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 & COMMUNICATION ENGINEERING

Department Vision

Imparting quality technical education through interdisciplinary research, innovation and teamwork for developing inclusive & sustainable technology in the area of Electronics and Communication Engineering.

Department Mission

- To impart quality technical education to produce industry-ready engineers with a research outlook.
- To train the Electronics & Communication Engineering graduates to meet future global challenges by inculcating a quest for modern technologies in the emerging areas.
- To create centres of excellence in the field of Electronics & Communication Engineering with industrial and university collaborations.
- To develop entrepreneurial skills among the graduates to create new employment opportunities.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1. To apply concepts of mathematics, science and computing to Electronics and Communication Engineering

PEO2. To design and develop interdisciplinary and innovative systems.

PEO3. To inculcate effective communication skills, team work, ethics, leadership in preparation for a successful career in industry and R & D organizations.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO	Description
PSO1	Should be able to clearly understand the concepts and applications in the field of Communication/networking, signal processing, embedded systems and semiconductor technology.
PSO2	Should be able to associate the learning from the courses related to Microelectronics, Signal processing, Microcomputers, Embedded and Communication Systems to arrive at solutions to real world problems.
PSO3	Should have the capability to comprehend the technological advancements in the usage of modern design tools to analyze and design subsystems/processes for a variety of applications.
PSO4	Should possess the skills to communicate in both oral and written forms, the work already done and the future plans with necessary road maps, demonstrating the practice of professional ethics and the concerns for societal and environmental wellbeing.

Lead Society: Institute of Electrical and Electronics Engineers (IEEE)

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2016 SCHEME

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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.	**ES**	Engineering Science
10.	**HSS**	Humanities and Social Sciences
11.	**ME**	Mechanical Engineering
12.	**PHY**	Engineering Physics
13.	**SEE**	Semester End Examination
14.	**MAT**	Engineering Mathematics

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R V COLLEGE OF ENGINEERNG, BENGALURU-560 059

(Autonomous Institution Affiliated to VTU, Belagavi)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

THIRD SEMESTER CREDIT SCHEME								
Sl. No.	**Course Code**	**Course Title**	**BoS**	**Credit Allocation**				**Total Credits**
				L	**T**	**P**	**S**	
1	16MA31B	Discrete and Integral Transforms	MAT	3	1	0	0	4
2	16ET32	Environmental Technology	BT	2	0	0	0	2
3	16EC33	Analog Microelectronic Circuits	ECE	4	0	1	0	5
4	16EC34	Analysis & Design of Digital Circuits	ECE	3	0	1	1	5
5	16EC35	Network Analysis & Synthesis	ECE	3	1	0	1	5
6	16EC36	Control Systems	ECE	3	0	0	1	4
7	16DCS37	Bridge Course C Programming *	CSE	2	0	0	0	0
		Total No. of Credits						**25**
		No. Of Hrs.		**18+2***	**4**	**4**	**12****	

FOURTH SEMESTER CREDIT SCHEME								
Sl. No	**Course Code**	**Course Title**	**BOS**	**Credit Allocation**				**Total Credits**
				L	**T**	**P**	**S**	
1	16MA41B	Linear algebra and Probability Theory	MAT	3	1	0	0	4
2	16EM42B	Engineering Materials	ECE	2	0	0	0	2
3	16EC43	Advanced Digital System Design using Verilog HDL	ECE	3	0	1	1	5
4	16EC44	Microprocessor & Microcontroller	ECE	3	0	1	1	5
5	16EC45	Signals and Systems	ECE	3	1	0	0	4
6	16EC46	Fields & Waves	ECE	3	0	0	1	4
7	16HS47	Professional Practice-II (Communication Skills and Professional Ethics)	HSS	0	0	1	0	1
8	16DMA48	Bridge Course Mathematics*	MAT	2	0	0	0	0
		Total No. of Credits						**25**
		No. Of Hrs.		**17 +2***	**4**	**4**	**12****	

*Mandatory Audit course for lateral entry diploma students

**Non-contact hours

Semester: III		
DISCRETE AND INTEGRAL TRANSFORMS **(Theory)** **(COMMON TO ECE, EEE, EI, TC)**		
Course Code: 16MA31B		**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	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.	**09 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.	**09 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.	**09 Hrs**
UNIT-IV	
Fourier Transform: Fourier Integral theorem, Complex Fourier transform, Fourier sine transform, Fourier cosine transform, Properties of Fourier transform, Convolution theorem, Parseval's identity, Applications of Fourier transform.	**09 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.	**09 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1:	Comprehend 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, Khanna Publishers, 40th Edition, 2007, ISBN: 81-7409-195-5.
2.	A Text Book of Engineering Mathematics, N.P Bali & Manish Goyal, Lakshmi Publications, 7th Edition, 2010, ISBN: 978-81-7008-992-6.
3.	Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 9th Edition, 2007, ISBN: 978-81-265-3135-6.
4.	Higher Engineering Mathematics, B. V. Ramana, Tata McGraw-Hill, 2008, ISBN: 13-978-07-063419-0; ISBN: 10-0-07-063419-X.

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**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**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

Semester: III		
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:	Awareness in 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

Semester: III		
ANALOG MICROELECTRONIC CIRCUITS (Theory & Practice)		
Course Code: 16EC33		**CIE Marks:** 100+50
Credits: L:T:P:S 4:0:1:0		**SEE Marks:** 100+50
Hours: 48L		**SEE Duration:** 03+03 Hrs

Course Learning Objectives: The students will be able to	
1	Apply the knowledge of BJTs and MOSFETs to design practical electronic circuits.
2	Design and conduct experiments using BJTs/MOSFETs/Op Amps and to analyze and interpret the results.
3	Design electronic sub systems such as feedback amplifiers, oscillators, power amplifiers to meet the required specifications.
4	Communicate and discuss effectively the technical details with reference to analog electronic subsystems using BJTs, MOSFETs and Op Amps.

UNIT-I	
MOS Field Effect Transistors (MOSFETS): Device structure and physical operation, current voltage characteristics, MOSFET as an amplifier and as a switch, biasing, small signal operation and models, MOSFET internal capacitors and high frequency model and frequency response of common source amplifier	**10 Hrs**
UNIT-II	
Bipolar Junction Transistors (BJTs): BJT as an amplifier and as a switch, small signal models, internal capacitors and high frequency model, frequency response of the common emitter amplifier, Darlington pair.	**09 Hrs**
UNIT-III	
IC Biasing & Differential Amplifiers: Current sources and current mirrors, MOS and BJT differential pairs, small signal operation, MOS differential amplifier with active load and frequency response of the differential amplifier.	**10 Hrs**
UNIT-IV	
Operational Amplifiers: Effect of finite open loop gain, finite bandwidth, slew rate, input and output impedances, large signal operation, Applications-Schmitt trigger**,** waveform generators, precision rectifiers and voltage regulators.	**09 Hrs**
UNIT-V	
Feedback Amplifiers and Large Signal Amplifiers: Properties of negative feedback, the four basic feedback topologies, practical circuits of the four types of feedback with opamps, classification of output stages, class A, class AB, class B circuits, thermal resistance and heat sinking of power transistors.	**10 Hrs**
LABORATORY EXPERIMENTS	
1. Design & testing of half wave / full wave rectifier circuits, and Zener diode voltage regulator. 2. Design &testing of (a) Inverting amplifier (b) Non-inverting amplifier (c) Summing circuit (d) Comparator and (e) Schmitt trigger, using operational amplifier. 3. Static characteristics of NMOS transistor 4. Design and testing of RC phase shift and Wien bridge oscillator circuits using operational amplifier. 5. Design & testing of an RC coupled amplifier using BJT in CE configuration. 6. Design & testing of Darlington emitter follower circuit with and without boot strapping. 7. LC Oscillators: Hartley and Colpitts oscillators using BJT 8. Design and testing of class B and class AB power amplifier circuits.	

9. Design of voltage shunt feedback amplifier using opamp. 10. Design of a linear voltage regulator using opamp.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Analyze the working of devices like MOSFETs, BJTs and OPAMPs.
CO2:	Illustrate the working of precision rectifiers, oscillators and amplifiers.
CO3:	Apply the knowledge to design amplifier, precision rectifier, oscillators and waveform generators
CO4:	Evaluate electronic sub systems with respect to the desired specifications

Reference Books	
1.	Microelectronic Circuits Theory and Applications, Adel S Sedra, & Kenneth C Smith, adapted by A Chandorkar, International version, Oxford University Press, 5th Edition, 2009. ISBN: 0195338839.
2.	Fundamentals of Microelectronics, Behzad Razavi, Wiley, 2nd Edition, 2013, ISBN-10: 1118156323
3.	Electronic Devices and Circuits, Jacob Millman, Christos C Halkias & Satyabrata Jit, Tata McGraw Hill publication, 2nd edition, 2008. ISBN: 0070634556
4.	Electronic Devices and Circuit Theory, Robert L Boylestad & Louis Nashelsky, PHI publication, 10th Edition, 2008. ISBN: 9788131725290.

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

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 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**	**3**	**3**	**-**	**1**	**2**	**2**	**-**	**3**	**-**	**-**	**2**
CO2	**3**	**3**	**3**	**-**	**1**	**2**	**2**	**-**	**3**	**-**	**-**	**2**
CO3	**3**	**3**	**3**	**2**	**1**	**2**	**2**	**2**	**3**	**2**	**-**	**2**
CO4	**3**	**3**	**3**	**2**	**1**	**2**	**2**	**2**	**3**	**2**	**-**	**2**

Low-1 Medium-2 High-3

Semester: III		
ANALYSIS AND DESIGN OF DIGITAL CIRCUITS (Theory & Practice)		
Course Code: 16EC34		**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 concept of logic circuit: truth table, K- map, Boolean Algebra and logic functions, SoP (sum of products) and PoS (product of sums), canonical algebraic equations, minterms and maxterms.
2	Design and use standard combinational circuit building blocks: multiplexers, demultiplexers, binary decoders and encoders, decoders, Arithmetic Circuits, code converters
3	Implement different sequential circuits using various flip flops to realize state machines for given timing behaviour.
4	Analyze processor organization & design arithmetic & logic unit by using combinational & sequential circuits.

UNIT-I	
Digital Integrated Circuits: Digital IC Logic Families: Transistor-Transistor Logic (TTL), Emitter Coupled Logic (ECL), N-MOS and P-MOS basics, Complementary MOS (CMOS) Logic **Characteristics and Performance Parameters of CMOS Inverter**: Introduction, Propagation delay, Sourcing, Sinking, Fan-in, Fan-out, V_{IH}, V_{OH}, V_{IL}, V_{OL} and corresponding currents, Noise margin, Power dissipation, power consumption, power-delay product as a figure of merit. **Simplification Technique:** K-Map, Numerical Examples.	**08 Hrs**
UNIT-II	
Combinational Circuits Design and Analysis: Parallel Adder/ Subtractor using IC 7483, Decoders, Encoders, Multiplexers and De-Multiplexers. Priority encoder and Magnitude comparator. Arithmetic circuits and code converters using Multiplexers and Decoders. Concepts of ripple carry and carry look ahead adders. Binary multiplier	**07 Hrs**
UNIT-III	
Sequential Circuits Design and Analysis I: Introduction, Latches and Flip Flops, Triggering of Flip Flops, Flip Flop Excitation Tables, Flip-Flop conversions, Registers, Shift Registers and Various Operations, Ring counters, Johnson counters and Sequence generators, Serial adder.	**07 Hrs**
UNIT-IV	
Sequential Circuits Design and Analysis II: Introduction, Ripple Counters, Synchronous Counters, Analysis of Clocked Sequential Circuits, State Reduction, Design Procedure, Design of Counters, Design with State Equations.	**07 Hrs**
UNIT-V	
Design of a Processor Unit: Introduction, Processor Organization, Arithmetic Logic Unit, Design of Arithmetic Unit, Design of Logic unit, Design of Arithmetic and Logic unit, Status Register, Design of Shifter, The Complete Processor unit and op-code generation.	**07 Hrs**
LABORATORY EXPERIMENTS	
1. a) Realization of Binary Adder and Subtractor using universal gates and IC-7483. b) Practice Question: Design a parallel binary subtractor to get actual difference based on the value of Cout. 2. a) Arithmetic circuits- Realize the given Boolean expressions using MUX/DEMUX using IC-74153, IC-74139. b) Practice Question: Realize FA/FS using MUX/DEMUX. 3. a) Code convertors i) Binary to Gray ii) Excess-3 to Binary b) Practice Question i) Binary to excess-3 using IC-7483 ii) Binary to	

Gray using Decoder 4. a) Design a two-bit magnitude comparator using logic gates. b) Drive the LED Display using IC-7447. c) Practice Question: Design an n-bit comparator using IC-7483(make use of cascading facility) 5. a) Design a Master-Slave JK-FF using NAND gates. Also design D-FF and T-FF using same. Observe the waveform using CRO. b) Practice Question: Observe the race around condition using Master alone. 6. a) Realization of asynchronous mod-n counter using IC-7490, IC-7493. b) Using IC-7495 perform SISO, SIPO, PISO, PIPO, Shift left operations. c) Design ring and Johnson counter using IC-7495 b) Practice Question: Design mod-99 counter using IC-7490. 7. a) Design of synchronous up/down counter using IC-7476. b) Design a synchronous counter to count given sequence c) Using presettable counters IC-74192/193 perform mod-n counts. d) Practice Question: Design Mod-n counter using above mentioned IC's. 8. Design a priority encoder for driving Flash ADC and hexadecimal number conversion. 9. Using IC-74192/193, drive the LED display. 10. Design a control logic for any two specified ALU operation.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Apply the knowledge of digital electronics to construct combinational and sequential logic designs.
CO2:	Develop a solution to real-life problems based on the knowledge of digital electronics.
CO3:	Demonstrate the engineering solutions using methodology obtained through extensive research with the help of modern engineering tools owing to the ethical responsibilities.
CO4:	Analyze and update the earned knowledge for obtaining sustainable solutions for technological enhancements in the field of digital electronics.

Reference Books	
1.	Digital Logic and Computer Design, M. Morris Mano, Pearson Education Inc., 13th Edition, 2011, ISBN: 978-81-7758-409-7.
2.	Digital Principle and Design, Donald D. Givone,1st Edition, 2002, Mc Graw-Hill, ISBN: 978-0072525038
3.	Digital Fundamentals, Thomas Floyd, 11th Edition,2015, Pearson Education India, ISBN: 978-0072551327.
4.	Fundamentals of Logic Design, Charles H. Roth (Jr.), 4th Edition, 1992, West publications, ISBN-13: 978-0-314-92218-2.

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**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**2**	**1**	**3**
CO2	**3**	**2**	**3**	**2**	**3**	**3**	**2**	**2**	**2**	**2**	**1**	**2**
CO3	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**2**	**3**	**3**
CO4	**3**	**3**	**3**	**3**	**1**	**3**	**-**	**-**	**-**	**1**	**1**	**3**

Low-1 Medium-2 High-3

Semester: III		
NETWORK ANALYSIS & SYNTHESIS (Theory)		
Course Code: 16EC35		**CIE Marks:** 100
Credits: L:T:P:S 3:1:0:1		**SEE Marks:** 100
Hours: 36L+24T		**SEE Duration:** 03Hrs
Course Learning Objectives: The students will be able to		
1	Use mesh and nodal analysis for formulating the transfer function of electrical networks & Apply network theorems for reducing complex electrical networks into simpler networks.	
2	Evaluate the initial and final values of different RL, RC and RLC networks for various input signals.	
3	Analyze resonance in electrical circuits	
4	Synthesis of an electrical network from a given impedance/admittance functions.	

UNIT-I	
Basic Concepts: Meaning of Networks and Network Analysis, Classification of Network Elements- Active and Passive, Linear & Non-Linear, Unilateral & Bilateral, Lumped & Distributed with examples. **Mesh and Node Analysis:** Loop and Node Analysis with Linearly Dependent and Independent Sources for DC and AC Networks including Concepts of Super Mesh and Super Node.	**07 Hrs**
UNIT-II	
Network Theorems: Analysis of Networks using Superposition, Reciprocity, Thevenin's & Norton's, Millman's & Maximum Power Transfer Theorem, Miller's theorem, Principle of Dual Networks.	**07 Hrs**
UNIT-III	
Initial Conditions & Transient Analysis in Networks: Behaviour of R, L, C components under switching conditions and their representations. Examination of initial and final values in different types of RL, RC and RLC networks, Transient Analysis of RL, RC and RLC network for series and parallel combination, Application of Laplace transformation to electrical circuit. **Resonance:** Introduction, Series resonance, Parallel resonance, Resonance between parallel RC, RL and RLC circuit.	**08 Hrs**
UNIT-IV	
Two Port Network Analysis: Introduction, Port in network, Network Configuration, Recurrent network, Parameter representation – z parameters, Y-parameters, Hybrid (h) – parameters, ABCD parameters, Inter-relations between parameters of Two Port Network, Expression of input and output impedances in terms of Two port parameters. Different types of interconnections of Two port networks	**07 Hrs**
UNIT-V	
Passive Network Synthesis: Introduction, Procedure of Synthesis, Properties of expressions of driving point admittances of LC networks, LC network Synthesis (Fosters canonic form), Cauer form of synthesis of RC and RL network.	**07 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1:	Apply the knowledge of mathematics & basic electrical concepts to describe, interpret and solve problems in network analysis.
CO2:	Analyze the strong grounding in the fundamentals of theorems, transient analysis, ports and synthesis approach in network analysis.
CO3:	Evaluate the network parameters in electric circuits
CO4:	Design and synthesis of electrical networks.

Reference Books	
1.	Circuit Theory - Analysis and Synthesis, A. Chakrabarti, 7th Edition, 2018, Dhanpat Rai & CO(Pvt) LTD Publishers, ISBN: 978-8177000009
2.	Networks and systems, D. Roy Choudhury, 2nd Edition, 2008, New Age International Publications, ISBN: 9788122427677
3.	Network Analysis, M. E. Van Valkenberg, PHI, 3rd Edition, 2006, ISBN-13: 978-8131701584
4.	Engineering Circuit Analysis, H Hayt, 8th Edition,2013, Mcgraw Higher Ed, ISBN: 9781259098635

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**	**-**	**2**
CO2	**3**	**2**	**2**	**-**	**3**	**-**	**-**	**2**	**-**	**1**	**-**	**2**
CO3	**3**	**3**	**3**	**3**	**3**	**2**	**1**	**3**	**2**	**2**	**1**	**3**
CO4	**3**	**3**	**3**	**3**	**1**	**2**	**1**	**2**	**2**	**2**	**1**	**3**

Low-1 Medium-2 High-3

Semester: III		
CONTROL SYSTEMS (Theory)		
Course Code: 16EC36		**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 basics of control system Mathematical modeling of electrical and mechanical systems.
2	Analyze control systems using signal flow graphs and block diagram techniques
3	Compute time domain response of first and second order systems.
4	Compute the stability of the system using RH criterion, root locus method in time domain analysis. Analyze the stability of the system using Bode Plot in frequency domain analysis.

UNIT-I	
Basic Ideas of Control Systems and Mathematical Models of Physical Systems Definition of Control System, Requirements of a Control System, Classification of Control Systems - Linear, Non- Linear, Analog and Digital, Open Loop and Closed Loop (in detail), Single- Input, Single- Output, Multiple Input Multiple Output Systems, Differential equations of Physical Systems and Transfer Function (Mechanical systems and electrical systems).	**08 Hrs**
UNIT-II	
Block Diagram and Signal Flow Graphs: Block Diagram Reduction, Signal Flow Graphs, Mason's Gain Formula (No Proof), Relative Advantages, Conversion from electrical circuit to SFG and Block diagram to SFG. **Time Response of Feedback Control Systems:** Standard Test Signals, Step Response for First and Second Order, Impulse Response for First and Second Order, Distinction between Type and Order of the System.	**07 Hrs**
UNIT-III	
Time Response of Feedback Control Systems: Time Domain Specifications for Second Order System. tr, td, tp, Mp, Steady State Error Analysis e_{ss}, Error Constants, Kp, Kv, Ka.	**07 Hrs**
UNIT-IV	
Root Locus Technique and Bode Plots Concepts of Stability, Types of Stability, Asymptotic Stability. Definition of Root Locus Diagram, Steps to Draw the Root Locus Diagram, Bode Plots	**07 Hrs**
UNIT-V	
Introduction to design and Advances in control System The design Problem, Preliminary Considerations of classical Design, Realization of Basic Compensators, Tuning of PI, PD and PID Controllers.	**07 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1:	Apply the knowledge of mathematics & basic electrical concepts to solve problems in control systems.
CO2:	Analyze the fundamentals of control theory.
CO3:	Evaluate the performance of different systems in time & frequency domain analysis.
CO4:	Design and develop the mathematical models for physical systems.

Reference Books	
1.	Control Systems Engineering, Nagarath and M. Gopal, New Age International (P) limited Publishers, 5th Edition, 2007, ISBN: 81-224-2008-7.
2.	Modern Control Engineering, K. Ogata, Prentice-Hall of India Pvt. Ltd. 4th Edition, 2015, ISBN: 978-361-5673-4.
3.	Automatic Control Systems, Kuo & Golnaraghi, 9 editions, Wiley; Ninth edition (2014), 978-8126552337

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**	**3**	**-**	**-**	**1**	**1**	**-**	**2**	**2**	**1**	**-**	**2**
CO2	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**1**	**1**	**-**	**2**
CO3	**3**	**3**	**2**	**2**	**2**	**1**	**-**	**2**	**2**	**1**	**1**	**2**
CO4	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**2**	**2**	**1**	**1**	**2**

Low-1 Medium-2 High-3

Semester: IV		
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	
ArraysOne 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.

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**	**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

Semester: IV		
LINEAR ALGEBRA AND PROBABILITY THEORY (Theory) (COMMON TO ECE, EI, TC)		
Course Code: 16MA41B		**CIE Marks:** 100
Credits: L:T:P:S 3:1:0:0		**SEE Marks:** 100
Hours: 45L+24T		**SEE Duration:** 03Hrs

Course Learning Objectives: The students will be able to	
1	Understand the basics of matrix theory, Eigenvalues, Eigenvectors, 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.	**09 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.	**09 Hrs**
UNIT-III	
Linear Algebra - III :Orthogonal Vectors , Orthogonal Projections, Orthogonal and orthonrmal Bases, Orthogonal and Orthonormal Matrices, Gram-Schmidt Orthogonalization, QR Factorizations, Least Square Problems, Diagonalization of a Matrix, Singular Value Decomposition.	**09 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.	**09 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.	**09 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1:	Comprehend 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, orthogonality and probability & distribution to nondeterministic situations.
CO4:	Estimate and interpret - Rank-Nullity, Diagonalisation, SVD, central tendency and sampling theory occurring in engineering problems.

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

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**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
CO2	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
CO3	**1**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
CO4	**3**	**3**	**2**	**2**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**2**

Low-1 Medium-2 High-3

Semester: IV		
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. Edns: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

Semester: IV		
ADVANCED DIGITAL SYSTEM DESIGN USING VERILOG HDL (Theory & Practice)		
Course Code: 16EC43		**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	Write HDL models that can be automatically synthesized into integrated circuits using programmable hardware such as FPGAs
2	An understanding of how to take a electronic design from concept to register transfer level (RTL) verification and synthesis to final programmable device implementation
3	Experience in writing HDL models of combinational and sequential circuits, synthesizing models, performing simulation,
4	Writing test modules and fitting designs within resource, power, and timing constraints of an FPGA by using automatic place and route CAD software.

UNIT-I	
Introduction to Verilog: Design Methodology-An Introduction: Verilog History, System representation, Number representation and Verilog ports. **Verilog Data Types:** Net, Register and Constant. **Verilog Operators:** Logical, Arithmetic, Bitwise, Reduction, Relational, Concatenation and Conditional. **Verilog Primitives**. **Logic Simulation, Design Verification, and Test Methodology:** Four-Value Logic and Signal Resolution in Verilog, Test Methodology Signal Generators for Test benches, Event-Driven Simulation, Sized Numbers. **Propagation Delay.**	**08 Hrs**
UNIT-II	
Modeling Styles: Dataflow Modeling: Boolean Equation-Based Models of Combinational Logic, Propagation Delay and Continuous Assignments. **Structural Modeling:** Design of Combinational Logic, Verilog Structural Models, Module Ports, Top-Down Design and Nested Modules. Gate level modelling **Behavioral Modeling**: Latches and Level-Sensitive Circuits in Verilog, Cyclic Behavioral Models of Flip-Flops and Latches, Cyclic Behavior and Edge Detection.A Comparison of Styles for Behavioral modeling, Behavioral Models of Multiplexers, Encoders, and Decoders.Dataflow Models of a Linear-Feedback Shift Register. Modeling Digital Machines with Repetitive Algorithms Machines with Multicycle Operations. Tasks & Functions.	**07 Hrs**
UNIT-III	
Algorithmic State Machine Charts for Behavioral Modeling: Algorithmic State Machine Charts for Behavioral Modeling, ASMD charts, Behavioral Models of Counters, Shift Registers, and Register Files and Arrays of Registers (Memories). Design Example: Keypad Scanner and Encoder. **Synthesis of Combinational Logic:** Introduction to Synthesis, Synthesis of Combinational Logic, Synthesis of Sequential Logic with Latches, Synthesis of Three-state Devices and Bus Interfaces	**07 Hrs**
UNIT-IV	
Synthesis of Sequential Logic: Synthesis of Sequential Logic with Flip-Flops, Synthesis of Explicit State Machines, Registered Logic, State Encoding, Synthesis of Implicit State Machines, Registers and Counters, Implicit State Machines, Resets, Synthesis of Gated Clocks and Clock Enables. **Implementation Fabrics:** Introduction of Programmable Logic Array (PLA), Programmable Array Logic (PAL), Programmability of PLDs. Complex PLDs (CPLDs), Field-Programmable Gate Arrays (Spartan 3 and Spartan 6) The Role of FPGAs in the ASIC Market, FPGA Technologies. Verilog-Based Design Flows for FPGAs and ASICs. Comparison of design implementation using CPLDs, FPGA and ASIC.	**07 Hrs**

UNIT-V	
Design of Processor Architectures for Arithmetic Processors: Number Representation: Signed Magnitude Representation of Negative Integers, Ones Complement Representation of Negative Integers, Twos Complement Representation of Positive and Negative Integers, Representation of Fractions. **Functional Units for Addition and Subtraction:** Ripple-Carry Adder, Carry Look-Ahead Adder, Overflow and Underflow. **Functional Units for Multiplication**: Combinational (Parallel) Binary Multiplier, Sequential Binary Multiplier, Sequential Multiplier Design: Hierarchical Decomposition STG-Based Controller Design, Efficient STG-Based Sequential Binary Multiplier	**07 Hrs**
LABORATORY EXPERIMENTS	
1. Multiplexer and De-multiplexer 2. Decoders and Encoders. 3. Code converters and Comparator. 4. Binary Adder (Ripple Adder and carry look ahead adder). 5. Flipflops. 6. Counters. 7. Shift Register 8. FSM- Sequence Detector, etc. 9. Serial Adder. 10. Multiplier. 11. RISC SPM- Processor.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Analyse synthesizable and non-synthesizable code for digital function
CO2:	Apply EDA tools for simulation, verification and synthesis of digital design.
CO3:	Develop digital systems from high-level HDL descript ion down to FPGA and ASIC implementation.
CO4:	Evaluate the design parameters with respect to speed, area and power.

Reference Books	
1.	Advanced Digital Design with the Verilog HDL, M.D. Ciletti, Prentice Hall PTR -2nd Editions ISBN: 0136019285.
2.	Verilog HDL: A Guide to Digital Design & Synthesis, Samir Palnitkar, SunSoft Press, 1stEdition, 1996, ISBN: 978-81-775-8918-4.
3.	Digital Systems Design Using Verilog, Roth, Charles, John, Lizy K, Kil Lee, Byeong ISBN 10: 1285051076 / ISBN 13: 9781285051079.
4.	Verilog Primer, J Bhaskar , Pearson / PHI, New Delhi, 3rd Edition, 2003

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**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**
CO2	**3**	**2**	**2**	**1**	**-**	**1**	**-**	**-**	**2**	**-**	**-**	**1**
CO3	**3**	**3**	**2**	**-**	**3**	**1**	**-**	**1**	**2**	**1**	**1**	**1**
CO4	**3**	**3**	**2**	**-**	**3**	**-**	**-**	**1**	**2**	**1**	**1**	**1**

Low-1 Medium-2 High-3

Semester: IV		
MICROPROCESSORS & MICROCONTROLLERS (Theory & Practice)		
Course Code: 16EC44		**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	Specify, design, implement, and debug simple microprocessor-based applications using the Intel 8086 architecture.
2	Understand & Analyze the architecture of 8051 microcontroller
3	Use software development tools to assemble, test and debug the programs by using breakpoints, single-stepping, monitoring the changes in register/memory contents, on a hardware platform or on an emulator.
4	Apply assembly directives and assembly language to implement flow control (sequential, conditional and iterative).
5	Design and interface the external components of microprocessor and microcontroller

UNIT-I	
MPU Organization: Block Diagram of Computer System, Functional units of a Microprocessor, Microprogrammed & Hardwired Control unit, Floating Point & Fixed-Point Processor, Instruction set Architectures, Harvard & Von-Neuman Architectures, Endianness, Instruction Format, Opcode **Intel's 8086 architecture**, Pin groups, Functioning, Segmentation, Maximum Mode, Minimum Mode, Address generation, Stack, Interrupts.	**08 Hrs**
UNIT-II	
8086 Assembly Language Programming: Addressing Modes of 8086, Instruction Formats, Program Development Tools, Assembler Directives, Instruction Set of 8086: Data Transfer Instructions, Arithmetic Instructions, Bit Manipulation Instructions, Branching Instructions, Processor Control Instructions, String Instructions, Macros, Procedures, Assembly Language Programming Examples.	**07 Hrs**
UNIT-III	
Microprocessor Based System Design Clock generator, Bus Buffering & Latching, Bus Timings, Memory Devices, Address Decoding, Interfacing Memory I/O sub System: Busy Wait, DMA, Interrupt Driven, Memory Maps, I/O Port address decoding, 8255, Interrupt Based IO Design, Simple computer design	**07 Hrs**
UNIT-IV	
Hardware of 8051 Microcontrollers: Introduction to Embedded system, Microcontroller, Comparison of Microprocessor and Microcontroller, Intel MCS 51 family, Architecture and Pin Functions of 8051 Microcontroller, CPU Organization, Program Counter, Timing and Machine Cycles, Internal Memory Organization, Registers, Stack, Input/ Output Ports, Counters and Timers, Serial Data Input and Output, Interrupts, Power Saving Modes.	**07 Hrs**
UNIT-V	
8051 Microcontroller Based System Design: I/O Port Programming, Programming timers, Asynchronous Serial Data Communication, Interrupt Service Routines. Programming in C, Inline Assembly, Interfacing Matrix Keyboard and Seven Segment Displays, Interfacing ADC in polled mode & Interrupt Mode, and DAC, Interfacing of LCD.	**07 Hrs**
LABORATORY EXPERIMENTS	
Experiments with 8086 Assembly using MASM 1. Data Transfer Programs: Block Moves & Exchange (With & Without Overlap) with &without String Instructions. 2. Arithmetic Operations: Addition, Multiplication & Division on 32-Bit Data.	

3. a) Code Conversions: Use XLAT Instruction to Convert Binary to BCD, Input from Keyboard & Display Result on the Console. b) ASCII Operations: Addition, Subtraction, Multiplication 4. a) Search for a Key in an Array of Elements using Linear Search, Binary Search. Find Efficiency in each case. b) Sort an Array Using Bubble Sort & Selection Sort. Find Efficiency in each case. **Experiments with 8051 C using Keil software** 5. a) Write 8051 C program to interface Logic Controller card and perform various logical functions. 6. b) Write 8051 C program to interface stepper motor to rotate in clockwise/ anti clockwise directions & and to rotate the motor through predefined angle of rotation. 7. a) Write 8051 C program to interface elevator card & simulate the operations of the elevator. 8. b) Write 8051 C program to interface DAC to generate sine wave. 9. a) Write 8051 C program to interface 4 x 4 keypad & display the key pressed on LCD 10. b) Write 8051 C program to interface seven segment display & realize 4 digit BCD counter. 11. a) Write 8051 C program to interface ADC in polled mode. 12. b) Write 8051 C program t/o interface ADC in interrupt mode. 13. c) Generate PWM wave on pin P3.1 to control speed of DC motor. Control the duty cycle by analog input. 14. Design 8051 based system to measure the frequency of TTL waveform. 15. Design 8051 based system for automatic controlling of light.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Interpret the architecture, instruction set, memory organization and addressing modes of the microprocessors and microcontrollers.
CO2:	Apply the knowledge of microprocessor and microcontroller for implementing assembly language/C programming.
CO3:	Analyze pin functions / ports for implementing peripheral interfaces with microprocessors and microcontrollers.
CO4:	Engage in self-study to formulate, design, implement, analyze and demonstrate an application realized on embedded processors through assignments.

Reference Books	
1.	Micro-Processors and Interfacing-Programming & Hardware, Douglas Hall, TMH, 2nd Edition, 2002, ISBN-10- 0070601674
2.	The Intel Micro-processors, Architecture, Programming and Interfacing, Barry B. Brey, Pearson Education, 6th Edition, 2008, ISBN-10: 0135026458
3.	The 8051 Microcontroller Architecture, Programming &Applications, Kenneth J. Ayala, Thomson Learning, 2nd Edition, 2004.
4.	The 8051 Microcontroller and Embedded Systems, Muhammad A Mazidi, Pearson Education, 2nd Edition, 2009.

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**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**1**
CO2	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**1**
CO3	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**1**
CO4	**3**	**3**	**3**	**3**	**2**	**1**	**1**	**2**	**1**	**3**	**2**	**3**

Low-1 Medium-2 High-3

Semester: IV		
SIGNALS AND SYSTEMS (Theory)		
Course Code: 16EC45		**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	Express a signal and a system in both time and frequency domains and develop a mathematical process to migrate between the two representations of the same entity.
2	Analyze a complex signal in terms of basic signals in continuous and discrete time flavours.
3	Define discrete-time signals and systems, and express the differences with their continuous-time analogy.
4	Understand the computation of FFT algorithm in linear filtering & correlations

UNIT-I	
Introduction to Signals and System Definition of Signals, Classification of Signals, Basic Operations on Signals: Operations Performed on the Independent and Dependent Variable, Precedence Rule, Elementary Signals. Definition of Systems, System Viewed as Interconnection of Operations, Properties of Systems. Convolution Sum, Convolution Sum Evaluation Procedure	**08 Hrs**
UNIT-II	
Linear Time Invariant Systems Convolution Integrals, Convolution Integrals Evaluation Procedure, Interconnections of LTI System, Relations between LTI System Properties and Impulse Response Representation, Difference Equation Representation of LTI System and Solving Difference Equation, Block diagram representation of systems, Difference Equation, Complex sinusoids and frequency response of LTI Systems	**07 Hrs**
UNIT-III	
Applications of Fourier Representations to Mixed Signal class: Introduction, Fourier Transform Representations of periodic signals, Convolution and multiplication with Mixtures of periodic and Non-Periodic signals, Fourier Transform representation of discrete time signals, sampling Concept.	**07 Hrs**
UNIT-IV	
Frequency Considerations: Frequency domain Sampling and Reconstruction of Discrete time signals, DFT as a linear Transformation, Relationship of DFT to other transforms. **Properties of DFT:** Periodicity, Linearity and Symmetry properties, Multiplication of two DFTs and circular convolution, additional DFT properties. **Linear filtering methods based on the DFT:** Use of DFT in linear filtering, Filtering of long data sequences.	**07 Hrs**
UNIT-V	
Efficient computation of DFT: FFT Algorithms Direct computation of DFT, divide and conquer approach of the DFT. Radix-2 FFT Algorithm and Implementation of FFT Algorithms: Efficient computation of DFT of two real sequences, Efficient computation of DFT of a 2N – point real sequence, Use of the FFT Algorithm in linear Filtering and correlation.	**07 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1:	Analyze the fundamental concepts of the both continuous and discrete signals and systems, Representation of both periodic & aperiodic signals in frequency domain
CO2:	Apply the properties of signals and analyze both continuous and discrete systems commonly found in communication, signal processing and control systems.
CO3:	Analyze continuous & discrete systems both in time & frequency domain
CO4:	Develop reasonably accurate mathematical model for physical systems. Justify the linear time approximation to the models, produce block diagram implementation of the mathematical

	models and analyze the block diagram realizations with a view toward designing more complex systems or sophisticated models.

Reference Books	
1.	Signals and Systems, Simon Haykin and Barry Van Veen, John Wiley & Sons, 2nd Edition, 2008.
2.	Digital Signal Processing A Practical Approach, Emmanuel C. Ifeachar, Barrie E. Jervis, Pearson Education , 2nd Ed., 2003
3.	"Signals and Systems", V. Oppenheim, Alan Willsky and A. Hamid Nawab, Pearson Education Asia/ PHI, 2nd Edition, 2006
4.	"Digital Signal Processing", Proakis G & Dimitris G. Manolakis , PHI, 3rd Edition, 2007.

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**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**2**
CO2	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**2**
CO3	**3**	**3**	**2**	**1**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**2**
CO4	**3**	**3**	**3**	**1**	**2**	**-**	**-**	**1**	**1**	**1**	**-**	**2**

Low-1 Medium-2 High-3

Semester: IV		
FIELDS & WAVES (Theory)		
Course Code: 16EC46		**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	Apply knowledge of mathematics, science, and engineering basics to the analysis and design of electrical systems involving electric and magnetic fields as well as electromagnetic waves.
2	Interpret and apply the concepts which comes in RF communication
3	Develop and design mathematical models of communication channels
4	Analyze and compare different type of wave propagation

UNIT-I	
Electrostatics 1: Coulomb's law, illustrative examples, Electric Field Intensity, Applications (field due to Line charge distribution, Surface charge distribution- Sheet, Circular ring, disk), Illustrative examples. Flux, flux density, Gauss's Law, Divergence Theorem(qualitative treatment), Application of Gauss's Law (Field due to Continuous Volume Charge, Line Charge, Sheet Charge, Metal Sphere, Spherical shell) Illustrative examples.	**08 Hrs**
UNIT-II	
Electrostatics-2: Electric Potential, Relation between E and V, Applications (Field and potential due to Line charge distribution, Surface charge distribution- sheet), Energy Density in an Electric Field , Illustrative examples. Boundary Conditions (dielectric-dielectric, dielectric-conductor), Poisson's and Laplace's Equations, Applications of Laplace's and Poisson's Equations (Different capacitors), Illustrative examples.	**07 Hrs**
UNIT-III	
Magneto Static Fields-1: Current, Current density**,** Biot -Savart Law, Applications (Infinite linear conductor, current carrying in loop, solenoid), Magnetic Flux and Flux Density, Ampere's Circuital Law, Stroke's theorem (qualitative treatment), Applications (Infinite line current, sheet current, coaxial transmission line), Problems.	**07 Hrs**
UNIT-IV	
Magneto Static Fields-2: Magnetic Boundary Conditions, **Maxwell's Equations:** Introduction, Faraday's Law, Transformer and Motional EMFs, Displacement Current, Maxwell's Equations in Final Forms, Time-Varying Potentials, Time-Harmonic Fields, Illustrative examples	**07 Hrs**
UNIT-V	
Electromagnetic Waves: Introduction, Waves in General, Wave Propagation in Lossy Dielectrics, Plane Waves in Lossless Dielectrics, Plane Waves in Free Space, Plane Waves in Good Conductors, Power and the Poynting Vector, Reflection of a Plane Wave at Normal Incidence. Illustrative examples.	**07 Hrs**

Course Outcomes: After completing the course, the students will be able to	
CO1:	Interpret & apply the basic concepts of electric fields, magnetic fields and electromagnetic waves.
CO2:	Apply the basic concepts to solve complex problems in electric fields, magnetic fields and electromagnetic waves.
CO3:	Analyze different charge and current configurations to derive the electromagnetic field equations
CO4:	Design simple solutions for applications in electric and electronic circuits, electrical machines and communication systems.

Reference Books	
1.	Elements of Electromagnetics, Matthew N O Sadiku, Oxford University Press, 4th Edition, 2007, ISBN-13: 978-0195300482
2.	Engineering Electromagnetics, William H. Hayt Jr. and John A. Buck, Tata McGraw Hill, 6th Edition, 2001, ISBN: 978-0071089012
3.	Electromagnetics Waves and Radiating Systems, Edward C. Jordan and Keith G. Balmain, Prentice Hall of India, 2nd Edition, 1968. Reprint 2002.
4.	Electromagnetics with Applications, John Krauss and Daniel A. Fleisch, McGraw Hill, 5th Edition, 1999, ISBN-10: 0072899697/ISBN-13: 978-0072899696

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**	**3**	**3**	**3**	**1**	**1**	**1**	**-**	**1**	**1**	**-**	**3**
CO2	**3**	**2**	**3**	**1**	**1**	**1**	**1**	**-**	**-**	**1**	**-**	**3**
CO3	**3**	**3**	**2**	**2**	**2**	**1**	**1**	**-**	**-**	**1**	**-**	**3**
CO4	**3**	**3**	**3**	**3**	**2**	**1**	**1**	**-**	**-**	**1**	**-**	**3**

Low-1 Medium-2 High-3

Semester: III & IV		
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:** --
Hours: 18 Hrs		**SEE Duration:** --

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 behavior 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 Counseling & Guidance, Career Orientation. Balancing Personal & Professional Life	**06 Hrs**
UNIT-V	
Professional Practice - Professional Dress Code, Time Sense, Respecting People & their Space, Relevant Behavior 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-awareness

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

Scheme of Continuous Internal Examination (CIE)

Evaluation 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 and grading is done. 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.	

Mapping of Course Outcomes (CO) to Program Outcomes (PO)

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

Low-1 Medium-2 High-3

Semester: IV		
BRIDGE COURSE MATHEMATICS (Theory)		
Course Code: 16DMA48		**CIE Marks:** 100
Credits: L:T:P:S 2:0:0		**SEE Marks:** 100
Hours: 26L (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.

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. Introduction-partial derivatives, simple problems. Total derivative, Composite functions, Jacobians- 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; Khanna Publishers, 40th Edition; 2007, ISBN: 81-7409-195-5.
2	Advanced Engineering Mathematics, R. K. Jain & S.R.K. Iyengar, Narosa Publishing House, 2002, 817319-420-3; Chapters: 1, 2, 8, 15;
3	Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 9th Edition; 2007, ISBN: 978-81-265-3135-6, Chapters: 6, 10, 12;
4	A Text Book of Engineering Mathematics, N.P Bali & Manish Goyal, Lakshmi Publications, 7th Edition; 2010, ISBN: 978-81-7008-992-6; Chapters: 6, 18, 16, 8, 26;

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.

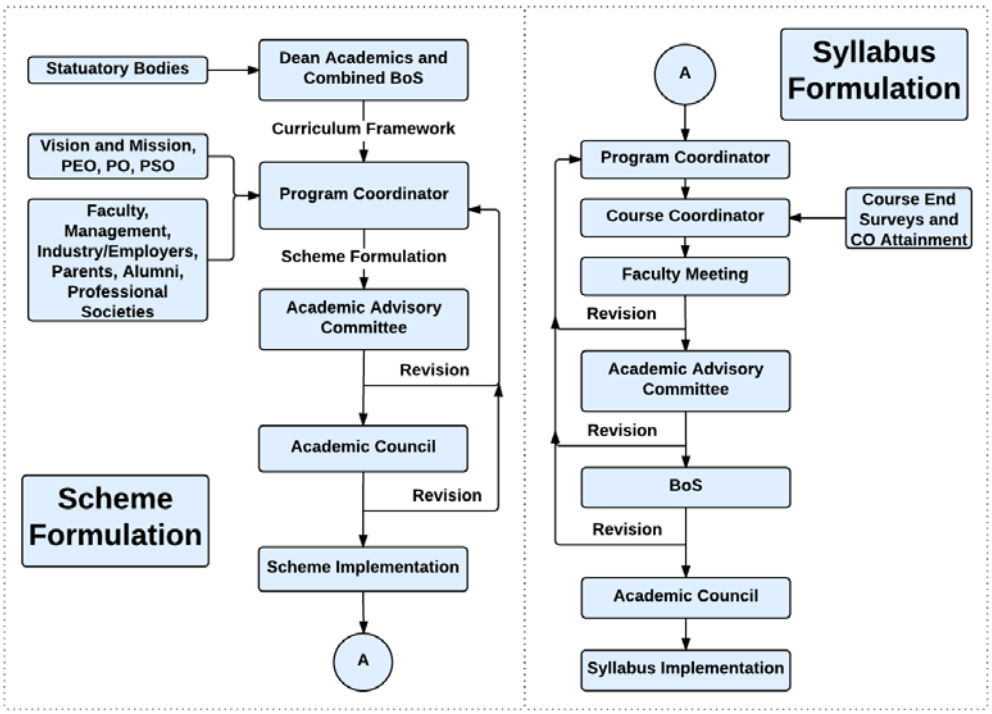
Semester End Evaluation (SEE); Theory (100 Marks)

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.

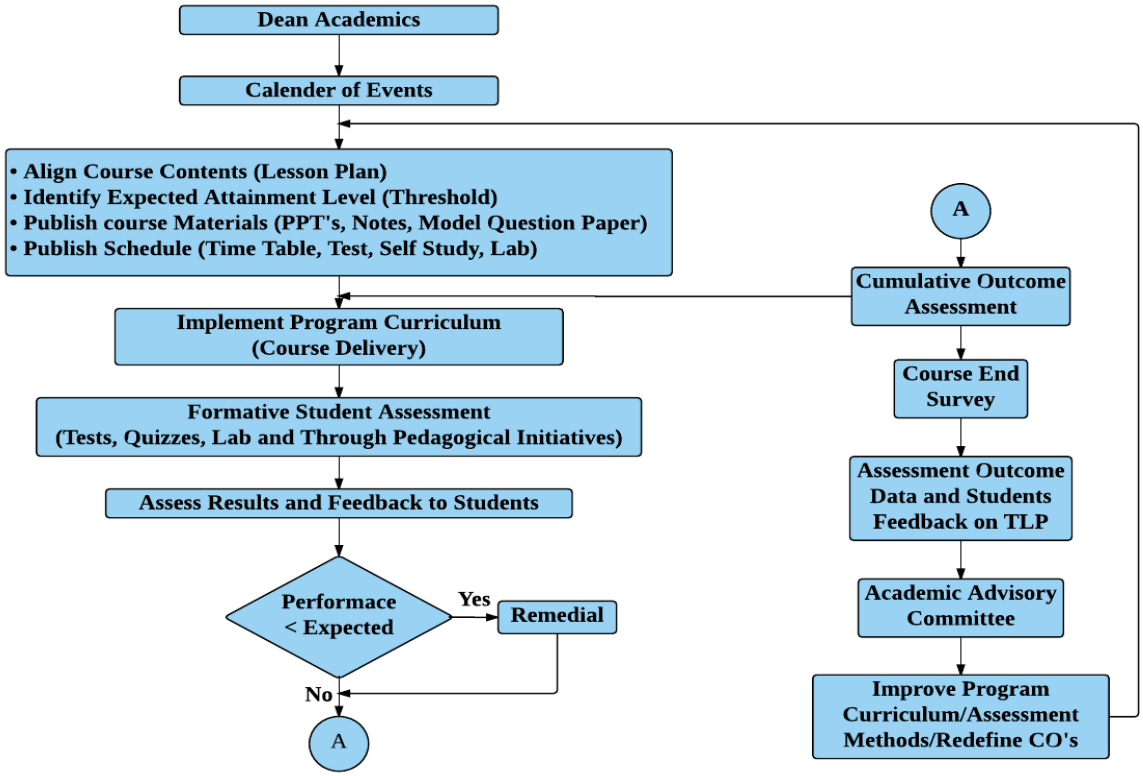
CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**2**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
CO2	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**
CO3	**3**	**3**	**2**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

Low-1 Medium-2 High-3

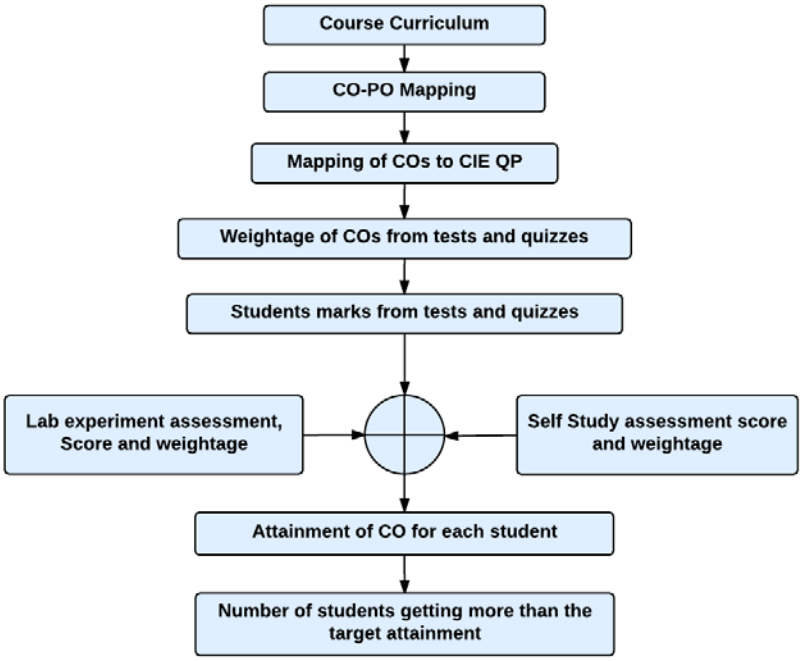
Curriculum Design Process



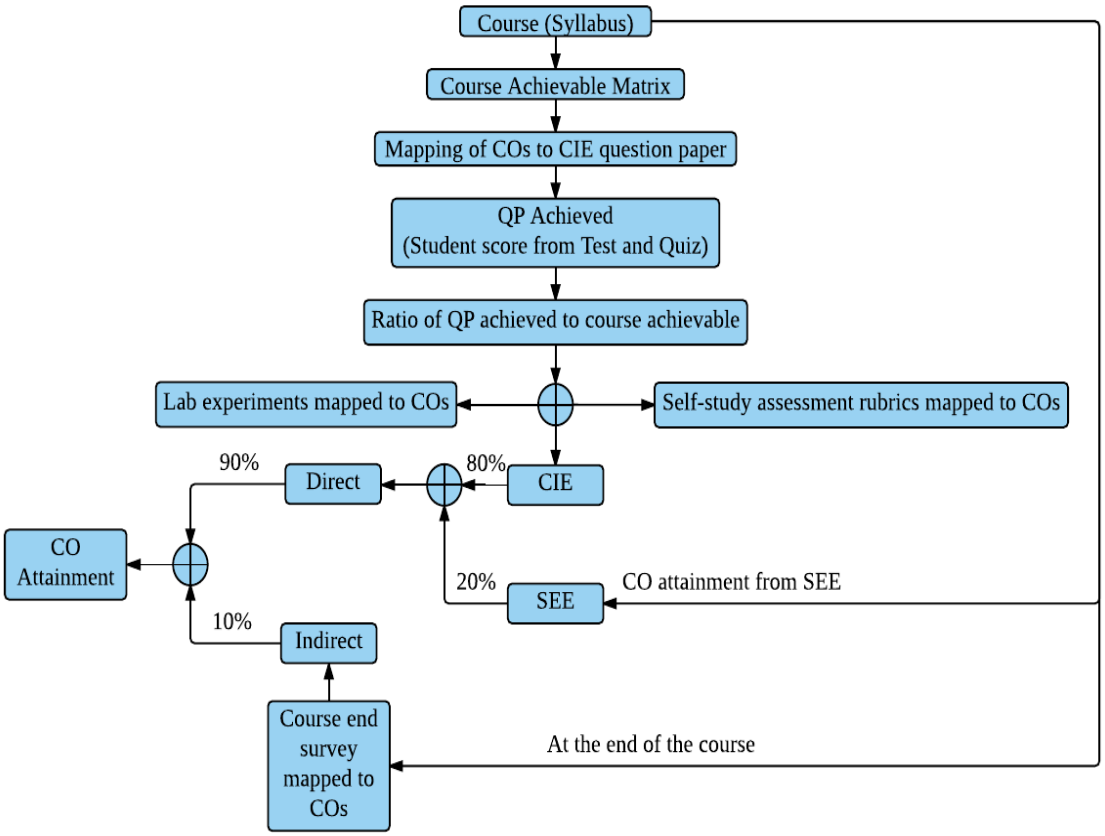
Academic Planning and Implementation



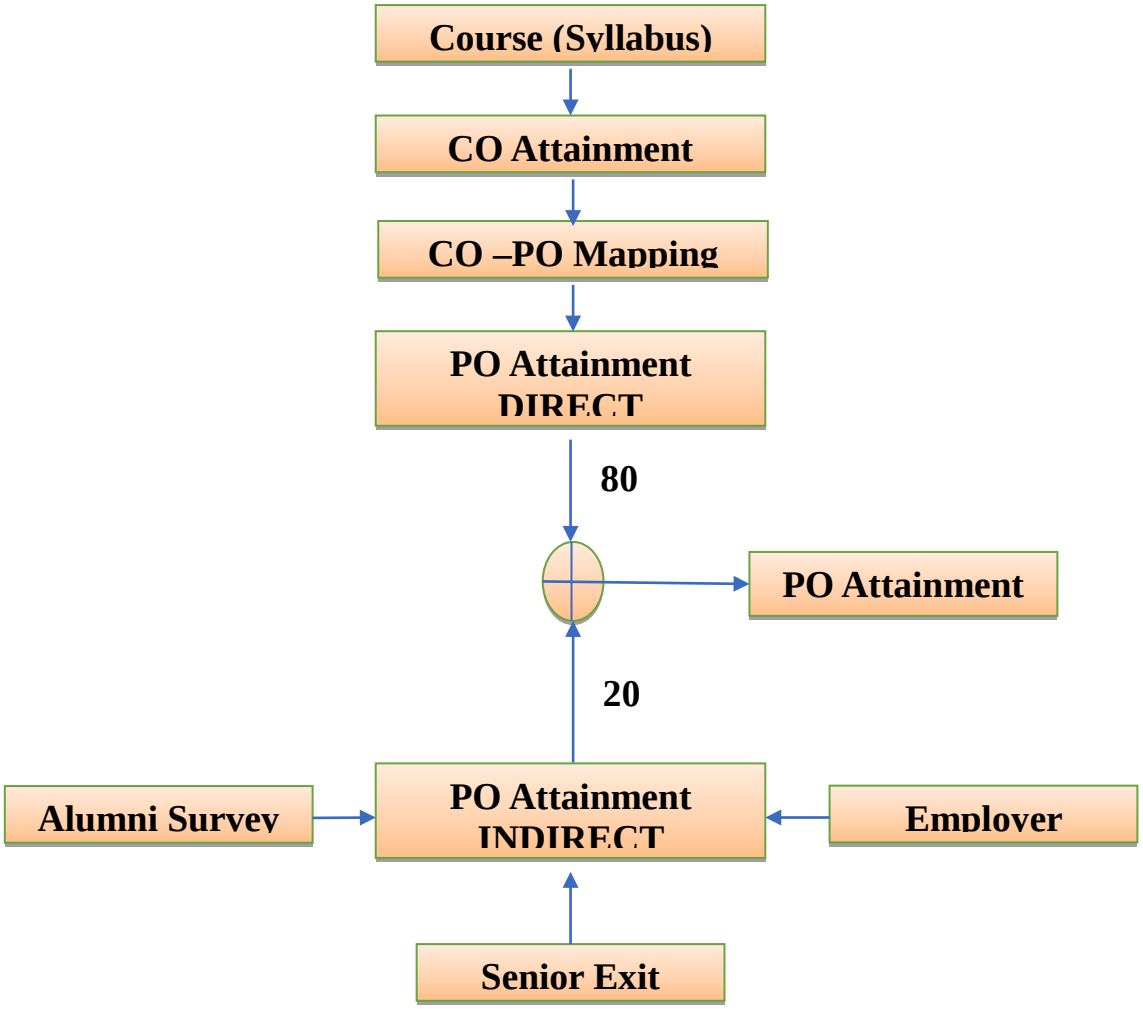
Process for Course Outcome Attainment



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.