RV College of Engineering®

Bachelor of Engineering (B.E)

Scheme And Syllabus Of III & IV Semesters
(2022 Scheme)

B.E. Programs : AS, BT, CH, CS, CS - AI, CS - CD, CS - CY, CV, EC, EE, ET, IM, IS, ME.
M. Tech (13) MCA, M.Sc. (Engg.)
Ph.D. Programs : All Departments are recognized as Research Centres by VTU Except AI & AS

2024

99TH
NIRF RANKING IN ENGINEERING (2024)

TIMES HIGHER EDUCATION WORLD UNIVERSITY RANKINGS-2023
1501+
TIMES HIGHER EDUCATION WORLD UNIVERSITY RANKINGS-2023 (ASIA)
501-600

EDUFUTURE EXCELLENCE AWARD
BEST PRIVATE ENGINEERING UNIVERSITY (SOUTH)
BY ZEE DIGITAL

1001+
SUBJECT RANKING (ENGINEERING)

801+
SUBJECT RANKING (COMPUTER SCIENCE)

IIRF 2023
ENGINEERING RANKING INDIA
NATIONAL RANK-10
STATE RANK - 2
ZONE RANK - 5

QS-IGUAGE DIAMOND UNIVERSITY RATING (2021-2024)

CURRICULUM STRUCTURE

61 CREDITS PROFESSIONAL CORES (PC)

23 CREDITS BASIC SCIENCE

22 CREDITS ENGINEERING SCIENCE

18 CREDITS PROJECT WORK / INTERNSHIP

12 CREDITS* OTHER ELECTIVES & AEC

12 CREDITS PROFESSIONAL ELECTIVES

12 CREDITS HUMANITIES & SOCIAL SCIENCE

160 CREDITS TOTAL

*ABILITY ENHANCEMENT COURSES (AEC), UNIVERSAL HUMAN VALUES (UHV), INDIAN KNOWLEDGE SYSTEM (IKS), YOGA.

17
Centers of Excellence

11
Centers of Competence

212
Publications On Web Of Science

669
Publications Scopus (2023 - 24)

1093
Citations

70
Patents Filed

39
Patents Granted

61
Published Patents

11
Skill Based Laboratories Across Four Semesters

MOUS: 90+WITH INSDUSTRIES / ACADEMIC INSTITUTIONS IN INDIA & ABROAD

EXECUTED MORE THAN RS.40 CRORES WORTH SPONSORED RESEARCH PROJECTS & CONSULTANCY WORKS SINCE 3 YEARS

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Ph.D. Programs : All Departments are recognized as Research Centres by VTU Except AI & AS

2024

VISION

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

MISSION

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

QUALITY POLICY

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

CORE VALUES

Professionalism, Commitment, Integrity, Team Work, Innovation

RV College of Engineering®
Mysore Road, RV Vidyaniketan Post,
Bengaluru - 560059, Karnataka, India

ELECTRONICS & COMMUNICATION ENGINEERING

DEPARTMENT VISION

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

DEPARTMENT MISSION

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

PROGRAM EDUCATIONAL OBJECTIVES

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

PEO2: To design and develop interdisciplinary and innovative systems.

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

PROGRAM SPECIFIC OUTCOMES

PSO1: Should be able to clearly understand the concepts and applications in the field of Communication/networking, signal processing, embedded systems, and semiconductor technology.

PSO2: Should be able to associate the learning from the courses related to Microelectronics, Signal processing, Microcomputers, Embedded and Communication Systems to arrive at solutions to real world problems.

PSO3: Should have the capability to comprehend the technological advancements in the usage of modern design tools to analyze and design subsystems/processes for a variety of applications.

PSO4: Should possess the skills to communicate in both oral and written forms, the work already done and the future plans with necessary road maps, demonstrating the practice of professional ethics and the concerns for societal and environmental wellbeing.

LEAD SOCIETY

Institute of Electrical and Electronics Engineers (IEEE)

INDEX

III Semester			
Sl. No.	**Course Code**	**Course Title**	**Page No.**
1.	MA231AT	Linear Algebra, Fourier Transforms and Statistics	1
2.	CV232TA/ ME232TB/ BT232TC	Environment & Sustainability / Material Science for Engineers / Bio Safety Standards & Ethics	3
3.	EC233AI	Analog Microelectronic Circuits	10
4.	EC234AI	Analysis and Design of Digital Circuits with HDL (Common to EC, EI, ET, EE)	12
5.	EC235AT	Network Analysis & Control Engineering	15
6.	HS237LX	Ability Enhancement Courses	17
7.	CS139AT	Bridge Course: C Programming	32

IV Semester			
Sl.No.	**Course Code**	**Course Title**	**Page No.**
1	EC241AT	Mathematics for Communication Engineering	35
2	CV242TA/ ME242TB/ BT242TC	Environment & Sustainability / Engineering Science Materials / Bio Safety Standards & Ethics	3
3	EI243AI	Microcontroller & Programming (Common to EC, EI, EE, ET)	37
4	EC244AI	Signals & Systems (Common to EC, EI)	40
5	EC345AT	Transmission lines and Electromagnetic Fields	43
6	EC246TX	Professional Core Elective – Group A	***
7	EC247DL	Design Thinking Lab	46
8	HS248AT	Universal Human Values	48
9	MAT149AT	Bridge Course: Mathematics	50

Abbreviations

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

2022 SCHEME - CREDITS AND COMPONENTS													
III SEMESTER													
Sl. No.	**Course Code**	**Course Title**	**Credit Allocation**				**BoS**	**Category**	**Max marks CIE**		**SEE duration**	**Max marks SEE**	
			L	**T**	**P**	**Total**			**Theory**	**Lab**		**Theory**	**Lab**
1	MA231AT	Linear Algebra, Fourier Transforms and Statistics	3	1	0	**4**	MA	Theory	100	***	3	100	***
2	CV232TA/ ME232TB/ BT232TC	Environment & Sustainability / Material Science for Engineers / Bio Safety Standards & Ethics	3	0	0	**3**	CV/ ME/ BT	Theory	100	***	3	100	***
3	EC233AI	Analog Microelectronic Circuits	3	0	1	**4**	EC	Theory + Lab	100	50	3	100	50
4	EC234AI	Analysis and Design of Digital Circuits with HDL (Common to EC, EI, ET, EE)	3	0	1	**4**	EC	Theory + Lab	100	50	3	100	50
5	EC235AT	Network Analysis & Control Engineering	3	1	0	**4**	EC	Theory	100	***	3	100	***
6	HS237LX	Ability Enhancement Courses	0	0	2	**2**	HSS	Lab	***	50	2	***	50
7	CS139AT	Bridge Course: C Programming	2(A)	0	0	**AUDIT**	CS	Theory	50	***	***	***	***
		Total				**21**							

2022 SCHEME - CREDITS AND COMPONENTS													
IV SEMESTER													
Sl. No.	**Course Code**	**Course Title**	**Credit Allocation**				**BoS**	**Category**	**Max marks CIE**		**SEE Duration**	**Max marks SEE**	
			L	**T**	**P**	**Total**			**Theory**	**Lab**		**Theory**	**Lab**
1	EC241AT	Mathematics for Communication Engineering	3	0	0	**3**	EC	Theory	100	***	3	100	***
2	CV242TA/ ME242TB/ BT242TC	Environment & Sustainability/ Material Science for Engineers / Bio Safety Standards & Ethics	3	0	0	**3**	CV/M E/BT	Theory	100	***	3	100	***
3	EI243AI	Microcontroller & Programming (Common to EC, EI, EE, ET)	3	0	1	**4**	EI	Theory + Lab	100	50	3	100	50
4	EC244AI	Signals & Systems (Common to EC, EI)	3	0	1	**4**	EC	Theory + Lab	100	50	3	100	50
5	EC345AT	Transmission lines and Electromagnetic fields	3	0	0	**3**	EC	Theory	100	***	3	100	***
6	EC246TX	Professional Core Elective - Group A	2	0	0	**2**	EC	**NPTEL**	50	***	***	50	***
7	EC247DL	Design Thinking Lab	0	0	2	**2**	EC	Lab	***	50	2	***	50
8	HS248AT	Universal Human Values	2	0	0	**2**	HSS	Theory	50	***	2	50	***
9	MAT149AT	Bridge Course: Mathematics	2 (A)	0	0	**AUDIT**	MA	Theory	50	***	***	***	***
		Total				**23**							

GROUP-A Professional MOOC Electives		
Sl. No.	**Course Code**	**Course Title**
1.	EC246TA	Electronics Equipment Integration & Prototype Building
2.	EC246TB	Programming, Data Structures & Algorithms Using Python
3.	EC246TC	Introduction To Machine Learning
4.	EC246TD	Data Base Management System
5.	EC246TE	Design And Analysis of Algorithms
6.	EC246TF	An Introduction to Coding Theory
7.	EC246TG	An Introduction to Operating Systems
8.	EC246TH	VLSI Interconnects

Semester: III

LINEAR ALGEBRA, FOURIER TRANSFROMS AND STATISTICS
Category: PROFESSIONAL CORE COURSE
(Common to EC, EE, EI, ET)
(Theory)

Course Code	**:**	**MA231TA**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:1:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L+30T**		**SEE Duration**	**:**	**03 Hrs**

Unit-I — **09 Hrs**

Linear Algebra - I:
Vector spaces, subspaces, linear dependence and independence, basis, dimension, four fundamental subspaces, rank-nullity theorem. Linear transformations - matrix representation, kernel and image of a linear transformation, dilation, reflection, projection, and rotation matrices. Implementation using MATLAB.

Unit – II — **09 Hrs**

Linear Algebra - II:
Inner product, orthogonal matrices, orthogonal and orthonormal bases, Gram-Schmidt process, QR-factorization. Least squares solution. Eigen values and Eigen vectors (recapitulation), diagonalization of a matrix (symmetric matrices) and singular value decomposition. Implementation using MATLAB.

Unit –III — **09 Hrs**

Fourier Series:
Introduction, periodic function, even and odd functions. Dirichlet's conditions, Euler formulae for Fourier series, complex Fourier series, problems on time periodic signals, Fourier sine series, Fourier cosine series. Harmonic analysis. Implementation using MATLAB.

Unit –IV — **09 Hrs**

Fourier Transforms:
Complex Fourier transform from infinite Fourier series, Fourier sine transform, Fourier cosine transform, properties - linearity, scaling, time-shift and modulation. Convolution theorem, Parseval identities. Implementation using MATLAB.

Unit –V — **09 Hrs**

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

Course Outcomes: After completing the course, the students will be able to: -	
CO1	Illustrate the fundamental concepts of linear algebra, statistics, Fourier series and Fourier transforms.
CO2	Apply the acquired knowledge of linear algebra, statistics, Fourier series and Fourier transforms to solve the problems of engineering applications.
CO3	Analyze the solution of the problems obtained from appropriate techniques of linear algebra, statistics, Fourier transforms and Fourier series to the real - world problems and optimize the solution.
CO4	Interpret the overall knowledge of linear algebra, statistics, Fourier series and Fourier transforms gained to demonstrate the problems arising in many practical situations.

Reference Books	
1.	Linear Algebra and its Applications, David C. Lay, 3rd Edition, 2002, Pearson Education India, ISBN-13: 978-81-7758-333-5.
2.	Linear Algebra with Applications, Steven J. Leon, 9th Edition, 2014, Pearson, ISBN: 13:978-0321962218.
3.	The Fast Fourier Transform- An Introduction to its Theory and Applications, E. Oran Brigham, 1st Edition, 1973, Prentice Hall Inc., ISBN: 13-978-0133074963.
4.	Higher Engineering Mathematics, B.S. Grewal, 44th Edition, 2015, Khanna Publishers, ISBN: 978- 81-933284-9-1.

RUBRICS FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted &each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**20**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). **TWO TESTS** will be conducted. Each test will be evaluated for 50 Marks, adding up to 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. **Phase I (20) & Phase II (20) ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRICS FOR SEMESTER END EXAMINATION (THEORY)		
Q.NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	**20**
	PART B (Maximum of THREE Sub-divisions only)	
2	Unit 1: (Compulsory)	**16**
3 & 4	Unit 2: Question 3 or 4	**16**
5 & 6	Unit 3: Question 5 or 6	**16**
7 & 8	Unit 4: Question 7 or 8	**16**
9 &10	Unit 5: Question 9 or 10	**16**
	TOTAL	**100**

Semester: III						
BIO SAFETY STANDARDS AND ETHICS **Category: PROFESSIONAL CORE COURSE** **(Common to all programs)** **(Theory)**						
Course Code	**:**	**BT232TC/BT242TC**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**3 Hrs**

Unit-I	**09 Hrs**
Biohazards, Bio Safety Levels and Cabinets: Introduction to Biohazards, Biological Safety levels, Bio safety Cabinets, Study of various types of Bio safety cabinets. Various parameters for design of Biosafety cabinets (Materials used for fabrication, sensors, filters, pumps, compressors)	
Unit – II	**08 Hrs**
Biosafety Guidelines: Biosafety guidelines of Government of India, GMOs & LMOs, Roles of Institutional Biosafety Committee, RCGM (Review committee o Genetic manipulation), GEAC (Genetic Engg Approval Committee) for GMO applications in food and agriculture. Overview of National Regulations and relevant International Agreements including Cartagena Protocol.	
Unit –III	**10 Hrs**
Food Safety Standards: FSSAI (Food Safety and Standards Authority of India), Functions, License, types of FSSAI Licenses and compliance rules. **Food Hygiene:** General principles of food microbiology and overview of foodborne pathogens, sources of microorganisms in the food chain (raw materials, water, air, equipment, etc.) Quality of foods, Microbial food spoilage and Foodborne diseases, Overview of beneficial microorganisms and their role in food processing and human nutrition, Food Analysis and Testing, General principles of food safety management systems, Hazard Analysis Critical Control Point (HACCP).	
Unit –IV	**09 Hrs**
Food Preservations, Processing, and Packaging: Food Processing Operations, Principles, Good Manufacturing Practices HACCP, Good production, and processing practices (GMP, GAP, GHP, GLP, BAP, etc.) Overview of food preservation methods and their underlying principles including novel and emerging methods/principles Overview of food packaging methods and principles including novel packaging materials.	
Unit –V	**09 Hrs**
Food safety and Ethics: Food Hazards, Food Additives, Food Allergens Drugs, Hormones, and Antibiotics in Animals. Factors That Contribute to Foodborne Illness, Consumer Lifestyles and Demand, Food Production and Economics, History of Food Safety, The Role of Food Preservation in Food Safety. **Ethics:** Clinical ethics, Health Policy, Research ethics, ethics on Animals. Biosafety and Bioethics.	

Course Outcomes: After completing the course, the students will be able to	
CO1	Have a comprehensive knowledge of Biohazards and bio safety levels
CO2	Understand the biosafety guidelines and their importance to the society
CO3	Acquire knowledge with respect to the Food standards, Hygiene, food processing and packing
CO4	Appreciate the food safety, Ethics, biosafety, and bio ethics

Reference Books	
1	IPR Biosafety and Bioethics, Deepa Goel, Shomini Parashar, 1st Edition, Pearson, 2013, ISBN: 978-8131774700.
2	The Food Safety, Cynthia A Roberts, Oryx Press, 1st Edition, 2001, ISBN: 1–57356–305–6.
3	Food Safety Management Systems, Hal King, Springer Cham, 2020, ISBN: 978-3-030-44734-2.
4	Bioethics: The Basics, Routledge, Alastair V. Campbell, 2nd Edition, 2017, ISBN: 978-0415790314.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**20**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	**20**
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1: (Compulsory)	**16**
3 & 4	Unit 2: Question 3 or 4	**16**
5 & 6	Unit 3: Question 5 or 6	**16**
7 & 8	Unit 4: Question 7 or 8	**16**
9 & 10	Unit 5: Question 9 or 10	**16**
	TOTAL	**100**

Semester: IV						
MATERIAL SCIENCE FOR ENGINEERS **Category: PROFESSIONAL CORE** **(Common to all Programs)** **(Theory)**						
Course Code	**:**	**ME232TB/ME242TB**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45 L**		**SEE Duration**	**:**	**03 Hrs**

Unit-I	**09 Hrs**
The Fundamentals of Materials: The electronic structure of atoms, Types of atomic and molecular bonds; ionic bonding; covalent bonding; metallic bonding; secondary bonding; mixed bonding; hybridization. Energy bands in metals, insulators, and semiconductors. Basic crystallography. Defects and dislocations. Types of Materials: Polymers, metals and alloys, semiconductors, ceramics, composites	
Unit – II	**09 Hrs**
Material Behavior: Conductivity, thermal properties, thermal conductivity, thermoelectric effects. Dielectric behaviors and temperature dependence of the dielectric constant, insulating materials, ferroelectricity, piezoelectricity. thermocouple, super conductor, optical properties. Stress-strain, Elastic deformation, plastic deformation, hardness, viscoelastic deformation, impact energy, Fracture toughness, Fatigue, Heat capacity, Thermal expansion, Thermal conductivity, thermal shock	
Unit –III	**09 Hrs**
Materials and their Applications: Semiconductors, Dielectric, optoelectronics and structural materials, Ferrous alloys, Nonferrous alloy, cement, concrete, ceramic and glasses, processing the structural Materials, polymers, Thermoset and thermoplastic polymers, composites: fibre-reinforced, aggregated composites, mechanical properties of composites, Electronic Packaging Materials, Biomaterials	
Unit –IV	**09 Hrs**
Heat Treatment: Post Processing heat treatment of electronic devices for long duration, Thermal Oxidation, Diffusion, Rapid Thermal Processing for electronic devices, Heat treatment, stress relieving, Annealing, spherodizing, Normalizing, hardening, Tempering process, Ferrous heat treatment, formation of austenite of heating, construction of Time Temperature Transformation curves. Special heat treatment such as carburizing, nitriding, Cyaniding, Surface hardening, Flame and induction hardening, defect in the heat treatment	
Unit –V	**09 Hrs**
Nanomaterials: Introduction, Synthesis of Nanomaterials: ball milling, Solgel, Vapour deposition growth, pulse laser, Magnetron sputtering, lithography. Nano porous Materials such Zeolites, mesoporous materials, carbon nanotubes and graphene. Characterisation such as Nano structure, spectroscopic technique, automatic force microscopy, FRPs, fabrics bioresorbable and bio-erodable materials, ceramic, glasses, biomaterials: biocompatibility, implant associated materials.	

Course Outcomes: After completing the course, the students will be able to: -	
CO1	Understand behaviour of various materials such as metals, composites and special materials
CO2	Analyse materials, composition, and their phase transformation
CO3	Investigate solidification process during casting and materials degradation
CO4	Recognize different types of Non-destructive testing methods to find subsurface defects in the materials.

Reference Books	
1	Material Science and Engineering, William D Callister, 6th Edition, 1997, John Wiley and Sons, ISBN: 9812-53-052-5.
2	Introduction to Physical Metallurgy, Sydney H Avner, 1994, Mc. Graw Hill Book Company, ISBN: 0-07-Y85018-6.
3	Material Science and Engineering, William F Smith, 4th Edition, 2008, Mc. Graw Hill Book Company, ISBN: 0-07-066717-9.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**20**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	**20**
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1: (Compulsory)	**16**
3 & 4	Unit 2: Question 3 or 4	**16**
5 & 6	Unit 3: Question 5 or 6	**16**
7 & 8	Unit 4: Question 7 or 8	**16**
9 & 10	Unit 5: Question 9 or 10	**16**
	TOTAL	**100**

Semester: III						
ENVIRONMENT & SUSTAINABILITY **Category: PROFESSIONAL CORE** **(Common to all Programs)** **(Theory)**						
Course Code	**:**	**CV232TA/ CV232TA**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45 L**		**SEE Duration**	**:**	**3 Hrs**

Unit-I	**10 Hrs**
Environment and Biodiversity: Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow– ecological succession. Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity. **Environmental Pollution:** Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Occupational Health and Safety Management system (OHASMS). Environmental protection, Environmental protection acts.	
Unit – II	**09 Hrs**
Renewable Sources of Energy: Energy management and conservation, New Energy Sources: Need of new sources. Different types of new energy sources. Energy Cycles, carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization-Socioeconomical and technological change. Applications of - Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy.	
Unit –III	**09 Hrs**
Sustainability and Management: Introduction to Environmental Economics, Environmental Audit, Development, GDP, Sustainability - concept, needs and challenges-economic, social and aspects of sustainability - from unsustainability to sustainability-millennium development goals and protocols. **Sustainable Development Goals:** Targets, indicators and intervention areas Climate change - Global, Regional and local environmental issues and possible solutions. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry.	
Unit –IV	**08 Hrs**
Sustainability Practices: Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment. Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Linear vs. cyclical resource management systems, need for systems thinking and design of cyclical systems, circular economy, industrial ecology, green technology. Specifically apply these concepts to: Water Resources, Energy Resources, Food Resources, Land & Forests, Waste management.	
Unit –V	**08 Hrs**
Corporate Social Responsibility (CSR): Meaning & Definition of CSR, History & evolution of CSR. Concept of Charity, Corporate philanthropy, Corporate Citizenship, CSR-an overlapping concept. Concept of sustainability & Stakeholder Management. Relation between CSR and Corporate governance; environmental aspect of CSR; Chronological evolution of CSR in India. Sustainability Reporting: Flavor of GRI, Dow Jones Sustainability Index, CEPI. Investor interest in Sustainability.	

Course Outcomes: After completing the course, the students will be able to:	
CO1	Understand the basic elements of Environment and its Biodiversity.
CO2	Explain the various types of pollution and requirement for sustainable strategy for present scenario.
CO3	Evaluate the different concepts of sustainability and its significance for welfare of all life forms.
CO4	Recognize the role of Corporate social responsibility in conserving the Environment.
Reference Books	
1	Perspectives in Environmental Studies, Anubha Kaushik and C. P. Kaushik's, 6th Edition, New Age International Publishers ,2018.
2	Environmental Science and Engineering, Benny Joseph, Tata McGraw-Hill, New Delhi, 2016.
3	Introduction to Environmental Engineering and Science, Gilbert M. Masters, 2nd edition, Pearson Education, 2004.
4	Sustainability Engineering: Concepts, Design and Case Studies, Allen, D. T. and Shonnard, D. R,Prentice Hall.
5	Engineering applications in sustainable design and development, Bradley. A.S; Adebayo, A.O., Maria, P, Cengage learning.
6	Environment Impact Assessment Guidelines, Notification of Government of India, 2006.
7	Basic Concepts in Environmental Management, Mackenthun, K.M., Lewis Publication, London, 1998.
8	Environmental Studies: From Crisis to Cure, R. Rajagopalan, Oxford University Press, 2011, ISBN: 9780198072089.
9	Environmental Science, Daniel D. Chiras, Jones & Bartlett Publishers, 01-Feb-2012, ISBN: 9781449645311.
10	Corporate Social Responsibility Part I, Part II, Part III by David Crowther and Guler Aras.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**20**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). Two tests will be conducted. Each test will be evaluated for 50 Marks, adding up to 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1: (Compulsory)	16
3 & 4	Unit 2: (Internal Choice)	16
5 & 6	Unit 3: (Internal Choice)	16
7 & 8	Unit 4: (Internal Choice)	16
9 & 10	Unit 5: (Internal Choice)	16
	TOTAL	**100**

Semester: III						
ANALOG MICROELECTRONIC CIRCUITS **Category: PROFESSIONAL CORE COURSE** **(Theory & Practice)**						
Course Code	**:**	**EC233AI**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:1**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L+15P**		**SEE Duration**	**:**	**03 Hrs +03 Hrs**

Unit-I	**09 Hrs**
Bipolar Junction Transistors (BJTs) Circuit Analysis: BJT circuits at dc, Biasing in discrete BJT amplifier circuits, small signal operation and models, early effect, BJT as an amplifier – CE stage, CE stage with degeneration, CC stage, H parameter model, discrete amplifier design problems, Darlington pair. BJT internal capacitors and high frequency model, frequency response of CE amplifier.	
Unit – II	**09Hrs**
MOS Field Effect Transistors (MOSFETS): Device structure and physical operation, current voltage characteristics, MOSFET circuits at dc, Biasing in discrete MOS amplifier circuits, small signal operation and models, channel length modulation, transconductance, Body effect, Introduction to RF MOSFETs.	
Unit –III	**09 Hrs**
MOSFET as an Amplifier: Small signal analysis (including CLM) of CS stage with resistive load, diode connected load, current source load. CS stage with degeneration, CG and CD stages. MOSFET internal capacitors and high frequency model, frequency response of CS amplifier.	
Unit –IV	**09 Hrs**
Feedback Amplifiers and Large Signal Amplifiers: Properties of negative feedback, the four basic feedback topologies, practical circuits of the two types of feedback with opamp (Voltage series feedback), classification of output stages, class A, class AB, class B circuits, thermal resistance and heat sinking of power transistors.	
Unit –V	**09Hrs**
Operational Amplifiers: Effect of finite open loop gain. **Linear Opamp Circuits** - Inverting, Non inverting configurations, Difference Amplifier, Instrumentation Amplifier. **Nonlinear Opamp circuits** -Precision rectifier, Schmitt trigger, Working and applications of IC555 Timer	

Practical's: Hardware Experiments

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

Innovative Experiments

1. Design of voltage series feedback configuration in LTspice.
2. Design of voltage Shunt feedback configuration in LTspice.

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

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

RUBRICS FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY & LAB)		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted &each quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**20**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). **TWO TESTS** will be conducted. Each test will be evaluated for 50 Marks, adding upto100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20) **ADDING UPTO 40 MARKS.**	**40**
4.	**LAB:** Conduction of laboratory exercises, lab report, observation, and analysis (20 Marks), lab test (10 Marks) and Innovative Experiment/ Concept Design and Implementation (20 Marks) adding up to 50 Marks**. THE FINAL MARKS WILL BE 50 MARKS.**	**50**
	MAXIMUM MARKS FOR THE CIE	**150**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1: (Compulsory)	16
3 & 4	Unit 2: (Internal Choice)	16
5 & 6	Unit 3: (Internal Choice)	16
7 & 8	Unit 4: (Internal Choice)	16
9 & 10	Unit 5: (Internal Choice)	16
	TOTAL	**100**

RUBRIC FOR SEMESTER END EXAMINATION (LAB)		
Q.NO.	**CONTENTS**	**MARKS**
1	Write Up	10
2	Conduction of the Experiments	20
3	Viva	20
	TOTAL	**50**

Semester: III						
ANALYSIS AND DESIGN OF DIGITAL CIRCUITS WITH HDL **Category: PROFESSIONAL CORE COURSE** **(Theory & Practice)** **(Common to EC, EI, ET, EE)**						
Course Code	**:**	**EC234AI**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:1**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L+30P**		**SEE Duration**	**:**	**03 Hrs + 03 Hrs**

Unit-I	**09 Hrs**
Introduction to Verilog: Verilog History, System representation, Number representation and Verilog ports. Verilog Data Types: Net, Register and Constant. Verilog Operators: Logical, Arithmetic, Bitwise, Reduction, Relational, Concatenation and Conditional. Verilog Primitives. Logic Simulation, Design Verification, and Test Methodology: Four-Value Logic and Signal Resolution in Verilog, Test Methodology Signal Generators for Test benches, Event-Driven Simulation, Sized Numbers. Introduction to Modeling Styles: Dataflow modeling, Behavioral modelling, Structural modelling.	
Unit – II	**09 Hrs**
Combinational Circuits Design: Arithmetic circuits, code converters and logic functions implementation using Decoders/ De-Multiplexers and Multiplexers. Design of a Priority encoder, Magnitude comparator, Parallel Adder/Subtractor, Concepts of ripple carry and carry look ahead adders and BCD adder. **Dataflow/Behavioural/Structural Modelling:** Verilog Data flow/Behavioral/Structural Models, Module Ports, Top-Down Design and Nested Modules.	
Unit –III	**09 Hrs**
Introduction, Latches and Flip Flops: Triggering of Flip Flops, Characteristics Equation Flip Flop Excitation Tables, Flip-Flop conversions. Propagation delay, setup and hold time. **Synchronous Sequential Circuits Design:** Introduction to FSM (Mealy and Moore), Analysis of Clocked Sequential Circuits, State table and Reduction, State Diagram, Design of synchronous Counter, Programmable mod-n counter. **Behavioral Modeling:** Latches and Flip Flop Circuits in Verilog, design of synchronous counters using Verilog.	
Unit –IV	**09 Hrs**
Asynchronous Sequential Circuit Design: Design of Ripple/Asynchronous Counter (mod-n counter), Effects of Propagation delay in Ripple Counter, Integrated Circuit Ripple Counter. **Registers:** Registers, Shift Registers and Various Operations, Ring counters, Johnson counters, Serial Adder. Design of Sequence Detector and Sequence Generators (PRBS). **Behavioral Modeling:** Design of synchronous counters and shift registers using Verilog.	
Unit –V	**09 Hrs**
ALU Design: Processor Organization, Design of Arithmetic Unit, Design of Logic unit, Design of Arithmetic and Logic unit, Status Register, Design of Shifter, The Complete Processor unit and op-code generation.	
Practical:	

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

Innovative Experiment:

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

Reference Books	
1.	Verilog HDL: A Guide to Digital Design & Synthesis, Samir Palnitkar, SunSoft Press, 1st Edition, 1996, ISBN: 978-81-775-8918-4.
2.	Digital Logic and Computer Design, M. Morris Mano, Pearson Education Inc., 13th Impression, 2011, ISBN: 978-81-7758-409-7.
3.	Fundamentals of Logic Design, Charles H. Roth (Jr.), West publications, 4th Edition, 1992, ISBN-13: 978-0-314-92218-2.
4.	Digital Fundamentals, Thomas Floyd, 11th Edition, Pearson Education India, ISBN 13: 978-1-292-07598-3, 2015.
5.	Digital Principle and Design, Donald D. Givone, Mc Graw-Hill, ISBN: 0-07-119520-3 (ISE), 2003.

Course Outcomes: After completing the course, the students will be able to: -	
CO1	Analyze and design different types of digital circuits for area, delay and power constraints.
CO2	Apply the knowledge of digital circuits to construct sub-systems useful for digital system designs.
CO3	Implement digital circuits for a particular application considering performance parameters.
CO4	Evaluate the performance of different digital systems to apply in real world applications.

RUBRICS FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY & LAB)		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted &each quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**20**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). **TWO TESTS** will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20) **ADDING UPTO 30 MARKS.**	**40**
4.	**LAB:** Conduction of laboratory exercises, lab report, observation, and analysis (20Marks), lab test (10 Marks) and Innovative Experiment/ Concept Design and Implementation (20 Marks) adding up to 50 Marks**. THE FINAL MARKS WILL BE 50 MARKS.**	**50**
	MAXIMUM MARKS FOR THE CIE	**150**

RUBRICS FOR SEMESTER END EXAMINATION (THEORY)		
Q.NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	20
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1: (Compulsory)	16
3 & 4	Unit 2: Question 3 or 4	16
5 & 6	Unit 3: Question 5 or 6	16
7 & 8	Unit 4: Question 7 or 8	16
9 &10	Unit 5: Question 9 or 10	16
11	Lab Component (Compulsory)	16
	TOTAL	**100**

RUBRIC FOR SEMESTER END EXAMINATION (LAB)		
Q.NO.	**CONTENTS**	**MARKS**
1	Write Up	10
2	Conduction of the Experiments	20
3	Viva	20
	TOTAL	**50**

Semester: III						
NETWORK ANALYSIS AND CONTROL ENGINEERING **Category: PROFESSIONAL CORE COURSE** **(Theory)**						
Course Code	**:**	**EC235AT**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:1:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L+15T**		**SEE Duration**	**:**	**03 Hrs**

Unit-I	**09 Hrs**
Fundamentals: Loop and Node analysis with linear dependent and independent sources for DC and AC networks. **Network Theorems:** Superposition, Reciprocity, Thevenin's, Norton's, Maximum Power transfer and Millman's theorems.	
Unit – II	**09 Hrs**
Transient Behaviour & Initial Conditions: Evaluation of initial and final conditions in R-L, R-Cand R-L-C Circuits for DC networks. Laplace transformation and applications.	
Unit –III	**09 Hrs**
Basic Ideas of Control Systems, Mathematical Models of Physical Systems Classification of Control Systems, Open Loop and Closed Loop (in detail), Differential equations of Physical Systems and Transfer Function (and electrical systems) Block Diagram Reduction, Signal Flow Graphs(simple examples)	
Unit –IV	**09 Hrs**
Time Response of Feedback Control Systems: Standard Test Signals, Step Response for First and Second Order, Impulse Response for First and Second Order system(only for under damped condition), Distinction between Type and Order of the System. Time Domain Specifications for Second Order System. t_r, t_d, t_p, M_p,(no derivation) Steady State Error Analysis e_{ss}, Error Constants, K_p, K_v, K_a.	
Unit –V	**09 Hrs**
Stability Analysis: Concepts of Stability, Types of Stability, Asymptotic Stability, RH Criteria, Introduction to Root Locus, Stability Analysis using Root Locus Diagram, Bode Plots(Basics).	

Reference Books	
1.	Network Analysis, M.E. Van Valkenberg (2000), Prentice Hall of India, 3rd Edition, 2000, ISBN:9780136110958.
2.	Networks and systems, Roy Choudhury, 2nd Edition, New Age International Publications, 2006,ISBN: 9788122427677.
3.	Modern Control Engineering, K. Ogata, 5th Edition, Pearson, ISBN-13: 978-9332550162.
4.	Control Systems Engineering, Nagarath and M. Gopal, New Age International (P) limited Publishers, 5th Edition, 2007, ISBN: 81-224-2008-7.

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

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**20**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q. NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	**20**
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1: (Compulsory)	**16**
3 & 4	Unit 2: Question 3 or 4	**16**
5 & 6	Unit 3: Question 5 or 6	**16**
7 & 8	Unit 4: Question 7 or 8	**16**
9 & 10	Unit 5: Question 9 or 10	**16**
	TOTAL	**100**

Semester: III						
NATIONAL SERVICE SCHEME(NSS) (Practical)						
Course Code	**:**	**HS237LA**		**CIE**	**:**	**50 Marks**
Credits: L: T: P	**:**	**0:0:2**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**13P**		**SEE Duration**	**:**	**02 Hrs**

Prerequisites:

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

Content	**13 Hrs**

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

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

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

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

ASSESSMENT AND EVALUATION PATTERN		
WEIGHTAGE	**50%**	**50%**
	CIE	**SEE**
Presentation 1- Selection of topic- (phase 1) Justification for Importance, need of the hour with surveyed data.	**10**	*****
EXPERIENTIAL LEARNING Presentation 2 (phase 2) Content development, strategies for implementation methodologies.	**10**	*****
Case Study-based Teaching-Learning	**10**	Implementation strategies of the project with report
Sector wise study & consolidation	**10**	
Video based seminar (4-5 minutes per student)	**10**	
TOTAL MARKS FOR THE COURSE	**50 MARKS**	**50 MARKS**

Semester: III						
NATIONAL CADET CORPS(NCC) (Practical)						
Course Code	**:**	**HS237LB**		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	**0:0:2**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**15P**		**SEE Duration**	**:**	**02 Hrs**

Unit-I	**07 Hrs**
Drill: Foot Drill- Drill ki Aam Hidayaten, Word ki Command, Savdhan, Vishram, Aram Se, Murdna,Kadvar Sizing, Teen Line Banana, Khuli Line, Nikat Line, Khade Khade Salute Karna	
Unit – II	**03 Hrs**
Weapon Training (WT): Introduction & Characteristics of 7.62 Self Loading rifle, Identification of rifle parts	
Unit –III	**03 Hrs**
Adventure activities: Trekking and obstacle course	
Unit –IV	**02 Hrs**
Social Service and Community Development (SSCD): Students will participate in various activities throughoutthe semester e.g., Blood donation Camp, Swachhata Abhiyan, Constitution Day, All National Festival	

Course Outcomes: After completing the course, the students will be able to: -	
CO1	Understand that drill as the foundation for discipline and to command a group for common goal.
CO2	Understand the importance of a weapon its detailed safety precautions necessary for prevention of accidents and identifying the parts of weapon.
CO3	Understand that trekking will connect human with nature and cross the obstacles to experience army way of life.
CO4	Understand the various social issues and their impact on social life, Develop the sense of self-less social service for better social & community life.

Reference Books	
1.	NCC Cadet Hand Book by R K Gupta, Ramesh Publishing House, New Delhi, Book code:R- 1991, ISBN: 978-93-87918-57-3, HSN Code: 49011010
2.	nccindia.ac.in

ASSESSMENT AND EVALUATION PATTERN		
WEIGHTAGE	**50%**	**50%**
	CIE	**SEE**
Presentation 1- Selection of topic- (phase 1) Justification for Importance, need of the hour with surveyed data.	**10**	*****
EXPERIENTIAL LEARNING Presentation 2 (phase 2) Content development, strategies for implementation methodologies.	**10**	*****
Case Study-based Teaching-Learning	**10**	Implementation strategies of the project with report
Sector wise study & consolidation	**10**	
Video based seminar (4-5 minutes per student)	**10**	
TOTAL MARKS FOR THE COURSE	**50 MARKS**	**50 MARKS**

Semester: III						
PHYSICAL EDUCATION (SPORTS & ATHLETICS) (Practical)						
Course Code	**:**	**HS237LC**		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	**0:0:2**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**30P**		**SEE Duration**	**:**	**2.5 Hrs**
Content						**30 Hrs**

Topics for Viva:

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

Course Outcomes: After completing the course, the students will be able to: -	
CO1	Understand the basic principles and practices of Physical Education and Sports.
CO2	Instruct the Physical Activities and Sports practices for Healthy Living.
CO3	To develop professionalism among students to conduct, organize & Officiate Physical Education andSports events at schools and community level.

Reference Books	
1.	Health, Exercise and Fitness, Muller, J. P. (2000), Delhi: Sports.
2.	Play Field Manual, Anaika ,2005, Friends Publication New Delhi.
3.	IAAF Manual.
4.	Track and Field Marking and Athletics Officiating Manual, M.J Vishwanath,2002, Silver Star Publication, Shimoga.
5.	Steve Oldenburg (2015) Complete Conditioning for Volleyball, Human Kinestics.
Note: Skills of Sports and Games (Game Specific books) may be referred	

ASSESSMENT AND EVALUATION PATTERN		
WEIGHTAGE	**50%**	**50%**
	CIE	**SEE**
Presentation 1- Selection of topic- (phase 1) Justification for Importance, need of the hour with surveyed data.	**10**	*****
EXPERIENTIAL LEARNING Presentation 2 (phase 2) Content development, strategies for implementation methodologies.	**10**	*****
Case Study-based Teaching-Learning	**10**	Implementation strategies of the project with report
Sector wise study & consolidation	**10**	
Video based seminar (4-5 minutes per student)	**10**	
TOTAL MARKS FOR THE COURSE	**50 MARKS**	**50 MARKS**

Semester: III						
MUSIC (Practical)						
Course Code	**:**	**HS237LD**		**CIE**	**:**	**50 Marks**
Credits: L: T: P	**:**	**0:0:2**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**13P**		**SEE Duration**	**:**	**02 Hrs**
Content						**13 Hrs**

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

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

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

Course Outcomes: After completing the course, the students will be able to: -	
CO1	Understand basics of Music and improve their skills.
CO2	Appreciate the impacts on health and well-being.
CO3	Perform and present music in a presentable manner.
CO4	Develop skills like team building and collaboration.

Reference Books	
1.	Music Cognition: The Basics by Henkjan Honing.
2.	Basic Rudiments Answer Book - Ultimate Music Theory: Basic Music Theory Answer Book by Glory St Germain.
3.	Elements Of Hindustani Classical Music by Shruti Jauhari.
4.	Music in North India: Experiencing Music, Expressing Culture (Global Music Series) by George E. Ruckert.

ASSESSMENT AND EVALUATION PATTERN		
WEIGHTAGE	**50%**	**50%**
	CIE	**SEE**
Presentation 1- Selection of topic- (phase 1) Justification for Importance, need of the hour with surveyed data.	**10**	*****
EXPERIENTIAL LEARNING Presentation 2 (phase 2) Content development, strategies for implementation methodologies.	**10**	*****
Case Study-based Teaching-Learning	**10**	Implementation strategies of the project with report
Sector wise study & consolidation	**10**	
Video based seminar (4-5 minutes per student)	**10**	
TOTAL MARKS FOR THE COURSE	**50 MARKS**	**50 MARKS**

Semester: III						
DANCE (Practical)						
Course Code	**:**	**HS237LE**		**CIE**	**:**	**50 Marks**
Credits: L: T: P	**:**	**0:0:2**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**13P**		**SEE Duration**	**:**	**02 Hrs**
Contents						**13 Hrs**

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

Course Outcomes: After completing the course, the students will be able to: -	
CO1	Understand the fundamentals of dancing.
CO2	Adapt to impromptu dancing.
CO3	Ability to pick choreography and understand musicality.
CO4	To be able to do choreographies and perform in front of a live audience.

Reference Books	
1.	Dance Composition: A practical guide to creative success in dance making, Jacqueline M. Smith

ASSESSMENT AND EVALUATION PATTERN		
WEIGHTAGE	**50%**	**50%**
	CIE	**SEE**
Presentation 1- Selection of topic- (phase 1) Justification for Importance, need of the hour with surveyed data.	**10**	*****
EXPERIENTIAL LEARNING Presentation 2 (phase 2) Content development, strategies for implementation methodologies.	**10**	*****
Case Study-based Teaching-Learning	**10**	Implementation strategies of the projectwith report
Sector wise study & consolidation	**10**	
Video based seminar (4-5 minutes per student)	**10**	
TOTAL MARKS FOR THE COURSE	**50 MARKS**	**50 MARKS**

Semester: III						
THEATER (LIGHT CAMERA & ACTION) **(Practical)**						
Course Code	**:**	**HS237LF**		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	**0:0:1**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**13P**		**SEE Duration**	**:**	**02 Hrs**
Contents						**13 Hrs**

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

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

Reference Books	
1.	The Empty Space by Peter Brook.
2.	The Viewpoints Book: A Practical Guide to Viewpoints and Composition by Anne Bogart and Tina Landau.

ASSESSMENT AND EVALUATION PATTERN		
WEIGHTAGE	**50%**	**50%**
	CIE	**SEE**
Presentation 1- Selection of topic- (phase 1) Justification for Importance, need of the hour with surveyed data.	**10**	*****
EXPERIENTIAL LEARNING Presentation 2 (phase 2) Content development, strategies for implementation methodologies.	**10**	*****
Case Study-based Teaching-Learning	**10**	Implementation strategies of the project with report
Sector wise study & consolidation	**10**	
Video based seminar (4-5 minutes per student)	**10**	
TOTAL MARKS FOR THE COURSE	**50 MARKS**	**50 MARKS**

Semester: III						
ART WORK & PAINTING (Practical)						
Course Code	**:**	**HS237LG**		**CIE**	**:**	**50 Marks**
Credits: L: T: P	**:**	**0:0:2**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**13P**		**SEE Duration**	**:**	**02 Hrs**

Contents **13 Hrs**

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

AND

ONE EDUCATIONAL VISIT TO AN ART MUSEUM / INSTITUTE / GALLERY

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

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

Reference Books	
1.	Catching the Big Fish: Meditation, Consciousness, and Creativity, David Lynch
2.	Art & Fear: Observations on the Perils (and Rewards) of Artmaking, David Bayles & Ted Orland

ASSESSMENT AND EVALUATION PATTERN		
WEIGHTAGE	**50%**	**50%**
	CIE	**SEE**
Presentation 1- Selection of topic- (phase 1) Justification for Importance, need of the hour with surveyed data.	**10**	*****
EXPERIENTIAL LEARNING Presentation 2 (phase 2) Content development, strategies for implementation methodologies.	**10**	*****
Case Study-based Teaching-Learning	**10**	Implementation strategies of the projectwith report
Sector wise study & consolidation	**10**	
Video based seminar (4-5 minutes per student)	**10**	
TOTAL MARKS FOR THE COURSE	**50 MARKS**	**50 MARKS**

Semester: IV						
PHOTOGRAPHY & FILM MAKING (Practical)						
Course Code	**:**	**HS237LH**		**CIE**	**:**	**50 Marks**
Credits: L: T: P	**:**	**0:0:2**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**13P**		**SEE Duration**	**:**	**02 Hrs**
Contents						**13 Hrs**

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

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

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

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Understand basics of photography and videography and improve their skills.
CO 2	Appreciate the skills acquired from photography.
CO 3	Perform and present photos and films in a presentable manner.
CO 4	Develop skills like team building and collaboration.

Reference Books	
1.	Read This If You Want to Take Great Photographs – Henry Carroll
2.	The Digital Photography Book: Part 1 – Scott Kelby

ASSESSMENT AND EVALUATION PATTERN		
WEIGHTAGE	**50%**	**50%**
	CIE	**SEE**
Presentation 1- Selection of topic- (phase 1) Justification for Importance, need of the hour with surveyed data.	**10**	*****
EXPERIENTIAL LEARNING Presentation 2 (phase 2) Content development, strategies for implementation methodologies.	**10**	*****
Case Study-based Teaching-Learning	**10**	Implementation strategies of the project with report
Sector wise study & consolidation	**10**	
Video based seminar (4-5 minutes per student)	**10**	
TOTAL MARKS FOR THE COURSE	**50 MARKS**	**50 MARKS**

SEMESTER: III						
BRIDGE COURSE: C PROGRAMMING (Mandatory Audit Course) (Common to all programs)						
Course Code	**:**	**CS139AT**		**CIE**	**:**	**50 Marks**
Credits: L: T: P	**:**	**2:1:0**				

Unit-I	**06 Hrs**
Introduction to Programming: Definition of a computer. Components of computer system, Programming Languages. Design and implementation of efficient programs. Program Design Tools: Algorithms, Flowcharts and Pseudo codes. Types of Errors.	
Unit – II	**06 Hrs**
Introduction to C: Introduction, structure of a C program, Writing the first program, Files used in a C program. Compiling and executing C Programs using comments, C Tokens, Character set in C, Keywords, Identifiers, Basic Data Types in C, Variables, Constants, I/O statements in C. Operators in C, Type conversion and type casting, scope of variables.	
Unit –III	**06 Hrs**
Decision Control and Looping Statements: Introduction to decision control, conditional branching statements, iterative statements, Nested loops, Break and continue statements, goto statements **Arrays:** Introduction, Declaration of Arrays, Accessing elements of an array, Storing values in arrays, Operations on Arrays- Traversing, Inserting and Deletion of element in an array. Two dimensional arrays- Operations on two dimensional arrays.	
Unit –IV	**06 Hrs**
Strings: Introduction, Operations on strings- finding length of a string, converting characters of a string into uppercase and lowercase, concatenating two strings, appending a string to another string, comparing two string, reversing a string. String and character Built in functions. **Functions:** Introduction, use of functions, Function declaration/function prototype, Function definition, Function call, Return statement.	
Unit -V	**06 Hrs**
Functions: Passing parameters to a function, Built-in functions. Passing arrays to functions. Recursion. **Structures and Pointers:** Introduction: Structure Declaration, Typedef declaration, initialization of structures, accessing members of a structures, Introduction to pointers, declaring pointer variables	

Course Outcomes: After completing the course, the students will be able to: -	
CO1	Apply logical skills to solve the engineering problems using C programming constructs.
CO2	Evaluate the appropriate method/data structure required in C programming to develop solutions by investigating the problem.
CO3	Design a sustainable solution using C programming with societal and environmental concern by engaging in lifelong learning for emerging technology

CO4	Demonstrate programming skills to solve inter-disciplinary problems using modern tools effectively by exhibiting team work through oral presentation and written reports.

Reference Books

1.	Programming in C, Reema Thareja, 2018, Oxford University Press. ISBN: 9780199492282.
2.	The C Programming Language, Kernighan B.W and Dennis M. Ritchie, 2015, 2nd Edition, Prentice Hall, ISBN (13): 9780131103627.
3.	Turbo C: The Complete Reference, H. Schildt, 2000, 4th Edition, McGraw Hill Education, ISBN-13: 9780070411838.
4.	Algorithmic Problem Solving, Roland Backhouse, 2011, Wiley, ISBN: 978-0-470-68453-5.

Implement the following programs using CC/GCC compiler

1. Familiarization with programming environment: Concept of creating, naming, and saving the program file in gedit/vi editor, Concept of compilation and execution, Concept of debugging in GDB environment.
2. Implementation and execution of simple programs to understand working of
   - Formatted input and output functions- printf() and scanf().
   - Escape sequences in C.
   - Using formula in a C program for specific computation: For example: computing area of circle, converting Celsius to Fahrenheit, area of a triangle, converting distance in centimetres to inches, etc.
   - Preprocessor directives (#include, #define).
3. Execution of erroneous C programs to understand debugging and correcting the errors like:
   - Syntax / compiler errors.
   - Run-time errors.
   - Linker errors.
   - Logical errors.
   - Semantical errors.
4. Implementation and execution of simple programs to understand working of operators like:
   - Unary.
   - Arithmetic.
   - Logical.
   - Relational.
   - Conditional.
   - Bitwise.
5. Develop a C program to compute the roots of the equation ax2 + bx + c = 0.
6. Develop a C program that reads N integer numbers and arrange them in ascending or descending order using selection sort and bubble sort technique.
7. Develop a C program for Matrix multiplication.
8. Develop a C program to search an element using Binary search and linear search techniques.
9. Using functions develop a C program to perform the following tasks by parameter passing to read a string from the user and print appropriate message for palindrome or not palindrome.
10. Develop a C program to compute average marks of ‘n’ students (Name, Roll_No, Test Marks) and search a particular record based on ‘Roll_No’.
11. Develop a C program using pointers to function to find given two strings are equal or not.
12. Develop a C program using recursion, to determine GCD, LCM of two numbers and to perform binary to decimal conversion.

RUBRICS FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted & Each Quiz will be evaluated for 05 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**10**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). **TWO TESTS** will be conducted. Each test will be evaluated for 25 Marks, adding up to 50 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 20 MARKS.**	**20**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. **Phase I (10) & Phase II (10) ADDING UPTO20 MARKS**.	**20**
MAXIMUM MARKS FOR THE CIE THEORY		**50**

Semester: IV						
MATHEMATICS FOR COMMUNICATION ENGINEERING **Category: PROFESSIONAL CORE COURSE** **(Theory)**						
Course Code	**:**	**EC241AT**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**03 Hrs**

Unit-I — **09 Hrs**

Random Variables and Processes:
Ensemble, PDF, Independence, Expectations, Stationarity, Correlation Functions (ACF, CCF, Addition, and Multiplication), Ergodic Random Processes, Power Spectral Densities (Wiener Khinchine, Addition and Multiplication of RPs, Cross spectral densities), Linear Systems (output Mean, Cross correlation and Autocorrelation of Input and output), Exercises with Noise. Discrete form statement of Wiener – Khinchine Theorem

Unit – II — **09 Hrs**

Sampling and Analog to Digital Conversion:
Digital communication blocks and impediments, Low Pass Sampling Theorem (Impulse, Pulse and Flat top). Pulse-Code Modulation (PCM) – Uniform Quantization, Non uniform Quantization- Robust quantizer (μ-law and A-law), with SNR derivations. Differential Pulse Code Modulation (DPCM), Delta Modulation with SNR derivation

Unit –III — **09 Hrs**

Digital Multiplexing and Demultiplexing
Framing with overheads, Types- Synchronous, Asynchronous, Quasi-Synchronous. Demultiplexing FSM, Retiming FSM with Plesiochronous buffering.

Low Pass Signal Representation:
Bandpass signals and equivalent low pass signal representation, Quadrature signal receivers, Geometric Representation of Signals in terms of a low pass basis set, Gram Schmidt procedure

Unit –IV — **09 Hrs**

Digital Communication Transmitter:

Baseband Pulse Transmission: Line Codes: Unipolar, Polar, Bipolar - AMI, Manchester signalling, PSD derivations for these pulses.

Baseband signal – M-PAM, Carrier Modulated PAM. Bandpass band limited signals BPSK, QPSK, M-PSK, M-QAM - Basic parameters (d_{min} and Avg. energy), Transmitter Architectures and PSD.
Power limited orthogonal signals – BFSK, DPSK.

Communication through AWGN Channels-I

Estimation Basics: Center point sampling, Averaging and Matched Filter - Correlation Receiver.

Unit –V — **09 Hrs**

Communication through AWGN Channels-II:

Detection Basics - MAP and MLI Estimation of Binary signals with AWGN, Probability of error for binary signaling, Probability of error for binary baseband Line codes as examples.

Coherent Demodulation Scheme
Probability of symbol error for Band limited M-symbol constellations - M-PAM, M-PSK and M-QAM. (Lower and upper bounds on Pe)
Receiver Architecture for M-symbol band limited constellations with applications to BPSK, MPSK and M-QAM

Course Outcomes: After completing the course, the students will be able to:-	
CO1	Interpret mathematical representations of communication signals, systems, and channels, understanding their behavior and properties.
CO2	Associate and apply the concepts of digital formatting, reconstruction to digital transmitter and receivers used in cellular and other communication devices.
CO3	Apply mathematical methods and techniques to analyze communication system performance, such as calculating signal-to-noise ratio, bandwidth requirements, and modulation efficiency.
CO4	Assess the reliability and validity of mathematical predictions and simulations in predicting communication system performance under various conditions.

Reference Books	
1.	Modern Digital and Analog communication Systems, B.P.Lathi and Zhi Ding, 4th Edition, 2010, Oxford University Press, ISBN: 9780198073802
2.	Digital Communication Systems, Simon Haykin, Wiley, Special Edition, Standard Edition, 2013, ISBN: 978-8126542314
3.	Fundamentals of Communication Systems, Proakis and Salehi, Pearson Education India; 2nd Edition, 2013, ISBN: 978-0133354850
4.	Analog & Digital Communication: Schaum's Outline Series, Hwei Hsu, 3rd Edition,2017, McGraw Hill Education, ISBN: 978-0070151505

RUBRICS FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted &each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**20**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). **TWO TESTS** will be conducted. Each test will be evaluated for 50 Marks, adding up to 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. **Phase I (20) & Phase II (20) ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**
RUBRICS FOR SEMESTER END EXAMINATION (THEORY)		
Q.NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	**20**
	PART B (Maximum of THREE Sub-divisions only)	
2	Unit 1: (Compulsory)	**16**
3 & 4	Unit 2: Question 3 or 4	**16**
5 & 6	Unit 3: Question 5 or 6	**16**
7 & 8	Unit 4: Question 7 or 8	**16**
9 &10	Unit 5: Question 9 or 10	**16**
	TOTAL	**100**

Semester: IV

MICROCONTROLLER & PROGRAMMING
Category: PROFESSIONAL CORE COURSE
(Theory& Practice)
(Common to EC, EI, EE, ET)

Course Code	**:**	**EI243AI**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:1**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L+15P**		**SEE Duration**	**:**	**03 Hrs+ 03 Hrs**

Unit-I — **09 Hrs**

Introduction to Processing Units

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

Unit – II — **08 Hrs**

Cortex M Architecture

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

Unit –III — **09 Hrs**

Digital and Analog IO

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

Unit –IV — **09 Hrs**

Serial Ports

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

Unit –V — **09 Hrs**

Interrupts and Timers

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

Practical: Programming in ARM Assembly using Keil

1. Data Transfer Programs: Block Moves & Exchange (With & Without Overlap) with &without String Instructions.
2. Arithmetic Operations: Addition, Multiplication & Division on 32-Bit Data.
3. Search for a Key in an Array of Elements using Linear Search, Binary Search.

Programming in Keil using embedded C in STM32CubeMX

4. Program digital IOs control LEDs, seven segment interface, push buttons.
5. Program digital IOs to control stepper and motor drivers for given specifications.
6. Program ADC and show analog to digital conversion. Display digital value on suitable interface.
7. Program ADC and show interfacing of analog sensor for given specifications.
8. Program USART and serial data transfer.
9. Program SPI and show the configuration and data transfer between SPI slave device and master.
10. Program to configure NVIC and writing interrupt service routines.

Innovative Experiments:

1. Program SPI and show the configuration and data transfer between SPI slave device and master.
2. Program ADC and show interfacing of analog sensor for given specifications.
3. Data transfer in polling, interrupt and DMA based modes.
4. Real time Audio applications: Flanging effect.

Course Outcomes: After completing the course, the students will be able to: -	
CO1	Analyse the architecture, instruction set and memory organization of processing units used to build computers and embedded systems.
CO2	Compile the information of ADCs, DACs, Serial ports and interrupts available on embedded processors to map to real world requirements.
CO3	Apply the knowledge of microcontroller for programming peripherals using registers and APIs generated using auto code generators.
CO4	Formulate and design different applications on embedded processors to solve problems related to society.

Reference Books	
1	The Definitive Guide to the ARM Cortex-M3& M4 Processors, Joseph Yiu, 3rd Edition, Newness (Elsevier), 2014, ISBN:978-93-5107-175-4.
2.	STM32 Arm Programming for Embedded Systems, Shujen Chen, Eshragh Ghaemi, Muhammad Ali Mazidi, Microdigitaled, ISBN: 978-0997925944.
3.	Reference manuals: STM32F4xx, STM32cubeMX, SPI.
4.	White Paper: Cortex-M for Beginners - An overview of the Arm Cortex-M processor family and comparison.

RUBRICS FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY & LAB)		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted &each quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**20**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). **TWO TESTS** will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20) **ADDING UPTO 40 MARKS.**	**40**
4.	**LAB:** Conduction of laboratory exercises, lab report, observation, and analysis (20 Marks), lab test (10 Marks) and Innovative Experiment/ Concept Design and Implementation (20 Marks) adding up to 50 Marks**. THE FINAL MARKS WILL BE 50 MARKS.**	**50**
	MAXIMUM MARKS FOR THE CIE	**150**

RUBRICS FOR SEMESTER END EXAMINATION (THEORY)		
Q.NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	**20**
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1: (Compulsory)	**16**
3 & 4	Unit 2: Question 3 or 4	**16**
5 & 6	Unit 3: Question 5 or 6	**16**
7 & 8	Unit 4: Question 7 or 8	**16**
9 &10	Unit 5: Question 9 or 10	**16**
	TOTAL	**100**

RUBRIC FOR SEMESTER END EXAMINATION (LAB)		
Q.NO.	**CONTENTS**	**MARKS**
1	Write Up	10
2	Conduction of the Experiments	20
3	Viva	20
	TOTAL	**50**

Semester: IV

SIGNALS & SYSTEMS
Category: PROFESSIONAL CORE COURSE
(Theory& Practice)
(Common to EC, EI)

Course Code	**:**	**EC244AI**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:1**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L+15P**		**SEE Duration**	**:**	**03 Hrs +03 Hrs**

Unit-I — **09 Hrs**

Introduction to Signals and Systems:

Definition of Signals, Types and Classification of Signals with examples, Basic Operations on Signals, definition of Systems, Properties of Systems, System Viewed as Interconnection of Operations. Conversion of analog to digital signals.

Unit – II — **09 Hrs**

Time Domain Representations of Linear Time Invariant Systems:

Convolution Sum, concepts of Convolution Integrals, Interconnections of LTI System, Relations between LTISystems, Properties of LTI systems, Applications.

Unit –III — **09 Hrs**

Applications of Fourier Representations:

Review of Fourier transform, Concepts of DTFS and DTFT with properties (no derivation), computation of DTFTfor basic periodic and non-periodic signals, Applications.

Unit –IV — **09 Hrs**

The Discrete Fourier transforms - Properties and Applications:

Concept of DFT, Properties of DFT, Periodicity, Linearity and Symmetry properties, Multiplication of two DFTs,circular correlation and circular convolution. Linear filtering methods based on the DFT. Filtering of long data sequence.

Efficient computation of Radix – 2 FFT Algorithms up to 4-point FFT

Unit –V — **09 Hrs**

Time and Frequency Domain Features:

Time domain features like mean, variance, correlation, skewness, energy, envelop of signal etc., Frequencydomain features like dominant frequency, peak value etc., Classification of signals based on feature extraction.

Practical's:

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

Innovative Experiment

1. Demonstrate of any real time applications using microcontroller.

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	Analysis the strong fundamentals in discrete time signal processing.
CO3	Analyze discrete system and validate the functionality of the same using simulation tool.
CO4	Design discrete systems to meet specific requirement for signal processing application.

Reference Books	
1.	Signals and Systems, Simon Haykin and Barry Van Veen, John Wiley & Sons, 2nd Edition,2008. **(Unit 1 and 2)**
2.	Digital Signal Processing, Proakis G & Dimitris G. Manolakis, PHI, 3rd Edition, 2007. **(Unit 3,4 and 5)**
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, PearsonEducation, 2nd Edition, 2003

RUBRICS FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY & LAB)		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted &each quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**20**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). **TWO TESTS** will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20) **ADDING UPTO 40 MARKS.**	**40**
4.	**LAB:** Conduction of laboratory exercises, lab report, observation, and analysis (20 Marks), lab test (10 Marks) and Innovative Experiment/ Concept Design and Implementation (20 Marks) adding up to 50 Marks**. THE FINAL MARKS WILL BE 50 MARKS.**	**50**
	MAXIMUM MARKS FOR THE CIE	**150**

RUBRICS FOR SEMESTER END EXAMINATION (THEORY)		
Q.NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	**20**
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1: (Compulsory)	**16**
3 & 4	Unit 2: Question 3 or 4	**16**
5 & 6	Unit 3: Question 5 or 6	**16**
7 & 8	Unit 4: Question 7 or 8	**16**
9 &10	Unit 5: Question 9 or 10	**16**
	TOTAL	**100**

RUBRIC FOR SEMESTER END EXAMINATION (LAB)		
Q.NO.	**CONTENTS**	**MARKS**
1	Write Up	10
2	Conduction of the Experiments	20
3	Viva	20
	TOTAL	**50**

Semester: IV						
TRANSMISSION LINES & ELECTROMAGNETIC FIELDS **Category: PROFESSIONAL CORE COURSE** **(Theory)**						
Course Code	**:**	**EC345AT**		**CIE**	**:**	**100 Marks**
Credits: L: T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**03 Hrs**

Unit-I — **09 Hrs**

Transmission Lines:

Lumped-Element Model, Transmission-Line Equations, Wave Propagation on a Transmission Line, Voltage Reflection Coefficient, Standing Waves, Wave Impedance of the Lossless Line, Short-Circuited Line, Open- Circuited Line, Power Flow on a Lossless Transmission Line, Instantaneous Power, Time-Average Power, Illustrative examples.

Unit – II — **09 Hrs**

The Smith Chart: Wave Impedance, SWR, Voltage Maxima and Minima, Impedance Matching, Lumped-ElementMatching, Single-Stub Matching, Problems

Review of Vector Calculus and Columb's Law.

Electrostatic Fields:

Gauss's Law Flux, Flux density, Gauss's Law, Divergence Theorem (qualitative treatment), Application of Gauss'sLaw (Field due to Continuous Line Charge, Sheet Charge, Metal Sphere, Spherical shell),

Unit –III — **09 Hrs**

Electric Potential, Relation between E and V, Applications (Field and potential due to Line charge distribution, Surface charge distribution- sheet), Poisson's and Laplace's Equations, Applications of Laplace's and Poisson's Equations (Different capacitors), Energy density, Boundary Valued Problem in Electrostatics (dielectric-dielectric, dielectric-conductor)

Unit –IV — **09 Hrs**

Review of Biot -Savart Law.

Magnetics:

Ampere's Circuital Law, Applications (Infinite line current, sheet current, coaxial transmission line), Stroke's theorem (qualitative treatment), Solenoid, Magnetic potentials, Scalar Magnetic Potentials, Vector Magnetic Potentials, Poisson's and Laplace's Equations in Magnetics, Boundary Valued Problem in Magnetics Illustrative examples

Unit –V — **09 Hrs**

Time Varying Fields:

Introduction, Faraday's Law, Transformer and Motional EMFs, Displacement Current, Maxwell's Equations in Final Forms, Time-Varying Potentials, Time-Harmonic Fields, Illustrative examples

Plane Wave Propagation:

Lossy Dielectrics, Plane Waves in Lossless Dielectrics, Plane Waves in Free Space, Plane Waves in Good Conductors, Power and the Poynting Vector, Reflection of a Plane Wave at Normal Incidence. Illustrative examples.

Reference Books	
1.	Principles Of Electromagnetics, Matthew N O Sadiku Oxford University Press, 6th Edition, 2007, ISBN-13: 978-0199461851.
2.	Engineering Electromagnetics, William H. Hayt Jr., John A. Buck, Tata McGraw Hill, 6th Edition, 2001, ISBN: 978-0071089012
3.	Introduction to Electromagnetic Engineering, Roger E. Harrington, Dover Books on Electrical Engineering, 2003, ISBN-13: 978-1580539395.
4.	Fundamentals of Applied Electromagnetics, Fawwaz Ulaby, Umberto Ravaioli, Pearson Education Limited 7th Edition, ISBN-13: 978-1292082448.
Course Outcomes: After completing the course, the students will be able to:-	
CO1	Explain fundamental laws governing electromagnetic fields and evaluate the physical quantities of electromagnetic fields (Field intensity, Flux density etc.), in different media using the fundamental laws.
CO2	Determine the electromagnetic fields exerted on charged particles, current elements, working principle of various electric and electromagnetic energy conversion devices and transmission lines.
CO3	Design electromagnetic energy storage devices like capacitor, inductor which are frequently used in electrical systems and power transfer in Transmission lines.
CO4	Deduce and justify the concepts of electromagnetic waves, means of transporting energy or information in the form of radio waves, TV signals, radar beams, light rays and transmission lines.

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**20**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO tests will be conducted. Each test will be evaluated for 50 Marks, adding upto 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. Case study-based teaching learning (10), Program specific requirements (10), Video based seminar/presentation/demonstration (20**) ADDING UPTO 40 MARKS**.	**40**
	MAXIMUM MARKS FOR THE CIE THEORY	**100**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q.NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	**20**
	PART B (Maximum of TWO Sub-divisions only)	
2	Unit 1: (Compulsory)	**16**
3 & 4	Unit 2: Question 3 or 4	**16**
5 & 6	Unit 3: Question 5 or 6	**16**
7 & 8	Unit 4: Question 7 or 8	**16**
9 & 10	Unit 5: Question 9 or 10	**16**
	TOTAL	**100**

SEMESTER: IV						
DESIGN THINKING LAB **Category: PROFESSIONAL CORE COURSE** **(Practical)**						
Course Code	**:**	**EC247DL**		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	**0:00:02**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**26P**		**SEE Duration**	**:**	**02 Hrs**
						26 Hrs

Guidelines for Design Thinking Lab (DTL):

1. 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 must 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 must 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.
9. 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: -	
CO1	Interpret the process of Design Thinking to solve real world problems from the end user view point.
CO2	Apply design thinking tools to make decisions and attain a feasible solution.
CO3	Identify and solve a Capstone project with sustainable goals using Design Thinking.
CO4	Develop a pretotype and optimize it further through demonstrations.

RUBRICS FOR THE CONTINUOUS INTERNAL EVALUATION		
#	**COMPONENTS**	**MARKS**
1.	Empathy, Ideate evaluation	**10**
2.	Design evaluation	**15**
3.	Prototype evaluation, Digital Poster presentation and report submission	**25**
MAXIMUM MARKS FOR THE CIE		**50**

RUBRICS FOR SEMESTER END EXAMINATION		
#	**COMPONENTS**	**MARKS**
1.	Written presentation of synopsis: Write up	**05**
2.	Presentation/Demonstration of the project	**15**
3.	Demonstration of the project	**20**
4.	Viva	**05**
5.	Report	**05**
MAXIMUM MARKS FOR THE SEE		**50**

SEMESTER: IV						
UNIVERSAL HUMAN VALUES **(Theory)** **(Common to all Programs)**						
Course Code	**:**	**HS248AT**		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	**2:0:0**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**28L**		**SEE Duration**	**:**	**02 Hrs**

Unit-I	**10 Hrs**

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education:
Purpose and motivation for the course, recapitulation from Universal Human Values-I, Self-Exploration 'Natural Acceptance'and Experiential Validation Continuous Happiness and Prosperity- Human Aspirations, Right understanding, Relationship and Physical Facility, Understanding Happiness and Prosperity correctly.
Practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility.

Understanding Harmony in the Human Being - Harmony in Myself!:
Understanding human being as a co- existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' Understanding the Body as an instrument of Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Health;
Practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life.

Unit – II	**10 Hrs**

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

Unit –III	**08 Hrs**

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

Course Outcomes: After completing the course, the students will be able to: -	
CO1	Become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions,
CO2	Understand human relationships and human nature in mind so that they will have better critical ability.
CO3	Become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
CO4	Apply what they have learnt to their own self in different day-to-day settings in real life.

Reference Books	
1.	Human Values and Professional Ethics, R. R. Gaur, R Sangal, G P Bagaria, 1st Edition, 2010, Excel Books, New Delhi, ISBN: 9788174467812.
2.	Human Values, A.N. Tripathi, 3rd Edition, 2019, New Age Intl. Publishers, New Delhi, ISBN: 9788122425895.
3.	India Wins Freedom, Maulana Abdul Kalam Azad, 1st Edition, 1988, Orient Blackswan, ISBN: 97881250051481.
4.	The Story of My Experiments with Truth, Mohandas Karamchand Gandhi, 1st Edition, 2011, CreateSpace Publishing platform, ISBN: 9781463694876.
5.	Small is Beautiful, E. F Schumacher, 1st Edition, 2011, (PBD)VINTAGE, ISBN: 9780099225614.

RUBRICS FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted & Each Quiz will be evaluated for 5 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**10**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). **TWO TESTS** will be conducted. Each test will be evaluated for 25 Marks, adding up to 50 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 20 MARKS.**	**20**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. **Phase I (10) & Phase II (10) ADDING UPTO 20 MARKS**.	**20**
MAXIMUM MARKS FOR THE CIE THEORY		**50**

RUBRICS FOR SEMESTER END EXAMINATION (THEORY)		
Q.NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	**10**
	PART B (Maximum of THREE Sub-divisions only)	
2	Unit 1: (Compulsory)	**08**
3 & 4	Unit 2: Question 3 or 4	**08**
5 & 6	Unit 3: Question 5 or 6	**08**
7 & 8	Unit 4: Question 7 or 8	**08**
9 &10	Unit 5: Question 9 or 10	**08**
	TOTAL	**50**

Semester: IV						
BRIDGE COURSE: MATHEMATICS (Mandatory Audit Course) (Common to all programs)						
Course Code	**:**	**MAT149DT**		**CIE**	**:**	**50 Marks**
Credits: L: T: P	**:**	**2:0:0**				

Unit-I	**10 Hrs**

Multivariable Calculus:

Partial Differentiation: Introduction, simple problems. Total derivative, composite functions. Jacobians – simple problems.

Vector Differentiation:

Introduction, velocity and acceleration, gradient, divergence – solenoidal vector function, curl – irrotational vector function and Laplacian, simple problems.

Unit – II	**10 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 –III	**10 Hrs**

Numerical Methods:

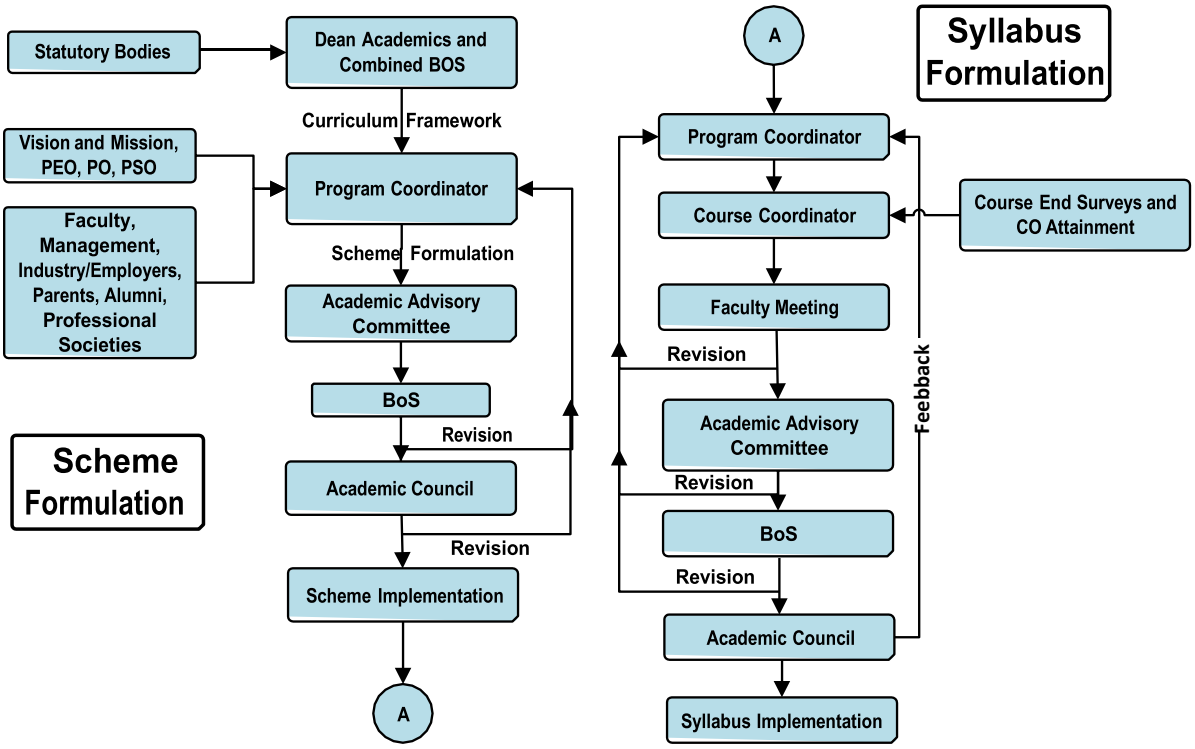
Solution of algebraic and transcendental equations – Intermediate value property, Newton-Raphson method. Solution of first order ordinary differential equations – Taylor series and 4^{th} order Runge-Kutta methods. Numerical integration – Simpson's $1/3^{rd}$, $3/8^{th}$ and Weddle's rules. (All methods without proof)**.**

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

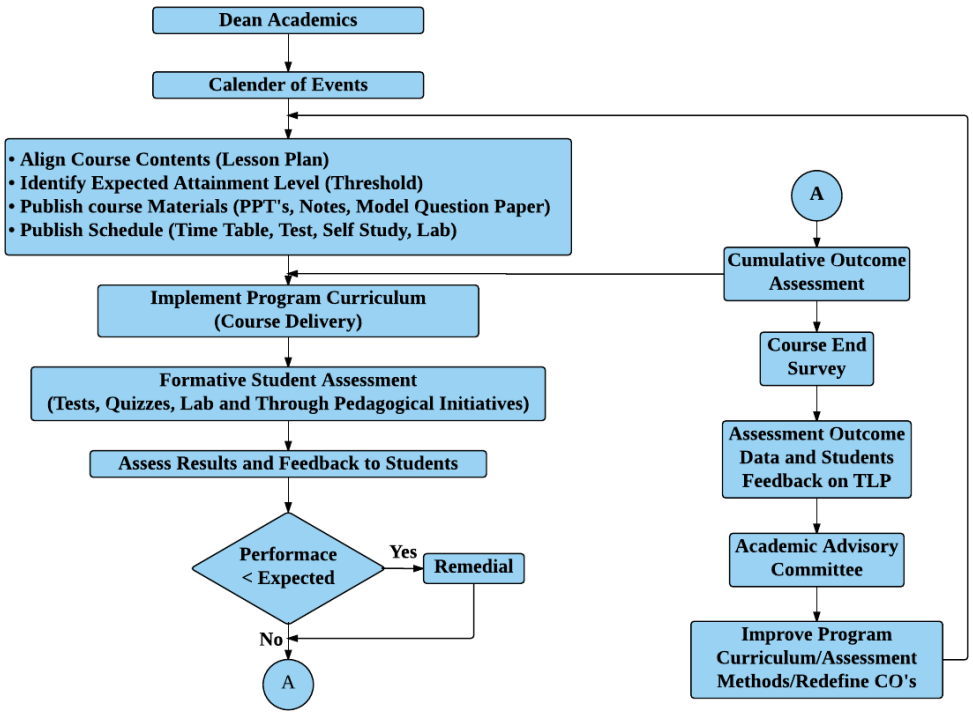
Reference Books	
1.	Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers, 44^{th} Edition, 2015, ISBN: 978-81-933284-9-1.
2.	Higher Engineering Mathematics, B.V. Ramana, 11^{th} Edition, 2010, Tata McGraw-Hill, ISBN: 978-0-07-063419-0.
3.	A Text Book of Engineering Mathematics, N.P. Bali &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

RUBRICS FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. TWO QUIZZES will be conducted & Each Quiz will be evaluated for 05 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**10**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). TWO tests will be conducted. Each test will be evaluated for 25 Marks, adding up to 50 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 20 MARKS.**	**20**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. **Phase I (10) & Phase II (10) ADDING UPTO 20MARKS**.	**20**
MAXIMUM MARKS FOR THE CIE THEORY		**50**

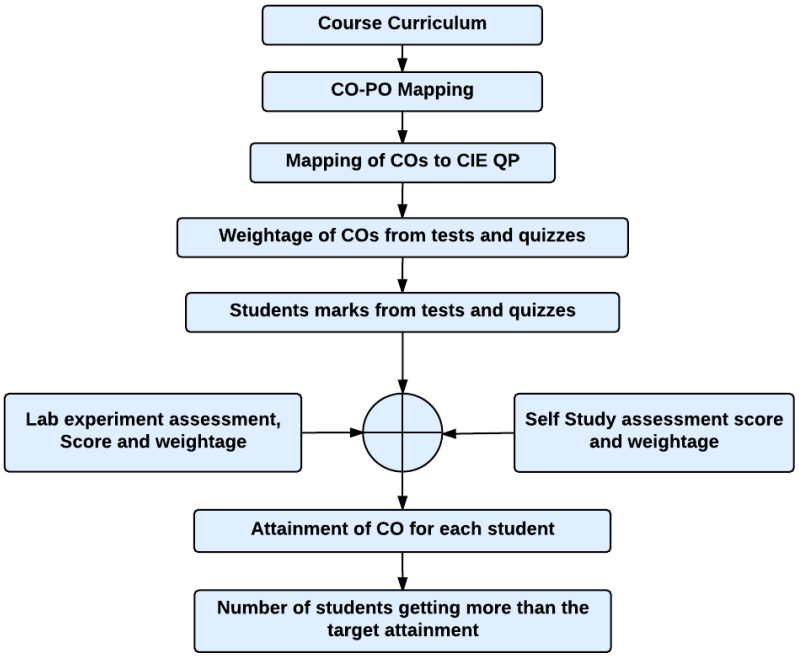
Curriculum Design Process



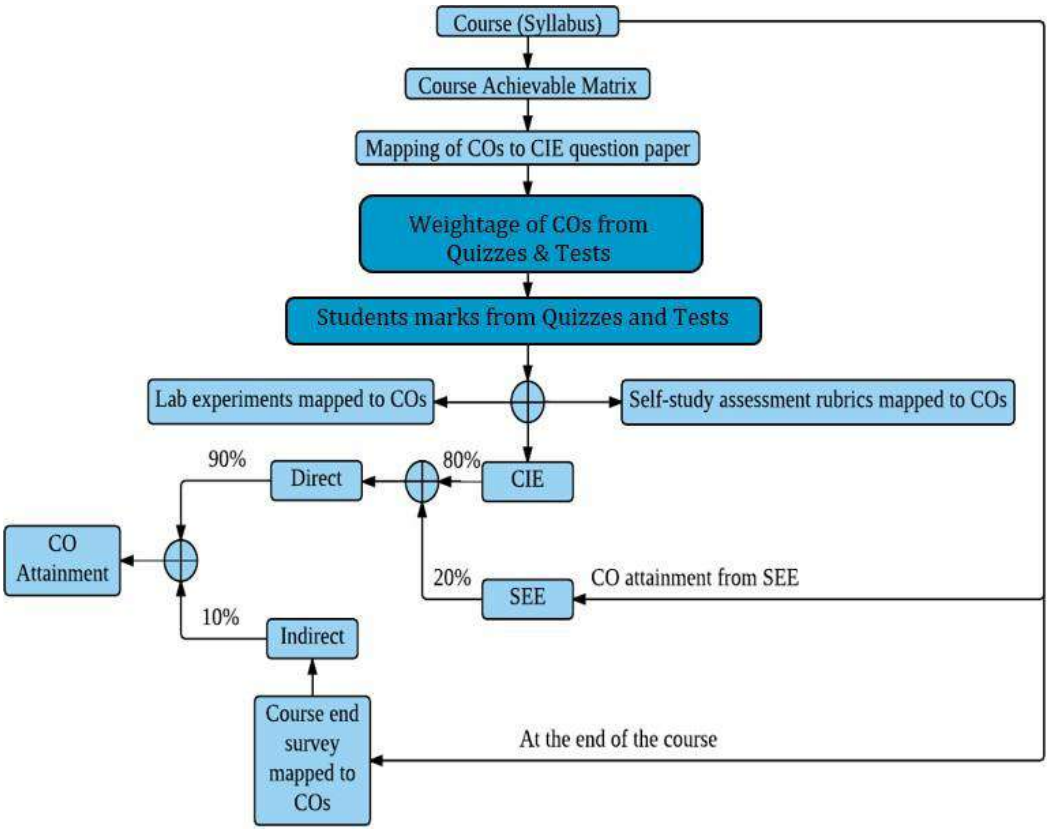
Academic Planning and Implementation



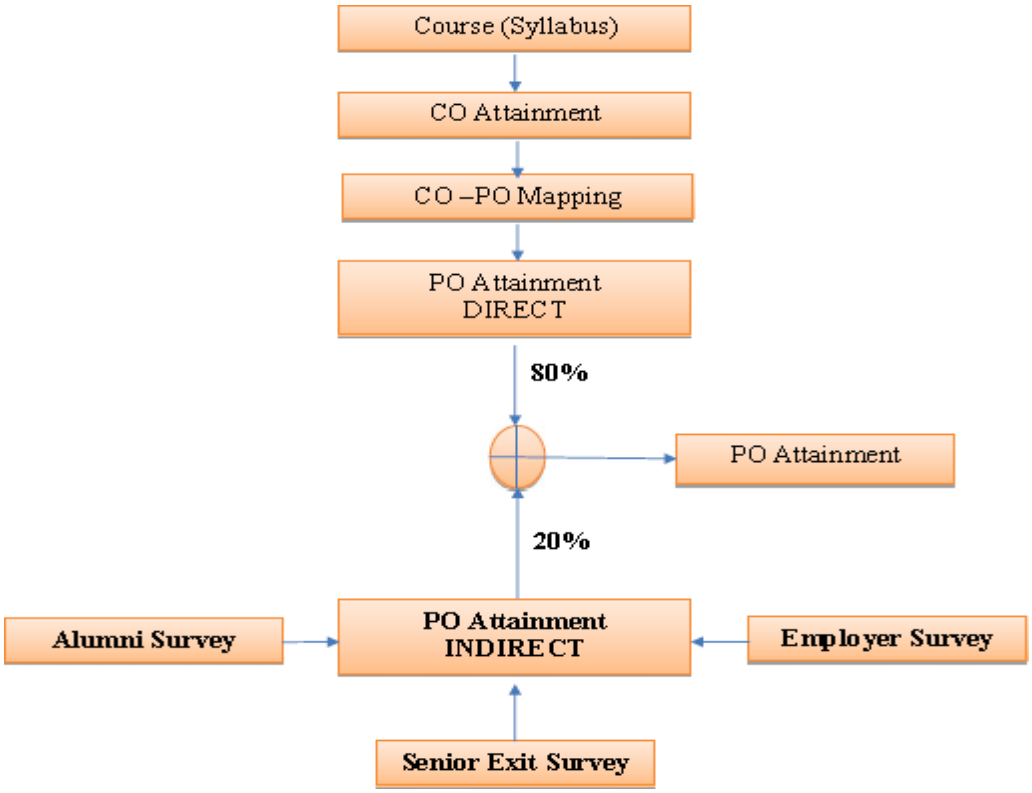
Process For Course Outcome Attainment



Final CO Attainment Process



Program Outcomes Attainment Process



PROGRAM OUTCOMES (POs)

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

KNOWLEDGE AND ATTITUDE PROFILES (WK)

WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness ofrelevant social sciences

WK2: Conceptually-based mathematics, numerical analysis, data analysis, statisticsand formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at theforefront of the discipline.

WK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost,re-use of resources, net zero carbon, and similar concepts, that supports engineeringdesign and operations in a practice area.

WK7: Knowledge of the role of engineering insociety and identified issues in engineeringpractice in the discipline, such as the professional responsibility of an engineer topublic safety and sustainable development.

WK8: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues

WK9: Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversityby reason of ethnicity, gender, age, physical ability etc. with mutual understanding andrespect, and of inclusive attitudes.

INNOVATIVE TEAMS OF RVCE

Ashwa Mobility Foundation (AMF): Designs and fabricates Formula-themed race cars and mobility solutions to address urban transportation issues.

Astra Robotics Team: Focuses on designing and building application-specific robots.

Coding Club: Helps students gain coding skills and succeed in competitions like GSoC and ACM-ICPC.

Entrepreneurship Development Cell (E-Cell): Promotes entrepreneurship through workshops, speaker sessions, and mentoring for startups.

Frequency Club Team: Works on software and hardware, emphasizing AI and Machine Learning.

Team Garuda: Develops a supermileage urban concept electric car and E-mobility products.

Team Jatayu: Builds low-cost UAVs with autonomous capabilities for various tasks.

Solar Car Team: Aims to create a solar electric vehicle for sustainable transportation.

Team Antariksh: Focuses on space technology and the development of operational rockets.

Team Chimera: Builds a Formula Electric Car through R&D in E-Mobility.

Helios Racing Team: Designs and tests All-Terrain Vehicles, participating in SAE's BAJA competitions.

Team Hydra: Develops autonomous underwater vehicles for tasks like water purification.

Team Krushi: Creates low-cost farming equipment to assist farmers in cultivation and harvesting.

Team Vyoma: Designs and tests radio-controlled aircraft and UAVs.

Team Dhruva: Engages in astronomy-related activities and collaborates on projects with organizations like ICTS and IIA.

Ham Club: Promotes Amateur Radio and explores technical innovations in communications, especially for disaster response.

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

NSS of RVCE

NCC of RVCE

VISION

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

MISSION

- To deliver outcome based Quality education, emphasizing on experientiallearning with the 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, benefiting all sections of the society.

QUALITY POLICY

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

CORE VALUES

Professionalism, Commitment, Integrity, Team Work, Innovation