RV Educational Institutions ®
RV College of Engineering ®

Autonomous Institution Affiliated to Visvesvaraya Technological University, Belagavi

Approved by AICTE, New Delhi

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Scheme & Syllabus of

III & IV Semesters (2021 Scheme)

(AS PER NEP-2020 GUIDELINES)

BACHELOR OF ENGINEERING (B.E)

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

(ACADEMIC YEAR 2022-2023)

ABBREVIATIONS

Sl. No.	Abbreviation	Meaning
1.	VTU	Visvesvaraya Technological University
2.	BS	Basic Sciences
3.	CIE	Continuous Internal Evaluation
4.	SEE	Semester End Examination
5.	PE	Professional Core Elective
6.	GE	Global Elective
7.	HSS	Humanities and Social Sciences
8.	PY	Physics
9.	CY	Chemistry
10.	MA	Mathematics
11.	AS	Aerospace Engineering
12.	AI & ML	Artificial Intelligence & Machine Learning
13.	BT	Biotechnology
14.	CH	Chemical Engineering
15.	CS	Computer Science & Engineering
16.	CV	Civil Engineering
17.	EC	Electronics & Communication Engineering
18.	EE	Electrical & Electronics Engineering
19.	EI	Electronics & Instrumentation Engineering
20.	ET	Electronics & Telecommunication Engineering
21.	IM	Industrial Engineering & Management
22.	IS	Information Science & Engineering
23.	ME	Mechanical Engineering

INDEX

Bachelor of Engineering in

ELECTRONICS AND COMMUNICATION ENGINEERING

III SEMESTER

Sl. No.	Course Code	Course Title	Credit Allocation				BoS	Category	CIE Duration (H)	Max Marks CIE		SEE Duration (H)	Max Marks SEE	
			L	T	P	Total				Theory	Lab		Theory	Lab
1	21MA31B	Linear algebra, Integral transforms and Fourier series	3	1	0	**4**	MA	Theory	1.5	**100**	****	**3**	**100**	****
2	21BT32A	Environmental Technology	2	0	0	**2**	BT	Theory	1	**50**	****	**2**	**50**	****
3	21EC33	Analog Microelectronic Circuits	3	0	1	**4**	EC	Theory+Lab	1.5	**100**	**50**	**3**	**100**	**50**
4	21EC34	Analysis and Design of Digital Circuits (Common with EC/EE/EI/ET)	3	0	1	**4**	EC	Theory+Lab	1.5	**100**	**50**	**3**	**100**	**50**
5	21EC35	Network Analysis and Control Systems	3	0	0	**3**	EC	Theory	1.5	**100**	****	**3**	**100**	****
6	21EC36	Digital System Design Using Verilog HDL	3	0	0	**3**	EC	Theory	1.5	**100**	****	**3**	**100**	****
7	21DMA37	Bridge Course: Mathematics	2(A)	0	0	**AUDIT**	MA	Theory	1	**50**	****	**2**	****	****
8	21HS38A / 21HS38V	Kannada Course: AADALITHA KANNADA (18HS38A) / VYAVAHARIKA KANNADA (18HS38V)	1	0	0	**1**	HSS	Theory	1	**50**	****	**2**	**50**	****
9	21HS39	Ability Enhancement course	0	0	1	**1**	HSS	Theory	1	****	**50**	**2**	****	**50**
10	21ECI310	Summer Internship-1	0	0	1	**1**	EC	Lab	1	****	**50**	**2**	****	**50**
						23								

* Summer Internship-1 will be done after the II sem for 03 Weeks

*ENGINEERING MATHEMATICS – III			
COURSE TITLE		**COURSE CODE**	**BRANCHES**
Linear algebra, Integral transforms and Number theory for CS & IS		21MA31A	CS and IS
Linear algebra, Integral transforms and Fourier series for AS, EC, EE, EI & ET		21MA31B	AS, EC, EE, EI, ET
Integral transforms, Optimization and Numerical Techniques for BT, CH, CV, IM & ME		21MA31C	BT, CH, CV, IM, ME
Mathematics for AI & ML		21MA31D	AI and ML
**** MANDATORY COURSES**			
Sl.No	**COURSE TITLE**	**COURSE CODE**	**BRANCHES**
1	Environmental Technology	21BT32A	All circuit Branches
2	Biology for Engineers	21BT32B	BT & AS
3	Engineering Materials	21ME32	ME, CH & AS
***** Bridge Course: Audit course for lateral entry diploma students (**Only CIE and NO SEE**)**			
Sl.No	**COURSE TITLE**	**COURSE CODE**	**BRANCHES**
1	Bridge Course Mathematics	21DMA37	AS,BT,CH,CV,EC,EE,EI, IM,ME&TE
2	Bridge Course C Programming	21DCS37	CS,IS & AI

Ability Enhancement Courses ***		
Sl.No	**Course code**	**Courses**
1	21HSAE39A	National Service Scheme (NSS)
2	21HSAE39B	National Cadet Corps (NCC)
3	21HSAE39C	Physical Education
4	21HSAE39D1/2/3	Music/Dance/Theatre
5	21HSAE39E1/2	Art work/ Photography & Film making

Bachelor of Engineering

ELECTRONICS AND COMMUNICATION ENGINEERING

IV SEMESTER

Sl. No.	Course Code	Course Title	Credit Allocation				BoS	Category	CIE Duration (H)	Max Marks CIE		SEE Duration (H)	Max Marks SEE	
			L	T	P	Total				Theory	Lab		Theory	Lab
1	21MA41A/B/C	Engineering Maths- IV *	2	1	0	**3**	MA	Theory	1.5	**100**	****	**3**	**100**	****
2	21EC42	Engineering Materials	2	0	0	**2**	EC	Theory	1	**50**	****	**2**	**50**	****
3	21EI43	Microcontrollers & Programming	3	0	1	**4**	EI	Theory+Lab	1.5	**100**	**50**	**3**	**100**	**50**
4	21EC44	Signals and Systems	3	0	1	**4**	EC	Theory+Lab	1.5	**100**	**50**	**3**	**100**	**50**
5	21EC45	Electromagnetic Fields and Applications	3	0	0	**3**	EC	Theory	1.5	**100**	****	**3**	**100**	****
6	21XX4AX	Professional Elective – Group A MOOC Courses	3	0	0	**3**	EC	MOOC	1	**50**	****	**2**	**50**	****
7	21XX47	Design Thinking Lab	**0**	0	2	**2**	EC	Lab	1	****	**50**	**2**	****	**50**
8	21DCS48	Bridge Course: C Programming***	2 (A)	0	0	**AUDIT**	CS	Theory	1.5	**50**	****	**2**	**50**	****
9	21HS49	Universal Human Values and Social Connect	1	0	0	**1**	HSS	Theory	1	**50**	****	**2**	**50**	****
						22								

* Summer Internship-II will be done after the IV sem for 04 Weeks

*ENGINEERING MATHEMATICS – IV			
Sl.No	**COURSE TITLE**	**COURSE CODE**	**BRANCHES**
1	Statistics and probability for Data Science	21MA41	CS, IS &AI
** MANDATORY COURSES			
Sl.No	**COURSE TITLE**	**COURSE CODE**	**BRANCHES**
1	Materials for Electronics Engineering (Common with EC/EE/ EI/ET).	21EC42	EC,EE,EI,TE
2	Environmental technology for AS, CH, IM & ME Programs	21ME42	AS,BT,CH,IM &ME
3	Environmental Technology	21BT42A	
4	Civil Engineering Materials for CV Program	21CV42	CV
5	Bio inspired Engineering	21BT42	AI,CS & IS
*** Bridge Course: Audit course for lateral entry diploma students			
Sl.No	**COURSE TITLE**	**COURSE CODE**	**BRANCHES**
1	Bridge Course Mathematics	21DMA48	CS,IS & AI
2	Bridge Course C Programming	21DCS48	AS,BT,CH,CV,EC,EE,EI,IM,ME & TE

GROUP A: PROFESSIONAL ELECTIVES (MOOC COURSES)			
Sl. No.	**Course Code**	**Course Title**	**Duration**
1.	21EC4A1	Design and Analysis of Algorithms	08 Weeks
2.	21EC4A2	Database Management System	08 Weeks
3.	21EC4A3	Object Oriented Analysis and Design	08 Weeks
4.	21EC4A4	Programming, Data Structures and Algorithms using Python	08 Weeks

Course Code	**:**	**21MA31B***	**LINEAR ALGEBRA, INTEGRAL TRANSFORMS AND FOURIER SERIES**	**CIE Marks**	**:**	**100**
Credits L-T-P	**:**	**3:01:00**		**SEE Marks**	**:**	**100**
Hours	**:**	**45L+15T**	***(Common to AS, EC, EE, EI, ET)***	**SEE Durations**	**:**	**03 Hrs**

UNIT - I **09 Hrs**

Linear Algebra I - Vector spaces, subspaces, linear dependence and independence, basis and dimension, four fundamental subspaces. Rank and nullity theorem (without proof). Linear transformations - matrix representation, kernel and image of a linear transformation, dilation, reflection, projection and rotation matrices.

UNIT - II **09 Hrs**

Linear Algebra II - Inner Products, orthogonal matrices, orthogonal and orthonormal bases, Gram-Schmidt process, QR-factorization. Eigen values and Eigen vectors, diagonalization of a matrix (symmetric matrices) and singular value decomposition.

UNIT - III **09 Hrs**

Laplace Transform - Laplace Transform: Existence and uniqueness of Laplace transform (LT), transform of elementary functions, region of convergence. Properties - linearity, scaling, s - domain shift, differentiation in the s - domain, division by t, differentiation and integration in the time domain. LT of special functions - Periodic functions (square wave, saw-tooth wave, triangular wave, full & half wave rectifier), Heaviside unit step function, unit impulse function.

UNIT - IV **09Hrs**

Inverse Laplace Transform - Definition, properties, evaluation using different methods. Convolution theorem (without proof) - problems. Application to solve ordinary linear differential equations.

UNIT - V **09 Hrs**

Fourier series and Fourier Transforms - Periodic function, even and odd functions. Dirichlet's conditions, Euler's formulae for Fourier series, problems on time periodic signals (square wave, half wave rectifier, saw-tooth wave and triangular wave), Fourier sine series, Fourier cosine series. Fourier integral theorem, complex Fourier and inverse Fourier transform, Fourier sine transform, Fourier cosine transform, properties - linearity, scaling, time-shift and modulation - problems.

Course Outcomes:
After going through this course the student will be able to:

CO1	:	Illustrate the fundamental concepts of linear algebra, Laplace and inverse Laplace transforms, Fourier series and Fourier transforms.
CO2	:	Apply the acquired knowledge of linear algebra, Laplace and inverse Laplace transforms, Fourier series and Fourier transforms to solve the problems of engineering applications.
CO3	:	Analyze the solution of the problems using appropriate techniques of linear algebra, integral transforms and Fourier series to the real world problems arising in many practical situations.
CO4	:	Interpret the overall knowledge of linear algebra, integral transforms and Fourier series gained to engage in life-long learning.

Reference Books:

1. Linear Algebra and its Applications, Gilbert Strang, 4th Edition, 2014, Cengage Learning India Edition, ISBN: 9788131501726, 8131501728.
2. A Text Book of Engineering Mathematics, N.P. Bali & Manish Goyal, 7th Edition, 2010, Lakshmi Publications, ISBN: 978-81-7008-992-6.
3. Higher Engineering Mathematics, B.S. Grewal, 44th Edition, 2015, Khanna Publishers, ISBN: 978- 81-933284-9-1.
4. Linear Algebra and its Applications, David C. Lay, 4th Edition, 2012, Pearson Education India, ISBN-13: 970321385178, ISBN-10: 0321385171.

Scheme of Continuous Internal Evaluation (CIE)
Theory (100 Marks) CIE is executed by way of Quizzes (Q), Tests (T) and Assignments (A). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 40 marks. A minimum of two assignments are given with a combination of two components among 1) Solving innovative problems 2) Seminar/new developments in the related course 3) Laboratory/field work 4) Minor project. Total CIE (Q+T+A) is 20+40+40=100 Marks

Scheme of Semester End Examination (SEE) for 100 marks
The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Course Code	**:**	**21BT32A/21BT 42A**	**ENVIRONMENTAL TECHNOLOGY**	**CIE Marks**	**:**	**50**
Credits L-T-P	**:**	**2:00:00**	***(Common to all branches)***	**SEE Marks**	**:**	**50**
Hours	**:**	**26 L**		**SEE Durations**	**:**	**90 mins**

UNIT - I	**08 Hrs**

Introduction: Climate action – Paris convention, Sustainable Developmental Goals in relation to environment, Components of environment, Ecosystem. Environmental education, Environmental acts & regulations, role of non-governmental organizations (NGOs), EMS: ISO 14000, Environmental Impact Assessment. Environmental auditing.

UNIT - II	**09 Hrs**

Pollution and its remedies: **Air pollution** – point and non-point sources of air pollution and their controlling measures (particulate and gaseous contaminants). Noise pollution, Land pollution (sources, impacts and remedial measures), **Water management**: Advanced water treatment techniques, water conservation methods. **Waste managemen**t: Solid waste, e-waste & biomedical waste – sources, characteristics & disposal methods. Concepts of Reduce, Reuse and Recycling of the wastes.
Waste to Energy: Different types of Energy, Conventional sources & Non-conventional sources of energy: Solar, Hydro Electric, Wind, Nuclear, Biomass & Biogas Fossil Fuels and Hydrogen.

UNIT - III	**09 Hrs**

Environmental design: Green buildings, green materials, Leadership in Energy and Environmental Design (LEED), Hydroponics, Organic Farming, Biofuels, IC engine to E mobility transition and its impacts, Carbon Credits, Carbon Foot Prints, Opportunities for Green Technology Markets, Carbon Sequestration. **Resource recovery system**: Processing techniques, Materials recovery systems, Biological conversion (composting and anaerobic digestion). Thermal conversion products (Combustion, Incineration, Gasification, Pyrolysis, use of Refuse Derived Fuels). Case studies.

Course Outcomes:
After going through this course the student will be able to:

CO1	:	Illustrate the fundamental concepts of linear algebra, Laplace and inverse Laplace transforms, Fourier series and Fourier transforms.
CO2	:	Apply the acquired knowledge of linear algebra, Laplace and inverse Laplace transforms, Fourier series and Fourier transforms to solve the problems of engineering applications.
CO3	:	Analyze the solution of the problems using appropriate techniques of linear algebra, integral transforms and Fourier series to the real world problems arising in many practical situations.
CO4	:	Interpret the overall knowledge of linear algebra, integral transforms and Fourier series gained to engage in life-long learning.

Reference Books:

1. Shashi Chawla, A Textbook of Environmental Studies, McGraw Hill Education, 2017, ISBN: 1259006387,

2. Richard A Schneider and Jerry A Nathanson, Basic Environmental Technology, Pearson, 6th Edition, 2022. ISBN: 9789332575134,

3. G. Tyler Miller (Author), Scott Spoolman (Author), (2020) Environmental Science – 15th edition, Publisher: Brooks Cole, ISBN-13: 978-1305090446 ISBN-10: 130509044

4. Howard S. Peavy, Donald R. Rowe and George Tchobanoglous. 2000. Environmental Engineering, McGraw Hill Education, First edition (1 July 2017). ISBN-10: 9351340260, ISBN-13: 978-9351340263

Scheme of Continuous Internal Evaluation (CIE)
Theory (100 Marks) CIE is executed by way of Quizzes (Q), Tests (T) and Assignments (A). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 40 marks. A minimum of two assignments are given with a combination of two components among 1) Solving innovative problems 2) Seminar/new developments in the related course 3) Laboratory/field work 4) Minor project. Total CIE (Q+T+A) is 20+40+40=100 Marks

Scheme of Semester End Examination (SEE) for 100 marks
The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Course Code	**:**	**21EC33**	**ANALOG MICROELECTRONIC CIRCUITS (Theory & Practice)**	**CIE Marks**	**:**	**100+50 Marks**
Credits L-T-P	**:**	**3:0:1**		**SEE Marks**	**:**	**100+50 Marks**
Hours	**:**	**42L+30P**		**SEE Durations**	**:**	**3 Hrs+3 Hrs**

UNIT - I **10 Hrs**

Bipolar Junction Transistors (BJTs)- BJT circuits at dc, Biasing in discrete BJT amplifier circuits, small signal operation and models, early effect, BJT as an amplifier – CE stage, CE stage with degeneration, CC stage, discrete amplifier design problems, Darlington pair.

UNIT - II **08 Hrs**

MOS Field Effect Transistors (MOSFETS) - Device structure and physical operation, current voltage characteristics, MOSFET circuits at dc, Biasing in discrete MOS amplifier circuits, small signal operation and models, channel length modulation, transconductance, Body effect.

UNIT - III **08 Hrs**

MOSFET as an Amplifier - Small signal analysis (including CLM) of CS stage with resistive load, diode connected load, current source load. CS stage with degeneration, CG and CD stages. MOSFET internal capacitors and high frequency model, frequency response of CS amplifier.

UNIT - IV **09 Hrs**

Operational Amplifiers - Introduction, Effect of finite open loop gain.
Linear Opamp Circuits – Analysis of Inverting, Noninverting configurations, Difference Amplifier, Instrumentation Amplifier.
Nonlinear Opamp circuits - Analysis of Schmitt trigger, Working and applications of IC555 Timer

UNIT - V **07Hrs**

Feedback Amplifiers and Large Signal Amplifiers - Properties of negative feedback, the four basic feedback topologies, practical circuits of the two types of feedback with op-amps (Voltage series feedback), classification of output stages, class A, class B circuits, thermal resistance and heat sinking of power transistors.

Course Outcomes:
After going through this course the student will be able to:

CO1	:	Analyse the working of opamps, BJTs and FETs under various biasing conditions.
CO2	:	Investigate the characteristics of circuits employing BJT, FET and opamp.
CO3	:	Apply the concepts of basic electronic devices to design various analog circuits
CO4	:	Evaluate the performance parameters of various analog subsystems.

Reference Books:

1. Microelectronic Circuits Theory and Applications, Adel S Sedra, & Kenneth C Smith, adapted by A Chandorkar, International version, 7th Edition, 2017, Oxford University Press, ISBN-13: 978-0199476299.

2. Fundamentals of Microelectronics, Behzad Razavi, 3rd Edition, 2021, Wiley, ISBN:97811119695141

3. Electronic Devices and Circuits , Jacob Millman, Christos C Halkias & Chetan D Parikh, 2nd edition, 2016, Tata McGraw Hill publication,. ISBN: 0070151423

4. Electronic Devices and Circuit Theory, Robert L Boylestad & Louis Nashelsky, 11th Edition, 2017, PHI publication,. ISBN: 9788131725290.

Practical's: Hardware Experiments
1. Design & testing of half wave and full wave rectifier circuits. 2. Design and Testing of Zener voltage Regulator
3. Design &testing of (a) Inverting amplifier (b) Non inverting amplifier (c) Summing circuit using operational amplifier.
4. Design &testing of (a) Comparator and (b) Schmitt trigger, using operational amplifier.
5. Static characteristics of NMOS transistor
6. Design and testing of RC phase shift and Wien bridge oscillator circuits using operational amplifier.
7. Design & testing of an RC coupled amplifier using BJT in CE configuration.
8. Design & testing of Darlington emitter follower circuit with and without boot strapping.
9. LC Oscillators: Hartley and Colpitts oscillators using BJT
10. Design and testing of class B power amplifier circuits.

Scheme of Continuous Internal Evaluation (CIE)
Theory (100 Marks) CIE is executed by way of Quizzes (Q), Tests (T) and Assignments (A). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 40 marks. A minimum of two assignments are given with a combination of two components among 1) Solving innovative problems 2) Seminar/new developments in the related course 3) Laboratory/field work 4) Minor project. Total CIE (Q+T+A) is 20+40+40=100 Marks

Scheme of Semester End Examination (SEE) for 100 marks
The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Course Code	**:**	**21EC34**	**ANALYSIS AND DESIGN OF DIGITAL CIRCUITS (Theory & Practice)**	**CIE Marks**	**:**	**100+50 Marks**
Credits L-T-P	**:**	**3:00:01**	***(Common to EC, EE, EI & ET)***	**SEE Marks**	**:**	**100+50 Marks**
Hours	**:**	**42 L+30P**		**SEE Durations**	**:**	**3 Hr+3 Hr**

UNIT - I **08 Hrs**

Number System: Decimal, Binary, Octal, Hexadecimal, 1's and 2's complements, Codes – Binary, BCD, Excess 3, Gray Codes and Conversion. Sum of products and Product of sums, Minterm and Maxterm, Karnaugh map Minimization. (Up to 4 Variables). Quine-McCluskey method of minimization.

Digital Integrated Circuits: Digital IC Logic Families: TTL family, Performance parameters.

UNIT - II **10 Hrs**

Combinational Logic Desing: Design of Half and Full Adders, Half and Full Subtractors using Universal gates., Binary Parallel Adder /Subtractor– Carry look ahead Adder, BCD Adder, Multiplier, Magnitude Comparator, Multiplexer, Demultiplexer, Decoder, Encoder, Priority Encoder, Parity Bit Generator/Checker.

UNIT - III **09 Hrs**

Latches and Flipflop:

Introduction, Latches and Flip Flops, Triggering of Flip Flops, Characteristics Equation Flip Flop Excitation Tables, Flip-Flop conversions. Propagation delay, setup and hold time.

Synchronous Sequential Circuits Design:

Introduction to FSM (Mealy and Moore), Analysis of Clocked Sequential Circuits, State table and Reduction, State Diagram, Design of synchronous Counter (mod-n counter), Integrated Circuit Synchronous Counter.

UNIT - IV **10 Hrs**

Asynchronous Sequential Circuit Design:

Design of Ripple/Asynchronous Counter (mod-n counter), Effects of Propagation delay in Ripple Counter, Integrated Circuit Ripple Counter

Registers:

Registers, Shift Registers and Various Operations, Ring counters, Johnson counters, Design of Sequence Detector and Sequence Generators (PRBS), Serial Adder/Subtractor Design.

UNIT - V **08 Hrs**

Arithmetic Logic Unit (ALU)design:

Processor Organization, 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.

Course Outcomes:

After going through this course the student will be able to:

CO1	:	Analyse and implement different types of digital circuits for area, delay and power constraints
CO2	:	Comprehend the knowledge of digital circuits to construct combinational and sequential sub-systems useful for digital system designs.
CO3	:	Design digital circuits for a particular application using simulation and hardware implementation.
CO4	:	Evaluate the performance of different digital circuits to apply in real world applications.

1. Digital Logic and Computer Design, M. Morris Mano, Pearson Education Inc., 13th Impression, 2011, ISBN: 978-81-7758-409-7.

2. Fundamentals of Logic Design, Charles H. Roth (Jr.), West publications, 4th Edition, 1992, ISBN-13: 978-0-314-92218-2.

3. Digital Fundamentals, Thomas Floyd, 11th Edition, Pearson Education India, ISBN 13: 978-1- 292-07598-3, 2015.

4. Digital Principles and Applications, Albert Paul Malvino and Donald P Leach, 7th Edition, Tata McGraw Hill Education Private Limited, 2011, ISBN (13 digit): 978-0-07-014170-4 and ISBN (10 digit): 0-07-014170-3.

Practical's:

1. Truth Table verification of NOT, AND, OR, XOR, XNOR, NAND, NOR gates using IC trainer kit. Realization of Binary Adder and Subtractor IC-7483.
2. Realization of Boolean Function using MUX/DEMUX (IC-74153, IC-74139.)
3. Design of synchronous 3-bit up/down counter using IC-7476/IC-74112 on IC trainer kit.
4. Realization of Binary Adder and Subtractor using Verilog
5. Realization of Multiplexer/Decoders/Encoder in Verilog.
6. Realization of D, T, JK flip flop in Verilog using behavioral modelling on FPGA board.
7. Design of synchronous (up/down/BCD counter in Verilog using behavioral modelling.
8. Design of Shift register, ring counter, Johnson counter using Verilog
9. Design **of Sequence generator** and detector.
10. Open ended experiment

Innovative Experiment:

1. Multiplier Designs (Booth, Wallace)
2. Basic Processor Design

Scheme of Continuous Internal Evaluation (CIE)

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Scheme of Semester End Examination (SEE) for 100 marks

The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Course Code	**:**	**21EC35**	**NETWORK ANALYSIS AND CONTROL SYSTEMS**	**CIE Marks**	**:**	**100**
Credits L-T-P	**:**	**3:00:00**		**SEE Marks**	**:**	**100**
Hours	**:**	**42L**		**SEE Durations**	**:**	**3 Hr**

UNIT - I	**09 Hrs**
Fundamentals - Mesh Loop and Node analysis with linear dependent and independent sources for DC and AC networks. Network Theorems: Superposition, Reciprocity, Thevenin's, Norton's, Maximum Power transfer and Millman's theorems.	
UNIT - II	**09 Hrs**
Transient Behavior & Initial Conditions - Evaluation of initial and final conditions in R-L, R-C and R-L-C Circuits for DC networks. Laplace transformation and applications. Two port Networks: Z, Y, ABCD and Hybrid parameters, their inter-relationships	
UNIT - III	**08 Hrs**
Basic Ideas of Control Systems, Mathematical Models of Physical Systems - Classification of Control Systems, Open Loop and Closed Loop (in detail), Differential equations of Physical Systems and Transfer Function (and electrical systems) Block Diagram Reduction, Signal Flow Graphs(simple examples)	
UNIT - IV	**08 Hrs**
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. Time Domain Specifications for Second Order System. tr, td, tp, Mp, Steady State Error Analysis, Error Constants, Kp, Kv, Ka.	
UNIT - V	**08 Hrs**
Stability Analysis - Concepts of Stability, Types of Stability, Asymptotic Stability, Root Locus Technique and Bode Plots, Introduction to Root Locus, Stability Analysis using Root Locus Diagram, Bode Plots.	

Course Outcomes:

After going through this course the student will be able to:

CO1	:	Apply the basic concepts and solve circuits with DC or AC excitation and coupled circuits using theorems and transformations
CO2	:	Compare the steady state and transient response of a circuit through application of inverse transformation and shifting theorems
CO3	:	Apply the knowledge of mathematics & basic electrical concepts to solve problems in control systems.
CO4	:	Evaluate the performance of different systems in time & frequency domain analysis.

Reference Books:

1. M.E. Van Valkenberg (2000), —Network analysisl, Prentice Hall of India, 3rdedition, 2000, ISBN: 9780136110958.
2. Roy Choudhury, "Networks and systems" , 2nd edition, New Age International Publications, 2006, ISBN: 9788122427677
3. "Modern Control Engineering" by K. Ogata. Pearson.
4. Katsuhiko Ogata, "Modern Control Engineering", Prentice Hall.
5. Nagarath and M. Gopal, "Control Systems Engineering", New Age International (P) limited Publishers, 5th Edition, 2007, ISBN: 81-224-2008-7.

Scheme of Continuous Internal Evaluation (CIE)

Theory (100 Marks) CIE is executed by way of Quizzes (Q), Tests (T) and Assignments (A). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 40 marks. A minimum of two assignments are given with a combination of two components among 1) Solving innovative problems 2) Seminar/new developments in the related course 3) Laboratory/field work 4) Minor project. Total CIE (Q+T+A) is 20+40+40=100 Marks

Scheme of Semester End Examination (SEE) for 100 marks

The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Course Code	**:**	**21EC36**	**DIGITAL SYSTEM DESIGN USING VERILOG HDL**	**CIE Marks**	**:**	**100**
Credits L-T-P	**:**	**3:00:00**		**SEE Marks**	**:**	**100**
Hours	**:**	**42L**		**SEE Durations**	**:**	**3 Hr**

UNIT - I	**08Hrs**

Design Flow Introduction-FPGA Introduction to Verilog: 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. 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 modeling

UNIT - II	**08 Hrs**

Structural Modeling - Design of Combinational Logic, Verilog Structural Models, Module Ports, Top-Down Design and Nested Modules. Gate level modeling 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.

UNIT - III	**09 Hrs**

Algorithmic State Machine Charts for Behavioral Modeling - Behavioral Models of Counters, Shift Registers, and Register Files and Arrays of Registers (Memories). Tasks & Functions Algorithmic State Machine Charts for Behavioral Modeling, ASMD charts, Design of FSM(Mealy-Moore) using Verilog, Design Example: Sequence detector/Generator Keypad Scanner and Encoder.

UNIT - IV	**09 Hrs**

Architectures for Arithmetic Processors- (Functional Units for Multiplication) - Sequential Binary Multiplier, Sequential Multiplier Design: Hierarchical Decomposition STG-Based Controller Design, Efficient STG-Based Sequential Binary Multiplier, Reduced-Register sequential multiplier, Multiplication of signed binary number.

UNIT - V	**08 Hrs**

Architectures for Arithmetic Processors (Functional Unit for Division)- Division of Unsigned Binary Number, Efficient Division of Unsigned Binary Numbers, Reduced Register Sequential Divider.

Course Outcomes:
After going through this course the student will be able to:

CO1	:	Analyze digital circuits and systems to model using Verilog HDL
CO2	:	Develop synthesizable code for digital function and apply EDA tools for simulation, verification and synthesis of digital design.
CO3	:	Apply design knowledge to FSM based digital modules using high-level HDL description and port it on to FPGA for verification
CO4	:	Design, develop and evaluate the the performance of efficient digital systems realized using various blocks.

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
3. Peter J. Ashenden, “Digital Design: An Embedded Systems Approach Using VERILOG”, Elsevier,2015, ISBN: 978-0-12-369527-
4. Digital Systems Design Using Verilog, Roth, Charles, John, Lizy K, Kil Lee, Byeong ISBN 10: 1285051076 / ISBN 13: 9781285051079.

Scheme of Continuous Internal Evaluation (CIE)
Theory (100 Marks) CIE is executed by way of Quizzes (Q), Tests (T) and Assignments (A). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 40 marks. A minimum of two assignments are given with a combination of two components among 1) Solving innovative problems 2) Seminar/new developments in the related course 3) Laboratory/field work 4) Minor project. Total CIE (Q+T+A) is 20+40+40=100 Marks

Scheme of Semester End Examination (SEE) for 100 marks
The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Course Code	**:**	**21DMA37**	**Bridge Course: MATHEMATICS**	**CIE Marks**	**:**	**50**
Credits L-T-P	**:**	**2:00:00**	***(Common to all branches)***	**SEE Marks**	**:**	**50**
Audit Course				**SEE Durations**	**:**	**2 Hr**

UNIT - I	**05 Hrs**
Differential Calculus - Partial derivatives – Introduction, simple problems. Total derivative, composite functions. Jacobians – simple problems.	
UNIT - II	05 Hrs
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.	
UNIT - III	06 Hrs
Differential Equations - Higher order linear differential equations with constant coefficients, solution of homogeneous equations - Complementary functions. Non homogeneous equations –Inverse differential operator method of finding particular integral based on input function (force function).	
UNIT - IV	05 Hrs
Numerical Methods - Solution of algebraic and transcendental equations – Intermediate value property, Newton-Raphson method. Solution of first order ordinary differential equations – Taylor series and 4th order Runge-Kutta methods. Numerical integration – Simpson's 1/3rd, 3/8th and Weddle's rules. (All methods without proof).	
UNIT - V	05 Hrs
Multiple Integrals - Evaluation of double integrals, change of order of integration. Evaluation of triple integrals. Applications – Area, volume and mass – simple problems.	

Course Outcomes:
After going through this course the student will be able to:

CO1	:	Illustrate the fundamental concepts of partial differentiation, double integrals, vector differentiation, solutions of higher order linear differential equations and numerical methods.
CO2	:	Derive the solution by applying the acquired knowledge of total derivatives of implicit functions, Jacobians, homogeneous linear differential equations, velocity and acceleration vectors to the problems of engineering applications.
CO3	:	Evaluate the solution of the problems using appropriate techniques of differential and integral calculus, vector differentiation, differential equations and numerical methods to the real world problems arising in many practical situations.
CO4	:	Compile the overall knowledge of differential and integral calculus, vector differentiation, differential equations and numerical methods gained to engage in life – long learning

Reference Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2015, ISBN: 978-81-933284-9-1.
2. Higher Engineering Mathematics, B.V. Ramana, 11th Edition, 2010, Tata McGraw-Hill, ISBN: 978-0-07-063419-0.
3. N.P. Bali & Manish Goyal, A Text Book of Engineering Mathematics, Lakshmi Publications, 7th Edition, 2010, ISBN: 978-81-31808320.
4. Advanced Engineering Mathematics, E. Kreyszig, 10th Edition (Reprint), 2016. John Wiley & Sons, ISBN: 978-0470458365.

Scheme of Continuous Internal Evaluation (CIE)
Theory (100 Marks) CIE is executed by way of Quizzes (Q), Tests (T) and Assignments (A). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 40 marks. A minimum of two assignments are given with a combination of two components among 1) Solving innovative problems 2) Seminar/new developments in the related course 3) Laboratory/field work 4) Minor project. Total CIE (Q+T+A) is 20+40+40=100 Marks

Scheme of Semester End Examination (SEE) for 100 marks
The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Course Code	**:**	**21HSAE39A/21 HSAE46A**	**NATIONAL SERVICE SCHEME**	**CIE Marks**	**:**	**50**
Credits L-T-P	**:**	**0:00:01**	***(Practical)***	**SEE Marks**	**:**	**50**
Hours	**:**	**13P**		**SEE Durations**	**:**	**2 Hours**

Prerequisites:

1. Students should have service-oriented mindset and social concern.
2. Students should have dedication to work at any remote place, any time with available resources and proper time management for the other works.
3. Students should be ready to sacrifice some of the timely will and wishes to achieve service-oriented targets on time.

Content	**13 Hrs**

Students must take up any one activity on below mentioned topics and has to prepare contents for awareness and technical contents for implementation of the projects and has to present strategies for implementation of the same. Compulsorily must attend one camp.

CIE will be evaluated based on their presentation, approach, and implementation strategies. (Any one of the below mentioned activity)

1. Helping local schools to achieve good result and enhance their enrolment in Higher/technical/ vocational education.
2. Preparing an actionable business proposal for enhancing the village/ farmer income and approach for implementation.
3. Developing Sustainable Water management system for rural/ urban areas and implementation approaches.
4. Setting of the information imparting club for women leading to contribution in social and economic issues.
5. Spreading public awareness/ government schemes under rural outreach program. (Minimum 5 programs)
6. Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc..
7. Social connect and responsibilities
8. Plantation and adoption of plants. Know your plants
9. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing
10. Waste management – Public, Private and Govt organization, 5 R's
11. Water conservation techniques – Role of different stakeholders - Implementation
12. Govt. School Rejuvenation and assistance to achieve good infrastructure.
13. Organize National integration and social harmony events/ workshops / seminars. (Minimum 2 programs)

AND ONE NSS-CAMP

Course Outcomes:

After going through this course the student will be able to:

CO1	:	Understand the importance of his/her responsibilities towards society.
CO2	:	Analyze the environmental and societal problems/ issues and will be able to design solutions for the same.
CO3	:	Evaluate the existing system and to propose practical solutions for the same for sustainable development.

Course Code	**:**	**21HSAE39B/ 21HSAE46B**	**NATIONAL CADET CORPS**	**CIE Marks**	**:**	**50**
Credits L-T-P	**:**	**0:00:01**	***(Practical)***	**SEE Marks**	**:**	**50**
Hours	**:**	**15P**		**SEE Durations**	**:**	**2 Hours**
Unit 1						**7 Hrs**
Drill (Contact Hrs. 12). Foot Drill- Drill ki Aam Hidayaten, Word ki Command, Savdhan, Vishram, Aram Se, Murdna, Kadvar Sizing, Teen Line Banana, Khuli Line, Nikat Line, Khade Khade Salute Karna						
Unit 2						**3 Hrs**
Weapon Training (WT): Introduction & Characteristics of 7.62 Self Loading rifle, Identification of rifle parts						
Unit 3						**3 Hrs**
Adventure activities: Trekking and obstacle course						
Unit 4						**2 Hrs**
Social Service and Community Development (SSCD): Students will participate in various activities throughout the semester e.g., Blood donation Camp, Swachhata Abhiyan, Constitution Day, All National Festival						
Course Outcomes: **After going through this course the student will be able to:**						
CO1	:	Understand that drill as the foundation for discipline and to command a group for common goal.				
CO2	:	Understand the importance of a weapon its detailed safety precautions necessary for prevention of accidents and identifying the parts of weapon.				
CO3	:	Understand that trekking will connect human with nature and cross the obstacles to experience army way of life.				
CO4	:	Understand the various social issues and their impact on social life, Develop the sense of self-less social service for better social & community life.				
Reference Books:						
1.NCC Cadet Hand Book by R K Gupta, Ramesh Publishing House, New Delhi, Book code:R- 1991, ISBN: 978-93-87918-57-3, HSN Code: 49011010						
2. nccindia.ac.in						

Course Code	**:**	**21HSAE39C/ 21HSAE46C**	**PHYSICAL EDUCATION (SPORTS & ATHLETICS)**	**CIE Marks**	**:**	**50**
Credits L-T-P	**:**	**0:00:01**	***(Practical)***	**SEE Marks**	**:**	**50**
Hours	**:**	**30P**		**SEE Durations**	**:**	**2:30 Hours**
Content						**30 Hrs**

Topics for Viva:

1. On rules and regulations pertaining to the games / sports
2. On dimensions of the court, size / weight of the ball and standards pertaining to that sports / game
3. Popular players and legends at state level / National level/ International level
4. Recent events happened and winner / runners in that particular sport / game
5. General awareness about sport / game, sports happenings in the college campus

Course Outcomes:

After going through this course the student will be able to:

CO1	:	Understand the basic principles and practices of Physical Education and Sports
CO2	:	Instruct the Physical Activities and Sports practices for Healthy Living
CO3	:	To develop professionalism among students to conduct, organize & Officiate Physical Education and Sports events at schools and community level

Reference Books:

1. Muller, J. P. (2000). Health, Exercise and Fitness. Delhi: Sports.
2.Vanaik.A (2005) Play Field Manual, Friends Publication New Delhi
3.IAAF Manual
4. M.J Vishwanath, (2002) Track and Field Marking and Athletics Officiating Manual, Silver Star Publication, Shimoga
5.Steve Oldenburg (2015) Complete Conditioning for Volleyball, Human Kinestics.

Note: Skills of Sports and Games (Game Specific books) may be referred

Course Code	**:**	**21HSAE39D1/ 21HSAE46D1**	**MUSIC**	**CIE Marks**	**:**	**50**
Credits L-T-P	**:**	**0:00:01**	***(Practical)***	**SEE Marks**	**:**	**50**
Hours	**:**	**13P**		**SEE Durations**	**:**	**2 Hours**

Prerequisites:

1. Students should know basics of music.

2. Students should have dedication to learn and improve on their musical skills.

3. Students should have participated in musical events and have basic knowledge on how to present their music.

Content	**13 Hrs**

1. Introduction to different genres of music
2. Evolution of genres in India: Inspiration from the world
3. Ragas, time and their moods in Indian Classical Music
4. Identification of ragas and application into contemporary songs
5. Adding your touch to a composition
6. Maths and Music: A demonstration
7. Harmonies in music
8. Chords: Basics and application into any song
9. Music Production-I
10. Music Production-II

Students have to form groups of 2-4 and present a musical performance/ a musical task which shall be given by the experts. The experts shall judge the groups and award marks for the same.

CIE will be evaluated based on their presentation, approach and implementation strategies. Students need to submit their certificates of any event they participated or bagged prizes in. This shall also be considered for CIE evaluation.

Course Outcomes:

After going through this course the student will be able to:

CO1	:	Understand basics of Music and improve their skills.
CO2	:	Appreciate the impacts on health and well being.
CO3	:	Perform and present music in a presentable manner.
CO4	:	Develop skills like team building and collaboration.

Reference Books:

1.Music Cognition: The Basics by Henkjan Honing

2. Basic Rudiments Answer Book - Ultimate Music Theory: Basic Music Theory Answer Book by Glory St Germain

3. Elements Of Hindustani Classical Music by Shruti Jauhari

4. Music in North India: Experiencing Music, Expressing Culture (Global Music Series) by George E. Ruckert

Course Code	**:**	**21HSAE39D2/ 21HSAE46D2**	**DANCE**	**CIE Marks**	**:**	**50**
Credits L-T-P	**:**	**0:00:01**	***(Practical)***	**SEE Marks**	**:**	**50**
Hours	**:**	**13P**		**SEE Durations**	**:**	**2 Hours**

Prerequisites:

1. Students should have the will and interest to learn dancing.

2. Students should have a positive mindset.

3. Students should be willing to interact and cooperate in group activities.

Content	**13 Hrs**

1. Introduction to Dance
2. Preparing the body for dancing by learning different ways to warm up.
3. Basics of different dance forms i.e. classical, eastern, and western.
4. Assessing the interest of students and dividing them into different styles based on interaction.
5. Advancing more into the styles of interest.
6. Understanding of music i.e. beats, rhythm, and other components.
7. Expert sessions in the respective dance forms.
8. Activities such as cypher, showcase to gauge learning.
9. Components of performance through demonstration.
10. Introduction to choreographies and routines.
11. Learning to choreograph.
12. Choreograph and perform either solo or in groups.

Course Outcomes:

After going through this course the student will be able to:

CO1	:	Understand the fundamentals of dancing.
CO2	:	Adapt to impromptu dancing.
CO3	:	Ability to pick choreography and understand musicality.
CO4	:	To be able to do choreographies and perform in front of a live audience.

Reference Books:

1.Dance Composition: A practical guide to creative success in dance making by Jacqueline M. Smith-Autard

Course Code	**:**	**21HSAE39D3/ 21HSAE46D3**	**LIGHTS CAMERA DRAMA**	**CIE Marks**	**:**	**50**
Credits L-T-P	**:**	**0:00:01**	***(Practical)***	**SEE Marks**	**:**	**50**
Hours	**:**	**13P**		**SEE Durations**	**:**	**2 Hours**

Prerequisites:

1. Students should have creative oriented mindset and social concern.

2. Students should have dedication to work with their classmates for long hours until a collective goal is reached.

3. Students should be ready to sacrifice some of the timely will and wishes to achieve targets on time.

Content	**13 Hrs**

1. Break the ICE
2. Introduction to freedom Talk to each and every single person for a period of 5 complete minutes. This is aimed at to make everyone in the room comfortable with each other. This helps everyone get over social anxiety, Shyness and Nervousness.
3. Ura
4. Rhythm Voice Projection, Voice Modulation, Weeping & Coughing Voice projection is the strength of speaking or singing whereby the voice is used powerfully and clearly. It is a technique employed to command respect and attention, as when a teacher talks to a class, or simply to be heard clearly, as used by an actor in a theatre.
5. It's Leviosa, Not Leviosaaa!
6. Speech work: Diction, Intonation, Emphasis, Pauses, Pitch and Volume Tempo Dialogues delivery. The art of dialogue delivery plays a vital role in in ensuring the efficacy of communication especially from the dramatic aspect of it, this unit discusses some tips to help the young actors improve their dialogue delivery skills:
7. Elementary, My dear Watson.
8. Responsibilities of an actor tools of an actor character analysis Observations aspects, Stage presence, concentration, conviction, confidence, energy and directionality.
9. Show time
10. Pick a genre: COMEDY, THRILLER, HORROR, and TRAGEDY: Showcase a performance. Stylized acting with reference to historical and mythological plays. Mime: conventional, occupational and pantomime Mono acting: different types of characters

Course Outcomes:

After going through this course the student will be able to:

CO1	:	Develop a range of Theatrical Skills and apply them to create a performance.
CO2	:	Work collaboratively to generate, develop and communicate ideas.
CO3	:	Develop as creative, effective, independent and reflective students who are able to make inform ed choices in process and performance.
CO4	:	Develop an awareness and understanding of the roles and processes undertaken in contemporary professional theatre practice.

Reference Books:

1.The Empty Space by Peter Brook

2.The Viewpoints Book: A Practical Guide to Viewpoints and Composition by Anne Bogart and Tina Landau

Course Code	**:**	**21HSAE39E1/ 21HSAE46E1**	**ART**	**CIE Marks**	**:**	**50**
Credits L-T-P	**:**	**0:00:01**	***(Practical)***	**SEE Marks**	**:**	**50**
Hours	**:**	**13P**		**SEE Durations**	**:**	**2 Hours**

Prerequisites:

Although there are no prerequisite qualifications for this subject, students must have a basic understanding of and interest in the fields of art and design in order to enroll in it.

Content	**13 Hrs**

1. Use points, line and curves to create various shapes and forms
2. Use of shapes and forms to create various objects and structures
3. Recognizing distinctions in objects when viewed from various perspectives and grasping basic notions of perspective
4. Students will be introduced to the significance of color in art, as well as the principles of color theory and application.
5. Applied the concepts of unity, harmony, balance, rhythm, emphasis and proportion, abstraction and stylization to create a composition.
6. Learn how to use which materials and for what types of art and textures.
7. Use of the above concepts to create art through the medium of collage, mosaic, painting, mural, batik, tie and dye.
8. Real world application of the above concepts in the form of book cover design and illustration, cartoon, poster, advertisements, magazine, computer graphics and animation
9. Familiarization with the many art forms and techniques of expression found throughout India.

AND

ONE EDUCATIONAL VISIT TO AN ART MUSEUM / INSTITUTE / GALLERY

Students must turn in assignments for each of the above said topics on a weekly basis and have to compulsorily take part in the museum visit. CIE will be evaluated based on a still life piece, a composition using any one of the media of composition and a presentation on Indian art styles and creation of a piece pertaining to the presented art style.

Course Outcomes:

After going through this course the student will be able to:

CO1	:	To use lines, shapes, and colors to depict the various sentiments and moods of life and nature.
CO2	:	To use one's creativity to develop forms and color schemes, as well as the ability to portray them effectively in drawing and painting on paper.
CO3	:	To develop the ability to properly use drawing and painting materials (surfaces, tools and equipment, and so on).
CO4	:	To improve their observation abilities by studying everyday items as well as numerous geometrical and non- geometrical (i.e. organic) shapes found in life and nature and to hone their drawing and painting talents in response to these insights.

Reference Books:

1.Catching the Big Fish: Meditation, Consciousness, and Creativity by David Lynch

2.Art & Fear: Observations on the Perils (and Rewards) of Artmaking by David Bayles & Ted Orland

Course Code	**:**	**21HSAE39E2/ 21HSAE46E2**	**PHOTOGRAPHY**	**CIE Marks**	**:**	**50**
Credits L-T-P	**:**	**0:00:01**	***(Practical)***	**SEE Marks**	**:**	**50**
Hours	**:**	**13P**		**SEE Durations**	**:**	**2 Hours**

Prerequisites:

1. Students should know basics of photography and cinematography.
2. Students should have dedication to learn and improve on their photography and film making skills.
3. Students should have participated in photography events.
4. Students should have a DSLR camera.

Content	**13 Hrs**

1. Introduction to photography.
2. Understanding the terminologies of DSLR.
3. Elements of photography.
4. Introduction to script writing, storyboarding.
5. Understanding the visualization and designing a set.
6. Basics of film acting
7. Video editing using software
8. Introduction to cinematography.
9. Understanding about lighting and camera angles.
10. Shooting a short film.

Students must form groups of 2-4 and present a short film which shall be given by the experts. The experts shall judge the groups and award marks for the same.

CIE will be evaluated based on their presentation, approach and implementation strategies. Students need to submit their certificates of any event they participated or bagged prizes in. This shall also be considered for CIE evaluation.

Course Outcomes:

After going through this course the student will be able to:

CO1	:	Understand basics of photography and videography and improve their skills
CO2	:	Appreciate the skills acquired from photography
CO3	:	Perform and present photos and films in a presentable manner
CO4	:	Develop skills like team building and collaboration

Reference Books:

1.Read This If You Want to Take Great Photographs – Henry Carroll

2. The Digital Photography Book: Part 1 – Scott Kelby

Course Code	**:**	**21XXI310**	**SUMMER INTERNSHIP - I**	**CIE Marks**	**:**	**50**
Credits L-T-P	**:**	**0:00:01**	***(Practical)***	**SEE Marks**	**:**	**50**
Duration	**:**	**3 Weeks**		**SEE Durations**	**:**	**2 Hours**

1. A minimum of 1 credit of internship after I year may be counted towards B.E. degree program.
2. During II semester to III semester transition, Three weeks of internship is mandatory.
3. Internship report and certificate need to be submitted at the end of the internship to the concerned department for the evaluation.
4. Internship evaluation will be done during III semester for 1 credit in two phases.

Students can opt the internship with the below options	**3 Weeks**

A. **Within the respective department at RVCE (Inhouse)** Departments may offer internship opportunities to the students through the available tools so that the students come out with the solutions to the relevant societal problems that could be completed within THREE WEEKS.

B. **At RVCE Center of Excellence/Competence**

RVCE hosts around 16 CENTER OP EIXCELLENCE in various domains and around 05 CENTER OP COMPETENCE. The details of these could be obtained by visiting the website https:/ /rvce.edu.in / rvce-center-excellence. Each center would be providing the students relevant training/internship that could be completed in three weeks.

C. **At Intern Shala**

Intern Shala is India's no.1 internship and training platform with 40000+ paid internships in Engineering. Students can opt any internship for the duration of three weeks by enrolling on to the platform through https: / /internsha1a.com

D. **At Engineering Colleges nearby their hometown**

Students who are residing out of Bangalore, should take permission from the nearing Engineering College of their hometown to do the internship. The nearby college should agree to give the certificate and the letter/email stating the name of the student along with the title of the internship held with the duration of the internship in their official letter head.

E**. At Industry or Research Organizations**

Students can opt for interning at the industry or research organizations like BEL, DRDO, ISRO, BHEL, etc.. through personal contacts. However, the institute/industry should provide the letter of acceptance through hard copy/email with clear mention of the title of the work assigned along with the duration and the name of the student.

Procedures for the Internship:

1. Request letter/Email from the office of respective departments should go to Places where internships are intended to be carried out with a clear mention of the duration of Three Weeks. Colleges/Industry/ CoEs/CoCs will confirm the training slots and the number of seats allotted for the internship via confirmation letter/ Email.
2. Students should submit a synopsis of the proposed work to be done during internship program. Internship synopsis should be assessed or evaluated by the concerned Colleges/Industry/CoEs/CoC. Students on joining internship at the concerned Colleges/Industry/ CoEs/CoCs submit the Daily log of student's dairy from the joining date.
3. Students will submit the digital poster of the training module/project after completion of internship.
4. Training certificate to be obtained from industry.

Course Outcomes:

After going through this course the student will be able to:

CO1	:	Develop communication, interpersonal,critical skills, work habits and attitudes necessary for employement.
CO2	:	Assess interests,abilities in their field of study, integrate theroy and practice and explore career opportunities prior to graduation.
CO3	:	Explore and use state of art modern engineering tools to solve the societal problems with affininity towards environment and involve in ethical professional practice.
CO4	:	Compile, document and communiate effectively on the intersnship activities with the engineering community.

SEMESTER: IV						
Course Code	:	21MA41	**STATISTICS AND PROBABILITY FOR DATA SCIENCE**	CIE Marks	:	100
Credits L-T-P	:	2:01:00	*(Common to ALL Programs)*	SEE Marks	:	100
Hours	:	30L+15T		SEE Durations	:	3 Hr

UNIT - I — 06 Hrs

Statistics:
Central moments, mean, variance, coefficients of skewness and kurtosis in terms of moments. Correlation analysis, rank correlation, linear and multivariate regression analysis – problems.

UNIT - II — 06 Hrs

Random Variables:
Random variables-discrete and continuous, probability mass function, probability density function, cumulative density function, mean and variance. Two or more random variables - Joint probability mass function, joint probability density function, conditional distribution and independence, Covariance and Correlation.

UNIT - III — 06 Hrs

Probability Distributions:
Discrete distributions - Binomial, Poisson. Continuous distributions – Exponential, Normal and Weibul.

UNIT - IV — 06 Hrs

Sampling and Estimation:
Population and sample, Simple random sampling (with replacement and without replacement). Sampling distributions of means (sigma known), Sampling distributions of mean (sigma unknown): t - distribution, Sampling distributions of variance (sigma unknown): Chi - squared distribution. Estimation - Maximum Likelihood Estimation (MLE).

UNIT -V — 06 Hrs

Inferential Statistics: Principles of Statistical Inference, Test of hypothesis - Null and alternative hypothesis, Procedure for statistical testing, Type I and Type II errors, level of significance, Tests involving the normal distribution, one – tailed and two – tailed tests, P – value, Special tests of significance for large and small samples (F, Chi – square, Z, t – test).

Course Outcomes:
After going through this course the student will be able to:

CO1	:	Illustrate the fundamental concepts of statistics, random variables, distributions, sampling, estimation and statistical hypothesis.
CO2	:	Apply the acquired knowledge of statistics, random variables, distributions, sampling, estimation and statistical hypothesis to solve the problems of engineering applications.
CO3	:	Analyze the solution of the problems using appropriate statistical and probability techniques to the real world problems arising in many practical situations.
CO4	:	Interpret the overall knowledge of statistics, probability distributions and sampling theory gained to engage in life-long learning.

Reference Books:

1. Theory and Problems of Probability, Seymour Lipschutz & Marc Lars Lipson, 2nd Edition, Schaum's Outline Series, McGraw – Hill,2000, ISBN: 9780071386517.

2. Applied Statistics and Probability for Engineers, Douglas C. Montgomery and George C. Runger, 7th Edition, John Wiley & Sons, 2019, ISBN: 9781119570615.

3. Probability & Statistics for Engineers & Scientists, Ronald E. Walpole & Raymond H. Myers, 9th edition, 2016, Pearson Education, ISBN-13: 9780134115856.

4. The Elements of Statistical Learning - Data Mining, Inference, and Prediction, Trevor Hastie Robert Tibshirani Jerome Friedman, 2nd Edition, 2009 (Reprint 2017), Springer, ISBN-10: 0387848576, ISBN-13: 9780387848570.

Scheme of Continuous Internal Evaluation (CIE)
Theory (100 Marks) CIE is executed by way of Quizzes (Q), Tests (T) and Assignments (A). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 40 marks. A minimum of two assignments are given with a combination of two components among 1) Solving innovative problems 2) Seminar/new developments in the related course 3) Laboratory/field work 4) Minor project. Total CIE (Q+T+A) is 20+40+40=100 Marks

Scheme of Semester End Examination (SEE) for 100 marks
The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Course Code	:	21EC42	**MATERIALS FOR ELECTRONICS ENGINEERING**	CIE Marks	:	50
Credits L-T-P	:	2:00:00	*(Common to EC, EE, EI & TE)*	SEE Marks	:	50
Hours	:	28L		SEE Durations	:	2 Hr

UNIT - I — 10 Hrs

Introduction: Classification and Properties of Materials, Materials Used in Electrical and Electronic Industries, Requirements and Future Developments of Electronic Materials, Case studies of advanced electronics materials and applications.
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

UNIT - II — 09 Hrs

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.
Organic Electronic Materials: Conducting Polymers, Charge carriers, Semiconducting Organic Materials, Organic Light Emitting Diode, Organic FET

UNIT - III — 09 Hrs

Semiconductor devices: Intrinsic & Extrinsic Semiconductors, temperature dependence of conductivity, direct and indirect recombination minority carrier life time Nanomaterials for Electronic Device Applications: Micro-/Nano-devices Using Nanostructured Materials: CNT transistor, Single electron transistor

Course Outcomes:
After going through this course the student will be able to:

CO1	:	Explain electronics material classification, different physical properties and to the extend device applications.
CO2	:	Define the transport mechanism (in solid state & organic), working principle of electronic material and assess material parameters for practical requirement.
CO3	:	Summarize various fabrication, characterization and synthesis techniques for the electronic nanomaterials and thin film growth.
CO4	:	Identify and calculate material parameters including electrical conductivity, resistivity, magnetic and optical properties for real-time electronic 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. Principles of Electronic Materials and Devices, S O Kasap, 4th Edition, 2018, McGraw Hill Education, ISBN-13: 978-0-07-802818-2
3. Electronic Properties of Materials, Rolf E. Hummel, 4th Edition, 2011, Springer, ISBN-13: 978-1489998415

Scheme of Continuous Internal Evaluation (CIE)
Theory (100 Marks) CIE is executed by way of Quizzes (Q), Tests (T) and Assignments (A). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 40 marks. A minimum of two assignments are given with a combination of two components among 1) Solving innovative problems 2) Seminar/new developments in the related course 3) Laboratory/field work 4) Minor project. Total CIE (Q+T+A) is 20+40+40=100 Marks

Scheme of Semester End Examination (SEE) for 100 marks
The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Course Code	:	21EI43	**MICROCONTROLLERS & PROGRAMMING (Theory and Practice)**	CIE Marks	:	100+50 Marks
Credits L-T-P	:	3:0:1		SEE Marks	:	100+50 Marks
Hours	:	45L+30P	*(Common to EI/ET/EC/EE)*	SEE Durations	:	3 Hrs+3 Hrs

UNIT - I **9 Hrs**

Introduction to Processing units Computer System, Processor, Block diagram, Processor logic unit, Control unit, Instruction format, Assembly language, High level language, Embedded computing applications, Microcontroller, Instruction set architectures (CISC, RISC), Harvard and Von Neumann, Floating and fixed point, Introduction of controller families: 8-bit, 16-bit,32 bit, 64 bit, ARM Processor families, Cortex A, Cortex R and Cortex M, Thumb 2 instruction set

UNIT - II 09 Hrs

Cortex M Architecture Advantages of Cortex M CPUs, Programmer's model: Operation modes & states, Registers, Special Registers, APSR, Memory System, Low power modes, Instruction Set: Memory access instructions, Arithmetic, Logical, Shift, Program flow control instructions, Programming examples, IDEs, ST-Link debugger.

UNIT - III 09 Hrs

Digital and Analog IO
ARM Cortex M4 MCUs, Memory organization, Reset & Clock Control, GPIO, Programming: interfacing LEDs and Push buttons, Analog to digital converters (ADC), Successive Approximation ADC, Programming and interfacing an analog sensor, Digital to Analog Converter(DAC), Programming

UNIT - IV 09 Hrs

Serial Port USART: Basics of serial communication(Synchronous, asynchronous), Framing, Sampling, Baud rate generation, Programming USART for character transmission, Serial Peripheral Interface, Programming SPI for data transfer

UNIT - V 09 Hrs

Interrupts and Timers Types of interrupts, Nested vector interrupt controller (NVIC) in Cortex-M cores, Interrupt vectors, Priorities, Programming interrupts, Timers, Controlling the operation, Programming with timers, Pulse width modulators, Programming modulators to generate PWM wave for given specifications.

Course Outcomes:
After going through this course the student will be able to:

CO1	:	Analyse the architecture, instruction set and memory organization of processing units used to build computers and embedded systems.
CO2	:	Comprehend the knowledge of ADCs, DACs, Serial ports and interrupts available on embedded processors to map to real world requirements.
CO3	:	Apply the knowledge of microcontroller for programming peripherals using registers and APIs generated using auto code generators.
CO4	:	Engage in usage of modern engineering tools to formulate, design and analyze different applications realized with embedded processors.

Reference Books:

1. The Definitive Guide to the ARM Cortex-M3& M4 Processors, Joseph Yiu, 3rd Edition, Newnes (Elsevier), 2014, ISBN:978-93-5107-175-4
2. STM32 Arm Programming for Embedded Systems, Shujen Chen, Eshragh Ghaemi, Muhammad Ali Mazidi, Microdigitaled, ISBN: 978-0997925944
3. Reference manuals: STM32F411, STMcubeMX, SPI
4. White Paper: Cortex-M for Beginners - An overview of the Arm Cortex-M processor family and comparison

Laboratory Component
Practical: Programming in ARM Assembly using Keil
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. Search for a Key in an Array of Elements using Linear Search, Binary Search. Programming in Keil using embedded C in STMCubeMX
4. Program digital IOs control LEDs, seven segment interface, push buttons.
5. Program digital IOs to control stepper and motor drivers for given specifications.
6. Program ADC and show analog to digital conversion. Display digital value on suitable interface.
7. Program ADC and show interfacing of analog sensor for given specifications.
8. Program USART and serial data transfer.
9. Program SPI and show the configuration and data transfer between SPI slave device and master.
10. Program to configure NVIC and writing interrupt service routines. PART B
Innovative Experiments (IE)
1.Program SPI and show the configuration and data transfer between SPI slave device and master.
2. Program ADC and show interfacing of analog sensor for given specifications.
3. Data transfer in polling, interrupt and DMA based modes.
4. Real time Audio applications: Flanging effect

Scheme of Continuous Internal Evaluation (CIE)
Theory (100 Marks) CIE is executed by way of Quizzes (Q), Tests (T) and Assignments (A). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 40 marks. A minimum of two assignments are given with a combination of two components among 1) Solving innovative problems 2) Seminar/new developments in the related course 3) Laboratory/field work 4) Minor project. Total CIE (Q+T+A) is 20+40+40=100 Marks

Scheme of Semester End Examination (SEE) for 100 marks
The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Course Code	:	21EC44	**SIGNALS & SYSTEMS (Theory and Practice)**	CIE Marks	:	100+50 M
Credits L-T-P	:	3:00:01	*Common to EC/EI*	SEE Marks	:	100+50 M
Hours	:	45L+30P		SEE Durations	:	3 Hr

UNIT - I	**09 Hrs**
Introduction to Signals and Systems: Definition of Signals, Types and Classification of Signals with examples, Basic Operations on Signals, definition of Systems, Properties of Systems, System Viewed as Interconnection of Operations. Conversion of analog to digital signals.	
UNIT - II	09 Hrs
Time domain representations of Linear Time Invariant Systems: Convolution Sum, concepts of Convolution Integrals, Interconnections of LTI System, Relations between LTI Systems, Properties of LTI systems, Applications.	
UNIT - III	09 Hrs
Applications of Fourier Representations: Review of Fourier transform, Concepts of DTFS and DTFT with properties (no derivation), computation of DTFT for basic periodic and non periodic signals, Applications.	
UNIT - IV	09 Hrs
The Discrete Fourier transforms - Properties and Applications: Concept of DFT, Properties of DFT, Periodicity, Linearity and Symmetry properties, Multiplication of two DFTs, circular correlation and circular convolution. Linear filtering methods based on the DFT. Filtering of long data sequence. Efficient computation of Radix – 2 FFT Algorithms upto 4 point FFT	
UNIT - V	09 Hrs
Time and frequency domain features: Time domain features like mean, variance, correlation, skewness, energy, envelop of signal etc., Frequency domain features like dominant frequency, peak value etc, Classification of signals based on feature extraction.	

Course Outcomes:
After going through this course the student will be able to:

CO1	:	Apply the knowledge of mathematics to understand the concept of signals and systems.
CO2	:	Analyze the fundamental concepts of the both continuous & discrete signals and systems.
CO3	:	Design discrete systems to meet specific requirement for signal processing applications.
CO4	:	Conduct experiments to validate the functionality of discrete systems using simulation tool.

Reference Books:

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

Practical's: Signal processing lab

1. Generation of the following discrete signals using MATLAB. (i) unit step (ii) unit impulse (iii) unit ramp (iv) Sinc (v) Gaussian Perform basic operations: time shifting, time scaling and time reversal for the above signals and plot.
2. Write a MATLAB program to FT of basic signals. Also plot its magnitude and phase spectrum. 3. Write a MATLAB program for calculating DFT and IDFT discrete time sequences using analytical calculation and inbuilt function.
4. Write a Python program for linear and circular convolution of two discrete time sequences. Plot all the sequences and verify the result by analytical calculation. 5. Write a Python program for circular correlation of two discrete time sequences. Plot all the sequences and verify the result by analytical calculation. 6. Write a python code to extract features in time domain for any signal
7. Write a python code to extract features in frequency domain for any signal
8. Develop a Simulink model to demonstrate Amplitude modulation and Demodulation.
9. Write a python Code to classify two signals using various features.
10. Demonstrate of any real time applications using microcontroller.

Scheme of Continuous Internal Evaluation (CIE)

Theory (100 Marks) CIE is executed by way of Quizzes (Q), Tests (T) and Assignments (A). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 40 marks. A minimum of two assignments are given with a combination of two components among 1) Solving innovative problems 2) Seminar/new developments in the related course 3) Laboratory/field work 4) Minor project. Total CIE (Q+T+A) is 20+40+40=100 Marks

Scheme of Semester End Examination (SEE) for 100 marks

The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Course Code	:	21EC45	**ELECTROMAGNETIC FIELDS AND APPLICATIONS**	CIE Marks	:	100
Credits L-T-P	:	3:0:0		SEE Marks	:	100
Hours	:	42L		SEE Durations	:	3 Hr

UNIT - I	**09 Hrs**
Review of Vector Calculus and Columb's Law. **Electrostatic fields**: Gauss's Law Flux, Flux density, Gauss's Law, Divergence Theorem(qualitative treatment), Application of Gauss's Law (Field due to Continuous Line Charge, Sheet Charge, Metal Sphere, Spherical shell), : Electric Potential, Relation between E and V, Applications (Field and potential due to Line charge distribution, Surface charge distribution-sheet), Poisson's and Laplace's Equations, Applications of Laplace's and Poisson's Equations (Different capacitors)	
UNIT - II	09 Hrs
Review of Biot -Savart Law. **Magnetics**: Ampere's Circuital Law, Applications (Infinite line current, sheet current, coaxial transmission line), Stroke's theorem (qualitative treatment), Solenoid, Magnetic potentials, Scalar Magnetic Potentials, Vector Magnetic Potentials, Poisson's and Laplace's Equations in Magnetics, Illustrative examples.	
UNIT - III	08 Hrs
Time Varying Fields: Introduction, Faraday's Law, Transformer and Motional EMFs, Displacement Current, Maxwell's Equations in Final Forms, Time-Varying Potentials, Time-Harmonic Fields, Illustrative examples Boundary Valued Problem in Electrostatics (dielectric-dielectric, dielectric-conductor), Magnetics, In time varying fields, Illustrative examples	
UNIT - IV	09 Hrs
Transmission lines: Lumped-Element Model, Transmission-Line Equations, Wave Propagation on a Transmission Line, Voltage Reflection Coefficient, Standing Waves, Wave Impedance of the Lossless Line, Short-Circuited Line, Open-Circuited Line, Power Flow on a Lossless Transmission Line, Instantaneous Power, Time-Average Power Illustrative examples.	
UNIT - V	08 Hrs
The Smith Chart: Wave Impedance, SWR, Voltage Maxima and Minima, Impedance Matching, Lumped-Element Matching, Single-Stub Matching, Problems **Plane Wave Propagation**: 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.	

Course Outcomes:
After going through this course the student will be able to:

CO1	:	Explain fundamental laws governing electromagnetic fields and evaluate the physical quantities of electromagnetic fields (Field intensity, Flux density etc.), in different media using the fundamental laws.
CO2	:	Determine the electromagnetic fields exerted on charged particles, current elements, working principle of various electric and electromagnetic energy conversion devices and transmission lines.
CO3	:	Design electromagnetic energy storage devices like capacitor, inductor which are frequently used in electrical systems and power transfer in Transmission lines.
CO4	:	Deduce and justify the concepts of electromagnetic waves, means of transporting energy or information, in the form of radio waves, TV signals, radar beams, light rays and transmission lines.

Reference Books:

1. Principles Of Electromagnetics, Matthew N O Sadiku Oxford University Press, 6th Edition, 2007, ISBN-13: 978-0199461851
2. Engineering Electromagnetics, William H. Hayt Jr. and John A. Buck, Tata McGraw Hill, 6th Edition, 2001, ISBN: 978-0071089012
3. Introduction to Electromagnetic Engineering, Roger E. Harrington, Dover Books on Electrical Engineering, 2003, ISBN-13: 978-1580539395
4. Fundamentals of Applied Electromagnetics, Fawwaz Ulaby, Umberto Ravaioli, Pearson Education Limited 7th Edition ISBN-13: 978-1292082448

Scheme of Continuous Internal Evaluation (CIE)
Theory (100 Marks) CIE is executed by way of Quizzes (Q), Tests (T) and Assignments (A). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 40 marks. A minimum of two assignments are given with a combination of two components among 1) Solving innovative problems 2) Seminar/new developments in the related course 3) Laboratory/field work 4) Minor project. Total CIE (Q+T+A) is 20+40+40=100 Marks

Scheme of Semester End Examination (SEE) for 100 marks
The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Course Code	:	21DCS47	**Bridge Course: C Programming**	CIE Marks	:	50 Marks
Credits L-T-P	:	2:00:00	*(Common to all Branches)*	SEE Marks	:	****
Hours	:	30L		SEE Durations	:	2 Hours

UNIT - I	08 Hrs

Introduction-Perspectives
Business Domains: Programming.
Applications: Design games, GUI, DBMS, Embedded Systems, Compilers and Operating Systems.
Introduction to Computer Concepts: Introduction to Computer Hardware, Software and its Types. Introduction to C programming: Programming paradigms, Basic structure of C program, Process of compiling and running a C program, Features of C language, Character set, C tokens, Keywords and Identifiers, Constants, Variables, Data types, Pre-processor directives. Handling Input and Output operations and operators: Formatted input/output functions, Unformatted input/output functions with programming examples using all functions.

UNIT - II	10 Hrs

Operators: Introduction to operator set, Arithmetic operators, Relational operators, Logical Operators, Assignment operators, Increment and Decrement operators, Conditional operators, Bit-wise operators, Special operators. **Expressions**: Arithmetic expressions, evaluation of expressions, Precedence of arithmetic operators, Type conversion in expressions, Operator precedence and associativity.
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.

UNIT - III	12 Hrs

Programming Constructs: Decision making and looping: The 'for','while','do-while' statements with examples, Jumps in loops. Arrays: Introduction to Arrays, Types of arrays, Declaration arrays, Initializing dimensional arrays (One Dimensional and Multidimensional Array) with examples.
String Operations: Introduction, Declaration and Initializing String Variables using arrays, String operations and functions with examples. Functions: Need for Functions, Types of functions (User Defined and Built –In), working with functions, Definition, declaration and its scope. Pointers: Introduction, Benefits of using pointers, Declaration and Initialization of pointers, Obtaining a value of a variable.

Course Outcomes:
After going through this course the student will be able to:

CO1	:	Apply logical skills to solve the engineering problems using C programming constructs.
CO2	:	Evaluate the appropriate method/data structure required in C programming to develop solutions by investigating the problem.
CO3	:	Design a sustainable solution using C programming with societal and environmental concern by engaging in lifelong learning for emerging technology
CO4	:	Demonstrate programming skills to solve inter-disciplinary problems using modern tools effectively by exhibiting team work through oral presentation and written reports.

Reference Books:

1. Programming in C, P. Dey, M. Ghosh, 2011, 2nd Edition, Oxford University press, ISBN (13): 9780198065289.
2. Algorithmic Problem Solving, Roland Backhouse, 2011, Wiley, ISBN: 978-0-470-68453-5
3. The C Programming Language, Kernighan B.W and Dennis M. Ritchie, 2015, 2nd Edition, Prentice Hall, ISBN (13): 9780131103627.
4. Turbo C: The Complete Reference, H. Schildt, 2000, 4th Edition, Mcgraw Hill Education, ISBN-13: 9780070411838.
5. Rasberry pi: https://www.raspberrypi.org/documentation/
6. Nvidia: https://www.nvidia.com/en-us/
7. Ardunio: https://www.arduino.cc/en/Tutorial/BuiltInExamples
8. Scratch software: https://scratch.mit.edu/

PRACTICE PROGRAMS:Implement the following programs using cc/gcc compiler
1. Develop a C program to compute the roots of the equation ax2 + bx + c = 0. 2. Develop a C program that reads N integer numbers and arrange them in ascending or descending order using selection sort and bubble sort technique.
3. Develop a C program for Matrix multiplication.
4. Develop a C program to search an element using Binary search and linear search techniques.
5. Using functions develop a C program to perform the following tasks by parameter passing to read a string from the user and print appropriate message for palindrome or not palindrome.
6. Develop a C program to compute average marks of 'n' students (Name, Roll_No, Test Marks) and search a particular record based on 'Roll_No'.
7. Develop a C program using pointers to function to find given two strings are equal or not.
8. Develop a C program using recursion, to determine GCD , LCM of two numbers and to perform binary to decimal conversion.

Scheme of Continuous Internal Evaluation (CIE)
Theory (100 Marks) CIE is executed by way of Quizzes (Q), Tests (T) and Assignments (A). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. Faculty may adopt innovative methods for conducting quizzes effectively. Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 40 marks. A minimum of two assignments are given with a combination of two components among 1) Solving innovative problems 2) Seminar/new developments in the related course 3) Laboratory/field work 4) Minor project. Total CIE (Q+T+A) is 20+40+40=100 Marks

Scheme of Semester End Examination (SEE) for 100 marks
The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one full question from each unit.

Course Code	:	21HSU48	Universal Human Values 2	CIE Marks	:	50
Credits L-T-P	:	1:00:01	*(Theory & Practical)*	SEE Marks	:	50
Hours	:	28L+14P		SEE Durations	:	2 Hours

UNIT - I — **05 Hrs**

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education: Purpose and motivation for the course, recapitulation from Universal Human Values-I, Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfil the above human aspirations: understanding and living in harmony at various levels. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

UNIT - II — **06 Hrs**

Understanding Harmony in the Human Being - Harmony in Myself!: Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - happiness and physical facility, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Health. Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

UNIT - III — **06 Hrs**

Understanding Harmony in the Family and Society- Harmony in Human Human Relationship: Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship, Understanding the meaning of Trust; Difference between intention and competence, Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family. Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

UNIT - IV — **05 Hrs**

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence: Understanding the harmony in the Nature, Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self-regulation in nature, Understanding Existence as Co-existence of mutually interacting units in all pervasive space, Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

UNIT - V — **06 Hrs**

Implications of the above Holistic Understanding of Harmony on Professional Ethics, Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations, Sum up. Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.

Course Outcomes:
After going through this course the student will be able to:

CO1	:	By the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions,
CO2	:	While keeping human relationships and human nature in mind. They would have better critical ability.
CO3	:	They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
CO4	:	It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction

Reference Books:

1.Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.

2.Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004

3.The Story of Stuff (Book).

4.The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi

5.Small is Beautiful - E. F Schumacher.

6.Slow is Beautiful - Cecile Andrews.

ASSESSMENT AND EVALUATION PATTERN

This is a compulsory credit course. The assessment is to provide a fair state of development of the student, so participation in classroom discussions, self-assessment, peer assessment etc. will be used in evaluation. Example: Assessment by faculty mentor: 10 marks Self-assessment: 10 marks Assessment by peers: 10 marks Socially relevant project/Group Activities/Assignments: 20 marks Semester End Examination: 50 marks. The overall pass percentage is 40%. In case the student fails, he/she must repeat the course

Course Code	:	21EC46	DESIGN THINKING LAB	CIE Marks	:	50
Credits L-T-P	:	0:00:02	*(Practical)*	SEE Marks	:	50
Duration	:	3 Weeks		SEE Durations	:	2 Hours

1.Students are advised to form a heterogenous Groups consisting of 4 students in each group
2. Each group has to select a one of the following themes identified by the department
3.A Mentor allotment for every group to monitor the progress

A. **Within the respective department at RVCE (Inhouse)** Departments may offer internship opportunities to the students through the available tools so that the students come out with the solutions to the relevant societal problems that could be completed within THREE WEEKS.

B. **At RVCE Center of Excellence/Competence**

RVCE hosts around 16 CENTER OP EIXCELLENCE in various domains and around 05 CENTER OP COMPETENCE. The details of these could be obtained by visiting the website https:/ /rvce.edu.in / rvce-center-excellence. Each center would be providing the students relevant training/internship that could be completed in three weeks.

C. **At Intern Shala**

Intern Shala is India's no.1 internship and training platform with 40000+ paid internships in Engineering. Students can opt any internship for the duration of three weeks by enrolling on to the platform through https: / /internsha1a.com

D. **At Engineering Colleges nearby their hometown**

Students who are residing out of Bangalore, should take permission from the nearing Engineering College of their hometown to do the internship. The nearby college should agree to give the certificate and the letter/email stating the name of the student along with the title of the internship held with the duration of the internship in their official letter head.

E**. At Industry or Research Organizations**

Students can opt for interning at the industry or research organizations like BEL, DRDO, ISRO, BHEL, etc.. through personal contacts. However, the institute/industry should provide the letter of acceptance through hard copy/email with clear mention of the title of the work assigned along with the duration and the name of the student.

Procedures for the Internship:

1. Request letter/Email from the office of respective departments should go to Places where internships are intended to be carried out with a clear mention of the duration of Three Weeks. Colleges/Industry/ CoEs/CoCs will confirm the training slots and the number of seats allotted for the internship via confirmation letter/ Email.
2. Students should submit a synopsis of the proposed work to be done during internship program. Internship synopsis should be assessed or evaluated by the concerned Colleges/Industry/CoEs/CoC. Students on joining internship at the concerned Colleges/Industry/ CoEs/CoCs submit the Daily log of student's dairy from the joining date.
3. Students will submit the digital poster of the training module/project after completion of internship.
4. Training certificate to be obtained from industry.

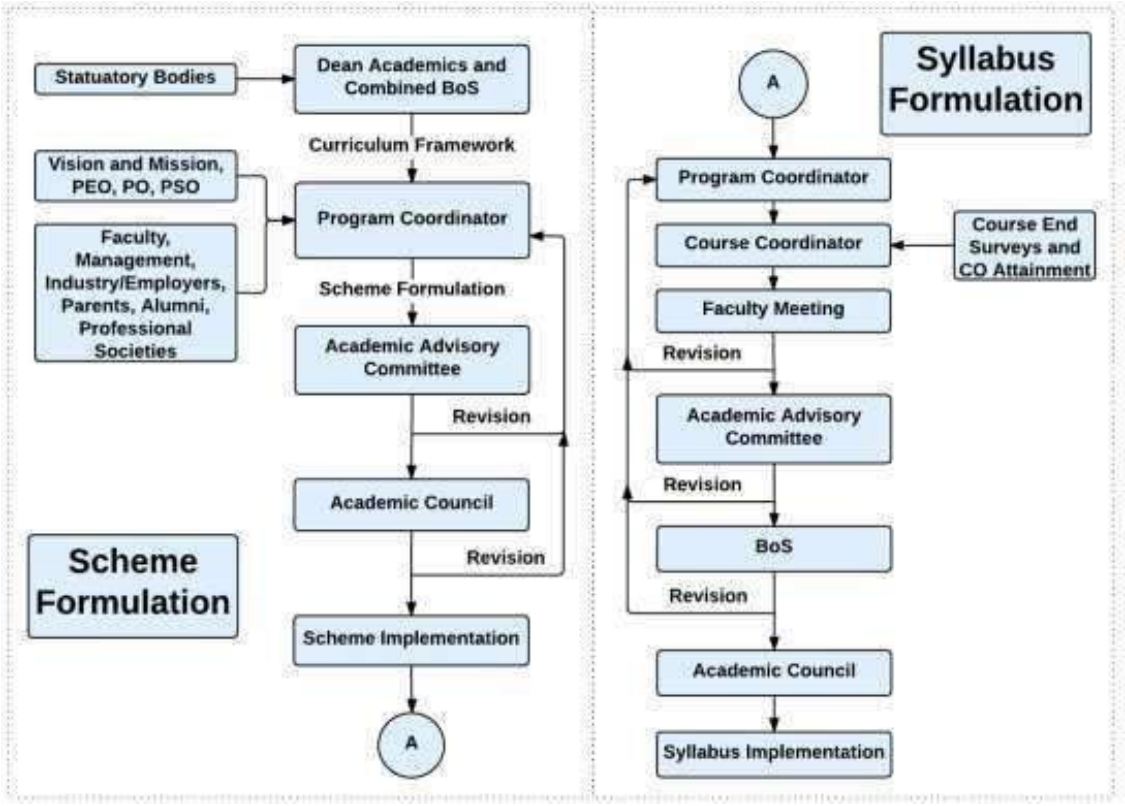
Phase of Evaluation:

Phase 1:		**Empathize and define:** Present detailed empathy covering survey from end user, market, manufacturer, designer, etc to arrive at a single point of view for the problem statement considering the issues of the local environment. The survey should be recorded in the form of google forms/audio/video recording, etc.
Phase II:		**Ideate and Internal Pretotype:** Ideate and obtain a feasible methodology to develop pretotype/prototype to solve the problem statement.
Phase III:		**Pretotype demonstration and its outcomes:** Internal testing of pretotype/prototype for the problem defined along with obtained outcomes and documentation. Prototype/pretotype will be in the form of hardware module/mobile app/software development.

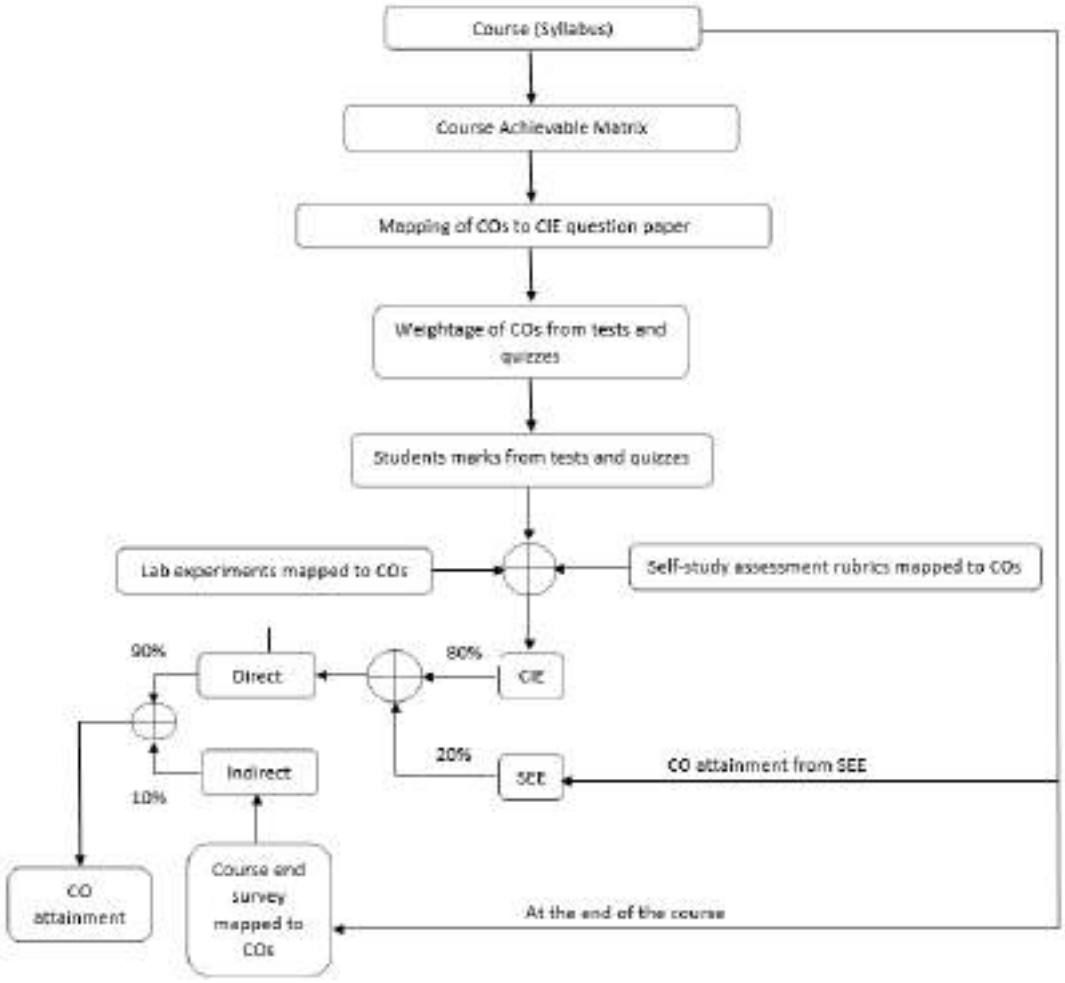
Course Outcomes:
After going through this course the student will be able to:

CO1	:	Interpret the process of Design Thinking to solve real world problems from the end user view point.
CO2	:	Apply design thinking tools to make decisions and attain a feasible solution.
CO3	:	Identify and solve a Capstone project with sustainable goals using Design Thinking.
CO4	:	Develop a pretotype and optimize it further through demonstrations.

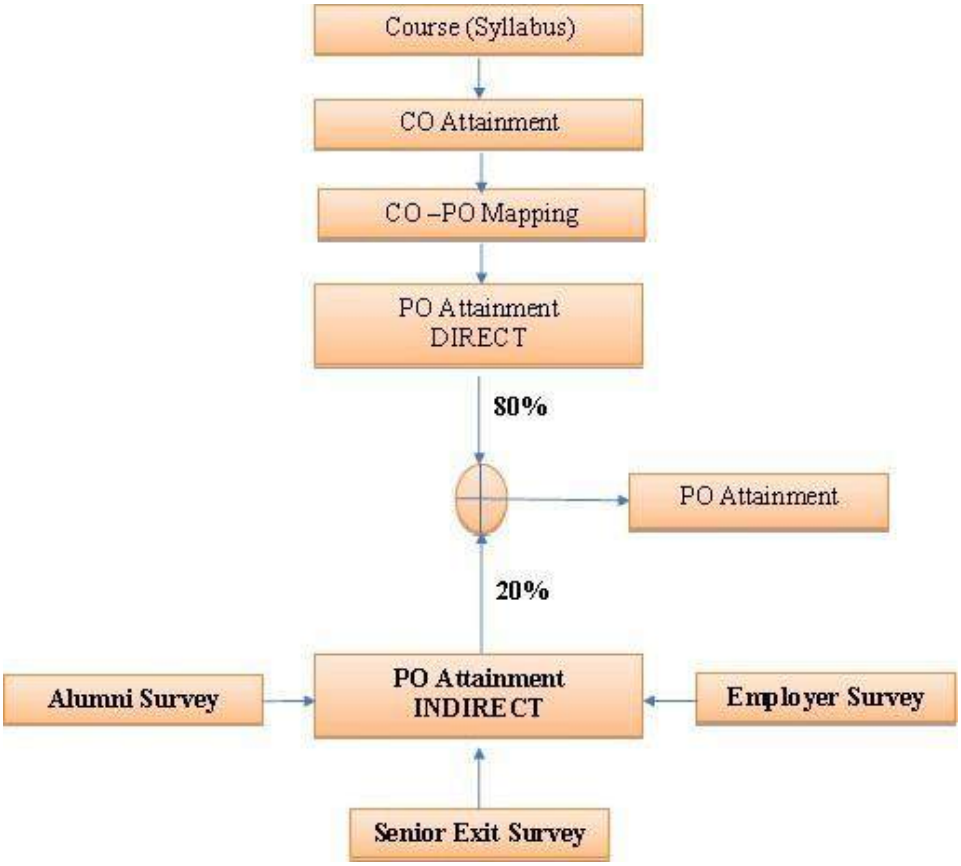
Curriculum Design Process



Final Course Outcomes(COs) Attainment Process



Program Outcomes (POs) Attainment Process



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 the 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 the 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.