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

ELECTRICAL AND ELECTRONICS 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 Technical 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
ELECTRICAL & ELECTRONICS

ENGINEERING

Department Vision

Attain technical excellence in Electrical and Electronics Engineering through graduate programs and interdisciplinary research related to sustainability in power, energy and allied fields.

Department Mission

- To provide technical education that combines rigorous academic study and the excitement of innovation enabling the students to engage in lifelong learning
- To establish Centre of Excellence in sustainable electrical energy, smart grids and systems
- To establish tie-ups with industries and institutions of repute and to foster building up of a wide knowledge base to keep in tune with upcoming technologies.
- To motivate commitment of faculty and students to collate, generate, disseminate, persevere, knowledge and to work for the benefit of society.
- To develop simple, appropriate and cost effective inclusive technologies which are instrumental in the up-liftment of the rural society.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1. To provide a strong foundation in Mathematics, Science and Electrical & Electronics Engineering to comprehend, analyze, design, innovate and develop products for real world applications.

PEO 2. To inculcate ethical attitude, effective communication skills, leadership qualities and team spirit for a successful professional career with concern for society.

PEO 3. To provide a holistic academic environment to foster excellence, entrepreneurship and multidisciplinary approach to inculcate an aptitude for research and lifelong learning

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO	Description
PSO1	The B.E. EEE Program must demonstrate knowledge and competence in the application of circuit analysis, control systems, field theory, analog and digital electronics, Power Electronics, microcontrollers , microprocessors, Signal processing and conditioning, computer hardware and software to the design, building , testing, protection and operation of electrical machines, power systems, electrical and electronic systems.
PSO2	The B.E. EEE Program must demonstrate knowledge and competence in the application of basic sciences, rigorous mathematics and project management techniques in the design of complex electrical and electronic systems.
PSO3	The B.E. EEE Program must demonstrate the ability to effectively work in a team, communicate correctly and develop an ethical attitude and concern for society and environment. .

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 and Telecommunication Engineering
17.	IS	Information Science & Engineering
18.	BT	Biotechnology
19.	AS	Aerospace Engineering
20.	PY	Physics
21.	CY	Chemistry
22.	MA	Mathematics

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THIRD SEMESTER CREDIT SCHEME							
Sl. No.	**Course Code**	**Course Title**	**BoS**	**Credit Allocation**			**Total Credits**
				L	**T**	**P**	
1.	18MA31B*	Discrete and Integral Transforms	MA	4	1	0	**5**
2.	18BT32A**	Environmental Technology	BT	2	0	0	**2**
3.	18EE33	Analog Electronic Circuits (common to EE, EI & ET)	EE	4	0	1	**5**
4.	18EC34	Analysis & Design of Digital Circuits (Common EC, EE, ET & EI)	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 EC, EE & 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

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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 prescribed for the students who do not understand the kannada language(**NON KARNATAKA Students**)

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	MA	4	1	0	**5**
2.	18EC42**	Engineering Materials (Common to EC, EE, ET & EI)	EC	2	0	0	**2**
3.	18EE43	Electrical Machines-I	EE	3	0	1	**4**
4.	18EI44	Microprocessor and Microcontroller (Common to EE, EE, ET & EI)	EI	3	0	1	**4**
5.	18ET45	Signals and Systems (Common to EC, EE, EI & ET)	ET	3	1	0	**4**
6.	18EE46	Control Systems (Common to EE & EI)	EE	3	0	0	**3**
7.	18EE47	Design Thinking lab	EE	0	0	2	**2**
8.	18DCS48***	Bridge Course: C Programming	CS	2	0	0	**0**
9.	18HS49	Professional Practice-II Communication Skills	HSS	0	0	1	**1**
Total Number of Credits				18	2	5	**25**
Total number of Hours/Week				**18+2*** **	**4**	**4+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

- Bridge Course C programming will have 1 hour theory in lab

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**	**:**	**3.00 Hours**

Course Learning Objectives:	
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: On completion of the course, the student should have acquired the ability 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	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**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						
ENVIRONMENTAL TECHNOLOGY (Theory)(Common to EC,EE,ET&EI)						
Course Code	**:**	**18BT32A**		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	**2:0:0**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**27L**		**SEE Duration**	**:**	**1.5Hours**

Course Learning Objectives:	
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	**06 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: On completion of the course, the student should have acquired the ability 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	Environmental Science , G. Tyler Miller, Scott Spoolman, 15th edition, 2012, Publisher: Brooks Cole, ISBN-13: 978-1305090446 ISBN-10: 130509044
2	Environment Management., Vijay Kulkarni and T. V. Ramachandra 2009. TERI Press; ISBN: 8179931846, 9788179931844
3	Environmental Engineering and Management, Suresh K. Dhameja 2010, Publisher:S.K. Kataria and sons . ISBN-10**:** 8185749450**,** ISBN-13: 978-8185749457.
4	Environmental Systems Engineering, Linvil Gene Rich, 2003. McGraw-Hill; ISBN: 9780070522503

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 60. The marks component for experiential learning is 10. The total marks of CIE are 100.

The total CIE for theory is 15(Q)+30(T)+05(EL) =50 marks

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

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

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

High-3: Medium-2: Low-1

Semester: III						
ANALOG ELECTRONIC CIRCUITS (Theory & Practice) (Common to EE, ET & EI)						
Course Code	**:**	**18EE33**		**CIE**	**:**	**100 + 50 Marks**
Credits: L:T:P	**:**	**4:0:1**		**SEE**	**:**	**100 + 50 Marks**
Total Hours	**:**	**50L+33P**		**SEE Duration**	**:**	**3.00+3.00Hours**

Course Learning Objectives:	
1	To study and understand the various biasing methods and ac models for transistors
2	To study different parameters and basic circuits of op-amps
3	To design signal generation circuits, wave shaping circuits and active filters using Op-amps.
4	To familiarize various analog ICs and their applications

Unit-I	**09 Hrs**
Transistors Biasing: fixed bias and voltage divider bias. Bias stabilization, stability factor, Thermal runaway **BJT AC Analysis:** Amplification in AC Domain, BJT Modelling- r_e model and Hybrid Equivalent Model for CE and CC configurations **MOSFET**-Structure and characteristics, voltage divider bias for depletion and enhancement type MOSFETs	
Unit – II	**11 Hrs**
Frequency response of BJT Amplifiers: General frequency considerations, Normalization process, low frequency analysis, high frequency response **Power Amplifiers:** Series fed and Transformer coupled class A, class B and class AB amplifiers, IC TS472 power amplifier, heat sink for power amplifiers **Feedback Amplifiers**: Characteristics of Feedback, Feedback Topologies, Analysis of series-series and series-shunt Feedback Amplifiers	
Unit -III	**11 Hrs**
Operational amplifier: Internal Structure of Op-Amps, Parameters and Characteristics of Practical Op-Amps. **OP-AMPS Applications:** Basic applications, Instrumentation amplifier, AC amplifier, V to I & I to V converters, Opamp circuits using diode, Sample & Hold Schmitt trigger - regenerative comparator, Astable & mono - stable multi- vibrators. **Wave form generator:** Square wave generator, Triangular wave generator and saw tooth-wave generator.	
Unit –IV	**10 Hrs**
Active Filters Comparison of Active and Passive filters. Butterworth filters(Butterworth function for n=2 and n=3) ,First order low and high pass filter, Second order Low and high pass filters, Butterworth second order low pass filters. Band pass filter (wide-band and narrow band), Band reject filters (wide-band and narrow band) and All-pass filter. **Oscillators:** Principles of oscillators, Phase shift oscillator, Quadrature Oscillator, Three phase oscillator, Wein Bridge Oscillator	
Unit –V	**09 Hrs**
Analog IC's And Applications: Voltage controlled oscillators-NE/SE-566, 555 Timer-functional block diagram, monostable and astable multivibrators and its applications, Digital to analog converters-R-2R ladder, weighted resistor D/A converters, IC D/A converters, Analog to digital converters-successive approximation A/D converter and IC A/D converter. Voltage Regulators: Discrete Voltage Regulator, IC Voltage Regulators (IC 78XX, 79XX, LM317)	

Lab Experiments:

1. RC coupled amplifier.
2. MOSFET Characteristics
3. a. Design of inverting amplifier, non-inverting amplifier, integrator using IC 741
   b. Basics of PSPICE
4. Study the working of half wave and full wave Precision Rectifiers using operational amplifier IC741
5. Design and implementation of peak detector and clamming circuit
6. Design and implement a Schmitt trigger circuit for given UTP & LTP using op-amp.
7. Design and implementation square and ramp wave generators for given frequency using operational amplifier IC 741
8. Design and simulation of First order High pass filter, Low pass filter, wide Band Pass filter and wide Band reject filter for the given pass band gain and cut-off frequency and plot the frequency response.
9. a. Design and implement a Astable multivibrator for a given frequency and duty cycle using NE555 Timer.
   b. Design of Monostable multivibrator for a given frequency using NE555 timer
10. Realization of 4 bit DAC using R-2R ladder network and asynchronous decade Counter IC 7490.
11. Design of Voltage Regulator using IC 7900

Design of analog circuits using PSPICE

12. Schmitt trigger circuit for given UTP & LTP
13. First order High pass filter, Low pass filter, wind Band Pass filter and wide Band reject filter for the given pass band gain and cut-off To plot the frequency response.
14. Generation of ramp wave for a given frequency using NE555 timer.
    Implement FSK modulator using IC 555.

Course outcomes: On completion of the course, the student should have acquired the ability to	
CO1:	Understand and Remember the basic fundamentals of transistor biasing and operational amplifiers
CO2:	Analyze the performance of Op-amp and build simple circuits using op-amps
CO3:	Apply the concepts to design various applications of op-amps
CO4:	Design a complete analog electronic system using various analog IC's for a specific application.

Reference Books	
1	Electronic Devices and Circuits theory, Robert L. Boylestead, Louis Nashelsky, 11th Edition, 2009, Pearson. ISBN-10: 0-495-66772-2
2	Microelectronics circuits Analysis and Design, M.H Rashid, 2nd Edition, 2011,Thomson, ISBN:0-534-95174-0
3	Microelectronics circuits, Sedra & Smith, 5th Edition, 2004, Publisher: Oxford University Press, *ISBN*-13: 978-0195338836
4	Microelectronics,, Millman & Grabel: 2nd Edition , 2011, Publisher: Mcgraw Hill*ISBN13:9780074637364.*

Continuous Internal Evaluation (CIE): Total marks: 100+50=150
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. The total CIE for theory is 100.

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): Total marks: 100+50=150
Theory – 100 Marks
SEE for 100 marks is executed by means of an examination. The Question paper for each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

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

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

High-3 : Medium-2 : Low-1

Semester: III						
ANALYSIS & DESIGN OF DIGITAL CIRCUITS (Theory & Practice) (Common to EC, EE, ET & EI)						
Course Code	**:**	**18EC34**		**CIE**	**:**	**100 + 50 Marks**
Credits: L:T:P	**:**	**4:0:1**		**SEE**	**:**	**100 + 50 Marks**
Total Hours	**:**	**50L+33P**		**SEE Duration**	**:**	**3.00+3.00 Hours**

Course Learning Objectives:	
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	**09 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	**11Hrs**
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 generator and Sequence detectors.	
Unit –V	**09 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.	
Laboratory Experiments for Practice:	

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 prepare and design in advance and practice in the lab.

List of Experiments:

1. a) Realization of Binary Adder and Subtractor using universal gates and IC-7483.

   b) Practice Question: (i) Design a parallel binary subtractor to get actual difference based on the value of C_{OUT}. (ii) Design incrementor and decrementor circuits using **IC-74LS83**
2. a) Arithmetic circuits- Realize the given Boolean expressions using MUX/DEMUX using **IC- 74LS153, IC-74LS139**.
   b) Practice Question: Realize FA/FS using MUX/DEMUX.
3. a) Code convertors i) Binary to Gray ii) Excess-3 to Binary
   b) Practice Question (i) Binary to excess-3 using **IC-74LS83** (ii) Binary to Gray using Decoder.
4. a) Design a two-bit magnitude comparator using logic gates.
   b) Drive the LED Display using **IC-74LS47**.
   c) Practice Question: Design an n-bit comparator using **IC-74LS85** (make use of cascading facility).
5. a) Design a Master-Slave JK-FF using NAND gates. Also design D-FF and T-FF using same. Observe the waveform using CRO.
   b) Practice Question: Observe the race around condition using Master alone.
6. a) Realization of asynchronous mod-n counter using **IC-74LS90, IC-74LS93**.
   b) Using **IC-74LS95** perform SISO, SIPO, PISO, PIPO, Shift left operations.
   c) Design ring and Johnson counter using **IC-74LS95**
   d) Practice Question: Design mod-99 counter using **IC-74LS90**.
7. a) Design of synchronous up/down counter using **IC-74LS76**.
   b) Design a synchronous counter to count given sequence
   c) Using pre-settable counters **IC-74LS192/LS193** perform mod-n counts.
   d) Practice Question: Design Mod-n counter using above mentioned IC's.
8. Design a priority encoder for driving Flash ADC and hexadecimal number conversion.
9. Using **IC-74LS192/LS193**, drive the LED display.
10. Design control logic for any two specified ALU operation.

Course outcomes: On completion of the course, the student should have acquired the ability 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:	Demonstrate the engineering solutions using methodology obtained through extensive research with the help of modern engineering tools owing to the ethical responsibilities.
CO4:	Analyze and update the earned knowledge for obtaining sustainable solutions for technological enhancements in the field of digital electronics.

Reference Books	
1	Digital Logic and Computer Design, M. Morris Mano, 13th Impression, 2011,Pearson Education Inc., ISBN: 978-81-7758-409-7.
2	Fundamentals of Logic Design, Charles H. Roth (Jr.), 4th Edition, 1992, West publications, ISBN-13: 978-0-314-92218-2.
3	Digital Fundamentals, Thomas Floyd, 11th Edition, 2015, Pearson Education India, ISBN 13: 978-1-292-07598-3.
4	Digital Principle and Design, Donald D. Givone, Edition illusfree, 2007, McGRaw Hill , ISBN 0071195203, 978007119520
5	Digital Principles and Applications, Albert Paul Malvino and Donald P Leach, 7Th Edition, 2011, Tata McGraw Hill Education Private Limited, ISBN (13 digit): 978-0-07-014170-4 and ISBN (10 digit): 0-07-014170-3

Continuous Internal Evaluation (CIE): Total marks: 100+50=150
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. The total CIE for theory is 100.
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): Total marks: 100+50=150
Theory – 100 Marks

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

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

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

High-3 : Medium-2 : Low-1

Semester: III						
PRINCIPLES OF ELECTROMAGNETIC FIELDS (Theory) (Common to EE, EC, ET)						
Course Code	**:**	**18ET35**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**40L**		**SEE Duration**	**:**	**3.00 Hours**

Course Learning Objectives:	
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	**08 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 Volume Charge, 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. 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	**07 Hrs**
Magneto Static Fields-2: Magnetic potentials, Magnetic energy, Magnetic Boundary Conditions, Force due to magnetic fields(Charged particle, Current element) , Lorentz Force equation. **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 and transmission: Normal incidence and oblique incidence. Illustrative examples.	

Course outcomes: On completion of the course, the student should have acquired the ability to	
CO1:	Understand the basic concepts of electric fields, magnetic fields and electromagnetic waves.
CO2:	Apply the basic concepts to solve complex problems in electric fields, magnetic fields and electromagnetic waves.
CO3:	Analyze different charge and current configurations to derive the electromagnetic field equations
CO4:	Design simple solutions for applications in electric and electronic circuits, electrical machines and communication systems.

Reference Books	
1	Principles of Electromagnetics, Matthew N O Sadiku , 4th edition, 2007, Oxford University Press ,ISBN: 9780198062295, 019806229X
2	Field and Wave Electromagnetics, David K. Cheng, 2nd Edition, 1989, Pearson Education Asia, Indian Reprint 2001, ISBN: 9789332535022/9788177585766, 8177585762
3	Electro magnetics with Applications, John Krauss and Daniel A. Fleisch, William C Brown Pub, 5th Edition, 1999. ISBN-13: 978-0072899696
4	Engineering Electromagnetics, William H. Hayt Jr. and John A. Buck , 6th Edition, 2001,Tata McGraw Hill, ISBN-13: 978-0071202299

Continuous Internal Evaluation (CIE): Total marks: 100
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. The total CIE for theory is 100.

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

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

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	-	-	-	-	-	-	-	1	-	1
CO2	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 (Common to EE, EC & ET)						
Course Code	**:**	**18EE36**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**40L**		**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 parallel 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 - 978813173231197

Continuous Internal Evaluation (CIE): Total marks: 100
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. The total CIE for theory is 100.
Total CIE is 30(Q) +50(T) +20(EL) =100 Marks.

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

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	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						
MATHEMATICS **Bridge Course** **(COMMON TO ALL BRANCHES)**						
Course Code	**:**	**18DMA37**		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	**2:0:0**		**SEE**	**:**	**50 Marks**
Audit Course				**SEE Duration**	**:**	**2.00 Hours**

Course Learning Objectives:	
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 –Invers differential operator Methods 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: On completion of the course, the student should have acquired the ability 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	B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2015, ISBN: 978-81-933284-9-1.
2	Higher Engineering Mathematics, B.V. Ramana, 11th Edition, 2010, Tata McGraw-Hill, ISBN: 978-0-07-063419-0.
3	N.P. Bali & Manish Goyal, A Text Book of Engineering Mathematics, Lakshmi Publications, 7th Edition, 2010, ISBN: 978-81-31808320.
4	Erwin Kreyszig, Advanced Engineering Mathematics, 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**	**:**	**3.00 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**	**:**	**2.00 Hours**

Course Learning Objectives:	
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, Characterization of conducting polymers, Semiconducting Organic Materials, Organic Superconductors, Organic Piezoelectric Materials.	
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: On completion of the course, the student should have acquired the ability 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 05 marks adding up to 15 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 25 marks each and the sum of the marks scored from three tests is reduced to 30. The marks component for experiential learning is 05. The total marks of CIE are 50. 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 each course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 10 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 8 marks adding up to 40 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

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

High-3 : Medium-2 : Low-1

Semester: IV						
ELECTRICAL MACHINES– I (Theory & Practice)						
Course Code	**:**	**18EE43**		**CIE**	**:**	**100+50 Marks**
Credits: L:T:P	**:**	**3:0:1**		**SEE**	**:**	**100+50 Marks**
Total Hours	**:**	**40L+33P**		**SEE Duration**	**:**	**3.00+3.00Hours**

Course Learning Objectives:	
1	Apply the theory of electromagnetism in analyzing electrical machines.
2	Describe the construction, characteristics and operation of the transformers and induction machines.
3	Develop and analyze the equivalent circuit model of transformers and induction motors to evaluate their performance characteristics at different loading conditions.
4	Design and estimate the physical dimensions of the machine in relation to the output.

Unit-I	**08 Hrs**
Theory Of Transformer: Principle, Types of transformer, Equivalent circuit, Phasor diagram, Losses, Predetermination of efficiency & regulation, Tap changing transformers, All day efficiency, Causes of failure of transformers. **Auto Transformers:** Applications, advantages & limitations.	
Unit – II	**09 Hrs**
Industrial Tests: H.V.Flash test, Sumner's test. **Parallel Operation:** Polarity test, load sharing of transformers in parallel. **3-Phase Transformers:** Y: Y, Y: Δ, Δ: Y, andΔ:Δ, open delta connection, Scott connection, phasor diagrams. Harmonics in transformers.	
Unit -III	**09 Hrs**
Induction Machine: Production of rotating magnetic field, operation on no-load and load, phasor diagram, Power flow diagram- calculation of HP, torque, efficiency and power factor. Torque – slip characteristics, Maximum torque, Performance of Induction Motors: No load and blocked rotor tests, equivalent circuit, circle diagram, Cogging and crawling	
Unit –IV	**07 Hrs**
Method of starting induction motors. Speed control of induction motor by pole changing method, stator voltage control and Rotor resistance control. Single Phase Induction Motors: Double field revolving theory, Starting methods and type of motors, Single phase series motors, repulsion motors. Induction Generator :principle of working ,isolated induction generator, Advantages ,Limitations and applications of Induction Generator	
Unit –V	**07 Hrs**
Main dimensions of Transformers: Design on main dimensions, Design of windings, Design of insulations, Design of core sections(single phase, Three phase), problems. **Main dimensions of Induction motors:** Design on specifications, Stator design, Rotor Design(Single phase , Three phase),problems.	

Laboratory Experiments
1. SC, OC test on 1 - phase transformer. Predetermination of efficiency & regulation from equivalent circuit. Verification of efficiency & regulation by load test at UPF. 2. Sumpner's test 3. Parallel operation of two dissimilar 1phase transformers. 4. Connection of 3 single phase transformers in star – star, star-delta etc. and determination of efficiency & voltage relationship for balanced direct loading. 5. Scott connection-for balanced and unbalanced loads. 6. Load test on 3phase Induction motor – performance evaluation from Equivalent circuit and

Circle Diagram. Speed control of 3 - phase induction motor – stator voltage & rotor resistance control.

7. Load test on 1-phase Induction motor. Change the serial number and include one more test.
8. Load test on Induction generator to draw a plot of output versus speed.

Course outcomes: On completion of the course, the student should have acquired the ability to	
CO1:	Understand the operation of transformers and induction motors.
CO2:	Analyze the performance characteristics of Transformer and Induction motors.
CO3:	Evaluate, assess and compare the operation of machines at different loadings.
CO4:	Design the various parts of the machine by changing different parameters in steps to obtain maximum output

Reference Books	
1	Performance and Design of A.C. Machines, M. G. Say, C.B.S. Publishers.3rd Edition, 2005, I SBN-10: 8123910274
2	Electrical Machines , Ashfaq Hussain, ,.3rd Edition, 2017, Dhanpatrai and Co, ISBN-9788177001662
3	A Course in Electrical Machine Design,.A.K. Sawhney, Danpat Rai and Co, 2001, ISBN 007-709610
4	Principles of Electrical Machine Design, R.K Agarval, S.K Kotari and sons, 3rd Edition 2007. SBN 10: 9380027125 / ISBN 13: 9789380027128.

Continuous Internal Evaluation (CIE):

Total marks: 100+50=150 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. The total CIE for theory is 100.

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.

Theory – 100 Marks

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

Laboratory- 50 Marks

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

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

High-3 : Medium-2 : Low-1

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

Course Learning Objectives:	
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.

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Course outcomes: On completion of the course, the student should have acquired the ability 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	Micro-Processors and Interfacing-Programming & Hardware, Douglas Hall, TMH, 2nd Edition, 2002, ISBN-10- 0070601674
2	The Intel Micro-processors, Architecture, Programming and Interfacing, Barry B. Brey, Pearson Education, 6th Edition, 2008, ISBN-10: 0135026458
3	The 8051 Microcontroller Architecture, Programming &Applications, Kenneth J. Ayala, Thomson Learning, 2nd Edition, 2004. Publisher: Cengage Learning; ISBN-13: 978-1401861582
4	The 8051 Microcontroller and Embedded Systems, Muhammad A Mazidi, 2nd Edition, 2009, Pearson Education, ISBN: 13: 978-0131194021

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**

High-3 : Medium-2 : Low-1

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

Course Learning Objectives:	
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	**08 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	**08 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 LTI System and Solving Difference Equations.	
Unit -III	**08 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 Concept.	
Unit –IV	**08 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, Filtering of long data sequences.	
Unit –V	**07 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 – point real sequence.	

Course outcomes: On completion of the course, the student should have acquired the ability to	
CO1:	Understand representation of basic signals, LTI system and its response in time and frequency domains.
CO2:	Apply various mathematical operations on signals.
CO3:	Analyze both continuous and discrete time systems in time, frequency and z-domains
CO4:	Design simple signal conditioning systems

Reference Books	
1	Signals and Systems, Simon Haykin and Barry Van Veen, 2nd Edition, 2008. John Wiley & Sons, ISBN: 13: 978-0471164746
2	Digital Signal Processing, Proakis G & Dimitris G. Manolakis , PHI, 4th Edition, 2007, ISBN: 13: 978-8131710005
3	Signals and Systems, V Oppenheim, Alan Willsky and A Hamid Nawab, Alan, 2nd Edition, 2006,Pearson Education Asia/ PHI, ISBN 10: 0138147574
4	Digital Signal Processing A Practical Approach, Emmanuel C. Ifeachar, Barrie E. Jervis, 2nd Edition., 2001, Pearson Education, ISBN: 13: 978-0201596199

Continuous Internal Evaluation (CIE): Total marks:
100 Theory – 100 Marks

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

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

Semester End Evaluation (SEE): Total marks:
100 Theory – 100 Marks

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

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**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: IV						
CONTROL SYSTEMS (Theory) (Common to EE & EI)						
Course Code	**:**	**18EE46**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**40L**		**SEE Duration**	**:**	**3.00 Hours**

Course Learning Objectives:	
1	Acquire the knowledge of classical control system analysis techniques, system response and performance characteristics
2	Develop mathematical model and simulate single-input single-output linear systems
3	Design a system to analyze and evaluate stability of feedback control systems using both time and frequency domain methods to meet desired needs
4	Express the effects of PID controllers and compensators on the system performance

Unit-I	**08 Hrs**
Introduction: Definitions, Classification of control systems open loop and closed loop, linear and nonlinear, time variant and time invariant, continuous and discrete time systems. Block diagram of a typical closed loop control system showing the basic structure and different terminologies . Modeling and Representation Of Control System: The transfer function concept, transfer function of simple electrical networks, different forms of transfer functions, transfer function of a closed loop system, block diagrams and signal flow graphs. Masons gain formula. Modeling of mechanical translational and rotational systems and their electrical analog, gear trains, modeling of a.c &d.c servomotors.	
Unit – II	**09 Hrs**
Time Response of Feedback Control Systems: Standard test signals, step response of first and second order systems, time domain specifications. Type and order of the system, Steady state error and static error constants. Effect of feedback on sensitivity. **Stability Analysis:** Concept of stability, types of stability, Routh Hurwitz criterion, relative stability analysis.	
Unit -III	**09 Hrs**
Root Locus: Introduction, concept of magnitude and angle criterion, construction of root loci, root contours. Effect of adding a pole/zero to the system. Introduction to frequency domain: Frequency domain specifications, concept of phase margin and gain margin, correlation between time and frequency response.	
Unit –IV	**07 Hrs**
Frequency Domain Analysis: Introduction to frequency domain plots. Polar plots, Principle of argument, Nyquist plots and Nyquist stability criterion. Bode plots, stability analysis using Bode diagrams.	
Unit –V	**07 Hrs**
Controllers and Compensators: Basic control actions P, PI, PD and PID controllers and their effects on the dynamic and static behavior of the system. Lag, lead and lead-lag compensators, realization using RC networks. Design of controllers (PID) using Root locus and compensators (lag-lead) using bode plots.	

Course outcomes: On completion of the course, the student should have acquired the ability to	
CO1:	Comprehend the different types of control systems and their building blocks
CO2:	Analyze the different systems by means of their transfer function
CO3:	Evaluate the performance of systems and assess their stability
CO4:	Design the system or compensator for the desired performance parameters

Reference Books	
1	Control System Engineering , J Nagarath and I.J.Nagarath and M Gopal, 5th edition, 2007, New age international publishers, ISBN: 81-224-1775-2M.Gopal , "Control systems - Principles and design", TMH,2nd edition,2006, ISBN: 0071231277, 9780071231275
2	K.Ogata, "Modern control engineering", Pearson education, 2004, 4th edition. ISBN: 1-317-1887-2
3	Modern Control Systems , R.C. Dorf and R.H.Bishop, 12th Edition,2010, Addison Wesley, ISBN 13: 978-0136024583
4	Automatic Control Systems, Kuo B.C 9th Edition, 2014, ., Prentice Hall of India Ltd., New Delhi, ISBN- 13: 978-8126552337

Continuous Internal Evaluation (CIE): Total marks:
100 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. The total CIE for theory is 100.

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

Semester End Evaluation (SEE): Total marks:
100 Theory – 100 Marks

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

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**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: IV						
Design Thinking Lab						
Course Code	**:**	**18EE47**		**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**	**:**	**50 Marks**
Credits: L:T:P	**:**	**2:0:0**		**SEE**	**:**	**50 Marks**
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	**04 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	**04 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	**06 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	**06 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	**08 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.	

Laboratory Component	
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 delimiters, 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.	Compute the roots of the equation $ax^2 + bx + c = 0$and print using five-decimal places. The roots are real $-b \pm \sqrt{D}/ 2a$if the discriminant $D = b^2-4ac$ is non-negative. If the discriminate is negative, then the roots are complex conjugate$-b /2a \pm \sqrt{-D}i/ 2a$. a) The program should accept the values of a, b and c from the keyboard. b) No solution if both a and b are zero. The program terminates with appropriate message. c) Linear equation if $a = 0$ but $b \neq 0$ and the root is $-c/b$. The program prints out the root with appropriate message and the program terminates. d) Calculate the discriminant D and determines the corresponding roots. e) Display all possible roots of a quadratic equation with appropriate message.
6a.	Write a program to print out a multiplication table as given below. 1 2 3 4 5 6 7 8 9 10 2 4 6 8 10 12 14 16 18 20 3 6 9 12 15 18 21 24 27 30 4 8 12 16 20 24 28 32 36 40 5 10 15 20 25 30 35 40 45 50 Write a C program to generate the patterns using for loops. Example: (to print * if it is even number) 1 ** 333 ****
6b.	55555
7a.	Write a C program to find the Greatest common divisor(GCD)and Least common multiplier(LCM)
7b.	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	Write a C program to find the length ofthe string without using library function.

1b.	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: On completion of the course, the student should have acquired the ability 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	H. Schildt, Turbo C: The Complete Reference, Mcgraw Hill Education, 4th Edition, 2000, 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 (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 60. The marks component for experiential learning is 10. The total marks of CIE are 100.

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

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

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**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 /Semester**		**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.	
	6 Hrs
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	

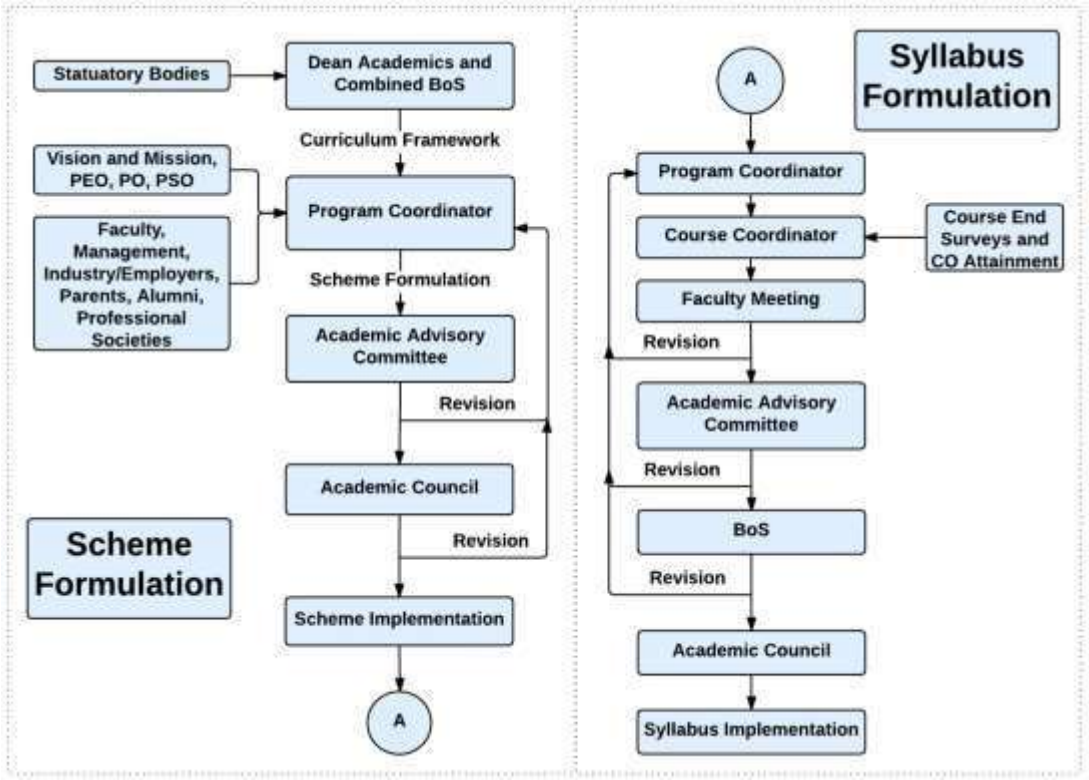
Course Outcomes: After completing the course, the students will be able to	
CO1:	Inculcate skills for life, such as problem solving, decision making, stress management
CO2:	Develop leadership and interpersonal working skills and professional ethics.
CO3:	Apply verbal communication skills with appropriate 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

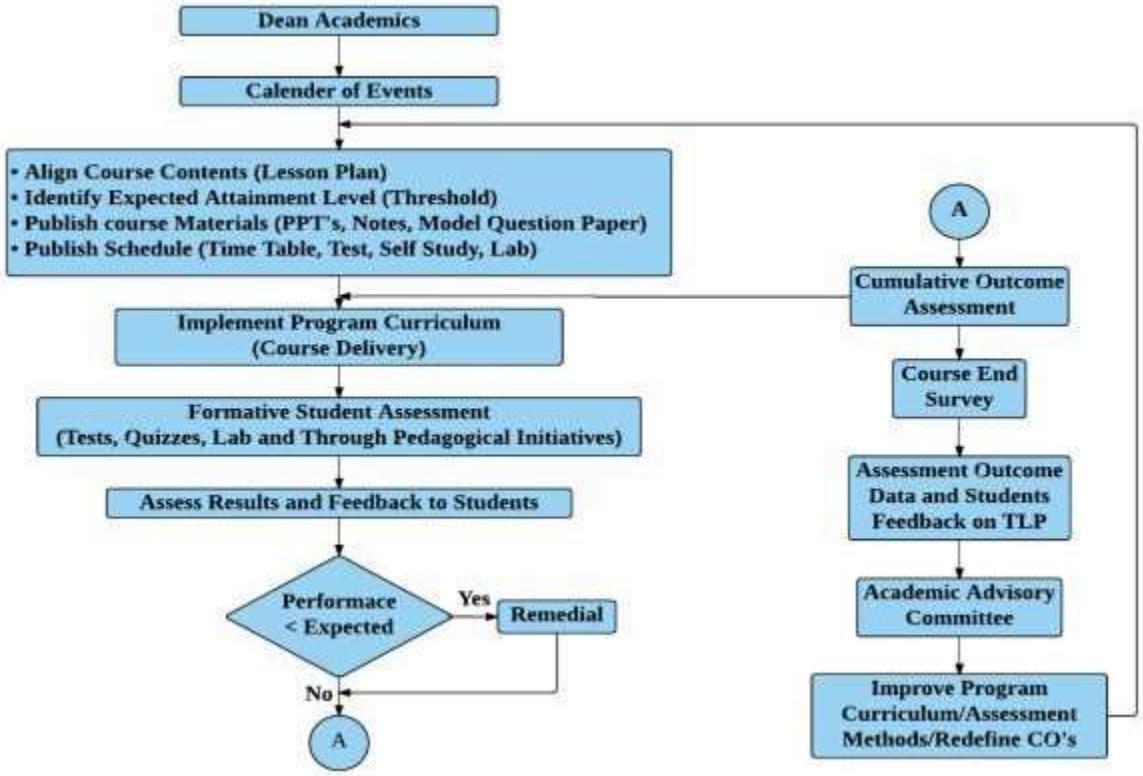
Scheme of Continuous Internal Examination and Semester End Examination

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.	

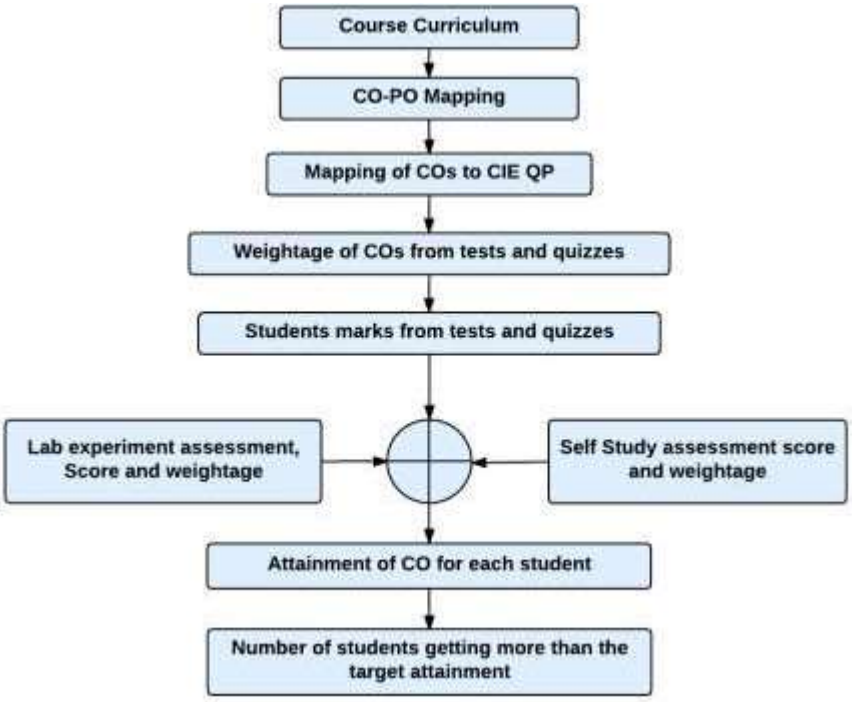
Curriculum Design Process



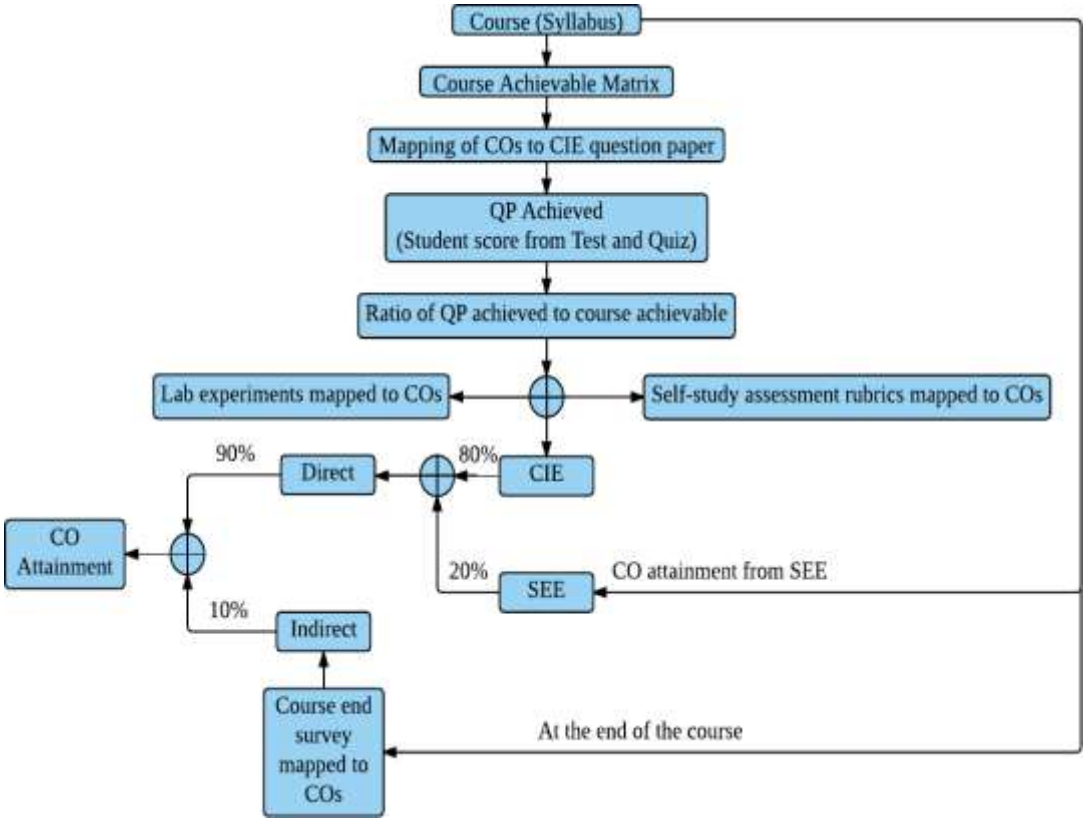
Academic Planning and Implementation



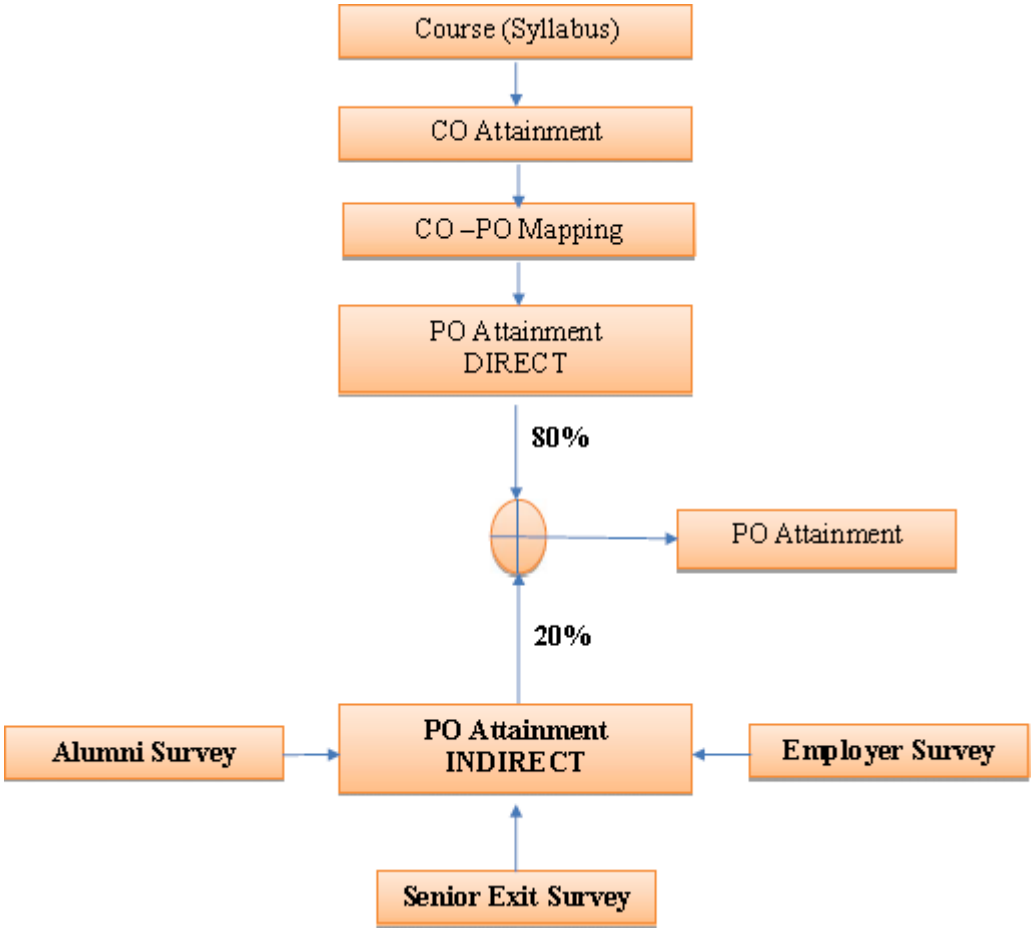
Process for Course Outcome Attainment



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.