. 2nd edition. Simon Monk. McGraw Hill. ISBN-13: 978-1259641633

CO-PO MAPPING															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	-	-	-	-	-	1	-	1
CO2	3	3	3	1	1	-	-	-	-	-	-	-	1	2	1
CO3	2	2	3	2	2	-	-	-	-	-	-	-	1	1	2
CO4	2	2	2	1	-	-	-	-	-	-	-	-	1	-	1
CO5	2	2	2	1	-	-	-	-	-	-	-	-	1	1	1

Course Title	**Java Programming Lab**						
Course Code	**22EIL406B**						
Category	Ability Enhancement Course **(AEC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	00	00	02	00	02	13	01
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

COURSE OBJECTIVES:

1. To teach fundamentals of Java programs and its executions.
2. To familiarize files and exceptions concepts.
3. To write GUI programs using Applet

Expt. No.	**Experiments**
1	Write a Java program to understand how to accept input using Scanner or BufferedReader and print output using System.out.println statement
2	Write a Java program that prompts the user for an integer and then prints out all prime numbers up to that integer. (use Scanner class to read input)
3	Read in a, b, c and use the quadratic formula. If the discriminate b2-4ac is negative, display a message stating that there are no real solutions.
4	Write a Java program that checks whether a given string is a palindrome or not.
5	Write a Java program that implements Bubble sort algorithm for sorting in descending order and also shows the number of interchanges occurred for the given set of integers.
6	Write a Menu driven program in java to implement simple banking application. Application should read the customer name, account number, initial balance, rate of interest, contact number and address field etc. Application should have following methods. a. createAccount() b. deposit() c. withdraw() d. computeInterest() e. displayBalance()
7	Write a Java program to create a Student class with following fields i. Student USN ii. Student Name iii. Department. Create ‘n’ number of Student objects where ‘n’ value is passed as input to constructor.

8	Write a Java program to create an abstract class named Shape that contains two integers and an empty method named print Area (). Provide three classes named Rectangle, Triangle, and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape.
9	Write a Java program to read copy content of one file to other by handling all file related exceptions
10	Write a Java program that reads a file name from the user, and then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file.
11	Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -,*, % operations. Add a text field to display the result. Handle any possible exceptions like divided by zero.
12	Develop an applet in Java that displays a simple message

COURSE OUTCOMES:

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

1. Implement Object oriented features and use of different exception handling mechanisms
2. Apply the concept of files and exceptions
3. Able to design GUI in Java using Applet

Text Books:

1. Herbert Schildt, Java-The Complete Reference, Seventh Edition, Tata McGraw Hill Publication,7th edition
2. E. Balguruswamy, Programming with java A primer, Fifth edition, Tata McGraw Hill Publication,5th edition 2014

Reference Books:

1. D.T. Editorial Services, Java 8 Programming Black Book, Dreamtech Press,6th edition, 2015
2. H. M.Deitel, P. J. Deitel, S. E. Santry, Advanced Java 2 Platform How to Program Prentice Hall, 10th , 5th edition, 2002

CO-PO MAPPING															
CO/PO	Po1	Po2	Po3	Po4	Po5	Po6	Po7	Po8	Po9	P10	Po11	Po12	Pso1	Pso2	Pso3
CO1	3	2	2	1	3										2
CO2	3	2	2	1	3										2
CO3	3	2	2	1	3										2
CO4	3	2	2	1	3										2

Course Title	**C++ Programming Lab**						
Course Code	**22EIL406C**						
Category	Ability Enhancement Course – III (AEC)						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	00	00	02	00	02	13	01
CIE Marks: 50	**SEE Marks: 50**		**CIE Marks: 50**		**SEE Marks: 50**		

Course Objectives:

In this course students will be able to:

1. Understand the OOPs principles and basic constructs of C++
2. Understand about constructors , operator overloading, pointers and friend functions
3. gain knowledge on inheritance and polymorphism
4. Use the generic programming features of C++ including file handling, Exception handling

Sl no.	**Program**
1	Write a C++ Program to test arithmetic operators
2	Model a C++ Program to swap 2 values by writing a function that uses call by reference technique.
3	Develop a C++ program to demonstrate function overloading.
4	Given that an EMPLOYEE class contains following members: data members: Employee number, Employee name, Basic, DA, IT, Net Salary and print data members.
5	Build a C++ program to read the data of N employee and compute Net salary of each employee (DA=70% of Basic and Income Tax (IT) =30% of the gross salary).
6	Model a C++ program illustrating how the constructors are implemented and the order in which they are called when the classes are inherited.
7	Create a program using copy constructor to copy data of an object to another object
8	Develop a program to overload operators like *,<<,>> using friend function.
9	Model a C++ program to create single and multilevel inheritance
1(	Write a program to maintain the records of person with details(Name and Age) and find the eldest among them. The program must use this pointer to return the result.
1	Build a C++ program to create a text file, check file created or not, if created it will write some text into the file and then read the text from the file.
1	Write a function which throws a division by zero exception and catch it in catch block. Write a C++ program to demonstrate usage of try, catch and throw to handle exception.

Course Outcome:

1. Develop a solution for the problems based on class and objects
2. Apply the concepts of operator overloading, pointers and friend functions to solve the given problem
3. Achieve code reusability and extensibility by means of Inheritance and Polymorphism
4. Implement the features of C++ including exceptions and file handling for providing programming solutions to complex problems

Text books:

1. Object oriented programming in TURBO C++ Robert Lafore, Galgotia Publications, 7th Edition, 2017, ISBN: 978-8131722824.

2. C++ the complete reference, Herbert Schildt, 6th Edition, Tata McGraw Hill, 2013

Reference Book:

1. Object oriented programming with C++, E Balaguruswamy, Tata McGraw Hill Publications', 6th edition, 2013, ISBN: 978-1259029936

CO-PO MAPPING															
CO/PO	Po1	Po2	Po3	Po4	Po5	Po6	Po7	Po8	Po9	P10	Po11	Po12	Pso1	Pso2	Pso3
CO1	3	2	2	1	3										2
CO2	3	2	2	1	3										2
CO3	3	2	2	1	3										2
CO4	3	2	2	1	3										2

Course Title	**Verilog Programming Lab**						
Course Code	**22EIL406D**						
Category	Ability Enhancement Course – III (AEC)						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	00	00	02	00	02	13	01
CIE Marks: 50	**SEE Marks: 50**		**CIE Marks: 50**		**SEE Marks: 50**		

Course Learning Objectives: This course will enable students to:

- Familiarize with the CAD tool to write HDL programs.
- Understand simulation and synthesis of digital design.
- Program FPGAs/CPLDs to synthesize the digital designs.
- Interface hardware to programmable ICs through I/O ports.
- Choose either Verilog or VHDL for a given Abstraction level.

Note: Programming can be done using Xilinx ISA Compiler. Download the programs on a FPGA board.

Sl. No	Programs
1	To convert a Boolean expression into logic gate circuit and simulate it in different dataflow/structural description
2	Verilog Code for Shift register
3	Verilog Code for ALU
4	Verilog Code for Instruction Memory
5	Verilog code for 16-bit single-cycle MIPS processor
6	License Plate Recognition in Verilog HDL
7	How to load a text file into FPGA using Verilog HDL
8	Verilog code for Traffic Light Controller
9	Verilog code for PWM Generator
10	Verilog code for counter
11	Design a finite state machine in Verilog to detect the given sequence of bits.
12	Write Verilog code using FSM to simulate elevator operation

Course Outcome:

1. Understand the basics of Hardware Description Languages, Program structure and basic language elements of Verilog
2. Understand types of modelling, modules, functions of Verilog and simulate and synthesize related Programs.
3. Design, Simulate and Synthesize various Verilog descriptions for Combinational circuits.
4. Design, Simulate and Synthesize various Verilog descriptions for Sequential circuits.

Text Books:

1. “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

	Po1	**Po2**	**Po3**	**Po4**	**Po5**	**Po6**	**Po7**	**Po8**	**Po9**	**Po10**	**Po11**	**Po12**	**Pso1**	**Pso2**	**Pso3**
Co1	2	1	1	2	3							2		2	3
Co2	2	2	2	2	3							2		2	3
Co3	2	2	2	2	3							2		2	3
Co4	2	2	2	2	3							2		2	3