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 2024-25

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**	**Electrical and Electronic Measurements**
22EIT306B	**Operating System**	**22EIT306D**	**Network Analysis**
Ability Enhancement Course – III 22EIT308x **OR** 22EIL308x			
22EIL308A	**Programming and Simulation Lab**	**22EIL308C**	**Web Technologies Lab**
22EIL308B	**Signal Analysis using SCI Lab**	**22EIT308D**	**Data structures using C**

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**	**Industrial Drives and Control**
22EIT405B	**Computer Organization and Architecture**	**22EIT405D**	**Micro and Nano Technology**
Ability Enhancement Course / Skill Enhancement Course – IV 22XXT405x OR 22XXL406x			
22EIL406A	**Arduino Programming Lab**	**22EIL406C**	**8051 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: Circuit Symbol, The i_D –V_{DS} Characteristics, The MOSFET as an amplifier and as a switch. MOSFET circuits at DC (with Numerical)	**08**
2	**MOSFET Amplifier: Biasing in MOSamplifier circuits:** Biasing by Fixing V_{GS}, Biasing by Fixing V_G and Connecting a Resistance in the Source, Biasing Using a Drain-to-Gate Feedback Resistor **Small-Signal Operation and Models:** The DC Bias Point, The Signal Current in the Drain Terminal, Small-Signal Equivalent-Circuit Models, The Transconductance g_m, The Common-Source (CS) Amplifier, The Common-Drain or Source-Follower Amplifier, 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

Sl.No	**Course outcomes**	Bloom's Taxonomy Level
1	Illustrate the working principle of different electronic circuit and their applications.	Knowledge, understand (Level-1, Level-2)
2	Analyze the equivalent model and performance of transistors and op-amp as an amplifiers.	Understand, Analyze (Level-2, Level-4)
3	Design the analog electronic circuits using op-amp.	Apply, Analyze (Level-3, Level-4)
4	Analyze the operation of op amp based IC's for various applications .	Apply, Analyse, (Level-3, Level-4)
5	Use modeling/simulation parameters with standard equivalent circuit models to predict correctly the expectedperformance of various general-purpose electronic circuits.	Analyse and evaluate (Level-4, Level-5)

MAPPING of COs with POs

	Po1	Po2	Po3	Po4	Po5	Po6	Po7	Po8	Po9	Po10	Po11	Po12	Pso1	Pso2	Pso 3
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															

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, PearsonEducation, 20015.

Reference Books

1. **"Electronic Devices and Circuit Theory",** Robert L. Boylestad and Louis Nashelsky, PHI/PearsonEducation. 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 f0 ≥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

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. **Verilog behavioural description** of Synchronous and Asynchronous counters, sequential counters.	08 Hours

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

Sl.No	**Course outcomes**	Bloom's Taxonomy Level
1	Understanding Boolean functions, Simplification of expressions using k-map and Quine-Mc.Cuskey minimization technique	Knowledge, understand (Level-1, Level-2)
2	Understanding Verilog code, writing verilog code Simulation Analysis and evealuate the result.	Knowledge, understand (Level-1, Level-2)
3	Write Verilog code for combinational and sequential circuits and analyze the result	Apply, Analyze (Level-3, Level-4)
4	Design and evaluate code converters, encoders and decoders and write Verilog code for the same.	Analyse and evaluate (Level-4, Level-5)
5	Analyze synchronous and asynchronous circuits , write Verilog code for the same and evaluate	Analyse and evaluate (Level-4, Level-5)

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															

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

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:** Definition, Classification &selection of sensors, General Structure of smart sensors & its components, Characteristic of smart sensors and applications. **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	**Motion, Proximity And Ranging Sensors:** Motion Sensors Potentiometers, Resolver, Encoders – Optical, Accelerometer, ProximitySensors - 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. **Applications:** weather monitoring systems, water monitoring systems, Battery monitoring systems.	**08**
5	**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	**08**

	methods. **Pressure Measurement:** Monometers, Membranes, High pressure measurement, Mcleod Gage, Knudsen gage	

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

Course Outcome

SI NO	Descriptive	Descriptive blooms taxonomy level
CO1	Illustrate the characteristics of transducers	Knowledge, Understand (Level 1, Level 2)
CO2:	Demonstrate the operation of Ultrasonic, Laser and Radar sensors	Knowledge, Understand (Level 1, Level 2)
CO3	Demonstrate the operation of encoders, flow meters, pressure measurement, level andradiation sensors	Knowledge, Analyze (Level 1, Level 4)
CO4	Analyze and develop signal conditioning circuits for resistive sensors	Apply, Evaluate (Level 3, Level 5)
CO5	Analyze the performance of various sensors, transducers for different applications	Create, Analyze (Level 5, Level 4)

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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, TataMcGraw-Hill Education, 2nd Edition, 2003
3. Ramon Pallas-Areny and John G Webster Sensors and signal Conditioning John Wiley NewYork , 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	Pso 1	Pso2	Pso 3
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 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=10**		**Duration of SEE: 03 Hours**		

Course Objectives

Sl.No.	Description
1.	To understand the functional elements of sensing and transduction principles of various types of transducer/sensors
2.	Familiarize with signal conditioning circuits
3.	Understand the Operation of Digital and analog conversion.

Sl.No	Experiments
1.	To Study the characteristics of LVDT with signal conditioning circuit
2.	To Study the characteristics of Strain Gauge/ Load cell using Wheatstone bridge and signal conditioning circuit
3.	To Study the characteristics of Resistance Temperature Detector (RTD) and design the signal conditioning circuit suitable for controller
4.	To Study the characteristic of Thermistor with respect to Temperature and design the signal conditioning circuit suitable for controller
5.	To Study the characteristic of Thermocouple by varying Temperature and design the signal conditioning circuit suitable for controller
6.	Measurement of unknown Resistance using a Wheatstone bridge.
7.	To Study the characteristics of capacitor transducer with signal conditioning circuit
8.	To 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 outcome:

Sl.No.	Description	Bloom's Taxonomy Level
1.	Recognize the Different Sensors for various parameter Measurement	Knowledge, Understand (Level 1,Level 2)
2.	Design a signal conditioning circuits for various sensors.	Understand, Design (Level 2, Level 3)
3.	Illustrate the principle, design and working of transducers for the measurement of displacement, strain and temperature	Understand, design (Level 2, Level 3)

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

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	**Operating system**						
Course Code	**22EIT306B**						
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. General understanding of structure of modern computers

2. Understanding of purpose, structure and functions of operating systems

3. Illustration of key OS aspects by suitable example

Unit		**No. of Hrs**
1	**INTRODUCTION TO OPERATING SYSTEMS AND CLASSIFICATION:** Introduction to operating system, Mainframe systems, Desktop systems, multiprocessor system, Distributed system, Clustered system, Real time system, Handled system, Feature migration, computing environments? Operating system structures: System components, OS Services, System calls, System programs, System structure, Virtual machines.	**8**
2	**PROCESS, INTER PROCESS COMMUNICATION, THREADS & CPU SCHEDULING:** Process concept, Process scheduling, Operation on processes, Co-operating processes, Inter process communication. Threads – overview, Multithreading models, Threading issues, P threads, Java threads. CPU scheduling – Basic concepts, Scheduling criteria, Scheduling algorithms, multiple processors scheduling, real time scheduling	**8**
3	**PROCESS SYNCHRONIZATION AND HANDLING DEADLOCKS:** The critical section problem, Synchronization hardware, Semaphores, Classical problems of synchronization, critical regions, monitors. **DEADLOCK** – System model, Deadlock characterization, Methods for handling deadlocks – deadlock prevention, deadlock avoidance, deadlock detection and recovery from deadlock	**8**
4	**STORAGE MANAGEMENT:** Main memory management – Background, Swapping, Contiguous, allocation, Paging, Segmentation, Segmentation with paging Virtual memory – Background, Demand paging, Process creation, Page replacement algorithms, Allocation of frames, Thrashing **FILE SYSTEM INTERFACE** – File concept, Access methods, Directory structure, File system mounting, File system implementation, Directory implementation, Allocation methods, free space management. Mass storage structures – Disk structure, Disk scheduling methods, Disk management, Swap space management.	**8**
5	**PROTECTION AND SECURITY:** Goals of protection, domain of protection, access matrix, implementation of access matrix, Revocation of	**8**

	access rights, The security problem, Authentication, Program threats, System threats, Security systems and facilities, Intrusion detection.	

Course outcome:

By the end of the course student will be able to

1. Describe the general architecture of computers
2. Understand and analyze theory and implementation of: processes, resource control (concurrency etc.), physical and virtual memory, scheduling, I/O and files
3. Describe, contrast and compare differing structures for operating systems

	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. **Operating System Concepts**-by Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, 6th edition, John wiley & sons 2003.

REFERENCE BOOKS:

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

Course Title	**Electrical and Electronic Measurements**						
Course Code	**22EIT306C**						
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: 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. of Hrs**
1	**Basics of Measurements:** Accuracy, Precision, resolution, reliability, repeatability, validity, Errors and their analysis, Standards of measurement. **Electronic Instruments for Measuring Basic Parameters: Amplified** DC meter, AC Voltmeter, True- RMS responding Voltmeter, Electronic multi-meter, Digital voltmeter, Vector Voltmeter. Bridge Measurement: DC bridges- wheatstone bridge, AC bridges – Kelvin, Hay, Maxwell, Schering and Wien bridges, Wagner ground Connection.	**8**
2	**Signal Generators:** Sine wave generator, Frequency – Synthesized Signal Generator, Sweep frequency Generator. Pulse and square wave generators. Function Generators.	**8**
3	Oscilloscopes: Cathode Ray Tube, Vertical and Horizontal Deflection Systems, Delay lines, Probes and Transducers, Specification of an Oscilloscope. Oscilloscope measurement Techniques, Special Oscilloscopes – Storage Oscilloscope, Sampling Oscilloscope	**8**
4	Signal Analysis: Wave Analyzer, Spectrum Analyzer. Frequency Counters: Simple Frequency Counter; Measurement errors; extending frequency range of counters	**8**
5	**Digital Data Acquisition System:** Interfacing transducers to Electronics Control and Measuring System. Instrumentation Amplifier, Isolation Amplifier. An Introduction to Computer-Controlled Test Systems.IEEE-488 GPIB Bus	**8**

Course Outcome

1. Understand the use of various electrical & electronic measurements, 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.

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

Text Books:

1. Modern Electronics Instrumentation & Measurement Techniques, by Albert D.Helstrick and William D.Cooper, Pearson Education. Selected portion from Ch.1, 5-13.

2. Elements of Electronics Instrumentation and Measurement-3rd Edition by Joshph J.Carr.Pearson Education. Selected portion from Ch.1,2,4,7,8,9,13,14,18,23 and 25.

Reference Books :

1. Electronics Instruments and Instrumentation Technology – Anand, PHI 4. Doebelin, E.O., Measurement systems, McGraw Hill, Fourth edition, Singapore, 1990

Course Title	**Network Analysis**						
Course Code	**22EIT306D**						
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 develop skills for analysis of network theorems
2. To understand concept of resonance in electric circuits and its applications.
3. To understand the concept of Laplace Transformation and applications
4. To understand fundamental knowledge about two port network parameters

Unit		**No. of Hrs**
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.	**8**
2	**Network Theorems – 1:** Superposition, Reciprocity and Millman's theorems. **Network Theorems - II:** Thevinin's and Norton's theorems; Maximum Power transfer theorem. **Network Topology:** Graph of a network, Concept of tree and co-tree, incidence matrix, tie-set, tie-set and cut-set schedules, Formulation of equilibrium equations in matrix form, Solution of electrical networks, Principle of duality**.**	**8**
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.	**8**
4	**Laplace Transformation & Applications**: Solution of networks, step, ramp and impulse responses, waveform Synthesis.	**8**
5	**Two port network parameters:** Definition of z, y, h and transmission parameters, modeling with these parameters, relationship between parameters sets.	**8**

Course Outcomes:

After completion of the course the students is able to

1. Apply the network theorems for the Analysis of electrical circuit networks
2. Analyze and determine the behavior of resonance circuits

3. Apply Laplace transformation to determine the response of electrical networks
4. Determine the relationships between two port network parameters

	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 BOOKS:

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

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

REFERENCE BOOKS:

1. **"Engineering Circuit Analysis",** Hayt, Kemmerly and DurbinTMH 6th Edition, 2002
2. **"Analysis of Linear Systems"**, David K. Cheng, Narosa Publishing House, 11th reprint, 2002

Course Title	**Programming and Simulation Lab**						
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	

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	**Signal Analysis using SCI Lab**						
Course Code	**22EIL308B**						
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:

The objectives of the course are to equip the students with the knowledge on:

1. Understand the concepts and advantages of digital signal processing techniques
2. To understand the frequency domain analysis techniques of discrete time signals using DFT
3. To determine DFT using FFT
4. To learn the design of Digital IIR and FIR filters using different techniques
5. Apply digital signal processing techniques for various applications

Expt.No.	Syllabus
1	DFT / IDFT of given Discrete Time Signal
2	Frequency Response of a System
3	Implementation of FFT of a given Sequence
4	Determination of Power Spectrum of a given Signal
5	Implementation of Lowpass FIR Filter for given specifications
6	Implementation of IIR Filter for given specifications
7	Generation of DTMF Signals
8	Implementation of Decimation Process
9	Implementation of Interpolation Process
10	Implementation of Sampling rate conversion by a factor I/D
11	Impulse response of First order and Second order systems
12	Finding the Fourier Series Coefficients of a Periodic Discrete Time Signal
13	Generation of Sinusoidal signal based on recursive difference equation

Course Outcome:

Students who complete this course will be able to:

CO1: Understand the concepts of digital signal processing

CO2: Understand and apply Fast Fourier Transform techniques.

CO3: Identify and apply different digital filtering techniques in signal processing for DSP applications.

Text Books:

1. Digital Signal Processing Principles, Algorithms and Applications, John G Proakis and Manolakis, Pearson, Fourth Edition, 2014

2. Digital Signal Processing- S K MITRA, Mc Graw-Hill. Publication 4th Edition, 2010

Reference Books:

1. Digital Signal Processing with Matlab Examples volume1, Jose Maria Giron-Sierra, © Springer Science+Business Media Singapore 2017.

2.Digital Signal Processing Fundamentals and Applications, Li Tan Purdue, Jean Jiang

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

Course Title	**Web Technologies Lab**						
Course Code	**22EIL308C**						
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:

Sl.No.	Description
1.	Learn how to design and develop a Web page using HTML and CSS.
2.	Learn how to link pages so that they create a Web site.
3.	Design and develop a Web site using text, images, links, lists, and tables for navigation and layout.
4.	Style the page using CSS, internal style sheets, and external style sheets.

Exp. No.	Syllabus
1	Write a HTML program for the demonstration of Lists. a. Unordered List b. Ordered List c. Definition List d. Nested List
2	Write a HTML program for demonstrating Hyperlinks. a. Navigation from one page to another. b. Navigation within the page.
3	Write a HTML program for time-table using tables.
4	Write a HTML program to develop a static Home Page using frames.
5	Write a HTML program to develop a static Registration Form.
6	Write a HTML program to develop a static Login Page.
7	Write a HTML program to develop a static Web Page for Shopping Cart.
8	Write HTML for demonstration of cascading style sheets. a. Embedded style sheets. b. External style sheets. c. Inline styles.
9	Write a javascript program to validate USER LOGIN page.
10	Write a javascript program for validating REGISTRATION FORM.
11	Write a program to design a simple calculator using JavaScript.
12	A user validation web application, where the user submits the login name & password to the server. The name and password are checked against the data already available in Database and if the data matches, a successful login page is returned. Otherwise failure message is shown to the user.

Text Book:

1.Web Technologies, Achyut S. Godbole, Atul Kahate Tata McGraw Hill, Edition, 2, *Tata McGraw-Hill*, 2008

Reference Books:

1. HTML & CSS : The complete reference – Thomas A. Powel, 5th edition, McGraw Hill Education,2017
2 .*JavaScript Bible*. Authors, *Danny Goodman*, Michael Morrison, Paul Novitski, Tia Gustaff Rayl. Edition 7, John Wiley & Sons, 2010

3 HTML5: Discover How To Create HTML 5 Web Pages With Ease (HTML5 CSS3 JavaScript),Preston Prescott, Kindle Edition ,2015

Course outcome:

Sl. No.	Description	Bloom's Taxonomy Level
1.	Create web pages using HTML and Cascading Styles sheets	Understand, Design (Level 2, Level 3)
2.	Design and implement dynamic websites with good aesthetic sense of designing	Understand, Design (Level 2, Level 3)
3.	Analyze a web page and identify its elements and attributes	Design , Analyze (Level 3, Level 4)
4.	Create dynamic web pages using JavaScript	Understand, Design (Level 2, Level 3)
5.	Implement the web applications with Database PHP/ Servlets and /JSP.	Understand, Design (Level 2, Level 3)
6.		

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

Course Title	**Data structures using C**						
Course Code	**22EIT308D**						
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	15	01
CIE Marks: 50	**SEE Marks: 50**		**CIE Marks: 50**		**SEE Marks: 50**		

Course Objectives:

In this course students will be able to:

Sl. No.	**Description**
1.	Explain fundamentals of data structures and their applications essential for programming/problem solving.
2.	Illustrate linear representation of data structures: Stack, Queues, Lists, and Trees.
3.	Demonstrate sorting and searching algorithms.
4.	Find suitable data structure during application development/Problem Solving.

Sl.no	**Syllabus**	**No of Teaching hours**
1.	**Classification of Data Structures:** Primitive and Non- Primitive, Linear and Nonlinear; Data structure Operations, ADT, Array as ADT, Operations - Insert, Delete, Search, Sort	03
2.	**Stack:** Definition, Representation, Stack as ADT, Operations and Applications: Infix to postfix conversion, infix to prefix, postfix to infix conversion	03
3.	**Queue:** Definition, Representation, Queue as ADT, Operations, Queue Variants: Circular Queue, Priority Queue, Applications of Queues.	03
4.	**Linked List:** Linked list as a data Structure, Inserting and removing nodes from a list, Linked implementations of stacks	03
5.	**Trees:** Definitions, Terminologies, Array and linked Representation of Binary Trees, Types- Complete/full, Almost	03

	Complete, Strictly, Skewed, Binary tree Traversals - Inorder, postorder, preorder	

Textbooks:

1. Data Structures Using C and C++ by YedidyahLangsam and Moshe J. Augenstein and Aaron M Tenanbanum, 2nd Edition, Pearson Education Asia, 2015.

Reference books:

1. Data Structures Using C , Balaguruswamy:, McGraw Hill Education,2017
2. Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Ed, Universities Press, 2014
3. Principles of Data Structures using C & C++ by Vinu V. Das, New Age International, 2006

Course outcome:

Sl. No.	Description	Bloom's Taxonomy Level
1	Identify different data structures and their applications.	Knowledge, Understand (Level 1, Level 2)
2	Apply Stack and queues in solving problems	Understand, Apply (Level 2,Level 3)
3	Implement the applications of data structures in a high-level language	Understand, Design (Level 2, Level 3)
4	Explore the applications of trees to model and solve the real-world problem	Understand, Apply (Level 2,Level 3)

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

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

Sl.no	Description
1	To understand the different ways of system representations such as Transfer function representation and state space representations and to assess the system dynamic response
2	To assess the system performance using time domain analysis and methods for improving it.
3	To assess the system performance using frequency domain analysis and techniques for improving the performance.
4	To design various controllers and compensators to improve system performance.

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

Sl.No	Description	Description Bloom's Taxonomy Level
CO1	Understand the modeling of linear-time-invariant systems using transfer function and state space forms.	Knowledge, Understand (Level 1, Level 2)
CO2	Understand various feedback control strategies.	Knowledge, Understand (Level 1, Level 2)
CO3	Analyze the system response and stability in both time domain and frequency domain	Knowledge, Analyze (Level 1, Level 4)
CO4	Apply and Design different types of compensators using in time-domain and frequency domain specifications.	Apply, Evaluate (Level 3, Level 5)
CO5	Analyze the system response and stability of systems represented in state space form	Analyze (Level 4)
CO6	Model and Analyze the linear discretized time systems.	Create, Analyze (Level 5, Level 4)

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

Sl.no	Description
1	To introduce the terminology, concepts and practices in process modeling and automatic process control.
2	To impart knowledge in using final control elements in processes.
3	To know the design on controller in process control systems.
4	To analyze the tuning of elements in control loop
5	Understand the practical implementation of various control strategies.

Unit	Syllabus Content	No. of Hrs
1	**Introduction To Process Control**: Need for process control, Line diagrams- Definition of P & I diagrams- Use of letter code of identification of Instruments, Process Control loop: Block Diagram and Physical diagram, Control system Evaluation, Continuous and batch processes- Mathematical model of level processes- Interacting and non-interacting systems- Mathematical model for Interacting and non- interacting systems.	**8**
2	**Final control**: introduction to final control operation, signal conversions: Analog electrical signals, Digital Electric signals and Pneumatic signals, actuators: Electrical Actuators: Solenoid, Dc motor, Ac motor, stepper motor, Pneumatic actuator and hydraulic actuator, control elements: Mechanical, Electrical, Fluid Valves.	**8**
3	**Controller principles and modes**: Introduction, Process Characteristics, Process Equation, Process Load, Process Lag, Process Regulation, Control System Parameters: Characteristics of ON- OFF controllers -Characteristics of Single speed floating controllers. Continuous Controller Modes: Proportional (P), Integral (I) and Derivative (D) modes, Composite Controllers: P+I, P+D and P+I+D control modes with Applications & Problems.	**8**
4	**Control-loop characteristics**: Introduction, control system configuration. Single variable, cascade control, multivariable control system, control system quality: Definition of Quality, Measurement of Quality , stability, stability criteria and process loop tuning: Open-Loop Transient Response Method, Ziegler-Nichols Method**.**	**8**
5	**Advanced control strategies:** Cascade control, Feedforward control, ratio control. **Process control Applications**: Building conditioning control: Fan control and temperature control, batch control description and terminology: Batch	**8**

	Automation, Product Management, safety interlocking, Boiler control: role of sensors, safety interlocking.	

Practical Component

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

Course outcome:

On successful completion of the course the student is able to

Sl.No	Description	Description Bloom's Taxonomy Level
CO1	Understand technical terms and nomenclature associated with Process control domain.	Knowledge, Understand (Level 1, Level 2)
CO2	Use of different final control elements in a process.	Understand, Apply (Level 2, Level 3)
CO3	Design the suitable controllers for process control systems.	Analyze, Design (Level 4, Level 5)
CO4	Analyze the controller tuning techniques for process control system.	Analyze (Level 4)
CO5	Choose the proper control system for the automatic control system.	Analyze (Level 4)

CO-PO MAPPING															
CO/PO	**Po1**	**Po2**	**Po3**	**Po4**	**Po5**	**Po6**	**Po7**	**Po8**	**Po9**	**Po10**	**Po11**	**Po12**	**Pso1**	**Pso2**	**Pso3**
Co1	2	1										1			
Co2	2	2	2									1	2		
Co3	3	3	2	2	2							1	2	2	
Co4	3	3	2	2	2							1	2	2	
Co5	3	2	1	2	2						1	1	2	2	

Text Book:

1. Process Control Instrumentation Technology-C D Johnson, PHI Publication. 8th Edition, 2009
2. Seborg ,D.E., Mellichamp, D.P., Edgar, T.F., and Doyle,F.J.,III, "Process Dynamics and Control", John Wiley and Sons, 4th ed., 2016
3. D.R. Coughanour, 'Process Systems analysis and Control',McGraw- Hill, 3rd ed., 2013
4. Instrument Engineers Handbook-(Vol 2)-B G Liptak,Chilton Book Company, 4th edition 1995.

Reference Book:

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
3. P.W. Murrill , “Fundamentals of Process Control Theory”, 3rd ed.,ISA Books

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

Sl. No.	**Description**
1.	To understand the operation of various circuits like sample and hold circuits, multiplexer and relay driving circuit.
2.	To design Lead and Lag compensating networks.
3.	To analyze the performance of a second order control system in time domain and in frequency domain.
4.	To analyze the stability of the system.
5.	Understand the effect of changing the design parameters on control system performance

Sl.No	**Experiments**
1.	Study the operation of Sample and Hold circuits using discrete components and IC.
2.	Time Domain Analysis of Second Order System using discrete components
3.	Frequency response characteristics of Second Order System using discrete components
4.	To study the operation of Unipolar and Bipolar analog Multiplexer.
5.	Verify the function of programmable gain amplifier using analog multiplexer
6.	Design relay driving circuits using photo devices (LDR & Optocouplers).
7.	To draw the frequency response characteristics of the lag and lead compensator network
8.	Design of state feedback controller
9.	Design of Full Order and Reduced Order Observer using MATLAB
10.	Mathematical modeling of a physical systems
11.	Comparative study of Bode, Nyquist and root locus with respect to stability.
12.	Constant gain compensation in time and frequency domain
13.	Case study on Real time control of 2DOF helicopter control

Course outcome:

Sl. No.	Description	Bloom's Taxonomy Level
1.	Analyze the effect of sample and hold circuits, multiplexer and relay driving circuits.	Understand, Analyze (Level 2, Level 4)
2.	Design and analyze Lead and Lag compensators for given specifications	Understand, Design, (Level 2, Level 3)
3.	Perform time response and frequency analysis of a second order control system	Understand, Design (Level 2,Level 3)
4.	Examine the stability criteria for a control system using root locus, Bode and Nyquist plot	Knowledge, Understand (Level 1,Level 2)
5.	Examine the effect of changing the design parameters on control system performance	Knowledge, Understand (Level 1,Level 2)

	Po1	Po2	Po3	Po4	Po5	Po6	Po7	Po8	Po9	Po10	Po11	Po12	Pso1	Pso2	Pso3
Co1	**3**	**1**	**1**	**1**	**2**							**1**	**2**	**1**	**3**
Co2	**1**	**2**	**1**	**1**	**2**							**1**	**2**	**1**	**3**
Co3	**3**	**1**	**2**	**1**	**2**							**1**	**2**	**1**	**3**
Co4	**2**	**2**	**2**	**1**	**2**							**2**	**2**	**1**	**3**
Co5	**2**	**1**	**2**	**1**	**2**							**2**	**2**	**1**	**3**

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															

Course Title	**Computer Organization and Architecture**						
Course Code	**22EIT405B**						
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**		

Unit		**No. of Hrs**
1	STRUCTURE OF COMPUTERS: Computer types, Functional units, Basic operational concepts, VonNeumann Architecture, Bus Structures, Software, Performance, Multiprocessors and Multicomputer, Data representation, Fixed and Floating point, Error detection and correction codes. COMPUTER ARITHMETIC: Addition and Subtraction, Multiplication and Division algorithms, Floating-point Arithmetic Operations, Decimal arithmetic operations.	**8**
2	BASIC COMPUTER ORGANIZATION AND DESIGN: Instruction codes, Computer Registers, Computer Instructions and Instruction cycle. Timing and Control, Memory-Reference Instructions, Input-Output and interrupt. Central processing unit: Stack organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Complex Instruction Set Computer (CISC) Reduced Instruction Set Computer (RISC), CISC vs RISC	**8**
3	REGISTER TRANSFER AND MICRO-OPERATIONS: Register Transfer Language, Register Transfer, Bus and Memory Transfers, Arithmetic Micro-Operations, Logic Micro-Operations, Shift Micro-Operations, Arithmetic logic shift unit. MICRO-PROGRAMMED CONTROL: Control Memory, Address Sequencing, Micro-Program example, Design of Control Unit.	**8**
4	MEMORY SYSTEM: Memory Hierarchy, Semiconductor Memories, RAM(Random Access Memory), Read Only Memory (ROM), Types of ROM, Cache Memory, Performance considerations, Virtual memory, Paging, Secondary Storage, RAID	**8**
5	NPUT OUTPUT: I/O interface, Programmed IO, Memory Mapped IO, Interrupt Driven IO, DMA. MULTIPROCESSORS: Characteristics of multiprocessors, Interconnection structures, Inter Processor Arbitration, Inter processor Communication and Synchronization, Cache Coherence.	**8**

Sl.No	Description	Description Bloom's Taxonomy Level
CO1	Explain digital logic and its use in digital systems.	Knowledge, Understand (Level 1, Level 2)
CO2	Understand machine level representation of data.	Understand, Analyze (Level 2, Level 4)
CO3	Understand assembly level machine organization.	Design (Level 5)
CO4	Describe memory system organization and architecture.	Analyze (Level 4)
CO5	Describe interfacing and communication.	Design (Level 5)

CO-PO MAPPING															
CO/PO	**Po1**	**Po2**	**Po3**	**Po4**	**Po5**	**Po6**	**Po7**	**Po8**	**Po9**	**Po10**	**Po11**	**Po12**	**Pso1**	**Pso2**	**Pso3**
Co1	2	1	1												
Co2	3	3	2	1	1							1	2		
Co3	3	2	2	1	1							2	2	2	
Co4	3	3	2	2	2							2	2	2	
Co5	3	3	2	2	2						1	2	2	2	

TEXT BOOKS:

1. M. Moris Mano (2006), Computer System Architecture, 3rd edition, Pearson/PHI, India.

REFERENCE BOOKS:

1. Carl Hamacher, Zvonks Vranesic, SafeaZaky (2002), Computer Organization, 5th edition, McGraw Hill, New Delhi, India.

2. William Stallings (2010), Computer Organization and Architecture- designing for performance, 8th edition, Prentice Hall, New Jersy.

3. Anrew S. Tanenbaum (2006), Structured Computer Organization, 5th edition, Pearson Education Inc,

4. John P. Hayes (1998), Computer Architecture and Organization, 3rd edition, Tata McGrawHil

Course Title	**Industrial Drives and Control**						
Course Code	**22EIT405C**						
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

The objective of this subject is to:

Sl.no	Description
1	To introduce the concept of selection, Justification and Utilization of Electric drives
2	Characterize the operation of motor, drive, sensor and mechanical power within the drive.
3	Understand the operation of DC and AC Motor drive.
4	Understand the method of starting and braking of electric motor.
5	To have a knowledge of various motor drive applications.

Unit		No. of Hrs
1	Concept of electric drive, Advantages of Electrical Drives, Power modulators, Dynamics of motor load system: Fundamental torque equations, Components of Load Torque, Classification of load torque, electrical braking, converter motor system, speed control and multiquadrant operation**.**	**8**
2	**DC DRIVE**: Starting and braking operations of DC motor drive-Speed control of DC motors - Ward Leonard scheme - Drawbacks - Ward Leonard Ilgener scheme - Thyristor converter fed DC Drives: single, two quadrant operation, Chopper fed DC Drives: control strategies - single, two quadrant operation.	**8**
3	**THREE PHASE INDUCTION MOTOR DRIVES**: Speed control of three phase induction motors: Stator control - Stator voltage, frequency and voltage/frequency control - VSI,CSI. **Rotor control**: Rotor resistance control- Static control of rotor resistance using DC Chopper, slip power recovery schemes -Kramer and Scherbius drives.	**8**
4	**THREE PHASE SYNCHRONOUS MOTOR DRIVES:** Speed control of three phase synchronous motors - types of control , Voltage source and current source converter fed synchronous, Effects of harmonics on the performance of AC motors, Closed loop control of drive motors, Marginal angle control and power factor control.	**8**
5	**DRIVE APPLICATIONS** : Selection of drives and control schemes for steel rolling mills, Paper mills and cranes - Traction- conventional DC and AC Traction drives- DC Traction using Chopper Controlled Drives- Poly phase AC motors for Traction Motors	**8**

Course outcome:

On successful completion of the course the student is able to

Sl.No	Description	Description Bloom's Taxonomy Level
CO1	Understand different types of drives and its application.	Knowledge, Understand (Level 1, Level 2)
CO2	Analyze the construction, characteristics and application of D.C. motor	Understand, Analyze (Level 2, Level 4)
CO3	Design the converter for AC and DC drives.	Design (Level 5)
CO4	Analyze the speed control of three phase synchronous motor drive.	Analyze (Level 4)
CO5	Design torque, speed and position controller of motor drives control schemes for steelrolling mills. Paper mills, lifts and cranes	Design (Level 5)

Text Book:

1. Gopal K. Dubey, "Fundamentals of Electrical Drives", Alpha Science International Ltd, 2001.
2. Vedam Subramanyam, "Thyristor control of Electric Drives", Tata Mc Graw Hill, New Delhi 1991.
3. Rashid M.H., "Power Electronics circuits Devices and Applications", Prentice Hall, 3rd Edition, New Delhi, 2009

Reference Book:

1. Gopal K. Dubey, " Power Semiconductor Controlled Drives", Prentice Hall, 1989
2. PS.K.Pillai, " A First Course on Electrical Drives", New age international Publishers Pvt Ltd,1989,Reprint 2004.
3. Thyristorized Power Controllers- G. K. Dubey, S. R. Doradla, A. Joshi & R.M.K. Sinha, New Age International (P) Ltd. Publishers, 9th Reprint, 2009.
4. P.C.Sen, "Thyristor DC Drives", John Wiley & Sons New York 1981.
5. B.K.Bose, "Power Electronic & AC drives", Prentice Hall, 2006.

CO-PO MAPPING															
CO/PO	**Po1**	**Po2**	**Po3**	**Po4**	**Po5**	**Po6**	**Po7**	**Po8**	**Po9**	**Po10**	**Po11**	**Po12**	**Pso1**	**Pso2**	**Pso3**
Co1	2	1	1												
Co2	3	3	2	1	1							1	2		
Co3	3	2	2	1	1							2	2	2	
Co4	3	3	2	2	2							2	2	2	
Co5	3	3	2	2	2						1	2	2	2	

Course Title	**Micro Systems and Nanotechnology**						
Course Code	**22EIT405D**						
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:

The objective of this course is to make the students to

Sl.no	Description
1.	To impart fundamental knowledge of Microsystems and their manufacturing
2.	To provide knowledge of fabrication process, modeling
3.	Understand the integration of Microsystems and different packaging technologies
4.	To impart basic knowledge on various synthesis and characterization techniques involved in Nanotechnology.

Unit No	**Syllabus**	**No of Teaching hours**
1	**Overview of MEMS and Microsystems and working principles of** microsystems: MEMS and Microsystems, Typical MEMs and Microsystems products, Evolution of microfabrication, microsystems and microelectronics, Multidisciplinary nature of microsystems design and manufacture, Applications of microsystems in Automotive, Healthcare Aerospace and other industries.	**08 Hours**
2	Micro sensors, Actuator systems: Micro sensors: Silicon Capacitive Accelerometer, Piezo resistive pressure sensor, Portable blood Analyser Micro actuation: using thermal forces, SMA, Piezoelectric crystals, Electrostatic Forces. MEMS with Micro actuators- Micro grippers, Micro motors, Micro valves, Micro pumps, Micro accelerometers	**08 Hours**
3	**Miniaturization and Micromachining technologies:** Introduction to scaling, scaling in rigid body dynamics, electrostatic forces, electromagnetic forces, electricity. Silicon as a material for micromachining, Thin film deposition, Lithography, etching, Silicon micromachining- surface, Bulk, LIGA. Advanced process for Microfabrication- Wafer	**08 Hours**

	bonding techniques, Special Microfabrication Techniques. Special Materials for Microsystems	
4	**Introduction to nanotechnology:** Nanotechnology-definition, classification based on the dimension, Effects of the Nano-metre Length Scale, Fabrication methods Top- down processes-Milling, Lithography, Bottom-up processes- Vapour phase deposition methods,Plasma-assisted deposition processes	**08 Hours**
5	Methodologies for nanotechnology characterization: Electronmicroscopy- Scanning electron microscopy, Transmission electron microscopy, Scanning probe techniques- Scanning tunnelling microscopy , Atomic force microscopy, **Applications of nanotechnology-** electronics and Medical field.	**08 Hours**

Course Outcomes:

At the end of the course the student is able to

Sl.No	Description	Description Bloom's Taxonomy Level
1.	Understand the fundamental knowledge of Microsystems for varied applications	Knowledge, Understand (Level 1, Level 2)
2.	Understand the integration of various functions into a very small space from submicrometrs to some millimeters.	Knowledge, Analyze (Level 1, Level 4)
3.	Understand the fundamentals of Nanotechnology.	Knowledge, Understand (Level 1, Level 2)
4.	Gain knowledge on various synthesis and characterization techniques involved in Nanotechnology	Knowledge, Analyze (Level 1, Level 4)
5.	Get familiarized with nanotechnology potentialities.	Understand ,Apply (Level 2, Level 3)

	Po1	**Po2**	**Po3**	**Po4**	**Po5**	**Po6**	**Po7**	**Po8**	**Po9**	**Po10**	**Po11**	**Po12**	**Pso1**	**Pso2**	**Pso3**
Co1	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**2**	**2**
Co2	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**2**	**2**
Co3	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**1**
Co4	**2**	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**1**	**-**
Co5	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**1**

Text Books:

1. **Micro and Smart systems**: G.K Ananhasuresh, K.J.Vinoy, S. Gopalakrishan, K.N Baht, Wiley India Publishers 1st edition 2010.

2.T. Pradeep, " *A Textbook of Nanoscience and Nanotechnology*", Tata McGraw Hill Education Pvt. Ltd., 2012.

Reference Books:

1. MEMS and Microsystems: design and manufacture-Tai-Ran Tsu, Tata McGraw-Hill, 6th reprint 2012
2. MEMS-Nitaigour Premchand Mahalik, Tata McGraw-Hill, 2007
3. Hari Singh Nalwa, "*Nanostructured Materials and Nanotechnology*", Academic Press, 2002.

Course Title	**Arduino Programming 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 Node MCU and investigate the practicality of integrating them into the laboratory classes.

Expt. No.	**Experiments**
1	Implement Digital output from Arduino i) blinking of inbuilt ii) External LED iii) Alternate LED
2	Implement an Arduino based simple digital I/O system i) LED control using switch ii) LED control touch sensor
3	Arduino program to interfacing RGB LED
4	Implement serial communication using Arduino and Node MCU
5	Illustrate the Serial monitor
6	Arduino program to control intensity of LED using analog pin.
7	Arduino program to run DC motor clockwise and anti-clockwise
8	Arduino program to measure distance using ultrasonic sensor
9	Arduino program to measure to monitor temperature and humidity values using DHT sensor
10	Arduino program to interface a 2x16 LCD to display counter / characters
11	Arduino program to Controlling angular position of Servo motors from serial monitor
12	Arduino program to upload random generated values to ThinSpeak platform

Sl.No	Description	Description Bloom's Taxonomy Level
1.	Understand the uses open-source cloud platform like ThinkSpeak and Arduino IDE	Knowledge, Analyze (Level 1, Level 4)
2.	Design a circuits using Arduino board and NodeMCU	Knowledge, Analyze (Level 1, Level 4)
3.	Implement various functions using Arduino & NodeMCU board and different sensors	Create, Analyze (Level 5, Level 4)
4.	Write and analyze the sensor data on ThingSpeak cloud platform	Create, Analyze (Level 5, Level 4)

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	**8051 Microcontroller 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

This course is designed to

Sl.no	Description
1	To understand the concept and Architecture of 8051 Microcontroller.
2	To understand and program the microcontroller using assembly and C- Progrmming techniques
3	To understand the concepts and principles of interrupts in microcontroller and its use in serial programming.
4	To learn Interfacing of Counter, Motor, LCD & Keyboard to the microcontroller.

I.PROGRAMMING

Note: Programming exercise is to be done on 8051

Expt No	Syllabus
1	Data Transfer - Block move, Exchange, Sorting, Finding largest element in an array.
2	Arithmetic Instructions - Addition/subtraction, multiplication and division.
3	Finding the square, Cube of a number – (16 bits Arithmetic operations – bit addressable).
4	Boolean & Logical Instructions (Bit manipulations).
5	Code conversion: BCD – ASCII; ASCII – Decimal; Decimal - ASCII; HEX - Decimal and Decimal - HEX
6	Interface 8051 to count up and down in seven segment display.
7	Alphanumeric LCD panel and Hex keypad input interface to 8051.
8	Stepper motor control interface to 8051.
9	DC motor control interface to 8051.
10	Generate different waveforms Sine, Square, Triangular, Ramp etc. using DAC interface to 8051; change the frequency and amplitude.

Course outcome:

At the end of the course, the student is able to

Sl.No	Description	Description Bloom's Taxonomy Level
CO1	Write and Program the microcontroller for the given task efficiently using assembly language and C – language Programming techniques.	Apply(Level 3)
CO2	Use interrupts for serial peripheral interfaces	Apply, Analyze (Level 3, Level 4)
CO3	Interface Microcontroller with external peripherals.	Apply, Analyze (Level 3, Level 4)

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