RV Educational Institutions ®
RV College of Engineering ®

Autonomous Institution Affiliated to Visvesvaraya Technological University, Belagavi

Approved by AICTE, New Delhi

Go, change the world

BACHELOR OF ENGINEERING (B.E)
2022 SCHEME

SCHEME & SYLLABUS
SECOND YEAR B.E. PROGRAM

ELECTRICAL & ELECTRONICS ENGINEERING

ACADEMIC YEAR 2023-2024

Electrical and Electronics Engineering

Department Vision

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

Department Mission

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

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1. To provide a strong foundation in Mathematics, Science and Engineering fundamentals as well as comprehend, analyze, design, innovate and develop products for real life applications.

PEO2. To inculcate ethical attitude, effective communication skills, leadership qualities and team spirit for a successful professional career with concern for society.

PEO3. To provide a holistic academic environment to foster excellence, entrepreneurship and multidisciplinary approach to inculcate an aptitude for research and lifelong learning.

PROGRAM SPECIFIC OUTCOMES (PEOs)

PSO	Description
PSO1	The B.E EEE Program must demonstrate knowledge and competence in the application of circuit analysis, control systems, field theory, analog and digital electronics, Power Electronics, microcontrollers , microprocessors, Signal processing and conditioning, computer hardware and software to the design, building , testing, protection and operation of electrical machines, power systems, electrical and electronic systems.
PS02	The B.E. EEE Program must demonstrate knowledge and competence in the application of basic sciences, rigorous mathematics and project management techniques in the design of complex electrical and electronic systems.
PSO3	The B.E. EEE Program must demonstrate the ability to effectively work in a team, communicate correctly and develop an ethical attitude and concern for society and environment.

ABBREVIATIONS

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

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Bachelor of Engineering in
ELECTRICAL AND ELECTRONICS ENGINEERING

III SEMESTER

Sl. No.	Course Code	Course Title	Credit Allocation				BoS	Category	CIE Duration (H)	Max Marks CIE		SEE Duration (H)	Max Marks SEE	
			L	T	P	Total				Theory	Lab		Theory	Lab
1	MAT231AT	Linear Algebra, Fourier Transform and Statistics	3	1	0	**4**	MA	Theory	1.5	**100**	****	**3**	**100**	****
2	XX232AT	Basket Courses - **Group A**	3	0	0	**3**	CV/ME/BT	Theory	1.5	**100**	****	**3**	**100**	****
3	EE233AI	Electronics& Linear Integrated Circuits	3	0	1	**4**	EE	Theory+ Lab	1.5	**100**	**50**	**3**	**100**	**50**
4	EC234AI	Analysis and Design of Digital Circuits with HDL	3	0	1	**4**	EC	Theory+ Lab	1.5	**100**	**50**	**3**	**100**	**50**
5	EE235AT	Signals and Network Analysis	3	1	0	**4**	EE	Theory	1.5	**100**	****	**3**	**100**	****
6	HS237XL	Ability Enhancement Courses - **Group C**	0	0	2	**2**	HSS	Lab	1	****	**50**	**2**	****	**50**
7	CS139DT	Bridge Course : C Programming	2(A)	0	0	**AUDIT**	CS	Theory	1	**50**	****	****	****	****
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ENGINEERING MATHEMATICS - III			
Sl.No	**COURSE TITLE**	**COURSE CODE**	**BRANCHES**
1	Linear algebra, fourier transforms and statistics	MAT231AT	EC,EE, EI, ET
2	Statistics, laplace transform and numerical methods	MAT231BT	AS, BT, CH, IM, ME
3	Linear algebra and probability theory	MAT231CT	CD,CS,CY,IS
4	Applied mathematics for civil engineering	MAT231DT	CV
5	Mathematics for artificial intelligence & machine learning	MAT231ET	AI & ML
BASKET COURSES GROUP-A (Students can select any ONE COURSE out of THREE COURSES in ODD Sem & ONE COURSE out of remaining courses in EVEN Sem)			
Sl.No	**COURSE TITLE**	**COURSE CODE**	**BRANCHES**
1	Environment & Sustainability	CV232AT	Common to all
2	Material Science for Engineers	ME232AT	
3	Bio Safety Standards and Ethics	BT232AT	
Bridge Course: Audit course for lateral entry diploma students			
Sl.No	**COURSE TITLE**	**COURSE CODE**	**BRANCHES**
1	Bridge Course C Programming	CS139BT	Common to all

ABILITY ENHANCEMENT COURSES – GROUP-C		
Sl. No.	**Course Code**	**Course Title**
1	HS237AL	National Service Scheme
2	HS237BL	National Cadet Corps
3	HS237CL	Physical Education : Sports & Athletics
4	HS237DL	Music
5	HS237EL	Dance
6	HS237FL	Theater (Light Camera & Action)
7	HS237GL	Art Work & Painting
8	HS237HL	Photography & Film Making

Bachelor of Engineering in
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IV SEMESTER

Sl. No.	Course Code	Course Title	Credit Allocation				BoS	Category	CIE Duration (H)	Max Marks CIE		SEE Duration (H)	Max Marks SEE	
			L	T	P	Total				Theory	Lab		Theory	Lab
1	MAT241AT	Probability Theory and Linear Programming	3	0	0	**3**	MA	Theory	1.5	**100**	****	**3**	**100**	****
2	XX232AT	Basket Courses - **Group A**	3	0	0	**3**	CV/ME/BT	Theory	1.5	**100**	****	**3**	**100**	****
3	EI343AI	Microcontroller & Programming	3	0	1	**4**	EI	Theory + Lab	1.5	**100**	**50**	**3**	**100**	**50**
4	EE244AI	Power Electronics and Applications	3	0	1	**4**	EE	Theory + Lab	1.5	**100**	**50**	**3**	**100**	**50**
5	ET345AT	Principles of Electromagnetics	3	0	0	**3**	ET	Theory	1.5	**100**	****	**3**	**100**	****
6	EE246XT	Professional Elective Courses - **Group B**	2	0	0	**2**	EE	**NPTEL**	1	**50**	****	**2**	**50**	****
7	EE247DT	Design Thinking Lab	0	0	2	**2**	EE	Lab	1	****	**50**	**2**	****	**50**
8	HS248AT	Universal Human Values	2	0	0	**2**	HSS	Theory	1	**50**	****	**2**	**50**	****
9	MAT149DT	Bridge Course: Mathematics	2 (A)	1	0	**AUDIT**	MA	Theory	1.5	**50**	****	****	****	****
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ENGINEERING MATHEMATICS - IV			
Sl.No	**COURSE TITLE**	**COURSE CODE**	**BRANCHES**
1	Probability Theory and Linear Programming	MAT241AT	AS,CH,CV,EE,EI,ET,ME
2	Discrete Mathematical Structures and Combinatorics	CS241AT	AI&ML,CD,CY,CS,IS
3	Biostatistics	BT241AT	BT
4	Mathematics for Communication Engineering	EC241AT	EC
5	Statistics for Data Analytics	IM241AT	IM
BASKET COURSES GROUP-A (Students can select any ONE COURSE out of THREE COURSES in ODD Sem & ONE COURSE out of remaining courses in EVEN Sem)			
Sl.No	**COURSE TITLE**	**COURSE CODE**	**BRANCHES**
1	Environment & Sustainability	CV232AT	Common to all
2	Material Science for Engineers	ME232AT	
3	Bio Safety Standards and Ethics	BT232AT	
***** Bridge Course: Audit course for lateral entry diploma students**			
Sl.No	**COURSE TITLE**	**COURSE CODE**	**BRANCHES**
1	Bridge Course Mathematics	MAT149DT	Common to all

GROUP A: PROFESSIONAL ELECTIVES (MOOC COURSES)			
Sl. No.	**Course Code**	**Course Title**	**Duration**
1.	EE246AT	Sensor Technologies: Physics, Fabrication and Circuits	8 Weeks
2.	EE246BT	Programming, Data Structures and Algorithms Using Python	8 Weeks
3.	EE246CT	Business Analytics & Text Mining Modeling Using Python	8 Weeks
4.	EE246DT	Embedded Systems Design	8 Weeks
5.	EE246ET	An Introduction to Coding Theory	8 Weeks

Semester: III						
LINEAR ALGEBRA, FOURIER TRANSFORMS AND STATISTICS (Theory) (EC, EE, EI, ET)						
Course Code	**:**	MAT231DT		**CIE**	**:**	**100 Marks**
Credits: L: T: P	**:**	3:1:0		**SEE**	**:**	**100 Marks**
Total Hours	**:**	45L+30T		**SEE Duration**	**:**	**3.00 Hours**

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.

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 AND SUSTAINABILITY **Category: Professional Core Course** **Stream: Electronics (Common to all Programs)** **(Theory)**						
Course Code	**:**	CV232AT		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	**100 Marks**
Total Hours	**:**	45L		**SEE Duration**	**:**	**3.00 Hours**

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 Pollution. 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- Socio-economical 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**
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. 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 –IV	**08 Hrs**
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. **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.	
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: -	
CO 1	Understand the basic elements of Environment and its Biodiversity.
CO 2	Explain the various types of pollution and requirement for sustainable strategy for present scenario.
CO 3	Evaluate the different concepts of sustainability and its significance for welfare of all life forms.
CO 4	Recognize the role of Corporate social responsibility in conserving the Environment.

Reference Books	
1.	'Environmental Science and Engineering', Benny Joseph, Tata McGraw-Hill, New Delhi, 2016. ISBN-13 - 978-9387432352
2.	'Introduction to Environmental Engineering and Science', Gilbert M.Masters, Wendell P Ela, 3rd edition, Pearson Education, 2006. ISBN-13 - 978-0132339346
3.	Environment Impact Assessment Guidelines, Notification of Government of India, 2006
4.	A Handbook of Corporate Governance and Social Responsibility (Corporate Social Responsibility), David Crowther and Guler Aras, Gower Publishing Ltd, ISBN - 13 - 978-0566088179

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						
BIO SAFETY STANDARDS AND ETHICS **Category: PROFESSIONAL CORE COURSE** **(Common to all programs)** **(Theory)**						
Course Code	**:**	**BT232AT**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**3 Hours**

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 Licences 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	Comprehensive knowledge of Biohazards and bio safety levels
CO2	Understanding the biosafety guidelines and their importance to the society
CO3	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: III						
MATERIALS SCIENCE FOR ENGINEERS **Category: Professional Core** **(Theory)**						
Course Code	**:**	ME232AT		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	**100 Marks**
Total Hours	**:**	40L		**SEE Duration**	**:**	**3 Hours**

Unit-I	**06 Hrs**
The Fundamentals of Materials The electronic structure of atoms, types of atomic and molecular bonds: ionic bond, covalent bond, metallic bond, secondary bonds, mixed bonding, hybridization. Energy bands in metals, insulators, and semiconductors. Basic crystallography. Defects and dislocations. Types of materials: polymers, metals and alloys, ceramics, semiconductors, composites.	
Unit – II	**10 Hrs**
Material behaviour Thermal properties: thermal conductivity, thermoelectric effects, heat capacity, thermal expansion coefficient, thermal shock, thermocouple. Electrical Properties: dielectric behaviours and temperature dependence of the dielectric constant, insulating materials, ferroelectricity, piezoelectricity, super conductor. Optical properties: luminescence, optical fibers, Mechanical Properties: Stress-strain diagram, elastic deformation, plastic deformation, hardness, viscoelastic deformation, impact energy, fracture toughness, fatigue.	
Unit –III	**10 Hrs**
Materials and their Applications Semiconductors, dielectrics, optoelectronics, structural materials, ferrous alloys, nonferrous alloys, cement, concrete, ceramic, and glasses. Polymers: thermosets and thermoplastics, composites: fibre-reinforced, aggregated composites, electronic packaging materials, biomaterials, processing of structural materials.	
Unit –IV	**07 Hrs**
Heat Treatment Post processing heat treatment of electronic devices: thermal oxidation, diffusion, rapid thermal processing. Heat treatment of ferrous materials: annealing, spheroidizing, normalizing, hardening, tempering. formation of austenite, construction of Time Temperature Transformation (TTT) curves. Special heat treatment processes: carburizing, nitriding, cyaniding, flame, and induction hardening. Defects in heat treatment.	
Unit-V	**07 Hrs**
Nanomaterials Synthesis of nanomaterials: ball milling, sol-gel, vapour deposition growth, pulse laser, magnetron sputtering, lithography. Nano porous materials: zeolites, mesoporous materials, carbon nanotubes, graphene, nano FRPs, nano fabrics, bioresorbable and bio-erodable materials, nano ceramic, nano glasses, nano biomaterials, nano implant associated materials. Characterisation of nano structures, spectroscopic techniques, automatic force microscopy.	

Course Outcomes: After completing the course, the students will be able to:	
CO1	Understand the classification of materials, their atomic structure, and properties.
CO2	Investigate the properties and applications of different materials.
CO3	Analyse the effect of different heat treatment processes.
CO4	Recognize different types of nanomaterials, synthesis methods and characterisation techniques.

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
4.	A.S. Edelstein and R.C. Cammarata, Nanomaterials: Synthesis, Properties and Applications, CRC Press 1996, ISBN:978-0849322749

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**) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). 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						
ELECTRONICS AND LINEAR INTEGRATED CIRCUITS **Category: Professional Core Course** **(Theory and Practice)**						
Course Code	**:**	EE233AI		**CIE**	**:**	100Marks
Credits: L:T:P	**:**	3:0:1		**SEE**	**:**	100 Marks
Total Hours	**:**	42 L+30P		**SEE Duration**	**:**	3 Hours

Unit-I	**10 Hrs**
Semiconductor Devices: **Semiconductor Diodes:** Ideal diode, Semiconductor Materials, Energy Levels, Extrinsic Materials- n- and p-Type, Semiconductor Diode, Resistance levels, Diode Equivalent Circuits, Load-Line Analysis, Zener Diodes, Light-Emitting Diodes (LEDs). **Bipolar Junction Transistors:** Transistor Construction and Operation, CB Configuration, Transistor Amplifying Action, CE Configuration, CC Configuration, Operating Point, Fixed-Bias, Voltage-Divider Bias, Amplification in the AC domain, The r_e Transistor Model, RC Coupled Amplifier, Gain, Input Resistance, Frequency Response. **MOSFET:** Enhancement MOSFETs, Depletion MOSFETs, Output Characteristics, CMOS.	
Unit-II	**08 Hrs**
Operational Amplifier Characteristics: Ideal Operational Amplifier, Practical Operational Amplifier, DC Performance Characteristics of Op-Amp, AC Performance Characteristics of Op-Amp, Frequency Compensation, Noise, Open-Loop Op-Amp Configurations, Closed-Loop Op-Amp Configurations, Differential Amplifier, General Description, Manufacturer's Specifications and Electrical Characteristics of the Op-Amp, Power Supply Connections.	
Unit –III	**10 Hrs**
Applications of Operational Amplifiers: Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, Voltage-Controlled Voltage Source, Current Sources, Inverting Current Amplifier, Current-Controlled Current Source, Voltage to Current Converter, Current to Voltage Converter, Adder or Summing Amplifier, Subtractor, Adder-Subtractor, Instrumentation Amplifier, AC Amplifier, Integrator, Differentiator, Logarithmic Amplifier, Antilogarithmic Amplifier. **Operational Amplifier-Non-linear Circuits:** Op-Amp Comparators, Schmitt Trigger, Precision Rectifier, Analog Switches, Peak Detectors, Sample and Hold Circuits, Clippers, Clampers.	
Unit –IV	**09 Hrs**
Active Filters: Comparison between Passive and Active Networks, Active Network Design, Design of Low-Pass Filters, General Second-Order Active Filter with Unity Gain and Variable Gain, Design of High-Pass Filters, Band-Pass Filters, Band-Reject Filters, All-Pass Filters, State-Variable Filter, Impedance Converter, Impedance Gyration, Generalised Impedance Converter, Switched Capacitor Filters. **Waveform Generator:** Sine-Wave Generators, Multivibrators, Triangular Wave Generators, Sawtooth Wave Generators, Function Generator, Timer IC 555.	
Unit –V	**08 Hrs**
Voltage Regulators: Basics of Voltage Regulator, Linear Voltage Regulators using Op-Amps, IC Voltage Regulators, Three-Terminal Adjustable Voltage Regulator, General Purpose Regulator, Switched Mode Power Supplies. **D/A and A/D Converters:** Analog and Digital Data Conversions, Specifications of D/A Converter, Basic D/A Conversion Techniques, Sampling Process, High Speed Sample-and-Hold Circuit, A/D Converters, Specifications of A/D Converter, Classification of A/D Converters, Over-Sampling A/D Converters.	

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Understand the basics of electronic devices for modern day applications
CO 2	Analyze the performance of OPAMP and build simple circuits using OPAMP
CO 3	Apply the concepts to design various applications of OPAMP
CO 4	Design a system using various ICs for a specific application

Reference Books	
1.	Linear integrated circuits, S Shalivahanan, V S Kanchana Bhaskaran, 1st Edition, Mc.Grawhill Publications, 2018, ISBN: 10:0-07-064818-2.
2.	Electronic Devices and Circuit Theory, Robert L.Boylestad, Louis Nashelsky, 8th Edition, 2010, Pantice-Hall India, .ISBN:81-203-2064-6.
3.	Microelectronics circuits Analysis and Design, M.H Rashid, 2nd Edition, 2011, Thomson Publication, ISBN: 0-534-95174-0.
4.	Microelectronics circuits, Sedra & Smith, 5th Edition, Oxford Publication, ISBN-13: 978-0195338836.

Laboratory Component

Hardware design and simulation of the following to be carried out

1. Input and output characteristics of transistor in CE configuration
2. Frequency response of RC coupled amplifier
3. Experimental verification of simple applications of OPAMP 741 such as inverting amplifier, non-inverting amplifier, adder/subtractor, integrator and differentiator circuits
4. Design and implementation of peak detector, half wave and full wave precision rectifiers using operational amplifier IC741
5. Design and implementation of a Schmitt trigger circuit for given UTP & LTP using op-amp
6. Design and implementation of active 2nd order low pass and high pass filters and to obtain the frequency response of the filters
7. Realization of 4 bit DAC using R-2R ladder network and asynchronous decade counter IC 7490
8. Realization of 2 bit flash type ADC
9. Design and implementation of RC phase shift oscillator by simulation and experiment

PART B

Innovative Experiments (IE)

A. Design and implementation of astable and monostable multivibrators using 555 timer
B. Analysis of function generator using operational amplifier (sine, triangular, and square wave)
C. Analysis of voltage comparator
D. Design of voltage regulator using IC 7900
E. Generation of ramp wave for a given frequency using NE 555 timer

RUBRICFOR 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. Each quiz is evaluated for 10 marks adding up to 20 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 **50Marks**, 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 (10) Designing & Modeling (10) **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 (THEORY + PRACTICE)	**150**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q.NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type of 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**

RUBRIC FOR SEMESTER END EXAMINATION (LAB)		
Q.NO.	**CONTENTS**	**MARKS**
1	Write Up	10
2	Conduction of the Experiments	30
3	Viva	10
	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**	**:**	100Marks
Credits: L:T:P	**:**	3:0:1		**SEE**	**:**	100 Marks
Total Hours	**:**	45 L+ 30P		**SEE Duration**	**:**	3 Hours

Unit-I	**09 Hrs**
Introduction to Verilog: Design Methodology-An Introduction: Verilog History, System representation, Number representation and Verilog ports. Verilog Data Types: Net, Register and Constant. Verilog Operators: Logical, Arithmetic, Bitwise, Reduction, Relational, Concatenation and Conditional. Verilog Primitives. Logic Simulation, Design Verification, and Test Methodology: Four-Value Logic and Signal Resolution in Verilog, Test Methodology Signal Generators for Test benches, Event-Driven Simulation, Sized Numbers. 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.	

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.

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.

Laboratory Component

1. Truth Table verification of NOT, AND, OR, XOR, XNOR, NAND, NOR gates using IC trainer kit.

   Realization of Binary Adder and Subtractor IC-7483.
2. Realization of Boolean Function using MUX/DEMUX (IC-74153, IC-74139.)
3. Design of synchronous 3-bit up/down counter using IC-7476/IC-74112 on IC trainer kit.
4. Realization of Binary Adder and Subtractor using Verilog
5. Realization of Multiplexer/Decoders/Encoder in Verilog.
6. Realization of D, T, JK flip flop in Verilog using behavioural modelling on FPGA board.
7. Design of synchronous (up/down/BCD counter in Verilog using behavioural modelling.
8. Design of Shift register, ring counter, Johnson counter using Verilog.
9. Design of Sequence generator and detector.

Innovative Experiment:

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

RUBRICFOR 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. Each quiz is evaluated for 10 marks adding up to 20 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 **50Marks**, 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 (10) Designing & Modeling (10) **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 (THEORY + PRACTICE)	**150**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q.NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type of 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**

RUBRIC FOR SEMESTER END EXAMINATION (LAB)		
Q.NO.	**CONTENTS**	**MARKS**
1	Write Up	10
2	Conduction of the Experiments	30
3	Viva	10
	TOTAL	**50**

Semester: III						
SIGNALS & NETWORK ANALYSIS **Category: Professional Core Course** **(Theory)**						
Course Code	**:**	EE235AT		**CIE**	**:**	100Marks
Credits: L:T:P	**:**	3:1:0		**SEE**	**:**	100 Marks
Total Hours	**:**	45 L+ 28 T		**SEE Duration**	**:**	3 Hours

Unit-I	**09 Hrs**
Introduction to different signals and systems: Signal and system types, Classification of signals-Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals, Classification of systems- CT systems and DT systems-Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable, step response, impulse response and convolution integral.	
Unit – II	**09 Hrs**
Signal analysis: Periodic signal: Fourier series and properties; Aperiodic signal: Fourier Transform - its properties and sinusoidal steady state analysis of systems; **Network Fundamentals & Equations:** Introduction, voltage and current sources, classification of sources, source transformation, source shifting, Mesh and Node analysis with linear dependent and independent sources for DC and AC Networks.	
Unit –III	**09 Hrs**
Network Theorems: Superposition, Reciprocity, Thevenin's, Norton's, Maximum Power transfer and Millman's theorems forAC and DC excited networks. **Poly phase Circuits:** Analysis of unbalanced loads connected to balanced Star connected three-phase supply.	
Unit –IV	**09 Hrs**
Laplace Transformation and Applications: Behaviour of circuit elements under switching conditions and their representation. Application ofLaplace transforms for circuit analysis, Evaluation of initial and final conditions in R-L, R-C and R-L-C Circuits for DC and AC excitations. Waveform synthesis, Network functions of single port & two port networks-Driving point & transfer functions.	
Unit –V	**09 Hrs**
Two port networks: Impedance (Z), Admittance (Y), Transmission (ABCD) and Hybrid parameters, their inter relationship.Analysis Series and parallel connection of networks. **Coupled Circuits:** Introduction, Dot convention, series and parallel circuits, Analysis of coupled circuits.	

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Understand the basic concepts of circuits, theorems, coupled circuits, resonant circuits, three phase unbalanced circuits Laplace transform.
CO 2	Analyse DC and AC circuits, coupled circuits, resonant circuits, poly-phase circuits and two port networks.
CO 3	Evaluate the performance of networks in the steady state and transient state of AC and DC circuits.
CO 4	Apply Laplace Transform and Design the Electric Circuit.

Reference Books	
1.	Engineering Circuit Analysis, Hayt, Kemmerly and Durbin, 8th Edition, 2002,TMH, ISBN-10: 0071122273.
2.	Network Analysis, M.E Van Valkenberg, 3rd Edition, Reprint 2002, PHI, ISBN81-7808-729-42.
3.	Circuit Analysis, A NAgoor Kani, 1st Edition, McGraw Hill Education, 2018, ISBN-13: 978-9387572720.
4.	Network Theory, K Channa Venkatesh , D Ganesh Rao, 1st Edition, Pearson Education,2012, ISBN-13- 9788131732311
5.	Signals and Systems, V. Oppenheim, Alan Willsky and A. Hamid Nawab, Pearson EducationAsia/ PHI, 2nd Edition, 2006.

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	**:**	**HS237AL**		**CIE**	**:**	**50 Marks**
Credits: L: T: P	**:**	**0:0:2**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**26 P**		**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, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc...
7. Social connect and responsibilities
8. Plantation and adoption of plants. Know your plants
9. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing
10. Waste management – Public, Private and Govt organization, 5 R's
11. Water conservation techniques – Role of different stakeholders - Implementation
12. Govt. School Rejuvenation and assistance to achieve good infrastructure.
13. Organize National integration and social harmony events/ workshops / seminars. (Minimum 2 programs) and ONE NSS-CAMP.

Course Outcomes: After 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 thesame.
CO3	Evaluate the existing system and to propose practical solutions for the same for sustainabledevelopment.

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	**:**	**HS237BL**		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	**0:0:2**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**26 P**		**SEE Duration**	**:**	**02 Hrs**

Unit-I	**07 Hrs**
Drill: Foot Drill- Drill ki Aam Hidayaten, Word ki Command, Savdhan, Vishram, Aram Se, Murdna, KadvarSizing, 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	**:**	**HS237CL**		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	**0:0:2**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**26 P**		**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	:	**HS237DL**		**CIE**	:	**50 Marks**
Credits: L: T: P	:	**0:0:2**		**SEE**	:	**50 Marks**
Total Hours	:	**26 P**		**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 GlorySt 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	:	**HS237EL**		**CIE**	:	**50 Marks**
Credits: L: T: P	:	**0:0:2**		**SEE**	:	**50 Marks**
Total Hours	:	**26 P**		**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 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						
Theater (Light Camera & Action) (Practical)						
Course Code	**:**	**HS237FL**		**CIE**	**:**	**50 Marks**
Credits: L:T:P	**:**	**0:0:2**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**26 P**		**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. This is aimed at to make everyone in the room comfortable with each other. This helps everyone get over social anxiety, Shyness and Nervousness.
3. Ura
4. Rhythm Voice Projection, Voice Modulation, Weeping & Coughing Voice projection is the strength of speaking or singing whereby the voice is used powerfully and clearly. It is a technique employed to command respect and attention, as when a teacher talks to a class, or simply to be heard clearly, as used by an actor in a theatre.
5. It's Leviosa, Not Leviosaaa!
6. Speech work: Diction, Intonation, Emphasis, Pauses, Pitch and Volume Tempo Dialogues delivery. The art of dialogue delivery plays a vital role in in ensuring the efficacy of communication especially from the dramatic aspect of it, this unit discusses some tips to help the young actors improve their dialogue delivery skills:
7. Elementary, My dear Watson.
8. Responsibilities of an actor tools of an actor character analysis Observations aspects, Stage presence, concentration, conviction, confidence, energy and directionality.
9. Show time
10. Pick a genre: COMEDY, THRILLER, HORROR, and TRAGEDY: Showcase a performance. Stylized acting with reference to historical and mythological plays. Mime: conventional, occupational and pantomime Mono acting: different types of characters

Course Outcomes: After 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	**:**	**HS237GL**		**CIE**	**:**	**50 Marks**
Credits: L: T: P	**:**	**0:0:2**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**26 P**		**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: III						
PHOTOGRAPHY & FILM MAKING (Practical)						
Course Code	:	**HS237HL**		**CIE**	:	**50 Marks**
Credits: L: T: P	:	**0:0:2**		**SEE**	:	**50 Marks**
Total Hours	:	**26 P**		**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 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 photography and videography and improve their skills.
CO2	Appreciate the skills acquired from photography.
CO3	Perform and present photos and films in a presentable manner.
CO4	Develop skills like team building and collaboration.

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

ASSESSMENT AND EVALUATION PATTERN		
WEIGHTAGE	**50%**	**50%**
	CIE	**SEE**
Presentation 1- Selection of topic- (phase 1) Justification for Importance, need of the hour withsurveyed data.	**10**	*****
EXPERIENTIAL LEARNING Presentation 2 (phase 2) Content development, strategies for implementationmethodologies.	**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	**:**	**CS139DT**		**CIE**	**:**	**50 Marks**
Credits: L: T: P	**:**	**2:1:0**				

Unit-I	**08 Hrs**

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

Unit – II	**10 Hrs**

Operators: Introduction to operator set, Arithmetic operators, Relational operators, Logical Operators, Assignment operators, Increment and Decrement operators, Conditional operators, Bit-wise operators, Special operators**.**
Expressions: Arithmetic expressions, evaluation of expressions, Precedence of arithmetic operators, Type conversion in expressions, Operator precedence and associativity.
Decision Making and Branching: Decision making with 'if' statement, Simple 'if' statement, the 'if…else' statement, nesting of 'if…else' statements, The 'else if' ladder, The 'switch' statement, The '?:' operator, The 'goto' statement.

Unit –III	**12 Hrs**

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

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Apply logical skills to solve the engineering problems using C programming constructs.
CO 2	Evaluate the appropriate method/data structure required in C programming to develop solutions by investigating the problem.
CO 3	Design a sustainable solution using C programming with societal and environmental concern by engaging in lifelong learning for emerging technology
CO 4	Demonstrate programming skills to solve inter-disciplinary problems using modern tools effectively by exhibiting team work through oral presentation and written reports.

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

Practice Programs: Implement the following programs using CC/GCC compiler

1. Develop a C program to compute the roots of the equation $ax^2 + bx + c = 0$. 2. Develop a C program that reads N integer numbers and arrange them in ascending or descending order using selection sort and bubble sort technique.
2. Develop a C program for Matrix multiplication.
3. Develop a C program to search an element using Binary search and linear search techniques.
4. 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.
5. 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'.
6. Develop a C program using pointers to function to find given two strings are equal or not.

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						
PROBABILITY THEORY AND LINEAR PROGRAMMING (Theory) (AS, CH, CV, EE, EI, ET, ME)						
Course Code	**:**	MAT241AT		**CIE**	**:**	**100 Marks**
Credits: L: T:P	**:**	2:1:0		**SEE**	**:**	**100 Marks**
Total Hours	**:**	30L+26T		**SEE Duration**	**:**	**3.00 Hours**

Unit-I	**06 Hrs**
Random Variables: Random variables-discrete and continuous, probability mass function, probability density function, cumulative distribution function, mean and variance. Two or more random variables - Joint probability mass function, joint probability density function, conditional distribution and independence, Covariance and Correlation. Implementation using MATLAB.	
Unit – II	**06 Hrs**
Probability Distributions: Discrete distributions - Binomial, Poisson and Geometric. Continuous distributions – Exponential, Uniform, Normal and Weibull. Implementation using MATLAB.	
Unit –III	**06 Hrs**
Sampling Distributions and Estimation: Population and sample, Sampling distributions - Simple random sampling (with replacement and without replacement). Standard error, Sampling distributions of means (σ known), Sampling distributions of proportions, Sampling distribution of differences and sums. Estimation-point estimation, interval estimation. Implementation using MATLAB.	
Unit –IV	**06 Hrs**
Inferential Statistics: Principles of Statistical Inference, Test of hypothesis - Null and alternative hypothesis, Procedure for statistical testing, Type I and Type II errors, level of significance, Tests involving the normal distribution, one – tailed and two – tailed tests, P – value, Special tests for large and small samples (F, Chi – square, Z, t – test). Implementation using MATLAB.	
Unit –V	**06 Hrs**
Linear Programming: Mathematical formulation of linear programming problem. Solving linear programming problem using Graphical, Simplex and Big M methods. Implementation using MATLAB.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Illustrate the fundamental concepts of random variables, distributions, sampling, inferential statistics and optimization.
CO2:	Compute the solution by applying the acquired knowledge of random variables, distributions, sampling, inferential statistics and optimization to the problems of engineering applications.
CO3:	Evaluate the solution of the problems using appropriate probability and optimization techniques to the real-world problems arising in many practical situations.
CO4:	Interpret the overall knowledge of random variables, probability distributions, sampling theory, inferential statistics and optimization gained to engage in life – long learning.

Reference Books	
1	Probability & Statistics for Engineers & Scientists, Ronald E. Walpole & Raymond H. Myers, 9th Edition, 2016, Pearson Education, ISBN-13: 978-0134115856.
2	Applied Statistics and Probability for Engineers, Douglas C. Montgomery and George C. Runger, 6th Edition, 2014, John Wiley & Sons, ISBN:13 9781118539712, ISBN (BRV):9781118645062.
3	Introduction to Probability and Statistics for Engineers and Scientists, Sheldon Ross, 5th Edition, 2014, Academic Press, ISBN: 13-978-0123948113.
4	Higher Engineering Mathematics, B.S. Grewal, 44th Edition, 2015, Khanna Publishers, ISBN: 81-7409-195-5.

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						
BIO SAFETY STANDARDS AND ETHICS **Category: PROFESSIONAL CORE COURSE** **(Common to all programs)** **(Theory)**						
Course Code	**:**	**BT242AT**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	**3:0:0**		**SEE**	**:**	**100 Marks**
Total Hours	**:**	**45L**		**SEE Duration**	**:**	**3 Hours**

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 Licences 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	Comprehensive knowledge of Biohazards and bio safety levels
CO2	Understanding the biosafety guidelines and their importance to the society
CO3	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						
ENVIRONMENT AND SUSTAINABILITY **Category: Professional Core Course** **Stream: Electronics (Common to all Programs)** **(Theory)**						
Course Code	**:**	**CV242AT**		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	**100 Marks**
Total Hours	**:**	45L		**SEE Duration**	**:**	**3.00 Hours**

Unit-I	**09 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 Pollution. 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- Socio-economical 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**
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. 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 –IV	**09 Hrs**
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. **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.	
Unit –V	**09 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: -	
CO 1	Understand the basic elements of Environment and its Biodiversity.
CO 2	Explain the various types of pollution and requirement for sustainable strategy for present scenario.
CO 3	Evaluate the different concepts of sustainability and its significance for welfare of all life forms.
CO 4	Recognize the role of Corporate social responsibility in conserving the Environment.

Reference Books	
1.	'Environmental Science and Engineering', Benny Joseph, Tata McGraw-Hill, New Delhi, 2016. ISBN-13 - 978-9387432352
2.	'Introduction to Environmental Engineering and Science', Gilbert M.Masters, Wendell P Ela, 3rd edition, Pearson Education, 2006. ISBN-13 - 978-0132339346
3.	Environment Impact Assessment Guidelines, Notification of Government of India, 2006
4.	A Handbook of Corporate Governance and Social Responsibility (Corporate Social Responsibility), David Crowther and Guler Aras, Gower Publishing Ltd, ISBN - 13 - 978-0566088179

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						
MATERIALS SCIENCE FOR ENGINEERS **Category: Professional Core** **(Theory)**						
Course Code	**:**	ME242AT		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	**100 Marks**
Total Hours	**:**	40L		**SEE Duration**	**:**	**3 Hours**

Unit-I	**06 Hrs**
The Fundamentals of Materials The electronic structure of atoms, types of atomic and molecular bonds: ionic bond, covalent bond, metallic bond, secondary bonds, mixed bonding, hybridization. Energy bands in metals, insulators, and semiconductors. Basic crystallography. Defects and dislocations. Types of materials: polymers, metals and alloys, ceramics, semiconductors, composites.	
Unit – II	**10 Hrs**
Material behaviour Thermal properties: thermal conductivity, thermoelectric effects, heat capacity, thermal expansion coefficient, thermal shock, thermocouple. Electrical Properties: dielectric behaviours and temperature dependence of the dielectric constant, insulating materials, ferroelectricity, piezoelectricity, super conductor. Optical properties: luminescence, optical fibers, Mechanical Properties: Stress-strain diagram, elastic deformation, plastic deformation, hardness, viscoelastic deformation, impact energy, fracture toughness, fatigue.	
Unit –III	**10 Hrs**
Materials and their Applications Semiconductors, dielectrics, optoelectronics, structural materials, ferrous alloys, nonferrous alloys, cement, concrete, ceramic, and glasses. Polymers: thermosets and thermoplastics, composites: fibre-reinforced, aggregated composites, electronic packaging materials, biomaterials, processing of structural materials.	
Unit –IV	**07 Hrs**
Heat Treatment Post processing heat treatment of electronic devices: thermal oxidation, diffusion, rapid thermal processing. Heat treatment of ferrous materials: annealing, spheroidizing, normalizing, hardening, tempering. formation of austenite, construction of Time Temperature Transformation (TTT) curves. Special heat treatment processes: carburizing, nitriding, cyaniding, flame, and induction hardening. Defects in heat treatment.	
Unit-V	**07 Hrs**
Nanomaterials Synthesis of nanomaterials: ball milling, sol-gel, vapour deposition growth, pulse laser, magnetron sputtering, lithography. Nano porous materials: zeolites, mesoporous materials, carbon nanotubes, graphene, nano FRPs, nano fabrics, bioresorbable and bio-erodable materials, nano ceramic, nano glasses, nano biomaterials, nano implant associated materials. Characterisation of nano structures, spectroscopic techniques, automatic force microscopy.	

Course Outcomes: After completing the course, the students will be able to:	
CO1	Understand the classification of materials, their atomic structure, and properties.
CO2	Investigate the properties and applications of different materials.
CO3	Analyse the effect of different heat treatment processes.
CO4	Recognize different types of nanomaterials, synthesis methods and characterisation techniques.

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
4.	A.S. Edelstein and R.C. Cammarata, Nanomaterials: Synthesis, Properties and Applications, CRC Press 1996, ISBN:978-0849322749

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**) Phase 2 will be done in the exhibition mode (Demo/Prototype/any outcome). 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**

MICROCONTROLLER AND PROGRAMMING Category: Professional Core Course (Common to EI/ET/EC/EE) (Theory and Practice)						
Course Code	**:**	EI243AI		**CIE**	**:**	100+50 Marks
Credits: L:T:P	**:**	3:0:1		**SEE**	**:**	100+50 Marks
Total Hours	**:**	45L+30P		**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	**09 Hrs**
Cortex M Architecture: Advantages of Cortex M CPUs, Programmer's model: Operation modes & states, Registers, Special Registers, APSR, Memory System, Low power modes, Instruction Set: Memory access instructions, Arithmetic, Logical, Shift, Program flow control instructions, Programming examples, IDEs, ST-Link debugger	
Unit –III	**09 Hrs**
Digital and Analog IO: ARM Cortex M4 MCUs, Memory organization, Reset & Clock Control, GPIO, Programming: interfacing LEDs and Push buttons, Analog to digital converters (ADC), Successive Approximation ADC, Programming and interfacing an analog sensor, Digital to Analog Converter (DAC), Programming	
Unit –IV	**09 Hrs**
Serial Port USART: Basics of serial communication (Synchronous, asynchronous), Framing, Sampling, Baud rate generation, Programming USART for character transmission, Serial Peripheral Interface, Programming SPI for data transfer.	
Unit –V	**09 Hrs**
Interrupts and Timers: Types of interrupts, Nested vector interrupt controller (NVIC) in Cortex-M cores, Interrupt vectors, Priorities, Programming interrupts, Timers, Controlling the operation, Programming with timers, Pulse width modulators, Programming modulators to generate PWM wave for given specifications.	

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Analyse the architecture, instruction set and memory organization of processing units used to build computers and embedded systems.
CO 2	Compile the information of ADCs, DACs, Serial ports and interrupts available on embedded processors to map to real world requirements.
CO 3	Apply the knowledge of microcontroller for programming peripherals using registers and APIs generated using auto code generators.
CO 4	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, Newnes (Elsevier), 2014, ISBN:978-93-5107-175-4.
2.	STM32 Arm Programming for Embedded Systems, Shujen Chen, Eshragh Ghaemi, Muhammad Ali Mazidi, Microdigitaled, ISBN: 978-0997925944.
3.	Reference manuals: STM32F411, STMcubeMX, SPI
4.	White Paper: Cortex-M for Beginners - An overview of the Arm Cortex-M processor family and comparison.

Laboratory Component

Practical: Programming in ARM Assembly using Keil

1. Data Transfer Programs: Block Moves & Exchange (With & Without Overlap) with &without String Instructions.
2. Arithmetic Operations: Addition, Multiplication & Division on 32-Bit Data.
3. Search for a Key in an Array of Elements using Linear Search, Binary Search. Programming in Keil using embedded C in STMCubeMx
4. Program digital IOs control LEDs, seven segment interface, push buttons.
5. Program digital IOs to control stepper and motor drivers for given specifications.
6. Program ADC and show analog to digital conversion. Display digital value on suitable interface.
7. Program ADC and show interfacing of analog sensor for given specifications.
8. Program USART and serial data transfer.
9. Program SPI and show the configuration and data transfer between SPI slave device and master.
10. Program to configure NVIC and writing interrupt service routines.

Innovative Experiment:

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.

RUBRICFOR 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. Each quiz is evaluated for 10 marks adding up to 20 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 **50Marks**, 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 (10) Designing & Modeling (10) **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 (THEORY + PRACTICE)	**150**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q.NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type of 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**

RUBRIC FOR SEMESTER END EXAMINATION (LAB)		
Q.NO.	**CONTENTS**	**MARKS**
1	Write Up	10
2	Conduction of the Experiments	30
3	Viva	10
	TOTAL	**50**

Semester: IV						
POWER ELECTRONICS & APPLICATIONS **Category: Professional Core Course** **(Theory & Practice)**						
Course Code	**:**	EE244AI		**CIE**	**:**	150 Marks
Credits: L:T:P	**:**	3:0:1		**SEE**	**:**	150 Marks
Total Hours	**:**	45 L+ 30P		**SEE Duration**	**:**	3 Hours

Unit-I	**09 Hrs**
Power Semiconductor Devices: Introduction to power electronics, Types of Power Electronic Circuits. Control Characteristics of Power devices, Study of switching devices (Construction and working) - SCR, MOSFET and IGBT. Static and dynamic characteristics of SCR, MOSFET and IGBT, Turn on methods of SCR using R, RC and UJT triggering, Microprocessor based triggering of SCR. Device ratings and protection using snubber circuits, Parallel operation of MOSFETs.	
Unit – II	**09 Hrs**
Phase Controlled Converter Circuits: Analysis and performance parameters evaluation of single-phase semi converter with and without freewheeling diode and full converter, with pure R, RL and highly inductive load. Analysis and performance parameters evaluation of three phase full converter with highly inductive load and RL load.	
Unit –III	**08 Hrs**
Choppers: Analysis and performance evaluation of step down and step-up chopper with R & RL load. Classification and analysis of choppers (single, two and four quadrant). Operation of Buck, Boost, Buck-Boost converters.	
Unit –IV	**10 Hrs**
Inverters and control: Voltage source and Current source inverter. Analysis and performance parameters evaluation of single phase VSI and three phase VSI with 180 degree and 120-degree conduction. PWM control of inverters single pulse width, multiple pules-width, sinusoidal pulse width modulation and space vector pulse width modulation.	
Unit –V	**09 Hrs**
AC Voltage Controller And Applications Of Power Electronics: **AC Voltage Controller:** Principle and analysis of on-off control and phase control of Single-phase semi and Bi-directional AC voltage controllers with R and RL load, **Applications Of Power Electronics:** Power Electronics application in Electric vehicle (operation of DC-DC Bi directional converter) and micro grid (Multilevel inverter). Principle of operation of UPS (online and offline) and Switch Mode power Supply system (Block diagram Approach).	

Course Outcomes: After completing the course, the students will be able to: -	
CO 1	Comprehend the construction and working of Power semiconductor devices
CO 2	Analyze the basic concepts of conversion of Electrical energy
CO 3	Evaluate the performance parameters of power electronic converters
CO 4	Design of Power Electronic Converters to UPS, SMPS

Reference Books	
1.	Power Electronics, M.D. singh and K.B. Khanchandani, 2nd Edition, 2017, TMH,, ISBN-13: 978-0-07-058389-4.
2.	Power Electronics, Circuit Devices and Applications M. H. Rashid, 4th Edition, 2013 Pearson Education India, ISBN-13: 978-0133125900.
3.	Power Electronics, P.S. Bimbhra, 2nd Edition.1998, Khanna Publishers, ISBN: 978-0-07-154353-8,
4.	Power Electronics Essentials & Applications, L Umanand, 1st Editon, 2013, Willey Publisher, ISBN-978-81-265-1945-3.

LABORATORY COMPONENT

1. Static characteristics of SCR, MOSFET and IGBT.
2. UJT and digital firing circuit for a single phase controlled rectifier.
3. Performance parameter Evaluation of Single phase semi and fully controlled converter with R and R-L loads (conventional & Simulation).
4. Performance parameter Evaluation Three phase fully controlled converter using R load (conventional & Simulation).
5. Performance parameter Evaluation of Single phase bridge voltage sources inverter connected to R and RL load.(conventional & Simulation).
6. Speed control of a separately excited DC motor using a MOSFET / IGBT chopper.
7. Speed control of single phase induction motor using single phase AC voltage controller.
8. V/f method speed control of induction motor.

PART B

Innovative Experiments (IE)

1. Modelling and simulation of power converter circuits using Matlab (Simulink)/PSIM Software.
2. Power electronics Simulation using Virtual labs.
3. Open ended experiments Based on Applications of power converters.
4. Microcontroller based firing for SCR/MOSFET using Embedded software.

RUBRICFOR 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. Each quiz is evaluated for 10 marks adding up to 20 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 **50Marks**, 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 (10) Designing & Modeling (10) **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 (THEORY + PRACTICE)	**150**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q.NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type of 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**

RUBRIC FOR SEMESTER END EXAMINATION (LAB)		
Q.NO.	**CONTENTS**	**MARKS**
1	Write Up	10
2	Conduction of the Experiments	30
3	Viva	10
	TOTAL	**50**

Semester: IV						
PRINCIPLES OF ELECTROMAGNETICS (Theory) (Common to EE/ET)						
Course Code	**:**	ET345AT		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	**100 Marks**
Total Hours	**:**	40L		**SEE Duration**	**:**	**3Hours**

Unit-I	**08 Hrs**
Electrostatics 1: Coulomb's law, illustrative examples, Electric Field Intensity, Applications (field due to Line charge distribution, Surface charge distribution- sheet, Circular ring, disk), Illustrative examples. Flux, flux density Gauss' Law, Divergence Theorem (qualitative treatment), Application of Gauss's Law (Field due to Continuous Volume Charge, Line Charge, Sheet Charge, Metal sphere, spherical shell) Illustrative examples.	
Unit – II	**08 Hrs**
Electrostatics 2: Work done to move a point charge, Electric potential, Relation between E and V, Applications (field and potential due to Line charge distribution, Surface charge distribution- sheet, Circular ring), Energy Density in an Electric Field, Illustrative examples. Boundary Conditions (dielectric-dielectric, dielectric-conductor), Poisson's and Laplace's Equations, Applications Laplace's and Poisson's Equations (different capacitors, Coaxial conductors), Illustrative examples.	
Unit –III	**08 Hrs**
Magnetostatic Fields 1: Biot -Savart Law, Ampere's Circuital Law, Applications of Ampere's Law, Maxwell's Equation, Magnetic Flux Density, Maxwell's Equations for Static EM Fields. **Magnetic Forces and Materials:** Forces due to Magnetic Fields, Magnetization in Materials, Classification of Magnetic Materials.	
Unit –IV	**08 Hrs**
Magnetostatic Fields 2: Magnetic Boundary Conditions, Inductors, and Inductances, Solanoid, Toroid Inductors **Maxwell's Equations:** Introduction, Faraday's Law, Transformer and Motional EMFs, Displacement Current, Maxwell's Equations in Final Forms, Time-Varying Potentials, Time- Harmonic Fields, Illustrative examples.	
Unit –V	**08 Hrs**
Electromagnetic Waves: Introduction, Waves in General ,Wave Propagation in Lossy Dielectrics, Plane Waves in Lossless Dielectrics, Plane Waves in Free Space, Plane Waves in Good Conductors, Power and the Poynting Vector. Reflection of plane waves, Normal Incidence, Application Note-Microwaves	

Course Outcomes: After completing the course, the students will be able to:-	
CO1	Understand the basic concepts of electric fields, magnetic fields and electromagnetic waves.
CO2	Apply the basic concepts to solve complex problems in electric fields, magnetic fields and electromagnetic waves
CO3	Analyze different charge and current configurations to derive the electromagnetic field equations
CO4	Design simple solutions for applications in electric and electronic circuits, electrical machines and communication systems.

Reference Books	
1.	Principles of Electromagnetics, Matthew N O Sadiku , 4th edition, 2007, Oxford University Press ,ISBN: 9780198062295, 019806229X
2.	Electromagnetic Field Theory, S Salivahanan 2nd Edition, 2018, Mc Graw Hill India, ISBN:978-9353162573
3.	Field and Wave Electromagnetics, David K. Cheng, 2nd Edition, 1989, Pearson Education Asia, Indian Reprint 2001, ISBN: 9789332535022/9788177585766, 8177585762
4.	Engineering Electromagnetics, William H. Hayt Jr. and John A. Buck , 6th Edition, 2001,Tata McGraw Hill, ISBN-13: 978-0071202299

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 **Professional Core Course** **(Practice)**						
Course Code	**:**	EE247DL		**CIE**	**:**	50 Marks
Credits: L:T:P	**:**	0:0:2		**SEE**	**:**	50 Marks
Total Hours	**:**	30 P		**SEE Duration**	**:**	2 Hours

Unit-I	**09 Hrs**

Guidelines for Design Thinking Lab:

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

The Design Thinking lab tasks would involve:

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

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

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

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (LAB)		
#	**COMPONENTS**	**MARKS**
1.	Conduction of laboratory exercises, lab report, observation, and analysis	20
2.	Innovative Experiment/ Concept Design and Implementation	20
3.	Lab test	10
	MAXIMUM MARKS FOR THE CIE THEORY	**50**

RUBRIC FOR SEMESTER END EXAMINATION (LAB)		
Q.NO.	**CONTENTS**	**MARKS**
1	Write Up	10
2	Conduction of the Experiments	30
3	Viva	10
	TOTAL	**50**

Semester: IV						
UNIVERSAL HUMAN VALUES (Theory) (Common to all Programs)						
Course Code	:	HS248XT		**CIE**	:	50 Marks
Credits: L:T:P	:	2:0:0		**SEE**	:	50 Marks
Total Hours	:	28 L		**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 fromone's own life.	
Unit – II	**10 Hrs**
Understanding Harmony in the Family and Society- Harmony in Human Relationship: Understanding valuesin human-human relationship; meaning of Justice and program for its fulfilment to ensure mutual happiness; Trustand 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: -	
CO 1	By the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions,
CO 2	While keeping human relationships and human nature in mind. They would have better critical ability.
CO 3	They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
CO 4	It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

Reference Books	
1.	Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2.	Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004
3.	The Story of Stuff (Book).
4.	The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5.	Small is Beautiful - E. F Schumacher.
6.	Slow is Beautiful - Cecile Andrews.

RUBRICFOR 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) (AS, BT, CH, CV, EC, EE, EI, ET, IM, ME)						
Course Code	**:**	MAT149DT		**CIE**	**:**	50 Marks
Credits: L: T: P	**:**	2:0:0		**SEE**	**:**	**NO SEE** (AUDIT COURSE)
Total Hours	**:**	30L				

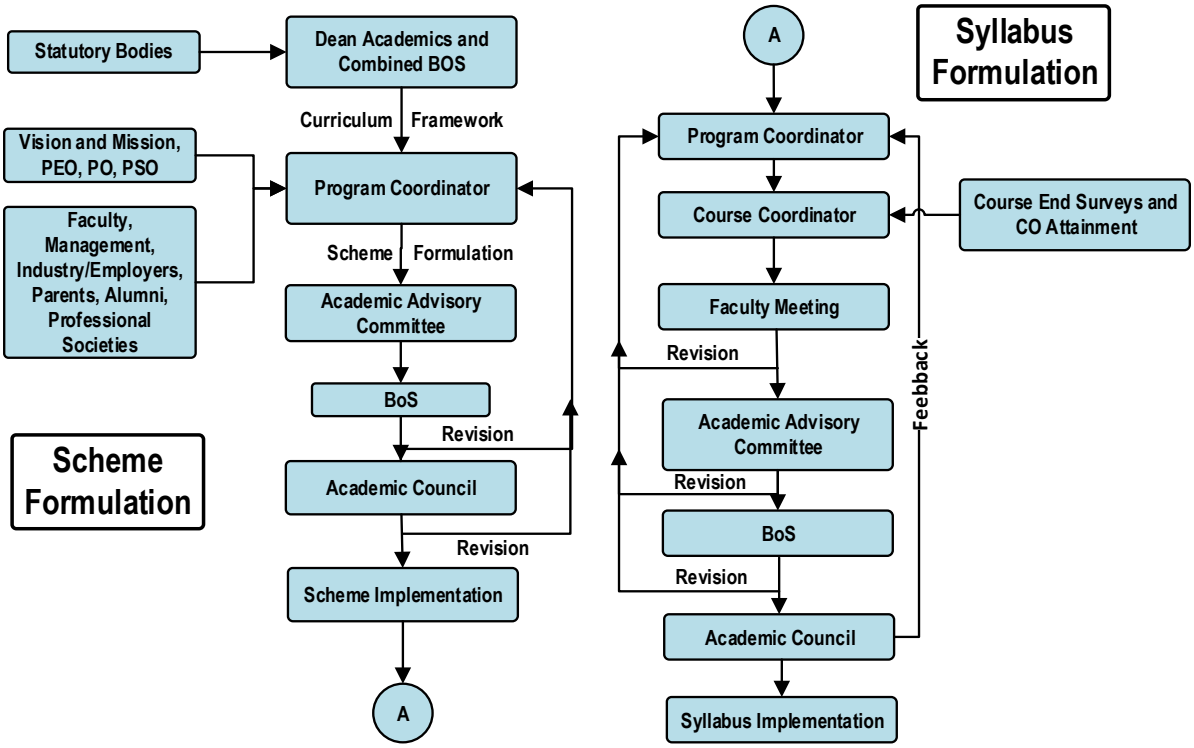
Unit-I	**10 Hrs**
Multivariable Calculus: **Partial Differentiation:** Introduction, simple problems. Total derivative, composite functions. Jacobians – simple problems. **Vector Differentiation:** Introduction, velocity and acceleration, gradient, divergence – solenoidal vector function, curl – irrotational 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, higher order linear differential equations and numerical methods.
CO2:	Derive the solution by applying the acquired knowledge of differential calculus, 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.
CO4:	Compile the overall knowledge of differential calculus, vector differentiation, differential equations and numerical methods gained to engage in life – long learning.

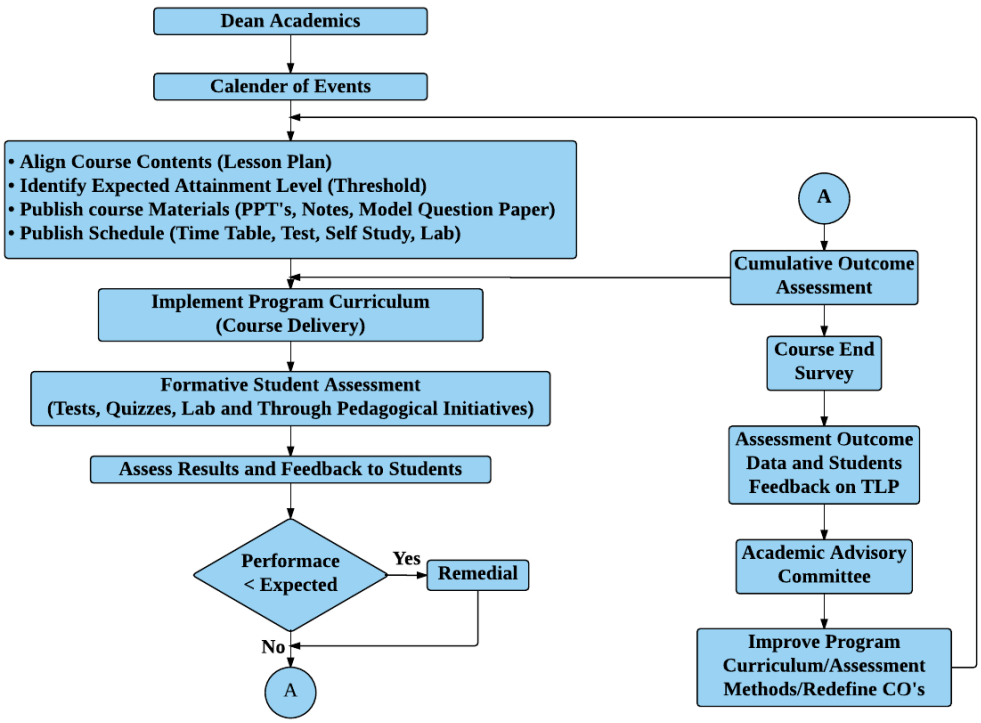
Reference Books	
1	Higher Engineering Mathematics, B.S. Grewal, 44^{th} Edition, 2015, Khanna Publishers, ISBN: 978-81-933284-9-1.
2	Higher Engineering Mathematics, B.V. Ramana, 11^{th} Edition, 2010, Tata McGraw-Hill, ISBN: 978-0-07-063419-0.
3	A Textbook of Engineering Mathematics, N.P. Bali & Manish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

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 30 Marks, adding upto 60 Marks. **FINAL TEST MARKS WILL BE AVERAGE OF TWO TESTS.**	**30**
	MAXIMUM MARKS FOR THE CIE THEORY	**50**

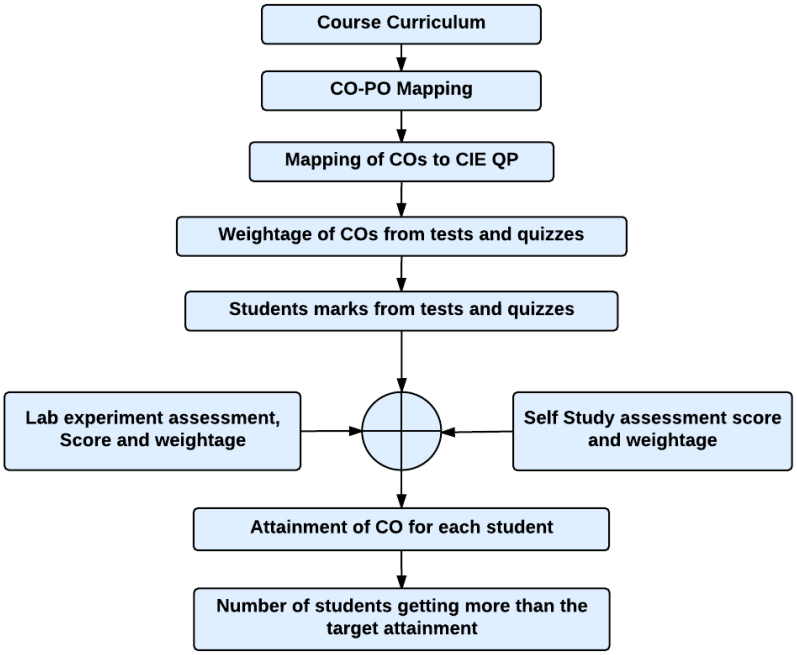
Curriculum Design Process



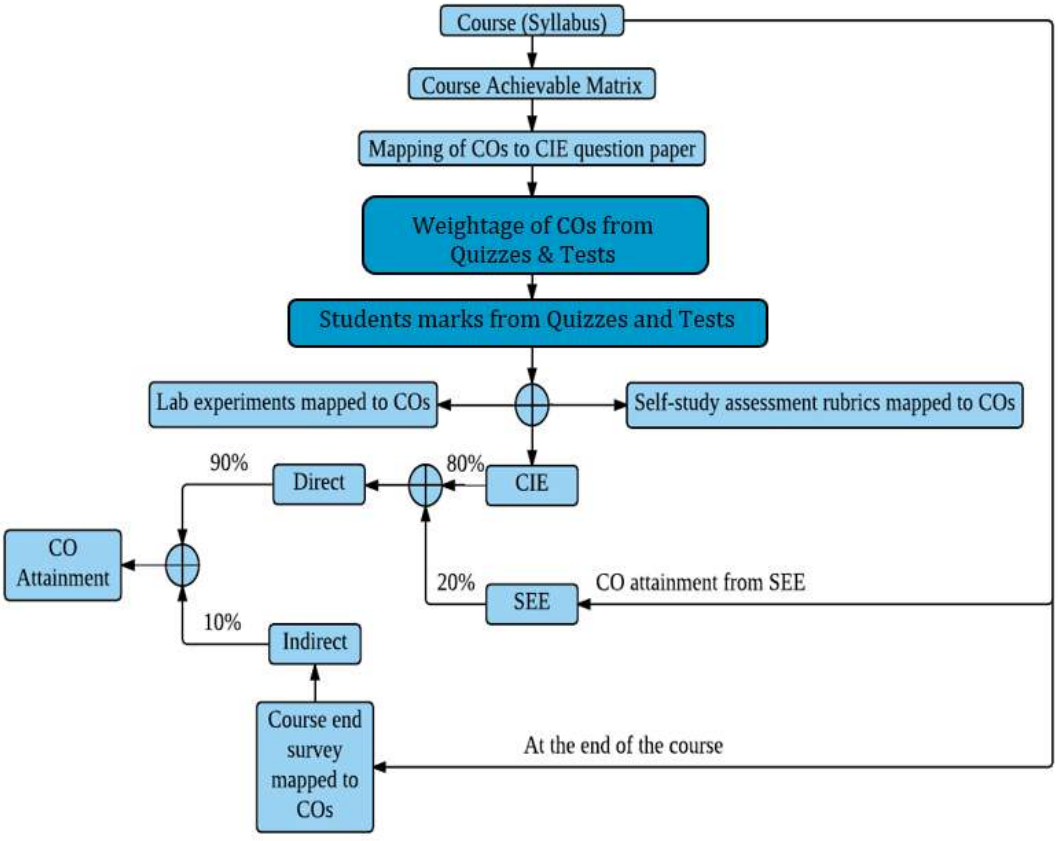
Academic Planning and Implementation



Process For Course Outcome Attainment



Final CO Attainment Process



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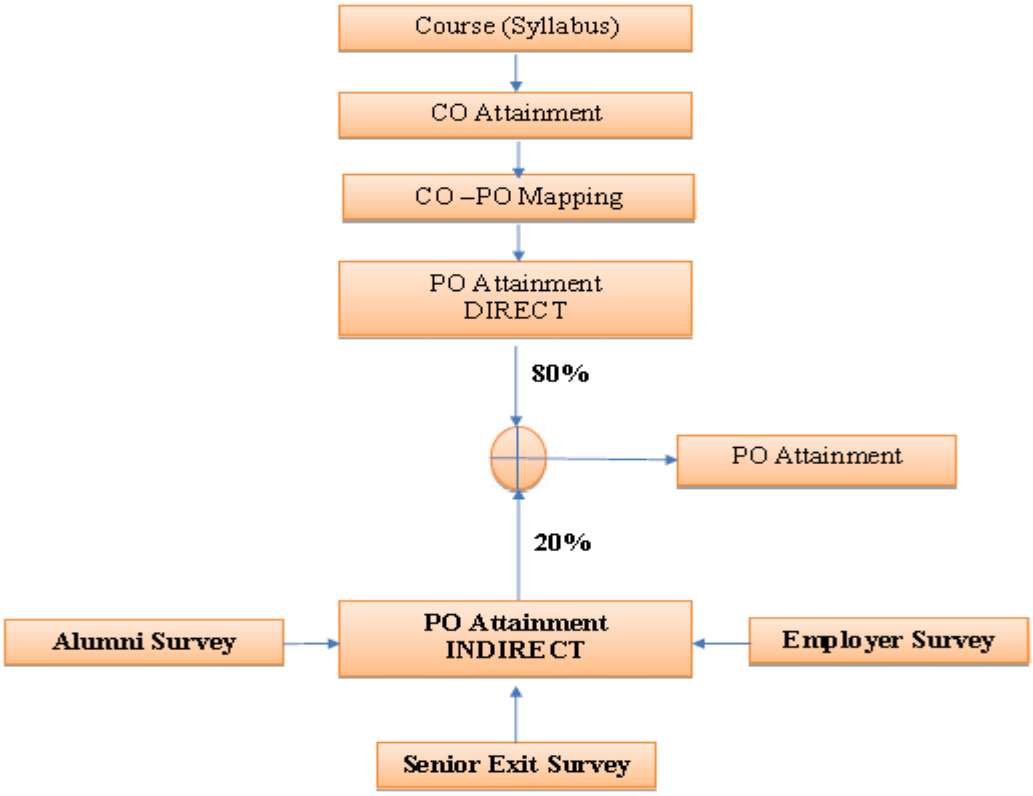
Program Outcomes Attainment Process



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PROGRAM OUTCOMES (POs)

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation for the solution of complex engineering problems.

2. **Problem analysis:** Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, and cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling to complex engineering activities, with an understanding of the limitations.

6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.