MOOGAMBIGAI CHARITABLE AND EDUCATIONAL TRUST

Rajarajeswari College of Engineering

(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)
#14, Ramohalli Cross, Kumbalagodu, Mysore Road, Bengaluru–560074

Electronics and Communication Engineering

III & IV Semester Scheme and Syllabus

(2025 Scheme)

VISION

To empower young minds through technology, research and innovation, to produce technically competent and socially responsible professionals in higher education.

MISSION

1. To deliver excellence in education through innovative teaching, impactful research, and continuous skill development, preparing students to meet global challenges with technical expertise and ethical responsibility.
2. To foster a transformative learning environment that integrates technology, research and practical experience, empowering students to become skilled professionals and socially conscious leaders.
3. To cultivate a culture of lifelong learning and professional excellence by encouraging creativity, research, and community engagement, equipping students with the skills to thrive in a dynamic world.
4. To provide a holistic educational experience that combines advanced technology, hands-on research, and community-focused learning, shaping students into competent, ethical professionals who contribute positively to society.

QUALITY POLICY

Rajarajeswari College of Engineering is committed to imparting quality technical education that nurtures competent, ethical professionals with global relevance. We ensure academic excellence through a dynamic, outcome-based curriculum, experienced faculty, and cutting-edge infrastructure. Continuous improvement is driven by innovation, research and strong industry collaboration. We foster holistic development and a progressive environment that supports lifelong learning, teamwork, and professional growth.

CORE VALUES

Academic Excellence, Integrity, Innovation, Global Competence, Continuous Improvement.

Electronics and Communication Engineering

DEPARTMENT VISION

Actualize high Quality Electronics and Communication Engineering professionals showcasing Innovation, Research and Performance in the Frontier areas and capable of working local, global, environment contributing for Societal development through sustainable technology keeping high moral values.

DEPARTMENT MISSION

1. To give strong fundamental and contemporary knowledge to students with excellent curriculum and faculty.
2. Promoting Innovation and Research by creating ambiance by collaborating Industry & academics also involving them to do societal beneficial projects.
3. Imparting ethics to students through relevant practices.

PROGRAM OUTCOMES (POs)

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

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

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

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

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

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

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

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

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

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

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

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Able to take up career in the Electronics & Communication industries to contribute by innovative design and products to help society.

PEO2: Capable to work in team with good communication skills, leadership qualities and ethics.

PEO3: Professional empowering by taking up higher education or updating knowledge in line with the changing trends of technology.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Demonstrate the competency to analyze the real time problems related to Electronics and communication industry and able to design and develop products with the cutting edge technology.

PSO2: Demonstrate leadership qualities to resolve the complex multidisciplinary engineering, societal challenges in the ethical manner.

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MOOGAMBIGAI CHARITABLE AND EDUCATIONAL TRUST

Rajarajeswari College of Engineering

(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

Scheme of Teaching and Examinations – 2025 Scheme

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

III Semester **Academic Year: 2026-27**

S.No	Course Category and Course Code		Course Title	TD/ PSB	Teaching Hours / Semester				Examination				Credits
					Lecture	Tutorial	Practical	TW+SL	CIE Marks	SEE Marks	Total marks	SEE Duration in hours	
					L	T	P	S					
1.	ASC	B25MEE301	Transform calculus , Fourier series and Probability Distributions (Common to ECE, EEE)	Maths	**42**	**28**	**0**	**50**	**50**	**50**	**100**	**3**	**4**
2.	PCC	B25EC302	Network Analysis	EC	**28**	**28**	**0**	**34**	**50**	**50**	**100**	**3**	**3**
3.	IPCC	B25EC303	Digital System Design using Verilog	EC	**28**	**28**	**28**	**36**	**50**	**50**	**100**	**3**	**4**
4.	PCC	B25EC304	Analog Electronics Circuits	EC	**28**	**28**	**0**	**34**	**50**	**50**	**100**	**3**	**3**
5.	PCC	B25EC305	Python Application Programming	EC	**42**	**0**	**0**	**48**	**50**	**50**	**100**	**3**	**3**
6.	PCCL	B25ECL306	Analog And Digital Systems Design Laboratory	EC	**0**	**0**	**28**	**2**	**50**	**50**	**100**	**3**	**1**
7.	AEC	B25ECL307	Python Application Programming Lab	EC	**0**	**0**	**28**	**2**	**50**	**50**	**100**	**3**	**1**
8.	SDC	B25ECP308	Community / Societal Project	ECE	**0**	**0**	**0**	**30**	**50**	**50**	**100**	**3**	**1**
9.	NCMC	B25MAD309	Additional Mathematics - I	Maths	**42**	**0**	**0**	**0**	**100**	**-**	**100**	**-**	**PP**
10.	NCMC	B25NSK310A/ B/C/D/E	National Service Scheme /National Cadet Corps / Physical Education Yoga / Music	HSS	**0**	**0**	**0**	**28**	**100**	**-**	**100**		**PP**
11	SEC	B25SKL300	Skill Laboratory	Concerned Dept.	**0**	**0**	**30**	**0**	**100**	**-**	**100**	**-**	**1**
								TOTAL	**700**	**400**	**1100**		**21**

BSC: Basic Science Course, HSMC: Humanity, Social sciences including Management courses, IPCC: Integrated Professional Core Course, PCC: Professional Core Course, PCCL: Professional Core Course laboratory, NCMC: Non-Credit Mandatory Course, AEC: Ability Enhancement Course, SDC: Skill Development Course, L: Lecture, T: Tutorial, P: Practical, Self-Learning, S:SDA- Skill Development Activity, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation, PP: Pass, NP: Not Pass, XX: Programme Code (EC, CS, IS etc.,), Y: A/B/C/D**,** K: Indicates Common Course to all the streams of Engineering

NSS / NCC / PE / Yoga / Music: All students are required to register for any one of the following courses: National Service Scheme/National Cadet Corps/Physical Education/Yoga/ Music - with the respective course coordinator during the first week of the third semester. College shall submit Continuous Internal Evaluation (CIE) marks for each semester based on the activities completed by students under these selected courses. Students may opt for different activities/options across semesters. For instance, a student participating in PE during 3rd semester may choose NSS in the 4th semester or Yoga. Activities shall be conducted over two semesters (III&IV), and successful completion of the registered course/or courses along with the required CIE score is mandatory for the award of the degree. Institutions must ensure that events are appropriately scheduled and reflected in the semester-wise calendar for NSS, PE, Music, and Yoga activities.

These courses shall not be considered for the calculation of SGPA or CGPA and for vertical progression. However, completion of course(s) is compulsory for degree eligibility.

The courseB25XX307Y – Ability Enhancement Course Laboratory can be offered either as a single compulsory course. Alternatively, the course B25XX307Y - Ability Enhancement Course Laboratory shall be offered as multiple elective options under the course codesB25XX307Y (where Y =A/B/C/D)

HOD **Dean-Academics** **Principal**

MOOGAMBIGAI CHARITABLE AND EDUCATIONAL TRUST

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

Scheme of Teaching and Examinations – 2025 Scheme

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

IV Semester **Academic Year: 2026-27**

S. No	Course Category and Course Code		Course Title	TD / PSB	Teaching Hours / Semester				Examination				Credits
					Lecture	Tutorial	Practical	TW + SL	CIE Marks	SEE Marks	Total marks	SEE Duration in hours	
					L	T	P	S					
1.	ASC/ PCC	B25MEC401	Statistics, Linear Algebra and complex variables	Maths	**42**	**28**	**0**	**50**	**50**	**50**	**100**	**3**	**4**
2.	PCC	B25EC402	Electromagnetic Field Theory (Common to ECE & EEE)	EC	**42**	**28**	**0**	**50**	**50**	**50**	**100**	**3**	**4**
3.	IPCC	B25EC403	Control Engineering	EC	**28**	**28**	**28**	**36**	**50**	**50**	**100**	**3**	**4**
4.	PCC	B25EC404	Principles of Communication System	EC	**28**	**28**	**0**	**34**	**50**	**50**	**100**	**3**	**3**
5.	BSC	B25BEK405	Biology for Engineers	EC	**28**	**0**	**0**	**2**	**50**	**50**	**100**	**2**	**2**
6.	PCCL	B25ECL406	Analog Communication lab	EC	**0**	**0**	**28**	**2**	**50**	**50**	**100**	**3**	**1**
7.	AEC	B25ECL407	LabVIEW Programming	EC	**0**	**0**	**28**	**2**	**50**	**50**	**100**	**3**	**1**
8.	SDC	B25ECP408	Environmental Science Project	EC	**0**	**0**	**0**	**30**	**50**	**50**	**100**	**3**	**1**
9.	NCMC	B25MAD409	Additional Mathematics - II	Maths	**42**	**0**	**0**	**0**	**100**	**-**	**100**	**-**	**PP**
10.	NCMC	B25NSK410A/ B/C/D/E	National Service Scheme /National Cadet Corps / Physical Education Yoga / Music	HSS	**0**	**0**	**0**	**28**	**100**	**-**	**100**		**PP**
11.	SEC	B25SKL400	Skill Laboratory	Concerned Dept.	**0**	**0**	**30**	**0**	**100**	**-**	**100**	**-**	**1**
								TOTAL	**700**	**400**	**1100**		**21**

BSC: Basic Science Course, IPCC: Integrated Professional Core Course, PCC: Professional Core Course, PCCL: Professional Core Course Laboratory, NCMC: Non-Credit Mandatory Course, AEC: Ability Enhancement Course, L: Lecture, T: Tutorial, P: Practical, S: Self-Learning, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation, PP: Pass, NP: Not Pass, EC: Programme Code (EC, CS, IS etc.,), Y: A/B/C/D**,** K: Indicates Common Course to all the streams of Engineering

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These courses shall not be considered for the calculation of SGPA or CGPA and for vertical progression. However, completion of course(s) is compulsory for degree eligibility.

The course **B25XX407Y** – Ability Enhancement Course Laboratory can be offered either as a single compulsory course. Alternatively, the course **B25XX407Y** - Ability Enhancement Course Laboratory shall be offered as multiple elective options under the course codes **B25XX407Y** (where Y =A/B/C/D)

Environmental Science Project: The Environmental Science Project is an applied learning component designed to develop students' awareness, understanding, and responsibility toward the environment. It provides an opportunity to study real-world environmental issues and apply scientific and engineering principles to design feasible and sustainable solutions.

HoD **Dean-Academics** **Principal**

Semester-III					
Transform Calculus, Fourier Series and Probability Distributions **Category: ASC** **(Common to EEE, ECE)**					
Course Code	:	**B25MEE301**	CIE	:	50 Marks
Teaching Hours L : T : P : S	:	42:28:0:50	SEE	:	50 Marks
Total Hours/Semester	:	120	Total	:	100 Marks
Credits	:	4	SEE Duration	:	3 Hrs

Course Learning Objective is	
1	To learn to use the Fourier series to represent periodical physical phenomena in engineering analysis and to enable the student to express non-periodic functions to periodic functions using the Fourier series
2	To analyze signals in terms of Fourier transforms and z transforms.
3	To analyze problems by applying Partial Differential Equations.
4	To introduce the concept of random variables, probability distributions, specific discrete and continuous distributions with practical application in Computer Science Engineering and social life situations.
5	To understand the random process for use in communication engineering.

Module-1	**No. of Hours**
Fourier series: Periodic functions, Dirichlet's condition. Fourier series expansion of functions with period $2\pi$and with arbitrary period: periodic rectangular wave, Half-wave rectifier, rectangular pulse, Saw tooth wave. Half-range Fourier series. Triangle and half range expansions, Practical harmonic analysis, and variation of periodic current. **Self-study:** Typical waveforms, complex form of Fourier series.	14
Module-2	**No. of Hours**
Fourier Transforms and z-transforms: Infinite Fourier transforms Fourier cosine and sine transforms, Inverse Fourier transforms, Inverse Fourier cosine and sine transforms. Z-transform-definition, Standard z-transforms, Damping and shifting rules, Problems. Initial value and final value theorems, Inverse z-transform and applications to solve difference equations. Self Study: Initial value and final value theorems, problems. **Self-study:** Convolution theorems of Fourier Transforms.	14
Module 3	**No. of Hours**
Partial Differential Equations(PDE): Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Homogeneous PDEs involving derivatives with respect to one independent variable only. Solution of Lagrange's linear PDE. Derivation of one-dimensional heat equation and wave equation, Solution of separation of variables.	14
Module-4	**No. of Hours**
Probability Distributions: Review of basic probability theory. Random variables (discrete and continuous), probability mass and density functions. Mathematical expectation, mean and variance. Binomial, Poisson, normal distributions, Exponential distributions, -problems (derivations for mean and standard deviation for Binomial and Poisson distributions only)-Illustrative examples. **Self-study:** Test of hypothesis for means, single proportions only.	14
Module-5	**No. of Hours**
Two dimensional Random variables: Joint probability mass function, Marginal probability function, conditional probability function. Random Process: Classification of random process, description of random process, stationary random process – first order, second order and Strict-sense stationary processes, Autocorrelation and Cross- correlation functions. **Self-study:** Joint density function, marginal density function, conditional probability density function, covariance, correlation coefficient. **Application:** Bayesian network.	14

Course Outcomes: At the end of the course, the students will be able to	
CO1	Demonstrate the Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing, and field theory.
CO2	To use Fourier transforms to analyse problems in solving continuous-time signals. ToapplyZ-Transform techniques to solve difference equations.
CO3	Analyze problems by applying Partial Differential Equations.
CO4	Apply discrete and continuous probability distributions in analyzing the probability models arising in the engineering field. Demonstrate the validity of testing the hypothesis.
CO5	To understand the random process for use in communication engineering.

Text Books	
1.	B.S.Grewal: "Higher Engineering Mathematics", Khanna publishers,44thEd.2018
2.	E.Kreyszig:"Advanced Engineering Mathematics", John Wiley & Sons,8thEd.(Reprint),2016
Reference Books	
1.	V. Ramana: "Higher Engineering Mathematics", McGraw-Hill Education, 11thEdition.
2.	Dr.D S Chandrasekhar: "Engineering Mathematics-I", Prism, 8th Edition.
3.	Gupta C.B, Sing S.R and Mukesh Kumar: "Engineering Mathematic for Semester I and II", McGraw Hill Education (India) Pvt. Ltd, 2015.

Web links and Video lectures (e-Resources)
1. https://nptel.ac.in/courses/12286025 2. VTUEDUSATPROGRAMME –20 3. http://www.class-central.com/subject/math(MOOCs)

ASSESSMENT STRUCTURE:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40 out of 100 marks.

CONTINUOUS INTERNAL EVALUATION (CIE):

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	**Internal Assessment1**	**50**	**40 (Average of Best two Assessments)**	**50**
	Internal Assessment2	**50**		
	Internal Assessment3	**50**		
AAT	**Any Two Assessments as per regulations**	**20**	**10**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Total Marks				**100**

SEMESTER END EXAMINATION (SEE):

1. The Question paper for each course contains two parts, Part – A and Part – B.
2. Part – A consists of **Short Answer Questions** (2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple Choice Questions are not allowed.
3. Part – B consists of 10 questions, two questions of 16 marks (with max. of 3 sub questions) from each module with internal choice. Students shall answer five full questions, selecting one full question from each module.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	1	-	-	-	-	1	-	2
CO2	3	3	3	1	-	-	-	-	1	-	2
CO3	3	3	3	1	-	-	-	-	1	-	2
CO4	3	3	2	2	-	-	-	-	1	-	2
CO5	3	3	2	2	-	-	-	-	1	-	2

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Semester-III					
Network Analysis **Category: PCC**					
Course Code	:	**B25EC302**	CIE	:	50 Marks
Teaching Hours L : T : P : S	:	28:28:0:34	SEE	:	50 Marks
Total Hours/Semester	:	90	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Learning Objective is	
1.	To understand the mesh and nodal techniques to solve an electrical network.
2.	To Solve different problems related to electrical circuits using network theorems.
3.	To study the behaviour of networks subjected to transient conditions.
4.	To study two port network parameters like Z, Y, T and h and their inter-relationships and applications
5.	To study of RLC Series and parallel tuned circuit.

Module – 1	**No. of Hours**
Basic Concepts: Practical sources, Source transformations, Network reduction using Star – Delta transformation, Loop and node analysis with linearly dependent and independent sources for DC and AC networks.	12
Module – 2	**No. of Hours**
Network Theorems: Superposition, Millman‘s theorems, Thevinin‘s and Norton‘s theorems, Maximum Power transfer theorem.	11
Module – 3	**No. of Hours**
Transient behavior and initial conditions: Behavior of circuit elements under switching condition and their Representation, evaluation of initial and final conditions in RL, RC and RLC circuits for AC and DC excitations	11
Module – 4	**No. of Hours**
Two port network parameters: Definition of Z, Y, h and Transmission parameters, modelling with these parameters, relationship between parameters sets, Interconnection of Two ports. **Graph Theory:** Graph of networks, Graph terminologies, Incidence Matrix, Loop matrix.	11
Module – 5	**No. of Hours**
Resonance: Series Resonance: Variation of Current and Voltage with Frequency, Selectivity and Bandwidth, Q-Factor. Parallel Resonance: Selectivity and Bandwidth, Maximum Impedance Conditions with C, L and f Variable, current in Anti-Resonant Circuit.	11

Course Outcomes: At the end of the course, the students will be able to	
CO1	Determine currents and voltages using source transformation, source shifting, mesh, nodal analysis and reduce given network using star-delta transformation.
CO2	Solve network problems by applying Superposition, Thevenin‘s, Norton‘s, Maximum Power Transfer and Millman‘s Theorems.
CO3	Calculate current and voltages for the given circuit under transient conditions.
CO4	Solve the given network using specified two port network parameter like Z or Y or T or h.
CO5	Analyze the concept of resonance.

Text Books	
1.	M.E. Van Valkenberg (2000), ―Network analysis‖, Prentice Hall of India, 3rd edition, 2008, ISBN: 9780136110958
2.	Roy Choudhury, ―Networks and systems‖, 2nd edition, New Age International Publications, 2006, ISBN: 9788122427677
3.	Circuit theory and networks, Ravish R Singh, 2nd edition, MC Graw Hill Education Pvt ltd, 2019.

Reference Books	
1.	Hayt, Kemmerly and Durbin ―Engineering Circuit Analysis‖, TMH 7th Edition,2010
2.	J. David Irwin /R. Mark Nelms, ―Basic Engineering Circuit Analysis‖, John Wiley, 8thedition, 2006
3.	Charles K Alexander and Mathew N O Sadiku, ― Fundamentals of Electric Circuits‖, Tata McGraw-Hill, 3rdEdition, 2009.

ASSESSMENT STRUCTURE:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40 out of 100 marks.

CONTINUOUS INTERNAL EVALUATION (CIE):

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	**Internal Assessment1**	**50**	**40 (Average of Best two Assessments)**	**50**
	Internal Assessment2	**50**		
	Internal Assessment3	**50**		
AAT	**Any Two Assessments as per regulations**	**20**	**10**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Total Marks				**100**

SEMESTER END EXAMINATION (SEE):

1. The Question paper for each course contains two parts, Part – A and Part – B.
2. Part – A consists of **Short Answer Questions** (2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple Choice Questions are not allowed.
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CO-PO Mapping

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CO1	3	1	2	1	1	-	-	-	-	1	1
CO2	3	1	2	1	1	-	-	-	-	1	1
CO3	3	1	2	1	1	-	-	-	-	1	1
CO4	3	1	2	1	1	-	-	-	-	1	1
CO5	3	1	2	1	1	-	-	-	-	1	1

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Semester-III					
Digital System Design using Verilog **Category: IPCC**					
Course Code	:	**B25EC303**	CIE	:	50 Marks
Teaching Hour L : T : P : S	:	28:28:28:36	SEE	:	50 Marks
Total Hours/Semester	:	120	Total	:	100 Marks
Credits	:	4	SEE Duration	:	3 Hrs

Course Learning Objective is	
1.	To study the concepts of simplifying Boolean expression using K-map techniques and Quine-McCluskey minimization techniques.
2.	To study the concepts of designing and analyzing combinational logic circuits.
3.	To impart design methods and analysis of sequential logic circuits.
4.	To impart the concepts of Verilog HDL-data flow and behavioural models for the design of digital systems.
5.	To study the gate level modelling techniques using HDL.

Module – 1	**No. of Hours**
Principles of Combinational Logic: Principles of Combinational Logic: Definition of combinational logic, Canonical forms, Generation of switching equations from truth tables, Karnaugh maps- up to 4 variables, Quine-McCluskey Minimization Technique. Quine-McCluskey using Don't Care Terms.	12
Module – 2	**No. of Hours**
Logic Design with MSI Components and Programmable Logic Devices: Logic Design with MSI Components and Programmable Logic Devices: Binary Adders and Subtractors, Comparators, Decoders, Encoders, Multiplexers, Programmable Logic Devices (PLDs).	11
Module – 3	**No. of Hours**
Sequential Circuit Design: Flip-Flops and its Applications: The Master-Slave Flip-flops (Pulse-Triggered flip-flops): SR flip-flops, JK flip flops, Characteristic equations, Registers, Binary Ripple Counters, Synchronous Binary Counters, Counters based on Shift Registers, Design of Synchronous mod-n Counter using clocked T, JK, D and SR flip-flops.	11
Module– 4	**No. of Hours**
Introduction to Verilog & Data flow description: Introduction to Verilog Structure of Verilog module, Operators, Data Types, Styles of Description. **Verilog Data flow description:** Highlights of Data flow description, Structure of Data flow description.	11
Module– 5:	**No. ofHours**
Verilog Behavioral & Structural description: Verilog Behavioral description: Structure, Variable Assignment Statement, Sequential Statements, Loop Statements, Verilog Behavioral Description of Multiplexers. Verilog Structural description: Highlights of Structural description, Organization of structural description, Structural description of ripple carry adder.	11

LABORATORY

Sl. No	List of Experiments
1.	To simplify the given Boolean expressions and realize using Verilog program
2.	Write a Verilog program for the following combinational designs - Encoder, decoder, multiplexer, de-multiplexer, comparator(Any 3 program)
3.	Write a Verilog code to describe the functions of a Full Adder using three modeling styles.
4.	To realize the following Code converters using Verilog Behavioral description. Binary to Gray, Binary to Excess-3
5.	To realize 4-bit ALU using Verilog program.
6.	Develop the Verilog code for the following flip-flops, SR, D, JK and T.
7.	To realize Counters - up/down (BCD and Binary) using Verilog Behavioral description.
8.	Verilog Program to interface a Stepper motor to the FPGA/CPLD and rotate the motor in the specified direction (by N steps).
9.	Verilog programs to interface a Relay or ADC to the FPGA/CPLD and demonstrate its working.
10.	Verilog programs to interface DAC to the FPGA/CPLD for Waveform generation.
11.	Verilog programs to interface Switches and LEDs to the FPGA/CPLD and demonstrate its working.
12.	Verilog programs to interface for a 4x4 keypad matrix.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Analyse combinational logic and perform Boolean optimization through K-Map and Quine–McCluskey approaches.
CO2	Analyse and design for combinational logic circuits.
CO3	Analyze the concepts of Flip Flops (SR, D, T and JK) and to design the synchronous sequential circuits using Flip Flops.
CO4	Demonstrate knowledge of the basic syntax, structure, and elements of Verilog programming
CO5	Model Combinational circuits and sequential circuits using Verilog descriptions.

Text Books	
1.	Digital Principles and Design by Donald DGivone,McGrawHill, 2002.
2.	Digital Logic Applications and Design by John MYarbrough,Thomson Learning,2001.
3.	HDL Programming VHDL and Verilog by Nazeih M Botros, 2009 reprint, Dream techpress. Impression 2019.

Reference Books	
1.	Fundamentals of logic design, by Charles H Roth Jr., Cengage Learning
2.	Verilog HDL-A Guide to Digital Design and Synthesis IEEE 1364-2001 Compliant by Samir Palnitkar
3.	Fundamentals of HDL,by Cyril PR, Pearson/Sanguine2010

Web links and Video lectures (e-Resources)
1. https://www.youtube.com/playlist?list=PLwdnzlV3ogoVlY7iVqr-FhWUQEX7JDdiP
2. Digital Systems Design Using Verilog - Charles Roth, Lizy K. John, ByeongKil Lee - Google Books

ASSESSMENT STRUCTURE:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40 out of 100 marks.

CONTINUOUS INTERNAL EVALUATION (CIE):

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	Internal Assessment1	50	40 (Average of Best two Assessments)	50/2 = 25
	Internal Assessment2	50		
	Internal Assessment3	50		
AAT	Any One Assessment as per Regulations	20	10	
Laboratory	Lab Conduction & Record	Evaluating each expt. for 10 marks	10	25
	Internal Test	50	15	
SEE	Semester End Examination	100	50	50
Total Marks				100

SEMESTER END EXAMINATION (SEE):

1. The Question paper for each course contains two parts, Part – A and Part – B.
2. Part – A consists of **Short Answer Questions** (2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple Choice Questions are not allowed.
3. Part – B consists of 10 questions, two questions of 16 marks (with max. of 3 sub questions) from each module with internal choice. Students shall answer five full questions, selecting one full question from each module.
4. The laboratory component of the **integrated course** shall be CIE only. However, in SEE, the questions from the practical component shall be included.
5. The maximum marks from the practical component to be included in the SEE question paper is **16 marks.**
6. Question papers to be set as per the Blooms Taxonomy levels.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	3	1	3	-	-	-	-	1	1
CO2	3	1	3	1	3	-	-	-	-	1	1
CO3	3	1	3	1	3	-	-	-	-	1	1
CO4	2	1	2	1	3	-	-	-	-	1	1
CO5	2	1	2	1	3	-	-	-	-	1	1

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Semester-III					
Analog Electronics Circuits **Category: PCC**					
Course Code	:	**B25EC304**	CIE	:	50 Marks
Teaching Hours L : T : P : S	:	2 8: 28 : 0 : 34	SEE	:	50 Marks
Total Hours/Semester	:	90	Total	:	100 Marks
Credits		3	SEE Duration	:	3 Hrs

Course Learning Objective is	
1.	To study the analysis of BJT small signal amplifier circuits.
2.	To study the Design of FET Amplifiers and analyse the basic amplifier configurations using small signal equivalent circuit models.
3.	To study the Design of operational amplifiers circuits as Comparators, DAC and Mono-stable and Astable multi-vibrator circuits.
4.	To study the principle operation of Feedback and Oscillator circuits.
5.	To study the Analysis of Power amplifier circuits in different modes of operation.

Module – 1	**No. of Hrs**
BJT Small signal Analysis: Introduction, Voltage-Divider bias, CE emitter bias configuration, Emitter follower configuration, common base configuration, Approximate Hybrid Equivalent Circuit, Complete Hybrid Equivalent Model.	12
Module – 2	**No. of Hrs**
FET Biasing: Introduction, Fixed-Bias Configuration, Self-Bias Configuration, Voltage-Divider baising, FET small-signal Model, JEET- Fixed Configuration, JEET self-bias configuration, JEET Voltage-Divider configuration.	11
Module – 3	**No. of Hrs**
Op-amp Comparator and Converters: Basic comparator, zero crossing detector, Schmitt trigger, Analog-to-digital and Digital-to-analog data converters. **555 IC Timers**: Mono-stable multi-vibrator, Astable multi-vibrator operation. **Phase Locked Loops**: Operating Principles.	11
Module – 4	**No. of Hrs**
Feedback and Oscillator Circuits: Feedback concepts, feedback connection types, practical feedback circuits. **Oscillators:** operation, Phase shift oscillator, Wein bridge oscillator, Crystal oscillator.	11
Module – 5	**No. of Hrs**
Power Amplifiers: Introduction – definition and amplifier types, Series-Fed class A Amplifier, Transformer-coupled Class A Amplifier, \Class-B amplifier operation, circuits, Amplifier distortion, class C and D amplifiers.	11

Course Outcomes: At the end of the course, the students will be able to	
CO1	Analyse BJT small signal amplifier circuits.
CO2	Design FET VDB and self bias circuits.
CO3	Design operational amplifiers circuits as Comparators, DAC and Mono-stable and Astable multi-vibrator circuits.
CO4	Analyse Feedback and Oscillator circuits.
CO5	Analyse Power amplifier circuits in different modes of operation.

Text Books	
1.	Electronic Devices and Circuit, Boylestad & Nashelsky, 11thEdition, Pearson, January 2015.
2.	Op-amps and Linear Integrated Circuits, Ramakanth A Gayakwad, Fourth Edition, PHI

Reference Books	
1.	Integrated Electronics: Analog and Digital Circuits and Systems, Jacob Millman, Christos C. Halkias, McGraw-Hill, 2015.
2.	Microelectronic Circuits, Theory and Applications, Adel S Sedra, Kenneth C Smith, 6th Edition, Oxford, 2015.ISBN:978-0-19-808913-1

Web links and Video lectures (e-Resources)
1. https://youtu.be/faiEVOOCe-s?si=nfV7hqvTR6WfRcFw MOS transistor basics.
2. https://youtu.be/_gpEBYUnj6k?si=V5uAYVoN4DKZj0q8 MOSFET fabrication.

ASSESSMENT STRUCTURE:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40 out of 100 marks.

CONTINUOUS INTERNAL EVALUATION (CIE):

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	**Internal Assessment1**	**50**	**40 (Average of Best two Assessments)**	**50**
	Internal Assessment2	**50**		
	Internal Assessment3	**50**		
AAT	**Any Two Assessments as per regulations**	**20**	**10**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Grand Total				**100**

SEMESTER END EXAMINATION (SEE):

1. The Question paper for each course contains two parts, Part – A and Part – B.
2. Part – A consists of **Short Answer Questions** (2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple Choice Questions are not allowed.
3. Part – B consists of 10 questions, two questions of 16 marks (with max. of 3 sub questions) from each module with internal choice. Students shall answer five full questions, selecting one full question from each module.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	1	1	-	-	-	-	-	-	1
CO2	3	-	1	1	-	-	-	-	-	-	1
CO3	3	-	1	1	-	-	-	-	-	-	1
CO4	3	-	1	1	-	-	-	-	-	-	1
CO5	3	-	1	1	-	-	-	-	-	-	1

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Semester-III					
Python Application Programming **Category: PCC**					
Course Code	:	**B25EC305**	CIE	:	50 Marks
Teaching Hours L : T : P : S	:	42:0:0:48	SEE	:	50 Marks
Total Hours/Semester	:	90	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3Hrs

Course Learning Objective is	
1.	To learn the syntax and semantics of the Python programming language.
2.	To apply data structuring techniques using lists and tuples.
3.	To demonstrate the use of built-in functions to navigate the file system.
4.	To implement Object-Oriented Programming concepts in Python.
5.	To develop simple Python programs by integrating core concepts.

Module– 1	**No. of Hours**
Python Basics: Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program, Flow control: Boolean Values, Comparison Operators, Boolean Operators, Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules, Ending a Program Early with sys.exit(), Functions: def Statements with Parameters, Return Values and return Statements, The None Value, Keyword Arguments and print(), Local and Global Scope, The global Statement, Exception Handling, A Short Program: Guess the Number.	9
Module– 2	**No. of Hours**
Lists: The List Data Type, Working with Lists, Augmented Assignment Operators, Methods, Example Program: Magic 8 Ball with a List, List-like Types: Strings and Tuples, References, Dictionaries and Structuring Data: The Dictionary Data Type, Pretty Printing, Using Data Structures to Model Real-World Things.	9
Module– 3	**No. of Hours**
Manipulating Strings: Working with Strings, Useful String Methods, Project: Password Locker, Project: Adding Bullets to Wiki Markup Reading and Writing Files: Files and File Paths, The os.path Module, The File Reading/Writing Process, Saving Variables with the shelve Module, Saving Variables with the print.format() Function, Project: Generating Random Quiz Files, Project: Multiclipboard.	8
Module– 4	**No. of Hours**
Organizing Files: The shutil Module, Walking a Directory Tree, Compressing Files with the zipfile Module, Project: Renaming Files with American-Style Dates to European-Style Dates, Project: Backing Up a Folder into a ZIP File, Debugging: Raising Exceptions, Getting the Trace back as a String, Assertions, Logging, IDLE‟s Debugger.	8
Module– 5	**No. of Hours**
Classes and objects: Programmer-defined types, Attributes, Rectangles, Instances as return values, Objects are mutable, Copying, Classes and functions: Time, Pure functions, Modifiers, Prototyping versus planning, Classes and methods: Object-oriented features, Printing objects, Another example, A more complicated example, Theinit method, The __str__ method, Operator overloading, Type-based dispatch, Polymorphism, Interface and implementation.	8

Course Outcomes: At the end of the course, the students will be able to	
CO1	Demonstrate proficiency in using loops and creating functions.
CO2	Apply methods to create and manipulate lists, tuples, and dictionaries.
CO3	Use string operations and methods to process text and develop simple programs.
CO4	Implement file handling techniques to read, write, organize files, and perform basic debugging.
CO5	Interpret the concepts of Object-Oriented Programming in Python.

Text Books	
1.	Al Sweigart, "Automate the Boring Stuff with Python",1st Edition, No Starch Press, 2015.
2.	Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Green Tea Press, 2015.

Reference Text Books	
1.	Gowrishankar S, Veena A, "Introduction to Python Programming", 1st Edition, CRC Press/Taylor & Francis, 2018. ISBN-13: 978-0815394372

Web links and Video lectures (e-Resources)
1. https://www.learnbyexample.org/python/
2. https://www.learnpython.org/
3. https://pythontutor.com/visualize.html#mode=edit

ASSESSMENT STRUCTURE:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40 out of 100 marks.

CONTINUOUS INTERNAL EVALUATION (CIE):

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	**Internal Assessment1**	**50**	**40 (Average of Best two Assessments)**	**50**
	Internal Assessment2	**50**		
	Internal Assessment3	**50**		
AAT	**Any Two Assessments as per regulations**	**20**	**10**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Total Marks				**100**

SEMESTER END EXAMINATION (SEE):

1. The Question paper for each course contains two parts, Part – A and Part – B.
2. Part – A consists of **Short Answer Questions** (2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple Choice Questions are not allowed.
3. Part – B consists of 10 questions, two questions of 16 marks (with max. of 3 sub questions) from each module with internal choice. Students shall answer five full questions, selecting one full question from each module.

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	3	2	1	3	3	-	2	-	-	2
CO2	2	3	2	1	3	3	-	2	-	-	2
CO3	2	3	2	1	3	3	-	2	-	-	3
CO4	2	3	2	1	3	3	-	2	-	-	2
CO5	2	3	2	1	3	3	-	2	-	-	2

Level 3 - High, Level 2 – Moderate, Level 1 - Low

Semester-III					
Analog and Digital Systems Design Laboratory **Category: PCCL**					
Course Code	:	**B25ECL306**	CIE	:	50 Marks
Teaching Hours L : T : P : S	:	0 : 0 : 28 : 2	SEE	:	50 Marks
Total Hours/Semester	:	30	Total	:	100 Marks
Credits	:	1	SEE Duration	:	3 Hrs

Course Learning Objective is	
1.	To understand the electronic circuit schematic and its working.
2.	To realize and test amplifier and oscillator circuits for the given specifications.
3.	To realize the op-amp circuits for the applications such as DAC, implement mathematical functions and precision rectifiers.
4.	To study the operation of Mono-stable and Astable multi-vibrator circuits using 555 timer IC.
5.	To design and test the combinational and sequential logic circuits for their functionalities. To use the suitable ICs based on the specifications and functions.

Sl. No	**List of Experiments**
1.	Design and set-up BJT/FET i) Colpitts Oscillator, ii) Crystal Oscillator
2.	Design and set up the precision half wave and full wave rectifiers using op-amp.
3.	Design 4-bit R – 2R Op-Amp Digital to Analog Converter (i) for a 4-bit binary input using toggle switches (ii) by generating digital inputs using mod-16 counter.
4.	Design and implement (a) Half Adder & Full Adder using basic gates and NAND gates, (b) Half subtractor & Full subtractor using NAND gates, (c) 4-variable function using IC74151(8:1MUX).
5.	Realize (i) Binary to Gray code conversion & vice-versa (IC74139), (ii) BCD to Excess-3 code conversion and vice versa
6.	a) Realize using NAND Gates: i) Master-Slave JK Flip-Flop, ii) D Flip-Flop and iii) T Flip-Flop b) Realize the shift registers using IC7474/7495: (i) SISO (ii) SIPO (iii) PISO (iv) PIPO (v) Ring counter and (vi) Johnson counter.
7.	Realize a) Design Mod – N Synchronous Up Counter & Down Counter using 7476 JK Flip-flop b) Mod-N Counter using IC7490 / 7476 c) Synchronous counter using IC74192.
8.	Design and test the following using 555 timer i) Monostable MultiVibrator ii) Astable Multi-vibrator
9.	Design and Test the second order Active Filters and plot the frequency response, i) Low pass Filter ii) High pass Filter
10.	Design Class B push pull amplifier using BJT.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Design and analyze the BJT/FET amplifier and oscillator circuits.
CO2	Design and test Op-amp circuits to realize the mathematical computations, DAC and precision rectifiers.
CO3	Design and test the combinational logic circuits for the given specifications.
CO4	Analyze the sequential logic circuits for the given functionality.
CO5	Analyze and design a stable and mono-stable multi-vibrator circuits using IC 555 timer.

ASSESSMENT STRUCTURE FOR LABORATORY:

- The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying 50% weightage.
- For both CIE and SEE, the student is required to conduct Two experiments
- To qualify and become eligible to appear for SEE, in the CIE component, a student must secure a minimum of 40% of 50 marks, i.e., 20 marks.
- To pass the SEE component, a student must secure a minimum of 35% of 50 marks, i.e., 18 marks. A student is deemed to have successfully completed the course if the combined total of CIE and SEE is at least 40 out of 100 marks.

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Laboratory	**Lab Conduction & Record**	**Evaluate each expt. for 10 marks**	**15**	**50**
	Laboratory Test 1	**50**	**15**	
	Laboratory Test 2	**50**	**20**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Total Marks				**100**

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	1	1	1	3	-	-	1	-	1	1
CO2	2	1	1	1	3	-	-	1	-	1	1
CO3	2	1	1	1	3	-	-	1	-	1	1
CO4	2	1	1	1	3	-	-	1	-	1	1
CO5	2	1	1	1	3	-	-	1	-	1	1

Level 3 - High, Level 2 - Moderate, Level 1 – Low

Semester-III					
Python Application Programming Lab **Category: AEC**					
Course Code	:	**B25ECL307**	CIE	:	50 Marks
Teaching Hours L : T : P : S	:	0 : 0 : 28 : 2	SEE	:	50 Marks
Total Hours/Semester	:	30	Total	:	100 Marks
Credits	:	1	SEE Duration	:	3 Hrs

Course Learning Objective is	
1.	To learn the syntax and semantics of the Python programming language.
2.	To illustrate the process of structuring the data using lists, tuples.
3.	To demonstrate the use of built-in functions to navigate the file system.
4.	To learn the text file processing using dictionaries, perform word frequency analysis and apply sorting techniques.
5.	To understand object-oriented programming concepts by implementing classes, objects, and functions for performing arithmetic operations on complex numbers in Python.

Sl. No	**List of Experiments**
1.	Develop a program to read the student details like Name, USN, and Marks in three subjects. Display the student details, total marks and percentage with suitable messages.
2.	Develop a program to read the name and year of birth of a person. Display whether the person is a senior citizen or not.
3.	Develop a program to generate Fibonacci sequence of length (N). Read N from the console.
4.	Write a function to calculate factorial of a number. Develop a program to compute binomialcoefficient (Given N and R).
5.	Read N numbers from the console and create a list. Develop a program to print mean, variance and standard deviation with suitable messages.
6.	Read a multi-digit number (as chars) from the console. Develop a program to print the frequency of each digit with suitable message.
7.	Develop a program to print 10 most frequently appearing words in a text file. [Hint: Use dictionary with distinct words and their frequency of occurrences. Sort the dictionary in the reverse order of frequency and display dictionary slice of first 10 items]
8.	Develop a program to sort the contents of a text file and write the sorted contents into a separate text file. [Hint: Use string methods strip(), len(), list methods sort(), append(), and file methods open(), read lines (), and write()].
9.	Develop a program to backing Up a given Folder (Folder in a current working directory) into a ZIP File by using relevant modules and suitable methods.
10.	Write a function named DivExp which takes TWO parameters a, b and returns a value c (c=a/b). Write suitable assertion for a>0 in function DivExp and raise an exception for when b=0. Develop a suitable program which reads two values from the console and calls a function DivExp.
11.	Define a function which takes TWO objects representing complex numbers and returns new complex number with a addition of two complex numbers. Define a suitable class ‘Complex’ to represent the complex number. Develop a program to read N (N >=2) complex numbers and to compute the addition of N complex numbers.

12.	Develop a program that uses class Student which prompts the user to enter marks in three subjects and calculates total marks, percentage and displays the score card details. [Hint: Use list to store the marks in three subjects and total marks. Use __init__() method to initialize name, USN and the lists to store marks and total, Use get Marks() method to read marks into the list, and display() method to display the score card details.]

Course Outcomes: At the end of the course, the students will be able to	
CO1	Demonstrate proficiency in handling loops and creation of functions.
CO2	Develop Python programs to process text files using dictionaries, perform frequency analysis of words
CO3	Develop programs for string processing and file organization
CO4	Develop Python programs to perform file handling operations, manipulate and sort text data using string and list methods,
CO5	Demonstrate programs using classes and objects to manage student data, implement constructors and methods,

ASSESSMENT STRUCTURE FOR LABORATORY:

- The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying 50% weightage.
- For both CIE and SEE, the student is required to conduct Two experiments
- To qualify and become eligible to appear for SEE, in the CIE component, a student must secure a minimum of 40% of 50 marks, i.e., 20 marks.
- To pass the SEE component, a student must secure a minimum of 35% of 50 marks, i.e., 18 marks. A student is deemed to have successfully completed the course if the combined total of CIE and SEE is at least 40 out of 100 marks.

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Laboratory	Lab Conduction & Record	Evaluate each expt. for 10 marks	15	50
	Laboratory Test 1	50	15	
	Laboratory Test 2	50	20	
SEE	Semester End Examination	100	50	50
Total Marks				100

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	2	2	-	2	3	-	-	-	-	-	1
CO2	2	2	-	2	3	-	-	-	-	-	1
CO3	2	2	-	2	3	-	-	-	-	-	1
CO4	2	2	-	2	3	-	-	-	-	-	1
CO5	2	2	-	2	3	-	-	-	-	-	1

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Semester - IV					
Statistics, Linear Algebra and Complex variables **Category: ASC**					
Course Code	:	**B25MEC401**	CIE	:	50 Marks
Teaching Hours L : T : P : S	:	42:28:0:50	SEE	:	50 Marks
Total Hours/Semester	:	120	Total	:	100 Marks
Credits	:	4	SEE Duration	:	3 Hrs

Course Learning Objective is	
1	To compute the solution by applying the acquired knowledge of linear algebra to the problems of engineering applications.
2	To calculate and interpret correlation coefficients to determine the strength and direction of linear relationships between variables.
3	To develop mathematical model to integrate some non integrable functions using special theorems.
4	To perform complex variables and to apply in signal transformation.
5	To formulate a variational problem for a given geometric setting.

Module-1	**No. of Hours**
Linear Algebra – II: Inner Products, orthogonal matrices, orthogonal and orthonormal bases, Gram-Schmidt process, QR-factorization. Eigen values and Eigen vectors (recapitulation), diagonalization of a matrix (symmetric matrices) and singular value decomposition.	10
Module-2	**No. of Hours**
Curve fitting & Statistical methods: Curve Fitting, Curve fitting by the method of least squares-fitting the curves of the form: $y = ax + b, y = ax^2 + bx + c \text{ and } y = ax^b$. Statistical methods: Introduction to Moments, Skewness, Kurtosis and problems. Karl Pearson's coefficient of correlation and lines of regression, rank co-rrelation.	10
Module 3	**No. of Hours**
Complex Variable –I: Review of a function of a complex variable, limits, continuity, and differentiability. Analytic function and connected theorem and properties, Cauchy-Riemann equations in Cartesian and polar forms, Milne's Thomson method-problems. Transformations: Conformal transformations, discussion of transformations: $w = z^2$, $w = e^z$ and $w = z + (1/z)(z \neq 0)$ & bilinear transformations-problems.	10
Module-4	**No. of Hours**
Complex Variable –II: Complex line integral ,properties of Complex line integral, Cauchy's theorem ,consequences of cauchy's theorem, cauchy's integral formula, generalized cauchy's integral formula, Laurent's theorem-Laurent's series , singularity and Residue, formulae for the residue at the pole, Cauchy's Residue theorem (without proof) and problems.	10
Module-5	**No. of Hours**
Calculus of variations: Introduction to variation of functional, external of functional, Euler equation–special cases, problems. Geodesics, Hanging cable and Brachistochrone problems.	10

Course Outcomes: At the end of the course, the students will be able to	
CO1	Compute the solution by applying the acquired knowledge of linear algebra to the problems of engineering applications.
CO2	Make use of correlation and regression analysis to fit a suitable mathematical model for the statistical data.
CO3	Illustrate the fundamental concepts of multivariate statistics, complex analysis, partial differential equations and variational problems
CO4	Understand the concept of complex variables and their applications in signal transformation.
CO5	Apply the ideas of complex differentiation and integration for solving related problems through theoretical approach.

Text Books	
1.	**RonaldE. Walpole, Raymond HMyers, Sharon LMyers & KeyingYe,** "Probability & Statistics for Engineers & Scientists", Pearson Education, 9th edition, 2017.
2.	**PeterBruce, Andrew Bruce & Peter Gedeck,** "Practical Statistics for Data Scientists", O'Reilly Media, Inc., 2nd edition, **2020**.

Reference Books	
1.	**ErwinKreyszig**," Advanced Engineering Mathematics", John Wiley & Sons,9th Edition, 2006.
2.	**B.S.Grewal**" Higher Engineering Mathematics", Khanna publishers, 44th Ed., 2021.
3.	**GHaribaskaran** "Probability, Queuing Theory & Reliability Engineering", Laxmi Publication, Latest Edition, 2006

ASSESSMENT STRUCTURE:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40 out of 100 marks.

CONTINUOUS INTERNAL EVALUATION (CIE):

Component	**Type of Assessment**	**Max. Marks**	**Max. Marks Scaling Down to**	**Total Marks**
Theory	**Internal Assessment1**	**50**	**40 (Average of Best two Assessments)**	**50**
	Internal Assessment2	**50**		
	Internal Assessment3	**50**		
Self Learning	**Any Two Assessments as per regulations**	**10+10**	**10**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Grand Total				**100**

SEMESTER END EXAMINATION (SEE):

1. The Question paper for each course contains two parts, Part – A and Part – B.
2. Part – A consists of **Short Answer Questions** (2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple Choice Questions are not allowed.
3. Part – B consists of 10 questions, two questions of 16 marks (with max. of 3 sub questions) from each module with internal choice. Students shall answer five full questions, selecting one full question from each module.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	2	-	-	-	-	1	-	2
CO2	3	3	3	2	-	-	-	-	1	-	2
CO3	3	3	3	2	-	-	-	-	1	-	2
CO4	3	3	3	2	-	-	-	-	-	-	2
CO5	3	3	3	2	-	-	-	-	-	-	2

Level 3 - High, Level 2 - Moderate, Level 1 – Low

Semester-IV					
Electromagnetic Field Theory **Category: PCC** **(Common to ECE,EEE)**					
Course Code	:	**B25EC402**	CIE	:	50 Marks
Teaching Hours L : T : P : S	:	42:28:0:50	SEE	:	50 Marks
Total Hours/Semester	:	120	Total	:	100 Marks
Credits	:	4	SEE Duration	:	3 Hrs

Course Learning Objective is	
1.	To prepare students with fundamental knowledge of electrostatics.
2.	To introduce the concepts and laws related to static magnetic fields.
3.	To equip students with a basic foundation in Maxwell's Equations.
4.	To introduce the concept of Wave propagation in various mediums.

Module– 1	**No. of Hours**
Electrostatics: Introduction, Review of vector calculus, Coordinate systems. Coulomb's Law in Vector Form, Electric Field Intensity, Electric Flux Density.	14
Module– 2	**No. of Hours**
Electrostatics (Contd.): Gauss Law –Applications- Charge distributions-line, surface, volume. Divergence of a vector and Divergence theorem, Maxwell's First equation (Electrostatics)Energy expended or work done in moving a point charge in an Electric field, The line integral, Electric current – Current density – continuity equation for current.	14
Module– 3	**No. of Hours**
Magnetostatics: Poisson's and Laplace's equation, Examples of the solution of Laplace's equation, Steady Magnetic field, Biot-Savart's law, Ampere's Circuital law, Curl & Stokes Theorem, Magnetic flux, Magnetic flux density.	14
Module– 4	**No. of Hours**
Time Varying Field: Force On A Moving Charge, Force on differential current elements, Force between differential current elements, Numerical problems, Magnetic Boundary conditions, Numerical problem, Faraday's law, Displacement current, Limitations of Ampere's law, Maxwell's equations.	14
Module– 5	**No. of Hours**
Uniform Plane Wave: Uniform Plane Wave: Wave propagation in free space, Wave Propagation in Dielectric, Conducting Media, Poynting theorem and Wave power, Propagation in Good Conductors.	14

Course Outcomes: At the end of the course, the students will be able to	
CO1	Apply the concept of electrostatics to measure Electric Force, Field Intensity, Flux density, Total charge.
CO2	Understand the concepts of Laplace & Poisson's Equation, and the applications of Electrostatics.
CO3	Apply the concept of magneto-statics to measure Magnetic Force, Field Intensity, Flux density Vector magnetic Potential and Boundary conditions.
CO4	Apply Maxwell's Equations on Time varying field problems.
CO5	Assess the Wave propagation in various mediums.

Text Books	
1.	"Engineering Electromagnetics", William H HaytJr, J.A. Buck, 9thEdition, Tata McGraw Hill, 2006, Special Indian Edition 2014.
2.	'Principles of Electromagnetics", Matthew N. O. Sadiku, S. V. Kulkarni, 6thEdition, Oxford University Press, 2007, 6thImpression 2018.

Reference Books	
1.	"Electromagnetic waves and radiating systems", Edward C Jordan, Keith G Balmain,2nd Edition PHI, 2005.
2.	"Electromagnetics and Applications" John D. Kraus, 2nd Edition
3.	"Elements of Engineering Electromagnetics" NannapaneniNarayanaRao, 6th Edition, Pearson Education.
4.	"Principles of Electromagnetics", Sadiku and Kulkarni, 6th Edition Oxford University Press 2015.

Web links and Video lectures (e-Resources)
1. https://nptel.ac.in/courses/108106073/
2. http://qeee.in/coursepack/generate_books/generated_books/1975/

ASSESSMENT STRUCTURE:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40 out of 100 marks.

CONTINUOUS INTERNAL EVALUATION (CIE):

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	**Internal Assessment1**	**50**	**40 (Average of Best two Assessments)**	**50**
	Internal Assessment2	**50**		
	Internal Assessment3	**50**		
AAT	**Any Two Assessments as per regulations**	**20**	**10**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Total Marks				**100**

SEMESTER END EXAMINATION (SEE):

1. The Question paper for each course contains two parts, Part – A and Part – B.
2. Part – A consists of **Short Answer Questions** (2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple Choice Questions are not allowed.
3. Part – B consists of 10 questions, two questions of 16 marks (with max. of 3 sub questions) from each module with internal choice. Students shall answer five full questions, selecting one full question from each module.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	1	2	1	-	-	-	-	1	1
CO2	3	1	1	2	1	-	-	-	-	1	1
CO3	3	1	1	2	1	-	-	-	-	1	1
CO4	3	1	1	2	1	-	-	-	-	1	1
CO5	3	1	1	2	1	-	-	-	-	1	1

Level-1-High, Level-2-Moderate, Level-3-Low

Semester-IV					
Control Engineering **Category: IPCC**					
Course Code	:	**B25EC403**	CIE	:	50 Marks
Teaching Hours L : T : P : S	:	28:28:28:36	SEE	:	50 Marks
Total Hours/Semester	:	120	Total	:	100 Marks
Credits	:	4	SEE Duration	:	3 Hrs

Course Learning Objective is	
1.	To understand basics of control systems and design mathematical models.
2.	To understand the techniques of block diagram reduction and Signal Flow Graph.
3.	To understand time domain and frequency domain analysis.
4.	To analyse the stability of a system from the transfer function.
5.	To study about the state space model of the system.

Module – 1	**No. of Hours**
Introduction to Control Systems: Types of Control Systems, Effect of Feedback Systems, Differential equation of Physical Systems -Mechanical Systems, Electrical Systems, Analogous Systems.	12
Module – 2	**No. of Hours**
Block diagrams and signal flow graphs: Transfer functions, Block diagram algebra and Signal Flow graphs.	11
Module – 3	**No. of Hours**
Time Response of feedback control systems: Standard test signals, Unit step response of First and Second order Systems. Time response specifications, Time response specifications of second order systems, steady state errors and error constants. Introduction to PI, PD and PID Controllers (excluding design).	11
Module – 4	**No. of Hours**
Stability analysis and Root Locus Techniques: Concepts of stability, Necessary conditions for Stability, Routh stability criterion, Relative stability analysis: more on the Routh stability criterion. The root locus concepts, Construction of root loci.	11
Module – 5	**No. of Hours**
Frequency domain analysis and stability: Correlation between time and frequency response, Bode Plots, Experimental determination of transfer function. Mathematical preliminaries, Nyquist Stability criterion, (Stability criteria related to polar plots are excluded) **State Variable Analysis:** Introduction to state variable analysis: Concepts of state, state variable and state models. State model for Linear continuous –Time systems, solution of state equations.	11

LABORATORY	
SI. No.	**List of Experiments**
1	Implement Block diagram reduction technique to obtain transfer function a control system.
2	Implement Signal Flow graph to obtain transfer function a control system.
3	Simulation of poles and zeros of a transfer function.
4	Implement time response specification of a second order Under damped System, for different damping factors.
5	Implement frequency response of a second order System.
6	Implement frequency response of a lead lag compensator.

7	Analyze the stability of the given system using Routh stability criterion.
8	Analyze the stability of the given system using Root locus.
9	Analyze the stability of the given system using Bode plots.
10	Analyze the stability of the given system using Nyquist plot.
11	Obtain the time response from state model of a system.
12	Implement PI and PD Controllers.
13	Implement Block diagram reduction technique to obtain transfer function a control system.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Deduce transfer function of a given physical system, from differential equation representation or Block Diagram representation and SFG representation.
CO2	Calculate time response specifications and analyse the stability of the system.
CO3	Draw and analyse the effect of gain on system behaviour using root loci.
CO4	Perform frequency response Analysis and find the stability of the system.
CO5	Represent State model of the system and find the time response of the system.

Text Book	
1.	Control Systems Engineering, I J Nagrath, M. Gopal, New age international Publishers, 5th edition.

Reference book	
1.	Modern control engineering, Katsuhiko Ogata, Person publishers, 5th edition
2.	Automatic control system, Benjamin. C. Kuo, FaridGolnaraghi, Wiley publishers, 8th Edition

Web links and Video lectures (e-Resources)
• https://nptel.ac.in/courses/108106098

ASSESSMENT STRUCTURE:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40 out of 100 marks.

CONTINUOUS INTERNAL EVALUATION (CIE):

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	**Internal Assessment1**	**50**	**40 (Average of Best two Assessments)**	**50/2 = 25**
	Internal Assessment2	**50**		
	Internal Assessment3	**50**		
AAT	**Any One Assessment as per Regulations**	**10+10**	**10**	
Laboratory	**Lab Conduction & Record**	**Evaluating each expt. for 10 marks**	**10**	**25**
	Lab Internal Test	**50**	**15**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Total Marks				**100**

SEMESTER END EXAMINATION (SEE):

1. The Question paper for each course contains two parts, Part – A and Part – B.
2. Part – A consists of **Short Answer Questions** (2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple Choice Questions are not allowed.
3. Part – B consists of 10 questions, two questions of 16 marks (with max. of 3 sub questions) from each module with internal choice. Students shall answer five full questions, selecting one full question from each module.
4. The laboratory component of the **integrated course** shall be CIE only. However, in SEE, the questions from the practical component shall be included.
5. The maximum marks from the practical component to be included in the SEE question paper is **16 marks.**
6. Question papers to be set as per the Blooms Taxonomy levels

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	2	-	1	-	-	-	-	1	1
CO2	3	-	2	-	1	-	-	-	-	1	1
CO3	3	-	2	-	1	-	-	-	-	1	1
CO4	3	-	2	-	1	-	-	-	-	1	1
CO5	3	-	2	-	1	-	-	-	-	1	1

Level 3 - High, Level 2 - Moderate, Level 1 – Low

Semester-IV					
Principles of Communication Systems **Category: PCC**					
Course Code	:	**B25EC404**	CIE	:	50 Marks
Teaching Hours L : T : P : S	:	28:28:0:34	SEE	:	50 Marks
Total Hours/Semester	:	90	Total	:	100 Marks
Credits	:	3	SEE Duration	:	3 Hrs

Course Learning Objective is	
1.	To understand and analyze concepts of analog Modulation schemes viz; AM, FM.
2.	To design and analyze the electronic circuits for AM and FM modulation and demodulation.
3.	To evolve the concept of SNR in the presence of channel induced noise and Receiver Performance of Modulation Techniques.
4.	To understand and Apply the concepts of digitization of signals.
5.	To design and evaluate the baseband transmission of PAM signals.

Module – 1	**No. of Hours**
Amplitude Modulation: Introduction, Amplitude Modulation: Time & Frequency Domain description, Switching modulator, Envelop detector. **Double Side Band-Suppressed Carrier modulation:** Time and Frequency Domain description, Ring modulator, Coherent detection, Costas Receiver, Quadrature Carrier Multiplexing. **Single Side-Band and Vestigial Sideband Methods of Modulation:** SSB Modulation, VSB Modulation, Frequency Translation, Frequency- Division Multiplexing, Theme Example: VSB Transmission of Analog and Digital Television.	12
Module – 2	**No .of Hours**
Angle Modulation: Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing, Phase-Locked Loop: Nonlinear model of PLL, Linear model of PLL, Nonlinear Effects in FM Systems. The Super-heterodyne Receiver	11
Module – 3	**No. of Hours**
Noise- Shot Noise, Thermal noise, White Noise, Noise Equivalent Bandwidth **Noise inanalog Modulation:** Introduction, Receiver Model, Noise in DSB-SC receivers. Noise in AM receivers, Threshold effect, Noise in FM receivers, Capture effect, FM threshold effect, FM threshold reduction, Pre-emphasis and De-emphasis in FM.	11
Module – 4	**No. of Hours**
Sampling and Quantization: Introduction, Why Digitize Analog Sources? The Low pass Sampling process Pulse Amplitude Modulation. Time Division Multiplexing, Pulse-Position Modulation, Generation of PPM Waves, Detection of PPM Waves. The Quantization Process, Quantization Noise.	11
Module – 5	**No. of Hours**
Pulse-Code Modulation: Sampling, Quantization, Encoding, Regeneration, Decoding. **Baseband Transmission of Digital signals:** Introduction, Intersymbol Interference, Eye Pattern, Nyquistcriterion for distortionless Transmission, Baseband M-ary PAM Transmission.	11

Course Outcomes: At the end of the course, the students will be able to	
CO1	Analyze the principles and performance of analog modulation techniques such as Amplitude Modulation (AM) and Frequency Modulation (FM).
CO2	Design and evaluate modulation and demodulation circuits for AM and FM systems using appropriate electronic components.
CO3	Assess the effect of channel-induced noise on signal quality and evaluate receiver performance using Signal-to-Noise Ratio (SNR) metrics for various analog modulation schemes.
CO4	Apply the concepts of signal sampling, quantization, and encoding in the digitization of analog signals.
CO5	Design and analyze baseband transmission systems using Pulse Amplitude Modulation (PAM), and evaluate

	their performance under ideal and noisy conditions.

Text Books	
1.	"Communication Systems", Simon Haykin&Moher, 5th Edition, John Wiley, India Pvt. Ltd, 2010, ISBN 978-81-265-2151
2.	"Modem Digital and Analog Communication Systems", B. P. Lathi, Oxford University Press, 4th edition

Reference Books	
1.	An Introduction to Analog and Digital Communication, Simon Haykin, John Wiley India Pvt. Ltd., 2008, ISBN 978-81-265-3653-5
2.	Principles of Communication Systems, H.Taub&D.L.Schilling, TMH, 2011.
3.	Communication Systems, Harold P.E, SamyA. Mahmoud, Lee Elliott Stern, Pearson Edition, 2004.

Web links and Video lectures (e-Resources)
1. **https://nptel.ac.in/courses/108104091**
2. **https://nptel.ac.in/courses/117102059**

ASSESSMENT STRUCTURE:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40 out of 100 marks.

CONTINUOUS INTERNAL EVALUATION (CIE):

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	**Internal Assessment1**	**50**	**40 (Average of Best two Assessments)**	**50**
	Internal Assessment2	**50**		
	Internal Assessment3	**50**		
AAT	**Any Two Assessments as per regulations**	**20**	**10**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Total Marks				**100**

SEMESTER END EXAMINATION (SEE):

1. The Question paper for each course contains two parts, Part – A and Part – B.
2. Part – A consists of **Short Answer Questions** (2 Marks/1 mark) for 20 marks covering the complete syllabus and it is compulsory. Multiple Choice Questions are allowed.
3. Part – B consists of 10 questions, two questions of 16 marks (with max. of 3 sub questions) from each module with internal choice. Students shall answer five full questions, selecting one full question from each module.

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	1	1	3	-	-	-	-	1	1
CO2	2	1	1	1	3	-	-	-	-	1	1
CO3	2	1	1	1	2	-	-	-	-	1	1
CO4	2	1	1	1	2	-	-	-	-	1	1
CO5	2	1	1	1	2	-	-	-	-	1	1

Level 3 - High, Level 2 - Moderate, Level 1 – Low

Semester-IV					
Analog Communication Lab **Category: PCCL**					
Course Code	:	**B25ECL406**	CIE	:	50 Marks
Teaching Hours L : T : P : S	:	0 : 0 : 28 : 2	SEE	:	50 Marks
Total Hours /Semester	:	30	Total	:	100 Marks
Credits	:	1	SEE Duration	:	3 Hrs

Course Learning Objective is	
1.	To understand the fundamental principles of analog communication systems, including concepts like amplitude modulation (AM), frequency modulation (FM), and phase modulation (PM).
2.	To design and test analog modulator and demodulator circuits, and to evaluate their performance in transmitting and receiving information.
3.	To design and implement analog pulse modulation such as PAM, PPM, PWM techniques.
4.	To demonstrate Multiplexing techniques like Time Division Multiplexing (TDM) in analog communication systems.
5.	To analyze the combination of multiple signals in Communication channels.

Sl. No	**List of Experiments**
1.	Amplitude Modulation and Demodulation of Standard AM
2.	Generation & Detection of DSBSC (LM741 and LF398 ICs can be used)
3.	Frequency Modulation using VCO and PLL FM Demodulation
4.	Pulse sampling, flat top sampling and reconstruction
5.	Pulse Amplitude Modulation and Demodulation
6.	Time Division Multiplexing and De-multiplexing of two band limited signals.
7.	Pre-Emphasis And De-Emphasis Circuits
8.	Design And Test BJT Mixer
9.	Pulse Width Modulation
10.	Pulse Position Modulation
11.	PLL Frequency Synthesizer
12.	Generation & Detection of PCM

Course Outcomes: At the end of the course, the students will be able to	
CO1	Demonstrate a strong understanding of the fundamental principles behind analog communication systems, modulation techniques like AM, FM, and PM.
CO2	Design and build analog modulator and demodulator circuits for AM, FM, and PM communication systems.
CO3	Acquire the skills to design and implement pulse modulation techniques like PAM, PPM, and PWM.
CO4	Demonstrate an understanding of multiplexing techniques, specifically Time Division Multiplexing (TDM), and its application in analog communication systems.
CO5	Apply their knowledge to efficiently combine multiple analog signals for transmission over shared communication channels.

ASSESSMENT STRUCTURE FOR LABORATORY:

- The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying 50% weightage.
- For both CIE and SEE, the student is required to conduct Two experiments
- To qualify and become eligible to appear for SEE, in the CIE component, a student must secure a minimum of 40% of 50 marks, i.e., 20 marks.
- To pass the SEE component, a student must secure a minimum of 35% of 50 marks, i.e., 18 marks. A student is deemed to have successfully completed the course if the combined total of CIE and SEE is at least 40 out of 100 marks.

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Laboratory	**Lab Conduction & Record**	**Evaluate each expt. for 10 marks.**	**15**	**50**
	Laboratory Test 1	**50**	**15**	
	Laboratory Test 2	**50**	**20**	
SEE	**Semester End Examination**	**100**	**50**	**50**
Total Marks				**100**

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	1	1	3	2	-	-	-	1	2	1
CO2	3	1	1	3	2	-	-	-	1	2	1
CO3	3	1	1	3	2	-	-	-	1	2	1
CO4	3	1	1	3	2	-	-	-	1	2	1
CO5	3	1	1	3	2	-	-	-	1	2	1

Level 3 - High, Level 2 - Moderate, Level 1 – Low

Semester-IV					
LabVIEW Programming **Category: AEC**					
Course Code	:	**B25ECL407**	CIE	:	50 Marks
Teaching Hours L : T : P : S	:	0 : 0 : 28 : 2	SEE	:	50 Marks
Total Hours/Semester	:	30	Total	:	100 Marks
Credits	:	1	SEE Duration	:	3 Hrs

Course Learning Objective is	
1.	To understanding Virtual Instrument concepts and data acquisition operation.
2.	To creating Virtual Instruments for practical works.
3.	To study the development of voltmeter using DAQ cards – Acquiring a voltage.

Sl. No	**List of Experiments**
1.	Basic arithmetic & logical operations
2.	Sum/Factorial of ‘n’ numbers using ‘for’ loop
3.	Build a Virtual Instrument that simulates a Water Level Detector.
4.	Programming exercises for loops in virtual instrumentation-Continuous Monitoring of Temperature.
5.	Programming exercises for graphs- Display Random Number into 3 different CHARTS (STRIP, SLOPE, SWEEP) and understand the difference between these in the UI. 4
6.	Programming Exercises on case and sequence structures:-Design the simple Calculator, making use of the inherent GUI present in the virtual instrumentation software.
7.	Programming Exercises on Arrays– Take a 2Darray input from the user and perform various array(and matrix) manipulations on it
8.	Programming Exercises on File Input output System – Read and write from ASCII and TDMS file
9.	Real time temperature acquisition and continuous monitoring using Virtual Instrumentation
INTERFACING	
10.	Developing voltmeter using DAQ cards – Acquiring a voltage and displaying it on a ‘meter’ indicator on the UI, thus designing a voltmeter
11.	Developing Signal Generator using DAQ Card – Using analog output; amplitude, shape and frequency controlled by user
12.	Develop Real time Temperature control using Thermistor

Course Outcomes: At the end of the course, the students will be able to	
CO1	create data acquisition, analysis and display operations using LabVIEW
CO2	Create user interfaces with charts, graph and buttons
CO3	Develop the programming structures and data types that exist in LabVIEW
CO4	Develop signal generator using DAQ cards.
CO5	Analyze real time temperature acquisition system.

ASSESSMENT STRUCTURE FOR LABORATORY:

- The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying 50% weightage.
- For both CIE and SEE, the student is required to conduct Two experiments
- To qualify and become eligible to appear for SEE, in the CIE component, a student must secure a minimum of 40% of 50 marks, i.e., 20 marks.
- To pass the SEE component, a student must secure a minimum of 35% of 50 marks, i.e., 18 marks. A student is deemed to have successfully completed the course if the combined total of CIE and SEE is at least 40 out of 100 marks.

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Laboratory	Lab Conduction & Record	Evaluate each expt. for 10 marks	15	50
	Laboratory Test 1	50	15	
	Laboratory Test 2	50	20	
SEE	Semester End Examination	100	50	50
Total Marks				100

CO-PO Mapping

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

Level 3 - High, Level 2 - Moderate, Level 1 – Low

Semester-III					
Community Project / Societal Project (Project Based Learning) **Category: SDC**					
Course Code	:	**B25ECP308**	CIE	:	50 Marks
Teaching Hours L : T : P : S	:	0:0:0:30	SEE	:	50 Marks
Total Hours/Semester	:	30	Total	:	100 Marks
Credits	:	1	SEE Duration	:	3 Hrs

Course Learning Objective is

Rapid urbanization, population growth, environmental concerns, energy demand, water scarcity, waste management, transportation issues and rural development challenges have created practical problems affecting communities and public welfare. This course aims to integrate technical knowledge, field exposure and societal engagement so that students identify real community issues, frame problem statements and attempt appropriate, feasible and sustainable engineering responses within the scope of a one-semester project.

Course outcome (Course Skill Set): At the end of the course, the student will be able to:

1. Identify and analyse societal problems through field interaction and technical assessment.
2. Develop skills in **project planning, field survey, data collection, implementation**, documentation and reporting.
3. Formulate feasible engineering problem statements and solutions considering practical constraints and sustainability aspects.
4. Apply principles of environmental responsibility, ethics and societal welfare in engineering practice through community-oriented interventions.
5. Exhibit multidisciplinary learning and problem-solving ability based on collected data, user feedback and baseline conditions.
6. Demonstrate teamwork and communication skills while interacting with technical and non-technical stakeholders and reflect on project impact on society.

Sustainable Development Goals: The faculty shall encourage students to undertake community projects that align with and contribute towards satisfying the National Board of Accreditation (NBA) Criterion 3.6, namely, Evidence of Addressing Sustainable Development Goals (SDGs), which is a major emphasis of the United Nations (UN).

Methods for project identification:

Students may identify the project topic using one or more of the following methods:

• Interaction with local rural or urban stakeholders such as local leaders, corporation/municipality personnel, NGOs, panchayat representatives, etc.

• Review of issues highlighted in print and electronic media, and social networks (WhatsApp, Facebook, X, Instagram, etc.).

• After selecting a broad topic, students shall collect data, conduct a feasibility survey, estimate timelines and resources, approximate expenditure, and then define the problem statement and objectives clearly.

List of Project Topics and Engineering Outcomes:

The following structured sequence of activities is to be carried out during the semester:

Sl. No.	Project title	Measurable engineering outcome	Mapped POs	SDGs
1	Rural and urban water conservation and management systems	Prepare a site-specific water-saving plan, estimate water demand–supply gap, and propose a feasible conservation intervention with quantified savings.	PO1, PO2, PO3, PO4, PO10, PO11	SDG 6, SDG 11, SDG 12
2	Waste management and recycling	Conduct waste audit, classify waste streams, and design a segregation/recycling workflow with measurable reduction in mixed waste.	PO2, PO3, PO4, PO6, PO8, PO10	SDG 11, SDG 12, SDG 13
3	Afforestation	Identify a degraded area, prepare plantation layout, and demonstrate survival-rate tracking and maintenance schedule for saplings.	PO2, PO3, PO4, PO6, PO7, PO11	SDG 11, SDG 13, SDG 15
4	Biogas generation and power generation	Estimate organic waste availability, size a small biogas system, and document expected gas output or energy yield.	PO1, PO2, PO3, PO4, PO5, PO10	SDG 7, SDG 11, SDG 12
5	DPR for solar power rural plant	Prepare a DPR with load assessment, panel sizing, cost estimate, and projected energy	PO1, PO2, PO3, PO4,	SDG 7, SDG 9,

		generation and payback.	PO5, PO10	SDG 11
6	DPR for electrification of village/tribal community	Map unserved/underserved households, propose electrification layout, and estimate coverage, losses, and implementation cost.	PO1, PO2, PO3, PO4, PO10, PO11	SDG 7, SDG 9, SDG 10
7	DPR for rural drainage system	Survey drainage bottlenecks, develop a drainage layout, and estimate runoff handling capacity and flood-risk reduction	PO1, PO2, PO3, PO4, PO6, PO10	SDG 6, SDG 9, SDG 11
8	Sustainability and environmental health projects	Assess local environmental health issues and propose interventions with measurable improvement in hygiene, safety, or resource use.	PO2, PO3, PO4, PO6, PO7, PO8	SDG 3, SDG 6, SDG 11, SDG 12
9	Plastic free campaigns	Measure plastic usage before and after awareness intervention and report percentage reduction or behavioural change.	PO2, PO3, PO6, PO7, PO8, PO10	SDG 11, SDG 12, SDG 13
10	Health and nutrition awareness	Conduct baseline and post-program awareness survey and document improvement in awareness score or adoption of healthier practices.	PO2, PO6, PO7, PO8, PO9, PO10	SDG 2, SDG 3, SDG 11
11	Societal projects involving health wellness	Identify a community health need and develop an awareness/service module with measurable participation and feedback outcomes.	PO2, PO3, PO6, PO8, PO9, PO10	SDG 3, SDG 11, SDG 17
12	Air quality monitoring system	Collect air-quality data, compare with reference limits, and present trends along with possible mitigation suggestions.	PO2, PO3, PO4, PO5, PO6, PO10	SDG 3, SDG 11, SDG 13
13	Plastic waste reduction campaign	Track collection, segregation, and replacement actions, and quantify reduction in plastic waste generation or littering.	PO2, PO3, PO6, PO7, PO8, PO10	SDG 11, SDG 12, SDG 13
14	Urban greening projects	Prepare greening plan, identify planting locations, and assess environmental benefits such as shade, aesthetics, or heat mitigation.	PO2, PO3, PO4, PO6, PO7, PO11	SDG 11, SDG 13, SDG 15
15	Smart agriculture solution	Design a low-cost monitoring or irrigation support solution and estimate improvement in water use efficiency or crop support.	PO1, PO2, PO3, PO4, PO5, PO10	SDG 2, SDG 6, SDG 9
16	Smart irrigation system	Estimate crop water requirement, propose control logic, and quantify water savings compared with conventional irrigation.	PO1, PO2, PO3, PO4, PO5, PO10	SDG 2, SDG 6, SDG 12
17	Food security initiatives / cold storage system	Estimate storage need, design a simple cold-chain concept, and document reduction in spoilage or wastage.	PO1, PO2, PO3, PO4, PO5, PO10	SDG 2, SDG 9, SDG 12
18	Human rights awareness with legal systems	Prepare and deliver an awareness module and assess increase in legal awareness and access-to-rights understanding.	PO6, PO7, PO8, PO9, PO10	SDG 5, SDG 10, SDG 16
19	Use of application / application program	Build or demonstrate a useful community app and measure usability, adoption, or efficiency improvement.	PO1, PO3, PO4, PO5, PO9, PO10	SDG 9, SDG 11, SDG 17
20	House tax collection through digital media	Develop a simple digital workflow or awareness support and measure improvement in compliance, convenience, or response time.	PO2, PO3, PO4, PO5, PO10, PO11	SDG 9, SDG 11, SDG 16

Suggested Learning Resources: Textbooks:

1. Phadke, N. D. Community Engagement and Social Innovation. 1st ed., Oxford University Press, New Delhi.
2. Garg, N. R. Project-Based Learning in Engineering Education. 1st ed., Pearson India Education Services, Noida.
3. Gupta, A. and P. Singh. Service Learning and Community Projects. 1st ed., McGraw-Hill Education (India), New Delhi.
4. Wilson, G. Practical Guide to Community Development Projects. 2nd ed., Routledge, London.

Reference books:

1. NPTEL courses on Project-Based Learning and Social Innovation.

2. SWAYAM courses on community engagement and sustainability.
3. UN Sustainable Development Goals portal: https://sdgs.un.org
4. MyGov India and local civic body portals for community initiatives.
5. YouTube resources on design thinking, social innovation, and community service learning.
6. NGO and government field-action case studies related to sanitation, water, health, education, and environment.

Web links and Video Lectures (e-Resources):
• NPTEL courses on Engineering Geology (IIT Roorkee, IIT Kharagpur).
• NPTEL courses on Soil Mechanics and Foundation Engineering (IIT Delhi, IIT Bombay).
• Virtual Labs – Geotechnical Engineering Virtual Lab (IIT Kanpur): https://vlab.co.in • Geological Survey of India (GSI) – Maps, reports, and publications: https://www.gsi.gov.in
• YouTube channels: Civil Engineering Essentials, The Engineering Classroom (soil mechanics experiments).
• American Society of Civil Engineers (ASCE) – Geotechnical resources and standards

Teaching Learning Process: The suggested TLP for Community / Societal Project is as follows;

Week	Teaching–Learning Activity	Faculty Role	Student Activity	Output
1	Course introduction, objectives, ethics, conduct, and assessment briefing	Explain course scope, rules, rubrics, and expected deliverables	Understand course requirements and form teams	Team list, course plan
2	Community problem identification and topic selection	Guide topic framing and feasibility	Identify local issues through discussion and observation	Shortlisted project topic
3	Stakeholder interaction and preliminary survey	Demonstrate survey methods and stakeholder engagement	Collect initial data from community/users	Survey notes, interview record
4	Problem statement and objectiveformulation	Review and refine problem statement	Prepare problem statement, scope, andobjectives	Approved problem statement
5	Literature/case study review and baseline analysis	Suggest relevant references and examples	Study existing solutions and compare approaches	Baseline analysis summary
6	Project planning and role assignment	Help teams organize tasks, timeline, and responsibilities	Plan activities, divide roles, and prepare schedule	Work plan / Gantt chart
7	Feasibility analysis and solution brainstorming	Check technical feasibility and practicality	Generate possible engineering solutions	Solution alternatives sheet
8	Selection of final solution and design approach	Review final concept and design logic	Finalize concept, methods, and expected outcome	Concept note / design outline
9	Data processing / calculations / sizing / mapping	Support computations and technical review	Analyze data, perform calculations, prepare maps/charts	Technical analysis sheet
10	Prototype / model / audit / DPR / app development	Monitor progress and correct technical issues	Develop the selected output	Working model / draft DPR / map / app
11	Testing, refinement, and implementation planning	Evaluate technical correctness and improvements	Test prototype or validate proposal with users	Test results / revised output
12	Field implementation / demonstration / awareness activity	Facilitate community interaction and documentation	Conduct implementation or demonstration	Photos, attendance, implementation record
13	Documentation of outcomes, feedback, and impact	Review report structure and completeness	Compile findings, stakeholder feedback, and observations	Draft report
14	Presentation preparation and viva practice	Conduct mock presentation and feedback	Prepare slides/poster and rehearse	Presentation deck

15	Final presentation, submission, and reflection	Evaluate performance using rubrics	Present project, submit report, reflect on learning	Final report, presentation, viva

ASSESSMENT STRUCTURE:

A. Continuous Internal Evaluation (CIE) – 50 marks

• Students, in batches of 3–4, shall undertake at least one project (or a combination of two related activities) aiming, as far as possible, at a logical implemented or implementable outcome.

• CIE will be conducted by a departmental committee (HoD/nominee, guide and one senior faculty) using the following rubrics totalling 50 marks:

CIE pass requirement:

• A student shall secure a minimum of 20 marks out of 50 in CIE to become eligible to appear for SEE.

• Students who fail to earn the required CIE marks may be given additional opportunities before closure of the semester; no re-doing of CIE is permitted after the end of the semester.

B. Semester End Examination (SEE)

• Examination duration: 3 hours.

• Maximum examination marks: 100

• The SEE shall be conducted batch-wise by a committee of three faculties: project guide, one faculty from the same department and one from a different department.

SEE pass requirement and overall passing rule:

• For a pass in SEE, a student shall secure minimum 35 marks out of 100.

• For declaration of a pass grade, the sum of CIE marks (out of 50) and scaled SEE marks (out of 50) shall be ≥ 40; otherwise, the student is awarded grade F (Fail).

CIE Rubric — Continuous Internal Evaluation (Total 50 marks):

Criterion	Weight (marks)	Excellent (Full marks)	Good	Fair	Needs Improvement
Problem identification & Relevance to society/industry /community	**8**	Problem is clearly identified with strong evidence of societal relevance and well-defined scope.	Problem is relevant and scope is clear with adequate supporting evidence.	Problem defined but justification or evidence is weak.	Problem unclear or not relevant; little/no supporting evidence.
Formation of problem statement; Engineering approach, innovation & feasibility	**10**	Problem statement is precise; approach is sound, innovative and clearly feasible.	Problem statement adequate; approach feasible with minor gaps.	Problem statement partial; approach feasibility is marginal.	Problem statement missing or approach not feasible.
Interaction with stakeholders; Data collection, analysis & interpretation	**8**	Thorough stakeholder engagement; data collection is comprehensive; analysis is well interpreted.	Good engagement; data and analysis adequate with minor gaps.	Limited engagement; data incomplete and analysis superficial.	Little/no stakeholder contact; insufficient or no data/ analysis.
Project documentation; Clarity, organization & problem solving demonstrated	**10**	Documentation is complete, well organized, analytical, and shows strong problem-solving.	Documentation complete and clear with some analytical content.	Documentation basic with omissions; problem-solving limited.	Documentation missing/poorly organized; no clear problem-solving

Communication & Presentation skills	**6**	Presentation is confident, structured, and answers queries fully; visuals effective.	Presentation clear and satisfactory; responds to most queries.	Presentation acceptable but lacks clarity or confidence; weak responses	Presentation poor or absent; unable to respond.
Contribution & Benefit to society (impact, sustainability)	**8**	Clear, demonstrable societal benefit and sustainability; realistic path to implementation.	Benefit plausible; sustainability considered with minor gaps.	Limited or unclear societal benefit; sustainability not well addressed.	No evident benefit or sustainability; project not community-oriented.

SEE Rubric — Semester End Examination (Enter marks out of 100; scaled to 50 later):

Criterion	Weight (marks)	Excellent (Full marks)	Good	Fair	Needs Improvement
Problem identification & Relevance to society/industry /community	**16**	Problem is clearly identified with strong evidence of societal relevance and well-defined scope.	Problem is relevant and scope is clear with adequate supporting evidence.	Problem defined but justification or evidence is weak.	Problem unclear or not relevant; little/no supporting evidence.
Formation of problem statement; Engineering approach, innovation & feasibility	**20**	Problem statement is precise; approach is sound, innovative and clearly feasible.	Problem statement adequate; approach feasible with minor gaps.	Problem statement partial; approach feasibility is marginal.	Problem statement missing or approach not feasible.
Interaction with stakeholders; Data collection, analysis & interpretation	**16**	Thorough stakeholder engagement; data collection is comprehensive; analysis is well interpreted.	Good engagement; data and analysis adequate with minor gaps.	Limited engagement; data incomplete and analysis superficial.	Little/no stakeholder contact; insufficient or no data/ analysis.
Project documentation; Clarity, organization & problem solving demonstrated	**20**	Documentation is complete, well organized, analytical, and shows strong problem-solving.	Documentation complete and clear with some analytical content.	Documentation basic with omissions; problem-solving limited.	Documentation missing/poorly organized; no clear problem-solving
Communication & Presentation skills	**12**	Presentation is confident, structured, and answers queries fully; visuals effective.	Presentation clear and satisfactory; responds to most queries.	Presentation acceptable but lacks clarity or confidence; weak responses	Presentation poor or absent; unable to respond.
Contribution & Benefit to society (impact, sustainability)	**16**	Clear, demonstrable societal benefit and sustainability; realistic path to implementation.	Benefit plausible; sustainability considered with minor gaps.	Limited or unclear societal benefit; sustainability not well addressed.	No evident benefit or sustainability; project not community-oriented.

Semester III					
Additional Mathematics – I **Category: NCMC** (Common to all disciplines of Engineering)					
Course Code	:	B25MAD309	CIE	:	100 Marks
Teaching Hours L : T : P: S	:	42:0:0:0	SEE	:	--
Total Hours	:	42	Total	:	100 Marks
Credits		PP	SEE Duration	:	--

Course Objective is
1. To Develop the knowledge of solving engineering problems of multivariable and algebraic series.
2. To Provide insight into applications of complex numbers and vector algebra.
3. To Apply the fundamentals of Vector differentiation.
4. To Familiarize the importance of Integral calculus.
5. To provide compressive understand of first order and first-degree differential equations.

Module-1	No. of Hours
Successive differentiation-problems. Taylor's & Maclaurin's series expansions-problems. Partial Differentiation: Euler's theorem (without Proof)-problems on first order derivatives only. Total derivatives-differentiation of composite functions. Jacobians -Problems.	**9**
Module-2	No. of Hours
Definitions and properties. Modulus and amplitude of a complex number, Argand's diagram, De-Moivre's theorem (without proof), Problems. Vector Algebra: Scalar and vectors. Addition, subtraction and multiplication of vectors- Dot and Cross products, problems. Scalar triple product, Problems.	**8**
Module-3	No. of Hours
Differentiation of vector functions. Velocity and acceleration of a particle moving on a space curve. Scalar and vector point functions. Gradient, Divergence, Curl-simple problems. Solenoidal and irrotational vector fields-Problems.	**8**
Module-4	No. of Hours
Review of elementary integral calculus. Reduction formulae for $sin^n x$, $cos^n x$ (without proof)-problems. Double and triple integrals-Simple problems.	**9**
Module-5	No. of Hours
Introduction-solutions of first order and first-degree differential equations: Variable separable method, Homogeneous differential equations, linear differential equations. Exact differential equations.	**8**

Course Outcomes: At the end of the course, the students will be able to	
CO1	Use derivatives and partial derivatives to calculate the rate of change of multivariate functions.
CO2	Apply concepts of complex numbers and vector algebra to analyse the problems arising in that area.
CO3	Analyse position, velocity and acceleration in two and three dimensions of vector-valued functions.
CO4	Learn techniques of integration including the evaluation of double and triple integrals.
CO5	Identify and solve first-order ordinary differential equations.
Text Books	
1	B.S.Grewal:"Higher Engineering Mathematics", Khanna publishers,44thEd.2018
2	E.Kreyszig:"Advanced Engineering Mathematics", John Wiley & Sons,8thEd.(Reprint),2016
Reference Text Books	
1	H. K. Dass, " Advanced Engineering Mathematics" S. Chand publication. 4. C. Ray Wylie, Louis C. Barrett : "Advanced Engineering Mathematics", 6" Edition, 2. McGraw
2	C. Ray Wylie, Louis C. Barrett : "Advanced Engineering Mathematics", 6" Edition, 2. McGraw
3	B.V. Ramana: "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill, 208.

Web links and Video lectures (e-Resources)
1. https://nptel.ac.in/courses/12286025 2. VTU EDUSAT PROGRAMME – 20 3. http://www.class-central.com/subject/math(MOOCs)

Assessment Details both (CIE only)

The weightage of continuous Internal Evaluation (CIE) is 100%. The minimum passing mark for the CIE is 40% of maximum marks (40 marks out of 100).
The CIE may comprise Assessment tests, assignments, quizzes or other academic activities, as decided by the concerned teacher. The distribution of marks among these activities shall be determined by the course teacher. The total marks awarded for all CIE activities shall be 100 marks.

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	**Internal Assessment1**	**50**	**80 (Average of Best two Assessments)**	**100**
	Internal Assessment2	**50**		
	Internal Assessment3	**50**		
AAT	**Any One Assessments as per regulations**	**20**	**20**	
Total Marks				**100**

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	2	-	-	-	-	1	-	2
CO2	3	3	3	2	-	-	-	-	1	-	2
CO3	3	3	3	2	-	-	-	-	-	-	2
CO4	3	3	3	2	-	-	-	-	-	-	2
CO5	3	3	3	2	-	-	-	-	-	-	2

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Semester-IV					
Biology for Engineers **Category: BSC** (Common to all disciplines of Engineering)					
Course Code	:	**B25BEK405**	CIE	:	50 Marks
Teaching Hours L : T : P : S	:	28:0:0:32	SEE	:	50 Marks
Total Hours/Semester	:	60	Total	:	100 Marks
Credits	:	2	SEE Duration	:	2Hrs

Course Learning Objective is	
1.	To study the concepts and types of artificial intelligence.
2.	To Demonstrate basic machine learning methods for regression, classification and clustering.
3.	To understand real-world applications across different disciplines.
4.	To make use of prompt engineering techniques to interact with generative AI tools.
5.	To study recent trends in artificial intelligence and machine learning.

Module– 1	**No. of Hours**
Introduction to Biology: The cell (as an information-processing unit): the basic unit of life, Structure and functions of a cell. The Plant Cell and animal cell, Prokaryotic and Eukaryotic cell, Stem cells (inspiration for regenerative bioelectronics) and their application. Importance of special biomolecules: Enzymes, vitamins and hormones. (Classification with one example each, Properties and functions)	6
Module– 2	**No. of Hours**
Biomolecules and Their Applications: DNA/RNA for bio-computing and molecular electronics, Forensics – DNA fingerprinting, lipids (biodiesel, cleaning agents/detergents), Enzymes (glucose-oxidase in biosensors, lignolytic enzyme in bio-bleaching). Human Blood substitutes - hemoglobin-based oxygen carriers (HBOCs) and perflourocarbons (PFCs).	6
Module– 3	**No. of Hours**
Human Organ Systems and Bio Designs: Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics. Engineering solutions for Parkinson's disease). Eye as a Camera system (architecture of rod and cone cells, optical corrections, cataract, lens materials, bionic eye). Heart as a pump system (architecture, electrical signalling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pace makers, defibrillators). Lungs as purification system (architecture, gas exchange mechanisms, spirometry, abnormal lung physiology - COPD, Ventilators, Heart-lung machine). Kidney as a filtration system (architecture, mechanism of filtration, CKD, dialysis systems).	5
Module– 4	**No. of Hours**
Nature-Bioinspired Materials and Mechanisms: Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying (GPS and aircrafts), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro), Shark skin (Friction reducing swim suits), Kingfisher beak (Bullet train).	6
Module– 5	**No. of Hours**
Trends Bioengineering: Bioprinting techniques and materials, 3D printing of ear, bone and skin. 3D printed foods. Electrical tongue and electrical nose in food science, DNA origami and Biocomputing, Bioimaging and Artificial Intelligence for disease diagnosis. Bioremediation and Bio mining. Medical imaging technologies—X-ray, CT, MRI and Ultrasound (overview);	5

Course Outcomes: At the end of the course, the students will be able to	
CO1	Elucidate the basic biological concepts via relevant industrial applications and case studies.
CO2	Evaluate the principles of design and development, for exploring novel bioengineering projects.
CO3	Corroborate the concepts of biomimetics for specific requirements.

CO4	Think critically towards exploring innovative biobased solutions for socially relevant problems.
Text Books	
1.	Engineering with Biology- Fundamentals and Applications, 2nd Edition, S. Fatima, R. S. Deshpande, M. Ziaullah, MahanteshMattada, Santosh Nejakar and Sadashiv Halbhavi, Najekar Publications, 2026

Reference Text Books	
1.	Biology for Engineers, Rajendra Singh C and Rathnakar Rao N, Rajendra Singh C and Rathnakar Rao N Publishing, Bengaluru, 2023.
2.	Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022
3.	Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.
4.	Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011 Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.
Web links and Video lectures (e-Resources)	
•https://nptel.ac.in/courses/121106008 •https://freevideolectures.com/course/4877/nptel-biology-engineers-other-non-biologists •https://ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-design-spring-2009	

ASSESSMENT STRUCTURE:

The assessment in each course is divided equally between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each carrying 50% weightage. To qualify and become eligible to appear for SEE, in the CIE, a student must score at least 40% of 50 marks, i.e., 20 marks. To pass the SEE, a student must score at least 35% of 50 marks, i.e., 18 marks. Notwithstanding the above, a student is considered to have passed the course, provided the combined total of CIE and SEE is at least 40marks out of 100 marks.

CONTINUOUS INTERNAL EVALUATION (CIE):

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	**Internal Assessment1**	**50**	**40**	**50**
	Internal Assessment2	**50**	**(Average of Best two Assessments)**	
	Internal Assessment3	**50**		
AAT	**Any Two Assessments as per Regulations**	**20**	**10**	
SEE	**Semester End Examination**	**50**	**-**	**50**
Grand Total				**100**

SEMESTER END EXAMINATION (SEE):

1. The Question paper shall be set for 50 marks and duration of SEE is 2 Hours.
2. Two questions of 10 marks (with minimum two sub questions) from each module with internal choice.
3. Students should answer five full questions, selecting one full question from each module.
4. Mention COs, POs, Bloom's Taxonomy levels in the question paper.

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	1	-	-	1	-	-	-	1	-	1
CO2	1	1	-	-	1	-	-	-	1	-	1
CO3	1	1	-	-	1	-	-	-	1	-	1
CO4	1	1	-	-	1	-	-	-	1	-	1
CO5	1	1	-	-	1	-	-	-	1	-	1

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Semester-IV					
Environmental Science Project (Project Based Learning) **Category: SDC**					
Course Code	:	**B25ECP408**	CIE	:	50 Marks
Teaching Hours L : T : P : S	:	0:0:0:30	SEE	:	50 Marks
Total Hours/Semester	:	30	Total	:	100 Marks
Credits	:	1	SEE Duration	:	3 Hrs

Course Learning Objective is

The Environmental Science Project is a practical, applied-learning course that builds students' environmental awareness and responsibility. It focuses on real issues such as climate change, pollution, biodiversity, resource use, soil erosion, and thermal comfort, using field surveys, case studies, data collection, audits, and analysis to develop feasible and sustainable solutions. Students may work individually or in groups of up to four, including interdisciplinary topics, and assessment is based on the prescribed rubrics.

Course outcome (Course Skill Set): At the end of the course, the student will be able to:

1. Identify and analyse environmental problems through field interaction and technical assessment.
2. Develop skills in project planning, field survey, data collection, implementation, documentation and reporting.
3. Formulate feasible environmental problem statements and solutions considering practical constraints and sustainability aspects.
4. Apply principles of environmental responsibility, ethics and societal welfare in engineering practice through community-oriented interventions.
5. Exhibit multidisciplinary learning and problem-solving ability based on collected data, user feedback and baseline conditions.
6. Demonstrate teamwork and communication skills while interacting with technical and non-technical stakeholders and reflect on project impact on society.

Sustainable Development Goals: The faculty shall encourage students to undertake community projects that align with and contribute towards satisfying the National Board of Accreditation (NBA) Criterion 3.6, namely, Evidence of Addressing Sustainable Development Goals (SDGs), which is a major emphasis of the United Nations (UN).

Methods for project identification:

Students may identify the project topic using one or more of the following methods: interaction with local rural or urban stakeholders such as local leaders, corporation/municipality personnel, NGOs, panchayat representatives, etc.; review of issues highlighted in print and electronic media, and social networks; and, after selecting a broad topic, collect data, conduct a feasibility survey, estimate timelines and resources, approximate expenditure, and define the problem statement and objectives clearly.

List of Project Topics and Engineering Outcomes:

The following structured sequence of activities is to be carried out during the semester:

Sl. No.	Project title	Measurable engineering outcome	Mapped POs	SDGs
1	Rural and urban water conservation and management systems	Prepare a site-specific water-saving plan, estimate water demand–supply gap, and propose a feasible conservation intervention with quantified savings.	PO1, PO2, PO3, PO4, PO10, PO11	SDG 6, SDG 11, SDG 12
2	Waste management and recycling	Conduct waste audit, classify waste streams, and design a segregation/recycling workflow with measurable reduction in mixed waste.	PO2, PO3, PO4, PO6, PO8, PO10	SDG 11, SDG 12, SDG 13
3	Afforestation	Identify a degraded area, prepare plantation layout, and demonstrate survival-rate tracking and maintenance schedule for saplings.	PO2, PO3, PO4, PO6, PO7, PO11	SDG 11, SDG 13, SDG 15
4	Biogas generation and	Estimate organic waste availability, size	PO1, PO2,	SDG 7,

	power generation	a small biogas system, and document expected gas output or energy yield.	PO3, PO4, PO5, PO10	SDG 11, SDG 12
5	DPR for solar power rural plant	Prepare a DPR with load assessment, panel sizing, cost estimate, and projected energy generation and payback.	PO1, PO2, PO3, PO4, PO5, PO10	SDG 7, SDG 9, SDG 11
6	DPR for electrification of village/tribal community	Map unserved/underserved households, propose electrification layout, and estimate coverage, losses, and implementation cost.	PO1, PO2, PO3, PO4, PO10, PO11	SDG 7, SDG 9, SDG 10
7	DPR for rural drainage system	Survey drainage bottlenecks, develop a drainage layout, and estimate runoff handling capacity and flood-risk reduction	PO1, PO2, PO3, PO4, PO6, PO10	SDG 6, SDG 9, SDG 11
8	Sustainability and environmental health projects	Assess local environmental health issues and propose interventions with measurable improvement in hygiene, safety, or resource use.	PO2, PO3, PO4, PO6, PO7, PO8	SDG 3, SDG 6, SDG 11, SDG 12
9	Plastic free campaigns	Measure plastic usage before and after awareness intervention and report percentage reduction or behavioural change.	PO2, PO3, PO6, PO7, PO8, PO10	SDG 11, SDG 12, SDG 13
10	Health and nutrition awareness	Conduct baseline and post-program awareness survey and document improvement in awareness score or adoption of healthier practices.	PO2, PO6, PO7, PO8, PO9, PO10	SDG 2, SDG 3, SDG 11
11	Societal projects involving health wellness	Identify a community health need and develop an awareness/service module with measurable participation and feedback outcomes.	PO2, PO3, PO6, PO8, PO9, PO10	SDG 3, SDG 11, SDG 17
12	Air quality monitoring system	Collect air-quality data, compare with reference limits, and present trends along with possible mitigation suggestions.	PO2, PO3, PO4, PO5, PO6, PO10	SDG 3, SDG 11, SDG 13
13	Plastic waste reduction campaign	Track collection, segregation, and replacement actions, and quantify reduction in plastic waste generation or littering.	PO2, PO3, PO6, PO7, PO8, PO10	SDG 11, SDG 12, SDG 13
14	Urban greening projects	Prepare greening plan, identify planting locations, and assess environmental benefits such as shade, aesthetics, or heat mitigation.	PO2, PO3, PO4, PO6, PO7, PO11	SDG 11, SDG 13, SDG 15
15	Smart agriculture solution	Design a low-cost monitoring or irrigation support solution and estimate improvement in water use efficiency or crop support.	PO1, PO2, PO3, PO4, PO5, PO10	SDG 2, SDG 6, SDG 9
16	Smart irrigation system	Estimate crop water requirement, propose control logic, and quantify water savings compared with conventional irrigation.	PO1, PO2, PO3, PO4, PO5, PO10	SDG 2, SDG 6, SDG 12
17	Food security initiatives / cold storage system	Estimate storage need, design a simple cold-chain concept, and document reduction in spoilage or wastage.	PO1, PO2, PO3, PO4, PO5, PO10	SDG 2, SDG 9, SDG 12
18	Human rights awareness with legal systems	Prepare and deliver an awareness module and assess increase in legal awareness and access-to-rights understanding.	PO6, PO7, PO8, PO9, PO10	SDG 5, SDG 10, SDG 16

19	Use of application / application program	Build or demonstrate a useful community app and measure usability, adoption, or efficiency improvement.	PO1, PO3, PO4, PO5, PO9, PO10	SDG 9, SDG 11, SDG 17
20	House tax collection through digital media	Develop a simple digital workflow or awareness support and measure improvement in compliance, convenience, or response time.	PO2, PO3, PO4, PO5, PO10, PO11	SDG 9, SDG 11, SDG 16

Textbooks:

1. Phadke, N. D., Community Engagement and Social Innovation, Oxford University Press, New Delhi.
2. Garg, N. R., Project-Based Learning in Engineering Education, Pearson India Education, Services, Noida.
3. Gupta, A. and P. Singh, Service Learning and Community Projects, McGraw-Hill, Education (India), New Delhi.
4. Wilson, G., Practical Guide to Community Development Projects, Routledge, London.

Reference books:

1. NPTEL courses on Project-Based Learning and Social Innovation.
2. SWAYAM courses on community engagement and sustainability.
3. UN Sustainable Development Goals portal: https://sdgs.un.org
4. MyGov India and local civic body portals for community initiatives.
5. YouTube resources on design thinking, social innovation, and community service learning.
6. NGO and government field-action case studies related to sanitation, water, health, education, and environment.

Web links and Video Lectures (e-Resources):

• NPTEL courses on Engineering Geology (IIT Roorkee, IIT Kharagpur).
• NPTEL courses on Soil Mechanics and Foundation Engineering (IIT Delhi, IIT Bombay).
• Virtual Labs – Geotechnical Engineering Virtual Lab (IIT Kanpur): https://vlab.co.in • Geological Survey of India (GSI) – Maps, reports, and publications: https://www.gsi.gov.in
• YouTube channels: Civil Engineering Essentials, The Engineering Classroom (soil mechanics experiments).
• American Society of Civil Engineers (ASCE) – Geotechnical resources and standards

Teaching Learning Process: The suggested TLP for Community / Societal Project is as follows;

Week	Teaching–Learning Activity	Faculty Role	Student Activity	Output
1	Course introduction, objectives, ethics, conduct, and assessment briefing	Explain course scope, rules, rubrics, and expected deliverables	Understand course requirements and form teams	Team list, course plan
2	Community problem identification and topic selection	Guide topic framing and feasibility	Identify local issues through discussion and observation	Shortlisted project topic
3	Stakeholder interaction and preliminary survey	Demonstrate survey methods and stakeholder engagement	Collect initial data from community/users	Survey notes, interview record
4	Problem statement and objectiveformulation	Review and refine problem statement	Prepare problem statement, scope, andobjectives	Approved problem statement
5	Literature/case study review and baseline analysis	Suggest relevant references and examples	Study existing solutions and compare approaches	Baseline analysis summary
6	Project planning and role assignment	Help teams organize tasks, timeline, and	Plan activities, divide roles, and prepare	Work plan / Gantt chart

		responsibilities	schedule	
7	Feasibility analysis and solution brainstorming	Check technical feasibility and practicality	Generate possible engineering solutions	Solution alternatives sheet
8	Selection of final solution and design approach	Review final concept and design logic	Finalize concept, methods, and expected outcome	Concept note / design outline
9	Data processing / calculations / sizing / mapping	Support computations and technical review	Analyze data, perform calculations, prepare maps/charts	Technical analysis sheet
10	Prototype / model / audit / DPR / app development	Monitor progress and correct technical issues	Develop the selected output	Working model / draft DPR / map / app
11	Testing, refinement, and implementation planning	Evaluate technical correctness and improvements	Test prototype or validate proposal with users	Test results / revised output
12	Field implementation / demonstration / awareness activity	Facilitate community interaction and documentation	Conduct implementation or demonstration	Photos, attendance, implementation record
13	Documentation of outcomes, feedback, and impact	Review report structure and completeness	Compile findings, stakeholder feedback, and observations	Draft report
14	Presentation preparation and viva practice	Conduct mock presentation and feedback	Prepare slides/poster and rehearse	Presentation deck
15	Final presentation, submission, and reflection	Evaluate performance using rubrics	Present project, submit report, reflect on learning	Final report, presentation, viva

Assessment structure:

Continuous Internal Evaluation (CIE) – 50 marks

• Students, in batches of 3–4, shall undertake at least one project (or a combination of two related activities) aiming, as far as possible, at a logical implemented or implementable outcome.

• CIE will be conducted by a departmental committee (HoD/nominee, guide and one senior faculty) using the following rubrics totalling 50 marks:

• A student shall secure a minimum of 20 marks out of 50 in CIE to become eligible to appear for SEE.

• Students who fail to earn the required CIE marks may be given additional opportunities before closure of the semester; no re-doing of CIE is permitted after the end of the semester.

A. Semester End Examination (SEE)

• Examination duration: 3 hours. Maximum examination marks: 100

• The SEE shall be conducted batch-wise by a committee of three faculties: project guide, one faculty from the same department and one from a different department.

• For a pass in SEE, a student shall secure minimum 35 marks out of 100.

• For declaration of a pass grade, the sum of CIE marks (out of 50) and scaled SEE marks (out of 50) shall be ≥ 40; otherwise, the student is awarded grade F (Fail).

CIE Rubric — Continuous Internal Evaluation (Total 50 marks):

Criterion	Weight (marks)	Excellent (Full marks)	Good	Fair	Needs Improvement
Problem identification & Relevance to society/industry /community	**8**	Problem is clearly identified with strong evidence of societal relevance and well-defined scope.	Problem is relevant and scope is clear with adequate supporting evidence.	Problem defined but justification or evidence is weak.	Problem unclear or not relevant; little/no supporting evidence.
Formation of problem statement; Engineering approach, innovation & feasibility	**10**	Problem statement is precise; approach is sound, innovative and clearly feasible.	Problem statement adequate; approach feasible with minor gaps.	Problem statement partial; approach feasibility is marginal.	Problem statement missing or approach not feasible.
Interaction with stakeholders; Data collection, analysis & interpretation	**8**	Thorough stakeholder engagement; data collection is comprehensive; analysis is well interpreted.	Good engagement; data and analysis adequate with minor gaps.	Limited engagement; data incomplete and analysis superficial.	Little/no stakeholder contact; insufficient or no data/ analysis.
Project documentation; Clarity, organization & problem solving demonstrated	**10**	Documentation is complete, well organized, analytical, and shows strong problem-solving.	Documentation complete and clear with some analytical content.	Documentation basic with omissions; problem-solving limited.	Documentation missing/poorly organized; no clear problem-solving
Communication & Presentation skills	**6**	Presentation is confident, structured, and answers queries fully; visuals effective.	Presentation clear and satisfactory; responds to most queries.	Presentation acceptable but lacks clarity or confidence; weak responses	Presentation poor or absent; unable to respond.
Contribution & Benefit to society (impact, sustainability)	**8**	Clear, demonstrable societal benefit and sustainability; realistic path to implementation.	Benefit plausible; sustainability considered with minor gaps.	Limited or unclear societal benefit; sustainability not well addressed.	No evident benefit or sustainability; project not community-oriented.

SEE Rubric — Semester End Examination (Enter marks out of 100; scaled to 50 later):

Criterion	Weight (marks)	Excellent (Full marks)	Good	Fair	Needs Improvement
Problem identification & Relevance to society/industry /community	**16**	Problem is clearly identified with strong evidence of societal relevance and well-defined scope.	Problem is relevant and scope is clear with adequate supporting evidence.	Problem defined but justification or evidence is weak.	Problem unclear or not relevant; little/no supporting evidence.
Formation of problem statement; Engineering approach, innovation		Problem statement is precise; approach is sound, innovative and	Problem statement adequate; approach	Problem statement partial; approach feasibility is	Problem statement missing or approach not

& feasibility	**20**	clearly feasible.	feasible with minor gaps.	marginal.	feasible.
Interaction with stakeholders; Data collection, analysis & interpretation	**16**	Thorough stakeholder engagement; data collection is comprehensive; analysis is well interpreted.	Good engagement; data and analysis adequate with minor gaps.	Limited engagement; data incomplete and analysis superficial.	Little/no stakeholder contact; insufficient or no data/ analysis.
Project documentation; Clarity, organization & problem solving demonstrated	**20**	Documentation is complete, well organized, analytical, and shows strong problem-solving.	Documentation complete and clear with some analytical content.	Documentation basic with omissions; problem-solving limited.	Documentation missing/poorly organized; no clear problem-solving
Communication & Presentation skills	**12**	Presentation is confident, structured, and answers queries fully; visuals effective.	Presentation clear and satisfactory; responds to most queries.	Presentation acceptable but lacks clarity or confidence; weak responses	Presentation poor or absent; unable to respond.
Contribution & Benefit to society (impact, sustainability)	**16**	Clear, demonstrable societal benefit and sustainability; realistic path to implementation.	Benefit plausible; sustainability considered with minor gaps.	Limited or unclear societal benefit; sustainability not well addressed.	No evident benefit or sustainability; project not community-oriented.

Semester IV					
Additional Mathematics –II **Category: NCMC** (Common to all disciplines of Engineering)					
Course Code	:	**B25MAD409**	CIE	:	100 Marks
Teaching Hours L : T : P: S	:	42:0:0:0	SEE	:	--
Total Hours	:	42	Total	:	100 Marks
Credits		PP	SEE Duration	:	--

Course Learning Objective is	
1	To Compute the solution by applying the acquired knowledge of linear algebra to the problems of engineering applications.
2	To Develop the knowledge of solving differential equations and their applications in engineering.
3	To introduce the concept of basic probability theory with practical application in engineering and social life situations.
4	To Develop the knowledge of numerical methods and apply them to solve algebraic and Transcendental equations.
5	To Develop the knowledge of numerical methods and apply them to solve differential equations.

Module-1	No. of Hours
Introduction, Rank of a matrix by elementary row operations, Consistency of system of linear equations, Solution by Gauss Elimination method. Eigenvalues and eigenvectors of a square matrix. Problems.	9
Module-2	No. of Hours
Linear homogeneous/non homogeneous differential equations of second and higher-order with constant coefficients. Solution by using the inverse differential operator method. [Particular Integrals restricted to $(x)= e^{ax}$, sinax/ cosax, x^n .	9
Module 3	No. of Hours
Introduction, Sample space and Events, Axioms of Probability. Addition and Multiplication theorem. Conditional Probability. Independent events. Baye's theorem, Problems.	8
Module-4	No. of Hours
Finite differences, Interpolation/extrapolation using Newton's forward and Backward difference formulae (No derivation), Problems. Solution of polynomial and transcendental equations by Newton–Raphson and Regula–Falsi methods (no derivation), Problems. Numerical Integration: Simson's 1/3 rd rule and 3/8 rule, problems.	8
Module-5	No. of Hours
Numerical solution of first-order ordinary differential equations: Taylor's series method, Modified Euler's method, Runge-Kutta method of order 4, Milne's predictor-corrector method. Problems.	8

Course Outcomes: At the end of the course, the students will be able to	
CO1	Test for consistency and solve the system of linear equations.
CO2	Solve higher order differential equations.
CO3	Apply elementary probability theory and solve related problems.
CO4	Acquiring the knowledge of interpolation and solution of transcendental equations..
CO5	Acquiring the knowledge of numerical solution of differential equations.
Text Books	
1	Ronald E. Walpole, Raymond H Myers, Sharon L Myers & Keying Ye "Probability & Statistics for Engineers & Scientists", Pearson Education, 9th edition, 2017.
2	Peter Bruce, Andrew Bruce & Peter Gedeck "Practical Statistics for Data Scientists" O'Reilly Media, Inc., 2nd edition 2020.
Reference Text Books	
1	Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, 9th Edition, 2006.
2	B. S. Grewal "Higher Engineering Mathematics", Khanna publishers, 44th Ed., 2021.
3	G Haribaskaran "Probability, Queuing Theory & Reliability Engineering", Laxmi Publication, Latest

	Edition, 2006

Web links and Video lectures (e-Resources)
1. https://nptel.ac.in/courses/12286025 2. VTU EDUSAT PROGRAMME – 20 3. http://www.class-central.com/subject/math(MOOCs)

Assessment Details both (CIE Only)

The weightage of continuous Internal Evaluation (CIE) is 100%. The minimum passing mark for the CIE is 40% of maximum marks (40 marks out of 100).
The CIE may comprise Assessment tests, assignments, quizzes or other academic activities, as decided by the concerned teacher. The distribution of marks among these activities shall be determined by the course teacher. The total marks awarded for all CIE activities shall be 100 marks.

CIE	Type of Assessment	Max. Marks	Max. Marks Scaling Down to	Total Marks
Theory	**Internal Assessment1**	**50**	**80 (Average of Best two Assessments)**	**100**
	Internal Assessment2	**50**		
	Internal Assessment3	**50**		
AAT	**Any One Assessments as per regulations**	**20**	**20**	
Total Marks				**100**

CO-PO Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	2	-	-	-	-	1	-	2
CO2	3	3	3	2	-	-	-	-	1	-	2
CO3	3	3	3	2	-	-	-	-	-	-	2
CO4	3	3	3	2	-	-	-	-	-	-	2
CO5	3	3	3	2	-	-	-	-	-	-	2

Level 3 - High, Level 2 - Moderate, Level 1 - Low

Semester-III/IV					
National Service Scheme **Category: NCMC**					
Course Code	:	**B25NCK310A/410A**	CIE	:	100 Marks
Teaching Hours L : T : P : S	:	0:0:30:0	SEE	:	--
Total Hours/Semester	:	30	Total	:	100 Marks
Credits	:	PP	SEE Duration	:	--

Course objectives: National Service Scheme (NSS) will enable the students to:	
1.	Understand the community in general in which they work.
2.	Identify the needs and problems of the community and involve them in problem –solving.
3.	Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
4	Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.
5	Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

Syllabus	**30 Hours**
I. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing. **II.** Waste management– Public, Private and Govt organization. **III.** Setting of the information imparting club for women leading to contribution in social and economic issues. **IV.** Water conservation techniques – Role of different stakeholders– Implementation. **V.** Preparing an actionable business proposal for enhancing the village income and approach for implementation. **VI**. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education. **VII.** Developing Sustainable Water management system for rural areas and implementation approaches. **VIII.** Contribution to any national level initiative of Government of India. Forex. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc. **IX**. Spreading public awareness under rural outreach programs.(minimum5 programs). **X**. Plantation and adoption of plants. Know your plants. **XI**. Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs). **XII**. Govt. school Rejuvenation and helping them to achieve good infrastructure.	

Pedagogy – Guidelines, it may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.

Sl. No	Topic	Group Size	Location	Activity Execution	Reporting	Evaluation of the Project
1	Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.	May be individual or team	Farmers land/Villages/ roadside / community area/ College campus etc….	Site selection /proper consultation/ Continuous monitoring/ Information board		
2	Waste management– Public, Private and Govt organization.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers	Site selection /proper consultation/ Continuous monitoring/ Information board		

3	Setting of the information imparting club for women leading to contribution in social and economic issues.	May be individual or team	Women empowerment groups/ Consulting NGOs & Govt Teams / College campus etc.	Group selection/ pro per consultation/ Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
4	Water conservation techniques – Role of different stakeholders– Implementation.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers	site selection / proper consultation/ Continuous monitoring/ Information board		
5	Preparing an actionable business proposal for enhancing the village income and approach for implementation.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers	Group selection/pro per consultation/ Continuous monitoring/ Information board		
6	Helping local schools to achieve good results and enhance their enrolment in Higher/technical/ vocational education.	May be individual or team	Local government / private/ aided schools/Government Schemes officers	School selection/proper consultation/ Continuous monitoring/ Information board		
7	Developing Sustainable Water management system for rural areas and implementation approaches.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers	site selection/proper consultation/ Continuous monitoring/ Information board		
8	Contribution to any national level initiative of Government of India. Ex. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers	Group selection/pro per consultation/ Continuous monitoring / Information board		
9	Spreading public awareness under rural outreach programs.(minimum5 programs).	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers	Group selection/pro per consultation/ Continuous monitoring / Information board		
10	Plantation and adoption of plants. Know your plants.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers	Place selection/ proper consultation/ Continuous monitoring / Information board		
11	Organize National integration and	May be individual	Villages/ City Areas / Grama panchayat/	Place selection/ proper consultation/		

	social harmony events /workshops /seminars.	or team	public associations/ Government Schemes officers	Continuous monitoring / Information board		
12	Govt. school Rejuvenation and helping them to achieve good infrastructure.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/ Government Schemes officers	Place selection/ proper consultation/ Continuous monitoring / Information board		

Plan of Action (Execution of Activities For Each Semester)

Sl. No	Practice Session Description
1	Lecture session by NSS Officer
2	Students Presentation on Topics
3	Presentation - 1 , Selection of topic, PHASE - 1
4	Commencement of activity and its progress - PHASE - 2
5	Execution of Activity
6	Execution of Activity
7	Execution of Activity
8	Execution of Activity
9	Execution of Activity
10	Case study based Assessment, Individual performance
11	Sector wise study and its consolidation
12	Video based seminar for 10 minutes by each student At the end of semester with Report.

- In III and IV semester, each student should do activities according to the scheme and syllabus.
- At the end of every semester student performance has to be evaluated by the NSS officer for the assigned activity progress and its completion.

Course Learning Outcomes: Upon successful completion of this course, the student will be able to:	
1.	Understand the importance of his / her responsibilities towards society.
2.	Analyse the environmental and societal problems/issues and will be able to design solutions for the same.
3.	Evaluate the existing system and to propose practical solutions for the same for sustainable development.
4	Implement government or self-driven projects effectively in the field. CO5:
5	Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

- Students should present the progress of the activities as per the schedule in the prescribed practical session in the field. There should be positive progress in the vertical order for the benefit of society in general.
- **Suggested Learning Resources:**
- 1. NSS Course Manual, Published by NSS Cell, VTU Belagavi.
- 2. Government of Karnataka, NSS cell, activities reports and its manual.
- 3. Government of India, nss cell, Activities reports and its manual.

ASSESSMENT STRUCTURE:

This course is having only Continuous Internal Assessment (CIE) marks of 100. A student shall obtain a minimum of 40% marks out of 100 to qualify in the course.

Sl. No	Activity	Max. Marks
1.	Attendance	20
2.	Quizzes /Assignment – 2, each of 25marks	50
3.	Report/ Participation Certificate	30
Total		**100**

Semester-III/IV					
National Cadet Corps Category: NCMC					
Course Code	:	**B25NCK310B/410B**	CIE	:	100 Marks
Teaching Hours L : T : P : S	:	0:0:30:0	SEE	:	--
Total Hours/Semester	:	30	Total	:	100 Marks
Credits	:	PP	SEE Duration	:	--

Course Objectives	
1.	To develop character, camaraderie, discipline, secular outlook, the spirit of adventure, sportsman spirit, and ideals of selfless service amongst cadets by working in teams, honing qualities such as self-discipline, self- confidence, self-reliance, and dignity of labour in the cadets.
2.	To create a pool of organized, trained, and motivated youth with leadership qualities from all walks of life, who will serve the Nation regardless of which career they choose
3.	To provide a conducive environment to motivate young Indians to choose the Armed Forces as a career

Content	**No. of Hours**
Unit 1. Personality Development: Group Discussions - Change your Mindset, Public Speaking. **Unit 2.**LeadershipDevelopment: Case Studies– APJ Abdul Kalam, DeepaMalik, Maharana Pratap, N Narayan Murthy etc. **Unit 3.** Disaster management: Disaster Management Capsule, Organization, Types of Disasters, Essential Services, Assistance, Civil Defense Organization. **Unit 4**.Adventure:AdventureActivities **Unit 5.** Border & Coastal Areas: History, Geography &Topography of Border/ Coastal Areas. **Unit 6.** Drill: Arm Drill, Rifle ke saath Savdhan, Vishram aur Aram se, Rifle ke saath Parade Paraur Saj, Riflekesaath Visarjan, LineTod, Bhumi Shastra aur Uthao Shastra, BagalShastra aur Baju Shastra. **Unit 7**.WeaponTraining: Short Range firing. **Unit 8.**MapReading:SettingofMap,FindingsNorthandOwnPosition **Unit 9.**Field Craft & Battle Craft: Observation, Camouflage, Concealment. **Unit 10.** Obstacle Training: Obstacle training - Introduction, Safety-measures, Benefits. Obstacle Course- Straight balance, Clear Jump, Gate Vault, Zig- Zag Balance, High Wall	50

ASSESSMENT STRUCTURE:

This course is having only Continuous Internal Assessment (CIE) marks of 100. A student shall obtain a minimum of 40% marks out of 100 to qualify in the course.

Sl. No	Activity	Max. Marks
1.	Attendance	20
2.	Quizzes /Assignment – 2, each of 25marks	50
3.	Report/ Participation Certificate	30
Total		**100**

Semester-III/IV					
Physical Education **Category: NCMC**					
Course Code	:	**B25NCK310C/410C**	CIE	:	100 Marks
Teaching Hours L : T : P : S	:	0:0:30:0	SEE	:	--
Total Hours/Semester	:	30	Total	:	100 Marks
Credits	:	PP	SEE Duration	:	--

ourse Outcomes: At the end of the course, the student will be able to	
1.	Understand the fundamental concepts and skills of Physical Education, Health, Nutrition and Fitness
2.	Familiarization of health-related Exercises, Sports for overall growth and development
3.	Create a foundation for the professionals in Physical Education and Sports
4.	Participate in the competition at regional/state / national / international levels.
5.	Create consciousness among the students on Health, Fitness and Wellness in developing and maintaining a healthy lifestyle.
6	Understand and practice of Traditional Games

Syllabus	**30 Hours**

I. Orientation

1. Lifestyle
2. Health & Wellness
3. Pre-Fitness test.

II. General Fitness & Components of Fitness

1. Warming up (Free Hand exercises)
2. Strength – Push-up / Pull-ups
3. Speed – 30 Mtr Dash

III. Specific games (Any one to be selected by the student)

1. Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus.
2. Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up.

IV. Ethics and Moral Values

1. Ethics in Sports
2. Moral Values in Sports and Games

V. Specific Games (Any one to be selected by the student)

1. Volleyball – Attack, Block, Service, Upper Hand Pass and Lower hand Pass.
2. Athletics (Track Events) – Any event as per availability of Ground.

VI. Role of Organisation and administration

ASSESSMENT STRUCTURE:

This course is having only Continuous Internal Assessment (CIE) marks of 100. A student shall obtain a minimum of 40% marks out of 100 to qualify in the course.

Sl. No	Activity	Max. Marks
1.	Attendance	20
2.	Quizzes /Assignment – 2, each of 25marks	50
3.	Report/ Participation Certificate	30
Total		**100**

Semester-III/IV					
YOGA **Category: NCMC**					
Course Code	:	**B25NCK310D/410D**	CIE	:	100 Marks
Teaching Hours L : T : P : S	:	0:0:30:0	SEE	:	--
Total Hours/Semester	:	30	Total	:	100 Marks
Credits	:	PP	SEE Duration	:	--

Course Learning Objective is	
1.	Introduce students to the origin, history, philosophy, and fundamental concepts of Yoga.
2.	Familiarize students with the different schools of Yoga, its aims, objectives, and the importance of prayer in Yogic practice.
3.	Develop awareness of the rules, regulations, and safety precautions to be followed during Yogic practices.
4	Enable students to learn and practice Suryanamaskara and selected Yogasanas with proper techniques for improving physical and mental well-being.
5	Promote a healthy lifestyle by encouraging regular Yogic practice, correcting misconceptions about Yoga, and fostering positive health, self-discipline, and overall wellness.

Syllabus	**30 Hours**
I. Introduction of Yoga: Yoga, its origin, history and development. Yoga, its meaning, definitions. Different schools of yoga, Aim and Objectives of yoga, **II. Prayer:** importance of prayer Brief introduction of yogic practices for Yogic practices for common man to promote positive health, **III. Rules and regulations**: Rules to be followed during yogic practices by practitioner Suryanamaskara: Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar12 count, 2 rounds, **IV. Misconceptions of yoga**: Yoga its misconceptions, Difference between yogic and non yogic practices **V. Different types of Asanas-1:** Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits of each asana, Sitting 1. Padmasana, 2. Vajrasana, Standing 1. Vrikshana, 2. Trikonasana, Prone line 1. Bhujangasana, 2. Shalabhasana, Supine line 1. Utthitadvipadasana, 2. Ardhahalasana I. Patanjali's Ashtanga Yoga: Patanjali's Ashtanga Yoga, its need and importance. Suryanamaskar12 count 4 rounds. **VI. Different types of Asanas-2**: Sitting 1. Sukhasana, 2. Paschimottanasana, Standing 1. Ardhakati Chakrasana, 2. Parshva Chakrasana, Prone line 1. Dhanurasana Supine line 1. Halasana, 2. Karna Peedasana **VII. Kapalabhati**: Meaning, importance and benefits of Kapalabhati. 40 strokes/min 3 rounds **VIII. Pranayama**: 1. Suryanuloma –Viloma, 2. Chandranuloma-Viloma, 3-Suryabhedana, 4-Chandra Bhedana,	

Course Learning Outcomes: Upon successful completion of this course, the student will be able to:	
1.	Explain the origin, history, philosophy, objectives, and different schools of Yoga, along with its role in promoting holistic health and well-being.
2.	Understand and apply the rules, regulations, and ethical practices associated with Yogic exercises, including the significance of prayer and Suryanamaskara.
3.	Demonstrate the correct techniques of selected Yogasanas, such as sitting, standing, prone, and supine postures, while observing appropriate precautions.
4	Analyze the physical, mental, and therapeutic benefits of Yogic practices and distinguish between authentic Yogic practices and common misconceptions about Yoga.
5	Adopt Yoga as a regular lifestyle practice to enhance physical fitness, mental wellness, discipline, and overall quality of life.

Text books:

1. George Feuerstein : the yoga Tradition (its history, literature, philosophy and practice)
2. Sri Ananda: The complete Book of yoga Harmony of Body and Mind (Orient paper Backs: Vision Books Pvt.Ltd..1982.
3. B.K.S lyenkar: Light on the Yoga sutras of Patanjali (Haper Collins Publications India Pvt.Ltd.New Delhi.)
4. Science of Divinity and Realization of Self Vethathiri Publication, (6-11) WCSC, Erode

Reference books / Manuals:

1. Principles and Practice of Yoga in Health Care, Publisher: Handspring Publishing Limited. ISBN:9781909141209, 978190914209
2. Basavaraddi I V: Yoga in School Health, MDNIY New Delhi. 2009
3. Dr. HR. Nagendra: Yoga Research and application (Vivekanada Kendra Yoga Prakashana Bengalore)
4. Dr. Shirley Telles: Glimpses of Human Body (Vivekanda Kendra Yoga Prakashana Bengalore).

ASSESSMENT STRUCTURE:

This course is having only Continuous Internal Assessment (CIE) marks of 100. A student shall obtain a minimum of 40% marks out of 100 to qualify in the course.

Sl. No	Activity	Max. Marks
1.	Attendance	20
2.	Quizzes /Assignment – 2, each of 25marks	50
3.	Report/ Participation Certificate	30
Total		**100**

Semester-III/IV					
MUSIC **Category: NCMC**					
Course Code	:	**B25NCK310E / 410E**	CIE	:	100 Marks
Teaching Hours L : T : P : S	:	0:0:30:0	SEE	:	--
Total Hours/Semester	:	30	Total	:	100 Marks
Credits	:	PP	SEE Duration	:	--

Course Learning objectives: The course Will enable the students to:	
1.	Identify the major traditions Of Indian music. through notations and aurally.
2.	Analyse the compositions with respect to musical and lyrical content
3.	Demonstrate an ability to use music technology appropriately in a variety of setting.

Syllabus	**30 Hours**
I. Preamble: Contents of the curriculum intend to promote music as language to develop an analytical, Creative and intuitive Understanding. For this the student must experience music through study and direct participation in improvisation and composition. Origin of the Indian Music: Evolution of the Indian music system, Understanding Of Shruthi, Nada, Swara, Lay-a, Raga Talau Mela. **II. Compositions:** Introduction to the types of composition in Carnatic Music. Geethe, lath i, Swara, Swarajathi, Varna, Krithi. and Thillana, Notation System. **III. Composers:** Biography and contributions Of purandaradasa. Thyagaraja, Mysoro Vasudevacharya. **IV**. **Music Instruments**: Classification and construction of string instruments, Wind instrutnents. E*rcussion instruments, Idiophones (Ghana Vaadya), Examples of each class of Instrum ents **V**. **Abhyasa Gana:** Singing the swara exercises (Sarale Varase Only). dotation writing for Sarale Varase and Suladi Saptha Tala (Only in Mayamalavagowla Raga), Singing 4 Geethe in M alahari. And one jathi Swara One Krithi in a Mela raga	
Course Learning Outcomes: Upon successful completion of this course, the student will be able to:	
1.	Discuss the Indian system Of music and relate it to Other genres (Cognitive domain)
2.	Experience the emotions Of and develop empathy (AffRtive Domain)
3.	Ressond to queries on various patterns in a composition (Psycho Motor Domain)

ASSESSMENT STRUCTURE (CIE Only):

This course is having only Continuous Internal Assessment (CIE) marks of 100. A student shall obtain a minimum of 40% marks out of 100 to qualify in the course.

Sl. No	Activity	Max. Marks
1.	Attendance	20
2.	Quizzes /Assignment – 2, each of 25marks	50
3.	Report/ Participation Certificate	30
Total		**100**

Text Books

1. Vldushi Vasantha Madhavi, “Theory of Music” Prism Publication, 2007
2. T Sachidevi and T Sharadha “Karnataka Sangeetha Dharpana” Vol. 1 (English). Shreenivaas Prakaashana, 2018

References:

1. Lakshminarayana Subramaniam. Viji Subramanaim. -Classical Music of India: A Practical Guigee, Tranquer, 2018.