R.V.COLLEGE OF ENGINEERING

(Autonomous Institution Affiliated to VTU, Belagavi)

R.V. Vidyaniketan Post, Mysore Road

Bengaluru – 560 059

Bachelor of Engineering (B.E.)

Scheme and Syllabus for III & IV Semesters

2016 SCHEME

ELECTRONICS & INSTRUMENTATION ENGINEERING

Department Vision

Achieving academic excellence in Instrumentation Technology by adopting interdisciplinary research with a focus on sustainable and inclusive technologies.

Department Mission

- To create an environment for students to excel in domain areas and get motivated to involve in interdisciplinary research by utilizing state of the art infrastructure.
- To impart technical knowledge, encourage experiential learning and develop future professional leaders.
- To establish industry-academia networking and develop industry-ready students and future entrepreneurs, to meet societal & industrial challenges.
- To motivate lifelong learning and research in sustainable technologies to find improved solutions for the betterment of society.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Apply Instrumentation, Electronics, Controls and Automation concepts to develop technical solutions for industrial problems.

PEO2: Exhibit competency in adapting to various industrial challenges and work in inter-disciplinary projects with team spirit and professional ethics for achieving organizational goals.

PEO3: Pursue higher education in technology or management and achieve professional excellence by imbibing leadership qualities and communication skills.

PEO4: Become entrepreneurs with a focus on sustainable technologies and develop innovative solutions to meet industrial and societal needs.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO	Description
PSO1	Design, analyze and practice the instrumentation, controls and automation concepts and techniques required for industrial and/or research pursuits resulting in product development, publications or patents.
PSO2	Demonstrate the knowledge of basic science, mathematics, electronic system design and programming for real-time applications, towards developing industrial solutions and become technology leaders of future.

Lead Society: International Society of Automation (ISA)

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Abbreviations

Sl. No.	Abbreviation	Meaning
1.	**VTU**	Visvesvaraya Technological University
2.	**BS**	Basic Sciences
3.	**CIE**	Continuous Internal Evaluation
4.	**CS**	Computer Science and Engineering
5.	**CV**	Civil Engineering
6.	**CHY**	Chemistry
7.	**EC**	Electronics and Communication Engineering
8.	**EE**	Electrical and Electronics Engineering
9.	**EI**	Electronics and Instrumentation Engineering
10.	**ES**	Engineering Science
11.	**HSS**	Humanities and Social Sciences
12.	**ME**	Mechanical Engineering
13.	**PHY**	Engineering Physics
14.	**SEE**	Semester End Examination
15.	**MAT**	Engineering Mathematics

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R V COLLEGE OF ENGINEERNG, BENGALURU-560 059
(Autonomous Institution Affiliated to VTU, Belagavi)

DEPARTMENT OF
ELECTRONICS & INSTRUMENTATION ENGINEERING

THIRD SEMESTER CREDIT SCHEME								
Sl. No.	Course Code	Course Title	BoS	CREDIT ALLOCATION				
				L	**T**	**P**	**S**	**Total Credits**
1.	16MA31B	Discrete and Integral Transforms	MAT	3	1	0	0	4
2.	16ET32	Environmental Technology	BT	2	0	0	0	2
3.	16EI33	Linear IC's and Applications	EI	3	0	1	1	5
4.	16EI34	Digital Circuit Design	EI	3	0	1	1	5
5.	16EI35	Signals & Systems	EI	3	1	0	0	4
6.	16EI36	Measurements and Instrumentation	EI	3	0	0	1	4
7.	16DCS37	Bridge Course C Programming *	CS	2	0	0	0	0
Total number of Credits								**24**
Total Number of Hours / Week				**17+2***	**4**	**4**	**12****	**27**

FOURTH SEMESTER CREDIT SCHEME								
Sl. No.	Course Code	Course Title	BoS	CREDIT ALLOCATION				
				L	**T**	**P**	**S**	**Total Credits**
1.	16MA41B	Linear Algebra and Probability Theory	MAT	3	1	0	0	4
2.	16EM42B	Engineering Materials	EC	2	0	0	0	2
3.	16EI43	Microcontroller & Applications	EI	3	0	1	1	5
4.	16EI44	Sensors and Instrumentation	EI	3	0	1	1	5
5.	16EI45	Control Systems and Modelling	EI	3	1	0	0	4
6.	16EI46	Digital System Design using Verilog	EI	3	0	1	1	5
7.	16HS47	Professional Practice-II (Communication Skills & Professional Ethics)	HSS	0	0	1	0	1
8.	16DMA48	Bridge Course Mathematics**	MAT	2	0	0	0	0
Total number of Credits								**26**
Total Number of Hours / Week				**17+2****	**4**	**6**	**12****	**29**

*Mandatory Audit course for lateral entry diploma students
**Non-contact hour

III Semester		
DISCRETE AND INTEGRAL TRANSFORMS (Theory) (COMMON TO EC, EE, EI, TC)		
Course Code:16MA31B		**CIE Marks:** 100
Credits: L:T:P:S: 3:1:0:0		**SEE Marks:** 100
Hours: 36L+12T		**SEE Duration:** 03Hrs

Course Learning Objectives: The students will be able to	
1	Comprehend the existence and the role of transforms, inverse transforms and Fourier series in engineering problems.
2	Learn to find transform and inverse transform of continuous, discontinuous and discrete functions.
3	Develop the knowledge of periodic functions as a Fourier series subject to Dirichlet's conditions and derive the Fourier series using Euler's formulae.
4	Identify and solve initial and boundary value problems, interpret the physical significance of solutions using transform methods.

UNIT-I	
Laplace transform: Existence and uniqueness of Laplace Transform (LT), Transform of elementary functions, RoC. Properties of LT - Linearity, change of scale and first shifting. Transform of function - multiplied by t^n, division by t, derivatives and integral. LT of periodic function, Heaviside unit step function, Unit impulse function. Heaviside shift (second shift) theorem.	**07 Hrs**
UNIT-II	
Inverse Laplace Transform: Definition, properties of inverse Laplace transform, evaluation using different methods. Convolution theorem, problems. Application to solve ordinary linear differential equations and simultaneous differential equations.	**07 Hrs**
UNIT-III	
Fourier Series: Introduction, periodic function, even and odd functions, properties. Special waveforms - square wave, half wave rectifier, saw-tooth wave and triangular wave. Dirichlet's conditions, Euler's formula for Fourier series, Fourier series for functions of period 2L (particular cases) - problems. Half Range Fourier series- Construction of Half range cosine and sine series. Parseval's theorem for Root mean square value of a function (without proof). Complex form of Fourier series.	**08 Hrs**
UNIT-IV	
Fourier Transform: Fourier Integral theorem, Complex Fourier transform, Fourier sine transform, Fourier cosine transform, Properties of FT, Convolution theorem, Parseval's identity, Applications of FT.	**07 Hrs**
UNIT-V	
Z – Transform: Introduction, Z transform of standard functions, Linearity property, damping rule, shifting theorem, initial and final value theorems, convergence of Z transform, RoC, inverse Z transform using power series and partial fraction methods, convolution theorem, application to difference equations.	**07 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand - the significance of fundamental concepts of transforms and inverse transforms, even & odd functions, periodic phenomena.
CO2:	Demonstrate - the properties of transforms and inverse transforms, graphical representation

	of various wave forms.
CO3:	Evaluate - transforms of periodic, discontinuous and discrete functions, develop Fourier series of various type of functions.
CO4:	Apply - transform techniques to solve Differential equations and Difference equations in engineering problems.

Reference Books	
1.	Higher Engineering Mathematics, B.S. Grewal, 40th Edition, Khanna Publishers, 2007, ISBN: 81-7409-195-5.
2.	A Text Book of Engineering Mathematics, N.P Bali & Manish Goyal, 7th Edition, Lakshmi Publications, 2010, ISBN: 978-81-7008-992-6.
3.	Advanced Engineering Mathematics, Erwin Kreyszig, 9th Edition, John Wiley & Sons, 2007, ISBN: 978-81-265-3135-6.
4.	Higher Engineering Mathematics, B. V. Ramana, Tata McGraw-Hill, 2008, ISBN: 13-978-07-063419-0.

Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of quizzes (Q), tests (T) and Self-Study(S). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for Self-study is 20. The total marks of CIE are 100.

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

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

Low-1 Medium-2 High-3

III Semester		
ENVIRONMENTAL TECHNOLOGY (Theory)		
Course Code:16ET32		**CIE Marks:** 50
Credits: L:T:P:S: 2:0:0:0		**SEE Marks:** 50
Hours: 25L		**SEE Duration:** 02Hrs

Course Learning Objectives: The students will be able to	
1	Understand the various components of environment and the significance of the sustainability of healthy environment.
2	Recognize the implications of different types of the wastes produced by natural and anthropogenic activity.
3	Learn the strategies to recover the energy from the waste.
4	Design the models that help mitigate or prevent the negative impact of proposed activity on the environment

UNIT-I	
Introduction: Ecosystem – Types and structure of ecosystem. Components of environment, Environmental education, Environmental act & regulations. Global environmental issues, ISO 14000, Environmental Impact Assessment and Challenges.	**05 Hrs**
UNIT-II	
Environmental pollution: Causes, effects and control measures of Air, noise and land pollution. Air Pollution. Clean air act, Pollution standard index. Indoor air quality. Global atmospheric change - Global warming, Acid rain & Ozone depletion and their controlling measures.	**05 Hrs**
UNIT-III	
Water pollution and management: Pollutants in surface & ground water, water borne diseases. Water purification systems: physical & chemical treatment - aeration, solids separation, settling operations, coagulation, softening, filtration, disinfection, The common technologies for purification of drinking water - Ultraviolet radiation treatment, Reverse Osmosis. Rain water harvesting, water recycling, STP plant.	**05 Hrs**
UNIT-IV	
Renewable energy sources and technology for generation of energy: Different types of energy, conventional sources & non-conventional sources of energy, solar energy, wind energy, hydro electric energy, Geothermal Energy, Nuclear energy, Fossil Fuels & Biomass energy.	**05 Hrs**
UNIT-V	
Solid waste management: Types, causes, control and processing. Typical generation rates, estimation of solid waste quantities, factors that affect generation rates. Management - On site handling, collection, storage and processing techniques, ultimate disposal, landfills. Reduction and recycling of waste – waste to composite, energy.	**05 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1:	Identify the components of environment and exemplify the detrimental impact of anthropogenic activities on the environment.
CO2:	Differentiate the various types of wastes and suggest appropriate safe technological methods to manage the waste.
CO3:	Aware of different renewable energy resources and can analyse the nature of waste and propose methods to extract clean energy.
CO4:	Adopt the appropriate recovering methods to recover the essential resources from the wastes for reuse or recycling.

Reference Books	
1.	Introduction to environmental engineering and science, Gilbert, M.M., Pearson Education. 2nd Edition, 2004, ISBN: 8129072770.
2.	Environmental Engineering, Howard S. Peavy, Donald R. Rowe and George Tchobanoglous, 2000, McGraw Hill Series in water resources and Environmental Engg., ISBN: 0070491348.
3.	Environmental Science – 15th Edition, G. Tyler Miller, Scott Spoolman, 2012, Publisher: Brooks Cole, ISBN-13: 978-1305090446 ISBN-10: 130509044.
4.	Environment Management, Vijay Kulkarni and T. V. Ramachandra, 2009, TERI Press, ISBN: 8179931846, 9788179931844.

Continuous Internal Evaluation (CIE); Theory (50 Marks)

CIE is executed by way of quizzes (Q), tests (T) and Assignment. A minimum of three quizzes are conducted and each quiz is evaluated for 05 marks adding up to 15 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 25 marks each and the sum of the marks scored from three tests is reduced to 30. The marks component for Assignment is 05. The total marks of CIE are 50.

Semester End Evaluation (SEE); Theory (50 Marks)

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 10 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 8 marks adding up to 40 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

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

Low-1 Medium-2 High-3

III Semester		
LINEAR IC'S AND APPLICATIONS (Theory and Practice)		
Course Code:16EI33		**CIE Marks:** 100+50
Credits: L:T:P:S: 3:0:1:1		**SEE Marks:** 100+50
Hours: 36L		**SEE Duration:** 03Hrs+03Hrs

Course Learning Objectives: The students will be able to	
1	Understand the fundamentals and design the application circuits in op-amp.
2	Design different types of active filters for specific applications.
3	Differentiate and design various oscillator circuits.
4	Design analog application circuits using IC 555 and understand the need of different types of regulators.
5	Design basic ADC and DAC circuits.

UNIT-I	
Introduction: Bipolar Junction Transistor- operating point, JFET, OPAMP, CMOS devices and their differences.	**02 Hrs**
OP-AMP Applications Circuits: Instrumentation amplifier, precision Half-wave rectifiers, Precision Full-wave rectifiers, Threshold comparators, Zero-crossing detectors, Schmitt Triggers- inverting and non-inverting Schmitt trigger, Schmitt trigger with reference voltage, Peak detector, absolute value circuit.	**05 Hrs**
UNIT-II	
Active Filters: Introduction: Active and passive filters, Types of Active filters, Low-pass filters, (first order low pass filter, second order low pass filter, Butterworth low pass filters),Band-pass filters (wide band pass filters, narrow band pass filters) Band reject filters (wide band reject filters, narrow band reject filters), All pass filters.	**07 Hrs**
UNIT-III	
Sinusoidal and Non-Sinusoidal Oscillators: Classification and condition for oscillators, limitations, Types of oscillators, RC phase shift, Twin T oscillator, Wein bridge, Hartley, Colpitts, Crystal Oscillators, Voltage Controlled Oscillators, NE/SE-566, Square wave generators, Triangular wave generators, saw tooth-wave generators, relaxation oscillators.	**08 Hrs**
UNIT-IV	
555 timers, regulators and other applications: 555 Timer-functional block diagram, monostable and astable multi vibrators and its applications, Phase lock loops-phase detectors, integrated circuit PLL and applications of 565 PLL. Linear Regulators: Introduction, general purpose precision linear voltage regulator, three terminal regulators, regulation parameters.	**07 Hrs**
UNIT-V	
DAC and ADC: Sample and Hold circuits, Digital to analog converters-R-2R ladder, weighted resistor DAC, Successive approximation ADC and IC ADC, Flash type ADC, Dual slope ADC, Numerical Problems. **Single stage IC amplifiers:** Current source, current mirrors, current steering circuits, Common Source, Common Gate, Common Base amplifiers with active loads.	**07 Hrs**

Lab experiments (Using hardware and software)

1. Design and implement full wave and half wave rectifier circuits using opamp 741.
2. Design and implement Schmitt trigger circuits for given UTP and LTP.
3. Design and implement Active LPF and HPF using 741 for given cut off frequency.
4. Design and implement Notch filters using 741 for given frequency of 50Hz.
5. Design and implement low frequency oscillators such as RC phase shift and Wein bridge for given frequency.
6. Design and implement op-amp as relaxation oscillator for given frequency.
7. Design and implement Astable and monostable multivibrator using IC 555 timer.
8. Design and implement PLL and VCO using IC 565.
9. Design and implement Successive approximation type ADC. Plot its characteristics.
10. Design and implement 8-bit ADC using R-2R type.
11. Open ended experiment.
12. Open ended experiment.

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand the fundamentals of op-amps, timers, regulators, DAC,ADC etc.
CO2:	Apply the concepts of discrete electronic components in designing practical analog circuits.
CO3:	Analyze and evaluate the performance characteristics of analog circuits.
CO4:	Design and develop analog system for specific applications.

Reference Books	
1.	Microelectronics circuits Analysis and Design, Muhammed. H Rashid Thomson, 2nd Edition, 2011, ISBN: 978-0-495-66772-8.
2.	Microelectronics circuits, Sedra& Smith, Oxford, 5th Edition, 2009, ISBN-13: 978-0195338836.
3.	Electronic Devices and Circuits, Anil K Maini and Varsha Agarwal, John Wiley, 1st Edition, 2009, ISBN: 978-81-265-1895-1.
4.	Microelectronics, Jacob Millman, Arvin Grabel, TMH, 2nd Edition, 2010, ISBN 13: 9780074637364.

Continuous Internal Evaluation (CIE): Total marks: 100+50=150

Theory – 100 Marks

CIE is executed by way of quizzes (Q), tests (T) and Self-Study(S). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for Self-study is 20. The total CIE for theory is 100.

Laboratory- 50 Marks

The Laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of marks over number of weeks is considered for 40 marks. At the end of the semester a test is conducted for 10 marks. Total marks for the laboratory is 50.

Semester End Evaluation (SEE): Total marks: 100+50=150

Theory – 100 Marks

SEE for 100 marksis executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Laboratory- 50 Marks

Experiment Conduction with proper results is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

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

Low-1 Medium-2 High-3

III Semester		
DIGITAL CIRCUIT DESIGN (Theory and Practice)		
Course Code:16EI34		**CIE Marks:** 100+50
Credits: L:T:P:S: 3:0:1:1		**SEE Marks:** 100+50
Hours: 36L		**SEE Duration:** 03Hrs+03Hrs
Course Learning Objectives: The students will be able to		
1	Understand combinational logic circuits, simplification of algebraic equations using Karnaugh maps and Quine McCluskey techniques.	
2	Design and analyzedecoders, encoders, digital multiplexers, adders and subtractors, binary comparators.	
3	Explain the timing diagrams and operation of latches, flip-flops and their characteristic equations.	
4	Understand and design Mealy and Moore Models, Synchronous Sequential Circuits, State diagrams and Registers and Counters.	

UNIT-I	
Principles of combinational logic: Definition of combinational logic, canonical forms, Generation of switching equations from truth tables, Karnaugh maps-3,4,5 variables, incompletely specified functions (Don't care terms) simplification of max/min term equations, Quine-McCluskey minimization technique, Quine-McCluskey using don't care terms, Reduced prime implicants table.	**07 Hrs**
UNIT-II	
Analysis and design of combinational logic: General approach to combinational logic design, Decoders, BCD decoders, Encoders, digital multiplexers, Using multiplexers as Boolean function generators, Adders and subtractors, Cascading full adders, Look ahead carry adder, Binary comparators**.**	**07 Hrs**
UNIT-III	
Flip-Flops Basic Bistable elements, Latches, Timing considerations, the master-slave flip-flops (pulse-triggered flip-flops): SR flip-flops, JK flip-flops, Edge triggered flip-flops, Characteristic equations, Case studies.	**07 Hrs**
UNIT-IV	
Simple Flip-Flops Applications Registers, binary ripple counters, synchronous binary counters, Counters based on shift registers, Design of synchronous/asynchronous counters, Design of a synchronous/asynchronous mod-n counter using clocked T, J, K, D and SR flip-flops.	**07 Hrs**
UNIT-V	
Sequential Circuit Design Mealy and Moore models, State machine notation, Synchronous/ asynchronoussequential circuit analysis, Construction of state diagrams, counter design. **Logic Families** Transistor – Transistor Logic (TTL), Emitter – Coupled Logic (ECL), The MOS Field Effect Transistor, NMOS and PMOS Logic CMOS Logic.	**08 Hrs**

Lab Experiments:

1. Realization of AND, OR and XOR gates using NAND Gates.
   Realization of a Boolean Expression using Logic Gates.
2. Realization of Full Adder using Basic Gates and NAND Gates.
   Realization of Full Subtractor using Basic Gates and NAND Gates.
3. Realization of Parallel Adder and Subtractor using IC–7483.
   Realization of Binary to Gray Code Converter using IC 74139.
4. Realization of (Half/Full) Adder using IC 74153 multiplexer.

Realization of (Half/Full) Subtractor using IC 74153 multiplexer.

5. Design and realization of One and Two Bit Comparator using Basic Gates.
   Design of Four Bit Magnitude Comparator using IC7485.
6. Realization of BCD to 7-segment Decoder using IC – 7447.
   Realization of BCD to 7-segment Encoder using IC – 74147.
7. Realization of SR and JK Flip-Flops using universal Gates.
   Design and Realization of Master-Slave JK Flip Flop using NAND Gates.
8. Realization of Up-Down programmable counter using IC 74192 and IC 74193
9. Realization of shift registers various modes SIPO, SISO, PIPO, and PISO using IC 7495.
   Realization of Ring counter and Johnson counter using IC 7495.
10. Design and Verification of Parity Generator and Parity Checker.
    Design and Implement BCD to EXCESS-3 converter.
11. Design of Asynchronous/Synchronous Mod-8 Up and down counter using IC 7476.
    Design of Mod-N (5, 6, 9, 11, 15) Synchronous/Asynchronous Up counter using IC 7476
12. Open ended experiments.

Course Outcomes: After completing the course, the students will be able to	
CO1:	Acquire knowledge of Combinational and sequential circuits.
CO2:	Apply the concepts and implement Digital logic circuits.
CO3:	Analyse and evaluate the Combinational and sequential circuits design.
CO4:	Design and Develop State machine for specific applications.

Reference Books	
1.	Digital Logic Applications and Design, John M Yarbrough, Thomson Learning, 12th Edition, 2001. ISBN 981-240-062-1.
2.	Digital Principles and Design, Donald D. Givone, McGraw Hill, 1st Edition, 2002. ISBN 978-0-07-52906-9.
3.	Digital Fundamentals, Thomas L. Floyd, R. P. Jain, Pearson, 11th Edition, 2014, ISBN-13: 978-0132737968.
4.	Digital Circuits and Design, D. P. Kothari and J. S Dhillon, Pearson, 1st Edition, 2016, ISBN: 9789332543539.

Continuous Internal Evaluation (CIE): Total marks: 100+50=150

Theory – 100 Marks

CIE is executed by way of quizzes (Q), tests (T) and Self-Study(S). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for Self-study is 20. The total CIE for theory is 100.

Laboratory- 50 Marks

The Laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of marks over number of weeks is considered for 40 marks. At the end of the semester a test is conducted for 10 marks. Total marks for the laboratory is 50.

Semester End Evaluation (SEE): Total marks: 100+50=150

Theory – 100 Marks

SEE for 100 marksis executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I,

IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Laboratory- 50 Marks

Experiment Conduction with proper results is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

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

Low-1 Medium-2 High-3

III Semester		
SIGNALS & SYSTEMS (Theory)		
Course Code:16EI35		**CIE Marks:** 100
Credits: L:T:P:S: 3:1:0:0		**SEE Marks:** 100
Hours: 36L+24T		**SEE Duration:** 03Hrs

Course Learning Objectives: The students will be able to	
1	Understand the mathematical description of continuous time and discrete time signals and systems and classify into different categories based on their properties.
2	Analyze the signals in time domain using convolution.
3	Analyze linear time Invariant (LTI) system in Time and transform domains.
4	Apply mathematical transforms to study the behavior of various systems. And develop systems with the knowledge of difference equations and their responses.

UNIT-I	
Classification of signals and systems: Definition of signals and systems, Sampling of analog signals, Continuous Time and Discrete Time signal, Classification of signals as even, odd, periodic and non-periodic, deterministic and non-deterministic, energy and power. **Elementary signals/Functions:** Exponential, sine, impulse, step, ramp, rectangular, triangular, signum, sync functions. **Operations on signals:** Amplitude scaling, addition, multiplication, differentiation, integration (Accumulator for Discrete Time), time scaling, time shifting and time folding. **Systems:** Linear and nonlinear, time variant and invariant, causal and non-causal, static and dynamic, stable and unstable, invertible.	**09 Hrs**
UNIT-II	
Time domain representation of LTI System: Impulse response representation, computation of Convolution Sum and Convolution Integral, system properties in terms of impulse response, step response in terms of impulse response. Differential and Difference equation representation for LTI systems, Block diagram representation.	**09 Hrs**
UNIT-III	
Fourier Representation of continuous time signals: Introduction, Computation of Continuous time Fourier Series (CTFS), Inverse CTFS, Continuous time Fourier transforms (CTFT) and Inverse CTFT (derivation of series and transforms excluded) and their properties and significance. Frequency response of Continuous time LTI system. **Sampling:** Sampling Continuous-Time Signals, Reconstruction of Continuous Time Signals from Samples, Sampling theorem, Ideal Reconstruction and Practical Reconstruction.	**09 Hrs**
UNIT-IV	
Fourier Representation of Discrete time signals: Discrete time Fourier Series (DTFS), transforms (DTFT), inverse Fourier series and transforms (Derivation of series and transforms excluded) and their properties and significance**.** Frequency response of Discrete time LTI system.	**09 Hrs**
UNIT-V	
Discrete time system analysis using Z-Transform: Introduction, Z-transform of Finite and Infinite Duration Sequences, Region of	**09 Hrs**

convergence (ROC) and Stability, Properties of ROC, Properties of the Z-Transform, Inverse Z-Transform, Unilateral Z transform and its application to solve difference equations. Relationship between Z-transform and DTFT.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Classify signals and systems and Apply various mathematical operations on signals.
CO2:	Analyze both continuous and discrete time systems in time, frequency domain and z-domain and determine the performance of a system in time domain for the given impulse representation.
CO3:	Determine frequency components of given arbitrary time domain signal using Fourier techniques.
CO4:	Evaluate the characteristics of systems.

Reference Books	
1.	Signals and Systems, Simon Haykin,, John Wiley India Pvt. Ltd., 2nd Edition, 2003, ISBN: 978-0471138207
2.	Linear Systems and Signals, B. P. Lathi, Oxford University Press, 2005, ISBN: 978-0195158334.
3.	Fundamentals of Signals & Systems, Michael Roberts, 2nd Edition, Tata Mc Graw-Hill, 2010, ISBN: 978-0070702217.
4.	Signals and Systems, Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab, Pearson Education Asia / PHI, 2nd Edition, 1997,. Indian Reprint 2002, ISBN: 978-0136511759.

Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of quizzes (Q), tests (T) and Assignment. A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 60. The marks component for assignment is 10. The total marks of CIE are 100.

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marksis executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

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

Low-1 Medium-2 High-3

III Semester		
MEASUREMENTS AND INSTRUMENTATION (Theory)		
Course Code:16EI36		**CIE Marks:** 100
Credits: L:T:P:S: 3:0:0:1		**SEE Marks:** 100
Hours: 36L		**SEE Duration:**03Hrs
Course Learning 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	Analyze& apply DC/AC bridges and indicating instruments for unknown parameters measurement.	
3	Develop DAS and learn computer controlled instrument systems for inter-instrument communication through IEEE 488 bus.	
4	Apply the different calibration techniques for various types of electrical and electronic measuring instruments.	

UNIT-I	
Measurement and Measurement systems Significance of measurements, Methods of measurements, classification, Functions, Applications, Elements of Generalized measurement system with an example. **Quality of measurement systems** Static and Dynamic Characteristics of Instruments: Definitions and comparisons, Static Characteristics: Static error, static correction, scale range and scale span, reproducibility and drift, repeatability, Signal to noise ratio, sources of noise, accuracy, precision, linearity, hysteresis, threshold, dead time, Dynamic Characteristics: Fidelity, frequency response, dynamic error, etc., problems.	**07 Hrs**
UNIT-II	
DC Bridges: Measurement of low and medium Resistance: Ammeter, voltmeter method, Wheatstone bridge, Kelvin double bridge, Problems. **AC bridges:** Measurement of inductance, capacitance, Q of coil, Maxwell's Bridge, Wein bridge, Schering bridge, Applications, Limitations and Problems.	**07 Hrs**
UNIT-III	
Ammeters and Voltmeters: **DC Ammeters**: Ammeter shunt, Multirange ammeters, design problems. **DC voltmeter**: Multiplier resistance, Multi-range voltmeter, Voltmeter sensitivity, loading effect, design problems. **Digital Instruments:** Digital Voltmeter, ramp-type DVM, dual slope integrating DVM, Range changing, Digital multimeters, digital frequency meter, range changing, Digital Tachometer and Digital pH meter.	**08 Hrs**
UNIT-IV	
Instrument Calibration methods: Introduction, Comparison methods: DC voltmeter calibration, Deflection instrument calibration, DC Ammeter calibration. AC instrument calibration. Ohmmeter calibration. Digital multimeters as standard instruments. Calibration instruments: precision DC voltage source, voltage calibrator. Potentiometer calibration methods for DC ammeter and voltmeter calibration.	**07 Hrs**
UNIT-V	
Data Acquisition system: Introduction, generalized DAS, objective of DAS, uses of DAS, Single channel DAS, Multichannel DAS, Computer based DAS. **Computer-Controlled Instrument Test Systems:** Introduction, testing an audio amplifier, testing a radio receiver, instrument used in	**07 Hrs**

computer-controlled instrumentation, IEEE-488 electrical interface instrumentation bus.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand the basic concepts of measurement, characteristics of instruments and techniques of inter- instrument communication and unknown variable measurements.
CO2:	Apply the concepts of DC/AC bridge circuits, analog and digital instruments, DAS and IEEE-488 bus protocols for designing measuring instruments.
CO3:	Analyze and evaluate the performance of various electrical and electronic instruments and data acquisition systems.
CO4:	Develop mathematical models, analyze and design various instrument systems and their calibration, through course activities.

Reference Books	
1.	Electronic Instrumentation and Measurements, David A Bell, PHI/ Pearson Education, 2nd Edition, 2012, ISBN: 978-81-203-2360.
2.	Electronic Instrumentation, H S Kalsi, TMH, 2nd Edition, 2010, ISBN: 978-00-707-2066.
3.	Modern Electronic Instrumentation and Measurement techniques, Albert D Helfrick, William D Cooper, PHI, 2007, ISBN: 978-81-203-0752-0.
4.	Electrical and Electronic Measurements and Instrumentation, A.K.Sawhney, Dhanpat Rai & sons, 18th Edition, ISBN: 81-7700-016-0.

Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of quizzes (Q), tests (T) and Self-Study(S). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for Self-study is 20. The total marks of CIE are 100.

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

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

Low-1 Medium-2 High-3

III Semester		
BRIDGE COURSE C PROGRAMMING (Theory)		
Course Code:16DCS37		**CIE Marks:** 100
Credits: L:T:P:S : 2:0:0:0 (Audit Course)		**SEE Marks:** 100
Hours: 24L		**SEE:** 03 Hrs
Course Learning Objectives: The students will be able to		
1	Develop arithmetic reasoning and analytical skills to apply knowledge of basic concepts of programming in C.	
2	Learn basic principles of problem solving through programming.	
3	Write C programs using appropriate programming constructs adopted in programming.	
4	Solve complex problems using C programming.	

UNIT-I	
Introduction to Reasoning, Algorithms and Flowcharts Skill development – Examples related to Arithmetical Reasoning and Analytical Reasoning. Fundamentals of algorithms and flowcharts.	**02 Hrs**
Introduction to C programming Basic structure of C program, Features of C language, Character set, C tokens, Keywords and Identifiers, Constants, Variables, Data types.	**01 Hrs**
Handling Input and Output operations Reading a character, Writing a character, Formatted input/output functions, Unformatted input/output functions.	**02 Hrs**
UNIT-II	
Operators and Expressions Arithmetic operators, Relational operators, Logical Operators, Assignment operators, Increment and decrement operators, Conditional operators, Bit-wise operators, Arithmetic expressions, evaluation of expressions, Precedence of arithmetic operators, Type conversion in expressions, Operator precedence and associativity.	**02 Hrs**
Programming Constructs **Decision Making and Branching** Decision making with 'if' statement, Simple 'if' statement, the 'if…else' statement, nesting of 'if…else' statements, The 'else if' ladder, The 'switch' statement, The '*?:'* operator, The '*goto'* statement. **Decision making and looping** The while statement, the do statement, The 'for' statement, Jumps in loops**.**	**03 Hrs**
UNIT-III	
Arrays One dimensional arrays, Declaration of one dimensional arrays. Initialization of one dimensional arrays, Two dimensional arrays, Initializing two dimensional arrays.	**02 Hrs**
Character Arrays and Strings Declaring and Initializing String Variables, Reading Strings from Terminal, Writing strings to screen, Arithmetic Operations on characters, String operations using with and without String handling functions.	**02 Hrs**
UNIT-IV	
User-defined functions Need for User Defined Functions, Definition of functions, Return values and their types, Function calls, Function declaration, Category of functions, Nesting of functions, Functions with arrays, Storage classes.	**03 Hrs**
Structures and Unions Introduction, Structure definition, Declaring structure variables, Accessing structure members, Structure initialization, Copying and comparing structure variables, Arrays of structure, Arrays within structures, Structures and functions, Unions.	**03 Hrs**

UNIT – V	
Pointers : Introduction , Accessing the address of a variable, Declaring and initializing of pointer variables, Accessing a variable using pointers, Chain of pointers, Pointer expressions, Pointer increments and scale factor, Pointers and arrays, Pointers and character strings.	**03 Hrs**
File Managements in C Basic concepts of files, Defining and opening a file, closing of a file, Input/Output operations on files.	**01 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand and explore the fundamental computer concepts and basic programming principles like data types, input/output functions, operators, programming constructs and user defined functions.
CO2:	Analyze and Develop algorithmic solutions to problems.
CO3:	Implement and Demonstrate capabilities of writing 'C' programs in optimized, robust and reusable code.
CO4:	Apply appropriate concepts of data structures like arrays, structures, and files to implement programs for various applications.

Reference Books:	
1.	Programming in C, P. Dey, M. Ghosh, 1st Edition, 2007, Oxford University press, ISBN -13: 9780195687910.
2.	The C Programming Language, Kernighan B.W and Dennis M. Ritchie, 2nd Edition, 2005, Prentice Hall, ISBN -13: 9780131101630.
3.	Turbo C: The Complete Reference, H. Schildt, 4th Edition, 2000, Mcgraw Hill Education, ISBN-13: 9780070411838.
4.	Understanding Pointers in C, Yashavant P. Kanetkar, 4th Edition, 2003, BPB publications, ISBN-13: 978-8176563581.

Scheme of Continuous Internal Evaluation:
CIE is executed by way of quizzes (Q), tests (T) and Assignment. A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. Faculty may adopt innovative methods for conducting quizzes effectively. The two tests are conducted and each test is evaluated for 30 marks adding up to 60 marks The marks component for assignment is 10. The total marks of CIE are 100.

Scheme of Semester End Examination:
SEE for 100 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

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

Low-1 Medium-2 High-3

IV Semester		
LINEAR ALGEBRA AND PROBABILITY THEORY **(Theory)** **(COMMON TO EC, EI, TC)**		
Course Code:16MA41B		**CIE Marks:** 100
Credits: L:T:P:S: 3:1:0:0		**SEE Marks:** 100
Hours: 36L+12T		**SEE Duration:** 03Hrs

Course Learning Objectives: The students will be able to	
1	Understand the basics of matrix theory, Eigen values, Eigen vectors, solution of system of linear equations.
2	View the concepts of vector spaces, linear transformation and orthogonality of matrices.
3	Apply the knowledge of the theory of probability in the study of uncertainties.
4	Use probability and sampling theory to solve random physical phenomena and implement proper distribution models.

UNIT-I	
Linear Algebra – I: Elementary transformations, Rank of matrix using Echelon form, geometry and consistency of system of linear equations, solution of system of linear equations using Gauss elimination method, Eigen values and Eigen vectors.	**07 Hrs**
UNIT-II	
Linear Algebra – II: Basic definition of Groups, Rings, Fields, Vector spaces, subspaces, Linear independence, Basis and Dimension, Linear transformation, matrix representation, Kernel and image of a linear transformation, Rank- Nullity theorem.	**07 Hrs**
UNIT-III	
Linear Algebra – III: Orthogonal Vectors , Orthogonal Projections, Orthogonal and orthonormal Bases, Orthogonal and Orthonormal Matrices, Gram-Schmidt Orthogonalization, QR Factorizations, Least Square Problems, Diagonalization of a Matrix, Singular Value Decomposition.	**07 Hrs**
UNIT-IV	
Probability: Baye's rule, Random Variables: Discrete and continuous, probability mass function, probability density function, cumulative density function, mean, variance, standard deviation-problems. Joint probability distributive function- Discrete and continuous, mean, covariance and correlation.	**08 Hrs**
UNIT-V	
Probability Distributions: Some standard discrete and continuous Distribution- Binomial, Poisson, Normal, Exponential and Geometric distributions. Sampling Theory: Sampling, sampling distributions, standard errors, student's t-distribution, chi-square distribution as a test of goodness of fit.	**07 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand - the fundamental concepts of Linear Algebra and Probability theory.
CO2:	Demonstrate - the properties of Eigen values and Eigen vectors, linear dependency of vectors, Orthogonality of vectors and matrices, random variables to describe probability functions.
CO3:	Apply - matrix theory to solve system of linear equations, linear transformations, orthogonal-ity and probability & distribution to nondeterministic situations.

CO4:	Estimate and interpret - Rank-Nullity, Diagonalization, SVD, central tendency and sampling theory occurring in engineering problems.

Reference Books	
1.	Linear Algebra and Its Applications, Gilbert Strang, 4th Edition, Cengage Learning India Edition, 2006, ISBN: 81-315-0172-8.
2.	Higher Engineering Mathematics, B.S. Grewal, 40th Edition, Khanna Publishers, 2007, ISBN: 81-7409-195-5.
3.	Schaum's Outline of Linear Algebra, S. Lipschutz and M. L. Lipson, 5th Edition, McGraw-Hill, ISBN: 978-0-07-179456-5.
4.	Theory and Problems of Probability - Schaum's Outline Series, Seymour Lipschutz & Marc Lars Lipson, 2nd Edition, McGraw-Hill, ISBN: 0-07-118356-6.

Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of quizzes (Q), tests (T) and Self-Study(S). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for Self-study is 20. The total marks of CIE are 100.

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

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

Low-1 Medium-2 High-3

IV Semester		
ENGINEERING MATERIALS **(Theory)** **(COMMON TO EC, EE, EI & TE)**		
Course Code:16EM42B		**CIE Marks:** 50
Credits: L:T:P:S 2:0:0:0		**SEE Marks:** 50
Hours: 24L		**SEE Duration:** 2 Hrs

Course Learning Objectives: The students will be able to	
1.	Understand electrical conduction (transport) in solids based on quantum mechanics and modern band theory
2.	Understand lattice vibration and thermal conduction (transport) in solids
3.	Understand major properties of bulk and nanostructured semiconductors & effects of dopant impurities and defects in semiconductors
4.	Understand the principles of light-solid interactions.

UNIT-I	
Introduction: Classification and Properties of Materials, Materials Used in Electrical and Electronic Industries, Requirements and Future Developments of Electronic Materials	**04 Hrs**
UNIT-II	
Classical Theory of Electrical Conduction and Conducting Materials: Resistivity, TCR (Temperature Coefficient of Resistivity) and Matthiessen's Rule, Traditional Classification of Metals, Insulators and Semiconductors, Drude's Free Electron Theory, Hall Effect, Wiedemann–Franz Law, Resistivity of Alloys, Nordheim's Rule, Resistivity of Alloys and Multiphase Solids, Materials for Electricity Transmission	**05 Hrs**
UNIT-III	
Thin Film Electronic Materials: Techniques for Preparation of Thin Films, Thin Film Conducting Materials, Thin Film Resistors, Transparent and Conductive Thin Films, Thin Film Magnetic Materials	**05 Hrs**
UNIT-IV	
Organic Electronic Materials: Conducting Polymers, Semiconducting Organic Materials, Organic Superconductors, Organic Piezoelectric Materials.	**05 Hrs**
UNIT-V	
Nanomaterials for Electronic Device Applications: Techniques for Preparation of Nanomaterials, Micro-/nano-devices Using Nanostructured Materials, graphene, carbon nano tubes	**05 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1:	Define different electronics materials properties, devices and its preparation techniques
CO2:	Classify & summarize different materials based on its function properties and its preparation for real time devices
CO3:	Identify electronics materials based on functional properties and preparation techniques
CO4:	Analyze the significance of emerging materials from appraising the existing materials properties and preparation techniques for devices and applications

Reference Books	
1.	Introduction to Electronic Materials for Engineers, Wei Gao & Zhengwei Li, Nigel Sammes, 2nd Edition, World Scientific Publishing Co. Pvt. Ltd, ISBN:9789814293693
2.	Flexible Electronics: Materials and Applications: William S, Wong and Alberto Salleo, ISBN 978-0-387-74362-2,2009

Continuous Internal Evaluation (CIE); Theory (50 Marks)

CIE is executed by way of quizzes (Q), tests (T) and Assignment. A minimum of three quizzes are conducted and each quiz is evaluated for 05 marks adding up to 15 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 25 marks each and the sum of the marks scored from three tests is reduced to 30. The marks component for Assignment is 05. The total marks of CIE are 50.

Semester End Evaluation (SEE); Theory (50 Marks)

SEE for 50 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 10 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 8 marks adding up to 40 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

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

Low-1 Medium-2 High-3

IV Semester		
MICROCONTROLLER & APPLICATIONS (Theory and Practice)		
Course Code: 16EI43		**CIE Marks:** 100+50
Credits: L:T:P:S: 3:0:1:1		**SEE Marks:** 100+50
Hours: 36L		**SEE Duration:** 03Hrs+03Hrs

Course Learning Objectives: The students will be able to	
1	Acquire knowledge about microcontroller and embedded system and their applications.
2	Understand the internal architecture and instruction set of microcontrollers
3	Introduce the programming concepts of microcontroller (ALP & C).
4	Understand the interfacing of different peripheral devices with Microcontrollers in industry.

UNIT-I	
Introduction to Embedded System: Introduction, desirable features and general characteristics of embedded system, model of an embedded system, microprocessor v/s microcontroller, example of a simple embedded system, figure of merit for an embedded system, classification of MCU:4/8/16/32 bit, CISC and RISC processors, von-neuman and Harward architecture, application domain of embedded systems. **8051 Architecture:** Block diagram of 8051, Pin diagram of 8051, Clock and machine cycle for 8051.	**07 Hrs**
UNIT-II	
Registers of 8051, internal memory of 8051, external memory interfacing, stack and stack pointer, timer and counters, parallel input/output ports, serial input/output ports and interrupts and baud rate calculations.	**07 Hrs**
UNIT-III	
Assembly language program-1: Addressing modes and data transfer: introduction, assembly language, flowchart and algorithm, 8051 data types and directives, addressing modes, data transfer with stack, data exchange and complete set of data transfer instructions. **Assembly language program-2:** Arithmetic and logic operators: introduction, addition, incrementing and decrementing, subtraction, multiplication, division, decimal addition, logical operations byte level and bit level, rotate operations, swap operation jump and CALL instructions.	**08 Hrs**
UNIT-IV	
8051 programming using C: Introduction, declaring variables, writing a simple C program, delay generation In C, programming ports of 8051 with C, operators in 8051 C, serial ports programming, Times/ counters programming, serial port in 8051 C, interrupts programming using C.	**07 Hrs**
UNIT-V	
Embedded Microcontroller (8051) interfacing: Introduction, interfacing a LED and a seven-segment display to an 8051, stepper motor interfacing, interfacing a DAC, DC Motor interfacing, ADC interfacing, temperature sensor interfacing. **Case study: A home protection system.**	**07 Hrs**

Lab Experiments:

1. Develop assembly language programs to perform Data Processing operations.
2. Construct assembly language Programs to demonstrate arithmetic operations.
3. Compose assembly language programs for Counters realization.
4. Construct assembly language Programs for Boolean & logical operations with

CALL & RET instructions.
5. Develop assembly language program for Code conversions.
6. Construct assembly language programs for Timer & Serial port communication.
7. Compose a C program to generate waveform using DAC Interface module.
8. Develop a C program to interface Stepper Motor.
9. Construct a C program to interface LCD.
10. Develop a C program to interface DC Motor.
11. Open-Ended Experiments

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand and remember the fundamentals of Microcontroller, architecture, instruction set, programming, interfacing peripherals and Embedded system.
CO2:	Apply the Instruction set, architectural features and addressing mode knowledge to write the program for specific application requirements.
CO3:	Analyse and evaluate different instruction set and addressing modes to write a compact code.
CO4:	Design /develop a real-time embedded system solution for a real time problem.

Reference Books	
1	The 8051 Microcontroller and Embedded Systems Using Assembly and C, Muhammad Ali Mazidi, Janice Gillespie Mazidi and Rollin D Mckinlay, Pearson PHI, 8th Edition, 2009, ISBN: 978-81-203-2954.
2	The 8051 Microcontrollers: Architecture, Programming and Applications, K. Uma Rao, Andhe Pallavi, Pearson Education, 1st Edition, 2010, ISBN: 8131732525.
3	Embedded Systems an Integrated approach, Lyla.B.Das, Pearson, 2nd Edition, 2016, ISBN: 978-81-317-8766-3.
4	Microprocessors 8086 Architecture, Programming and Interfacing, Sunil Mathur, PHI Learning Private Limited, 1st Edition, 2011, ISBN: 978-81-203-0409.

Continuous Internal Evaluation (CIE): Total marks: 100+50=150

Theory – 100 Marks

CIE is executed by way of quizzes (Q), tests (T) and Self-Study(S). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for Self-study is 20. The total CIE for theory is 100.

Laboratory- 50 Marks

The Laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of marks over number of weeks is considered for 40 marks. At the end of the semester a test is conducted for 10 marks. Total marks for the laboratory is 50.

Semester End Evaluation (SEE): Total marks: 100+50=150

Theory – 100 Marks

SEE for 100 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Laboratory- 50 Marks

Experiment Conduction with proper results is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

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

Low-1 Medium-2 High-3

IV Semester		
SENSORS AND INSTRUMENTATION (Theory and Practice)		
Course Code:16EI44		**CIE Marks:**100+50
Credits: L:T:P:S: 3:0:1:1		**SEE Marks:** 100+50
Hours: 36L		**SEE Duration:** 03Hrs+03Hrs

Course Learning Objectives: The students will be able to

1	Understand the fundamentals of transducers and sensors.
2	Demonstrate the working principles of different transducers and sensors.
3	Apply the principles of different type of sensors and transducers on state of art problems.
4	Design of signal conditioning circuits using op-amp and other analog ICs.

UNIT-I	
Introduction: Transducers: Definition of a transducer, Block Diagram, Active and Passive Transducers, Advantages of Electrical transducers. **Resistive Transducers:** **Potentiometers:** Characteristics, Loading effect, and problems. **Strain gauge:** Theory, Types, applications and problems. **Thermistor, RTD:** Theory, applications and problems. **Thermocouple:** Measurement of thermocouple output, compensating circuits, lead compensation, advantages and disadvantages of thermocouple.	**07 Hrs**
UNIT-II	
Inductive Transducers: Principle, Characteristics, Practical applications of LVDT and problems. **Capacitive Transducers:** Capacitive transducers using change in area of plates, distance between plates and change of dielectric constants, Applications of Capacitive Transducers and problems. **Piezo-electric Transducers:** Principle of operation, expression for output voltage, piezo-electric materials, equivalent circuit, loading effect and Problems.	**08 Hrs**
UNIT-III	
Chemical sensors: pH value sensor, dissolved oxygen sensor, oxidation-reduction potential sensor. **Light sensors**: Photo resistor, Photodiode, Phototransistor, Photocell, Photo-FET, Charge coupled device. **Tactile sensors:** Construction and operation, types.	**07 Hrs**
UNIT-IV	
Special Transducers: Hall effect transducers, Thin film sensors, and smart transducers: Principles and applications. **MEMS Sensors:** Advantages of MEMS, Lithography, LIGA process, Modelling of MEMS sensors, MEMS materials and fabrication, Examples and applications.	**07 Hrs**

UNIT-V	
Analog Signal Conditioning: **Principles of analog signal conditioning:** Signal level and bias changes, linearization, Filtering and impedance matching, concepts of loading. **Passive circuits:** Divider circuits and bridge circuits. **Op amp circuits in Instrumentation:** Differential instrumentation amplifier, V-I converter, I-V converter, linearization.	**07 Hrs**

Lab Experiments:

1. Characteristics of potentiometer resistance transducer and Measurement of strain using half and full bridge.
2. Characteristics of capacitance transducer & LVDT.
3. Characteristics of thermistor & RTD.
4. Characteristics of thermocouple & AD590.
5. Characteristics of LDR and photo transistor.
6. Characteristics of Piezoelectric transducer and load cell.
7. Design of electronic digital temperature indicator using thermocouple.
8. Design of electronic digital temperature indicator using RTD.
9. Design of electronic digital temperature indicator using thermistor.
10. Design of electronic digital strain indicator.
11. Open ended experiments..

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand the basic principles of different transducers and sensors.
CO2:	Apply the knowledge of transducers and sensors to comprehend digital instrumentation systems.
CO3:	Analyze and evaluate the performance of different transducers and sensors for various applications.
CO4:	Create a system using appropriate transducers and sensors for a particular application.

Reference Books	
1	Electrical and Electronic Measurements and Instrumentation, A.K.Sawhney, Dhanpat Rai and Sons, 18th Edition, 2008, ISBN: 81-7700-016-0.
2	Sensor systems: Fundamentals and applications, Clarence W.de Silva, CRC Press, 1st Edition 2016, ISBN: 9781498716246.
3	Transducers and Instrumentation, D.V.S. Murthy, PHI Publication, 2nd Edition 2008, ISBN: 978-81-203-3569-1.
4	Introduction to Measurement and Instrumentation, Arun K. Ghosh, PHI, 3rd Edition, 2009, ISBN: 978-81-203-3858-6.

Continuous Internal Evaluation (CIE): Total marks: 100+50=150

Theory – 100 Marks

CIE is executed by way of quizzes (Q), tests (T) and Self-Study(S). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for Self-study is 20. The total CIE for theory is 100.

Laboratory- 50 Marks

The Laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of marks over number of weeks is considered for 40 marks. At the end of the semester a test is conducted for 10 marks. Total marks for the laboratory is 50.

Semester End Evaluation (SEE): Total marks: 100+50=150

Theory – 100 Marks

SEE for 100 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Laboratory- 50 Marks

Experiment Conduction with proper results is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

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

Low-1 Medium-2 High-3

IV Semester		
CONTROL SYSTEMS AND MODELLING (Theory)		
Course Code:16EI45		**CIE Marks:** 100
Credits: L:T:P:S: 3:1:0:0		**SEE Marks:** 100
Hours: 36L		**SEE Duration:** 03Hrs

Course Learning Objectives: The students will be able to	
1	Develop model and simulate single-input single-output linear systems.
2	Identify, formulate and solve control engineering problems.
3	Write equivalent differential equation and transfer function models for a given system.
4	Acquire the knowledge of classical control system analysis techniques, system response and performance characteristics.
5	Analyze and evaluate stability of feedback control systems using both time and frequency domain methods.

UNIT-I	
Basic concepts of systems and control loops: Types of systems, continuous, discrete, Linear Time Variant, Linear Time invariant, Lumped and Distributed parameter systems, Linear Vs non-linear systems, Systems with delay, Open loop control system with examples, Close loop control system with examples and its merits over open loop system Effect of both on stability, gain and speed response of system	**07 Hrs**
UNIT-II	
Mathematical modelling: Block Diagrams and Signal Flow Graph Analysis. Block diagram reduction techniques. Modelling electrical, mechanical and electro mechanical systems. Mechanical-Electrical Analogy, Mathematical Modelling: DC Servo Motors.	**07 Hrs**
UNIT-III	
Transient and steady state response: Introduction: Type and Order of The Systems, Transient Response Analysis, First and second order systems, Unity Feedback Systems, Stability Criteria, BIBO Stability, relative and absolute stability, Routh-Hurwitz Criteria for Stability, Steady State Errors, Impulse and Step, Ramp, Responses of first and second order systems, Analysis of Transient Response Specifications: peak overshoot, settling time, rise time, peak time etc., mathematical analysis and problem.	**08 Hrs**
UNIT-IV	
Root locus techniques: Plot Locies of root from transfer function, Stability criteria and system response study from root locus, problems. **Frequency response techniques**: Nyquist criteria, Nyquist plots, Bode plots and effect of gain margin, phase margin on system parameters, Bandwidth, Polar plot and stability criteria.	**07 Hrs**
UNIT-V	
State space analysis Introduction, concept of state model, state representation of nth order linear system with r forcing function, state model of linear systems from differential equations, state space representation using physical variables.	**07 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand basic concepts and modelling of linear and non-linear systems.
CO2:	Analysis of properties of control systems, in time and frequency domains.
CO3:	Apply and evaluate system performance, in time and frequency domains.
CO4:	Develop a control system for given specifications.

Reference Books	
1	Control systems- Principles and design, M.Gopal, TMH, 2nd Edition, 2006, ISBN: 0-07-048289-6.
2	Advanced control systems, B.N.Sarkar, PHI, 1st Edition, 2013, ISBN: 978-8120347106.
3	Modern control engineering, K.Ogata, Pearson education, 2013, 5th Edition, ISBN: 978-0-13-615673-4.
4	Control system engineering, J Nagrath and M Gopal, New age international publishers, 5th Edition, 2007, ISBN: 81-224-1775-2.

Continuous Internal Evaluation (CIE); Theory (100 Marks)

CIE is executed by way of quizzes (Q), tests (T) and Assignment. A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 60. The marks component for assignment is 10. The total marks of CIE are 100.

Semester End Evaluation (SEE); Theory (100 Marks)

SEE for 100 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

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

Low-1 Medium-2 High-3

IV Semester		
DIGITAL SYSTEM DESIGN USING VERILOG (Theory and Practice)		
Course Code:16EI46		**CIE Marks:**100+50
Credits: L:T:P:S: 3:0:1:1		**SEE Marks:**100+50
Hours: 36L		**SEE Duration:** 03Hrs+03Hrs
Course Learning Objectives: The students will be able to		
1	Explain the structure and fundamental components of digital systems.	
2	Describe the fundamental architecture of digital functional units such as ALUs, registers and memory.	
3	Execute digital module designs from written functional and systems specifications.	
4	Analyze and synthesize design interfaces between two or more digital module.	

UNIT-I	
Introduction to Verilog HDL: Verilog as HDL, Levels of Design Description, Concurrency, Simulation and Synthesis, Function Verification, System Tasks, Programming Language Interface, Module, Simulation and Synthesis Tools (VIVADO Tool). **Language Constructs and Conventions:** Introduction, Keywords, Identifiers, White Space, Characters, Comments, Numbers, Strings, Logic Values, Strengths, Data Types, Scalars and Vectors, Parameters, Operators.	**07 Hrs**
UNIT-II	
Gate Level Modelling: Introduction, AND Gate Primitive, Module Structure, Other Gate Primitives, Illustrative Examples, Tristate Gates, Array of Instances of Primitives, Design of Flip-Flops with Gate Primitives, Delay, Strengths and Construction Resolution, Net Types, Design of Basic Circuit.	**07 Hrs**
UNIT-III	
Modelling at Dataflow Level: Introduction, Continuous Assignment Structure, Delays and Continuous Assignments, Assignment to Vector, Operators. **Behavioral Modelling:** Introduction, Operations and Assignments, Functional Bifurcation, 'Initial' Construct, Assignments with Delays, 'Wait' Construct, Multiple Always Block, Designs at Behavioral Level, Blocking and Non-Blocking Assignments.	**08 Hrs**
UNIT-IV	
Behavioral Modelling: The 'Case' Statement, Simulation Flow, 'If' an 'if-Else' Constructs, 'Assign- De-Assign' Constructs, 'Repeat' Construct, for loop, 'The Disable' Construct, 'While Loop', Forever Loop, Parallel Blocks, Force-Release, Construct, Event.	**07 Hrs**
UNIT-V	
Components Test and Verification: Test Bench - Combinational Circuits Testing, Sequential Circuit Testing, Test Bench Techniques, Design Verification, Assertion Verification.	**07 Hrs**

Lab Experiments Using VIVADO Tool:

1. Realization and simulation of two input Exclusive OR gate using Verilog HDL.
2. Realization and simulation of D, JK and T FF in CMOS using Verilog HDL.
3. Realization of a four-bit asynchronous counter using T FF.
4. Realization and simulation of one bit Full Adder in CMOS using Verilog HDL.
5. Realization and simulation of a given Boolean expression using Verilog HDL.
6. Realization and interfacing of DAC to the Xilinx XC3S400.
7. Realization and interfacing of DC motor to the Xilinx XC3S400.

8. Realization and simulation of LCD to the Xilinx XC3S400.
9. Open ended experiments.

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand and remember the fundamentals of Verilog HDL.
CO2:	Apply the Verilog HDL concepts to design digital circuits.
CO3:	Analyze and evaluate the different modelling techniques to design digital circuits.
CO4:	Design and implement digital circuits on FPGA.

Reference Books	
1	Verilog HDL, Samir Palnitkar, 2nd Edition, Pearson Education, 2013, ISBN: 978-0132599702.
2	Design Through Verilog HDL, T.R. Padmanabhan, B Bala Tripura Sundari, Wiley 2009, ISBN: 978-0-471-44148-9.
3	Fundamentals of Digital Logic with Verilog Design, Stephen Brown, Zvonkoc Vranesic, TMH, 3rd Edition, 2013, ISBN: 978-007338544.
4	Advanced Digital Logic Design using Verilog, State Machines & Synthesis for FPGA, Sunggu Lee, Cengage Learning, 2nd Edition, 2013, ISBN: 978-534551612.

Continuous Internal Evaluation (CIE): Total marks: 100+50=150

Theory – 100 Marks

CIE is executed by way of quizzes (Q), tests (T) and Self-Study(S). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for Self-study is 20. The total CIE for theory is 100.

Laboratory- 50 Marks

The Laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average of marks over number of weeks is considered for 40 marks. At the end of the semester a test is conducted for 10 marks. Total marks for the laboratory is 50.

Semester End Evaluation (SEE): Total marks: 100+50=150

Theory – 100 Marks

SEE for 100 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Laboratory- 50 Marks

Experiment Conduction with proper results is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

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

Low-1 Medium-2 High-3

IV Semester		
Professional Practice – II **COMMUNICATION SKILLS AND PROFESSIONAL ETHICS**		
Course Code:16HS47		**CIE Marks:** 50
Credits: L:T:P:S: 0:0:1:0		**SEE Marks:** NA
Hours: 18 Hrs		**CIE Duration:** 02 Hrs

Course Learning Objectives: The students will be able to	
1	Develop communication style, the essentials of good communication and confidence to communicate effectively.
2	Manage stress by applying stress management skills.
3	Ability to give contribution to the planning and coordinate Team work.
4	Ability to make problem solving decisions related to ethics.

III Semester	
UNIT-I	
Communication Skills: Basics, Method, Means, Process and Purpose, Basics of Business Communication, Written & Oral Communication, Listening. **Communication with Confidence & Clarity**- Interaction with people, the need the uses and the methods, Getting phonetically correct, using politically correct language, Debate & Extempore.	**06 Hrs**
UNIT-II	
Assertive Communication- Concept of Assertive communication, Importance and applicability of Assertive communication, Assertive Words, being assertive. **Presentation Skills**- Discussing the basic concepts of presentation skills, Articulation Skills, IQ & GK, How to make effective presentations, body language & Dress code in presentation, media of presentation.	**06 Hrs**
UNIT-III.A	
Team Work- Team Work and its important elements Clarifying the advantages and challenges of team work Understanding bargains in team building Defining behaviour to sync with team work Stages of Team Building Features of successful teams.	**06 Hrs**
IV Semester	
UNIT-III.B	
Body Language & Proxemics - Rapport Building - Gestures, postures, facial expression and body movements in different situations, Importance of Proxemics, Right personal space to maintain with different people.	**06 Hrs**
UNIT-IV	
Motivation and Stress Management: Self-motivation, group motivation, leadership abilities, Stress clauses and stress busters to handle stress and de-stress; Understanding stress - Concept of sound body and mind, Dealing with anxiety, tension, and relaxation techniques. Individual Counselling & Guidance, Career Orientation. Balancing Personal & Professional Life-	**06 Hrs**
UNIT-V	
Professional Practice - Professional Dress Code, Time Sense, Respecting People & their Space, Relevant Behaviour at different Hierarchical Levels. Positive Attitude, Self-Analysis and Self-Management. **Professional Ethics** - values to be practiced, standards and codes to be adopted as professional engineers in the society for various projects**.** Balancing Personal & Professional Life	**06 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1:	Inculcate skills for life, such as problem solving, decision making, stress management.
CO2:	Develop leadership and interpersonal working skills and professional ethics.

CO3:	Apply verbal communication skills with appropriate body language.
CO4:	Develop their potential and become self-confident to acquire a high degree of self.

Reference Books	
1.	The 7 Habits of Highly Effective People, Stephen R Covey, 2004 Edition, Free Press, ISBN: 0743272455.
2.	How to win friends and influence people, Dale Carnegie, 1st Edition, General Press, 2016, ISBN: 9789380914787.
3.	Crucial Conversation: Tools for Talking When Stakes are High, Kerry Patterson, Joseph Grenny, Ron Mcmillan, 2012 Edition, McGraw-Hill Publication ISBN: 9780071772204.
4.	Aptimithra: Best Aptitude Book, Ethnus, 2014 Edition, Tata McGraw Hill ISBN: 9781259058738.

Scheme of Continuous Internal Examination (CIE)
Evaluation of CIE will be carried out in TWO Phases.

Phase	Activity	Weightage
I	Test 1 is conducted in III Sem for 50 marks (15 Marks Quiz and 35 Marks Descriptive answers) after completion of Unit-1, Unit-2 and Unit -3.A for 18 hours of training sessions.	50%
II	Test 2 is conducted in IV Sem for 50 marks ((15 Marks Quiz and 35 Marks Descriptive answers) after completion of Unit -3B, Unit - 4 and Unit-5 for 18 hours of training sessions.	50%
	At the end of the IV sem Marks of Test 1 and Test 2 is consolidated for 50 marks (Average of Test1 and Test 2 (T1+T2/2). The grading is provided by the Coe. The final CIE marks is scrutinized by the committee comprising of HSS- Chairman, Training Co-ordinator, respective department Staff Placement co-ordinator before submitting to CoE.	

SEE: NA

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

Low-1 Medium-2 High-3

IV Semester		
BRIDGE COURSE MATHEMATICS I / II		
Course Code:16DMA48		**CIE Marks:** 100
Credits: L:T:P:S: 2:0:0:0		**SEE Marks:** 100
Audit Course		**SEE Duration:** 03Hrs

Course Learning Objectives: The students will be able to	
1	Understand the existence of polar coordinates as possible 2-D geometry, approximate a function of single variable in terms of infinite series.
2	Gain knowledge of multivariate functions, types of derivatives involved with these functions and their applications.
3	Recognize linear differential equations, apply analytical techniques to compute solutions.
4	Acquire concepts of vector functions, vector fields and differential calculus of vector functions in Cartesian coordinates.
5	Explore the possibility of finding approximate solutions using numerical methods in the absence of analytical solutions of various systems of equations.

Prerequisites :
Hyperbolic functions, Trigonometric formulas, methods of differentiation, methods of integration, reduction formulae, vector algebra.

UNIT-I	
Differential Calculus: Taylor and Maclaurin's series for function of single variable. Partial derivatives – Introduction, simple problems. Total derivative, Composite functions, Jacobian's- simple problems.	**05 Hrs**
UNIT-II	
Multiple Integrals: Evaluation of double and triple integrals – direct problems, change of order in double integral, change of variables to polar, cylindrical and spherical coordinate systems.	**05 Hrs**
UNIT-III	
Differential Equations: Higher order linear differential equations with constant coefficients, Complementary function and Particular integral, problems. Equations with variable coefficients – Cauchy and Legendre differential equations, problems.	**06 Hrs**
UNIT-IV	
Vector Differentiation: Introduction, simple problems in terms of velocity and acceleration. Concepts of Gradient, Divergence- solenoidal vector function, Curl- irrotational vector function and Laplacian, simple problems.	**05 Hrs**
UNIT-V	
Numerical Methods: Algebraic and transcendental equations – Regula-Falsi method, Newton-Raphson method. Ordinary Differential Equations – Taylor's, modified Euler's and 4^{th} order Runge-Kutta methods. Numerical Integration – Simpson's $1/3^{rd}$, $3/8^{th}$ and Weddle's rules.	**05 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1:	Demonstrate the understanding of the basics of polar coordinates, partial differentiation, multiple integrals, vector differentiation, classification and types of solutions of higher order linear differential equations, requirement of numerical methods and few basic definitions.
CO2:	Solve problems on total derivatives of implicit functions, double integrals by changing order

	of integration, homogeneous linear differential equations, velocity and acceleration vectors.
CO3:	Apply acquired knowledge to find infinite series form of functions, multiple integrals by changing order, solution of non-homogeneous linear differential equations, and numerical solution of equations.
CO4:	Evaluate multiple integrals by changing variables, different operations using del operator and numerical solutions of differential equations and numerical integration.

Reference Books	
1.	Higher Engineering Mathematics, B.S. Grewal, 40th Edition, Khanna Publishers, 2007, ISBN: 81-7409-195-5.
2.	Advanced Engineering Mathematics, R. K. Jain & S.R.K. Iyengar, Narosa Publishing House, 2002, ISBN: 817-3-19-420-3. Chapters: 1, 2, 8, 15.
3.	Advanced Engineering Mathematics, Erwin Kreyszig, 9th Edition, John Wiley & Sons, 2007, ISBN: 978-81-265-3135-6. Chapters: 6, 10, 12.
4.	A Text Book of Engineering Mathematics, N.P Bali & Manish Goyal, 7th Edition, Lakshmi Publications, 2010, ISBN: 978-81-7008-992-6. Chapters: 6, 18, 16, 8, 26.

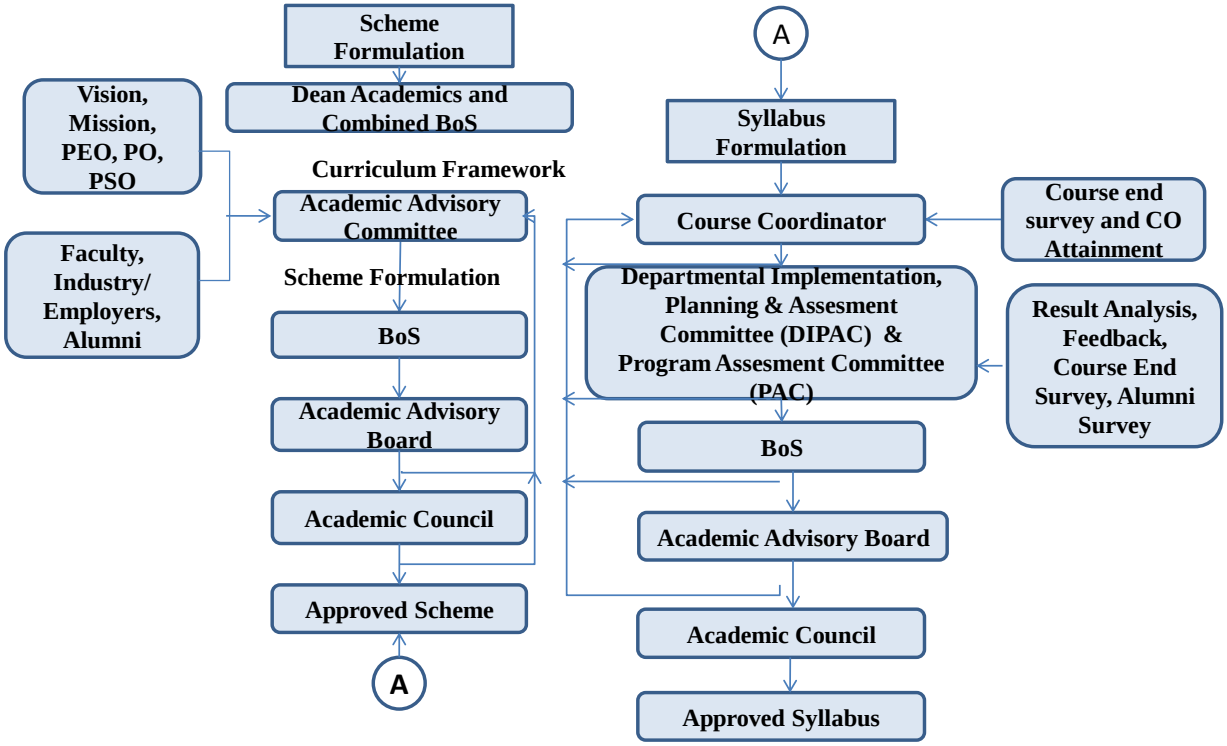
Continuous Internal Evaluation (CIE); Theory (100 Marks)
CIE consists of Two Tests each for 50 marks (20 marks for Quiz + 30 marks for descriptive questions)

Semester End Evaluation (SEE); Theory (100 Marks)
SEE for 100 marksis executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from each unit have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

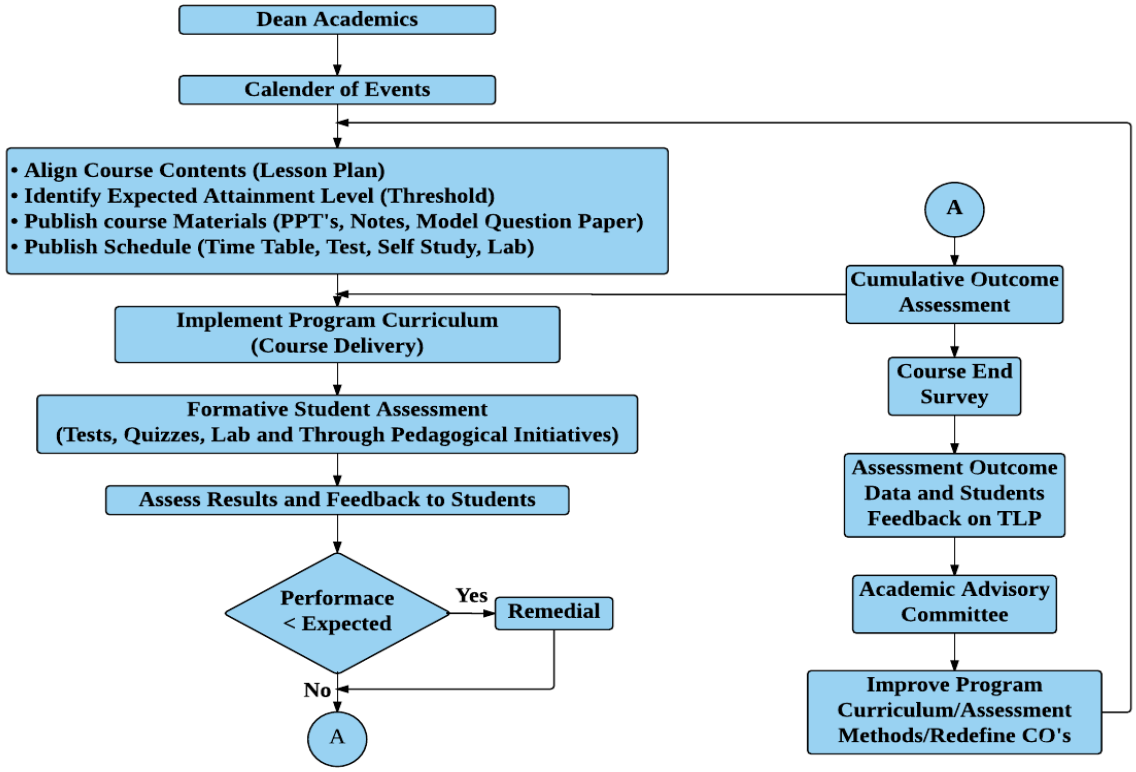
CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
CO2	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**1**
CO3	**3**	**3**	**1**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

Low-1 Medium-2 High-3

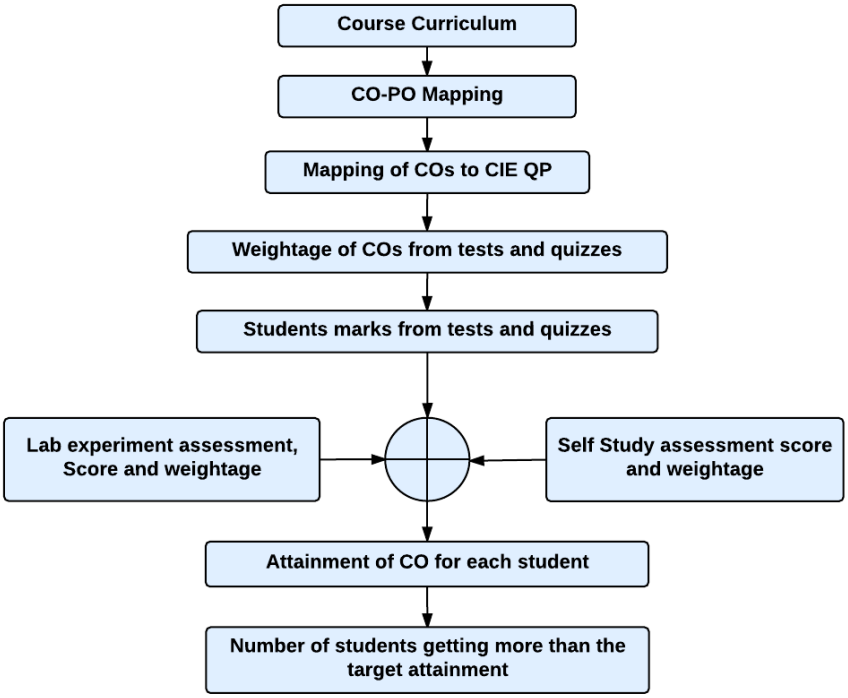
Curriculum Design Process



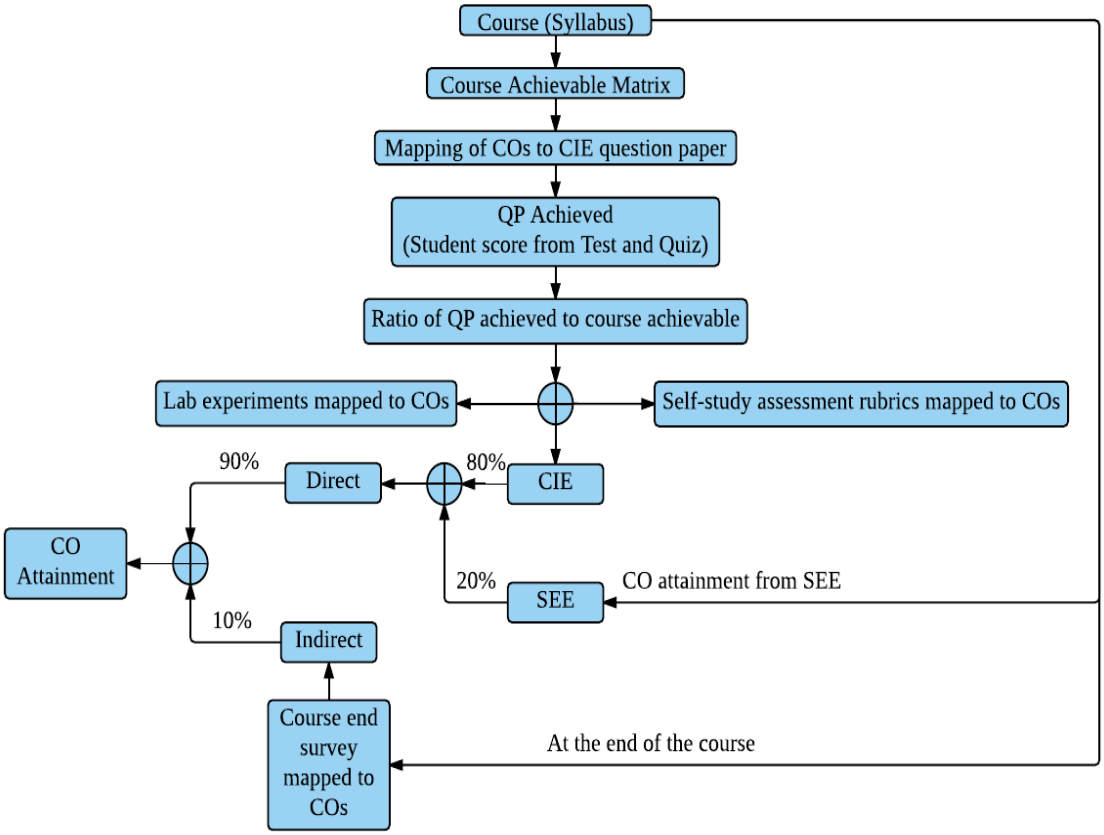
Academic Planning and Implementation



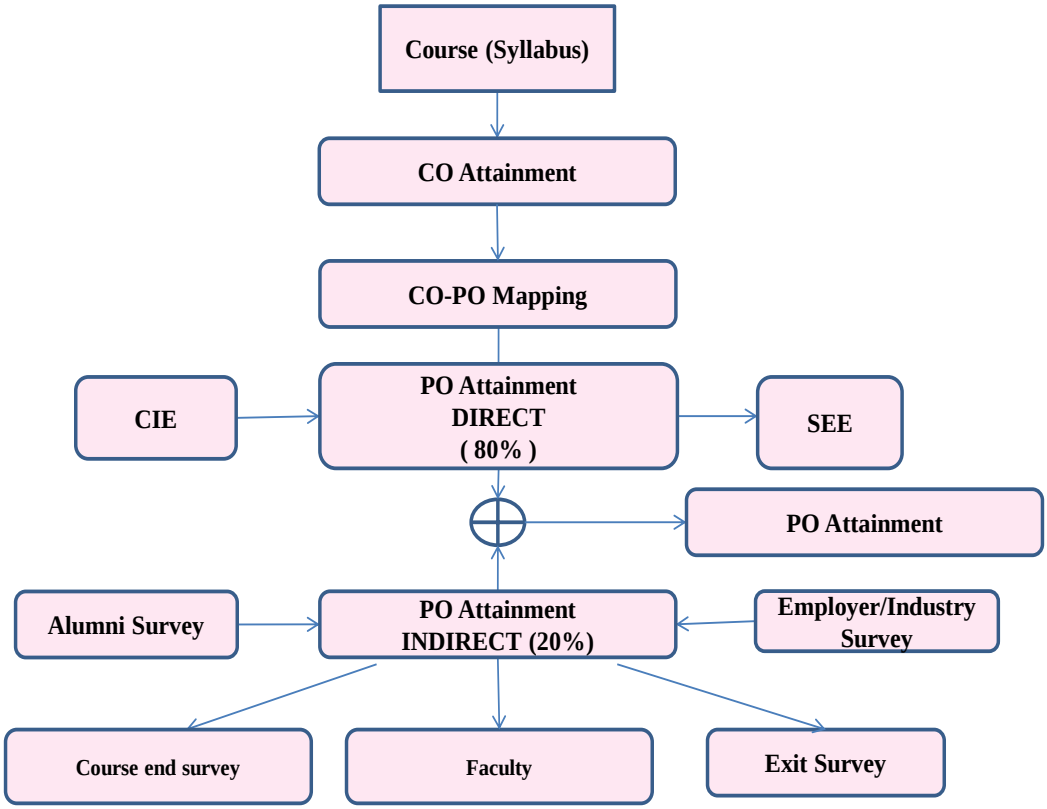
PROCESS FOR COURSE OUTCOME ATTAINMENT



Final CO Attainment Process



Program Outcome Attainment Process



Guidelines for Fixing Targets

- The target may be fixed based on last 3 years' average attainment

PROGRAM OUTCOMES (POs)

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation for the solution of complex engineering problems.

2. **Problem analysis:** Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet t h e specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling to complex engineering activities, with an understanding of the limitations.

6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with t h e society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.