RV COLLEGE OF ENGINEERING®

Go, change the world

RV COLLEGE OF ENGINEERING®

(An Autonomous Institution Affiliated to VTU, Belagavi)
Approved by AICTE, New Delhi, Accredited By NBA, New Delhi
RV Vidyaniketan Post, 8th Mile, Mysuru Road, Bengaluru- -560 059.

Bachelor of Engineering (B.E)

ELECTRONICS & INSTRUMENTATION ENGINEERING

(2018 Scheme)

III & IV Semester

ACADEMIC YEAR 2020-2021

Estd.1963

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RV Vidyaniketan Post, 8th Mile, Mysuru Road, Bengaluru- -560 059.

2020 Ranked 70th in Engineering Category

Accredited by NBA

One of the most preferred Technical Institutions

PROGRAMS OFFERED

B.E. Programs : AS, BT, CH, CS, CV, EC, EE, EI, ET, IM, IS, ME.
M.Tech (16), MCA, M.Sc. (Engg.)

Ph.D. Programs : All Departments are recognized as Research Centres by VTU

- Best NCC Institution for Karnataka & Goa Directorate for the year 2017-19
- Five RVCE Alumni cleared civil Services Exam in 2019-20
- Ranked in top 10 Pvt. College in the country by various magazines
- Ranked 3rd in Sports & Cultural Activities under VTU (2018-19)

Use of ICT in Teaching Learning Process

Holistic development of students through NCC, NSS Cultural activities, Community service & Sports.

Established Centre of Excellence in Macroelectronics & Internet of things

MoUs: 96+with Industries / Academic Institutions in India & abroad

Executed more than Rs. 40 crores worth sponsored research projects & consultancy works since 3 Years

UPSC Results (2019) : RVCE - Alumni

Name	:	Rahul Sharanappa Shankanur
Rank	:	17
Branch	:	ECE
Batch	:	2012

Name	:	Raghavendra
Rank	:	739
Branch	:	ECE
Batch	:	2012

Name	:	Harshavardhana B.J.
Rank	:	352
Branch	:	CSE
Batch	:	2015

Human Resource

RVCE - Greaves Cotton Ltd Centre of excellence in e-mobility

RV-Mercedes Benz Centre for Automotive Mechatronics

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R.V. Vidyaniketan Post, Mysore Road
Bengaluru – 560 059

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

2018 SCHEME

DEPARTMENT OF

ELECTRONICS AND INSTRUMENTATION ENGINEERING

DEPARTMENT VISION

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

DEPARTMENT MISSION

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

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

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

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

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

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

PROGRAM SPECIFIC OUTCOMES (PSOS)

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

Lead Society: International Society of Automation (ISA)

ABBREVIATIONS

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

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RV COLLEGE OF ENGINEERING®

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ELECTRONICS AND INSTRUMENTATION ENGINEERING

THIRD SEMESTER CREDIT SCHEME							
Sl. No.	**Course Code**	**Course Title**	**BoS**	**Credit Allocation**			**Total Credits**
				L	**T**	**P**	
1.	18MA31B*	Discrete and Integral Transforms	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 to EC,EE, EI& ET)	EC	4	0	1	**5**
5.	18EI35	Data Structures using C	EI	2	0	1	**3**
6.	18EI36	Measurement & Process Instrumentation	EI	3	0	0	**3**
7.	18DMA37***	Bridge Course: Mathematics	MA	2	0	0	**0**
8.	18HS38A / 18HS38V	Kannada Course: **AADALITHA KANNADA (18HS38A) / VYAVAHARIKA KANNADA (18HS38V)**	HSS	1	0	0	**1**
Total Number of Credits				**19**	**1**	**3**	**24**
Total number of Hours/Week				**19+3***	**2**	**7.5**	

*Engineering Mathematics – III

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

**

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

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

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

#Mandatory audit course for all students

#There are two text books prescribed by VTU for the Kannada Course:

1. Samskruthika Kannada **(AADALITHA KANNADA-18HS38A);**
2. Balake Kannada **(VYAVAHARIKA KANNADA-18HS38V);**

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

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ELECTRONICS AND INSTRUMENTATION ENGINEERING

FOURTH SEMESTER CREDIT SCHEME							
Sl. No	**Course Code**	**Course Title**	**BOS**	**Credit Allocation**			**Total Credits**
				L	**T**	**P**	
1.	18MA41B*	Linear Algebra, Statistics and Probability Theory	MA	4	1	0	**5**
2.	18EC42**	Engineering Materials	EC	2	0	0	**2**
3.	18EI43	Sensors and Actuators	EI	3	0	1	**4**
4.	18EI44	Microprocessor & Microcontroller (Common to EC,EI,EE,& ET)	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.	18EI47	Design Thinking lab	EI	0	0	2	**2**
8.	18DCS48 ***	Bridge Course: C Programming	CS	2	0	0	**0**
9.	18HS49	Professional Practice-I Communication Skills	HSS	0	0	1	**1**
Total Number of Credits				**18**	**2**	**5**	**25**
Total number of Hours/Week				**18+2***	**4**	**10+1**	

*ENGINEERING MATHEMATICS – IV

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

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

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

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

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

Semester: III						
DISCRETE AND INTEGRAL TRANSFORMS (Theory) (Common to EC, EE, EI &ET)						
Course Code	**:**	**18MA31B**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**4:1:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**52L+13T**		**SEE Duration**	**:**	**3.00 Hours**

Course Learning Objectives: The students will be able to

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

Unit-I	**10 Hrs**

Laplace Transform:

Existence and uniqueness of Laplace transform (LT), transform of elementary functions, region of convergence. Properties - linearity, scaling, s - domain shift, differentiation in the s - domain, division by t, differentiation and integration in the time domain. LT of special functions - Periodic functions (square wave, saw-tooth wave, triangular wave, full & half wave rectifier), Heaviside unit step function, unit impulse function, t - shift property. Relevant MATLAB commands to develop additional insight into the concepts.

Unit – II	**11 Hrs**

Inverse Laplace Transform:

Definition, properties, evaluation using different methods. Convolution theorem (without proof), problems. Application to solve ordinary linear differential equations. Relevant MATLAB commands to develop additional insight into the concepts.

Unit –III	**11Hrs**

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 Fourie's series of functions.

Unit –IV	**10Hrs**

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	**10Hrs**

Z-Transform:

Introduction, z - transform of standard functions, Region of convergence, properties - linearity, scaling, shifting theorem, initial and final value theorems. Inverse z - transform using power series and partial fraction expansions, convolution theorem (without proof), problems. Application to solve difference equations arising in communication and control systems. Relevant MATLAB commands to develop additional insight into the concepts.

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

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

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

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

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

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

SEE for 100 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 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

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

High-3: Medium-2: Low-1

Semester: III						
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	**:**	**26L**		**SEE Duration**	**:**	**02 Hours**

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	**05 Hrs**
Introduction: Environment - Components of environment, Ecosystem. Impact of anthropogenic activities on environment (agriculture, mining and transportation),Environmental education, Environmental acts & regulations, role of non-governmental organizations (NGOs), EMS: ISO 14000, Environmental Impact Assessment. Environmental auditing.	
Unit – II	**06 Hrs**
Environmental pollution: Air pollution – point and non point sources of air pollution and their controlling measures (particulate and gaseous contaminants). Noise pollution, Land pollution (sources, impacts and remedial measures). **Water management**: Water conservation techniques, water borne diseases & water induced diseases, arsenic & fluoride problems in drinking water and ground water contamination, advanced waste water treatment techniques.	
Unit -III	**06 Hrs**
Waste management, Solid waste management, e waste management & biomedical waste management – sources, characteristics & disposal methods. Concepts of Reduce, Reuse and Recycling of the wastes. **Energy** – Different types of energy, conventional sources & non-conventional sources of energy, solar energy, hydro electric energy, wind energy, Nuclear energy, Biomass & Biogas Fossil Fuels, Hydrogen as an alternative energy.	
Unit –IV	**05 Hrs**
Environmental design: Principles of Environmental design, Green buildings, green materials, Leadership in Energy and Environmental Design (LEED), soilless cultivation (hydroponics), organic farming, use of biofuels, carbon credits, carbon foot prints, Opportunities for green technology markets, carbon sequestration.	
Unit –V	**04 Hrs**
Resource recovery system: Processing techniques, materials recovery systems, biological conversion (composting and anaerobic digestion). Thermal conversion products (combustion, incineration, gasification, pyrolysis, use of Refuse Derived Fuels). Case studies of Biomass conversion, e waste.	

Course outcomes: 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	Introduction to environmental engineering and science, Gilbert, M.M, Pearson Education. India, 3rdEdition, 2015, ISBN: 9332549761, ISBN-13: 978-9332549760.
2	Environmental Engineering, Howard S. Peavy, Donald R. Rowe and George Tchobanoglous, McGraw Hill Education, 1stEdition, July 2017,ISBN-10: 9351340260, ISBN-13: 978-9351340263
3	Environmental Science, G. Tyler Miller , Scott Spoolman, Brooks Cole,15th Edition, 2012, ISBN-13: 978-1305090446 ISBN-10: 130509044
4	Environment Management, Vijay Kulkarni and T. V. Ramachandra, TERI Press, 2009, ISBN: 8179931846, 9788179931844

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

CIE is executed by way of quizzes (Q), tests (T) and Assignment (A). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks which will be reduced to 15marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 25 marks each and the sum of the marks scored from three tests is reduced to 30. The marks component for assignment is 05.

The total CIE for theory is 15(Q) +30(T)+05(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 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 08marks 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	**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
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 EE, EI &ET)						
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 thefrequency response. 9. Design and implement a Astable multivibrator for a given frequency and duty cycle using NE555 Timer. 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. 15. 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, Oxford University Press 5th Edition, 2004,*ISBN*-13: 978-0195338836
4	Microelectronics, Millman & Grabel: 2ndEdition, 2011, Mcgraw HillPublication, *ISBN13:9780074637364*.

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 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 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	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, EI &ET)						
Course Code	**:**	**18EC34**		**CIE**	**:**	**100+50 Marks**
Credits: L:T:P	**:**	**4:0:1**		**SEE**	**:**	**100+50 Marks**
Total Hours	**:**	**52L+33P**		**SEE Duration**	**:**	**03+03 Hours**

Course Learning Objectives: The students will be able to

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

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

		the value of C_{out} (correction circuit).
2.	a.	Arithmetic circuits- Realize the given Boolean expressions using MUX/DEMUX using IC-74153, IC-74139.
	b.	Practice Question: Realize FA/FS using MUX/DEMUX.
3.	a.	Code convertors i) Binary to Gray ii) BCD to Excess-3 using Decoder/Demux.
	b.	Practice Question i) Binary to excess-3 using IC-7483 ii) Gray to Binary using Decoder
4.	a.	Design a two-bit magnitude comparator using logic gates.
	b.	Drive the LED Display using IC-7447.
	c.	Practice Question: Design an n-bit comparator using IC-7485(make use of cascading facility)
5.	a.	Design a Master JK-FF using NAND gates. Also design D-FF and T-FF using same. Observe the waveform using CRO.
	b.	Practice Question: Design Master Slave JK-FF using P-Spice simulation software and observe the waveforms.
6.	a.	Realization of asynchronous mod-n counter using IC-7490, IC-7493.
	b.	Using IC-7495 perform SISO, SIPO, PISO, PIPO, Shift left operations.
	c.	Design ring and Johnson counter using IC-7495
	d.	Practice Question: Design mod-99 counter using IC-7490.
7.	a.	Design of synchronous 3-bit up/down counter using IC-7476/IC-74112
	b.	Design a synchronous counter to count given sequence.
	c.	Using presettable counters IC-74192/193 perform mod-n counts.
	d.	Practice Question: Design a synchronous 4-bit up/down counter using P-Spice simulation software and observe the waveforms.
8.		Design a sequence generator using a shift register to obtain a sequence Y= 100010011010111
9.		Using IC-74192/193, drive the LED display and generate a given sequence
10.		Design a 2-bit ALU operation using P-Spice simulation software and observe the waveforms

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

Reference Books	
1	Digital Logic and Computer Design, M. Morris Mano, Pearson Education Inc., 13th Impression, 2011, ISBN: 978-81-7758-409-7.
2	Fundamentals of Logic Design, Charles H. Roth (Jr.), West publications, 4th Edition, 1992, ISBN-13: 978-0-314-92218-2.
3	Digital Fundamentals, Thomas Floyd, 11th Edition, Pearson Education India, ISBN 13: 978-1-292-07598-3, 2015.
4	Digital Principle and Design, Donald D. Givone, Mc Graw-Hill, ISBN: 0-07-119520-3 (ISE), 2003.
5	Digital Principles and Applications, Albert Paul Malvino and Donald P Leach, 7Th Edition, Tata McGraw Hill Education Private Limited, 2011, ISBN (13 digit): 978-0-07-014170-4 and ISBN (10 digit): 0-07-014170-3

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

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

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

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

The Laboratory session is held every week as per the time table and the performance of the student is evaluated in every session. The average marks (AM) over number of weeks 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 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 20 marks covering the complete syllabus. Part B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

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

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

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

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

High-3: Medium-2: Low-1

Semester: III						
DATA STRUCTURES USING C (Theory & Practice)						
Course Code	**:**	**18EI35**		**CIE**	**:**	**100+50 Marks**
Credits: L:T:P	**:**	**2:0:1**		**SEE**	**:**	**100+50 Marks**
Total Hours	**:**	**27L+33P**		**SEE Duration**	**:**	**03+03 Hours**

Course Learning Objectives: The students will be able to

1	Explain fundamentals of data structures and their applications essential for programming/problem solving
2	Understand the basic operations and implementation of different data structures – Stacks, queues, linked list and binary trees.
3	Demonstrate sorting and searching algorithms
4	Find suitable data structure during application development/Problem Solving

Unit-I	**04 Hrs**
Introduction to Structures and Pointers **Introduction:** Types of Data Structures: Linear & non-linear Data Structures **Stacks:** Stack definitions & concepts, Representing stacks in C, Operations on stacks, Applications of Stacks: Infix to Postfix, Postfix expression evaluation	
Unit – II	**07 Hrs**
Recursion: Introduction to Recursion, Factorial function, Binary search, Towers of Hanoi problem, GCD of 2 numbers. **Queues :** The Queue and Its Sequential Representation: C implementation of Queues, Insertion, Deletion and Display operations, Circular Queue, **Dynamic Memory allocation:** malloc( ), calloc( ),free( ), realloc()	
Unit –III	**07 Hrs**
Linked Lists: Inserting and removing nodes from a list, getnode and freenode operations, Implementation (insertion, deletion and display) of singly Linked list, Doubly linked list, Circular singly linked list.	
Unit –IV	**05Hrs**
Trees: Basic definition, C Representations of Binary Trees, Binary search trees (BST) operations : Insertion, Tree Traversals : Infix, Postfix and Prefix traversals, General Expressions as Trees	
Unit –V	**04 Hrs**
Sorting: Bubble sort, Merge sort, Insertion sort.	

Practical:

1. Write program to create an array of structures with atleast 5 records,each record having the structure shown below:
   Usn Name Marks1 Marks2 Marks3
   Write necessary functions
   To display all the records in the file.
   To search for a specific record based on the Usn.
   In case the record is not found, suitable message should be displayed. Both the options in this case must be demonstrated.
2. Write a C program to construct a stack of integers and to perform the following operations on it :
   Push
   Pop
   Display

The program should print appropriate messages for stack overflow and stack underflow

3. Write a C program to convert and print a given valid parenthesized infix arithmetic expression to postfix expression. The expression consists of single character operands and the

binary operators + , - , * , & /

4. Write a C program to evaluate a valid suffix/postfix using stack. Assuming that the suffix/postfix expression is read as a single line consisting of non-negative single digit operands and binary arithmetic operators. The arithmetic operators are +(add), -(subtract), *(multiply),and /(divide).
5. Write recursive C program to
   i. Perform binary search
   ii. Find GCD of 2 numbers
6. Write a C program to simulate the working of a queue of integers using an array. Provide the following operations :
   i. Insert
   ii. Delete
   iii. Display
7. Write a C program to simulate the working of circular queue of integers using an array. Provide the following operations :
   i. Insert
   ii. Delete
   iii. Display
8. Write a C program using dynamic variables and pointers, to construct a singly linked list of integers
   i. The operations to be supported are:
   ii. The insertion operation
      a. At the front of the list
      b. At the back of the list
   iii. Deleting a node based on the info field id
   iv. Displaying all the nodes in the list
9. Write a C program to support the following operations on a doubly linked list where each node consists of integers :
   i. Create a doubly linked list by adding a node at front
   ii. Delete the node of a given data
   iii. Display the contents of the list.
10. Write a C program
    i. To construct a binary search tree of integers
    ii. To traverse the tree using all the methods i.e preoreder, inorder, postorder
11. Write a C program to implement merge sort
12. Write a C program to implement insertion sort.

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand and explore the fundamental concepts of various data structures.
CO2:	Analyze and represent various data structures.
CO3:	Design algorithms on different data structures like Stack, Queue, List, Tree and sorting.
CO4:	Implement programs with suitable data structure based on the requirements of the application.

Reference Books	
1	Data structures using C and C++, YedidyahLangsam, Moshe J. Augenstein, Aaron M. Tenenbaum, 2nd Edition, PHI/Pearson, 2016,ISBN-13: 978-0130369970
2	Fundamentals of Data Structures in C, Ellis Horowitz and Sartaj Sahni, 2nd Edition, Universities Press, 2014, ISBN-13: 978-0716782506.
3	Data Structures Schaum's Outlines, Seymour Lipschutz, Revised 1st Edition, McGraw Hill, 2014,ISBN-13: 978-0070701984.
4	An Introduction to Data Structures with Applications, Jean-Paul Tremblay & Paul G. Sorenson, 2nd Edition, McGraw Hill, 2017, ISBN-13: 978-0074624715.

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 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 20 marks covering the complete syllabus. Part B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

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

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

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

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**2**	**1**	**3**
CO2	**3**	**2**	**3**	**2**	**3**	**3**	**1**	**1**	**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						
MEASUREMENT & PROCESS INSTRUMENTATION (Theory)						
Course Code	**:**	**18EI36**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**39L**		**SEE Duration**	**:**	**3.00 Hours**
Course Learning Objectives: The students will be able to						
1	Understand the use of various electrical & electronic instruments, principles of operation, analysis, and calibration of instruments					
2	Analyse& apply DC/AC bridges and indicating instruments for unknown parameters measurement					
3	Develop DAS and learn computer controlled instrument systems for inter-instrument communication through IEEE488 bus.					
4	Apply the different calibration techniques for various types of electrical and electronic measuring instruments.					

Unit-I	**07 Hrs**
Measurement and Measurement systems Significance of measurements, Methods of measurements, classification, Functions, Applications, Elements of Generalized measurement system with an example. **Quality of measurement systems** Static and Dynamic Characteristics of Instruments: Definitions and comparisons, Static Characteristics: static error, static correction, scale range and scale span, reproducibility and drift, repeatability, Signal to noise ratio, sources of noise, accuracy, precision, linearity, hysteresis, threshold, dead time, Dynamic Characteristics: Fidelity, frequency response, dynamic error, etc., problems	
Unit – II	**09 Hrs**
DC Bridges: Measurement of low and medium Resistance: Wheatstone bridge, Kelvin double bridge, Problems. **AC bridges:** Measurement of inductance, capacitance, Q of coil, Maxwell's Bridge, Wein bridge, Schering bridge, Applications, Limitations and Problems. **Digital Instruments:** Digital Voltmeter, ramp-type DVM, dual slope integrating DVM, Range changing, Digital multimeters, digital frequency meter, range changing, Digital Tachometer and Digital pH meter	
Unit –III	**09 Hrs**
Flow, pressure, vibration measurement techniques: **Measurement of flow:** Turbine meter, Electromagnetic flow meter, Hot wire anemometer, Flow meter using thermistor,Ultrasonic flow transducer **Measurement of vibration:** Accelerometers, Potentiometric type, LVDT,Piezoelectric, Seismic Transducer. **Measurement of pressure:** Element of pressure sensing element, Diaphragm, Borden Tube, Bellows, Load cell	
Unit –IV	**07 Hrs**
Instrument Calibration methods: Introduction, Comparison methods: DC voltmeter calibration, Deflection instrument calibration, DC Ammeter calibration. AC instrument calibration. Ohmmeter calibration. Digital multimeters as standard instruments. Calibration instruments: precision DC voltage source, voltage calibrator. Potentiometer calibration methods for DC ammeter and voltmeter calibration.	
Unit –V	**07 Hrs**
Data Acquisition system: Introduction, generalized DAS, objective of DAS, uses of DAS, Single channel DAS, Multichannel DAS, Computer based DAS, Its Applications	

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

Reference Books	
1	Electronic Instrumentation and Measurements, David A Bell, 2nd Edition , PHI/ Pearson Education, 2013, ISBN: 978-0195696141
2	Electronic Instrumentation, H S Kalsi, TMH, 3nd Edition, 2017, ISBN: 978-0070702066
3	Modern electronic instrumentation and measurement techniques, Albert D Helfrick, William D Cooper , PHI, 3rd Edition, 2007, ISBN: 978-0132507219
4	Electrical and electronic Measurements and Instrumentation ,A.K. Sawhney, DhanpatRai&sons, 18thEdition,2015, ISBN: 978-8177001006

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 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 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**	**1**	**-**	**-**	**-**	**-**	**2**	**1**	**3**
CO2	**3**	**2**	**3**	**2**	**3**	**3**	**1**	**1**	**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						
MATHEMATICS **Bridge Course** **(Common to all branches)**						
Course Code	**:**	**18DMA37/48**		**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	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&Use mathematical IT tools to analyze and visualize the above concepts.

Unit-I	**05 Hrs**
Differential Calculus: Taylor and Maclaurin series for function of single variable. Partial derivatives – Introduction, simple problems. Total derivative, composite functions. Jacobians – simple problems.	
Unit – II	**05 Hrs**
Vector Differentiation: Introduction, simple problems in terms of velocity and acceleration. Concepts of gradient, divergence – solenoidal vector function, curl – irrotational vector function and Laplacian, simple problems.	
Unit –III	**06 Hrs**
Differential Equations: Higher order linear differential equations with constant coefficients, solution of homogeneous equations - Complementary functions. Non homogeneous equations –Inverse differential operator method of finding particular integral based on input function (force function).	
Unit –IV	**05 Hrs**
Numerical Methods: Solution of algebraic and transcendental equations – Intermediate value property, Newton-Raphson method. Solution of first order ordinary differential equations – Taylor series and 4^{th} order Runge-Kutta methods. Numerical integration – Simpson's $1/3^{rd}$, $3/8^{th}$ and Weddle's rules. (All methods without proof)**.**	
Unit –V	**05 Hrs**
Multiple Integrals: Evaluation of double integrals, change of order of integration. Evaluation of triple integrals. Applications – Area, volume and mass – simple problems.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Understand the concept of partial differentiation, double integrals, vector differentiation, solutions of higher order linear differential equations and requirement of numerical methods.
CO2:	Solve problems on total derivatives of implicit functions, Jacobians, homogeneous linear differential equations, velocity and acceleration vectors.
CO3:	Apply acquired knowledge to find infinite series expansion of functions, solution of non-homogeneous linear differential equations and numerical solution of equations.
CO4:	Evaluate triple integrals, area, volume and mass, different operations using del operator on scalar and vector point functions, numerical solution of differential equations and numerical integration.

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

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

Semester End Evaluation (SEE); Theory (50 Marks)
SEE for 50 marksis 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	**:**	18HS38V		**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 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 only objective type questions for 40 marks covering the complete syllabus. Part – B consists of essay type questions for 10 marks.

Semester: III

AADALITHA KANNADA
(Common to all branches)

Course Code	**:**	18HS38A		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	1:0:0		**SEE**	**:**	**50 Marks**
Total Hours	**:**	16Hrs		**CIE Duration**	**:**	**90 Minutes**

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 ತ್ತುಆಡಳಿತ ಕನ್ನಡದ ಪದಗಳ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.

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– ಕಾಗುಣಿತದ ತಪ್ಪು ಬಳಕೆಯಿಂದಾಗುವ ಲೋಪದೋಷಗಳು ಅಥವಾ ಸಾಧುರೂಪಗಳ ಬಳಕೆ, ಅಲ್ಪ ಪ್ರಾಣ ಮತ್ತು ಮಹಾಪ್ರಾಣಗಳ ಬಳಕೆಯಲ್ಲಿನ ವ್ಯತ್ಯಾಸದಿಂದಾಗುವ ಲೋಪದೋಷಗಳು, ಲೇಖನ ಚಿಹ್ನೆಗಳು, ಕನ್ನಡ ಭಾಷೆಯಲ್ಲಿನ ಲೋಪದೋಷಗಳು ಗೌರವ ಸೂಚಕಗಳ ಬಳಕೆ, ಭಾಷಾ ಬರಹದಲ್ಲಿ 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.ಜೆ.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 simple grammar and essay type questions.

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+13T**		**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 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 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

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

High-3: Medium-2: Low-1

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

Course Learning Objectives: The students will be able to

1	Understand the material classification and categorizes material related to various electronic properties
2	Understand fabrication & characterization techniques and nanomaterial growth
3	Understand the material electronics transport and applications in electronics industry
4	Understand to the extend electronic devices based on novel and emerging materials

Unit-I	**05 Hrs**
Introduction: Classification and Properties of Materials, Materials Used in Electrical and Electronic Industries, Requirements and Future Developments of Electronic Materials	
Unit – II	**07 Hrs**
Classical Theory of Electrical Conduction and Conducting Materials: Resistivity, TCR (Temperature Coefficient of Resistivity) and Matthiessen's Rule, Traditional Classification of Metals, Insulators and Semiconductors, Drude's Free Electron Theory, Hall Effect, Wiedemann–Franz Law, Resistivity of Alloys, Nordheim's Rule, Resistivity of Alloys and Multiphase Solids	
Unit –III	**05 Hrs**
Thin Film Electronic Materials: Techniques for Preparation of Thin Films, Thin Film Conducting Materials, Thin Film Resistors, Transparent and Conductive Thin Films, Thin Film Magnetic Materials	
Unit –IV	**05 Hrs**
Organic Electronic Materials: Conducting Polymers, Charge carriers, Synthesis of Conducting Polymers, Semiconducting Organic Materials, Organic Light Emitting Diode, Organic FET	
Unit –V	**05 Hrs**
Nanomaterials for Electronic Device Applications: Techniques for Preparation of Nanomaterials (Quantum Dots & CNT only), Micro-/Nano-devices Using Nanostructured Materials: CNT transistor, Single electron transistor	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Explain electronics material classification, different physical properties and to the extend device applications.
CO2:	Define the transport mechanism (in solid state & organic), working principle of electronic material and assess material parameters for practical requirement.
CO3:	Summarize various fabrication, characterization and synthesis techniques for the electronic nanomaterials and thin film growth.
CO4:	Identify and calculate material parameters including electrical conductivity, resistivity, magnetic and optical properties for real-time electronic applications.

Reference Books	
1	Introduction to Electronic Materials for Engineers, Wei Gao &Zhengwei Li, Nigel Sammes, 2nd Edition, World Scientific Publishing Co. Pvt. Ltd, ISBN:9789814293693
2	Principles of Electronic Materials and Devices, S O Kasap, 3rd Edition, 2017, McGraw Hill Education, ISBN-13: 978-0070648203
3	Electronic Properties of Materials, Rolf E. Hummel, 4th edition, 2011, Springer, ISBN-13: 978-1489998415

Continuous Internal Evaluation (CIE); Theory (50 Marks)
CIE is executed by way of quizzes (Q), tests (T) and Experiential Learning (EL). A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 15 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 30 marks each and the sum of the marks scored from three tests is reduced to 25. The marks component for experiential learning is 20.
Total CIE is 15(Q) +25(T) +10(EL) =50 Marks.

Semester End Evaluation (SEE); Theory (50 Marks)
SEE for 50 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 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						
SENSORS AND ACTUATORS (Theory & Practice)						
Course Code	**:**	**18EI43**		**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: The students will be able to

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

Unit-I	**07 Hrs**
Introduction: Definition of a transducer, Block Diagram, Active and Passive Transducers, Advantages of Electrical transducers. **Resistive Transducers:** **Potentiometers:** Characteristics, Loading effect, and problems. **Strain gauge:** Theory, Types, applications and problems. **Thermistor, RTD:** Theory, applications and problems. **Thermocouple:** Measurement of thermocouple output, compensating circuits, lead compensation, advantages and disadvantages of thermocouple.	
Unit – II	**09 Hrs**
Inductive Transducers: Principle, Characteristics, Practical applications of LVDT and problems. **Capacitive Transducers:** Capacitive transducers using change in area of plates, distance between plates and change of dielectric constants, Applications of Capacitive Transducers and problems. **Piezo-electric Transducers:** Principle of operation, expression for output voltage, piezo-electric materials, equivalent circuit, loading effect, Frequency response and problems. **Photo sensors**: Photo resistor, Photodiode, Phototransistor, Photocell, Photo-FET, Charge coupled device.	
Unit –III	**09 Hrs**
Chemical sensors: pH value sensor, dissolved oxygen sensor, oxidation-reduction potential sensor, Zirconium probe Sensors, Chem FET sensors **Tactile sensors:** Construction and operation, types. **Special Transducers:** Hall effect transducers, Thin film sensors and smart transducers: Principles and applications. **Fabrication Techniques for Thin film Sensors: Photo Lithography;** Types of photoresists, application of photoresists on substrate. **LIGA process**; General Description, Material for Substrate and Photoresists and Electroplating.	
Unit –IV	**07 Hrs**
Humidity Sensors and Moisture Sensors: Concept of humidity, Electrical Conductivity Sensors, Thermal Conductivity Sensors, Optical Hygrometer, Oscillating Hygrometer. **IR Sensors:** Golay cells, Thermopile, pyroelectric sensor, bolometers, Active Far-Infrared Sensors, Gas flame detectors	
Unit –V	**07Hrs**
Actuators: Introduction to Actuators, Types of Actuators: Thermal Actuators, Electromagnetic actuators, Hydraulic and Pneumatic Actuators, Smart Material Actuators.	
Practical: **Lab Experiments:** 1. Characteristics of potentiometer resistance transducer and Measurement of strain using half and full bridge. 2. Characteristics of capacitance transducer & LVDT.	

3. Characteristics of thermistor & RTD.
4. Characteristics of thermocouple & AD590.
5. Characteristics of LDR and photo transistor.
6. Characteristics of Piezoelectric transducer and load cell.
7. To verify the operation of a unipolar /bipolar analog multiplexer IC.
8. Design and rig up a sample and hold circuit using Basic circuit and IC and determine its Hold time for various sampling frequencies.
9. To test PGA using MUX
10. To drive a 12 V/300Ω relay circuit using LDR.
11. To measure the DC current transfer ratio (CTR) of an opto-coupler by plotting its input/output characteristics, and to design and study the opto-coupler (MCT2E) driven relay circuit.
12. Open ended experiments.

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

Reference Books	
1	Jacob Fraden,Handbook of Modern Sensors: Physics, Designs, and Applications, PHI Publication, 4th Edition 2008, ISBN: 978-1-4419-6465-6.
2	Clarence W.de Silva, Sensors and Actuators: Control systems Instrumentation,CRC Press, 2013 Edition, ISBN: 978-1-4200-4483-6.
3	A.K. Sawhney, Electrical and Electronic Measurements and Instrumentation, DhanpatRai and Sons, 18th Edition, 2008, ISBN: 81-7700-016-0.
4	Ganesh S Hegde, Mechatronics, PHI 3rd Edition, 2010, ISBN: 9781934015292.

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 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 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						
MICROPROCESSOR & MICROCONTROLLER (Theory & Practice) (Common to EI, EC, EE& ET)						
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: The students will be able to

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

Unit-I	**07 Hrs**
MPU Organization: Instruction set Architectures, Harvard & Von-Neuman Architectures, Micro programmed & Hardwired Control unit, Floating Point & Fixed-Point Processor, Endianness, **Intel's 8086 architecture**, Pin groups, Functioning, Segmentation, Address generation, Stack, Interrupts.	
Unit – II	**09 Hrs**
8086 Assembly Language Programming: Addressing Modes of 8086, Instruction Format, Program Development Tools, Assembler Directives, Instruction Set of 8086: Data Transfer Instructions, Arithmetic Instructions, Bit Manipulation Instructions, Branching Instructions, Processor Control Instructions, String Instructions, Macros, Procedures, Assembly Language Programming Examples	
Unit –III	**09 Hrs**
Hardware of 8051 Microcontrollers: Introduction to Embedded system, Microcontroller, Comparison of Microprocessor and Microcontroller, Intel MCS 51 family, Architecture and Pin Functions of 8051 Microcontroller, CPU Organization, Program Counter, Timing and Machine Cycles, Internal Memory Organization, Registers, Stack, Input/ Output Ports, Counters and Timers, Interrupts, Power Saving modes.	
Unit –IV	**07 Hrs**
8051 Microcontroller Based System Design: I/O Port Programming, Programming timers, Asynchronous Serial Data Communication, Interrupt Service Routines. Programming in C, Inline Assembly, Interfacing DAC, Interfacing Matrix Keyboard and Seven Segment Displays, Interfacing ADC in polled mode & Interrupt Mode, Interfacing LCD.	
Unit –V	**07 Hrs**
Peripheral Based Systems: Clock generator(8284), Memory Devices, Address Decoding, Interfacing Memory, I/O sub System: Busy wait, DMA, Interrupt Driven, Memory Maps, I/O Port address decoding, Introduction to 8255, Interfacing 8255 with 8086, Interrupt Based IO Design.	
Practical: Processor & Controller Lab: **Experiments with 8086 Assembly using MASM** 1. Data Transfer Programs: Block Moves & Exchange (With & Without Overlap) with &without String Instructions. 2. Arithmetic Operations: Addition, Multiplication & Division on 32-Bit Data.	

3. a) Code Conversions: Use XLAT Instruction to Convert Binary to BCD, Input from Keyboard & Display Result on the Console.
   b) ASCII Operations: Addition, Subtraction, Multiplication
4. a) Search for a Key in an Array of Elements using Linear Search, Binary Search. Find Efficiency in each case.
   b) Sort an Array Using Bubble Sort & Selection Sort. Find Efficiency in each case.

Interfacing experiments with 8051 C using Keil software

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

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

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

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

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

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

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

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

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

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

SEE for 100 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 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	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**1**
CO2	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**1**
CO3	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**1**	**-**	**1**
CO4	**3**	**3**	**3**	**3**	**2**	**1**	**1**	**2**	**1**	**2**	**1**	**3**

Low-1 Medium-2 High-3

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

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

Unit-I	**8Hrs**
Introduction to Signals and System: Definition of Signals, Classification of Signals, Basic Operations on Signals: Operations Performed on the Independent and Dependent Variable, Precedence Rule, Elementary Signals. Definition of Systems, System Viewed as Interconnection of Operations, Properties of Systems.	
Unit – II	**8 Hrs**
Time domain representations of Linear Time Invariant Systems : Convolution Sum, Convolution Sum Evaluation Procedure, Convolution Integrals, Convolution Integrals Evaluation Procedure, Interconnections of LTI System, Relations between LTI System Properties and the Impulse Response , step response, Difference Equation Representation of LTI System and Solving Difference Equations.	
Unit –III	**8 Hrs**
Applications of Fourier Representations to Mixed Signal classes: Review of Fourier representation of signals, Introduction to DTFS and DTFT, Introduction, Fourier Transform Representations of periodic signals, Convolution and multiplication with Mixtures of periodic and Non-Periodic signals, Fourier Transform representation of discrete time signals, sampling Concept.	
Unit –IV	**8 Hrs**
The Discrete Fourier transforms - 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	**7 Hrs**
Efficient computation of DFT - FFT Algorithms: Direct computation of DFT, Radix-2 FFT Algorithms and Implementation of FFT Algorithms, Applications of FFT algorithms, Efficient computation of DFT of two real sequences, Efficient computation of DFT of a 2N – point real sequence.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Analyze the fundamental concepts of the both continuous and discrete signals and systems, Representation of both periodic & aperiodic signals in frequency domain.
CO2:	Apply the properties of signals and analyze both continuous and discrete systems commonly found in communication, signal processing and control systems.
CO3:	Analyze continuous & discrete systems both in time & frequency domain.
CO4:	Apply efficient methods/algorithms for the computation of frequency domain representation & vice-versa.

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

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

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

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

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

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

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

High-3: Medium-2: Low-1

Semester: IV						
CONTROL SYSTEMS (Theory) (Common to EE,&EI)						
Course Code	**:**	**18EE46**		**CIE**	**:**	**100 Marks**
Credits: L:T:P:S	**:**	**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 .

Modelling 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. Modelling 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); 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 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 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	**:**	**18EI47**		**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						
BRIDGE COURSE C PROGRAMMING (Theory) (Common to All Diploma Students)						
Course Code	**:**	**18DCS48**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**2:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**27L**		**SEE Duration**	**:**	**3.00 Hours**

Course Learning Objectives:	
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 array, 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 delimeters, format specifiers in printf and scanf)
2.	Debug the errors and understand the working of input statements in a program by compiling the C-code.
3.	Implement C Program to demonstrate the working of operators and analyze the output.
4.	Simple computational problems using arithmetic expressions and use of each operator (+,-,/,%) leading to implementation of a Commercial calculator with appropriate message: a) Read the values from the keyboard b) Perform all the arithmetic operations. c) Handle the errors and print appropriate message.
5.	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$-b\ /2a \pm\sqrt{-}Di/\ 2a$. a) The program should accept the values of a,b and c from the keyboard. b) No solution ifbotha andb 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 theprogram 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
6b.	Write a C program to generatethe patternsusing for loops. Example: (to print * if it is even number) 1 ** 333 **** 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.	Write a C program to find the length ofthe string without using library function.

11b.	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 Assignment. A minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 60. The marks component for assignment is 10. The total marks of CIE are 100.

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

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

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	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: 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.	
	6Hrs
Motivation and Stress Management: Self-motivation, group motivation, leadership abilities, Stress clauses and stress busters to handle stress and de-stress; Understanding stress - Concept of sound body and mind, Dealing with anxiety, tension, and relaxation techniques**.** Individual Counselling& 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	

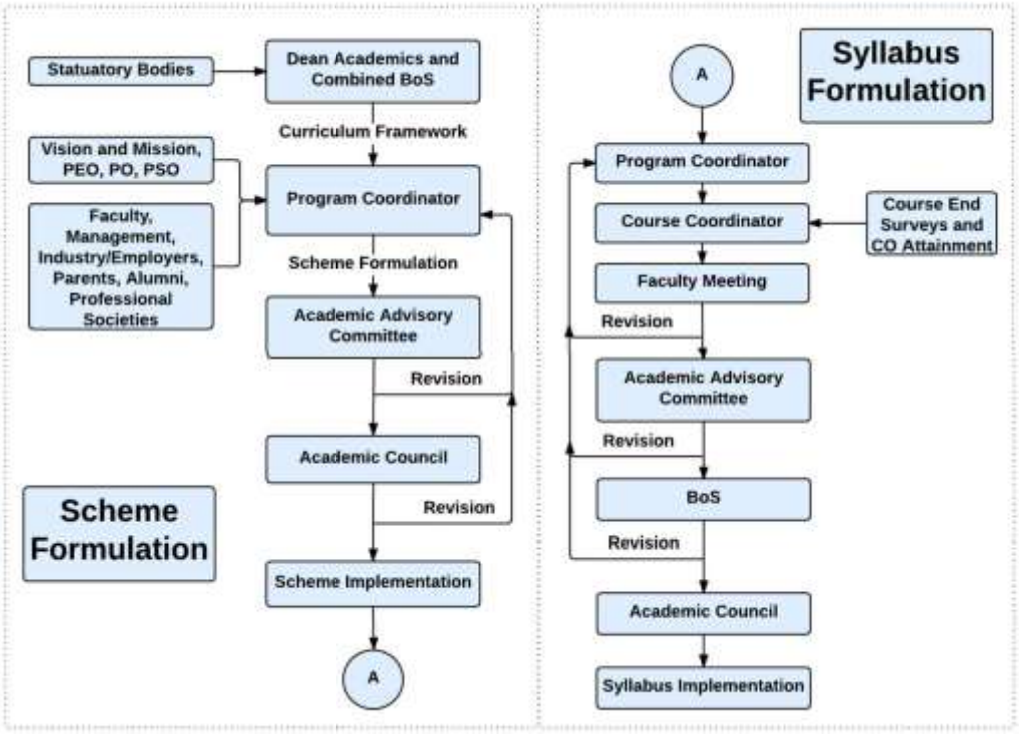
Course Outcomes: After completing the course, the students will be able to	
CO1:	Inculcate skills for life, such as problem solving, decision making, stress management
CO2:	Develop leadership and interpersonal working skills and professional ethics.
CO3:	Apply verbal communication skills with appropriate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

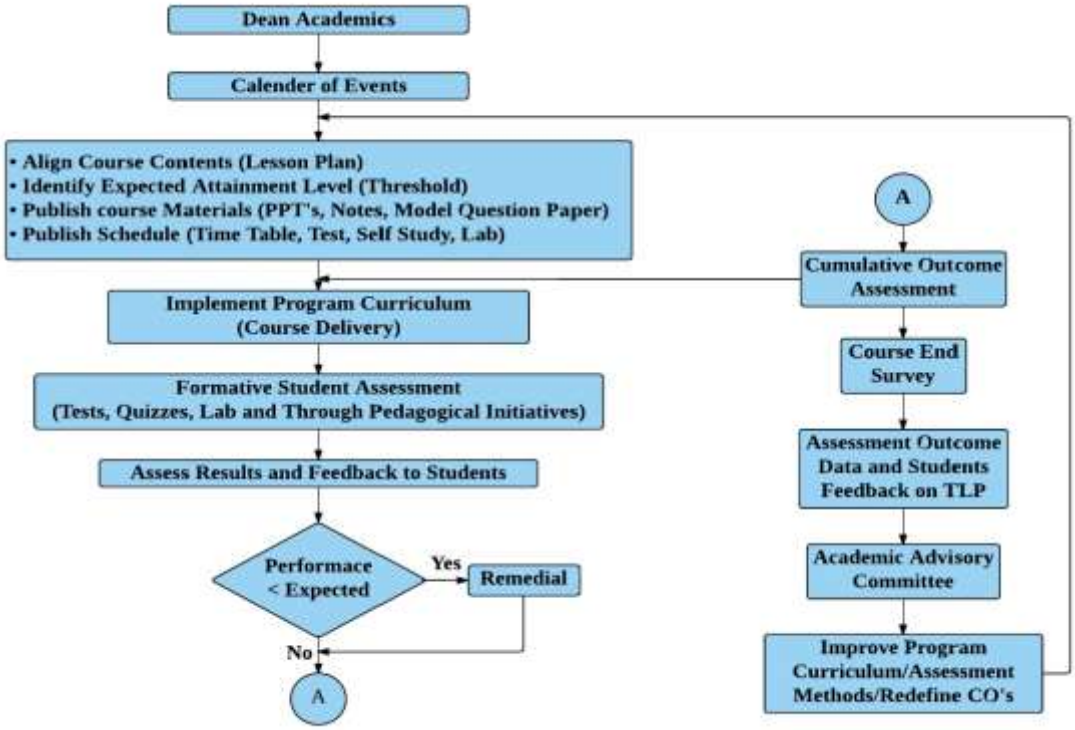
Scheme of Continuous Internal Examination and Semester End Examination:

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.	

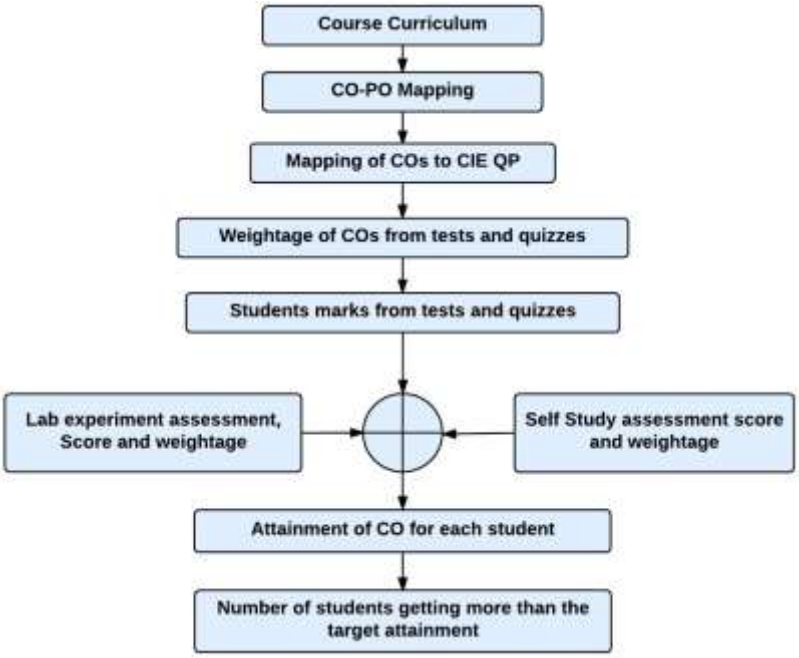
Curriculum Design Process



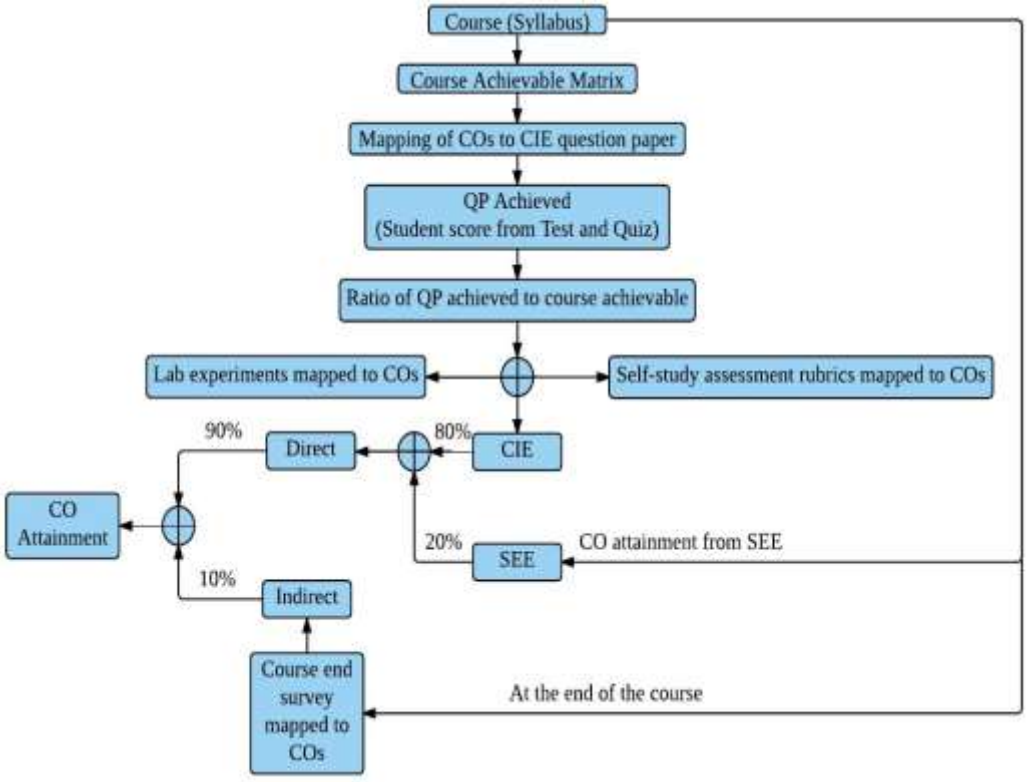
Academic Planning And Implementation



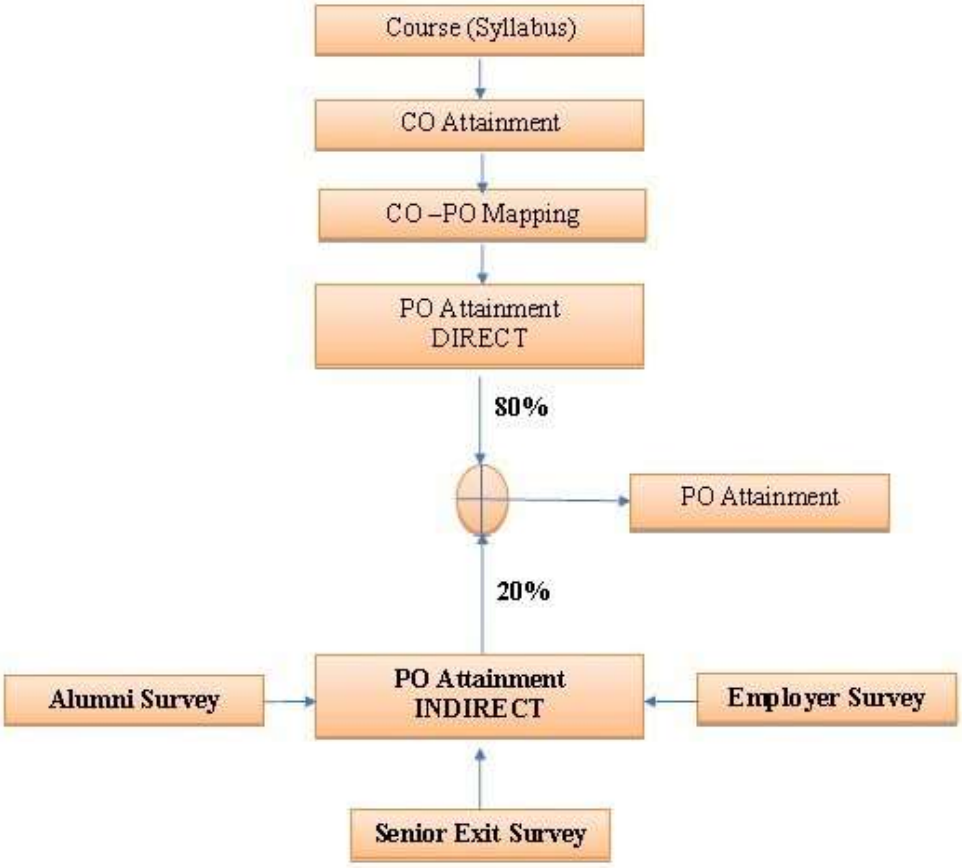
Process For Course Outcome Attainment



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.

Innovative Clubs of RVCE

1	**Ashwa Racing**	Ashwa Mobility Foundation (AMF) is a student R&D platform that designs and fabricates Formula theme race cars and future mobility solutions to tackle urban transportation problems.
2	**Astra Robitcs**	Team involved in the design, fabrication and building application specific robots.
3	**Coding Club**	To facilitate students the skills, confidence, and opportunity to change their world using coding and help them become successful in GSoC, ACM-ICPC, and other recognized coding competitions.
4	**Entrepreneurship Development Cell**	E-Cell is a student run body that aims to promote entrepreneurship by conducting workshops, speaker sessions and discussions on business and its aspects. We possess a mentor board to help startups grow.
5	**Frequency Club**	Team aims at contributing in both software and hardware domains mainly focusing on Artificial Intelligence, Machine Learning and it's advances.
6	**Garuda**	Design and development of supermileage urban concept electric car. Indigenous development of E-mobility products.
7	**Jatayu**	Build a low cost Unmanned Aerial Vehicle capable of Autonomous Navigation, Obstacle Avoidance, Object Detection, Localization, Classification and Air Drop of a package of optimum weight.
8	**Solar Car**	Build a roadworthy solar electric vehicle in order to build a green and sustainable environment.
9	**Team Antariksh**	Team Antariksh is a Space Technology Student Club whose goal is to understand, disseminate and apply the engineering skills for innovation in the field of Space technology. designing Nano-Satellite payload for ISRO PS4 Orbital platform, RVSAT-1 along with developing experimental rockets of various altitude.
10	**Team Chimera**	Building a Formula Electric Car through Research and Development in E-Mobility. Electrifying Formula Racing.
11	**Helios Racing**	Team involved in design, manufacturing and testing of All-Terrain Vehicles and other supportive tasks for the functioning of the team. Participating in BAJA competitions organized by SAE in India and the USA.
12	**Team Hydra**	Developing autonomous underwater vehicles and use it for various real world applications such as water purification, solid waste detection and disposal etc.
13	**Team Krushi**	Develop low cost equipments, which help farmers in cultivating and harvesting the crops. Use new technology applications to reduce the labour time hand cost for farmers. Aims at developing implants for Tractors.
14	**Team vyoma**	Design, fabrication and testing of radio controlled aircrafts and research on various types of unmanned aerial vehicles.
15	**Team Dhruva**	Organizing activities like quizzes based on astronomy.Stargazing and telescope handling sessions.Construction of a standard observatory. working on small projects with organizations like ICTS, IIA, ARIES etc.
16	**Ham club**	To popularize Amateur Radio as a hobby among students, alongside exploring technical innovations in the communications domain. Intended to provide human capital for service to the nation at times of natural calamities.

NCC

एकता और अनुशासन

NSS

राष्ट्रीय सेवा योजना
NATIONAL SERVICE SCHEME

"Not me but you"
" Education through
Community Service &
Community Service through education"

Cultural Activity Teams

1. **AALAP (Music club)**
2. **DEBSOC (Debating society)**
3. **CARV (Dramatics club)**
4. **FOOTPRINTS (Dance club)**
5. **QUIZCORP (Quizzing society)**
6. **ROTARACT (Social welfare club)**
7. **RAAG (Youth club)**
8. **EVOKE (Fashion team)**
9. **f/6.3 (Photography club)**
10. **CARV ACCESS (Film-making club)**

VISION

Leadership in Technical Education, Interdisciplinary Research & Innovation, with a Focus on sustainable and Inclusive Technologies.

MISSION

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

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