RV COLLEGE OF ENGINEERING®

(Autonomous Institution Affiliated to VTU, Belagavi)
R.V. Vidyaniketan Post, Mysore Road
Bengaluru – 560 059

Bachelor of Engineering (B.E.)
Scheme and Syllabus of III & IV Semesters

2018 SCHEME

ELECTRONICS & COMMUNICATION ENGINEERING

VISION

Leadership in Quality Technical Education, Interdisciplinary Research & Innovation, with a Focus on Sustainable and Inclusive Technology

MISSION

1. To deliver outcome based Quality education, emphasizing on experiential learning with the state of the art infrastructure.
2. To create a conducive environment for interdisciplinary research and innovation.
3. To develop professionals through holistic education focusing on individual growth, discipline, integrity, ethics and social sensitivity.
4. To nurture industry-institution collaboration leading to competency enhancement and entrepreneurship.
5. To focus on technologies that are sustainable and inclusive, benefiting all sections of the society.

QUALITY POLICY

Achieving Excellence in Techni-cal Education, Research and Consulting through an Outcome Based Curriculum focusing on Continuous Improvement and Innovation by Benchmarking against the global Best Practices.

CORE VALUES

Professionalism, Commitment, Integrity, Team Work, Innovation

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2018 SCHEME

DEPARTMENT OF
ELECTRONICS & COMMUNICATION ENGINEERING

DEPARTMENT VISION

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

DEPARTMENT MISSION

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

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

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

PEO2. To design and develop interdisciplinary and innovative systems.

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

PROGRAM SPECIFIC OUTCOMES (PSOS)

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

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

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.	CE	Professional Core Elective
6.	GE	Global Elective
7.	HSS	Humanities and Social Sciences
8.	CV	Civil Engineering
9.	ME	Mechanical Engineering
10.	EE	Electrical & Electronics Engineering
11.	EC	Electronics & Communication Engineering
12.	IM	Industrial Engineering & Management
13.	EI	Electronics & Instrumentation Engineering
14.	CH	Chemical Engineering
15.	CS	Computer Science & Engineering
16.	ET	Electronics & Telecommunication Engineering
17.	IS	Information Science & Engineering
18.	BT	Biotechnology
19.	AS	Aerospace Engineering
20.	PH	Physics
21.	CH	Chemistry
22.	MA	Mathematics

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ELECTRONICS AND COMMUNICATION ENGINEERING

THIRD SEMESTER CREDIT SCHEME							
Sl. No.	**Course Code**	**Course Title**	**BoS**	**Credit Allocation**			**Total Credits**
				L	**T**	**P**	
1.	18MA31B*	Discrete and Integral Transforms (Common to EC, EE, EI & ET)	MA	4	1	0	**5**
2.	18BT32A**	Environmental Technology (Common to EE, EC, EI, CS, ET & IS)	BT	2	0	0	**2**
3.	18EC33	Analog Microelectronic Circuits	EC	4	0	1	**5**
4.	18EC34	Analysis & Design of Digital Circuits (Common to EC, EE, EI & ET)	EC	4	0	1	**5**
5.	18ET35	Principles of Electromagnetic Fields (Common to EC, EE & ET)	ET	3	0	0	**3**
6.	18EE36	Network Analysis (Common to EE, EC & ET)	EE	3	0	0	**3**
7.	18DMA37***	Bridge Course: Mathematics	MA	2	0	0	**0**
8.	18HS38 #	Kannada Course	HSS	1	0	0	**1**
Total Number of Credits				**21**	**1**	**2**	**24**
Total number of Hours/Week				**21+2*** **	**2**	**5**	

*Engineering Mathematics - III

Sl. No	COURSE TITLE	COURSE CODE	PROGRAMMES
1.	Linear Algebra, Laplace Transform and Combinatorics	18MA31A	CS & IS
2.	Discrete and Integral Transforms	18MA31B	EC, EE, EI & ET
3.	Engineering Mathematics –III	18MA31C	AS, BT, CH, CV, IM & ME

**

Sl. No	COURSE TITLE	COURSE CODE	PROGRAMMES
1.	Environmental Technology	18BT32A	EE, EC, EI, CS, ET & IS
2.	Biology for Engineers	18BT32B	BT & AS
3.	Engineering Materials	18ME32	ME, CH & IM

*** Bridge Course: Audit course for lateral entry diploma students

Sl. No	COURSE TITLE	COURSE CODE	PROGRAMS
1	Bridge Course Mathematics	18DMA37	AS, BT,CH, CV, EC, EE, EI, IM, ME &ET
2	Bridge Course C Programming	18DCS37	CS & IS

There are two text books prescribed by VTU for the Kannada Course:
1. Samskruthika Kannada **(AADALITHA KANNADA)**;
2. Balake Kannada **(VYAVAHARIKA KANNADA)**;

The first text book is prescribed for the students who know Kannada to speak, read and write **(KARNATAKA STUDENTS)**. The second text book is for students who do not understand the Kannada language **(NON-KARNATAKA STUDENTS)**

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ELECTRONICS AND COMMUNICATION ENGINEERING

FOURTH SEMESTER CREDIT SCHEME							
Sl. No	**Course Code**	**Course Title**	**BOS**	**Credit Allocation**			**Total Credits**
				L	**T**	**P**	
1.	18MA41B*	Linear Algebra, Statistics and Probability Theory (Common to EC, EE, EI & ET)	MA	4	1	0	**5**
2.	18EC42**	Engineering Materials (Common to EC, EE, EI & ET)	EC	2	0	0	**2**
3.	18EC43	Advanced Digital System Design using Verilog HDL	EC	3	0	1	**4**
4.	18EI44	Microprocessor & Microcontroller (Common to EI, EC, EE & ET)	EI	3	0	1	**4**
5.	18ET45	Signals and Systems (Common to ET, EC, EE & EI)	ET	3	1	0	**4**
6.	18EC46	Analog Integrated Circuits Design	EC	3	0	0	**3**
7.	18EC47	Design Thinking lab	EC	0	0	2	**2**
8.	18DCS48 ***	Bridge Course: C Programming	CS	2	0	0	**0**
9.	18HS49	Professional Practice-I Communication Skills (Common to all Programmes)	HSS	0	0	1	**1**
Total Number of Credits				**18**	**2**	**5**	**25**
Total number of Hours/Week				**18+2*** **	**4**	**10+1**	

* ENGINEERING MATHEMATICS – IV

Sl. No	COURSE TITLE	COURSE CODE	PROGRAMMES
1.	Graph Theory, Statistics and Probability Theory	18MA41A	CS & IS
2.	Linear Algebra, Statistics and Probability Theory	18MA41B	EC, EE, EI & ET
3.	Engineering Mathematics –IV	18MA41C	AS, CH, CV & ME

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Sl. No	COURSE TITLE	COURSE CODE	PROGRAMMES
1.	Engineering Materials	18EC42	EC, EE, EI & ET
2.	Biology for Engineers	18BT42B	CS & IS
3.	Environmental Technology	18BT42A	CV, ME, IM, CH, BT & AS

*** Bridge Course: Audit course for lateral entry diploma students

Sl. No	COURSE TITLE	COURSE CODE	PROGRAMMES
1	Bridge Course Mathematics	18DMA48	CS & IS
2	Bridge Course C Programming	18DCS48	AS, BT, CH,CV,EC, EE,EI,IM, ME & ET

Note: Internship to be taken up during the vacation period after the 4th semester

Semester: III						
DISCRETE AND INTEGRAL TRANSFORMS (Theory) (Common to EC, EE, EI & ET)						
Course Code	**:**	18MA31B		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	4:1:0		**SEE**	**:**	100 Marks
Total Hours	**:**	52L+26T		**SEE Duration**	**:**	03 Hours

Course Learning Objectives: The students will be able to

1	Understand the existence and basic concepts of Laplace, Fourier and z - transforms.
2	Demonstrate the concepts of Laplace transform to solve ordinary differential equations.
3	Analyze the concept of periodic phenomena and develop Fourier series.
4	Solve difference equations; interpret the physical significance of solutions.
5	Use mathematical IT tools to analyze and visualize the above concepts.

Unit-I	**10 Hrs**
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, t - shift property. Relevant MATLAB commands to develop additional insight into the concepts.	
Unit – II	**11 Hrs**
Inverse Laplace Transform: Definition, properties, evaluation using different methods. Convolution theorem (without proof), problems. Application to solve ordinary linear differential equations. Relevant MATLAB commands to develop additional insight into the concepts.	
Unit –III	**11 Hrs**
Fourier Series: Introduction, periodic function, even and odd functions. Dirichlet's conditions, Euler's formulae for Fourier series, complex Fourier series, problems on time periodic signals (square wave, half wave rectifier, saw-tooth wave and triangular wave), Fourier sine series, Fourier cosine series. Relevant MATLAB commands to develop Fouries series of functions.	
Unit –IV	**10 Hrs**
Fourier Transform: Fourier integral theorem, complex Fourier transform, Fourier sine transform, Fourier cosine transform, properties - linearity, scaling, time-shift and modulation. Convolution theorem (without proof), problems. Parseval's identity. Relevant MATLAB commands to develop additional insight into the concepts.	
Unit –V	**10 Hrs**
Z-Transform: Introduction, z - transform of standard functions, Region of convergence, properties - linearity, scaling, shifting theorem, initial and final value theorems. Inverse z - transform using power series and partial fraction expansions, convolution theorem (without proof), problems. Application to solve difference equations arising in communication and control systems. Relevant MATLAB commands to develop additional insight into the concepts.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand the significance of fundamental concepts of transforms, inverse transforms and periodic phenomena.
CO2:	Demonstrate the properties of transforms and inverse transforms, graphical representation of various wave forms.
CO3:	Evaluate transforms of special functions, develop Fourier series of various type of functions.
CO4:	Apply transform techniques to solve differential equations and difference equations occurring in engineering problems.

Reference Books	
1	Higher Engineering Mathematics, B.S. Grewal, 44th Edition, 2015, Khanna Publishers, ISBN: 978- 81-933284-9-1.
2	A Text Book of Engineering Mathematics, N.P. Bali & Manish Goyal, 7th Edition, 2010, Lakshmi Publications, ISBN: 978-81-7008-992-6.
3	Advanced Engineering Mathematics, Erwin Kreyszig, 9th Edition, 2007, John Wiley & Sons, ISBN: 978-81-265-3135-6.
4	Signals and systems, Simon Haykins and Barry Van Veen, 2nd Edition, 2003, John Wiley & Sons, ISBN: 9971-51-239-4.

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

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

Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.

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

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

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

High-3: Medium-2: Low-1

Semester: III						
ENIVIRONMENTAL TECHNOLOGY (Theory) (Common to EC,EE,ET & EI)						
Course Code	**:**	18BT32A		**CIE**	**:**	50
Credits: L:T:P	**:**	2:0:0		**SEE**	**:**	50
Total Hours	**:**	26L		**SEE Duration**	**:**	02 Hours

Course Learning Objectives: The students will be able to

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

Unit-I	**05 Hrs**
Introduction: Environment - Components of environment, Ecosystem. Impact of anthropogenic activities on environment (agriculture, mining and transportation), Environmental education, Environmental acts & regulations, role of non-governmental organizations (NGOs), EMS: ISO 14000, Environmental Impact Assessment. Environmental auditing.	
Unit – II	**06 Hrs**
Environmental pollution: 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**: Water conservation techniques, water borne diseases & water induced diseases, arsenic & fluoride problems in drinking water and ground water contamination, advanced waste water treatment techniques.	
Unit –III	**06 Hrs**
Waste management, Solid waste management, e waste management & biomedical waste management – sources, characteristics & disposal methods. Concepts of Reduce, Reuse and Recycling of the wastes. **Energy** – Different types of energy, conventional sources & non-conventional sources of energy, solar energy, hydro electric energy, wind energy, Nuclear energy, Biomass & Biogas Fossil Fuels, Hydrogen as an alternative energy.	
Unit –IV	**05 Hrs**
Environmental design: Principles of Environmental design, Green buildings, green materials, Leadership in Energy and Environmental Design (LEED), soilless cultivation (hydroponics), organic farming, use of biofuels, carbon credits, carbon foot prints, Opportunities for green technology markets, carbon sequestration.	
Unit –V	**04 Hrs**
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 of Biomass conversion, e waste.	

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

Reference Books	
1	Introduction to environmental engineering and science, Gilbert, M.M. Pearson Education. India: 3rd Edition (2015). ISBN: 9332549761, ISBN-13: 978-9332549760.
2	Environmental Engineering, Howard S. Peavy, Donald R. Rowe and George Tchobanoglous. McGraw Hill Education, First edition (1 July 2017). ISBN-10**:** 9351340260, ISBN-13**:** 978-9351340263
3	Environmental Science, G. Tyler Miller (Author), Scott Spoolman (Author), – 15th Edition, Publisher: Brooks Cole, ISBN-13: 978-1305090446 ISBN-10: 130509044
4	Environment Management, Vijay Kulkarni and T. V. Ramachandra 2009 TERI Press; ISBN: 8179931846, 9788179931844

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

CIE is executed by way of quizzes (Q), tests (T) and Experiential Learning (EL). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 15 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 30 marks each and the sum of the marks scored from three tests is reduced to 25. The marks component for experiential learning is 20.

Total CIE is 15(Q) +30(T) +05(EL) =50 Marks.

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

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

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

High-3: Medium-2 : Low-1

Semester: III						
ANALOG MICROELECTRONIC CIRCUITS (Theory & Practice)						
Course Code	**:**	18EC33		**CIE**	**:**	100+50 Marks
Credits: L:T:P	**:**	4:0:1		**SEE**	**:**	100+50 Marks
Total Hours	**:**	50L + 33P		**SEE Duration**	**:**	03+03 Hours

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

Unit-I	**10 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, MOSFET as an amplifier – CS stage, CS stage with degeneration, CG and CD stages, discrete amplifier design problems.	
Unit – II	**10 Hrs**
Bipolar Junction Transistors (BJTs): BJT circuits at dc, Biasing in discrete BJT amplifier circuits – classic discrete circuit bias arrangement, two power supply version, collector to base bias, biasing using constant current source, small signal operation and models – re model, hybrid π model, collector current and transconductance, early effect, BJT as an amplifier – CE stage, CE stage with degeneration, CC stage, discrete amplifier design problems, Darlington pair.	
Unit –III	**10 Hrs**
High frequency model of MOSFET and BJT : MOSFET / BJT internal capacitors and high frequency model, frequency response of CS/ CE amplifier, **Current sources and current mirrors :** Basic current mirror, bipolar current mirror with base current compensation, Wilson current mirror using BJT, Wilson MOS mirror, Widlar current source, Cascode current mirror, design problems	
Unit –IV	**10 Hrs**
Operational Amplifiers: Effect of finite open loop gain, finite bandwidth, large signal operation of opamps - slew rate, output voltage saturation, output current limits, **Linear Opamp circuits** – Non inverting and inverting amplifiers, Difference and Instrumentation amplifiers. **Nonlinear Opamp circuits** - Schmitt trigger**,** Sine wave oscillators – Opamp RC oscillators - Phase shift and Wien bridge oscillator, LC tuned oscillators and crystal oscillators, precision rectifiers.	
Unit –V	**10 Hrs**
Feedback Amplifiers and Large Signal Amplifiers: Properties of negative feedback, the four basic feedback topologies, practical circuits of the two types of feedback with opamps (Voltage series and Voltage shunt feedbacks), classification of output stages, class A, class AB, class B circuits, thermal resistance and heat sinking of power transistors.	

Practical's:

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

Course Outcomes: After completing the course, the students will be able to	
CO1:	Explore the principles associated in designing amplifiers, oscillators and rectifiers.
CO2:	Analyse discrete analog circuits based on BJTs, MOSFETS and Opamps.
CO3:	Evaluate the performance parameters of discrete analog circuits based on standard specifications.
CO4:	Design discrete analog circuits based on BJTs, MOSFETS and Opamps.

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

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

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

Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.

Scheme of Continuous Internal Evaluation (CIE); Practical Test for 50 Marks

The Laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average marks (AM) over number of weeks is considered for 30 marks. At the end of the semester a test (T) is conducted for 10 marks. The students are encouraged to implement additional innovative experiments (IE) in the lab and are rewarded for 10 marks. Total marks for the laboratory is 50.

Total CIE is 30(AM) +10 (T) +10 (IE) =50 Marks.

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

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

Scheme of Semester End Examination (SEE); Practical Exam for 50 Marks

SEE for the practical courses will be based on experiment conduction with proper results, is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

Semester End Evaluation (SEE): Theory (100 Marks) + Practical (50 Marks) = Total 150 Marks

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

High-3: Medium-2 : Low-1

Semester: III						
ANALYSIS & DESIGN OF DIGITAL CIRCUITS (Theory & Practice) (Common to EC, EE, EI & ET)						
Course Code	**:**	18EC34		**CIE**	**:**	100+50 Marks
Credits: L:T:P	**:**	4:0:1		**SEE**	**:**	100+50 Marks
Total Hours	**:**	52L + 33P		**SEE Duration**	**:**	03+03 Hours

Course Learning Objectives: The students will be able to

1	Understand various types of logic families; explain the concept logic functions, SOP, POS and canonical expressions, simplification techniques.
2	Design and use standard combinational circuit building blocks: multiplexers, demultiplexers, binary decoders and encoders, decoders, Arithmetic Circuits, code converters
3	Implement different sequential circuits using various flip flops to realize state machines for given timing behavior.
4	Analyze processor organization and design arithmetic & logic unit by using combinational & sequential circuits.

Unit-I	**10 Hrs**
Digital Integrated Circuits: Digital IC Logic Families: Transistor-Transistor Logic (Totem pole TTL), Emitter Coupled Logic (ECL), Complementary MOS (CMOS) Logic. **Characteristics and Performance Parameters of CMOS Inverter**: Introduction, Propagation delay, Sourcing, Sinking, Fan-in, Fan-out, V_{IH}, V_{OH}, V_{IL}, V_{OL} and corresponding currents, Noise margin, Power dissipation, power consumption, power-delay product as a figure of merit. **Simplification Techniques:**5-variable K-Map, Quine-McClusky Minimization, Numerical Examples.	
Unit – II	**11 Hrs**
Combinational Circuits Design and Analysis: Parallel Adder/Subtractor using IC 7483, Decoders, Encoders, Multiplexers and De-Multiplexers, Priority encoder and Magnitude comparator, Arithmetic circuits and code converters using Multiplexers and Decoders, Concepts of ripple carry and carry look ahead adders, BCD adder.	
Unit –III	**11 Hrs**
Sequential Circuits Design and Analysis-I: Introduction, Latches and Flip Flops, Triggering of Flip Flops, Flip Flop Excitation Tables, Flip-Flop conversions, Registers, Shift Registers and Various Operations, Ring counters, Johnson counters, Ripple Counters.	
Unit –IV	**10 Hrs**
Sequential Circuits Design and Analysis II: Introduction, FSM (Melay and Moore), Analysis of Clocked Sequential Circuits, State table and Reduction, Design of synchronous Counters, Programmable counters. Design with State Equations, Sequence generators (PRBS).	
Unit –V	**10 Hrs**
Design of a Processor Unit: Introduction, Processor Organization, Arithmetic Logic Unit, Design of Arithmetic Unit, Design of Logic unit, Design of Arithmetic and Logic unit, Status Register, Design of Shifter, The Complete Processor unit and op-code generation.	
Practical's: **Note**: a) Out of ten experiments, for seven experiments manual will be provided. Each of these would also include practice experiments. Last three experiments are case studies and are compulsory. b) Practice questions: Students should design the experiment in advance and practice the lab. 1. a) Realization of Binary Adder and Subtractor using universal gates and IC-7483. b) Practice Question: Design a parallel binary subtractor to get actual difference based on the	

value of Count (correction circuit).

2. a) Arithmetic circuits- Realize the given Boolean expressions using MUX/DEMUX using IC-74153, IC-74139.
   b) Practice Question: Realize FA/FS using MUX/DEMUX.
3. a) Code convertors i) Binary to Gray ii) BCD to Excess-3 using Decoder/demux.

b) Practice Question i) Binary to excess-3 using IC-7483 ii) Gray to Binary using Decoder

4. a) Design a two-bit magnitude comparator using logic gates.
   b) Drive the LED Display using IC-7447.
   c) Practice Question: Design an n-bit comparator using IC-7485(make use of cascading facility)
5. a) Design a Master JK-FF using NAND gates. Also design D-FF and T-FF using same. Observe the waveform using CRO.
   b) Practice Question: Design a Master Slave JK-FF using P-Spice simulation software and observe the waveforms.
6. a) Realization of asynchronous mod-n counter using IC-7490, IC-7493.
   b) Using IC-7495 perform SISO, SIPO, PISO, PIPO, Shift left operations.
   c) Design ring and Johnson counter using IC-7495
   b) Practice Question: Design mod-99 counter using IC-7490.
7. a) Design of synchronous 3-bit up/down counter using IC-7476/IC-74112.
   b) Design a synchronous counter to count given sequence.
   c) Using presettable counters IC-74192/193 perform mod-n counts.
   d) Practice Question: Design a synchronous 4-bit up/down counter using P-Spice simulation software and observe the waveforms.
8. Design a sequence generator using a shift register to obtain a sequence Y= 100010011010111
9. Using IC-74192/193, drive the LED display and generate a given sequence
10. Design a 2-bit ALU operation using P-Spice simulation software and observe the waveforms.

Course Outcomes: After completing the course, the students will be able to	
CO1:	Apply the knowledge of digital electronics to construct combinational and sequential sub-systems useful for digital system designs.
CO2:	Develop a solution to real-life problems based on the knowledge of digital electronics.
CO3:	Implement the engineering solutions with the help of modern engineering tools,hardware design and practices.
CO4:	Analyze and update the knowledge for obtaining sustainable solutions for technological enhancements in the field of digital electronics.

Reference Books	
1	Digital Logic and Computer Design, M. Morris Mano, Pearson Education Inc., 13th 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 Principle and Design, Donald D. Givone, Mc Graw-Hill, ISBN: 0-07-119520-3 (ISE), 2003.
5	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

Continuous Internal Evaluation (CIE); Theory (100 Marks)
CIE is executed by way of quizzes (Q), tests (T) and Experiential Learning (EL). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for experiential learning is 20.
Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.

Scheme of Continuous Internal Evaluation (CIE); Practical Test for 50 Marks
The Laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average marks (AM) over number of weeks are considered for 30 marks. At the end of the semester a test (T) is conducted for 10 marks. The students are encouraged to implement additional innovative experiments (IE) in the lab and are rewarded for 10 marks. Total marks for the laboratory is 50.
Total CIE is 30(AM) +10 (T) +10 (IE) =50 Marks.

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

Scheme of Semester End Examination (SEE); Practical Exam for 50 Marks
SEE for the practical courses will be based on experiment conduction with proper results, is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

Semester End Evaluation (SEE): Theory (100 Marks) + Practical (50 Marks) = Total 150 Marks

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

High-3: Medium-2: Low-1

Semester: III						
PRINCIPLES OF ELECTROMAGNETIC FIELDS (Theory) (Common to EC, EE & ET)						
Course Code	**:**	18ET35		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	100 Marks
Total Hours	**:**	39L		**SEE Duration**	**:**	3.00 Hours
Course Learning Objectives: The students will be able to						
1	Apply knowledge of mathematics, science, and engineering basics to the analysis and design of electrical systems involving electric and magnetic fields as well as electromagnetic waves.					
2	Interpret and apply the concepts which comes in Antenna and RF communication.					
3	Develop and design mathematical models of communication channels.					

Unit-I	**07 Hrs**
Electrostatics 1: Coulomb's law, illustrative examples, Electric Field Intensity, Applications (field due to Line charge distribution, Surface charge distribution- Sheet, Circular ring, disk), Illustrative examples. Flux, Flux density, Gauss's Law, Divergence Theorem(qualitative treatment), Application of Gauss's Law (Field due to Continuous Line Charge, Sheet Charge, Metal Sphere, Spherical shell) Illustrative examples.	
Unit – II	**09 Hrs**
Electrostatics-2: Electric Potential, Relation between E and V, Applications (Field and potential due to Line charge distribution, Surface charge distribution- sheet), Energy Density in an Electric Field, Illustrative examples. Energy Density, Boundary Conditions (dielectric-dielectric, dielectric-conductor), Poisson's and Laplace's Equations, Applications of Laplace's and Poisson's Equations (Different capacitors), Illustrative examples.	
Unit –III	**09 Hrs**
Magneto Static Fields-1: Current, Current density**,** Biot -Savart Law, Applications (Infinite linear conductor, current carrying in loop, solenoid), Magnetic Flux and Flux Density, Ampere's Circuital Law, Stroke's theorem (qualitative treatment), Applications (Infinite line current, sheet current, coaxial transmission line), Problems.	
Unit –IV	**08 Hrs**
Magneto Static Fields-2: Magnetic potentials, Magnetic energy, Magnetic Boundary Conditions, Force due to magnetic fields(Charged particle, Current element), Lorentz Force equation, Inductors. **Maxwell's Equations:** Introduction, Faraday's Law, Transformer and Motional EMFs, Displacement Current, Maxwell's Equations in Final Forms, Time-Varying Potentials, Time-Harmonic Fields, Illustrative examples	
Unit –V	**07 Hrs**
Electromagnetic Waves: Introduction, Waves in General, Wave Propagation in Lossy Dielectrics, Plane Waves in Lossless Dielectrics, Plane Waves in Free Space, Plane Waves in Good Conductors, Power and the Poynting Vector, Numericals, Reflection of a Plane Wave at Normal Incidence. Illustrative examples.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Explain fundamental laws governing electromagnetic fields and evaluate the physical quantiti es of electromagnetic fields.
CO2:	Determine the electromagnetic fields exerted on charged particles, current elements and other devices.

CO3:	Design electromagnetic energy storage devices like capacitor, inductor which are frequently used in electrical systems.
CO4:	Deduce and justify the concepts of electromagnetic waves, means of transporting energy from two different medium.

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

Continuous Internal Evaluation (CIE); Theory (100 Marks)
CIE is executed by way of quizzes (Q), tests (T) and Experiential Learning (EL). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for experiential learning is 20.
Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.

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

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

High-3: Medium-2: Low-1

Semester: III						
NETWORK ANALYSIS (Theory) (Common to EE, EC & ET)						
Course Code	**:**	18EE36		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	100 Marks
Total Hours	**:**	39L		**SEE Duration**	**:**	3.00 Hours

Course Learning Objectives:	
1	Apply knowledge of mathematics, science, and engineering to the analysis and design of electrical circuits.
2	Apply the loop & nodal analysis to solve networks and complex networks using network theorems and concept of dot convention used in practice.
3	Analyze unbalanced loads connected to balanced three-phase supply and understand the concept of neutral shift.
4	Find the time constants, initial and final values, and complete responses for RLC circuits under ac and dc excitations.

Unit-I	**08 Hrs**
Practical sources, source transformation, source shifting, Loop and Node analysis with linear dependent and independent sources for DC and AC networks. Principle of duality.	
Unit – II	**08 Hrs**
Network Theorems: Superposition, Reciprocity, Thevenin's, Norton's, Maximum Power transfer and Millman's theorems. **Dot convention:** Analysis of coupled circuits , problems on the above, series and paralle circuits.	
Unit –III	**08 Hrs**
Polyphase Circuits: Analysis of unbalanced loads connected to balanced three-phase supply, neutral shift. **Two port networks:** Z, Y, ABCD and Hybrid parameters, their inter relationship and numerical problems	
Unit –IV	**08 Hrs**
Resonance in Networks: Series and parallel resonance, Q-factor, Bandwidth. Response by varying f, L, C. **Transient Behavior and Initial Conditions :** Behavior of circuit elements under switching conditions and their representation. Evaluation of initial and final conditions in R-L, R-C and R-L-C Circuits for DC and AC excitations.	
Unit –V	**08 Hrs**
Laplace Transformation and Applications: Definition, Laplace and inverse Laplace transforms of standard functions, shifting theorem. Waveform synthesis, initial and final value theorems. Impulse function, Convolution theorem, Network functions of single port & two port networks-Driving point & transfer functions (immetence function).	

Course outcomes: On completion of the course, the student should have acquired the ability to	
CO1:	Understand the basic concepts of circuits, theorems, three phase unbalanced circuits and waveform synthesis.
CO2:	Apply the basic concepts and solve circuits with DC or AC excitation and coupled circuits using theorems and transformations
CO3:	Compare the steady state and transient response of a circuit through application of inverse transformation and shifting theorems
CO4:	Design and implement a circuit as per the given specifications and constraints.

Reference Books	
1	Network Analysis, M.E Van Valkenberg, , 3rd Edition, Reprint 2002, PHI, *ISBN*81-7808-729-42.
2	Engineering Circuit Analysis, Hayt, Kemmerly and Durbin, 6th Edition, 2002, TMH, *ISBN*-10: 0071122273.
3	Electric circuits, Joseph Edminister and Mahmood Nahvi, 3rd Edition,2001, TMH, ISBN:0074635913
4	Network Theory, K Channa Venkatesh , D Ganesh Rao, 1st Edition, Pearson education,2012, ISBN-13- 9788131732311

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

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

Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.

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

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

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

High-3: Medium-2 : Low-1

Semester: III						
BRIDGE COURSE MATHEMATICS (Common to all branches)						
Course Code	**:**	18DMA37		**CIE**	**:**	50 Marks
Credits: L:T:P	**:**	2:0:0		**SEE**	**:**	50 Marks
Audit Course				**SEE Duration**	**:**	02 Hours

Course Learning Objectives: The students will be able to

1	Understand the concept of functions of several variables, types of derivatives involved with these functions and its applications, approximate a function of single variable in terms of infinite series.
2	Acquire concepts of vector functions, scalar fields and differential calculus of vector functions in Cartesian coordinates.
3	Explore the possibility of finding approximate solutions using numerical methods in the absence of analytical solutions of various systems of equations.
4	Recognize linear differential equations, apply analytical techniques to compute solutions.
5	Gain knowledge of multiple integrals and their applications.
6	Use mathematical IT tools to analyze and visualize the above concepts.

Unit-I	**05 Hrs**
Differential Calculus: Taylor and Maclaurin series for function of single variable. 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 4^{th} order Runge-Kutta methods. Numerical integration – Simpson's $1/3^{rd}$, $3/8^{th}$ 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 completing the course, the students will be able to	
CO1:	Understand the concept of partial differentiation, double integrals, vector differentiation, solutions of higher order linear differential equations and requirement of numerical methods.
CO2:	Solve problems on total derivatives of implicit functions, Jacobians, homogeneous linear differential equations, velocity and acceleration vectors.
CO3:	Apply acquired knowledge to find infinite series expansion of functions, solution of non-homogeneous linear differential equations and numerical solution of equations.

CO4:	Evaluate triple integrals, area, volume and mass, different operations using del operator on scalar and vector point functions, numerical solution of differential equations and numerical integration.

Reference Books	
1	Higher Engineering Mathematics, Khanna Publishers, B.S. Grewal, 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	A Text Book of Engineering Mathematics, N.P. Bali & Manish Goyal, Lakshmi Publications, 7th Edition, 2010, ISBN: 978-81-31808320.
4	Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 10th Edition, 2016, ISBN: 978-0470458365.

Continuous Internal Evaluation (CIE); Theory (50 Marks)
CIE is executed by way of quizzes (Q) and tests (T**)**. A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks adding up to 20 marks. The two tests are conducted for 30 marks each and the sum of the marks scored from two tests is reduced to 30.
Total CIE is 20(Q) +30(T)=50 Marks.

Semester End Evaluation (SEE); Theory (50 Marks)
SEE for 50 marks is executed by means of an examination. The Question paper for the course consists of five main questions, one from each unit for 10 marks adding up to 50 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

Semester: III

VYAVAHARIKA KANNADA
(Common to all branches)

Course Code	**:**	18HS38		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	1:0:0		**SEE**	**:**	**50 Marks**
Total Hours	**:**	16Hrs		**CIE Duration**	**:**	**90 Minutes**

Course Learning Objectives of Vyavaharika Kannada: The students will be able to

1	Motivate students to learn Kannada language with active involvement.
2	Learn basic communication skills in Kannada language (Vyavaharika Kannada).
3	Importance of learning local language Kannada.

VYAVAHARIKA KANNADA (BALAKE Kannada)
(to those students who does not know Kannada)

Unit-I — **4Hrs**

Parichaya(Introduction):
Necessity of learning local language, Tips to learn the language with easy methods, Hints for correct and polite conversation, History of kannada language.

Unit – II — **4Hrs**

Kannada alphabtets and Pronunciation:
Kannada aksharmale, Kannada stress letters (vattakshara), Kannada Khagunitha, Pronunciation, memorisation and usage of the Kannada letters.

Unit – III — **4Hrs**

Kannada vocabulary for communication:
Singular and Plural nouns, Genders, Interrogative words, Antonyms, Inappropriate pronunciation, Number system, List of vegetables, Fractions, Menu of food items, Names of the food items, words relating to time, words relating to directions, words relating to human's feelings and emotion, Parts of the human body, words relating to relationship.

Unit –IV — **4Hrs**

Kannada Grammar in Conversations:
Nouns, Pronouns, Use of pronouns in Kannada sentences, Adjectives and its usage, Verbs, Adverbs, Conjunctions, Prepositions, Questions constructing words, Simple communicative sentences in kannada. Activities in Kannada, Vocabulory, Conversation.

Course Outcomes: After completing the course, the students will be able to

1	Usage of local language in day today affairs.
2	Construction of simple sentences according to the situation.
3	Usage of honorific words with elderly people.
4	Easy communication with everyone.

Reference Books:

1	Vyavaharika Kannada patyapusthaka, L. Thimmesh, and V. Keshavamurthy, Prasaranga Visveshvaraya University, Belgaum.
2	Kannada Kali**,** K. N. Subramanya, S. Narahari, H. G. Srinivasa Prasad, S. Ramamurthy and S. Sathyanarayana, 5th Edition, 2019, RV College of Engineering Bengaluru.
3	Spoken Kannada**,** Kannada Sahithya Parishat, Bengaluru.

ವ್ಯಾವಹಾರಿಕ ಕನ್ನಡ (Kannada Version)

ಅಧ್ಯಾಯ – I — **4Hrs**

ಸ್ಥಳೀಯ ಅಥವಾ ಪ್ರಾದೇಶಿಕ ಭಾಷಾ ಕಲಿಕೆಯ ಅವಶ್ಯಕತೆ, ಭಾಷಾ ಕಲಿಕೆಯ ಸುಲಭ ವಿಧಾನಗಳು, ಸಂಭಾಷಣೆಗಾಗಿ ಸುಲಭ ಸೂಚ್ಯಗಳು ಕನ್ನಡ ಭಾಷೆಯ ಇತಿಹಾಸ.

ಅಧ್ಯಾಯ – II	**4Hrs**

ಕನ್ನಡ ಅಕ್ಷರಮಾಲೆ ಹಾಗೂ ಉಚ್ಚಾರಣೆ:

ಕನ್ನಡ ಅಕ್ಷರಮಾಲೆ, ಒತ್ತಕ್ಷರ, ಕಾಗುಣಿತ, ಉಚ್ಚಾರಣೆ, ಸ್ವರಗಳು ಉಚ್ಚಾರಣೆ, ವ್ಯಂಜನಗಳ ಉಚ್ಚಾರಣೆ.

ಅಧ್ಯಾಯ – III	**4Hrs**

ಸಂಭಾಷಣೆಗಾಗಿ ಕನ್ನಡ ಪದಗಳು:

ಏಕವಚನ, ಬಹುವಚನ, ಲಿಂಗಗಳು (ಸ್ತ್ರೀಲಿಂಗ, ಪುಲ್ಲಿಂಗ) ಪ್ರಶ್ನಾರ್ಥಕ ಪದಗಳು, ವಿರುದ್ಧಾರ್ಥಕ ಪದಗಳು, ಅಸಮಂಜಸ ಉಚ್ಚಾರಣೆ, ಸಂಖ್ಯಾ ವ್ಯವಸ್ಥೆ, ಗಣಿತದ ಚಿಹ್ನೆಗಳು, ಭಿನ್ನಾಂಶಗಳು.

ತರಕಾರಿಗಳ ಹೆಸರುಗಳು, ತಿಂಡಿಗಳ ಹೆಸರುಗಳು, ಆಹಾರಕ್ಕೆ ಸಂಬಂಧಿಸಿದ ಪದಗಳು, ಕಾಲ/ಸಮಯಕ್ಕೆ ಸಂಬಂಧಿಸಿದ ಪದಗಳು, ದಿಕ್ಕುಗಳ ಹೆಸರುಗಳು, ಭಾವನೆಗೆ ಸಂಬಂಧಿಸಿದ ಪದಗಳು, ಮಾನವ ಶರೀರದ ಭಾಗಗಳು, ಸಂಬಂಧದ ಪದಗಳು, ಸಾಮಾನ್ಯ ಸಂಭಾಷಣೆಯಲ್ಲಿ ಬಳಸುವಂತಹ ಪದಗಳು.

ಅಧ್ಯಾಯ – IV	**4Hrs**

ಸಂಭಾಷಣೆಯಲ್ಲಿ ಕನ್ನಡ ಬಳಕೆ:

ನಾಮಪದಗಳು, ಸರ್ವನಾಮಗಳು, ನಾಮವಿಶೇಷಣಗಳು, ಕ್ರಿಯಾಪದಗಳು, ಕ್ರಿಯಾವಿಶೇಷಣಗಳು, ಕನ್ನಡದಲ್ಲಿ ಸಂಯೋಜನೆಗಳು, ಉಪಸರ್ಗಗಳು, ಪ್ರಶ್ನಾರ್ಥಕ ಪದಗಳು, ವಿಚಾರಣೆಯ / ವಿಚಾರಿಸುವ / ಬೇಡಿಕೆಯ ವಾಕ್ಯಗಳು. ಕನ್ನಡದಲ್ಲಿ ಚಟುವಟಿಕೆಗಳು, ಶಬ್ದಕೋಶ, ಸಂಭಾಷಣೆ.

ವ್ಯವಹಾರಿಕ ಕನ್ನಡದ ಕಲಿಕಾ ಫಲಿತಾಂಶಗಳು :	
CO1:	ನಿತ್ಯ ಜೀವನದಲ್ಲಿ ಆಡುಭಾಷೆಯ ಬಳಕೆ.
CO2:	ಸಂದರ್ಭ, ಸನ್ನಿವೇಶಕ್ಕನುಗುಣವಾಗಿ ಸರಳ ಕನ್ನಡ ವಾಕ್ಯಗಳ ಬಳಕೆ.
CO3:	ಗೌರವ ಸಂಬೋಧನೆಯ ಬಳಕೆ.
CO4:	ಇತರರೊಡನೆ ಸುಲಭ ಸಂವಹನ.

ಆಧಾರ ಪುಸ್ತಕಗಳು :	
1	ವ್ಯವಹಾರಿಕ ಕನ್ನಡ ಪಠ್ಯಪುಸ್ತಕ, ಎಲ್.ತಿಮ್ಮೇಶ್ ಮತ್ತು ವಿ.ಕೇಶವಮೂರ್ತಿ, ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿದ್ಯಾಲಯ, ಬೆಳಗಾಂ.
2	ಕನ್ನಡ ಕಲಿ, ಕೆ.ಎನ್.ಸುಬ್ರಹ್ಮಣ್ಯಂ, ಎನ್.ಎಸ್.ನರಹರಿ, ಎಚ್.ಜಿ.ಶ್ರೀನಿವಾಸ ಪ್ರಸಾದ್, ಎಸ್.ರಾಮಮೂರ್ತಿ ಮತ್ತು ಎಸ್.ಸತ್ಯನಾರಾಯಣ, 2ನೇ ಮುದ್ರಣ 2019, ರಾ.ವಿ.ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ, ಬೆಂಗಳೂರು.
3	ಮಾತನಾಡುವ ಕನ್ನಡ, ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪರಿಷತ್, ಬೆಂಗಳೂರು.

Continuous Internal Evaluation (CIE); (50 Marks)

CIE is executed by way of quizzes (Q), tests (T) and Activity. A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks and the sum of the marks scored from two quizzes is reduced to 10. The two tests are conducted for 50 marks each and the sum of the marks scored from two tests is reduced to 30. The marks component for Activity is 10. **Total CIE is 10(Q) +30(T) +10(A) = 50 Marks.**

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

SEE for 50 marksis executed by means of an examination. The Question paper for the course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 25 marks covering the complete syllabus. Part – B consists of essay type questions, one from each unit for 5 marks adding up to 25 marks.

AADALITHA KANNADA
(Common to all branches)

ಆಡಳಿತ ಕನ್ನಡ (ಕನ್ನಡಿಗರಿಗಾಗಿ)

ಆಡಳಿತ ಭಾಷಾ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು: ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ

1	ಆಡಳಿತ ಕನ್ನಡದ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.
2	ಕನ್ನಡ ಭಾಷೆಯ ವ್ಯಾಕರಣದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು.
3	ಕನ್ನಡ ಭಾಷಾ ಬರಹದಲ್ಲಿ ಕಂಡುಬರುವ ದೋಷಗಳು ಹಾಗೂ ಅವುಗಳ ನಿವಾರಣೆ ಮತ್ತು ಲೇಖನ ಚಿಹ್ನೆಗಳನ್ನು ಪರಿಚಯಿಸುವುದು.
4	ಸಾಮಾನ್ಯ ಅರ್ಜಿಗಳು, ಸರ್ಕಾರಿ ಮತ್ತು ಅರೆಸರ್ಕಾರಿ ಪತ್ರ ವ್ಯವಹಾರದ ಬಗ್ಗೆ ಅರಿವು ಮೂಡಿಸುವುದು.
5	ಭಾಷಾಂತರ, ಪ್ರಬಂದ,ರಚನೆ, ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ ಮತ ್ತುಆಡಳಿತ ಕನ್ನಡದ ಪದಗಳ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.

ಆಡಳಿತ ಕನ್ನಡ
(ಕನ್ನಡ ಕಲಿತವರಿಗೆ)

ಅಧ್ಯಾಯ –I	**4Hrs**

ಕನ್ನಡ ಭಾಷೆ – ಸಂಕ್ಷಿಪ್ತ ವಿವರಣೆ:

ಪ್ರಸ್ತಾವನೆ–ಕನ್ನಡ ಭಾಷೆ, ಶ್ರಾವಣ (ಕವನ)– ದ.ರಾ.ಬೇಂದ್ರೆ (ಕವಿ), ಬೆಲ್ಜಿಯ ಹಾಡು (ಕವನ) –ಸಿದ್ದಲಿಂಗಯ್ಯ (ಕವಿ)
ಆಡಳಿತ ಭಾಷೆಕನ್ನಡ, ಆಡಳಿತ ಭಾಷೆಯ ಲಕ್ಷಣಗಳು, ಆಡಳಿತ ಭಾಷೆಯ ಪ್ರಯೋಜನಗಳು.

ಅಧ್ಯಾಯ –II	**4 Hrs**

ಭಾಷಾ ಪ್ರಯೋಗದಲ್ಲಾಗುವ ಲೋಪದೋಷಗಳು ಮತ್ತು ಅವುಗಳ ನಿವಾರಣೆ:

ಪ್ರಸ್ತಾವನೆ– ಕಾಗುಣಿತದತಪ್ಪು ಬಳಕೆಯಿಂದಾಗುವ ಲೋಪದೋಷಗಳು ಅಥವಾ ಸಾಧುರೂಪಗಳ ಬಳಕೆ, ಅಲ್ಪ ಪ್ರಾಣ ಮತ್ತು ಮಹಾಪ್ರಾಣಗಳ ಬಳಕೆಯಲ್ಲಿನ ವ್ಯತ್ಯಾಸದಿಂದಾಗುವ ಲೋಪದೋಷಗಳು, ಲೇಖನ ಚಿಹ್ನೆಗಳು, ಕನ್ನಡ ಭಾಷೆಯಲ್ಲಿನ ಲೋಪದೋಷಗಳು ಗೌರವ ಸೂಚಕಗಳ ಬಳಕೆ, ಭಾಷಾ ಬರದಲ್ಲಿ ಅನುಸರಿಸಬೇಕಾದ ಇನ್ನಿತರಕ್ರಮ, ಲೇಖನ ಚಿಹ್ನೆಗಳು ಮತ್ತು ಅವುಗಳ ಉಪಯೋಗ.

ಅಧ್ಯಾಯ –III	**4Hrs**

ಪತ್ರ ವ್ಯವಹಾರ:

ಪ್ರಸ್ತಾವನೆ– ಖಾಸಗಿ ಪತ್ರ ವ್ಯವಹಾರ, ಆಡಳಿತ ಪತ್ರಗಳು, ಅರ್ಜಿಯ ವಿವಿಧ ಬಗೆಗಳು ಮತ್ತು ಮಾದರಿಗಳು.

ಅಧ್ಯಾಯ –IV	**4Hrs**

ಪ್ರಬಂಧ, ಸಂಕ್ಷಿಪ್ತ ಪ್ರಬಂಧರಚನೆ ಮತ್ತು ಭಾಷಾಂತರ:

ಕನ್ನಡ ಶಬ್ಧಸಂಗ್ರಹ, ಜೋಡಿನುಡಿಗಳು, ಅನುಕರಣಾವ್ಯಯಗಳು, ಸಮಾನಾರ್ಥಕ ಪದಗಳು, ನಾನಾರ್ಥಗಳು, ವಿರುದ್ಧಪದಗಳು, ತತ್ಸಮ–ತದ್ಭವಗಳು, ದ್ವಿರುಕ್ತಿಗಳು, ನುಡಿಗಟ್ಟುಗಳು, ಶಬ್ಧಸಮೂಹಕ್ಕೆ ಒಂದು ಶಬ್ಧ, ಅನ್ಯದೇಶೀಯ ಪದಗಳು, ದೇಶೀಯಪದಗಳು.

ಆಡಳಿತ ಕನ್ನಡದ ಕಲಿಕಾ ಫಲಿತಾಂಶಗಳು:

CO1:	ಕನ್ನಡ ಬರಹದಲ್ಲಿ ವ್ಯಾಕರಣದ ಬಳಕೆ.
CO2:	ಕನ್ನಡದಲ್ಲಿ ಪತ್ರ ಬರೆಯುವಿಕೆ.
CO3:	ಕನ್ನಡ ಸಾಹಿತ್ಯ ಹಾಗೂ ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಆಸಕ್ತಿ ಮೂಡುವುದು.

ಆಧಾರ ಪುಸ್ತಕಗಳು :

1	ಆಡಳಿತ ಕನ್ನಡ ಪಠ್ಯಪುಸ್ತಕ, ಎಲ್.ತಿಮ್ಮೇಶ್ ಮತ್ತು ವಿ.ಕೇಶವಮೂರ್ತಿ, ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿದ್ಯಾಲಯ, ಬೆಳಗಾಂ.
2	ಕನ್ನಡ ಅನುಭವ, ಕೆ.ಎನ್.ಸುಬ್ರಹ್ಮಣ್ಯಂ, ಎನ್.ಎಸ್.ನರಹರಿ, ಎಚ್.ಜಿ.ಶ್ರೀನಿವಾಸಪ್ರಸಾದ್, ಎಸ್.ರಾಮಮೂರ್ತಿ ಮತ್ತು ಎಸ್.ಸತ್ಯನಾರಾಯಣ, 2ನೇ ಮುದ್ರಣ 2019, ರಾ.ವಿ.ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ, ಬೆಂಗಳೂರು.

Continuous Internal Evaluation (CIE); (50 Marks)

CIE is executed by way of quizzes (Q), tests (T) and Activity. A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks and the sum of the marks scored from two quizzes is reduced to 10. The two tests are conducted for 50 marks each and the sum of the marks scored from two tests is reduced to 30. The marks component for Activity is 10. **Total CIE is 10(Q) +30(T) +10(A) = 50 Marks.**

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

SEE for 50 marks is executed by means of an examination. The Question paper for the course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 10 marks covering the complete syllabus. Part – B is for 40 marks. It consists of essay type questions. Student has to answer any 4 questions out of 5 questions, each question carries 10 marks.

Semester: IV						
LINEAR ALGEBRA, STATISTICS AND PROBABILITY THEORY (Theory) (Common to EC, EE, EI & ET)						
Course Code	**:**	18MA41B		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	4:1:0		**SEE**	**:**	100 Marks
Total Hours	**:**	52L+26T		**SEE Duration**	**:**	03 Hours

Course Learning Objectives: The students will be able to

1	Understand the basics of Linear Algebra and Probability theory.
2	Demonstrate the concepts of linear transformation, orthogonality and factorization of matrices.
3	Apply the knowledge of the statistical analysis and theory of probability in the study of uncertainties.
4	Use probability and sampling theory to solve random physical phenomena and implement appropriate distribution models.
5	Use mathematical IT tools to analyze and visualize the above concepts.

Unit-I	**10 Hrs**
Linear Algebra – I: Vector spaces, subspaces, linear dependence, basis, dimension, four fundamental subspaces. Rank and nullity theorem (without proof). Linear transformations- projection, rotation and reflection matrices, matrix representation, kernel and image of a linear transformation.	
Unit – II	**11 Hrs**
Linear Algebra – II: Orthogonal and orthonormal bases, Gram-Schmidt process, QR- factorization, Eigen values and Eigen vectors (recapitulation). Diagonalization of a matrix (symmetric matrices), singular value decomposition. SVD applied to digital image processing (using MATLAB).	
Unit –III	**11 Hrs**
Statistics: Central moments, mean, variance, coefficients of skewness and kurtosis in terms of moments. Curve fitting by method of least squares, fitting of curves – Polynomial, exponential and power functions. Correlation and linear regression analysis –problems. Simulation using MATLAB.	
Unit –IV	**10 Hrs**
Probability: Basic concepts and Baye's rule. Random variables - Discrete and continuous, probability mass function, probability density function, cumulative density function, mean, variance - problems. Joint probability distribution function - Discrete and continuous, covariance, correlation and problems related to applications. Simulation using MATLAB.	
Unit –V	**10 Hrs**
Probability Distributions: Discrete and continuous distributions - Binomial, Poisson, Exponential and Normal. Sampling theory - Sampling, sampling distributions, standard errors, student's t-distribution, chi-square distribution as a test of goodness of fit, problems. Simulation using MATLAB.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand the fundamental concepts of linear algebra, probability and sampling theory.
CO2:	Solve the problems of vector spaces, linear transformation, measures of statistical data, curve fitting and functions of random variables.
CO3:	Apply the acquired knowledge to solve the problems on factorization of a matrix, correlation,

	regression, probability and sampling distributions.
CO4:	Evaluate decomposition of a matrix and estimate goodness of fit of problems occurring in engineering applications.

Reference Books	
1	Linear Algebra and Its Applications, Gilbert Strang, 4th Edition, 2006, Cengage Learning India Edition, ISBN: 81-315-0172-8.
2	Higher Engineering Mathematics, B.S. Grewal, 44th Edition, 2015, Khanna Publishers, ISBN: 978- 81-933284-9-1.
3	Schaum's Outline of Linear Algebra, Seymour Lipschutz and Marc Lipson, 5th Edition, 2012, McGraw Hill Education, ISBN-978-0-07179456-5.
4	Introduction to Probability and Statistics, S. Lipschutz and Schiller (Schaum's outline series), ISBN: 978-0-07-176249-6.

Continuous Internal Evaluation (CIE); Theory (100 Marks)
CIE is executed by way of quizzes (Q), tests (T) and Experiential Learning (EL). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. The marks component for experiential learning is 20. **Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.**

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

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

High-3: Medium-2 : Low-1

Semester: IV						
ENGINEERING MATERIALS **(Theory)** **(Common to EC, EE, EI & ET)**						
Course Code	**:**	18EC42		**CIE**	**:**	50 Marks
Credits: L:T:P	**:**	2:0:0		**SEE**	**:**	50 Marks
Total Hours	**:**	27L		**SEE Duration**	**:**	02 Hours

Course Learning Objectives: The students will be able to	
1	Understand the material classification and categorizes material related to various electronic properties
2	Understand fabrication & characterization techniques and nanomaterial growth
3	Understand the material electronics transport and applications in electronics industry
4	Understand to the extend electronic devices based on novel and emerging materials

Unit-I	**05 Hrs**
Introduction: Classification and Properties of Materials, Materials Used in Electrical and Electronic Industries, Requirements and Future Developments of Electronic Materials	
Unit – II	**07 Hrs**
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 –III	**05 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	
Unit –IV	**05 Hrs**
Organic Electronic Materials: Conducting Polymers, Charge carriers, Synthesis of Conducting Polymers, Semiconducting Organic Materials, Organic Light Emitting Diode, Organic FET	
Unit –V	**05 Hrs**
Nanomaterials for Electronic Device Applications: Techniques for Preparation of Nanomaterials (Quantum Dots & CNT only), Micro-/Nano-devices Using Nanostructured Materials: CNT transistor, Single electron transistor	

Course Outcomes: After completing the course, the students 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, 3rd Edition, 2017, McGraw Hill Education, ISBN-13: 978-0070648203
3	Electronic Properties of Materials, Rolf E. Hummel, 4th Edition, 2011, Springer, ISBN-13: 978-1489998415

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

CIE is executed by way of quizzes (Q), tests (T) and Experiential Learning (EL). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 15 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 30 marks each and the sum of the marks scored from three tests is reduced to 25. The marks component for Experiential Learning is 20.

Total CIE is 15(Q) +25(T) +10(EL) =50 Marks.

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

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

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

High-3: Medium-2: Low-1

Semester: IV						
ADVANCED DIGITAL SYSTEM DESIGN USING VERILOG HDL (Theory & Practice)						
Course Code	**:**	18EC43		**CIE**	**:**	100+50 Marks
Credits: L:T:P	**:**	3:0:1		**SEE**	**:**	100+50 Marks
Total Hours	**:**	40L + 33P		**SEE Duration**	**:**	03+03 Hours

Course Learning Objectives: The students will be able to

1	Design Digital circuit (combinational and sequential) and model using Verilog HDL, synthesis to obtain RTL
2	Write HDL models that can be synthesized into integrated circuits using programmable hardware such as FPGAs
3	Analyze flow of electronic design from concept to register transfer level (RTL) verification and synthesis to final programmable device implementation
4	Design a digital system which includes controller, data processor and output devices, model using Verilog and verify the functionality
5	Write test modules and fitting designs to verify the functionality in FPGA

Unit-I	**08 Hrs**
Introduction to Verilog: Design Methodology-An Introduction: Verilog History, System representation, Number representation and Verilog ports. Verilog Data Types: Net, Register and Constant. Verilog Operators: Logical, Arithmetic, Bitwise, Reduction, Relational, Concatenation and Conditional. Verilog Primitives. Logic Simulation, Design Verification, and Test Methodology: Four-Value Logic and Signal Resolution in Verilog, Test Methodology Signal Generators for Test benches, Event-Driven Simulation, Sized Numbers. Modeling Styles: Dataflow Modeling: Boolean Equation-Based Models of Combinational Logic, Propagation Delay and Continuous Assignments.	
Unit – II	**09 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. Tasks & Functions.	
Unit –III	**08 Hrs**
Algorithmic State Machine Charts for Behavioral Modeling: Algorithmic State Machine Charts for Behavioral Modeling, ASMD charts, Behavioral Models of Counters, Shift Registers, and Register Files and Arrays of Registers (Memories). Design Example: serial adder, sequence detector (Mealy-Moore) Keypad Scanner and Encoder. Functional Units for Addition and Subtraction: Ripple-Carry Adder, Carry Look-Ahead Adder, Overflow and Underflow, Array Multiplier.	
Unit –IV	**08 Hrs**
Design of Processor 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	**07 Hrs**
Synthesis of Combinational Logic: Introduction to Synthesis, Synthesis of Combinational Logic, Synthesis of Sequential Logic with Latches, Synthesis of Three-state Devices, Synthesis of Sequential Logic with Flip-Flops. Memories: General concepts, Memory Types, Asynchronous static RAM, Synchronous static RAM. Introduction to FPGA	
Practical's: 1. Multiplexer and De-multiplexer	

2. Decoders and Encoders.
3. Code converters and Comparator.
4. Binary Adder (Ripple Adder and carry look ahead adder).
5. Flipflops.
6. Counters.
7. Shift Register
8. FSM- Sequence Detector, etc.
9. Serial Adder.
10. Stepper Motor
11. DAC
12. Display Interfacing

Course Outcomes: After completing the course, the students will be able to	
CO1:	Analyze digital circuit and system and 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 verify the performance of efficient digital system using various digital 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, 1st Edition, 1996, ISBN: 978-81-775-8918-4. 3
3	Digital Design: An Embedded Systems Approach Using VERILOG, Peter J. Ashenden, 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.

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

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

Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.

Scheme of Continuous Internal Evaluation (CIE); Practical Test for 50 Marks

The Laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average mark (AM) over number of weeks is considered for 30 marks. At the end of the semester a test (T) is conducted for 10 marks. The students are encouraged to implement additional innovative experiments (IE) in the lab and are rewarded for 10 marks. Total marks for the laboratory is 50.

Total CIE is 30(AM) +10 (T) +10 (IE) =50 Marks.

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

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

Scheme of Semester End Examination (SEE); Practical Exam for 50 Marks

SEE for the practical courses will be based on experiment conduction with proper results, is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

Semester End Evaluation (SEE): Theory (100 Marks) + Practical (50 Marks) = Total 150 Marks

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

High-3: Medium-2: Low-1

Semester: IV						
MICROPROCESSOR & MICROCONTROLLER (Theory & Practice)						
Course Code	**:**	18EI44		**CIE Marks:**	**:**	100+50 Marks
Credits: L:T:P	**:**	3:0:1		**SEE Marks:**	**:**	100+50 Marks
Total Hours:	**:**	39L+33P		**SEE Duration:**	**:**	03+03 Hours

Course Learning Objectives: The students will be able to	
1	Specify, design, implement, and debug simple microprocessor-based applications using the Intel 8086 architecture.
2	Understand & Analyze the architecture of 8051 microcontroller
3	Use software development tools to assemble, test and debug the programs by using breakpoints, single-stepping, monitoring the changes in register/memory contents, on a hardware platform or on an emulator.
4	Apply assembly directives and assembly language to implement flow control (sequential, conditional and iterative).
5	Design and interface the external components of microprocessor and microcontroller

UNIT-I	**07 Hrs**
MPU Organization: Instruction set Architectures, Harvard & Von-Neuman Architectures, Micro programmed & Hardwired Control unit, Floating Point & Fixed-Point Processor, Endianness. **Intel's 8086 architecture**, Pin groups, Functioning, Segmentation, Address generation, Stack, Interrupts.	
UNIT-II	**09 Hrs**
8086 Assembly Language Programming: Addressing Modes of 8086, Instruction Format, Program Development Tools, Assembler Directives, Instruction Set of 8086: Data Transfer Instructions, Arithmetic Instructions, Bit Manipulation Instructions, Branching Instructions, Processor Control Instructions, String Instructions, Macros, Procedures, Assembly Language Programming Examples.	
UNIT-III	**09 Hrs**
Hardware of 8051 Microcontrollers: Introduction to Embedded system, Microcontroller, Comparison of Microprocessor and Microcontroller, Intel MCS 51 family, Architecture and Pin Functions of 8051 Microcontroller, CPU Organization, Program Counter, Timing and Machine Cycles, Internal Memory Organization, Registers, Stack, Input/ Output Ports, Counters and Timers, Interrupts, Power Saving Modes.	
UNIT-IV	**07 Hrs**
8051 Microcontroller Based System Design: I/O Port Programming, Programming timers, Asynchronous Serial Data Communication, Interrupt Service Routines. Programming in C, Inline Assembly, Interfacing DAC, Interfacing Matrix Keyboard and Seven Segment Displays, Interfacing ADC in polled mode & Interrupt Mode, Interfacing LCD.	
UNIT-V	**07 Hrs**
Peripheral Based Systems Clock generator(8284), Memory Devices, Address Decoding, Interfacing Memory, I/O sub System: Busy wait, DMA, Interrupt Driven, Memory Maps, I/O Port address decoding, Introduction to 8255, Interfacing 8255 with 8086, Interrupt Based IO Design.	

Practical: Processor & Controller Lab:
Experiments with 8086 Assembly using MASM

1. Data Transfer Programs: Block Moves & Exchange (With & Without Overlap) with &without String Instructions.
2. Arithmetic Operations: Addition, Multiplication & Division on 32-Bit Data.
3. a) Code Conversions: Use XLAT Instruction to Convert Binary to BCD, Input from Keyboard & Display Result on the Console.
   b) ASCII Operations: Addition, Subtraction, Multiplication

4. a) Search for a Key in an Array of Elements using Linear Search, Binary Search. Find Efficiency in each case.
   b) Sort an Array Using Bubble Sort & Selection Sort. Find Efficiency in each case.

Interfacing experiments with 8051 C using Keil software

5. Illustrate the interfacing of LCD and LED with variant of 8051 Microcontroller using C language.
6. Implement the interfacing of stepper motor and DC Motor with variant of 8051 Microcontroller using C programming language.
7. Implement the interfacing of ADC with variant of 8051 Microcontroller using C language.
8. Write a C program to interface 4 x 4 keypad with variant of 8051 Microcontroller
9. Write a C program to interface DAC and Elevator with variant of 8051 Microcontroller
10. Design 8051 based system to measure the frequency of TTL waveform. Design 8051 based system for automatic controlling of light.

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

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

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

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

Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.

Scheme of Continuous Internal Evaluation (CIE); Practical Test for 50 Marks

The Laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average marks (AM) over number of weeks is considered for 30 marks. At the end of the semester a test (T) is conducted for 10 marks. The students are encouraged to implement additional innovative experiments (IE) in the lab and are rewarded for 10 marks. Total marks for the laboratory is 50.

Total CIE is 30(AM) +10 (T) +10 (IE) =50 Marks.

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

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

Scheme of Semester End Examination (SEE); Practical Exam for 50 Marks

SEE for the practical courses will be based on experiment conduction with proper results, is evaluated for 40 marks and Viva is for 10 marks. Total SEE for laboratory is 50 marks.

Semester End Evaluation (SEE): Theory (100 Marks) + Practical (50 Marks) = Total 150 Marks

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

Low-1 Medium-2 High-3

Semester: IV						
SIGNALS AND SYSTEMS (Theory) (Common to ET, EC, EE & EI)						
Course Code	**:**	18ET45		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:1:0		**SEE**	**:**	100 Marks
Total Hours	**:**	39L + 26T		**SEE Duration**	**:**	3.00 Hrs

Course Learning Objectives: The students will be able to	
1	Express a signal and a system in both time and frequency domains and develop a mathematical process to migrate between the two representations of the same entity.
2	Analyze a complex signal in terms of basic signals in continuous and discrete time flavours.
3	Define discrete-time signals and systems, and express the differences with their continuous- time analogy.
4	Understand the computation of FFT algorithm in linear filtering & correlations.

Unit-I	**8 Hrs**
Introduction to Signals and System: Definition of Signals, Classification of Signals, Basic Operations on Signals: Operations Performed on the Independent and Dependent Variable, Precedence Rule, Elementary Signals. Definition of Systems, System Viewed as Interconnection of Operations, Properties of Systems.	
Unit – II	**8 Hrs**
Time domain representations of Linear Time Invariant Systems : Convolution Sum, Convolution Sum Evaluation Procedure, Convolution Integrals, Convolution Integrals Evaluation Procedure, Interconnections of LTI System, Relations between LTI System Properties and the Impulse Response, step response, Difference Equation Representation of	
Unit –III	**8 Hrs**
Applications of Fourier Representations to Mixed Signal classes: Review of Fourier representation of signals, Introduction to DTFS and DTFT, Introduction, Fourier Transform Representations of periodic signals, Convolution and multiplication with Mixtures of periodic and Non-Periodic signals, Fourier Transform representation of discrete time signals, sampling	
Unit –IV	**8 Hrs**
The Discrete Fourier transform - Its properties and Applications: Frequency domain Sampling and Reconstruction of Discrete time signals, DFT, DFT as a linear Transformation, Relationship of DFT to other transforms. Properties of DFT: Periodicity, Linearity and Symmetry properties, Multiplication of two DFTs and circular convolution, additional DFT properties. Linear filtering methods based on the DFT: Use of DFT in linear filtering,	
Unit –V	**7 Hrs**
Efficient computation of DFT - FFT Algorithms: Direct computation of DFT, Radix-2 FFT Algorithms and Implementation of FFT Algorithms, Applications of FFT algorithms, Efficient computation of DFT of two real sequences, Efficient computation of DFT of a 2N –	

Course Outcomes: After completing the course, the students will be able to	
CO1	Analyze the fundamental concepts of the both continuous and discrete signals and systems, Representation of both periodic & aperiodic signals in frequency domain.
CO2	Apply the properties of signals and analyze both continuous and discrete systems commonly found in communication, signal processing and control systems.

CO3	Analyze continuous & discrete systems both in time & frequency domain.
CO4	Apply efficient methods/algorithms for the computation of frequency domain representation & vice-versa.

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, 3rd Edition, 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

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

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

Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.

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

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

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

High-3: Medium-2: Low-1

Semester: IV						
ANALOG INTEGRATED CIRCUITS DESIGN (Theory)						
Course Code	**:**	18EC46		**CIE**	**:**	100 Marks
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	100 Marks
Total Hours	**:**	40L		**SEE Duration**	**:**	03 Hours

Course Learning Objectives: The students will be able to	
1	Design basic amplifiers and differential amplifiers using MOSFETs.
2	Design different opamp topologies for a given specification
3	Analyze stability of OPAMPs and apply the appropriate compensation technique.
4	Design and analysis of filters and oscillators
5	Design basic amplifiers and differential amplifiers using MOSFETs.

Unit-I	**08 Hrs**
Introduction to Analog Integrated Design: Models for analog design, body transconductance. **Single-stage Amplifiers** – CS stage, diode connected load, current source load and source degeneration, review of CD and CG stages (all amplifier analysis with body effect), Cascode stage & folded cascode concepts. Design of amplifier from specifications. **Differential Amplifiers** – MOS differential pair, Small signal operation - half circuit analysis, common mode response, differential amplifier with active load, common mode gain and CMRR, frequency response of the differential amplifier	
Unit – II	**09 Hrs**
Operational Amplifiers: General considerations – performance parameters, One-Stage Op amps – cascode opamps, telescopic opamps, folded cascode opamps, Two-Stage Op amps, Gain Boosting, Comparison of performance of various opamp topologies. Design of opamps from specifications.	
Unit –III	**09 Hrs**
Stability in feedback systems: Review of Bode rules, problem of instability, stability condition, gain-phase crossovers, phase margin, **Frequency Compensation**: Frequency response of CS amplifier - Miller effect, poles in a system, pole-splitting, Miller compensation. Two stage opamp - Compensation techniques, closed-loop stability, optimal phase margin.	
Unit –IV	**07 Hrs**
Noise: MOSFET noise models, types of noise – thermal, flicker, Representation of noise in circuits, Noise in single stage amplifiers (Common source only). **Integrated Oscillators** : Ring oscillators, LC oscillators – Cross coupled oscillators, VCO	
Unit –V	**07 Hrs**
Analog Filters : Classification of filters, transfer function of filters, Second order filters, active filters – sallen and key filters, KHN biquad, Tow Thomas, biquads based on simulated inductors. **Bandgap references**: Temperature independent references - Bipolar CTAT, PTAT, Band gap references (BGR)	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Apply the knowledge of MOSFET based discrete amplifiers to investigate various design trends in analog IC design
CO2:	Analyze the functionality of analog circuits & systems
CO3:	Design and implement analog integrated circuits
CO4:	Evaluate the different performance parameters of analog integrated circuits

Reference Books	
1	Design of Analog CMOS Integrated Circuits, Behzad Razavi, 2002, Mc GrawHill Edition, ISBN: 0-07-238032-2
2	CMOS Circuit Design, Layout and Simulation, R. Jacob Baker, Harry W. Li and David E. Boyce, 2002, IEEE Press, ISBN: 81-203-1682-7
3	CMOS Mixed-signal Circuit Design, R. Jacob Baker, 2009, IEEE Press, ISBN: 978-81-265-1657-5
4	Analysis and Design of Analog Integrated Circuits, Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, Robert G. Meyer, "", 4th edition, 2008, Wiley India Private Limited, ISBN:978-8126515691
5	Fundamentals of Microelectronics, Behzad Razavi, 2nd Edition, 2013, Wiley, ISBN-10: 1118156323

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

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

High-3: Medium-2 : Low-1

Semester: IV						
Design Thinking Lab						
Course Code	**:**	**18EC47**		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	**0:0:2**		**SEE**	**:**	**50 Marks**
Hours	**:**	**26P**		**SEE Duration**	**:**	**02 Hours**

Course Learning Objectives: To enable the students to:	
1	***Knowledge Application:*** Acquire the ability to make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to provide solutions of societal concern
2	***Communication:*** Acquire the skills to communicate effectively and to present ideas clearly and coherently to a specific audience in both the written and oral forms.
3	***Collaboration:*** Acquire collaborative skills through working in a team to achieve common goals.
4	***Independent Learning:*** Learn on their own, reflect on their learning and take appropriate action to improve it.

Guidelines for Design Thinking Lab:

1. The Design Thinking Lab (DTL) is to be carried out by a team of two-three students.
2. Each student in a team must contribute equally in the tasks mentioned below.
3. Each group has to select a theme that will provide solutions to the challenges of societal concern. Normally three to four themes would be identified by the by the department
4. Each group should follow the stages of Empathy, Design, Ideate, prototype and Test for completion of DTL.
5. After every stage of DTL, the committee constituted by the department along with the coordinators would evaluate for CIE. The committee shall consist of respective coordinator & two senior faculty members as examiners. The evaluation will be done for each student separately.
6. The team should prepare a Digital Poster and a report should be submitted after incorporation of any modifications suggested by the evaluation committee.

The Design Thinking lab tasks would involve:

1. Carry out the detailed questionnaire to arrive at the problem of the selected theme. The empathy report shall be prepared based on the response of the stake holders.
2. For the problem identified, the team needs to give solution through thinking out of the box innovatively to complete the ideation stage of DTL
3. Once the idea of the solution is ready, detailed design has to be formulated in the Design stage considering the practical feasibility.
4. If the Design of the problem is approved, the team should implement the design and come out with prototype of the system.
5. Conduct thorough testing of all the modules in the prototype developed and carry out integrated testing.
6. Demonstrate the functioning of the prototype along with presentations of the same.
7. Prepare a Digital poster indicating all the stages of DTL separately. A Detailed project report also should be submitted covering the difficulties and challenges faced in each stage of DTL.
8. Methods of testing and validation should be clearly defined both in the Digital poster as well as the report.

The students are required to submit the Poster and the report in the prescribed format provided by the department.

Course Outcomes: After completing the course, the students will be able to	
CO 1:	Interpreting and implementing the empathy, ideate and design should be implemented by applying the concepts learnt.
CO 2:	The course will facilitate effective participation by the student in team work and development of communication and presentation skills essential for being part of any of the domains in his / her future career.
CO 3:	Appling project life cycle effectively to develop an efficient prototype.
CO 4:	Produce students who would be equipped to pursue higher studies in a specialized area or carry out research work in an industrial environment.

Scheme of Evaluation for CIE Marks:

Evaluation will be carried out in three phases:

Phase	**Activity**	**Weightage**
I	Empathy, Ideate evaluation	10M
II	Design evaluation	15M
III	Prototype evaluation, Digital Poster presentation and report submission	25M
	Total	**50M**

Scheme of Evaluation for SEE Marks:

Sl. No.	**Evaluation Component**	**Marks**
1.	Written presentation of synopsis: Write up	5M
2.	Presentation/Demonstration of the project	15M
3.	Demonstration of the project	20M
4.	Viva	05M
5.	Report	05M
	Total	**50M**

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**H**	**H**	**H**	**H**	**M**	**M**	**L**	**M**	**M**	**M**	**M**	**M**
CO2	**H**	**H**	**H**	**H**	**M**	**M**	**L**	**M**	**M**	**M**	**M**	**M**
CO3	**H**	**H**	**H**	**H**	**M**	**M**	**L**	**M**	**M**	**M**	**M**	**M**
CO4	**L**	**L**	**L**	**L**	**L**	**L**	**L**	**M**	**L**	**M**	**L**	**L**

Semester: IV						
C PROGRAMMING **Bridge Course** **(Common to all branches)**						
Course Code	**:**	18DCS48		**CIE Marks**	**:**	**50**
Credits: L:T:P	:	2:0:0		**SEE Marks**	**:**	**50**
Audit Course				**SEE Duration**	**:**	**2.00 Hours**

Course Learning Objectives: The students will be able to

1.	Develop arithmetic reasoning and analytical skills to apply knowledge of basic concepts of programming in C.
2.	Learn basic principles of problem solving through programming.
3.	Write C programs using appropriate programming constructs adopted in programming.
4.	Solve complex problems using C programming.

Unit – I	**4 Hrs**
Introduction to Reasoning, Algorithms and Flowcharts: Skill development – Examples related to Arithmetical Reasoning and Analytical Reasoning. Fundamentals of algorithms and flowcharts **Introduction to C programming:** Basic structure of C program, Features of C language, Character set, C tokens, Keywords and Identifiers, Constants, Variables, Data types.	
Unit – II	**4 Hrs**
Handling Input and Output Operations Formatted input/output functions, Unformatted input/output functions with programming examples using different input/output functions. **Operators and Expressions** Arithmetic operators, Relational operators, Logical Operators, Assignment operators, Increment and decrement operators, Conditional operators, Bit-wise operators, Arithmetic expressions. Evaluation of expressions, Precedence of arithmetic operators, Type conversion in expressions, Operator precedence and associativity.	
Unit – III	**6 Hrs**
Programming Constructs **Decision Making and Branching** Decision making with 'if' statement, Simple 'if' statement, the 'if…else' statement, nesting of 'if…else' statements, The 'else if' ladder, The 'switch' statement, The '*?:'* operator, The '*goto'* statement. **Decision making and looping** The while statement, The do while statement, The 'for' statement, Jumps in loops**.**	
Unit – IV	**6 Hrs**
Arrays One dimensional arrays, Declaration of one dimensional arrays. Initialization of one dimensional arrays, Two dimensional arrays, Initializing two dimensional arrays. **Character Arrays and Strings** Declaring and Initializing String Variables, Reading Strings from Terminal, Writing strings to screen, String handling functions.	

Unit – V	8 Hrs
User-defined functions Need for User Defined Functions, Definition of functions, Return values and their types, Function calls, Function declaration. Examples. **Introduction to Pointers:** Introduction, Declaration and initialization of pointers. Examples **Structures and Unions:** Introduction, Structure and union definition, Declaring structure and union variables, Accessing structure members. Example programs.	

PRACTICE PROGRAMS	
1.	Familiarization with programming environment, concept of naming the program files, storing, compilation, execution and debugging. Taking any simple C- code. (Example programs having the delimeters, format specifiers in printf and scanf)
2.	Debug the errors and understand the working of input statements in a program by compiling the C-code.
3.	Implement C Program to demonstrate the working of operators and analyze the output.
4.	Simple computational problems using arithmetic expressions and use of each operator (+,-,/,%) leading to implementation of a Commercial calculator with appropriate message: a)Read the values from the keyboard b) Perform all the arithmetic operations. c) Handle the errors and print appropriate message.
5.	Write a C program to find and output all the roots if a given quadratic equation, for non-zero coefficients. (Using if…*else* statement).
6a. **6b.**	Write a C program to print out a multiplication table for a given NxN and also to print the sum table using skip count 'n' values for a given upper bound. Write a C program to generate the patterns using for loops. Example: (to print * if it is even number) 1 ** 333 **** 55555
7a. **7b.**	Write a C program to find the Greatest common divisor (GCD)and Least common multiplier (LCM) Write a C program to input a number and check whether the number is palindrome or not.
8.	Develop a C program for one dimensional, demonstrate a C program that reads N integer numbers and arrange them in ascending or descending order using bubble sort technique.
9.	Develop and demonstrate a C program for Matrix multiplication: a) Read the sizes of two matrices and check the compatibility for multiplication. b) Print the appropriate message if the condition is not satisfied and ask user to re-enter the size of matrix. c) Read the input matrix d) Perform matrix multiplication and print the result along with the input matrix.
10.	Using functions develop a C program to perform the following tasks by parameter passing concept: a) To read a string from the user Print appropriate message for palindrome or not palindrome

11a.1 **1b.**	Write a C program to find the length of the string without using library function. Write a program to enter a sentence and print total number of vowels.
12.	Design a structure 'Complex' and write a C program to perform the following operations: i. Reading a complex number. ii. Addition of two complex numbers. iii. Print the result
13.	Create a structure called student with the following members student name, rollno, and a structure with marks details in three tests. Write a C program to create N records and a) Search on roll no and display all the records. b) Average marks in each test. c) Highest marks in each test

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

Reference Books	
1.	Programming in C , P. Dey, M. Ghosh, First Edition, 2007, Oxford University press, ISBN (13): 9780195687910.
2.	The C Programming Language, Kernighan B.W and Dennis M. Ritchie, Second Edition, 2005, Prentice Hall, ISBN (13): 9780131101630.
3.	Turbo C: The Complete Reference, H. Schildt, 4th Edition, 2000, Mcgraw Hill Education, ISBN-13: 9780070411838.
4.	Understanding Pointers in C, Yashavant P. Kanetkar, 4th Edition, 2003, BPB publications, ISBN-13: 978-8176563581
5.	C IN DEPTH, S.K Srivastava, Deepali Srivastava, 3rd Edition, 2013, BPB publication, ISBN9788183330480

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

CIE is executed by way of quizzes (Q), tests (T**)** and lab practice (P). A minimum of two quizzes are conducted and each quiz is evaluated for 10 marks the sum of the marks scored from quizzes would be reduced to 10 marks. The two tests are conducted for 30 marks each and the sum of the marks scored from two tests is reduced to 30. The programs practiced would be assessed for 10 marks (Execution and Documentation).

Total CIE is 10(Q) + 30(T) + 10(P) = 50 Marks.

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

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

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

High-3: Medium-2 : Low-1

Semester: III and IV						
PROFESSIONAL PRACTICE – I COMMUNICATION SKILLS (Common to all Programmes)						
Course Code	**:**	**18HS49**		**CIE**	**:**	**50**
Credits: L:T:P	**:**	**0:0:1**		**SEE**	**:**	**50**
Total Hours	**:**	**18 hrs**		**SEE Duration**	**:**	**2 Hours**

Course Learning Objectives: The students will be able to

1	Understand their own communication style, the essentials of good communication and develop their confidence to communicate effectively.
2	Manage stress by applying stress management skills.
3	Ability to give contribution to the planning and coordinate Team work.
4	Ability to make problem solving decisions related to ethics.

III Semester	**6 Hrs**
Communication Skills: Basics, Method, Means, Process and Purpose, Basics of Business Communication, Written & Oral Communication, Listening. **Communication with Confidence & Clarity**- Interaction with people, the need the uses and the methods, Getting phonetically correct, using politically correct language, Debate & Extempore.	
	6 Hrs
Assertive Communication- Concept of Assertive communication, Importance and applicability of Assertive communication, Assertive Words, being assertive. **Presentation Skills-** Discussing the basic concepts of presentation skills, Articulation Skills, IQ & GK, How to make effective presentations, body language & Dress code in presentation, media of presentation.	
	6 Hrs
Team Work- Team Work and its important elements Clarifying the advantages and challenges of team work Understanding bargains in team building Defining behaviour to sync with team work Stages of Team Building Features of successful teams.	
IV Semester	**6 Hrs**
Body Language & Proxemics - Rapport Building - Gestures, postures, facial expression and body movements in different situations, Importance of Proxemics, Right personal space to maintain with different people.	
	6Hrs
Motivation and Stress Management: Self-motivation, group motivation, leadership abilities, Stress clauses and stress busters to handle stress and de-stress; Understanding stress - Concept of sound body and mind, Dealing with anxiety, tension, and relaxation techniques**.** Individual Counseling & Guidance, Career Orientation. Balancing Personal & Professional Life-	
	6 Hrs
Professional Practice - Professional Dress Code, Time Sense, Respecting People & their Space, Relevant Behaviour at different Hierarchical Levels. Positive Attitude, Self Analysis and Self-Management. **Professional Ethics** - values to be practiced, standards and codes to be adopted as professional engineers in the society for various projects. Balancing Personal & Professional Life	

Course Outcomes: After completing the course, the students will be able to

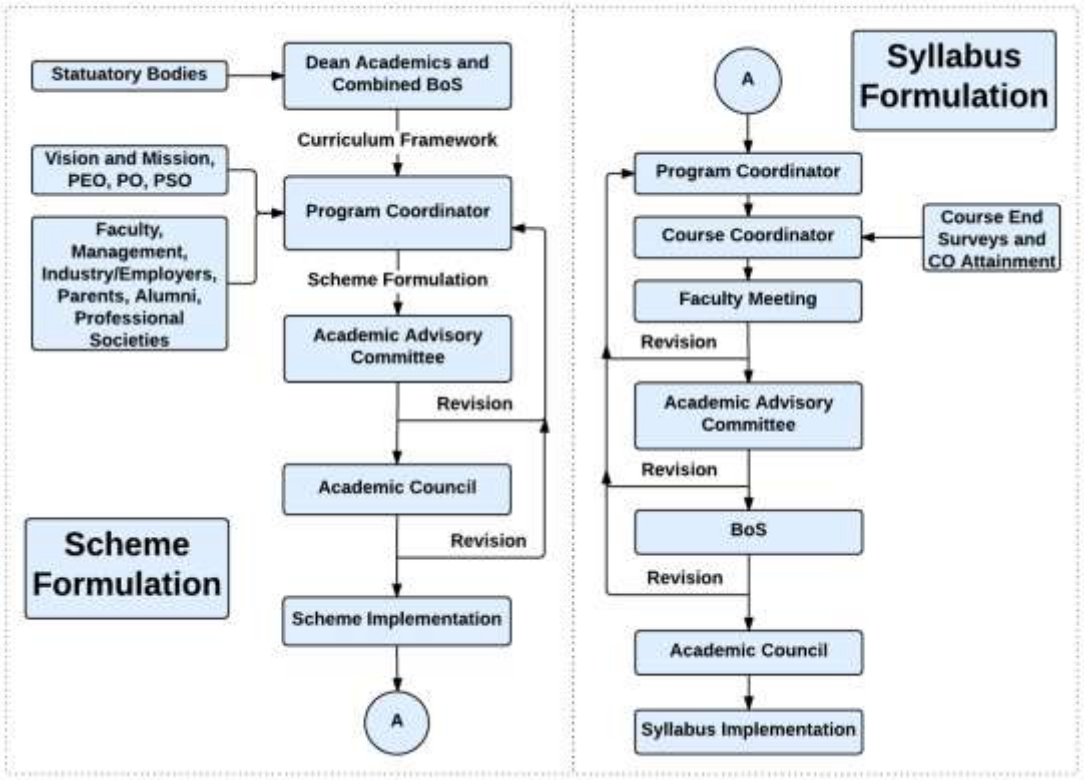
CO1:	Inculcate skills for life, such as problem solving, decision making, stress management
CO2:	Develop leadership and interpersonal working skills and professional ethics.
CO3:	Apply verbal communication skills with appropriate body language.
CO4:	Develop their potential and become self-confident to acquire a high degree of self

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

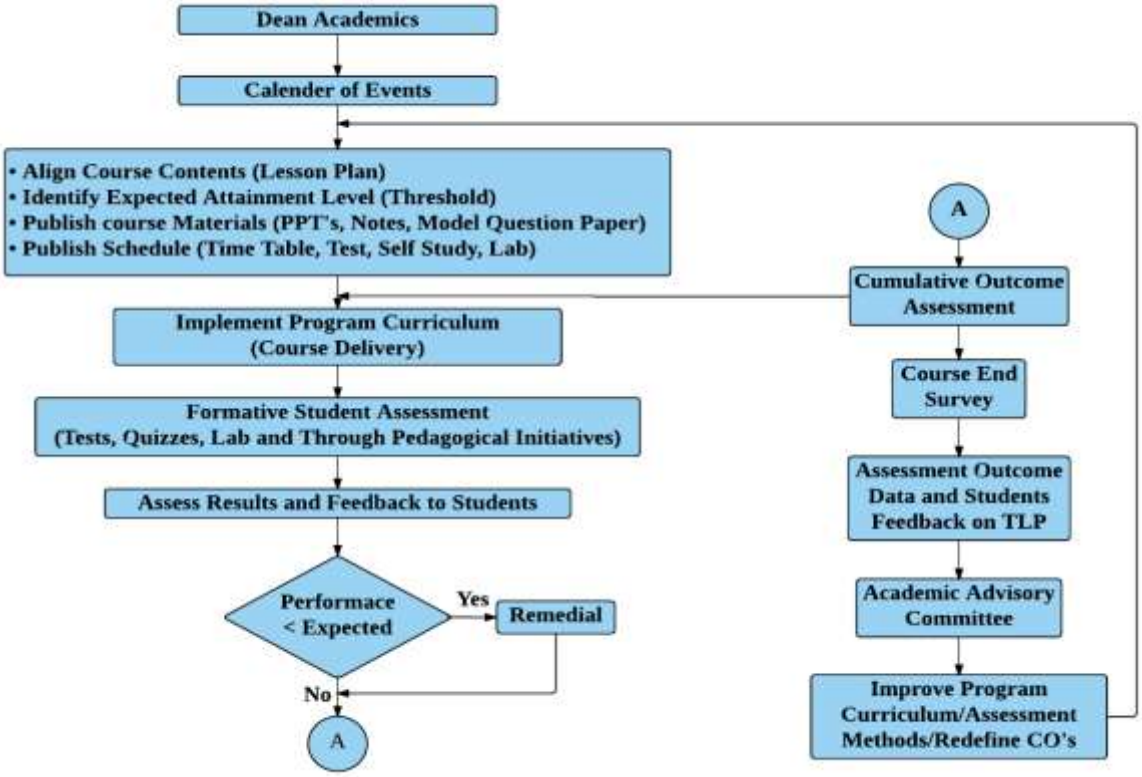
Scheme of Continuous Internal Examination and Semester End Examination

Phase	Activity	Weightage
Phase I III Sem	CIE will be conducted during the 3rd semester and evaluated for 50 marks. The test will have two components. The Quiz is evaluated for 15 marks and second component consisting of questions requiring descriptive answers is evaluated for 35 marks. The test & quiz will assess the skills acquired through the training module. SEE is based on the test conducted at the end of the 3rd semester The test will have two components a Quiz evaluated for 15 marks and second component consisting of questions requiring descriptive answers is evaluated for 35 marks.	50%
Phase II IV Sem	During the 4th semester a test will be conducted and evaluated for 50 marks. The test will have two components a Short Quiz and Questions requiring descriptive answers. The test & quiz will assess the skills acquired through the training module. SEE is based on the test conducted at the end of the 4th semester The test will have two components. The Quiz evaluated for 15 marks and second component consisting of questions requiring descriptive answers is evaluated for 35 marks	50%
Phase III At the end of IV Sem	At the end of the IV Sem Marks of CIE (3rd Sem and 4th Sem) is consolidated for 50 marks (Average of Test1 and Test 2 (CIE 1+CIE2)/2. At the end of the IV Sem Marks of SEE (3rd Sem and 4th Sem) is consolidated for 50 marks (Average of CIE 1 and CIE 2 (CIE 1+CIE2)/2.	

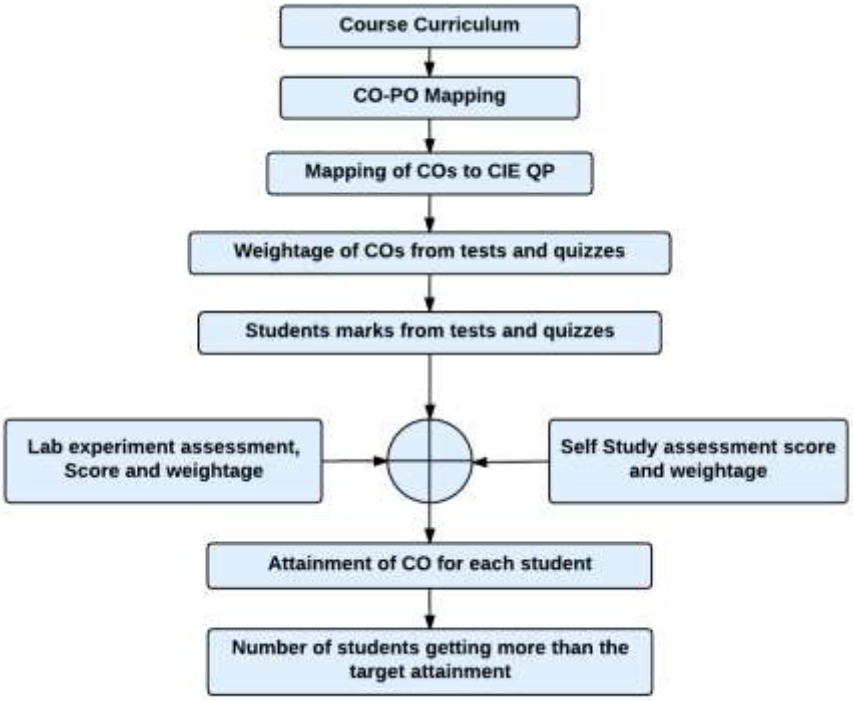
Curriculum Design Process



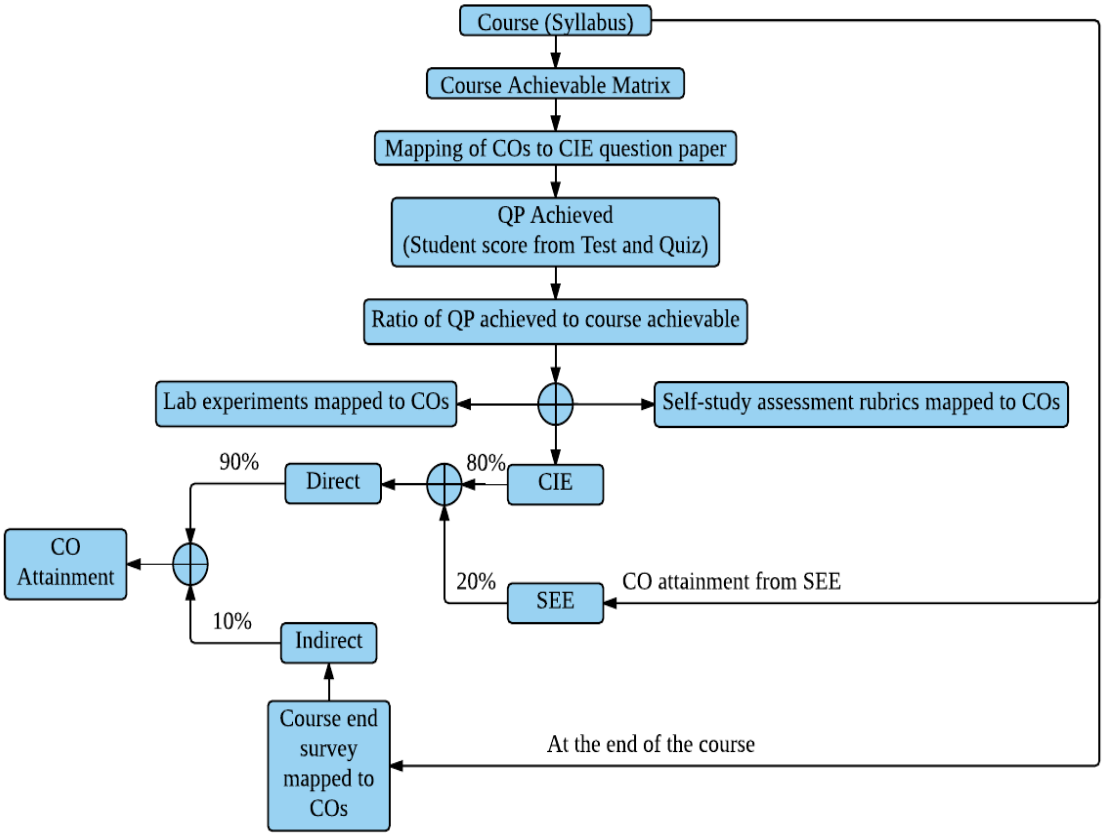
Academic Planning and Implementation



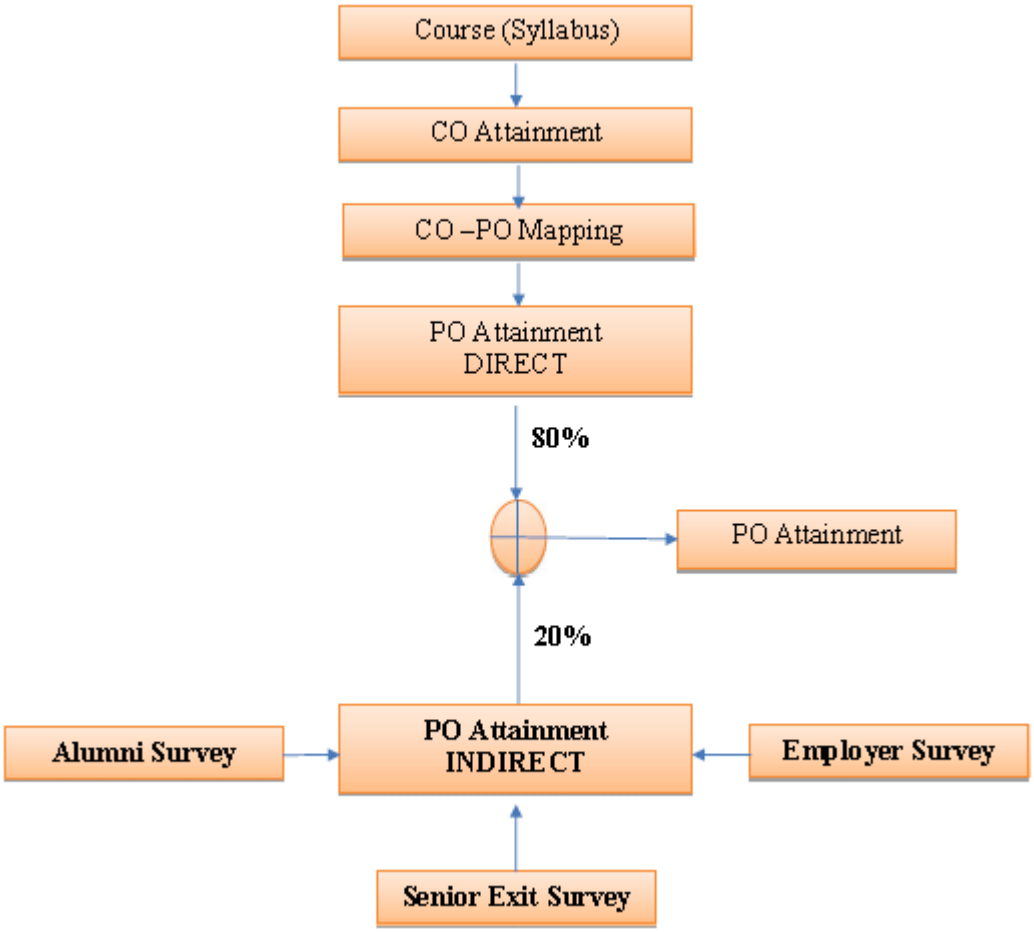
Process for Course Outcome Attainment



Final CO Attainment Process



Program Outcome 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.