Go, change the world

RV Educational Institutions ®
RV College of Engineering ®

Autonomous Institution Affiliated to Visvesvaraya Technological University, Belagavi

Approved by AICTE, New Delhi

BACHELOR OF ENGINEERING (B.E.)
2021 SCHEME

SCHEME & SYLLABUS
SECOND YEAR B.E. PROGRAMS

ELECTRONICS & COMMUNICATION ENGINEERING

ACADEMIC YEAR 2022-23

VISION

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

MISSION

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

QUALITY POLICY

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

CORE VALUES

Professionalism, Commitment, Integrity, Team Work, Innovation

ELECTRONICS & COMMUNICATION ENGINEERING

DEPARTMENT VISION

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

DEPARTMENT MISSION

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

PROGRAM EDUCATIONAL OBJECTIVES

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

PEO2: To design and develop interdisciplinary and innovative systems.

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

PROGRAM SPECIFIC OUTCOMES

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

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

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

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

LEAD SOCIETY

Institute of Electrical and Electronics Engineers (IEEE)

Abbreviations

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

INDEX

Bachelor of Engineering in

Electronics & Communication Engineering

III SEMESTER												
Sl. No.	Course Code	Course Title	Credit Allocation				BoS	Category	Max Marks CIE		Max Marks SEE	
			L	T	P	Total			Theory	Lab	Theory	Lab
1	21MA31B	Linear algebra, Integral transforms, and Fourier series	3	1	0	4	MA	Theory	100	****	100	****
2	21BT32A	Environmental Technology (Common to AI, CS, CV EC, EE, EI, ET & IS)	2	0	0	2	BT	Theory	50	****	50	****
3	21EC33	Analog Microelectronic Circuits	3	0	1	4	EC	Theory +Lab	100	50	100	50
4	21EC34	Analysis and Design of Digital Circuits (Common to EC/EE/ EI/ET)	3	0	1	4	EC	Theory +Lab	100	50	100	50
5	21EC35	Network Analysis and Control Systems	3	0	0	3	EC	Theory	100	****	100	****
6	21EC36	Digital System Design Using Verilog HDL	3	0	0	3	EC	Theory	100	****	100	****
7	21DMA37	Bridge Course: Mathematics	2	0	0	**AUDIT**	MA	Theory	50	****	****	****
8	21HS38A / 21HS38V	Kannada Course: AADALITHA KANNADA / VYAVAHARIKA KANNADA	1	0	0	1	HSS	Theory	50	****	50	****
9	21HSAE39A/ B/C/D/E	Ability Enhancement Course	0	0	1	1	HSS	Lab	****	50	****	50
10	21ECI310	Summer Internship- I	0	0	1	1	EC	Internship	****	50	****	50
		Total				**23**						

Bachelor of Engineering in

Electronics & Communication Engineering

IV SEMESTER												
Sl. No.	Course Code	Course Title	Credit Allocation				BoS	Category	Max Marks CIE		Max Marks SEE	
			L	T	P	Total			Theory	Lab	Theory	Lab
1	21MA41*	Statistics and Probability for Data Science	2	1	0	3	MA	Theory	100	****	100	****
2	21EC42**	Materials for Electronics Engineering (Common to EC/EE/ EI/ET)	2	0	0	2	EC	Theory	50	****	50	****
3	21EI43	Microcontroller & Programming (Common to EC/EE/ EI/ET)	3	0	1	4	EI	Theory + Lab	100	50	100	50
4	21EC44	Signals and Systems (Common to EC/EI)	3	0	1	4	EC	Theory + Lab	100	50	100	50
5	21EC45	Electromagnetic Fields and Applications	3	0	0	3	EC	Theory	100	****	100	***
6	21EC46	Design Thinking Lab	0	0	2	2	EC	Lab	****	50	****	50
7	21DCS47	Bridge Course: C Programming	2	1	0	**AUDIT**	CS	Theory	50	****	****	****
8	21HSU48	Universal Human Values and Professional Ethics	2	0	0	2	HSS	Theory	50	****	50	****
9	21EC4AX	Professional Core Elective - Group A	2	0	0	2	EC	MOOC	50	****	50	****
		Total				**22**						

Ability Enhancement Courses		
Sl. No.	**Course code**	**Course Title**
1	21HSAE39A	National Service Scheme (NSS)
2	21HSAE39B	National Cadet Corps (NCC)
3	21HSAE39C	Physical Education
4	21HSAE39D	Music/Dance/Theatre
5	21HSAE39E	Art work & Painting/ Photography & Film making

ELECTIVE: GROUP A		
Professional Core Electives - NPTEL / SWAYAM		
Sl. No.	**Course code**	**Course Title**
1	21EC4A1	Design and Analysis of Algorithms
2	21EC4A2	Database Management System
3	21EC4A3	Object Oriented Analysis and Design
4	21EC4A4	Programming, Data Structure and Algorithms using Python

Semester: III

LINEAR ALGEBRA, INTEGRAL TRANSFORMS AND FOURIER SERIES

Category: PROFESSIONAL CORE COURSE

(Common to AS, EC, EE, EI, ET)

(Theory)

Course Code	:	21MA31B		**CIE**	:	100 Marks
Credits: L: T: P	:	03:01:00		**SEE**	:	100 Marks
Total Hours	:	45L+15T		**SEE Duration**	:	03 Hrs

Unit-I — **09 Hrs**

Linear Algebra I:

Vector spaces, subspaces, linear dependence and independence, basis and dimension, four fundamental subspaces. Rank and nullity theorem (without proof). Linear transformations - matrix representation, kernel and image of a linear transformation, dilation, reflection, projection and rotation matrices.

Unit – II — **09 Hrs**

Linear Algebra II:

Inner Products, orthogonal matrices, orthogonal and orthonormal bases, Gram-Schmidt process, QR-factorization. Eigen values and Eigen vectors, diagonalization of a matrix (symmetric matrices) and singular value decomposition.

Unit –III — **09 Hrs**

Laplace Transform:

Laplace Transform: Existence and uniqueness of Laplace transform (LT), transform of elementary functions, region of convergence. Properties - linearity, scaling, s - domain shift, differentiation in the s - domain, division by t, differentiation, and integration in the time domain. LT of special functions - Periodic functions (square wave, saw-tooth wave, triangular wave, full & half wave rectifier), Heaviside unit step function, unit impulse function.

Unit –IV — **09 Hrs**

Inverse Laplace Transform:

Definition, properties, evaluation using different methods. Convolution theorem (without proof) - problems. Application to solve ordinary linear differential equations.

Unit –V — **09 Hrs**

Fourier series and Fourier Transforms:

Periodic function, even and odd functions. Dirichlet's conditions, Euler's formulae for Fourier series, problems on time periodic signals (square wave, half wave rectifier, saw-tooth wave and triangular wave), Fourier sine series, Fourier cosine series. Fourier integral theorem, complex Fourier and inverse Fourier transform, Fourier sine transform, Fourier cosine transform, properties - linearity, scaling, time-shift and modulation - problems.

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

CO1	Illustrate the fundamental concepts of linear algebra, Laplace and inverse Laplace transforms, Fourier series and Fourier transforms.
CO2	Apply the acquired knowledge of linear algebra, Laplace and inverse Laplace transforms, Fourier series and Fourier transforms to
CO3	solve the problems of engineering applications.
CO4	Analyze the solution of the problems using appropriate techniques of linear algebra, integral transforms and Fourier series to the real

Reference Books

1.	Linear Algebra and its Applications, Gilbert Strang, 4th Edition, 2014, Cengage Learning India Edition, ISBN: 9788131501726, 8131501728.

2.	A Text Book of Engineering Mathematics, N.P. Bali & Manish Goyal, 7th Edition, 2010, Lakshmi Publications, ISBN: 978-81-7008-992-6.
3.	Higher Engineering Mathematics, B.S. Grewal, 44th Edition, 2015, Khanna Publishers, ISBN: 978- 81-933284-9-1.
4.	Linear Algebra and its Applications, David C. Lay, 4th Edition, 2012, Pearson Education India, ISBN-13: 970321385178, ISBN-10: 0321385171.

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

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

Semester: III						
ENVIRONMENTAL TECHNOLOGY **Category: PROFESSIONAL CORE COURSE** **(Common to AI, CS, CV EC, EE, EI, ET & IS)** **(Theory)**						
Course Code	:	21BT32A		**CIE**	:	50 Marks
Credits: L: T: P	:	02:00:00		**SEE**	:	50 Marks
Total Hours	:	26 L		**SEE Duration**	:	02 Hrs

Unit-I	**09 Hrs**
Introduction: Climate action – Paris convention, Sustainable Developmental Goals in relation to environment, Components of environment, Ecosystem. Environmental education, Environmental acts & regulations, role of non-governmental organizations (NGOs), EMS: ISO 14000, Environmental Impact Assessment. Environmental auditing.	
Unit – II	**09 Hrs**
Pollution and its remedies: Air pollution – point and non-point sources of air pollution and their controlling measures (particulate and gaseous contaminants). Noise pollution, Land pollution (sources, impacts and remedial measures), Water management: Advanced water treatment techniques, water conservation methods. Waste management: Solid waste, e-waste & biomedical waste – sources, characteristics & disposal methods. Concepts ofReduce, Reuse and Recycling of the wastes. Waste to Energy: Different types of Energy, Conventional sources & Non-conventional sources of energy: Solar, Hydro Electric, Wind, Nuclear, Biomass & Biogas Fossil Fuels and Hydrogen.	
Unit – III	**08 Hrs**
Environmental design: Green buildings, green materials, Leadership in Energy and Environmental Design (LEED), Hydroponics, Organic Farming, Biofuels, IC engine to E mobility transition and its impacts, Carbon Credits, Carbon Foot Prints, Opportunities for Green Technology Markets, Carbon Sequestration. Resource recovery system: Processing techniques, Materials recovery systems, Biological conversion (composting and anaerobic digestion). Thermal conversion products (Combustion, Incineration, Gasification, Pyrolysis, use of Refuse Derived Fuels). Case studies.	

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

Reference Books	
1.	Shashi Chawla, A Textbook of Environmental Studies, McGraw Hill Education, 2017, ISBN: 1259006387.
2.	Richard A Schneider and Jerry A Nathanson, Basic Environmental Technology, Pearson, 6th Edition, 2022. ISBN: 9789332575134.
3.	G. Tyler Miller (Author), Scott Spoolman (Author), (2020) Environmental Science – 15th edition,

	Publisher: Brooks Cole, ISBN-13: 978-1305090446, ISBN-10: 130509044.
4.	Howard S. Peavy, Donald R. Rowe and George Tchobanoglous. 2000. Environmental Engineering, McGraw Hill Education, 1st edition (1 July 2017). ISBN-10: 9351340260, ISBN-13: 978-9351340263
5.	A Textbook of Environmental Studies, Shashi Chawla, McGraw Hill Education, 2017, ISBN: 1259006387.

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

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

Semester: III						
ANALOG MICROELECTRONIC CIRCUITS **Category: PROFESSIONAL CORE COURSE** **(Theory & Practice)**						
Course Code	:	21EC33		**CIE**	:	100+50 Marks
Credits: L: T: P	:	03:00:01		**SEE**	:	100+50 Marks
Total Hours	:	42L+30P		**SEE Duration**	:	03 Hrs+03 Hrs

Unit-I	**09 Hrs**
Bipolar Junction Transistors (BJTs): BJT circuits at dc, Biasing in discrete BJT amplifier circuits, small signal operation and models, early effect, BJT as an amplifier – CE stage, CE stage with degeneration, CC stage, discrete amplifier design problems, Darlington pair.	
Unit – II	**09 Hrs**
MOS Field Effect Transistors (MOSFETS): Device structure and physical operation, current voltage characteristics, MOSFET circuits at dc, Biasing in discrete MOS amplifier circuits, small signal operation and models, channel length modulation, transconductance, Body effect.	
Unit –III	**09 Hrs**
MOSFET as an Amplifier: Small signal analysis (including CLM) of CS stage with resistive load, diode connected load, current source load. CS stage with degeneration, CG and CD stages. MOSFET internal capacitors and high frequency model, frequency response of CS amplifier.	
Unit –IV	**08 Hrs**
Operational Amplifiers: Introduction, Effect of finite open loop gain. Linear Opamp Circuits – Analysis of Inverting, Noninverting configurations, Difference Amplifier, Instrumentation Amplifier. Nonlinear Opamp circuits - Analysis of Schmitt trigger, Working and applications of IC555 Timer	
Unit –V	**07 Hrs**
Feedback Amplifiers and Large Signal Amplifiers: Properties of negative feedback, the four basic feedback topologies, practical circuits of the two types of feedback with op-amps (Voltage series feedback), classification of output stages, class A, class B circuits, thermal resistance and heat sinking of power transistors.	

Course Outcomes: After completing the course, the students will be able to: -	
CO1	Analyze the working of opamp, BJTs and FETs under various biasing conditions.
CO2	Investigate the characteristics of circuits employing BJT, FET and opamp.
CO3	Apply the concepts of basic electronic devices to design various analog circuits
CO4	Evaluate the performance parameters of various analog subsystems.

Reference Books	
1.	Microelectronic Circuits Theory and Applications, Adel S Sedra, & Kenneth C Smith, adapted by A Chandorkar, International version, 7th Edition, 2017, Oxford University Press, ISBN-13: 978-0199476299.
2.	Fundamentals of Microelectronics, Behzad Razavi, 3rd Edition, 2021, Wiley, ISBN:97811119695141
3.	Electronic Devices and Circuits, Jacob Millman, Christos C Halkias, Chetan D Parikh, 2nd Edition, 2016, Tata McGraw Hill publication, ISBN:0070151423.
4.	Electronic Devices and Circuit Theory, Robert L Boylestad & Louis Nashelsky, 11th Edition, 2017, PHI publication, ISBN: 9788131725290.

Practical's: Hardware Experiments

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

Innovative Experiments

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

RUBRICS FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY & LAB)

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

RUBRICS FOR SEMESTER END EXAMINATION (THEORY)

Q.NO.	CONTENTS	MARKS
	PART A	
1	Objective type questions covering entire syllabus	**20**
	PART B (Maximum of 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**

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

Semester: III						
ANALYSIS AND DESIGN OF DIGITAL CIRCUITS **Category: PROFESSIONAL CORE COURSE** **(Common to EC, EE, EI & ET)** **(Theory & Practice)**						
Course Code	:	21EC34		**CIE**	:	100+50 Marks
Credits: L: T: P	:	03:00:01		**SEE**	:	100+50 Marks
Total Hours	:	42L+30P		**SEE Duration**	:	03 Hrs+03 Hrs

Unit-I	**08 Hrs**
Number System: Decimal, Binary, Octal, Hexadecimal, 1‘s and 2‘s complements, Codes-Binary, BCD, Excess 3, Gray Codes and Conversion. Sum of products and Product of sums, Minterm and Maxterm, Karnaugh map Minimization. (Up to 4 Variables). Quine-McCluskey method of minimization. Digital Integrated Circuits: Digital IC Logic Families: TTL family, Performance parameters.	
Unit – II	**10 Hrs**
Combinational Logic Design: Design of Half and Full Adders, Half and Full Subtractors using Universal gates., Binary Parallel Adder /Subtractor– Carry look ahead Adder, BCD Adder, Multiplier, Magnitude Comparator, Multiplexer, Demultiplexer, Decoder, Encoder, Priority Encoder, Parity Bit Generator/Checker.	
Unit –III	**09 Hrs**
Latches and Flipflop: 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 (mod-n counter), Integrated Circuit Synchronous Counter.	
Unit –IV	**10 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, Design of Sequence Detector and Sequence Generators (PRBS), Serial Adder/Subtractor Design.	
Unit –V	**08 Hrs**
Arithmetic Logic Unit (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	Comprehend 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 circuits to apply in real world applications.

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

Practical's:

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

Innovative Experiments:

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

RUBRICS FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY & LAB)

#	COMPONENTS	MARKS
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**20**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). **TWO TESTS** will be conducted. Each test will be evaluated for 50 Marks, adding up to 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. **Phase I (20) & Phase II (20) ADDING UPTO 40 MARKS**.	**40**
4.	**LAB:** Conduction of laboratory exercises, lab report, observation, and analysis (30 Marks), lab test (10 Marks) and Innovative Experiment/ Concept Design and Implementation (10 Marks) adding up to 50 Marks**. THE FINAL MARKS WILL BE 50 MARKS**	**50**
	MAXIMUM MARKS FOR THE CIE	**150**

RUBRICS FOR SEMESTER END EXAMINATION (THEORY)		
Q.NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	**20**
	PART B **(Maximum of 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**

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

Semester: III						
NETWORK ANALYSIS AND CONTROL SYSTEMS **Category: PROFESSIONAL CORE COURSE** **(Theory)**						
Course Code	:	21EC35		**CIE**	:	100 Marks
Credits: L: T: P	:	03:00:00		**SEE**	:	100 Marks
Total Hours	:	42L		**SEE Duration**	:	03 Hrs

Unit-I	**09 Hrs**
Fundamentals: Mesh Loop and Node analysis with linear dependent and independent sources for DC and AC networks. Network Theorems: Superposition, Reciprocity, Thevenin's, Norton's, Maximum Power transfer and Millman's theorems.	
Unit – II	**09 Hrs**
Transient Behaviour & Initial Conditions: Evaluation of initial and final conditions in R-L, R-C and R-L-C Circuits for DC networks. Laplace transformation and applications. Two port Networks: Z, Y, ABCD and Hybrid parameters, their inter-relationships	
Unit –III	**08 Hrs**
Basic Ideas of Control Systems, Mathematical Models of Physical Systems: Classification of Control Systems, Open Loop and Closed Loop (in detail), Differential equations of Physical Systems and Transfer Function (and electrical systems) Block Diagram Reduction, Signal Flow Graphs(simple examples).	
Unit –IV	**08 Hrs**
Time Response of Feedback Control Systems: Standard Test Signals, Step Response for First and Second Order, Impulse Response for First and Second Order, Distinction between Type and Order of the System. Time Domain Specifications for Second Order System. t_r, t_d, t_p, M_p (No derivation), Steady State Error Analysis, Error Constants, K_p, K_v, K_a.	
Unit –V	**08 Hrs**
Stability Analysis: Concepts of Stability, Types of Stability, Asymptotic Stability, Root Locus Technique and Bode Plots, Introduction to Root Locus, Stability Analysis using Root Locus Diagram, Bode Plots.	

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

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

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

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

Semester: III						
DIGITAL SYSTEM DESIGN USING VERILOG HDL **Category: PROFESSIONAL CORE COURSE** **(Theory)**						
Course Code	:	21EC36		**CIE**	:	100 Marks
Credits: L: T: P	:	03:00:00		**SEE**	:	100 Marks
Total Hours	:	42L		**SEE Duration**	:	03 Hrs

Unit-I	**09 Hrs**

Design Flow Introduction-FPGA Introduction to Verilog:

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. Modeling Styles: Dataflow Modeling: Boolean Equation-Based Models of Combinational Logic, Propagation Delay and Continuous Assignments. Structural Modeling: Design of Combinational Logic, Verilog Structural Models, Module Ports, Top-Down Design and Nested Modules. Gate level modelling

Unit – II	**09 Hrs**

Structural Modeling:

Design of Combinational Logic, Verilog Structural Models, Module Ports, Top-Down Design and Nested Modules. Gate level modeling Behavioral Modeling: Latches and Level-Sensitive Circuits in Verilog, Cyclic Behavioral Models of Flip-Flops and Latches, Cyclic Behavior and Edge Detection. A Comparison of Styles for Behavioral modeling, Behavioral Models of Multiplexers, Encoders, and Decoders. Dataflow Models of a Linear-Feedback Shift Register.

Unit –III	**08 Hrs**

Algorithmic State Machine Charts for Behavioral Modeling:

Behavioral Models of Counters, Shift Registers, and Register Files and Arrays of Registers (Memories). Tasks & Functions Algorithmic State Machine Charts for Behavioral Modelling, ASMD charts, Design of FSM(Mealy-Moore) using Verilog, Design Example: Sequence detector/Generator Keypad Scanner and Encoder.

Unit –IV	**08 Hrs**

Architectures for Arithmetic Processors:

(Functional Units for Multiplication) - Sequential Binary Multiplier, Sequential Multiplier Design: Hierarchical Decomposition STG-Based Controller Design, Efficient STG-Based Sequential Binary Multiplier, Reduced-Register sequential multiplier, Multiplication of signed binary number.

Unit –V	**08 Hrs**

Architectures for Arithmetic Processors (Functional Unit for Division):

Division of Unsigned Binary Number, Efficient Division of Unsigned Binary Numbers, Reduced Register Sequential Divider.

Course Outcomes: After completing the course, the students will be able to: -	
CO1	Analyze digital circuits and systems to model using Verilog HDL.
CO2	Apply design knowledge to FSM based digital modules using high-level HDL description.
CO3	Develop synthesizable code for digital system and verify the functionality for the same.
CO4	Design and evaluate the performance of efficient digital systems realized using various blocks.
Reference Books	
1.	Advanced Digital Design with the Verilog HDL, M.D. Ciletti, Prentice Hall, 2nd Edition, ISBN: 0136019285.
2.	Verilog HDL: A Guide to Digital Design & Synthesis, Samir Palnitkar, SunSoft Press, 1st Edition, 1996, ISBN: 978-81-775-8918-4.
3.	Digital Design: An Embedded Systems Approach using VERILOG, Peter J. Ashenden, Elsevier,2010,

	ISBN: 9788190935630.
4.	Digital Systems Design using Verilog, Roth, Charles, John, Lizy K, Kil Lee, Byeong, ISBN-10: 1285051076, ISBN-13: 9781285051079.

RUBRICS FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)

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

RUBRICS FOR SEMESTER END EXAMINATION (THEORY)

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

Semester: III						
Bridge Course: MATHEMATICS (Mandatory Audit Course) (Common to all programs)						
Course Code	:	21DMA37		**CIE**	:	50 Marks
Credits: L: T: P	:	02:00:00				

Unit-I	**10 Hrs**

Multivariable Calculus:

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

Vector Differentiation: Introduction, simple problems in terms of 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 4th order Runge-Kutta methods. Numerical integration – Simpson's 1/3rd, 3/8th and Weddle's rules. (All methods without proof)**.**

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

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

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

Semester: III						
ADALITHA KANNADA **Category: HUMANITIES & SOCIAL SCIENCES** **(Common to all Programs)** **(Theory)**						
Course Code	**:**	**21HS38A / 21HS46A**		**CIE**	**:**	50 Marks
Credits: L:T:P	**:**	1:0:0		**SEE**	**:**	50 Marks
Total Hours	**:**	15		**SEE Duration**	**:**	1 Hrs

Unit-I – ಲೇಖನಗಳು & ಆಧುನಿಕ ಪೂರ್ವದ ಕಾವ್ಯ ಭಾಗ	**06 Hrs**
1. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ - ಹಂಪ ನಾಗರಾಜಯ್ಯ 2. ಕರ್ನಾಟಕದ ಏಕೀಕರಣ: ಒಂದು ಅಪೂರ್ವ ಚರಿತ್ರೆ - ಜಿ. ವೆಂಕಟಸುಬ್ಬಯ್ಯ 3. ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ - ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ ಮತ್ತು ಪ್ರೋ.ವಿ. ಕೇಶವಮೂರ್ತಿ	
1. ವಚನಗಳು: ಬಸವಣ್ಣ, ಅಕ್ಕಮಹಾದೇವಿ, ಅಲ್ಲಮ ಪ್ರಭು, ಜೇಡರ ದಾಸಿಮಯ್ಯ, ಆಯ್ದಕ್ಕಿ ಲಕ್ಕಮ್ಮ 2. ಕೀರ್ತನೆಗಳು: ಅದರಿಂದೇನು ಫಲ ಇದರಿಂದೇನು ಫಲ- ಪುರಂದರದಾಸರು ತಲ್ಲಣಿಸದಿರು ಕಂಡ್ಯ ತಾಳು ಮನವೇ - ಕನಕದಾಸರು 3. ತತ್ವಪದಗಳು: ಸಾವಿರ ಕೊಡಗಳ ಸಿಟ್ಟು - ಶಿಶುನಾಳ ಶರೀಫ	
Unit –III ಆಧುನಿಕ ಕಾವ್ಯ ಭಾಗ & ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯ	**06 Hrs**
1. ಡಿವಿಜಿರವರ ಮಂಕುತಿಮ್ಮನ ಕಗ್ಗದಿಂದ ಆಯ್ದ ಕೆಲವು ಭಾಗಗಳು 2. ಕುರುಡು ಕಾಂಚಾಣ: ದಾ.ರಾ. ಬೇಂದ್ರೆ 3. ಹೊಸಬಾಳಿನ ಗೀತೆ: ಕುವೆಂಪು	
1. ಡಾ. ಸರ್. ಎಂ. ವಿಶ್ವೇಶ್ವರಯ್ಯ: ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ- ಎ.ಎನ್. ಮೂರ್ತಿರಾವ್ 2. ಕರಕುಶಲ ಕಲೆಗಳು ಮತ್ತು ಪರಂಪರೆಯ ವಿಜ್ಞಾನ: ಕರೀಗೌಡ ಬೀಚನಹಳ್ಳಿ	
Unit –V ಕಥೆ ಮತ್ತು ಪ್ರವಾಸ ಕಥನ	**03 Hrs**
1. ಯುಗಾದಿ: ವಸುಧೇಂದ್ರ 2. ಮೆಗಾನೆ ಎಂಬ ಗಿರಿಜನ ಪರ್ವತ: ಹಿ.ಚಿ.ಬೋರಲಿಂಗಯ್ಯ	

Course Outcomes: After completing the course, the students will be able to:-	
CO1	ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಕನ್ನಡದ ಸಂಸ್ಕೃತಿಯ ಪರಿಚಯವಾಗುತ್ತದೆ.
CO2	ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಆಸಕ್ತಿಯು ಮೂಡುತ್ತದೆ.
CO3	ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಆಧುನಿಕ ಕಾವ್ಯಗಳ ಬಗ್ಗೆ ಆಸಕ್ತಿಯು ಮೂಡುತ್ತದೆ.
CO4	ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯವಾಗುತ್ತದೆ. ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ, ಸಾಮಾನ್ಯ ಕನ್ನಡ ಹಾಗೂ ಆಡಳಿತ ಕನ್ನಡದ ಪದಗಳ ಪರಿಚಯವಾಗುತ್ತದೆ.

Reference Books (ಪರಾಮರ್ಶನ ಪುಸ್ತಕ)	
1	ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.

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 will be evaluated for **5 Marks** adding up to 10 Marks. **THE SUM OF TWO QUIZZES WILL BE CONSIDERED AS THE FINAL QUIZ MARKS.**	**10**
2.	**TESTS:** Students will be evaluated in test consisting of 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**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q.NO.	**CONTENTS**	**MARKS**
	PART A	
1	Question 1: Objective type questions covering entire syllabus	**10**
	PART B **(Maximum of TWO Sub-divisions only)**	
2	Unit 1: (Compulsory)	**12**
3 & 4	Unit 2: Question 3 or 4	**14**
5 & 6	Unit 3: Question 5 or 6	**14**
	TOTAL	**50**

Semester: III

VYAVAHARIKA KANNADA

Category: HUMANITIES & SOCIAL SCIENCES

(Common to all programs)

(Theory)

Course Code	:	21HS38V/21HS46V		**CIE**	:	50 Marks
Credits: L:T:P	:	1:0:0		**SEE**	:	50 Marks
Total Hours	:	15		**SEE Duration**	:	1 Hrs

Unit-I — **06 Hrs**

1. Introduction, Necessity of learning a local language. Methods to learn the Kannada language.
2. Easy learning of a Kannada Language: A few tips. Hints for correct and polite conversation, Listening and Speaking Activities, Key to Transcription.
3. ವೈಯಕ್ತಿಕ ಸ್ವಾಮ್ಯಸೂಚಕ/ಸಂಬಂಧಿತ ಸರ್ವನಾಮಗಳು ಮತ್ತು ಪ್ರಶ್ನಾರ್ಥಕ ಪದಗಳು- Personal Pronoun, Possessive Forms, Interrogative words. .

1. ನಾಮಪದಗಳ ಸಂಬಂಧಾರ್ಥಕ ರೂಪಗಳು, ಸಂದೇಹಾಸ್ಪದ ಪ್ರಶ್ನೆಗಳು ಮತ್ತು ಸಂಬಂಧವಾಚಕ ನಾಮಪದಗಳು.- Possessive forms of nouns, dubitive question and Relative nouns.
2. ಗುಣ, ಪರಿಮಾಣ ಮತ್ತು ವರ್ಣ/ ಬಣ್ಣ ವಿಶೇಷಣಗಳು, ಸಂಖ್ಯಾವಾಚಕಗಳು - Qualitative, Quantitative and Colour Adjectives, Numerals.
3. ಕಾರಕ ರೂಪಗಳು ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು - ಸಪ್ತಮಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯ -(ಅ, ಅದು, ಅವು, ಅಲ್ಲಿ) - Predictive Forms, Locative Case.

Unit –II — **06 Hrs**

1. ಚತುರ್ಥಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯದ ಬಳಕೆ ಮತ್ತು ಸಂಖ್ಯಾವಾಚಕಗಳು - Dative Cases, and Numerals.
2. ಸಂಖ್ಯಾಗುಣವಾಚಕಗಳು ಮತ್ತು ಬಹುವಚನ ನಾಮರೂಪಗಳು. -Ordinal numerals and Plural markers.
3. ನ್ಯೂನ/ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾಪದಗಳು ಮತ್ತು ವರ್ಣ ಗುಣವಾಚಕಗಳು -Defective/Negative Verbs & Colour Adjectives.

1. ಅಪ್ಪಣೆ/ಒಪ್ಪಿಗೆ, ನಿರ್ದೇಶನ, ಪ್ರೋತ್ಸಾಹ ಮತ್ತು ಒತ್ತಾಯಾರ್ಥಕ ರೂಪ ಪದಗಳು ಮತ್ತು ವಾಕ್ಯಗಳು
   Permission, Commands, encouraging and Urging words (Imperative words and sentences)
2. ಸಾಮಾನ್ಯ ಸಂಭಾಷಣೆಗಳಲ್ಲಿ ದ್ವಿತೀಯ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು ಸಂಭವನೀಯ ಪ್ರಕಾರಗಳು
   Accusative Cases and Potential Forms used in General Communication
3. "ಇರು" ಮತ್ತು "ಇರಲ್ಲ" - ಸಹಾಯಕ ಕ್ರಿಯಾ ಪದಗಳು, ಸಂಭಾವ್ಯ ಸೂಚಕ ಮತ್ತು ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾಪದಗಳು- Helping Verbs “iru and iralla”, Corresponding Future and Negation Verbs
4. ಹೋಲಿಕೆ, ಸಂಬಂಧ ಸೂಚಕ ಪದಗಳು, ವಸ್ತುಸೂಚಕ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾ ಪದಗಳು- Comparitive, Relationship, Identification and Negation Words

Unit –III — **03 Hrs**

1. ಕಾಲ ಮತ್ತು ಸಮಯದ ಹಾಗೂ ಕ್ರಿಯಾಪದಗಳ ವಿವಿಧ ಪ್ರಕಾರಗಳು- Different types of Tense, Time and Verbs
2. ದ್, ತ್, - ತು- ಇತು, ಆಗಿ -ಅಲ್ಲ, ಗ್, ಕ್ -ಇದೆ. ಕ್ರಿಯಾ ಪ್ರತ್ಯಯಗಳೊಂದಿಗೆ ಭೂತ, ಭವಿಷ್ಯ ಮತ್ತು ವರ್ತಮಾನ ಕಾಲ ವಾಕ್ಯ ರಚನೆ - Formation of Past, Future and Present Tense Sentences with Verb Forms
3. ಸಂಭಾಷಣೆಯಲ್ಲಿ ದಿನೋಪಯೋಗಿ ಕನ್ನಡ ಪದಗಳು -Daily usage Kannada Words in conversation.

Course Outcomes: After completing the course, the students will be able to:-	
CO1	To understand the necessity of learning of local language for leading life.
CO2	To speak, read and write Kannada language as per the requirement.
CO3	To communicate (converse) in Kannada language in their daily life.
CO4	To Listen and understand the Kannada language properly.

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

RUBRIC FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES**: Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted and each will be evaluated for 5 Marks adding up to 10 Marks. **THE SUM OF TWO QUIZZES WILL BE CONSIDERED AS THE FINAL QUIZ MARKS.**	**10**
2.	**TESTS**: Students will be evaluated in test consisting of descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analysing, 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**

RUBRIC FOR SEMESTER END EXAMINATION (THEORY)		
Q.NO.	**CONTENTS**	**MARKS**
	PART A	
1	Question 1: Objective type questions covering entire syllabus	**10**
	PART B **(Maximum of TWO Sub-divisions only)**	
2	Unit 1: (Compulsory)	**12**
3 & 4	Unit 2: Question 3 or 4	**14**
5 & 6	Unit 3: Question 5 or 6	**14**
	TOTAL	**50**

Semester: III						
NATIONAL SERVICE SCHEME(NSS) (Practical)						
Course Code	:	21HSAE39A		**CIE**	:	50 Marks
Credits: L: T: P	:	0:00:01		**SEE**	:	50 Marks
Total Hours	:	13P		**SEE Duration**	:	02 Hrs

Prerequisites:

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

Content	**13 Hrs**

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

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

1. Helping local schools to achieve good result and enhance their enrolment in Higher/technical/ vocational education.
2. Preparing an actionable business proposal for enhancing the village/ farmer income and approach for implementation.
3. Developing Sustainable Water management system for rural/ urban areas and implementation approaches.
4. Setting of the information imparting club for women leading to contribution in social and economic issues.
5. Spreading public awareness/ government schemes under rural outreach program. (Minimum 5 programs)
6. Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, 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 the same.
CO3	Evaluate the existing system and to propose practical solutions for the same for sustainable development.

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

Semester: III						
NATIONAL CADET CORPS(NCC) (Practical)						
Course Code	:	21HSAE39B		**CIE**	:	50 Marks
Credits: L:T:P	:	00:00:01		**SEE**	:	50 Marks
Total Hours	:	15P		**SEE Duration**	:	02 Hrs

Unit-I	**07 Hrs**
Drill: Foot Drill- Drill ki Aam Hidayaten, Word ki Command, Savdhan, Vishram, Aram Se, Murdna, Kadvar Sizing, Teen Line Banana, Khuli Line, Nikat Line, Khade Khade Salute Karna	
Unit – II	**03 Hrs**
Weapon Training (WT): Introduction & Characteristics of 7.62 Self Loading rifle, Identification of rifle parts	
Unit –III	**03 Hrs**
Adventure activities: Trekking and obstacle course	
Unit –IV	**02 Hrs**
Social Service and Community Development (SSCD): Students will participate in various activities throughout the 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	**:**	21HSAE39C		**CIE**	**:**	50 Marks
Credits: L:T:P	**:**	00:00:01		**SEE**	**:**	50 Marks
Total Hours	**:**	30P		**SEE Duration**	**:**	2.5 Hrs
Content						**30 Hrs**

Topics for Viva:

1. On rules and regulations pertaining to the games / sports
2. On dimensions of the court, size / weight of the ball and standards pertaining to that sports / game
3. Popular players and legends at state level / National level/ International level
4. Recent events happened and winner / runners in that sport / game
5. 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 and Sports 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	:	21HSAE39D1		**CIE**	:	50 Marks
Credits: L: T: P	:	00:00:01		**SEE**	:	50 Marks
Total Hours	:	13P		**SEE Duration**	:	02 Hrs

Content **13 Hrs**

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

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

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

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

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

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

Semester: III						
DANCE (Practical)						
Course Code	:	21HSAE39D2		**CIE**	:	50 Marks
Credits: L: T: P	:	0:00:01		**SEE**	:	50 Marks
Total Hours	:	13P		**SEE Duration**	:	02 Hrs

Contents **13 Hrs**

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

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

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

ASSESSMENT AND EVALUATION PATTERN		
WEIGHTAGE	**50%**	**50%**
	CIE	**SEE**
Presentation 1- Selection of topic- (phase 1) Justification for Importance, need of the hour with surveyed data.	**10**	*****
EXPERIENTIAL LEARNING Presentation 2 (phase 2) Content development, strategies for implementation methodologies.	**10**	*****
Case Study-based Teaching-Learning	**10**	Implementation strategies of the 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						
THEATRE (Practical)						
Course Code	:	21HSAE39D3		**CIE**	:	50 Marks
Credits: L:T:P	:	0:00:01		**SEE**	:	50 Marks
Total Hours	:	0:00:01		**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	:	21HSAE39E1		**CIE**	:	50 Marks
Credits: L: T: P	:	0:00:01		**SEE**	:	50 Marks
Total Hours	:	13P		**SEE Duration**	:	02 Hrs

Contents **13 Hrs**

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

AND

ONE EDUCATIONAL VISIT TO AN ART MUSEUM / INSTITUTE / GALLERY

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

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

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

ASSESSMENT AND EVALUATION PATTERN		
WEIGHTAGE	**50%**	**50%**
	CIE	**SEE**
Presentation 1- Selection of topic- (phase 1) Justification for Importance, need of the hour with surveyed data.	**10**	*****
EXPERIENTIAL LEARNING Presentation 2 (phase 2) Content development, strategies for implementation methodologies.	**10**	*****
Case Study-based Teaching-Learning	**10**	Implementation strategies of the 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						
PHOTOGRAPHY & FILM MAKING (Practical)						
Course Code	:	21HSAE39E2		**CIE**	:	50 Marks
Credits: L: T: P	:	0:00:01		**SEE**	:	50 Marks
Total Hours	:	13P		**SEE Duration**	:	02 Hrs

Contents **13 Hrs**

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

Students must form groups of 2-4 and present a short film which shall be given by the experts. The experts 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 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						
SUMMER INTERNSHIP - I (Practical)						
Course Code	:	21ECI310		**CIE**	:	50 Marks
Credits: L: T: P	:	00:00:01		**SEE**	:	50 Marks
Total Hours	:	3 Weeks		**SEE Duration**	:	02 Hrs
Students can opt the internship with the below options						3 Weeks

A. Within the respective department at RVCE (Inhouse) Departments may offer internship opportunities to the students through the available tools so that the students come out with the solutions to the relevant societal problems that could be completed within THREE WEEKS.

B. At RVCE Center of Excellence/Competence

RVCE hosts around 16 CENTER OP EXCELLENCE in various domains and around 05 CENTER OP COMPETENCE. The details of these could be obtained by visiting the website https:/ /rvce.edu.in / rvce-center-excellence. Each centre would be providing the students relevant training/internship that could be completed in three weeks.

C. At InternShala

Intern Shala is India's no.1 internship and training platform with 40000+ paid internships in Engineering. Students can opt any internship for the duration of three weeks by enrolling on to the platform through https: / /internshala.com

D. At Engineering Colleges nearby their hometown

Students who are residing out of Bangalore, should take permission from the nearing Engineering College of their hometown to do the internship. The nearby college should agree to give the certificate and the letter/email stating the name of the student along with the title of the internship held with the duration of the internship in their official letter head.

E. At Industry or Research Organizations

Students can opt for interning at the industry or research organizations like BEL, DRDO, ISRO, BHEL, etc.. through personal contacts. However, the institute/industry should provide the letter of acceptance through hard copy/email with clear mention of the title of the work assigned along with the duration and the name of the student.

Procedures for the Internship:

1. Request letter/Email from the office of respective departments should go to Places where internships are intended to be carried out with a clear mention of the duration of Three Weeks. Colleges/Industry/ CoEs/CoCs will confirm the training slots and the number of seats allotted for the internship via confirmation letter/ Email.
2. Students should submit a synopsis of the proposed work to be done during internship program. Internship synopsis should be assessed or evaluated by the concerned Colleges/Industry/CoEs/CoC. Students on joining internship at the concerned Colleges/Industry/ CoEs/CoCs submit the Daily log of student's dairy from the joining date.
3. Students will submit the digital poster of the training module/project after completion of internship.
4. Training certificate to be obtained from industry.

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

CO1	Develop interpersonal, critical skills, work habits and attitudes necessary for employment.
CO2	Assess interests, abilities in their field of study, integrate theory and practice and explore career opportunities prior to graduation.
CO3	Explore and use state of art modern engineering tools to solve the societal problems with affinity towards environment and involve in ethical professional practice.
CO4	Compile, document and communicate effectively on the internship activities with the engineering community.

RUBRICS FOR THE CONTINUOUS INTERNAL EVALUATION		
#	**COMPONENTS**	**MARKS**
1.	**REVIEW I:** Explanation of the application of engineering knowledge in industries, ability to comprehend the functioning of the organization/ departments, exhibiting professional and ethical practice, communication skills (oral and body language).	**20**
2.	**REVIEW II**: Presentation in the form digital poster, report writing, exhibiting ethics in report writing, oral presentation.	**30**
MAXIMUM MARKS FOR THE CIE THEORY		**50**

RUBRICS FOR SEMESTER END EXAMINATION		
The SEE examination shall be conducted by an external examiner (domain expert) and an internal examiner.		
Q.NO.	**CONTENTS**	**MARKS**
1	Write Up	**10**
2	Conduction of the Experiments	**20**
3	Viva	**20**
	TOTAL	**50**

SEMESTER: IV						
STATISTICS AND PROBABILITY FOR DATA SCIENCE **Category: PROFESSIONAL CORE COURSE** **(Common to ALL Programs)** **(Theory)**						
Course Code	**:**	21MA41		**CIE**	**:**	100 Marks
Credits: L: T: P	**:**	2:01:00		**SEE**	**:**	100 Marks
Total Hours	**:**	30L+15T		**SEE Duration**	**:**	03 Hrs

Unit-I	**06 Hrs**
Statistics: Central moments, mean, variance, coefficients of skewness and kurtosis in terms of moments. Correlation analysis, rank correlation, linear and multivariate regression analysis – problems.	
Unit – II	**06 Hrs**
Random Variables: Random variables-discrete and continuous, probability mass function, probability density function, cumulative density function, mean and variance. Two or more random variables - Joint probability mass function, joint probability density function, conditional distribution and independence, Covariance and Correlation.	
Unit –III	**06 Hrs**
Probability Distributions: Discrete distributions - Binomial, Poisson. Continuous distributions – Exponential, Normal and Weibul.	
Unit –IV	**06 Hrs**
Sampling and Estimation: Population and sample, Simple random sampling (with replacement and without replacement). Sampling distributions of means (sigma known), Sampling distributions of mean (sigma unknown): t - distribution, Sampling distributions of variance (sigma unknown): Chi - squared distribution. Estimation - Maximum Likelihood Estimation (MLE).	
Unit –V	**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 of significance for large and small samples (F, Chi – square, Z, t – test).	

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

Reference Books	
1.	Theory and Problems of Probability, Seymour Lipschutz & Marc Lars Lipson, 2nd Edition, Schaum's Outline Series,McGraw – Hill,2000, ISBN: 9780071386517.
2.	Applied Statistics and Probability for Engineers, Douglas C. Montgomery and George C. Runger, 7th Edition, John Wiley & Sons, 2019, ISBN: 9781119570615.
3.	Probability & Statistics for Engineers & Scientists, Ronald E. Walpole & Raymond H. Myers, 9th Edition, 2016, Pearson Education, ISBN-13: 9780134115856.

4.	The Elements of Statistical Learning - Data Mining, Inference, and Prediction, Trevor Hastie Robert Tibshirani Jerome Friedman, 2nd Edition, 2009 (Reprint 2017), Springer, ISBN-10: 0387848576, ISBN-13: 9780387848570.

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

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

SEMESTER: IV						
MATERIALS FOR ELECTRONICS ENGINEERING **Category: PROFESSIONAL CORE COURSE** **(Common to EC, EE, EI & TE)** **(Theory)**						
Course Code	**:**	21EC42		**CIE**	**:**	50 Marks
Credits: L: T: P	**:**	2:00:00		**SEE**	**:**	50 Marks
Total Hours	**:**	28L		**SEE Duration**	**:**	02 Hrs

Unit-I	**10 Hrs**
Introduction: Classification and Properties of Materials, Materials Used in Electrical and Electronic Industries, Requirements and Future Developments of Electronic Materials, Case studies of advanced electronics materials and applications. **Classical Theory of Electrical Conduction and Conducting Materials:** Resistivity, TCR (Temperature Coefficient of Resistivity) and Matthiessen's Rule, Traditional Classification of Metals, Insulators and Semiconductors, Drude's Free Electron Theory, Hall Effect, Wiedemann–Franz Law, Resistivity of Alloys, Nordheim's Rule, Resistivity of Alloys, and Multiphase Solids	
Unit – II	**09 Hrs**
Thin Film Electronic Materials: Techniques for Preparation of Thin Films, Thin Film Conducting Materials, Thin Film Resistors, Transparent and Conductive Thin Films, Thin Film Magnetic Materials. Organic Electronic Materials: Conducting Polymers, Charge carriers, Semiconducting Organic Materials, Organic Light Emitting Diode, Organic FET	
Unit –III	**09 Hrs**
Semiconductor devices: Intrinsic & Extrinsic Semiconductors, temperature dependence of conductivity, direct and indirect recombination minority carrier life time Nanomaterials for Electronic Device Applications: Micro-/Nano-devices Using Nanostructured Materials: CNT transistor, Single electron transistor	

Course Outcomes: After completing the course, the students will be able to: -	
CO1	Explain material classification, physical properties, and identify material for electronic applications.
CO2	Summarize various fabrication, characterization techniques for the electronics and nanomaterials used in thin film fabrication.
CO3	Calculate electronic properties including electrical conductivity, resistivity, magnetic and optical properties in materials.
CO4	Evaluate the transport mechanisms (in solid state & organic) of electronics material in practical applications.

Reference Books	
1.	Introduction to Electronic Materials for Engineers, Wei Gao & Zhengwei Li, Nigel Sammes, 2nd Edition, World Scientific Publishing Co. Pvt. Ltd, ISBN:9789814293693
2.	Principles of Electronic Materials and Devices, S O Kasap, 4th Edition, 2018, McGraw Hill Education, ISBN-13: 978-0-07-802818-2.
3.	Electronic Properties of Materials, Rolf E. Hummel, 4th Edition, 2011, Springer, ISBN-13: 9781489998415.

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

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

SEMESTER: IV						
MICROCONTROLLERS & PROGRAMMING **Category: PROFESSIONAL CORE COURSE** **(Common to EI, ET, EC & EE)** **(Theory and Practice)**						
Course Code	**:**	21EI43		**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: -	
CO1	Analyse the architecture, instruction set and memory organization of processing units used to build computers and embedded systems.
CO2	Compile the information of ADCs, DACs, Serial ports and interrupts available on embedded processors to map to real world requirements.
CO3	Apply the knowledge of microcontroller for programming peripherals using registers and APIs generated using auto code generators.
CO4	Formulate and design different applications on embedded processors to solve problems related to society.

Reference Books	
1.	The Definitive Guide to the ARM Cortex-M3& M4 Processors, Joseph Yiu, 3rd Edition, 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.

Practical's: 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 usingembedded 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 Experiments

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

RUBRICS FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)

#	COMPONENTS	MARKS
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**20**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). **TWO TESTS** will be conducted. Each test will be evaluated for 50 Marks, adding up to 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. **Phase I (20) & Phase II (20) ADDING UPTO 40 MARKS**.	**40**
4.	**LAB:** Conduction of laboratory exercises, lab report, observation, and analysis (30 Marks), lab test (10 Marks) and Innovative Experiment/ Concept Design and Implementation (10 Marks) adding up to 50 Marks**. THE FINAL MARKS WILL BE 50 MARKS**	**50**
	MAXIMUM MARKS FOR THE CIE	**150**

RUBRICS FOR SEMESTER END EXAMINATION (THEORY)

Q.NO.	CONTENTS	MARKS
	PART A	
1	Objective type questions covering entire syllabus	**20**
	PART B (Maximum of 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**

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

SEMESTER: IV						
SIGNALS AND SYSTEMS **Category: PROFESSIONAL CORE COURSE** **Common to EC/EI** **(Theory and Practice)**						
Course Code	**:**	21EC44		**CIE**	**:**	100+50 Marks
Credits: L: T: P	**:**	03:00:01		**SEE**	**:**	100+50 Marks
Total Hours	**:**	45L+30P		**SEE Duration**	**:**	03 Hrs + 03 Hrs
Unit-I						**09 Hrs**
Introduction to Signals and Systems: Definition of Signals, Types and Classification of Signals with examples, Basic Operations on Signals, definition of Systems, Properties of Systems, System Viewed as Interconnection of Operations. Conversion of analog to digital signals.						
Unit – II						**09 Hrs**
Time domain representations of Linear Time Invariant Systems: Convolution Sum, concepts of Convolution Integrals, Interconnections of LTI System, Relations between LTI Systems, Properties of LTI systems, Applications.						
Unit –III						**09 Hrs**
Applications of Fourier Representations: Review of Fourier transform, Concepts of DTFS and DTFT with properties (no derivation), computation of DTFT for basic periodic and non-periodic signals, Applications.						
Unit –IV						**09 Hrs**
The Discrete Fourier transforms - Properties and Applications: Concept of DFT, Properties of DFT, Periodicity, Linearity and Symmetry properties, Multiplication of two DFTs, circular correlation and circular convolution. Linear filtering methods based on the DFT. Filtering of long data sequence. Efficient computation of Radix – 2 FFT Algorithms up to 4-point FFT						
Unit –V						**09 Hrs**
Time and frequency domain features: Time domain features like mean, variance, correlation, skewness, energy, envelop of signal etc., Frequency domain features like dominant frequency, peak value etc, Classification of signals based on feature extraction.						

Course Outcomes: After completing the course, the students will be able to: -	
CO1	Apply the knowledge of mathematics to understand the concept of signals and systems.
CO2	Analyze the fundamental concepts of both continuous & discrete signals and systems.
CO3	Design discrete systems to meet specific requirements for signal processing applications.
CO4	Compile and simulate MATLAB/Python programs to validate the functionality of discrete systems.

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

Practical's: Signal Processing lab

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

Innovative Experiments

1. Write a python Code to classify two signals using various features.
2. Demonstrate of any real time applications using microcontroller.

RUBRICS FOR THE CONTINUOUS INTERNAL EVALUATION (THEORY)		
#	**COMPONENTS**	**MARKS**
1.	**QUIZZES:** Quizzes will be conducted in online/offline mode. **TWO QUIZZES** will be conducted & Each Quiz will be evaluated for 10 Marks. **THE SUM OF TWO QUIZZES WILL BE THE FINAL QUIZ MARKS.**	**20**
2.	**TESTS:** Students will be evaluated in test, descriptive questions with different complexity levels (Revised Bloom's Taxonomy Levels: Remembering, Understanding, Applying, Analyzing, Evaluating, and Creating). **TWO TESTS** will be conducted. Each test will be evaluated for 50 Marks, adding up to 100 Marks. **FINAL TEST MARKS WILL BE REDUCED TO 40 MARKS.**	**40**
3.	**EXPERIENTIAL LEARNING:** Students will be evaluated for their creativity and practical implementation of the problem. **Phase I (20) & Phase II (20) ADDING UPTO 40 MARKS**.	**40**
4.	**LAB:** Conduction of laboratory exercises, lab report, observation, and analysis (30 Marks), lab test (10 Marks) and Innovative Experiment/ Concept Design and Implementation (10 Marks) adding up to 50 Marks**. THE FINAL MARKS WILL BE 50 MARKS**	**50**
	MAXIMUM MARKS FOR THE CIE	**150**
RUBRICS FOR SEMESTER END EXAMINATION (THEORY)		
Q.NO.	**CONTENTS**	**MARKS**
	PART A	
1	Objective type questions covering entire syllabus	**20**
	PART B (Maximum of 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**

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

SEMESTER: IV

ELECTROMAGNETIC FIELDS AND APPLICATIONS

Category: PROFESSIONAL CORE COURSE
(Theory)

Course Code	**:**	21EC45		**CIE**	**:**	100 Marks
Credits: L: T: P	**:**	03:00:00		**SEE**	**:**	100 Marks
Total Hours	**:**	42L		**SEE Duration**	**:**	03 Hrs

Unit-I — **09 Hrs**

Review of Vector Calculus and Columb's Law.

Electrostatic fields:

Gauss's Law Flux, Flux density, Gauss's Law, Divergence Theorem (qualitative treatment), Application of Gauss's Law (Field due to Continuous Line Charge, Sheet Charge, Metal Sphere, Spherical shell), : Electric Potential, Relation between E and V, Applications (Field and potential due to Line charge distribution, Surface charge distribution- sheet), Poisson's and Laplace's Equations, Applications of Laplace's and Poisson's Equations (Different capacitors).

Unit – II — **09 Hrs**

Review of Biot -Savart Law.

Magnetics:

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

Unit –III — **08 Hrs**

Time Varying Fields:

Introduction, Faraday's Law, Transformer and Motional EMFs, Displacement Current, Maxwell's Equations in Final Forms, Time-Varying Potentials, Time-Harmonic Fields, Illustrative examples, Boundary Valued Problem in Electrostatics (dielectric-dielectric, dielectric-conductor), Magnetics, In time varying fields, Illustrative Examples

Unit –IV — **09 Hrs**

Transmission lines:

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

Unit –V — **08 Hrs**

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

Plane Wave Propagation:

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

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

CO1	Explain fundamental laws governing electromagnetic fields and evaluate the physical quantities of electromagnetic fields (Field intensity, Flux density etc.), in different media using the fundamental laws.
CO2	Determine the electromagnetic fields exerted on charged particles, current elements, working principle of various electric and electromagnetic energy conversion devices and transmission lines.
CO3	Design electromagnetic energy storage devices like capacitor, inductor which are frequently used in electrical systems and power transfer in Transmission lines.

CO4	Deduce and justify the concepts of electromagnetic waves, means of transporting energy or information in the form of radio waves, TV signals, radar beams, light rays and transmission lines.

Reference Books	
1.	Principles Of Electromagnetics, Matthew N O Sadiku Oxford University Press, 6th Edition, 2007, ISBN-13:978-0199461851.
2.	Engineering Electromagnetics, William H. Hayt Jr. and John A. Buck, Tata McGraw Hill, 6th Edition, 2001, ISBN: 978-0071089012.
3.	Introduction to Electromagnetic Engineering, Roger E. Harrington, Dover Books on Electrical Engineering, 2003, ISBN-13: 978-1580539395.
4.	Fundamentals of Applied Electromagnetics, Fawwaz Ulaby, Umberto Ravaioli, Pearson Education Limited 7th Edition ISBN-13: 978-1292082448.

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

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

SEMESTER: IV						
DESIGN THINKING LAB **Category: PROFESSIONAL CORE COURSE** **(Practical)**						
Course Code	**:**	21EC46		**CIE**	**:**	50 Marks
Credits: L:T:P	**:**	0:00:02		**SEE**	**:**	50 Marks
Total Hours	**:**	26P		**SEE Duration**	**:**	02 Hrs
						26 Hrs

Guidelines for Design Thinking Lab (DTL):

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

The Design Thinking lab tasks would involve:

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

Course Outcomes: After completing the course, the students will be able to: -	
CO1	Interpret the process of Design Thinking to solve real world problems from the end user view point.
CO2	Apply design thinking tools to make decisions and attain a feasible solution.

CO3	Identify and solve a Capstone project with sustainable goals using Design Thinking.
CO4	Develop a pretotype and optimize it further through demonstrations.

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

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

SEMESTER: IV						
Bridge Course: C Programming (Mandatory Audit Course) (Common to all programs)						
Course Code	:	21DCS47		**CIE**	:	50 Marks
Credits: L: T: P	:	02:01:00				

Unit-I	**08 Hrs**

Introduction-Perspectives
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 and functions 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 value of a variable.

Course Outcomes: After completing the course, the students will be able to: -	
CO1	Apply logical skills to solve the engineering problems using C programming constructs.
CO2	Evaluate the appropriate method/data structure required in C programming to develop solutions by investigating the problem.
CO3	Design a sustainable solution using C programming with societal and environmental concern by engaging in lifelong learning for emerging technology
CO4	Demonstrate programming skills to solve inter-disciplinary problems using modern tools effectively by exhibiting team work through oral presentation and written reports.

Reference Books	
1.	Programming in C, 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.	Rasberry pi: https://www.raspberrypi.org/documentation/
6.	Nvidia: https://www.nvidia.com/en-us/
7.	Ardunio: 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.
7. 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 UPTO 20 MARKS**.	**20**
	MAXIMUM MARKS FOR THE CIE THEORY	**50**

SEMESTER: IV

UNIVERSAL HUMAN VALUES AND PROFESSIONAL ETHICS
(Theory)
(Common to all Programs)

Course Code	**:**	21HSU48		**CIE**	**:**	50 Marks
Credits: L:T:P	**:**	02:00:00		**SEE**	**:**	50 Marks
Total Hours	**:**	28L		**SEE Duration**	**:**	02 Hrs

Unit-I — **10 Hrs**

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education: Purpose and motivation for the course, recapitulation from Universal Human Values-I, Self-Exploration 'Natural Acceptance' and Experiential Validation Continuous Happiness and Prosperity- Human Aspirations, Right understanding, Relationship and Physical Facility, Understanding Happiness and Prosperity correctly.

Practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility.

Understanding Harmony in the Human Being - Harmony in Myself! :Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' Understanding the Body as an instrument of Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Health;

Practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life.

Unit – II — **10 Hrs**

Understanding Harmony in the Family and Society- Harmony in Human Relationship: Understanding values in human-human relationship; meaning of Justice and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship, Understanding the meaning of Trust.

Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

Unit –III — **08 Hrs**

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence: Understanding the harmony in the Nature, Interconnectedness, and mutual fulfilment among the four orders of nature recyclability and self-regulation in nature, Understanding Existence as Co-existence of mutually interacting units in all pervasive space, Holistic perception of harmony at all levels of existence.

Practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Course Outcomes: After completing the course, the students will be able to: -	
CO1	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,
CO2	While keeping human relationships and human nature in mind. They would have better critical ability.
CO3	They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
CO4	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.

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

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

SEMESTER: IV						
DESIGN AND ANALYSIS OF ALGORITHMS **Category: PROFESSIONAL CORE ELECTIVE(GROUP-A)** **(Theory)**						
Course Code	**:**	21EC4A1		**CIE**	**:**	50 Marks
Credits: L:T:P	**:**	02:00:00		**SEE**	**:**	50 Marks
Total Hours	**:**	30L		**SEE Duration**	**:**	02 Hrs

Unit-I	**10 Hrs**
Introduction, Examples and motivation, Asymptotic complexity: formal notation, examples, Searching in list: binary search, Sorting: insertion sort, selection sort, merge sort, quicksort, stability and other issues, programming assignment, Graphs: Graph exploration: BFS, Graph exploration: DFS, DFS numbering and applications, Directed acyclic graphs, programming assignment.	
Unit – II	**10 Hrs**
Shortest paths: unweighted and weighted, Single source shortest paths: Dijkstra, Minimum cost spanning trees: Prim's Algorithm, Kruskal's Algorithm, Union-Find data Structure, programming assignment. Divide and conquer: counting inversions, nearest pair of points, Priority queues, heaps, Dijstra/Prims revisited using heaps, programming assignment Search Trees: Traversals, insertions, deletions, Balancing, Interval scheduling, Greedy: Proof strategies, Huffman Coding, Dynamic Programming: weighted interval scheduling programming assignment.	
Unit –III	**10 Hrs**
Dynamic Programming: memorization, edit distance, longest ascending subsequence, matrix multiplication | shortest paths: Bellman Ford, Floyd Warshall, programming assignment Intractability: NP completeness, reductions, examples	

Course Outcomes: After completing the course, the students will be able to: -	
CO1	Apply knowledge of computing and mathematics to algorithm design.
CO2	Employ graphs to model engineering problems, when appropriate. Construct algorithms that employ graph computations as key components, and analyze them.
CO3	Use divide-and-conquer techniques for solving suitable problems and greedy approach to solve an appropriate problem for optimal solution.
CO4	Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. construct dynamic-programming algorithms, and analyze them.

Reference Books	
1.	Introduction to the Design & Analysis of Algorithms, Anany Levitin, 2nd Edition, Pearson Education 2007.
2.	Introduction to Algorithms, T. H. Cormen, C. E. Leiserson, R. L. Rivest, Clifford Stein, 3rd Edition, PHI.
3.	Computer Algorithms, Ellis Horowitz and Sartaj Sahni, Silicon press, 2008
4.	Algorithms, Dasgupta, Sanjoy, Christos Papadimitriou, and Umesh Vazirani., McGraw-Hill, 2006. ISBN: 9780073523408.

SEMESTER: IV						
DATABASE MANAGEMENT SYSTEM **Category: PROFESSIONAL CORE ELECTIVE(GROUP-A)** **(Theory)**						
Course Code	**:**	21EC4A2		**CIE**	**:**	50 Marks
Credits: L:T:P	**:**	02:00:00		**SEE**	**:**	50 Marks
Total Hours	**:**	30L		**SEE Duration**	**:**	02 Hrs
Unit-I						**10 Hrs**
Overview, Introduction to RDBMS, Structured Query Language (SQL), Relational Algebra, Entity-Relationship Model.						
Unit – II						**10 Hrs**
Relational Database Design, Application Development, Case Studies, Storage and File Structure, Indexing and Hashing, Query Processing.						
Unit –III						**10 Hrs**
Query Optimization, Transactions (Serializability and Recoverability), Concurrency Control, Recovery Systems,						

Course Outcomes: After completing the course, the students will be able to: -	
CO1	Understand the fundamentals of Data Base management system, entity-relationship model, Relational Algebra, Database Design, Transaction Management.
CO2	Illustrate the working of data base & transactions by writing queries using SQL and Postgre SQL.
CO3	Analyze an information storage problem and derive an information model expressed in the form of an entity relation diagram and other optional analysis forms, such as a data dictionary
CO4	Design a data model that satisfies relational theory and provides users with business Queries, business forms and business reports.

Reference Books	
1.	Fundamentals of Database Systems, Elmasri, Navathe, 5th Edition, Pearson Education, 2007, ISBN-13: 9780321369574.
2.	Database Management Systems, Raghu Ramakrishnan, Johannes Gehrke, 3rd Edition, McGraw, ISBN-10: 0072465638.
3.	The art of Postgre SQL, Dimitri Fontain, 2nd Edition, O'Reilly Media Inc., 2014, ISBN- 9781788472296.
4.	Data base System Concepts, Silberschatz, Korth, Sudharshan, 6th Edition, McGraw-Hill, ISBN-10:9332901384

SEMESTER: IV						
OBJECT ORIENTED ANALYSIS AND DESIGN **Category: PROFESSIONAL CORE ELECTIVE(GROUP-A)** **(Theory)**						
Course Code	**:**	21EC4A3		**CIE**	**:**	50 Marks
Credits: L: T:P	**:**	02:00:00		**SEE**	**:**	50 Marks
Total Hours	**:**	30L		**SEE Duration**	**:**	02 Hrs
Unit-I						**10 Hrs**
Software Complexity: Understanding the challenges Object oriented analysis and design can address, Object Model: Defining the primitives of the OO paradigm, Classes and Objects: Bringing in the broader perspectives.						
Unit – II						**10 Hrs**
Classes and Objects: Identification approaches using Object oriented analysis and design, Unified Modeling Language-I.						
Unit –III						**10 Hrs**
Unified Modeling Language-II Object oriented analysis and design Case Studies: Applying Object oriented analysis and design in different contexts.						

Course Outcomes: After completing the course, the students will be able to: -	
CO1	Analyze and model software specifications and abstract object-based views for generic software systems.
CO2	Select the basic elements of modeling such as Things, Relationships and Diagrams depending on the views of UML Architecture.
CO3	Design Class and Object Diagrams that represent Static Aspects of a Software System.
CO4	Apply techniques of state chart diagrams and implementation diagrams to model behavioural aspects and runtime environment of software Systems.

Reference Books	
1.	The Unified Modeling Language User Guide, Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson Education, ISBN 0-321-24562-8.
2.	Fundamentals of Object-Oriented Design in UML, Meilir Page-Jones, 1st Edition, Addison-Wesley.
3.	Modeling Software Systems Using UML2, Pascal Roques, WILEY- Dreamtech India Pvt. Ltd.
4.	Object Oriented Analysis & Design, Atul Kahate, The McGraw-Hill Companies.

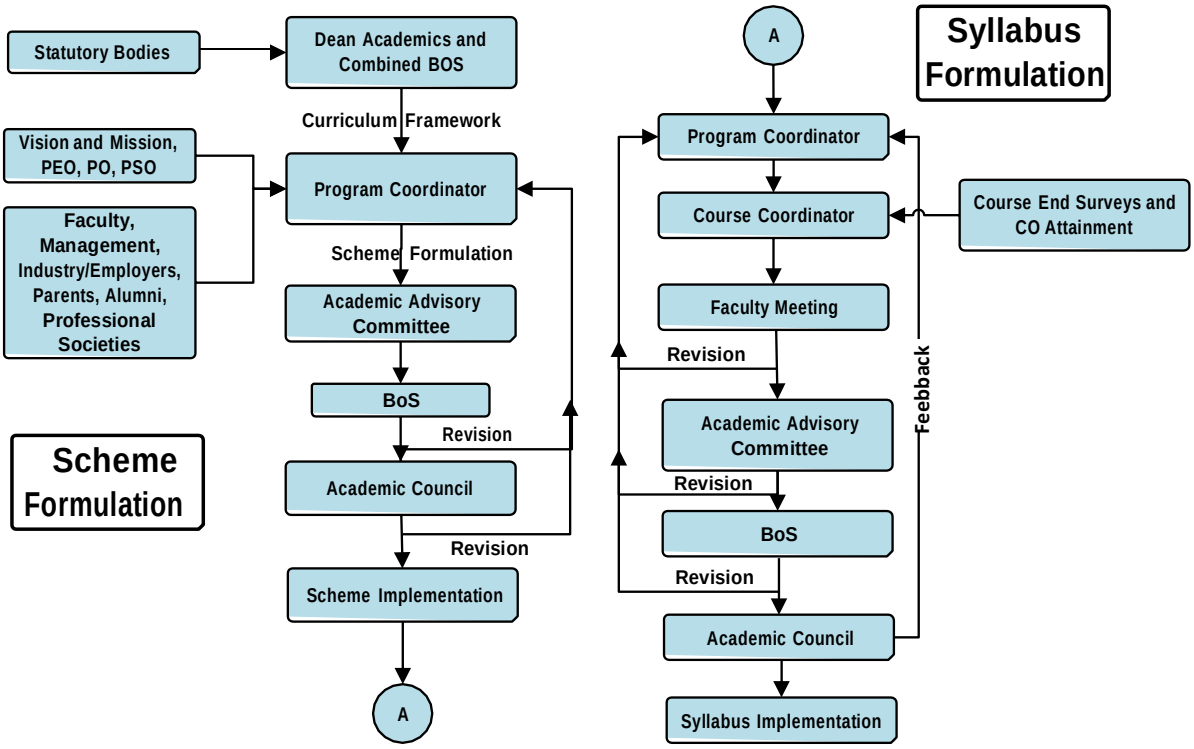
SEMESTER: IV						
PROGRAMMING, DATASTRUCTURES AND ALGORITHMS USING PYTHON **Category: PROFESSIONAL CORE ELECTIVE(GROUP-A)** **(Theory)**						
Course Code	**:**	21EC4A4		**CIE**	**:**	50 Marks
Credits: L:T:P	**:**	02:00:00		**SEE**	**:**	50 Marks
Total Hours	**:**	30L		**SEE Duration**	**:**	02 Hrs

Unit-I	**10 Hrs**
Informal introduction to programming, algorithms and data structures via GCD, Downloading and installing Python, GCD in Python: variables, operations, control flow - assignments, condition-als, loops, functions. Python: types, expressions, strings, lists, tuples, Python memory model: names, mutable and immutable values, List operations: slices, Binary search, Inductive function definitions: numerical and structural induction, Elementary inductive sorting: selection and insertion sort, In-place sorting. Basic algorithmic analysis: input size, asymptotic, complexity, O () notation, Arrays vs lists, Merge sort Quicksort, Stable sorting.	
Unit – II	**10 Hrs**
Dictionaries, More on Python functions: optional arguments, default values, Passing functions as Arguments, Higher order functions on lists: map, lter, list comprehension, Exception handling, Basic input/output, Handling files, String processing. Backtracking: N Queens, recording all solutions, Scope in Python: local, global, nonlocal names, Nested Functions, Data structures: stack, queue, Heaps.	
Unit –III	**10 Hrs**
Abstract datatypes, Classes, and objects in Python, linked lists: find, insert, delete, Binary search trees: find, insert, delete, Height-balanced binary search trees. Efficient evaluation of recursive definitions: memorization, Dynamic programming: examples, other programming languages: C and manual memory management, other programming paradigms: functional programming.	

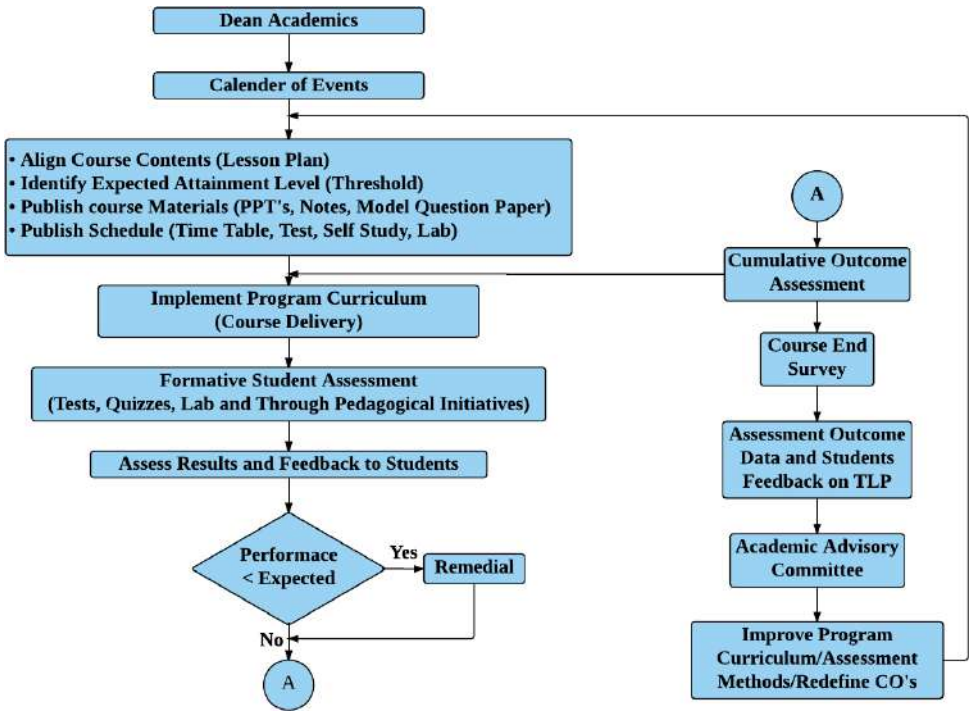
Course Outcomes: After completing the course, the students will be able to: -	
CO1	Explain basic principles of Python programming language.
CO2	Use existing data structures and algorithms found in python's libraries.
CO3	Analyze time and space complexity of various algorithms and data structures.
CO4	Apply data structures and algorithms to solve real world problems.

Reference Books	
1.	Data Structures and Algorithms in Python, Michael T. Goodrich, Roberto Tamassia. Michael H. Goldwasser, 1st Edition, Wiley, 2013, ISBN:1118290275.
2.	Fundamentals of Python Data Structures, Kenneth A. Lambert, 2nd Edition, Course Technology Inc, 2018, ISBN-10: 0357122755, ISBN-13: 978-0357122754.
3.	Introduction to the Design & Analysis of Algorithms, Anany Levitin, 2nd Edition, Pearson Education 2007.
4.	Computer Algorithms, Ellis Horowitz and Sartaj Sahani, Silicon press, 2008.

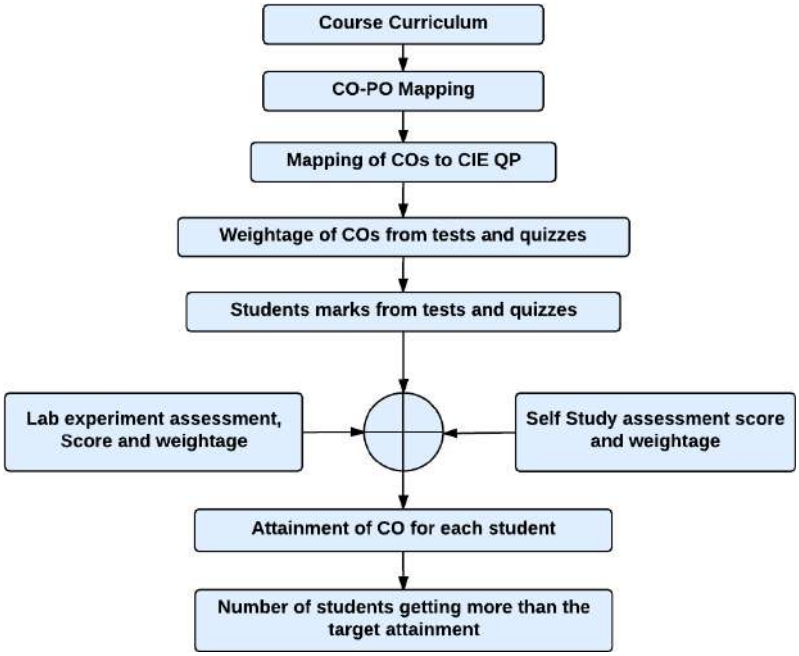
Curriculum Design Process



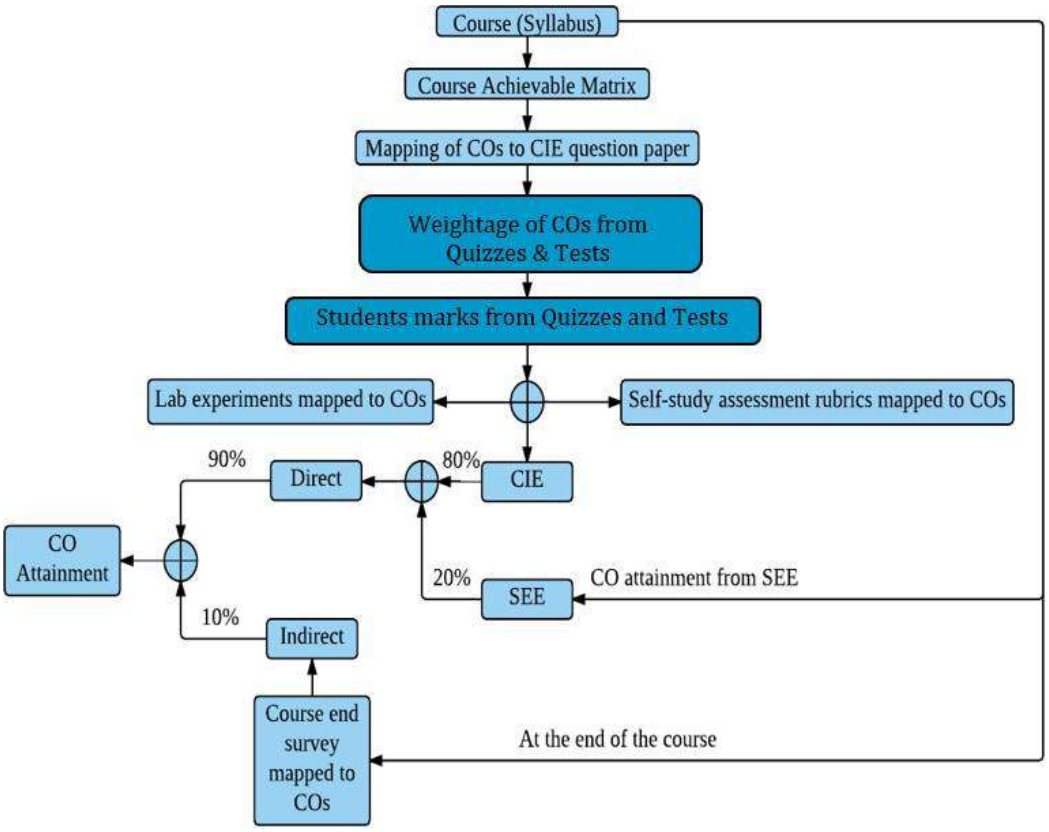
Academic Planning and Implementation



Process For Course Outcome Attainment



Final CO Attainment Process

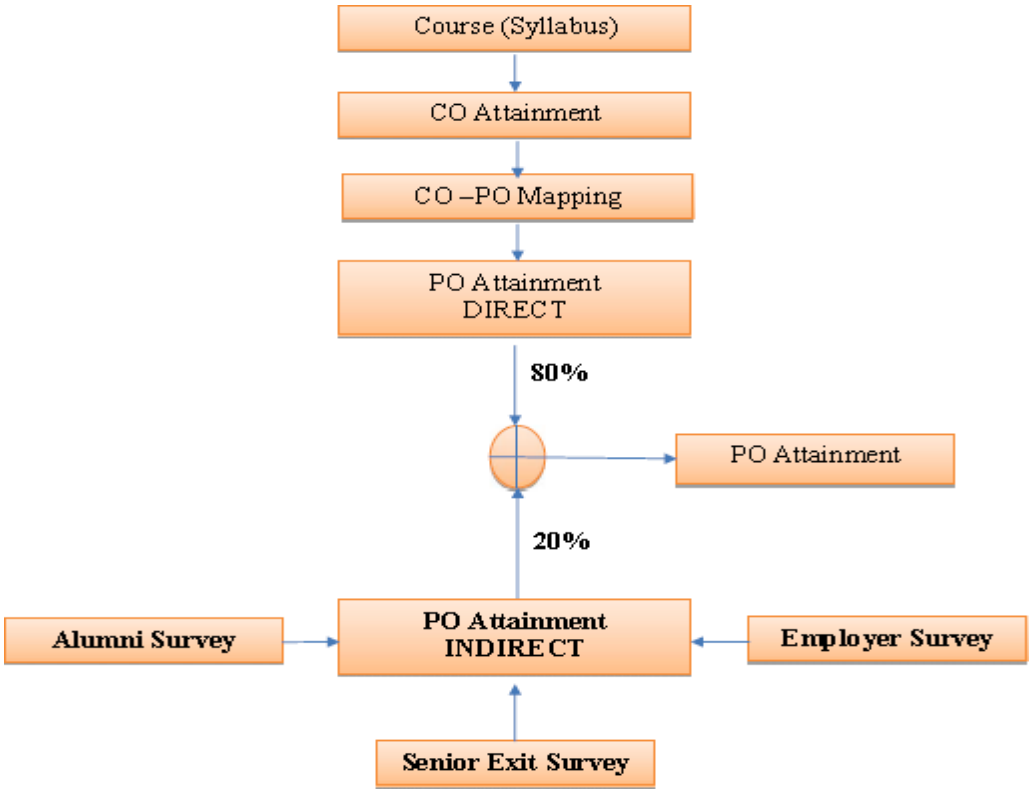


RV Educational Institutions ®
RV College of Engineering ®

Autonomous Institution Affiliated to Visvesvaraya Technological University, Belagavi

Approved by AICTE, New Delhi

Program Outcomes Attainment Process



RV Educational Institutions ®
RV College of Engineering ®

Autonomous Institution Affiliated to Visvesvaraya Technological University, Belagavi

Approved by AICTE, New Delhi

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.