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

Artificial Intelligence & Machine Learning

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.

Artificial Intelligence & Machine Learning

DEPARTMENT VISION

To bring out the competent and socially responsible engineers in the field of AI&ML Education, Research and Innovation.

DEPARTMENT MISSION

1. To Inculcate, the integration process of concepts in AI&ML domain.
2. To equip AI&ML graduates with skills to meet Industry and Societal challenges by skill enhanced training.
3. To promote Research and ethical culture through interaction for broader application in AIML domain.

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: Develop competent profession in the field of Artificial Intelligence and Machine Learning towards advanced skills in solving contemporary problems.

PEO2: Pursue their professional on technical and progress towards Research and Entrepreneurship.

PEO3: Progress as skilled in team and adapting leadership qualities and ethical values as per the society.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Design and develop AI&ML Solution, through modern engineering tools and Programming Language, Technical skills in presenting modern insights.

PSO2: Ability to adapt continues changing AI&ML domain for innovative challenges.

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MOOGAMBIGAI CHARITABLE AND EDUCATIONAL TRUST

Rajarajeswari College of Engineering

(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

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	B25MCS301	Probability and Statistics	Maths	42	28	0	50	50	50	100	3	4
2.	PCC	B25CS302	Data Structures and its Applications	AI	28	28	0	34	50	50	100	3	3
3.	IPCC	B25CS303	Digital Design and Computer Organization	AI	42	0	28	50	50	50	100	3	4
4.	PCC	B25CS304	Operating Systems	AI	42	0	0	48	50	50	100	3	3
5.	PCC	B25AI305	OOPs using Java	AI	42	0	0	48	50	50	100	3	3
6.	PCCL	B25CSL306	Data Structures and its Applications Lab	AI	0	0	28	2	50	50	100	3	1
7.	AEC	B25AIL307	OOPs using Java Lab	AI	0	0	28	2	50	50	100	3	1
8.	SDC	B25AIP308	Community/ Societal Project	AI	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	B25NCK310A/ B/C/D/E	National Service Scheme /National Cadet Corps / Physical Education/ Yoga /Music	HSS	2	0	0	0	100	-	-	100	PP
11.	SEC	B25SKL300	Skill Laboratory	Concerned Dept.	0	0	30	0	100	-	100	-	1
								TOTAL	700	400	1100		21

ASC: Applied Science Courses, BSC: Basic Science Course, HSMC: Humanities Studies and 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, S: Self-Learning, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation, PP/NP: Pass/Not Pass, XX: Programme Code (EC, CS, IS etc.,), Y: A/B/C/D, K: Indicates Common Course to all the streams of Engineering

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

MOOGAMBIGAI CHARITABLE AND EDUCATIONAL TRUST

Rajarajeswari College of Engineering

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

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	B25MCS401	Discrete Mathematical Structures	Maths	**42**	**28**	**0**	**50**	**50**	**50**	**100**	**3**	**4**
2.	PCC	B25CS402	Database Management Systems	AI	**42**	**28**	**0**	**50**	**50**	**50**	**100**	**3**	**4**
3.	IPCC	B25CS403	Design and Analysis of Algorithms	AI	**42**	**0**	**28**	**50**	**50**	**50**	**100**	**3**	**4**
4.	PCC	B25AI404	Principles of Artificial Intelligence	AI	**42**	**0**	**0**	**48**	**50**	**50**	**100**	**3**	**3**
5.	BSC	B25BEK405	Biology for Engineers	AI	**28**	**0**	**0**	**32**	**50**	**50**	**100**	**2**	**2**
6.	PCCL	B25CSL406	Database Management Systems lab	AI	**0**	**0**	**28**	**2**	**50**	**50**	**100**	**3**	**1**
7.	AEC	B25AIL407	Principles of Artificial Intelligence Lab	AI	**0**	**0**	**28**	**2**	**50**	**50**	**100**	**3**	**1**
8.	SDC	B25AIP408	Environmental Science Project	AI	**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	B25NCK410A/ 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**

ASC: Applied Science Courses, BSC: Basic Science Course, HSMC: Humanities Studies and 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, S: Self-Learning, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation, PP/NP: Pass/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. **Colleges shall submit Continuous Internal Evaluation (CIE) marks for each semester based on the activities completed by students under the selected course. 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 and 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 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

Probability and Statistics

Category: ASC

(Common to CSE, CSD, CSE(IC), ISE, AIML)

Course Code	:	**B25MCS301**	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 introduce the concept of random variables, probability distributions, specific discrete and continuous distributions with practical application in Computer Science Engineering and social life situations.
2.	To understand and analyze the probabilistic relationships between multiple random variables and determining relationships like co-variance and correlation.
3.	To Provide the principles of statistical inference and the basics of hypothesis testing with emphasis on some commonly Encountered hypotheses.
4.	To Determine whether an input has a statistically significant effect on the system's response through ANOVA testing.

Module-1	**No. of Hrs**
Probability Distributions: Review of Basic Probability Theory. Random Variables (Discrete And Continuous), Probability Mass and Density Functions, Mean And Variance. Binomial, Poisson, Exponential and Normal Distributions - Problems (Derivations For Mean And Standard Deviation For Binomial And Poisson Distributions Only)-Illustrative Examples.	10
Module-2	**No. of Hrs**
Joint Probability Distribution & Markov Chain: Joint Probability Distribution For Two Discrete Random Variables, Expectation, Covariance and Correlation. Markov Chain: Introduction To Stochastic Process, Probability Vectors, Stochastic Matrices, Regular Stochastic Matrices, Markov Chains, Higher Transition Probabilities, Stationary Distribution of Regular Markov Chains and Absorbing States.	10
Module-3	**No. of Hrs**
Statistical Inference-I: Introduction, Sampling Distribution, Standard Error, Testing Of Hypothesis, Levels Of Significance, Test of Significance, Confidence Limits, Simple Sampling Of Attributes, Test Of Significance For Large Samples, Comparison Of Large Samples.	10
Module-4	**No. of Hrs**
Statistical Inference-II: Sampling variables, Central limit theorem and confidence limits for unknown means. Test of significance for means of two small samples, Student's t- distribution, Chi-square distribution as a test of goodness of fit .F-distribution.	10
Module-5	**No. of Hrs**
Design of Experiments &ANOVA: Principles of experimentation in design, analysis of completely randomized design, randomized block design. The ANOVA, technique, basic principle of ANOVA, one-way ANOVA, two-way ANOVA, Latin-square design, and analysis of co-variance.	10

Course Outcomes: At the end of the course, the students will be able to	
CO1	Apply fundamental principles of probability to analyze uncertain events and real-world engineering problems.
CO2	Model and an analyze random variables and their probability distributions to interpret stochastic behavior in engineering contexts.
CO3	Apply appropriate probability distribution models for solving practical engineering scenarios**.**
CO4	Compute and interpret confidence intervals for population parameters**,** particularly the mean, to support statistical inference.
CO5	Utilize statistical methods and tools for data analysis and decision-making in engineering problem- solving.

Text Books	
1.	Ronalde, Walpole, Raymond HMyers, SharonL Myers&Keying Ye"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 Text Books	
1.	ErwinKreyszig, "Advanced Engineering Mathematics", John Wiley&Sons, 9th Edition, 2006.
2.	B.S. Grewal "Higher Engineering Mathematics", Khannapublishers, 44th Ed. 2021.
3.	G Haribaskaran "Probability, Queuing Theory & Reliability Engineering", Laxmi Publication, LatestEdition,2006
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):

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	PO12
CO1	3	3	-	-	2	-	-	-	-	1	-	2
CO2	3	3	-	-	2	-	-	-	-	1	-	2
CO3	3	3	-	-	2	-	-	-	-	1	-	2
CO4	3	3	-	-	2	-	-	-	-	1	-	2
CO5	3	3	-	-	2	-	-	-	-	1	-	2

Level3-High, Level2-Moderate, Level1 -Low

Semester III					
Data Structures and its Applications **Category: PCC** **(Common to CSE, CSD, AIML, CSE(IC), ISE)**					
Course Code	:	**B25CS302**	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 explain fundamentals of data structures and their applications essential for programming/problem solving.
2.	To apply stack, Queue and recursion operations to solve real world problems.
3.	To illustrate linear representation of data structures: Stack, Queues, Lists, Trees and Graphs.
4.	To demonstrate sorting and searching algorithms.
5.	To find suitable data structure during application development/Problem Solving.

Module– 1	**No. of Hrs**
Introduction: Data Structures, Classifications (Primitive &Non-Primitive), Data structure Operations, Review of Arrays, Structures, Self-Referential Structures, and Unions. Pointers and Dynamic Memory Allocation Functions. Representation of Linear Arrays in Memory, dynamically allocated arrays. Array Operations: Traversing, inserting, deleting, searching, and sorting. Multidimensional Arrays, Polynomials and Sparse Matrices. Strings: Basic Terminology, Storing, Operations and Pattern Matching algorithms. Programming Examples.	11
Module– 2	**No. of Hrs**
Stacks: Definition, Stack Operations, Array Representation of Stacks, Stacks using Dynamic Arrays, Stack Applications: Polish notation, Infix to postfix conversion, evaluation of postfix expression. Recursion - Factorial, GCD, Fibonacci Sequence, Tower of Hanoi, Ackerman's function. Queues: Definition, Array Representation, Queue Operations, Circular Queues, Circular queues using Dynamic arrays, Dequeues, Priority Queues, A Mazing Problem. Multiple Stacks and Queues. Programming Examples.	11
Module– 3	**No. of Hrs**
Linked Lists: Definition, Representation of linked lists in Memory, Memory allocation; Garbage Collection. Linked list operations: Traversing, Searching, Insertion, and Deletion. Doubly Linked lists, Circular linked lists, and header linked lists. Linked Stacks and Queues. Applications of Linked lists – Polynomials, Sparse matrix representation. Programming Examples.	12
Module– 4	**No. of Hrs**
Trees: Terminology, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals - Inorder, postorder, preorder; Additional Binary tree operations. Threaded binary trees, Binary Search Trees – Definition, Insertion, Deletion, Traversal, Searching, Application of Trees-Evaluation of Expression, Programming Examples	11

Module– 5	**No. of Hrs**
Graphs: Definitions, Terminologies, Matrix and Adjacency List Representation of Graphs, Elementary Graph operations, Traversal methods: Breadth First Search and Depth First Search. Sorting and Searching: Insertion Sort, Radix sort, Address Calculation Sort. Hashing: Hash Table organizations, Hashing Functions, Static and Dynamic Hashing. Files and Their Organization: Data Hierarchy, File Attributes, Text Files and Binary Files, Basic File Operations, File Organizations and Indexing.	11

Course Outcomes: At the end of the course, the students will be able to	
CO1	Use different types of data structures, operations and algorithms
CO2	Apply searching and sorting operations on files
CO3	Use stack, Queue, Lists, Trees and Graphs in problem solving
CO4	Implement all data structures in a high-level language for problem solving.
CO5	Identify the alternative implementations of data structure to solve real world problems

Text Books	
1.	Ellis Horowitz and SartajSahni, Fundamentals of Data Structures in C, 2nd Edition, Universities Press, 2014.
2.	Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Edition, McGraw Hill, 2014.

References Text Books	
1.	Gilberg&Forouzan, Data Structures: A Pseudo-code approach with C, 2nd Edition, Cengage Learning, 2014.
2.	ReemaThareja, Data Structures using C, 3rd Ed, Oxford press, 2012.
3.	Jean-Paul Tremblay & Paul G. Sorenson, An Introduction to Data Structures with Applications, 2nd Edition, McGraw Hill, 2013.

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	1	-	-	1	-	1	2
CO2	2	2	-	1	1	1	-	1	-	2	2
CO3	1	1	-	1	1	-	-	1	-	2	1
CO4	1	1	-	1	1	1	-	1	-	1	1
CO5	1	1	-	1	1	-	-	1	-	1	1

Semester-III

Digital Design and Computer Organization

Category: IPCC

(Common to CSE, AIML, CSD, ISE)

Course Code	:	**B25CS303**	CIE	:	50 Marks
Teaching Hours L : T : P : S	:	42:0:28:50	SEE	:	50 Marks
Total Hours/Semester	:	120	Total	:	100 Marks
Credits	:	4	SEE Duration	:	3 Hrs

Course Learning Objective is	
1	To demonstrate the functionalities of binary logic system.
2	To explain the working of combinational and sequential logic system.
3	To realize HDL Verilog programmes.
4	To realize the basic structure of computer system.
5	To illustrate the working of I/O operations and processing unit.

Module– 1	**No. of Hrs.**
Introduction: Binary Logic, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Digital Logic Gates, Introduction, The Map Method, Four-Variable Map, Don't-Care Conditions, NAND and NOR Implementation, Other Hardware Description Language – Verilog Model of a simple circuit.	9
Module– 2	**No. of Hrs.**
Combinational Logic: Introduction, Combinational Circuits, Design Procedure, Binary Adder-Sub tractor, Decoders, Encoders, Multiplexers. HDL Models of Combinational Circuits – Adder, Multiplexer, Encoder. Sequential Logic: Introduction, Sequential Circuits, Storage Elements: Latches, Flip-Flops.	9
Module– 3	**No. of Hrs.**
Basic Structures of Computer: Functional Units, Basic Operational Concepts, Bus structure, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. Machine Instructions and Programs: Memory Location and Addresses, Memory Operations, Instruction and Instruction sequencing, Addressing Modes	8
Module– 4	**No. of Hrs.**
Input/output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Direct Memory Access: Bus Arbitration, Speed, size and Cost of memory systems. Cache Memories – Mapping Functions	8
Module– 5	**No. of Hrs.**
Basic Processing Unit: Some Fundamental Concepts: Register Transfers, Performing ALU operations, fetching a word from Memory, Storing a word in memory. Execution of a Complete Instruction. Pipelining: Basic concepts, Role of Cache memory, Pipeline Performance.	8

Course Outcomes: At the end of the course, the students will be able to	
CO1	Apply the K–Map techniques to simplify various Boolean expressions.
CO2	Design different types of combinational and sequential circuits along with Verilog programs.
CO3	Describe the fundamentals of machine instructions, addressing modes and Processor performance.
CO4	Explain the approaches involved in achieving communication between processor and I/O devices
CO5	Analyse internal Organization of Memory and Impact of cache/Pipelining on Processor Performance.

LABORATORY

Sl. No	Name of the experiments
1.	Given a 4-variable logic expression, simplify it using appropriate technique and simulate the same using basic gates.
2.	Design a 4 bit full adder and subtractor and simulate the same using basic gates.
3.	Design a 2 bit half adder and subtractor and simulate the same using NAND and NOR gates
4.	Given a 4-variable logic expression, simplify it using appropriate technique and simulate the same using Verilog HDL
5.	Design Verilog HDL to implement simple circuits using structural, Data flow and Behavioural model.
6.	Design Verilog HDL to implement Binary Adder-Subtractor – Half and Full Adder, Half and Full Subtractor.
7.	Design Verilog HDL to implement Decimal adder.
8.	Design Verilog program to implement Different types of multiplexer like 2:1, 4:1 and 8:1.
9.	Design Verilog program to implement types of De-Multiplexer.
10.	Design Verilog program for implementing various types of Flip-Flops such as SR, JK and D.

Text Books	
1.	M. Morris Mano & Michael D. Ciletti, Digital Design With an Introduction to Verilog Design, 5th edition, Pearson Education
2.	Carl Hamacher, ZvonkoVranesic, SafwatZaky, Computer Organization, 5th Edition, Tata McGraw Hill.
References	
1.	Carl Hamacher, ZvonkoVranesic, SafwatZaky, NaraigManjikian, "Computer Organization and Embedded Systems", 6th Edition, Tata McGraw-Hill, 2012.
2.	William Stallings, "Computer Organization and Architecture – Designing for Performance", 10th Edition, Pearson Education, 2016.
3.	M. Morris Mano, "Digital Logic and Computer Design", Pearson Education, 2016.

ASSESSMENT STRUCTURE:
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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 Assessments 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	-	-	1	2
CO2	2	2	-	-	-	2	1	-	-	2	2
CO3	1	1	-	-	-	1	2	-	-	2	1
CO4	1	1	-	-	-	1	2	-	-	1	1
CO5	1	1	-	-	-	1	2	-	-	1	1

Semester-III					
Operating Systems **Category: PCC** **(Common to AIML, CSD, ISE, CSE)**					
Course Code	:	**B25CS304**	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	:	3 Hrs

Course Learning Objective is	
1.	To introduce the fundamental concepts of operating systems, their functions, and types
2.	To explain process management, scheduling algorithms, and inter-process communication.
3.	To describe memory management techniques, including paging, segmentation, and virtual memory
4.	To illustrate file systems, storage management, and input-output operations
5.	To explore synchronization mechanisms, deadlocks, and security aspects in operating systems
6.	To provide insights into modern operating systems such as Linux, Windows, and mobile OS.

Module– 1	**No. of Hrs**
Introduction to Operating Systems: Definition, Purpose, and Evolution of Operating Systems, Types of Operating Systems: Batch, Time-sharing, Distributed, Real-Time, and Mobile OS, Operating System Structure: Monolithic, Layered, Microkernel, and Hybrid, System Calls and Operating System Services	9
Module– 2	**No. of Hrs**
Process Management & CPU Scheduling Processes: Concept, Process Control Block (PCB), Process States, Threads: Single vs. Multithreading, User vs. Kernel Threads, CPU Scheduling: Scheduling Criteria, Preemptive & Nonpreemptive Scheduling, Scheduling Algorithms: FCFS, SJF, Priority Scheduling, Round Robin, Multi-Level Queue Scheduling, Inter process Communication (IPC) and Synchronization, Deadlocks: Detection, Prevention, Avoidance (Banker's Algorithm), Recovery	9
Module– 3	**No. of Hrs**
Memory Management: Memory Allocation: Contiguous & Non-Contiguous Allocation, Paging and Segmentation, Virtual Memory: Demand Paging, Page Replacement Algorithms (FIFO, LRU, Optimal), Thrashing and Working Set Model	9
Module– 4	**No. of Hrs**
File System & Storage Management File Concepts: File Attributes, File Types, File Access Methods, File System Structure: Directory Structure, File Allocation Methods (Contiguous, Linked, Indexed), Disk Scheduling Algorithms: FCFS, SSTF, SCAN, C-SCAN, LOOK, File Protection & Security	9
Module– 5	**No. of Hrs**
I/O Systems, Security, and Case Studies: I/O Hardware, Device Drivers, Interrupt Handling, Security and Protection in Operating Systems, Authentication and Access Control Mechanisms, Case Study: UNIX/Linux, Windows, Android Operating System	9

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the basic structure, functionalities, and design principles of an operating system.
CO2	Analyze process scheduling techniques and inter-process communication mechanisms.
CO3	Implement memory management techniques such as paging, segmentation, and virtual memory.
CO4	Evaluate file system structures, disk scheduling algorithms, and storage management strategies
CO5	Apply synchronization techniques to avoid race conditions and deadlocks.

Text Books	
1.	Abraham Silberschatz, Peter B. Galvin, Greg Gagne- "Operating System Concepts, 10th Edition, Wiley, 2018"
2.	William Stallings – "Operating Systems: Internals and Design Principles, 9th Edition, Pearson, 2018".

Reference Books	
1	Andrew S. Tanenbaum – "Modern Operating Systems, 4th Edition, Pearson, 2015".
2	DhananjayM.Dhamdhere–"Operating Systems: A Concept-Based Approach, 3rd Edition, McGraw-Hill, 2017"
3	Gary Nutt – "Operating Systems, 3rd Edition, Pearson, 2004"

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

Semester- III					
OOPs using Java **Category: PCC**					
Course Code	:	**B25AI305**	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 understand basic constructs of Java programming.
2.	To learn core OOP concepts in Java.
3.	To apply inheritance, interfaces, and packages.
4.	To handle exceptions and multithreading.
5.	To develop GUI applications and database connectivity using Swing and JDBC.

Module– 1	**No. of Hours**
An Overview of Java: Object Oriented Programming Concepts of Java, Characteristics of Java, Real-time applications of Java, Fundamental Programming Structures in Java, Primitive Data Types, Variables, Literals, and Keywords. Type Conversion and Casting, Automatic Type Promotion in Expressions, Arrays. **Operators:** Arithmetic Operators, Relational Operators, Boolean Operators, Logical Operators, Assignment Operator, Ternary Operator, Operator Precedence using Parentheses. **Control and Iterative Statements:** Introduction to if statements, Switch statement. While, do-While, For Loops, and Nested Loops, break, goto, and continue statements.	9
Module– 2	**No. of Hours**
Introducing Classes: Class Fundamentals, Declaring Objects, Assigning Object Reference Variables, Introducing Methods, Constructors, this Keyword, and Garbage Collection. **Methods and Classes:** Method Overloading, Objects as Parameters, Argument Passing, Returning Objects, Recursion, Access Control, understanding static, final, Nested and Inner Classes.	9
Module– 3	**No. of Hours**
Inheritance: Basics, Types, Access specifiers, using super, creating a Multilevel Hierarchy, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, Local Variable Type Inference and Inheritance. **Interfaces:** Introduction, Default Interface Methods, Use static Methods in an Interface, Private Interface Methods. **Packages:** Introduction, Packages and Member Access, Importing Packages.	8
Module– 4	**No. of Hours**
Exceptions Handling: Fundamentals, Exception Types, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses. **Multi-Threaded Programming**: Java Thread Model, The Main Thread, Creating a Thread, Creating Multiple Threads, Using is Alive () and join (), Thread Priorities, Synchronization, Inter thread Communication, Suspending, Resuming, and Stopping Threads, Obtaining a Thread's State.	8
Module– 5	**No. of Hours**
Graphics programming: Basics of Applets, working with 2D shapes, using color, fonts, images, and basics of event handling. **Swing:** Introduction, layout management, and Swing Components. **JDBC:** Introduction, JDBC Product Components, JDBC Architecture - Case studies.	8

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the object-oriented programming concepts
CO2	Design a class involving data members and methods for the given scenario.
CO3	Apply the concepts of inheritance and interfaces in solving real world problems.
CO4	Use the concept of exception handling and multi-threading in solving complex problem.

CO5	Design an application with AWT and swing components.

Text Books	
1.	Java - The Complete Reference, Herbert Schildt, Tata McGraw-Hill, 8th Edition, 2011.
2.	Core Java: Volume I – Fundamentals Cay S. Horstmann and Gary Cornell, 9th Edition, Sun Microsystems Press, 2013.
3.	Java SE 8 for Programmers Paul Deitel, Harvey Deitel / Pearson / 3rd Edion /2015

Reference Text Books	
1.	Understanding Object-oriented programming with Java Timothy Budd / Pearson Education / 2000
2.	The Java Programming Language-A primer Ken Arnold, James Gosling, David Holmes, , 4th Edition, Prentice Hall

Web links and Video lectures (e-Resources)

- https://docs.oracle.com/javase/tutorial/?utm_source=chatgpt.com
- https://nptel.ac.in/courses/106105191?utm_source=chatgpt.com
- https://www.geeksforgeeks.org/java/java/
- https://www.udemy.com/course/java-the-complete-java-developer-course/?utm_source=chatgpt.com
- https://www.youtube.com/playlist?list=PLsyeobzWxl7pe_IiTfNyr55kwJPWbgxB5

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

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

Semester-III					
Data Structures and its Applications Lab **Category: PCCL** **(Common to CSE, CSD, ISE, AIML)**					
Course Code	:	**B25CSL306**	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 implement linear data structures such as arrays, stacks, queues, linkied lists.
2.	To apply suitable data structures for solving various computational problems effectively and efficiently.
3.	To implement nonlinear data structures such as trees, and graphs.
4.	To apply nonlinear data structure to provide the solution for the given problem.
5.	To familiarize students with file handling and explore applications of data structures in real-world scenarios.

Sl. No	**List of Experiments**
1.	Develop a Program in C for the following: a) Declare a calendar as an array of 7 elements (A dynamically Created array) to represent 7 days of a week. Each Element of the array is a structure having three fields. The first field is the name of the Day (A dynamically allocated String), The second field is the date of the Day (A integer), the third field is the description of the activity for a particular day (A dynamically allocated String). b) Write functions create(), read() and display(); to create the calendar, to read the data from the keyboard and to print weeks activity details report on screen.
2.	Develop a Program in C for the following operations on Strings. a. Read a main String (STR), a Pattern String (PAT) and a Replace String (REP) b. Perform Pattern Matching Operation: Find and Replace all occurrences of PAT in STR with REP if PAT exists in STR. Report suitable messages in case PAT does not exist in STR Support the program with functions for each of the above operations. Don't use Built-in functions.
3.	Develop a menu driven Program in C for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX) a. Push an Element on to Stack b. Pop an Element from Stack c. Demonstrate how Stack can be used to check Palindrome d. Demonstrate Overflow and Underflow situations on Stack e. Display the status of Stack f. Exit Support the program with appropriate functions for each of the above operations
4.	Develop a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, % (Remainder), ^ (Power) and alphanumeric operands.
5.	Develop a Program in C for the following Stack Applications a. Evaluation of Suffix expression with single digit operands and operators: +, -, *, /, %,^ . b. Solving Tower of Hanoi problem with n disks

6.	Develop a menu driven Program in C for the following operations on Circular QUEUE of Characters (Array Implementation of Queue with maximum size MAX) a. Insert an Element on to Circular QUEUE b. Delete an Element from Circular QUEUE c. Demonstrate Overflow and Underflow situations on Circular QUEUE d. Display the status of Circular QUEUE e. Exit Support the program with appropriate functions for each of the above operations
7.	Develop a menu driven Program in C for the following operations on Singly Linked List (SLL) of Student Data with the fields: USN, Name, Programme, Sem, PhNo a. Create a SLL of N Students Data by using front insertion. b. Display the status of SLL and count the number of nodes in it c. Perform Insertion / Deletion at End of SLL d. Perform Insertion / Deletion at Front of SLL(Demonstration of stack) e. Exit
8.	Develop a menu driven Program in C for the following operations on Doubly Linked List (DLL) of Employee Data with the fields: SSN, Name, Dept, Designation,Sal, PhNo a. Create a DLL of N Employees Data by using end insertion. b. Display the status of DLL and count the number of nodes in it c. Perform Insertion and Deletion at End of DLL d. Perform Insertion and Deletion at Front of DLL e. Demonstrate how this DLL can be used as Double Ended Queue. f. Exit
9.	Develop a Program in C for the following operations on Singly Circular Linked List (SCLL) with header nodes a. Represent and Evaluate a Polynomial P(x,y,z) = 6x2y2z-4yz5+3x3yz+2xy5z-2xyz3 b. Find the sum of two polynomials POLY1(x,y,z) and POLY2(x,y,z) and store the result in POLYSUM(x,y,z) Support the program with appropriate functions for each of the above operations
10.	Develop a menu driven Program in C for the following operations on Binary Search Tree (BST) of Integers. a. Create a BST of N Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2 b. Traverse the BST in Inorder, Preorder and Post Order c. Search the BST for a given element (KEY) and report the appropriate message d. Exit
11.	Develop a Program in C for the following operations on Graph(G) of Cities a. Create a Graph of N cities using Adjacency Matrix. b. Print all the nodes reachable from a given starting node in a digraph using DFS/BFS
12.	Given a File of N employee records with a set K of Keys (4-digit) which uniquely determine the records in file F. Assume that file F is maintained in memory by a Hash Table (HT) of m memory locations with L as the set of memory addresses (2-digit) of locations in HT. Let the keys in K and addresses in L are Integers. Develop a Program in C that uses Hash function H: K →L as H(K)=K mod m (remainder method), and implement hashing technique to map a given key K to the address space L. Resolve the collision (if any) using linear probing.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Apply the concepts of pointers and structures in problem solving
CO2	Use different types of linked lists to solve problems
CO3	Demonstrate stack and queue data structures to solve problems.
CO4	Use the Binary search tree and graph data structures to solve problems.
CO5	Illustrate the operations performed on tree data structures, hash functions for problem solving.

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 one experiment each from both Part A and Part B.
- 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.
- In SEE component, Part A must be evaluating as 40% and Part B will be evaluating as 60%.
- 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	1	2	2	1	-	-	-	2	1	2	2
CO2	3	3	1	1	-	-	-	1	1	1	3
CO3	2	1	3	1	-	-	-	1	1	2	3
CO4	3	1	3	3	-	-	-	1	2	3	3
CO5	3	2	1	1	2	-	-	3	3	3	1

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

Semester-III					
OOPs using Java Lab **Category: AEC**					
Course Code	:	**B25AIL307**	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	:	2 Hrs

Course Learning Objective is	
1.	To understand the basic constructs of Java programming.
2.	To comprehend core Object-Oriented Programming (OOP) concepts in Java.
3.	To apply inheritance, interfaces, and package concepts.
4.	To implement exception handling and multithreading in Java.
5.	To develop GUI applications and database connectivity using Swing and JDBC.

Sl. No	**List of Experiments**
1.	a) Write a Java program to develop a calculator and to find the factorial of a given number. b) Write a Java program to compute the sum of all prime numbers between 1 and using control structures.
2.	a) Write a program to implement matrix addition and multiplication using 2D arrays. b) Create a class with method overloading to calculate the area of a rectangle, circle, and square.
3.	A class called Employee, which models an employee with an ID, name, and salary, is designed as shown in the following class diagram. The method raise Salary (percent) increases the salary by the given percentage. Develop the Employee class and a suitable main method for demonstration.
4.	Develop a JAVA program to create an outer class with a function display. Create another class inside the outer class named inner with a function called display, and call the two functions in the main class.
5.	Develop a JAVA program to create an abstract class Shape with abstract methods calculate Area () and Calculate Perimeter (). Create subclasses Circle and Triangle that extend the Shape class and implement the respective methods to calculate the area and perimeter of each shape.
6.	a) Demonstrate multilevel and multiple inheritance using suitable classes and interfaces. b) Use super () to invoke the parent class constructor and access parent class members.
7.	Create a user-defined package, define a class in the package, and access it from another program
8.	Develop a JAVA program to raise a custom exception (user-defined exception) for division By Zero using ry, catch, throw, and finally.
9.	Write a program to illustrate the creation of threads using the Runnable class. (Start method starts each of the newly created threads. Inside the run method, there is a sleep () for suspending the thread for 500 milliseconds.
10.	a) Write a Java program to demonstrate an applet with color and shape. b) Write the program to demonstrate AWT and Swing in Java.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Understand the object-oriented programming concepts
CO2	Design a class involving data members and methods for the given scenario.
CO3	Apply the concepts of inheritance and interfaces in solving real-world problems.
CO4	Use the concept of exception handling and multi-threading in solving complex problems.
CO5	Design an application with AWT and Swing components.

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 one experiment each from both Part A and Part B.
- 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.
- In SEE component, Part A must be evaluating as 40% and Part B will be evaluating as 60%.
- 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.

Component	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**

Semester-IV					
Discrete Mathematical Structures **Category: ASC** **(Common to AIML, ISE, CSD, CSE)**					
Course Code	:	**B25MCS401**	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	:	3Hrs

Course Learning Objective is	
1.	To enhance logical thinking and problem-solving abilities in students.
2.	To analyzingandsolvingcombinatorialproblemsusinglogicalreasoningandcreativity.
3.	To solve problems using counting techniques and combinatorics.
4.	To analyze and solve problems involving graph connectivity.
5.	To analyze and solve problems involving tree structures.

Module–1	**No. of hours**
Set Theory: Fundamentals of Set Theory, Set Operations, Laws of Set Theory, Counting And Venn Diagrams, Cartesian Product, Relations, Types of Relations, Functions, Types of Functions, Function of Composition, Inverse Functions. Mathematical Induction.	14
Module–2	**No. of hours**
Mathematical Logic: Logic And Counting: Fundamentals of Logic, Propositional Logic, Logical Connectives And Truth Tables, Logic Equivalence, Tautology And Contradiction, Contingency, Methods of Proof And Disproof.	14
Module–3	**No. of hours**
Elementary Combinatorics: Basis of counting, Combinations& Permutations, with repetitions, Constrained Repetitions, Binomial coefficients, Binomial Multinomial theorems, The principles of Inclusion–Exclusion, Pigeon-hole Principles and its applications.	14
Module–4	**No. of hours**
Graph Theory: Introduction, representing graphs, operations on graphs, Directed graphs, graph Isomorphism, Paths, Cycles, Euler Graph, Hamilton graph, Planar graphs.	14
Module–5	**No. of hours**
Trees and Lattices Theory: Introduction, applications of Trees, Spanning trees, Minimum Spanning trees, Prim's And Kruskul's Algorithms. **Lattices Theory:** Lattices and Algebraic systems, Principles of duality, basic properties.	14

Course Outcomes: At the end of the course, the students will be able to	
CO1	Apply concepts of set theory, relations, functions, and mathematical induction to solve Mathematical and engineering problems.
CO2	Apply counting techniques and mathematical logic to analyze and solve real-life problems.
CO3	Apply fundamental combinatorial methods to solve counting and arrangement problems.
CO4	Use basic concepts of graph theory to model and analyze theoretical and practical problems.
CO5	Analyze the problems involving tree structures in discrete mathematical contexts**.**

Text Books	
1.	RalphP. Grimaldi: Discrete and Combinatorial Mathematics, 5th Edition, Pearson Education.
2.	RichardBronson, Schaum's OutlineofMatrixOperations,McGraw-Hillpublications,2nd Edition.

Reference Text Books	
1.	Gregory Hartman, Fundamentals of Matrix Algebra, 3rd Edition.
2.	GaryHaggard, JohnSchlipf, Discrete Mathematics for Computer Science, Thomson Books.

Web links and Video lectures(e-Resources)
• https://nptel.ac.in/courses/12286025 • VTUEDUSATPROGRAMME– 20 • 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	2	-	-	-	1	-	-	-	-	-
CO2	2	3	-	1	-	-	1	-	-	-	-
CO3	2	1	-	-	-	-	-	1	-	-	-
CO4	1	1	-	-	-	-	-	-	-	-	-
CO5	1	1	-	-	-	-	-	-	-	-	-

Level3-High, Level2–Moderate, Level1 -Low

Semester-IV					
Database Management Systems **Category: PCC** **(Common to AIML, ISE, CSD, CSE, CSE(IC))**					
Course Code	:	**B25CS402**	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 introduce the fundamental concepts of database systems and data models, particularly the relational model.
2.	To understand and apply relational algebra and relational calculus for query formulation.
3.	To develop SQL queries for data definition, manipulation, and control.
4.	To understand the concepts of normalization and apply it to improve database design and eliminate anomalies.
5.	To gain knowledge of transaction processing, concurrency control, and recovery techniques to ensure data integrity and consistency.

Module– 1	**No. of Hrs**
Introduction to Databases: Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications. **Overview of Database Languages and Architectures:** Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment. **Conceptual Data Modelling using Entities and Relationships:** Entity types, Entity sets, attributes and structural constraints, Weak entity types, ER diagrams.	14
Module– 2	**No. of Hrs**
Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations. **Relational Algebra:** Unary and Binary relational operations, additional relational operations (aggregate, grouping) Examples of Queries in relational algebra. **Mapping Conceptual Design into a Logical Design:** Relational Database Design using ER-to Relational mapping.	14
Module– 3	**No. of Hrs**
SQL-Advance Queries: Views in SQL, Nested and co-related queries, Exists & Not Exists, joins & outer joins, specifying constraints as assertions and action Triggers, Check constraints. Comparisons using Null values & three-Valued logic. **SQL:** Specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL.	14
Module– 4	**No. of Hrs**
Normalization: Database Design Theory –Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, First, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form.	14
Module– 5	**No. of Hrs**
Transaction Processing - Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL. **Concurrency Control in Databases-** Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multiversion Concurrency control techniques, Validation Concurrency control techniques.	14

Course Outcomes: At the end of the course, the students will be able to	
CO1	Design entity relationship for the given scenario.
CO2	Design the relational model and mapping conceptual design in to a logical design.
CO3	Apply various structured Query Language (SQL) statements for database manipulation.
CO4	Analyze various normalization forms for the given application.
CO5	Understand the concepts of transaction management and recovery mechanisms.

Text Books	
1.	Fundamentals of Database Systems, RamezElmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson.
2.	Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill
3.	Elmasri and Navathe, —Fundamentals of Database Systems, 7th Edition, Pearson education, 2016
References Text Books	
1.	Abraham Silberschatz, Henry F. Korth and S. Sudarshan's Database System Concepts 6th Edition Tata Mcgraw Hill Education Private Limited
2.	G. K. Gupta —Database Management Systems, 3rd Edition, McGraw – Hill, 2018
3.	Dr. P.S. Deshpande, SQL and PL/SQL for Oracle 10g, Black Book, Dreamtech Press, 2012

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**	**10+10**	**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	-	-	-	3	1	-	-	1	2
CO2	2	2	-	-	-	2	1	-	-	2	2
CO3	1	1	-	-	-	1	2	-	-	2	1
CO4	1	1	-	-	-	1	2	-	-	1	1

Semester-IV					
Design and Analysis of Algorithms **Category: IPCC** **(Common to- AIML, ISE, CSD, CSE, CSE(IC))**					
Course Code	:	**B25CS403**	CIE	:	50 Marks
Teaching Hours L : T : P: S	:	42:0:28:50	SEE	:	50 Marks
Total Hours/Semester	:	120	Total	:	100 Marks
Credits	:	4	SEE Duration	:	3 Hrs

Course Learning Objective is	
1.	To learn the methods for analyzing algorithms and evaluating their performance.
2.	To demonstrate the efficiency of algorithms using asymptotic notations.
3.	To solve problems using various algorithm design methods, including brute force, greedy, divide and conquer, decrease and conquer, transform and conquer, dynamic programming, backtracking, and branch and bound.
4.	To learn the concepts of P and NP complexity classes.
5.	To apply algorithmic techniques in real-world problem solving and enhance logical and analytical thinking.

Module– 1	**No. of Hrs**
Introduction: What is an Algorithm? Fundamentals of Algorithmic Problem Solving. **Fundamentals of the analysis of algorithm efficiency:** Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non recursive Algorithms, Mathematical Analysis of Recursive Algorithms. **Brute force approaches:** Selection Sort and Bubble Sort, Sequential Search and Brute Force String Matching.	9
Module– 2	**No. of Hrs**
Brute force approaches: Exhaustive Search (Travelling Salesman problem and Knapsack Problem). **Decrease-and-conquer:** Insertion Sort, Topological Sorting. **Divide and conquer:** Merge Sort, Quick Sort, Binary Tree Traversals, Multiplication of Large Integers and Strassen's Matrix Multiplication.	9
Module– 3	**No. of Hrs**
Transform and Conquer: Balanced Search Trees, Heaps and Heapsort. **Space-time tradeoffs:** Sorting by Counting: Comparison counting sort. **Input Enhancement in String Matching:**Horspool's Algorithm.	8
Module– 4	**No. of Hrs**
Dynamic programming: Three basic examples, The Knapsack Problem and Memory Functions, Warshall's and Floyd's Algorithms. **The greedy method:** Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees and Codes	8
Module– 5	**No. of Hrs**
Limitations of algorithmic power: Decision Trees, P, NP, and NP-Complete Problems. **Coping with limitations of algorithmic power:** Backtracking (n-Queens problem, Subset-sum problem), Branch-and-Bound (Knapsack problem), Approximation algorithms for NPHard problems (Knapsack problem).	8

Course Outcomes: At the end of the course, the students will be able to	
CO1	Apply asymptotic notational method to analyze the performance of the algorithms in terms of time complexity.
CO2	Demonstrate divide & conquer approaches and decrease & conquer approaches to solve computational problems.
CO3	Make use of transform & conquer and dynamic programming design approaches to solve the given real world or complex computational problems.
CO4	Apply greedy and input enhancement methods to solve graph & string based computational problems.
CO5	Analyze various classes (P,NP and NP Complete) of problems.

LABORATORY

Sl. No	List of Experiments
1.	Design and implement C/C++ Program to sort a given set of n integer elements using Selection Sort method and compute its time complexity.
2.	Design and implement C/C++ Program to sort a given set of n integer elements using Quick Sort method and obtain its Time complexity
3.	Design and implement C/C++ Program to sort a given set of n integer elements using Merge Sort method and compute its time complexity.
4.	Design and implement C/C++ Program to obtain the Topological ordering of vertices in a given digraph
5.	Design and implement C/C++ Program to solve 0/1 Knapsack problem using Dynamic Programming method.
6.	a) Design and implement C/C++ Program to solve All-Pairs Shortest Paths problem using Floyd's algorithm. b) Design and implement C/C++ Program to find the transitive closure using Warshal's algorithm.
7.	Design and implement C/C++ Program to find Minimum Cost Spanning Tree of a given connected undirected graph using Kruskal's algorithm.
8.	Design and implement C/C++ Program to find Minimum Cost Spanning Tree of a given connected undirected graph using Prim's algorithm
9.	Design and implement C/C++ Program to find shortest paths from a given vertex in a weighted connected graph to other vertices using Dijkstra's algorithm
10.	Design and implement C/C++ Program to find a subset of a given set S = {sl , s2,.....,sn} of n positive integers whose sum is equal to a given positive integer d.
11.	Design and implement C/C++ Program to solve discrete Knapsack and continuous Knapsack problems using greedy approximation method.
12.	Design and implement C/C++ Program for N Queen's problem using Backtracking.

Textbooks	
1.	Introduction to the Design and Analysis of Algorithms, By AnanyLevitin, 3rd Edition (Indian), 2017, Pearson
References Textbooks	
1.	Computer Algorithms/C++, Ellis Horowitz, SatrajSahni and Rajasekaran, 2nd Edition, 2014, Universities Pres
2.	Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI.
3.	Design and Analysis of Algorithms, S. Sridhar, Oxford (Higher Education)

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 Assessments 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	1	-	2	1	-	-	1	-	1	2
CO2	2	2	-	2	1	-	-	1	-	2	2
CO3	1	1	-	2	1	-	-	-	-	2	1
CO4	1	1	-	2	1	-	-	-	-	1	1
CO5	1	1	-	2	1	-	-	-	-	1	1

Semester-IV					
Principles of Artificial Intelligence **Category: PCC**					
Course Code	:	**B25AI404**	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 introduce fundamental concepts and applications of Artificial Intelligence.
2.	To enable problem-solving using search techniques.
3.	To develop knowledge representation and logical reasoning skills.
4.	To understand uncertainty handling using probabilistic models.
5.	To explore intelligent decision-making systems.

Module– 1	**No. of Hours**
Introduction to Artificial Intelligence: Overview of Artificial Intelligence, historical development, and scope of AI in modern applications. Characteristics of intelligent systems and the interdisciplinary nature of AI. Concept of intelligent agents, agent structure, and agent–environment interaction. Classification of agents, including simple reflex, model-based, goal-based, and utility-based agents. Performance measures, rationality, and task environment specification using the PEAS framework.	9
Module– 2	**No. of Hours**
Problem Formulation and Uninformed Search: Problem formulation and representation as state space search. Components include the initial state, goal state, operators, and path cost. Uninformed search techniques include Breadth First Search, Depth First Search, Depth Limited Search, Iterative Deepening Search, and Uniform Cost Search. Analysis of completeness, optimality, time and space complexity of search strategies.	9
Module– 3	**No. of Hours**
Informed Search and Optimization Techniques: Informed (heuristic) search strategies including Greedy Best First Search and A* algorithm. Design and properties of heuristic functions. Admissibility and consistency of heuristics. Local search methods including hill climbing, simulated annealing, and genetic algorithms. Application of optimization techniques in problem-solving.	8
Module– 4	**No. of Hours**
Knowledge Representation and Logical Reasoning: Knowledge-based systems and representation of knowledge. Propositional logic including syntax, semantics, and inference rules. First Order Logic including predicates, quantifiers, and relations. Inference mechanisms including forward chaining and backward chaining. Resolution principle and its applications in automated reasoning and problem solving.	8
Module– 5	**No. of Hours**
Uncertainty and Probabilistic Reasoning: Uncertainty in AI and fundamentals of probability theory. Conditional probability and independence. Bayesian inference and belief updating using Bayes' theorem. Bayesian networks for probabilistic representation. Introduction to Hidden Markov Models and reasoning under uncertainty in dynamic environments.	8

Course Outcomes: At the end of the course, the students will be able to	
CO1	Explain fundamental concepts of Artificial Intelligence and intelligent agents
CO2	Apply appropriate search algorithms for solving AI problems
CO3	Represent knowledge and perform logical reasoning
CO4	Analyze uncertainty using probabilistic reasoning models
CO5	Design simple intelligent systems for decision making

Text Books	
1.	Stuart J. Russell and Peter Norvig, Artificial Intelligence, 3rd Edition, Pearson,2015
2.	Elaine Rich, Kevin Knight, Artificial Intelligence, 3rd edition, Tata McGraw Hill,2013
Reference Text Books	
1.	George F Lugar, Artificial Intelligence: Structure and Strategies for Complex, Pearson Education, 5th Edition,2011

2.	Nils J. Nilsson, Principles of Artificial Intelligence, Elsevier, 1980
3.	Saroj Kaushik, Artificial Intelligence, Cengage Learning, 2014

Web links and Video lectures (e-Resources)
• **https://www.kdnuggets.com/2019/11/10-free-must-read-books-ai.html** • **https://www.udacity.com/course/knowledge-based-ai-cognitive-systems--ud409** • **https://nptel.ac.in/courses/106/105/106105077/**

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	2	-	-	-	-	-	-	-	-	-
CO2	3	3	2	2	2	-	-	-	-	-	-
CO3	3	3	3	2	2	-	-	-	-	-	-
CO4	3	2	2	3	2	-	-	-	-	-	-
CO5	3	3	3	3	3	-	-	-	-	-	-

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

Semester-IV					
Database Management Systems Lab **Category: PCCL** **(Common to CSE, ISE, CSD, AIML)**					
Course Code	:	**B25CSL406**	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 Provide a strong foundation in database concepts, technology, and practice.
2.	To Practice SQL programming through a variety of database problems.
3.	To Understand the relational database design principles.
4.	To Demonstrate the use of concurrency and transactions in database.
5.	To Design and build database applications for real world problems

Sl. No	**List of Experiments**
1.	Implementation of DDL commands of SQL with suitable examples • Create • Alter • Drop • Truncate • Rename
2.	Implementation of DML commands of SQL with suitable examples • Insert • Update • Delete • Select
3.	Implementation of different types of function with suitable examples • Aggregate Function • Using Parentheses • Column Aliases • Literal Character Strings • Duplicate Row
4.	Implementation of different types of operators in SQL • Arithmetic Operators • Concatenation Operator • Comparison Operator (=,>,>=,<,<=,<>) • Other Comparison Operator (BETWEEN, IN, LIKE, IS NULL) • Logical Operator (AND, OR, NOT)
5.	Implementation of different types of Joins • Inner Join • Outer Join i. Left outer join ii. Right outer join iii. Full outer Join • Natural Join
6.	Study and Implementation of • Group By & having clause • Order by clause • Sorting in Descending & Ascending order
7.	Study & Implementation of different types of constraints. • Primary Key & Foreign Key Constraints • NOT NULL Constraints • Default 1 Constraints • Check constraints

	• Domain Constraints • Entity Integrity Constraints • Referential Integrity Constraints
8.	Consider the following schema for a Library Database: BOOK(Book_id, Title, Publisher_Name, Pub_Year) BOOK_AUTHORS(Book_id, Author_Name) PUBLISHER(Name, Address, Phone) BOOK_COPIES(Book_id,Programme_id,No-of_Copies) BOOK_LENDING(Book_id,Programme_id,Card_No,Date_Out, Due_Date) LIBRARY_PROGRAMME(Programme_id, Programme_Name, Address) Write SQL queries to 1. Retrieve details of all books in the library–id, title, name of publisher, authors, number of copies in each Programme, etc. 2. Get the particulars of borrowers who have borrowed more than 3 books,but from Jan 2017 to Jun 2017. 3. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation. 4. Partition the BOOK table base don year of publication .Demonstrate its working with a simple query. 5. Create a view of all books and its number of copies that are currently available in the Library.
9.	Consider the following schema for Order Database: SALESMAN(Salesman_id, Name, City, Commission) CUSTOMER(Customer_id, Cust_Name, City, Grade, Salesman_id) ORDERS(Ord_No,Purchase_Amt,Ord_Date,Customer_id,Salesman_id) Write SQL queries to 1. Count the customers with grades above Bangalore's average. 2. Find the name and numbers of all salesman who had more than one customer. 3. List all the salesman and indicate those who have and don't have customers in their cities (Use UNION operation.) 4. Create a view that finds the salesman who has the customer with the highest order of a day 5. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.
10.	Consider the schema for Movie Database: ACTOR(Act_id, Act_Name, Act_Gender) DIRECTOR(Dir_id, Dir_Name, Dir_Phone) MOVIES(Mov_id,Mov_Title,Mov_Year,Mov_Lang, Dir_id) MOVIE_CAST(Act_id, Mov_id, Role) RATING(Mov_id,Rev_Stars) Write SQL queries to 1. List the titles of all movies directed by„Hitchcock" 2. Find the movie names where one or more actors acted in two or more movies. 3. List all actors who acted in a movie before 2000 and also in a movie after 2015 (use JOIN operation). 4. Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title. 5. Update rating of all movies directed b 'Steven Spielber'to 5.

Course Outcomes: At the end of the course, the students will be able to	
CO1	Create, Update and query on the database.
CO2	Demonstrate the working of different concepts of DBMS.
CO3	Implement SQL commands for database schema creation and modification.
CO4	Apply Primary and Foreign Key constraints to enforce entity integrity and referential integrity.
CO5	Explain the purpose and functionality of different types of joins in relational databases.

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 one experiment each from both Part A and Part B.
- 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.
- In SEE component, Part A must be evaluating as 40% and Part B will be evaluating as 60%.
- 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	3	3	3	2	-	-	-	-	-	1
CO2	3	3	3	3	2	-	-	-	-	-	1
CO3	3	3	3	3	2	-	-	-	-	-	1
CO4	3	3	3	3	2	-	-	-	-	-	1
CO5	3	3	3	3	2	-	-	-	-	-	1

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

Semester-IV					
Principles of Artificial Intelligence Lab **Category: AEC**					
Course Code	:	**B25AIL407**	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 AI foundations and basic concepts.
2.	To apply AI techniques for problem-solving.
3.	To use heuristic search and propositional logic for reasoning.
4.	To perform inference using First Order Logic methods.
5.	To understand probabilistic reasoning and expert systems.

Sl. No	**List of Experiments**
1.	Implement and Demonstrate the Depth First Search Algorithm on the Water Jug Problem
2.	Implement and Demonstrate the Best First Search Algorithm on Missionaries-Cannibals Problems using Python.
3.	a. Implement A* Search algorithm b. Implement AO* Search algorithm
4.	Solve the 8-Queens Problem with suitable assumptions
5.	Implementation of TSP using a heuristic approach
6.	Implementation of the problem- solving strategies: either using Forward Chaining or Backwards Chaining
7.	Implement the resolution principle on FOPL-related problems
8.	Implement the Tic-Tac-Toe game using Python
9.	Build a bot that provides all the information related to text in the search box
10.	Implement any Game and demonstrate the game-playing strategies

Course Outcomes: At the end of the course, the students will be able to	
CO1	Apply knowledge of agent architectures, search, and reasoning techniques to various applications.
CO2	Compare various Searching and inference techniques..
CO3	Develop knowledge base sentences using propositional logic and first-order logic.
CO4	Describe the concepts of quantifying uncertainty.
CO5	Apply the concepts of expert systems to build applications.

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 one experiment each from both Part A and Part B.
- 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.
- In SEE component, Part A must be evaluating as 40% and Part B will be evaluating as 60%.
- 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
	Internal Test 1	50	15	
	Internal Test 2	50	20	
SEE	Semester End Examination	100	50	50
Total Marks				100

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

Common Courses
Semester III / IV

(2025 Scheme)

Semester-III					
Community Project / Societal Project (Project Based Learning) **Category: SDC**					
Course Code	:	**B25AIP308**	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	:	**B25AIP408**	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.(minimu m5 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.