Department: **Mathematics**		
Semester: **III**	Course Code: **BMATS24301**	Contact Hrs /week: 3
Course Title: **Discrete Mathematics** (Common for CSE/ISE/AI&DS/AI &ML/CS-AI&ML)		No. of Credits: 3 L : T : P : S = **3:0:0:0**
Course Category: Basic Science Course (BSC)		Total no. of Hours = 40
CIE: **50 Marks**	SEE: **50**	Exam Hours: **03**
Course Pre-requisites: Basic algebra and number theory Fundamental concepts of functions and relations Introductory set theory and probability concepts from high school mathematics		

1. PREAMBLE ABOUT THE COURSE

This course provides a foundation in discrete mathematical structures that are vital to computer science, information technology, and applied mathematics. The course covers set theory, logic, counting principles, relations, functions, and probability with emphasis on reasoning, proof techniques, and combinatorial problem-solving. Through structured learning and problem-oriented approaches, students will build the mathematical foundation required for algorithm design, data structures, and theoretical computer science.

2. COURSE LEVEL OBJECTIVES

By the end of this course, students will be able to:

1. Apply set theory and probability concepts**.**
2. Construct and evaluate logical statements**.**
3. Use counting principles and combinatorial techniques**.**
4. Analyze and classify relations and functions.
5. Identify and manipulate different types of functions.

3. COURSE OUTCOMES (COs) & COMPETENCIES

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Apply set theory, counting principles, and basic probability concepts to model and solve problems in computer	PO1, PO2, PO5	L3	WK1, WK2, WK3,WK6	8

	science, including algorithm analysis and data representation.				
CO2	Construct and evaluate logical statements using truth tables, rules of inference, and quantifiers to develop valid proofs and verify program correctness.	PO1, PO2, PO5	L3	WK1, WK2, WK3,WK6	8
CO3	Solve combinatorial problems using counting techniques, permutations, combinations, and mathematical induction to support algorithm design and complexity analysis.	PO1, PO2, PO5	L2	WK1, WK2, WK3,WK6	8
CO4	Analyze relations and their properties using matrices and graphs, and interpret equivalence and partial order relations using Hasse diagrams and partitions in discrete structures.	PO1, PO2, PO5	L4	WK1, WK2, WK3,WK6.	8
CO5	Apply function theory, generating functions, and recurrence relations to model computational processes and analyze recursive algorithms.	PO1, PO2, PO5	L3	WK1, WK2, WK3,WK6	8

WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
I	Sets and Subsets, Set Operations and the Laws of Set Theory, Counting and Venn Diagrams. Probability, Axioms of probability, Conditional probability, Bayes theorem.	CO1	8
II	Fundamentals of Logic: Basic Connectives and Truth Tables, Logic Equivalence, The Laws of Logic Logical Implication: Rules of Inference, Quantifiers, Definitions, and the Proofs of Theorems.	CO2	8
III	Fundamental Principles of Counting: The Rules of Sum and Product, Permutations, Combinations: The Binomial Theorem, Combinations with Repetition. The Well Ordering Principle: Mathematical Induction, Recursive Definitions.	CO3	8
IV	Relations: Cartesian Products and Relations, Properties of Relations, Computer Recognition: Zero-One Matrices and Directed Graphs, Partial Orders: Hasse Diagrams, Equivalence Relations and Partitions.	CO4	8

V	Functions: Plain and One-to-One, Onto Functions. Function Composition and Inverse Functions. Generating function and first order recurrence relation.	CO5	8

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition
1	Discrete and Combinatorial Mathematics	Ralph P. Grimaldi	Pearson Education	5th
2	Higher Engineering Mathematics	B. S. Grewal	Khanna Publishers	44th
3	Discrete Mathematics and its Applications	Kenneth H. Rosen	McGraw Hill	6th
4	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10th
5	Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks	T Veerarajan	Tata McGraw Hill Co	4^{th}

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCS/WEB RESOURCE

1. https://nptel.ac.in/courses
2. https //swayam.gov.in/nptel onlinecourses.nptel.ac.in/
3. https://academicearth.org/online-college-courses/
4. https://elearning.vtu.ac.in/

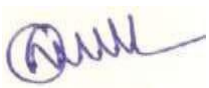
7. EVALUATION METHODOLOGY

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Components	Marks
Test 1	40 Marks
Test 2	40 Marks
Assignment	10 Marks
Final CIE Marks	Average of 2 tests + Assignment Marks



8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs → / COs ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	**1**	-	-	1	-	-	-	-	-	-
CO2	3	1	-	-	1	-	-	-	-	-	-
CO3	3	1	-	-	1	-	-	-	-	-	-
CO4	3	1	-	-	1	-	-	-	-	-	-

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs → / COs ↓	PSO1	PSO2	PSO3
CO1	-	-	-
CO2	-	-	-
CO3	-	-	-
CO4	-	-	-

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

*****

Department: **Computer Science and Engineering (AI & ML)**		
Semester: **III**	Course Code: **BCI24302**	Contact Hrs /week: **3**
Course Description: **Operating Systems**		No. of Credits:**4** L : T : P : S = **3:0:2:0**
Course Category: **IPCC**		Total no. of Hours = 50
CIE: **50 Marks**	SEE: **50 Marks**	Exam Hours: **03**
Course Pre-requisites: Programming in C		

1. PREAMBLE ABOUT THE COURSE

The Operating System is a fundamental component of computer science and engineering, serving as the interface between hardware and software. This course provides an in-depth understanding of how operating systems function, manage resources, and provide services for computer programs. Students will explore core concepts such as process management, memory management, file systems, input/output handling, and security. By studying both theoretical foundations and practical implementations, learners will gain the skills necessary to analyze, design, and work with modern operating systems, equipping them for further study and professional practice in system-level programming and software development.

2. COURSE LEVEL OBJECTIVES

- To Demonstrate the need for OS and different types of OS
- To discuss suitable techniques for management of different resources
- To demonstrate different APIs/Commands related to processor,

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Explain core OS concepts processes, scheduling, synchronization, memory, file systems, storage, and protection.	PO1,PO2,PO3, PO5,PO11, PSO1,PSO2	L2	WK1,WK2,WK3, WK4,WK5, WK6,WK8	10

CO2	Apply scheduling and synchronization techniques for process and resource management.	PO1,PO2,PO3, PO5,PO11, PSO1,PSO2	L3	WK1,WK2,WK3, WK4,WK5, WK6,WK6	10
CO3	Demonstrate memory allocation, paging, segmentation, and file system organization.	PO1,PO2,PO3, PO5,PO11, PSO1,PSO2	L3	WK1,WK2,WK3, WK4,WK5, WK6,WK7	10
CO4	Analyze the performance of OS algorithms in scheduling, memory, and file systems.	PO1,PO2,PO3, PO5,PO11, PSO1,PSO2	L4	WK1,WK2,WK3, WK4,WK5, WK6,WK8	10

WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
I	Introduction to operating systems, System structures: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Special-purpose systems; Computing environments. Operating System Services: User - Operating System interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating System structure; Virtual machines; Operating System debugging, Operating System generation; System boot. **Textbook 1: Chapter – 1 (1.1-1.12), 2 (2.2-2.11)**	CO1, CO4	10
II	Process Management: Process concept; Process scheduling; Operations on processes; Inter process communication Multi-threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues. Process Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Thread scheduling; Multiple-processor scheduling, **Textbook 1: Chapter – 3 (3.1-3.4), 4 (4.1-4.4), 5 (5.1 -5.5)**	CO1, CO2, CO4	10
III	**Process Synchronization**: Synchronization: The critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; **Deadlocks:** System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention;	CO1, CO2, CO4	10

	Deadlock avoidance; Deadlock detection and recovery from deadlock. **Textbook 1: Chapter – 6 (6.1-6.6), 7 (7.1 -7.7)**		
IV	**Memory Management:** Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation. **Virtual Memory Management:** Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing. **Textbook 1: Chapter -8 (8.1-8.6), 9 (9.1-9.6)**	CO1, CO3, CO4	10
V	**File System, Implementation of File System:** File system: File concept; Access methods; Directory and Disk structure; File system mounting; File sharing; Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management. **Secondary Storage Structure, Protection**: Mass storage structures; Disk structure; Disk attachment; Disk scheduling; Disk management; Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix **Textbook 1: Chapter – 10 (10.1-10.5) ,11 (11.1-11.5),12 (12.1-12.5), 14 (14.1-14.4)**	CO1, CO3, CO4	10

Lab Programs

1. Develop a c program to implement the Process system calls (fork (), exec(), wait(), create process, terminate process)
2. Simulate the following CPU scheduling algorithms to find turnaround time and waiting time
   a) FCFS b) SJF c) Round Robin d) Priority.
3. Develop a C program to simulate producer-consumer problem using semaphores.
4. Develop a C program which demonstrates interprocess communication between a reader process and a writer process. Use mkfifo, open, read, write and close APIs in your program.
5. Develop a C program to simulate Bankers Algorithm for DeadLock Avoidance.
6. Develop a C program to simulate the following contiguous memory allocation Techniques:
   a) Worst fit b) Best fit c) First fit.
7. Develop a C program to simulate page replacement algorithms:
   a) FIFO b) LRU
8. Simulate following File Organization Techniques
   a) Single level directory b) Two level directory
9. Develop a C program to simulate the Linked file allocation strategies.
10. Develop a C program to simulate SCAN disk scheduling algorithm.

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Operating System Principles	Abraham Silberschatz, Peter Baer Galvin, Greg Gagne	Wiley-India	8th edition,2015	1,2,3,4,5
2	Understanding Operating System	Ann McHoes Ida M Fylnn	Cengage Learning	6th Edition	All Modules
3	Operating Systems: A Concept Based Approach	D.M. Dhamdhere	McGraw-Hill	3rd Edition, 2013	All Modules
4	An Introduction to Operating Systems: Concepts and Practice	P.C.P. Bhatt	PHI (EEE)	4th Edition, 2014	All Modules
5	Operating Systems: Internals and Design Principles	William Stallings	Pearson	6th Edition	All Modules

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCS/WEB RESOURCE

1. Introduction to Operating Systems:- https://onlinecourses.nptel.ac.in/noc21_cs72/preview
2. Introduction to Operating Systems Specialization:- https://www.coursera.org/specializations/codio-introduction-operating-systems

7. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks
b) Semester End Examination (SEE) = 50 marks
Total = 100 marks

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

CIE Framework:

Two tests are to be conducted for 40 marks each. The average of the two tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

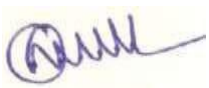


Table: Distribution of weightage for CIE & SEE of Integrated courses

	Component	Marks	Total Marks
CIE	CIE Test-1	**30**	**50**
	CIE Test-2	**30**	
	Lab	**20**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs → / **COs ↓**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	2		2						2
CO2	2	3	2		2						2
CO3	2	2	2		2						2
CO4	2	3	2		3						2

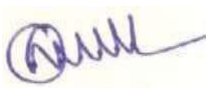
Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs → / **COs ↓**	**PSO1**	**PSO2**
CO1	2	1
CO2	2	1
CO3	2	1
CO4	2	1

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

*****



GLOBAL ACADEMY OF TECHNOLOGY

Autonomous Institution Affiliated to Visveswaraya Technological University
Approved by UGC, AICTE and Govt of Karnataka

Department: **Computer Science and Engineering (AI & ML)**		
Semester: **III**	Course Code: **BCI24303**	Contact Hrs /week: **3**
Course Description: **Digital Logic Design and Computer Organization**		No. of Credits:**4** L : T : P : S = **3:0:2:0**
Course Category: **IPCC**		Total no. of Hours = 50
CIE: **50 Marks**	SEE: **50 Marks**	Exam Hours: **03**
Course Pre-requisites: Basic Electronics		

1. PREAMBLE ABOUT THE COURSE

Digital Logic Design and Computer Organization form the backbone of computer engineering, providing essential insights into how computing systems are built and function at the hardware level. This course introduces the principles of digital logic, including number systems, Boolean algebra, combinational and sequential circuits, and progresses into the structural design of computer systems, covering data paths, control units, memory hierarchy, and instruction execution. For students of CSE (AI & ML), understanding these foundational concepts is crucial, as they bridge the gap between low-level hardware mechanisms and high-level intelligent systems, enabling optimized implementation of algorithms and efficient utilization of computing resources.

2. COURSE LEVEL OBJECTIVES

- Understand the basic digital principles and working of various logic gates, and different techniques for simplification of Boolean function
- Design combinational logic circuits and describe their applications
- Understand the working of Flip-Flops
- Understand the basic processing unit and memory system of a computer.
- Learn arithmetic and logical operations with integer and floating-point operands

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

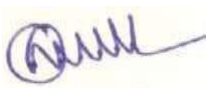
Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours

CO1	Explain machine instructions, addressing modes, and input/output mechanisms in computer systems.	PO1,PO2, PO3,PO5, PO9,PSO1	L2	WK1,WK2, WK3,WK4, WK5,WK6	10
CO2	Interpret the minimization of combinational logic expressions using K-map and Quine–McCluskey approaches.	PO1,PO2, PO3,PO5, PO9,PSO1	L2	WK1,WK2, WK3,WK4, WK5,WK6	10
CO3	Illustrate the basic processing unit, memory hierarchy, and performance implications of cache design in computer architecture.	PO1,PO2, PO3,PO5, PO9,PSO1	L2	WK1,WK2, WK3,WK4, WK5,WK6	10
CO4	Implement combinational circuits (Adders, Subtractors, Multiplexers, Decoders, Code Converters) and sequential circuits (Flip-Flops, Counters, Registers).	PO1,PO2, PO3,PO4, PO5,PSO1	L3	WK1,WK2, WK3,WK4, WK5,WK6,WK8	10
CO5	Demonstrate arithmetic operations such as addition, subtraction, multiplication, and floating-point computations using hardware or simulation tools.	PO1,PO2, PO3,PO4, PO5,PO9, PSO1	L3	WK1,WK2, WK3,WK4, WK5,WK6,WK8	10

WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
I	**Combinational Logic Circuits:** Boolean functions, The Map Method: Two, Three, Four Variable Maps, Map Manipulation, Product-of-Sums, Sum-of-Products Optimization, Don't Care Conditions, The Tabulation Method, Determination of Prime Implicants **Text Book: T1 Chapters:4, 5, 6**	CO2	10

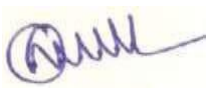


II	**Data Processing Circuits:** Adders, Subtractors, Code Converters, Magnitude Comparators, Multiplexers, De-multiplexers, Encoders, Decoders, Introduction to Flip-Flops, Types of Flip flops, Various Representation of Flip-Flops, JK Master-Slave Flip-Flop **Text Book: T1 Chapters: 9, 11**	CO4	10
III	**Machine Instructions and Programs**: Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes, Assembly Language **Input / Output Organization:** Basic Input and Output Operations, Accessing IO Devices, Interrupts-Interrupt Hardware, Enabling and Disabling Interrupts. **Text Book: T2 Chapters: 2, 3**	CO1, CO3	10
IV	**Basic Processing Unit:** Some Fundamental Concepts, Instruction Execution, Hardwired Control, Hardware Components. **Memory System:** Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Cache Memories – Mapping Functions, Replacement Algorithms, Performance Considerations. **Text Book: T2 Chapter: 5, 8**	CO3	10
V	**Arithmetic:** Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers, Signed Operand Multiplication, Floating-point Numbers and Operations **Text Book: T2 Chapter: 9**	CO5	10

Lab Programs

NOTE :- Hardware experiments to be conducted using logic trainer kits and simulation experiments to be conducted using open-source software like Logisim.

1. a. Study and verify the truth tables of AND, OR, NOT, NOR, NAND and XOR Logic Gates.
   b. Simplify the given Boolean expression and realize it using Basic gates and Universal Gates.
2. Design and implement Half Adder, Full Adder, Half Subtractor, and Full Subtractor using Logic Gates. Also simulate their working.
3. Given a 4-variable logic expression, simplify it using appropriate technique and realize the simplified logic expression using 8:1multiplexer IC.
4. Design and implement 4-bit Parity checker.
5. Design and implement Code converter i) Binary to Gray ii) Gray to Binary Code using Logic gates.
6. Realize a J-K Master Slave flip-flop using NAND gates and verify its truth table.
7. Demonstrating Immediate, Direct, Indirect, Register and Indexed addressing modes
8. Design and implement a program that interacts with the user via the console, takes input using keyboard interrupts, and outputs the result.



9. Design and implement a program that performs signed operand multiplication using Booth's algorithm.
10. Implement a simple cache memory simulation with different mapping functions (Direct-Mapped, Associative, and Set-Associative) and a basic replacement algorithm (Least Recently Used - LRU or FIFO).

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Fundamentals of Logic Design	Charles H. Roth, Jr. and Larry L. Kinney	Thomson	6th Edition, 2010	1,2
2	Computer Organization	Carl Hamacher, Zvonko Vranesic, and Safwat Zaky	McGraw Hill Education India	6th Edition, 2012	3,4,5
3	Digital Systems Principles and Applications	Neal S. Widmer, Greg Moss, and Ronald J. Tocci	Pearson	12th Edition, 2022	1,2
4	Computer Organization & Architecture	William Stallings	Pearson	9th Edition, 2015	3,4,5

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCS/WEB RESOURCE

1. Digital System Design :- https://onlinecourses.nptel.ac.in/noc21_ee39/preview
2. Computer architecture and organization: https://onlinecourses.nptel.ac.in/noc20_cs64/preview

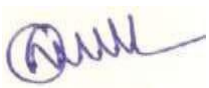
7. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks
b) Semester End Examination (SEE) = 50 marks
Total = 100 marks

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

CIE Framework:



Two tests are to be conducted for 40 marks each. The average of the two tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

Table: Distribution of weightage for CIE & SEE of Integrated courses

	Component	Marks	Total Marks
CIE	CIE Test-1	**30**	**50**
	CIE Test-2	**30**	
	Lab	**20**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs → / **COs ↓**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	2		1				1		
CO2	3	3	2		2				1		
CO3	3	3	3		2				1		
CO4	3	2	3	2	1						
CO5	3	3	2	2	2				2		

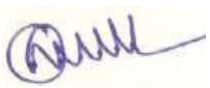
Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs → / **COs ↓**	**PSO1**	**PSO2**
CO1	2	-
CO2	2	-
CO3	2	-
CO4	2	-
CO5	2	-

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

*****



Department: **Computer Science and Engineering (AI & ML)**		
Semester: **III**	Course Code: **BCI24304**	Contact Hrs /week: **3**
Course Description: **Data Structures and its Applications**		No. of Credits:**3** L : T : P : S = **3:0:0:0**
Course Category: **PCC**		Total no. of Hours = 40
CIE: **50 Marks**	SEE: **50 Marks**	Exam Hours: **03**
Course Pre-requisites: Programming in C		

1. PREAMBLE ABOUT THE COURSE

The course Data Structures is a core subject in computer science and engineering that focuses on the efficient organization, storage, and retrieval of data. It introduces essential data structures such as arrays, linked lists, stacks, queues, trees, graphs, and hash tables, along with their real-world applications and implementation techniques. Emphasizing both theoretical understanding and practical skills, the course enables students to analyze algorithm efficiency, make informed choices of data structures for specific problems, and write optimized, maintainable code. It lays a strong foundation for advanced topics in algorithms, software engineering, and system design.

2. COURSE LEVEL OBJECTIVES

- To Provide knowledge of basic data structures and its implications.
- To develop skills to apply appropriate data structures in problem solving.
- To efficiently implement the different data structures and solutions for specific problems
- Create and use appropriate data structures in C programs for solving for real life problems
- Implement programs with suitable data structure based on the requirements of the application

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Demonstrate an understanding of linear and non-linear data structures and its application.	PO1,PO2, PO3,PO11, PSO1,PSO2	L3	WK2,WK6, WK8	08

CO2	Use the different data structure to provide solutions for complex problems.	PO1,PO2, PO3,PO4, PO11,PSO1,PSO2	L3	WK2,WK3, WK4,WK6	08
CO3	Analyze the solution using modern tools for various linear data structures.	PO1,PO2, PO3,PO5, PO11,PSO1,PSO2	L4	WK2,WK4, WK6	08
CO4	Design the programs with suitable non-linear data structure based on application requirements.	PO1,PO2, PO3,PO11, PSO1,PSO2	L6	WK2,WK4, WK6	08

WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
I	**Introduction:** Introduction to Data Structures, Review of arrays, Types of Data Structures, Linear & non-linear Data Structures. **Stacks: Stack** definitions & Concepts, Representing stacks in C, Operations on stacks, Applications of Stacks: Infix to Postfix, Infix to Prefix, Postfix expression evaluation .Recursion: Sample Programs. **Textbook 1: chapter 2,3**	CO1, CO2, CO3	08
II	**Queues:** Representation of Queues, Operations, circular queues. Application of Queues, Priority of queues. **Dynamic Memory allocation:** malloc(), calloc(), free(), realloc() **Linked Lists:** Definition and terminology, Singly Linked List(SLL),Various Operations on SLL: insertion and deletion and display, Programming Examples Such as Polynomials and others. **Textbook 1:chapter 4**	CO2, CO3	08
III	**Circular Linked List(CSLL):** Definition, Various Operations, Application. **Doubly Linked List(DLL):** Definition, Various Operations, Applications: Sparse matrix and Others. **Trees:** Definition, Terminology, Binary Trees(BT), Binary Search Tree(BST): Insertion, Deletion and Traversals: Preorder, Postorder, In-order **Textbook 1: chapter 4,5**	CO2, CO3, CO4	08
IV	**Expression Trees (ET):** Definition, Construction of Expression Tree. **Threaded Binary Tree:** Types and application	CO2, CO4	

	Heap: Definition, Construction, Applications of Heap, Priority Queue. **Textbook 1: chapter 6**		08
V	**Balanced tree:** AVL trees, B tree, B+ tree, Splay. **Graphs:** Introduction, Matrix and List Representation. **Hashing:** Open Hashing, Closed Hashing, Collision, Collision Resolution Strategies. **Textbook 1: chapter 7,8**	CO2, CO4	08

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Data Structures Using C and C++	Yedidyah Langsam, Moshe J. Augenstein, Aaron M. Tenenbaum	PHI/ Pearson	2nd Edition, 2009	All modules
2	Data Structures and Algorithm Analysis in C++	Mark Allen Weiss	Addison-Wesley	4th Revised Edition, 2013	All modules
3	Data Structures Using C	Reema Thareja	Oxford Higher Education	1st Edition, 2011	All modules

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCS/WEB RESOURCE

1. Data Structures:- https://onlinecourses.swayam2.ac.in/cec25_ma15/preview

7. EVALUATION METHODOLOGY

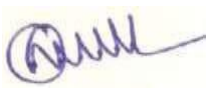
a) Continuous Internal Evaluation (CIE) = 50 marks
b) Semester End Examination (SEE) = 50 marks
Total = 100 marks

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

CIE Framework:

Two tests are to be conducted for 40 marks each. Average of all two tests marks is added to the test component. In order to encourage innovative methods while delivering a course,



the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

Table: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	AAT	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs → / **COs ↓**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	3	3								2
CO2	1	2	2	2							2
CO3	1	2	3		3						2
CO4	1	1	3								2

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs → / **COs ↓**	**PSO1**	**PSO2**
CO1	2	
CO2	2	
CO3	2	
CO4	2	

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

*****

GLOBAL ACADEMY OF TECHNOLOGY

Autonomous Institution Affiliated to Visveswaraya Technological University
Approved by UGC, AICTE and Govt of Karnataka

Department: **Computer Science and Engineering (AI & ML)**		
Semester: **III**	Course Code: **BCIL24305**	Contact Hrs /week: **2**
Course Description: **Data Structures Laboratory**		No. of Credits:**1** L : T : P : S = **0:0:2:0**
Course Category: **PCCL**		Total no. of Hours = **26**
CIE: **50 Marks**	SEE: **50 Marks**	Exam Hours: **03**
Course Pre-requisites: Programming in C		

1. PREAMBLE ABOUT THE COURSE

The **Data Structures Laboratory** course is designed to provide students with hands-on experience in implementing and manipulating various data structures. The course focuses on understanding the core concepts of data structures and their real-world applications. Students will work with fundamental structures such as arrays, linked lists, stacks, queues, trees, graphs, and hash tables. By using a programming language (typically C, C++, or Python), students will learn how to implement these structures and perform operations like insertion, deletion, traversal, and searching. The course will also introduce algorithms for sorting, searching, and graph traversal. The goal is to equip students with a solid understanding of how data can be efficiently organized and processed to optimize performance in computational tasks. Through practical exercises and projects, students will develop problem-solving skills and gain insight into the importance of choosing appropriate data structures for different types of applications.

2. COURSE LEVEL OBJECTIVES

- Understand the elementary data structure with an emphasis of problem solving.
- Develop skills to design and analyze simple linear and non-linear data structures.
- Strengthen the ability of the students to identify and apply suitable data structures for the given real-world problem.
- Enable them to gain knowledge in practical applications of data structures.

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

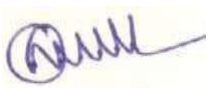
Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours

CO1	Implement stack and queue operations using array.	PO1,PO2,PO3, PO5,PO8, PO10,PSO1	L3	WK2,WK3, WK4,WK6	05
CO2	Demonstrate Recursive functions.	PO1,PO2,PO3, PO5,PO8, PO10,PSO1	L3	WK2,WK3, WK4,WK6	05
CO3	Demonstrate the working of Linked Lists.	PO1,PO2,PO3, PO5,PO8, PO10,PSO1	L3	WK2,WK3, WK4,WK6	05
CO4	Implement Binary tree traversals.	PO1,PO2,PO3, PO5,PO8, PO10,PSO1	L3	WK2,WK3, WK4,WK6	05
CO5	Implement priority queue, heap and hashing.	PO1,PO2,PO3, PO5,PO8, PO10,PSO1	L3	WK2,WK3, WK4,WK6	06

WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

SL.NO	Lab Programs
1	Develop a menu driven Program 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 Overflow and Underflow situations on Stack d. Display the status of Stack e. Exit Support the program with appropriate functions for each of the above operations.
2	Develop a Program 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
3	Develop and Implement a Program for evaluation of Stack Suffix expression with single digit operands and operators: +, -, *, /, %, ^.
4	Develop recursive program to i) To Find GCD of 2 numbers ii) To Solve the Tower of Hanoi Problem
5	Develop a menu driven Program for the following operations on QUEUE of Characters (Array Implementation of QUEUE with maximum size MAX) a. Enqueue an Element on to Queue b. Dequeue an Element from Queue c. Demonstrate Overflow and Underflow situations on Queue d. Display the status of Queue e. Exit Support the program with appropriate functions for each of the above operation.
6	Implement a program to multiply two polynomials using singly linked list.
7	Design a doubly linked list to represent sparse matrix. Each node in the list can have the row and column index of the matrix element and the value of the element. Print the complete matrix as the output.
8	Write a program to create Binary Tree and to traverse the tree using In-order, Preorder and Post order.
9	Write a program to implement priority queue using Heap.



10	Write a program to implement Hashing using Linear probing. Implement insertion, deletion, search, and display.

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Programs Covered
1	Fundamentals of Data Structures in C	Ellis Horowitz, Sartaz Sahni	University Press	2nd Edition, 2008 (Reprinted 2016)	All programs
2	Schaum's Outlines, Data Structures with C	Seymour Lipschutz	McGraw Hill	Special Indian Edition, 13th Reprint, 2015	All programs

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCS/WEB RESOURCE

1. Data Structures:- https://onlinecourses.swayam2.ac.in/cec25_ma15/preview

7. EVALUATION METHODOLOGY

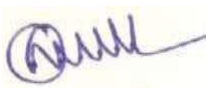
a) Continuous Internal Evaluation (CIE) = 50 marks
b) Semester End Examination (SEE) = 50 marks
Total = 100 marks

CIE Framework:

ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
WEIGHTAGE	**50%**	**50%**
Record	10	**50**
Test	20	
Experimental Learning(Mini Project)	20	NIL
Total Marks for The Course	**50**	**50**

8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs → / COs ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11



CO1	3	3	3		2			2		2	
CO2	3	3	3		2			2		2	
CO3	3	3	3		2			2		2	
CO4	3	3	3		2			2		2	
CO5	3	3	3		2			2		2	

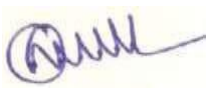
Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs → / **COs ↓**	**PSO1**	**PSO2**
CO1	2	
CO2	2	
CO3	2	
CO4	2	
CO5	2	

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

*****



Department: **Computer Science and Engineering (AI & ML)**		
Semester: **III**	Course Code: **BCI24306A**	Contact Hrs /week: **3**
Course Description: **Unix Programming**		No. of Credits:**3** L : T : P : S = **3:0:0:0**
Course Category: **ETC/PLC**		Total no. of Hours = 40
CIE: **50 Marks**	SEE: **50 Marks**	Exam Hours: **03**
Course Pre-requisites: Operating Systems		

1. PREAMBLE ABOUT THE COURSE

The course **Unix Programming** introduces students to the Unix operating system and its powerful programming environment. It focuses on the fundamentals of Unix commands, shell scripting, file systems, process management, system calls, and inter-process communication. The course aims to equip students with the skills necessary to develop robust, efficient, and portable software using Unix-based tools and environments. Emphasis is placed on hands-on practice, enabling learners to master command-line operations, automate tasks using shell scripts, and write system-level programs. This course lays a strong foundation for careers in systems programming, DevOps, and software development in Unix/Linux environments.

2. COURSE LEVEL OBJECTIVES

- Understand effective use of Unix concepts, commands and terminology
- Identify, access, and evaluate UNIX file system
- Explain the fundamental design of the unix operating system
- Familiarize with the systems calls provided in the unix environment
- Design and build an application/service over the unix operating system

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Explain UNIX architecture, features, envi-	PO1,PO2,PO3, PO5,PSO1.	L2	WK1,WK2, WK3,WK4, WK5	08

	ronment, standardization, file system and process concepts				
CO2	Apply UNIX commands for file, directory, permissions, text processing, and shell utilities.	PO1,PO2,PO3, PO4,PO5,PSO1.	L3	WK1,WK2, WK3,WK4, WK5	08
CO3	Develop shell programs using variables, control structures, pipes, and regular expressions.	PO1,PO2,PO3, PO4,PO5,PSO1.	L3	WK1,WK2, WK3,WK4, WK5	08
CO4	Demonstrate UNIX system programming concepts including File I/O, Process Control, IPC, Signals, and Daemons.	PO1,PO2,PO3, PO4,PO5,PSO1.	L3	WK1,WK2, WK3,WK4, WK5	08

WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
I	Introduction: Unix Components/Architecture. Features of Unix. The UNIX Environment and UNIX Structure, Posix and Single Unix specification. General features of Unix commands/ command structure. Command arguments and options. Basic Unix commands such as echo, printf, ls, who, date, passwd, cal, Combining commands. Meaning of Internal and external commands. The type command: knowing the type of a command and locating it. The root login. Becoming the super user: su command. Unix files: Naming files. Basic file types/categories. Organization of files. Hidden files. Standard directories. Parent-child relationship. The home directory and the HOME variable. Reaching required files- the PATH variable, manipulating the PATH, Relative and absolute pathnames. Directory commands – pwd, cd, mkdir, rmdir commands. The dot (.) and double dots (..) notations to represent present and parent directories and their usage in relative path names. File related commands – cat, mv, rm, cp, wc and od commands. Text Book1: Chapter-1, 2, 3, 4, 5	CO1, CO2	08

II	File attributes and permissions: The ls command with options. Changing file permissions: the relative and absolute permissions changing methods. Recursively changing file permissions. Directorypermissions.The shells interpretive cycle: Wild cards. Removing the special meanings of wild cards. Three standard files and redirection. Connecting commands: Pipe. Basic and Extended regular expressions. The grep, egrep. Typical examples involving different regular expressions. Shell programming: Ordinary and environment variables. The. profile. Read and read-only commands. Command line arguments. exit and exit status of a command. Logical operators for conditional execution. The test command and its shortcut. The if, while, for and case control statements. The set and shift commands and handling positional parameters. The here (<<) document and trap command. Simple shell program examples. Text Book1: Chapter-6,8,13,14	CO2, CO3	08
III	Unix Standardization and Implementations: Introduction, Unix Standardization, UNIX System Implementation. File I/O: Introduction, File Description, open, create, read, write, close, fcntl functions. Files and Dictionaries: mkdir and rmdir functions, reading dictionaries, chdir, fchdir and getcwd functions. Device Special files. The Environment of a UNIX Process: Introduction, main function, Process Termination, Command-Line Arguments, Environment List, Memory Layout of a C Program, Shared Libraries, Memory Allocation, Environment Variables, setjmp and longjmp Functions, getrlimit, setrlimit Functions. Text Book 2: 2,3,4,7.	CO1	08
IV	Process Control: Introduction, Process Identifiers, fork, vfork, exit, wait, waitpid, wait3, wait4 Functions, Race Conditions, exec Functions. Overview of IPC Methods, Pipes, popen, pclose Functions, Coprocesses, FIFOs, System V IPC, Message Queues, Semaphores. Shared Memory, Client-Server Properties, Passing File Descriptors, An Open Server-Version 1. Text Book2: Chapter 8, 15,17	CO1, CO3, CO4	08
V	Signals and Daemon Processes: Introduction, Signal Concepts, Signal Functions, SIGCLD Semantics, Kill and Raise functions, Alarm and Pause Functions, Signal Sets, sigprocmask Function, sigpending function, sigaction function, sigsetjmp and siglongjmp functions, sigsuspend function, abort function, system function, sleep, nanosleep and clock_nanosleep functions, sigqueue functions, job-control signals, signal names and numbers. Daemon Processes: Introduction, Daemon Characteristics, Coding Rules, Error Logging, Client-Server Model. Text Book 2: Chapter 10, 13	CO4	08

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Unix Concepts and Applications	Sumitabha Das	Tata McGraw Hill	4th Edition	1,2
2	Advanced Programming in the UNIX Environment	W.Richard Stevens	Pearson Education	2nd Edition, 2005	3,4,5
3	Unix System Programming Using C++	Terrence Chan	PHI	1999	3,4,5
4	UNIX & Shell Programming	M.G. Venkatesh Murthy	Pearson Education	1st Edition	1,2
5	Linux Command Line and Shell Scripting Bible	Richard Blum, Christine Brenham	Wiley	2nd Edition, 2014	1,2

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCS/WEB RESOURCE

1. https://www.coursera.org/learn/codio-unix-system-basics
2. https://www.udemy.com/course/essential-unix-skills-for-developers

7. EVALUATION METHODOLOGY

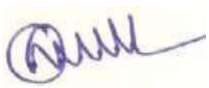
a) Continuous Internal Evaluation (CIE) = 50 marks
b) Semester End Examination (SEE) = 50 marks
Total = 100 marks

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

CIE Framework:

Two tests are to be conducted for 40 marks each. Average of all two tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and ena-



bles them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

Table: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	AAT	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs → / **COs ↓**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	1		1						
CO2	3	3	3	1	2						
CO3	3	3	3	2	3						
CO4	3	2	2	2	2						

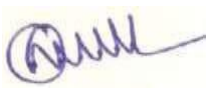
Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs → / **COs ↓**	**PSO1**	**PSO2**
CO1	1	
CO2	1	
CO3	1	
CO4	1	

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

*****



Department: **Computer Science and Engineering (AI & ML)**		
Semester: III	Course Code: **BCI24306B**	Contact Hrs /week: **3**
Course Description: **Metric Spaces**		No. of Credits:**3** L : T : P : S = **3:0:0:0**
Course Category: **ETC/PLC**		Total no. of Hours = 40
CIE: **50 Marks**	SEE: **50 Marks**	Exam Hours: **03**
Course Pre-requisites: Mathematics		

1. PREAMBLE ABOUT THE COURSE

The Metric Spaces course is designed to introduce students to the foundational concepts of mathematical analysis, focusing on the study of spaces equipped with a distance function, known as metric spaces. This course provides a deep understanding of key mathematical structures and their properties, which are essential for various applications in computer science, particularly in fields such as artificial intelligence, machine learning, and data science. By exploring the concepts of continuity, convergence, compactness, and connectedness, students will gain the mathematical tools needed to analyze and solve complex problems in algorithms, optimization, and computational theory. This course not only enhances students' theoretical knowledge but also equips them with the ability to apply these concepts to real-world computational challenges.

2. COURSE LEVEL OBJECTIVES

- Provide insight into the theory of sets
- Learn basic concepts of metric spaces
- Understand the concepts of connected sets and compact spaces

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Explain basic facts about the cardinality of a set and various set-theoretic paradoxes.	PO1,PO2,PO3	L2	WK1,WK2, WK3,WK4	08
CO2	Apply the concepts of open and closed spheres and	PO1,PO2,PO3	L3	WK1,WK2, WK3,WK4	08

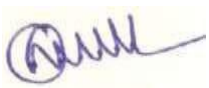
	bounded sets to solve problems.				
CO3	Demonstrate standard concepts of metric spaces and their properties.	PO1,PO2,PO3	L3	WK1,WK2, WK3,WK4	08
CO4	Experiment with the continuity of a function defined on metric spaces and homomorphism.	PO1,PO2,PO3	L3	WK1,WK2, WK3,WK4	08

WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
I	Finite and infinite sets, countable and uncountable sets, cardinality of sets, Schroder-Bernstein theorem, cantor's theorem, Order relation in cardinal numbers, Arithmetic of cardinal numbers, Partially ordered set, Zorn's lemma and axioms of choice, various set-theoretic paradoxes.	CO1	08
II	Definition and examples of metric spaces, Open spheres and Closed spheres, Neighborhoods, Open sets, Interior, Exterior and boundary points, Closed sets, Limit points and isolated points, Interior and closure of a set, Boundary of a set, Bounded sets, Distance between two sets, Diameter of a set.	CO1, CO2	08
III	Cauchy and Convergent sequences, Completeness of metric spaces, Cantor's intersection theorem, Dense sets and separable spaces, Nowhere dense sets and Baire's category theorem,continuous and uniformly continuous functions, Homeomorphism. Banach contraction principle	CO1, CO3	08
IV	Compact spaces, Sequential compactness, Bolzano-Weierstrass property, Compactness and finite intersection property, Heine-Borel theorem, Totally bounded set, equivalence of compactness and sequential compactness	CO1, CO3	08
V	Separated sets, Disconnected and connected sets, components, connected subsets of R, Continuousfunctions on connected sets. Local connectedness and arc-wise connectedness	CO1, CO4	08

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS



S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Metric Spaces	P.K. Jain & Khalil Ahmad	Narosa	4th Edition,2019	1,2,3
2	Metric Spaces	Micheal O. Searcoid	Springer-Verlag	3rd Edition,2009	4,5
3	Metric Spaces	Satish Shirali & Harikishan L. Vasudeva	Springer-Verlag	1st Edition 2006	All modules
4	Topology of Metric Spaces	S. Kumaresan	Narosa	2nd Edition (2011)	All modules
5	Introductions to Topology and Modern Analysis	G.F. Simmons	McGraw-Hill	1st Edition, 2004	All modules

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCS/WEB RESOURCE

1. http://nptel.ac.in/courses.php?disciplineID=111
2. http://www.class-central.com/subject/math(MOOCs)

7. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks
b) Semester End Examination (SEE) = 50 marks
Total = 100 marks

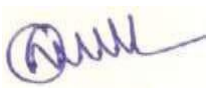
Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

CIE Framework:

Two tests are to be conducted for 40 marks each. Average of all two tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

Table: Distribution of weightage for CIE & SEE



	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	AAT	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs → / **COs ↓**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	1	-		-	-	-	-	-	-
CO2	1	3	2	-		-	-	-	-	-	-
CO3	1	3	2			-	-	-	-	-	-
CO4	2	3	-	2		-	-	-	-	-	-

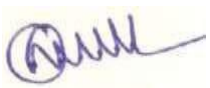
Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs → / **COs ↓**	**PSO1**	**PSO2**
CO1	-	-
CO2	-	-
CO3	-	-
CO4	-	-

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

*****



Department: **Computer Science and Engineering (AI & ML)**		
Semester: III	Course Code: **BCI24306C**	Contact Hrs /week: **3**
Course Description: **Optimization Techniques**		No. of Credits:**3** L : T : P : S = **3:0:0:0**
Course Category: **ETC/PLC**		Total no. of Hours = 40
CIE: **50 Marks**	SEE: **50 Marks**	Exam Hours: **03**
Course Pre-requisites: Fundamentals of Mathematics and algebra		

1. PREAMBLE ABOUT THE COURSE

Optimization techniques form the foundation of many modern computational methods and play a critical role in the design and training of machine learning models. This course introduces students to the principles and practices of optimization with a focus on applications in computer science and artificial intelligence. Starting with the fundamentals of vector calculus, the course progresses through practical applications in deep learning, explores both convex and non-convex optimization problems, and covers a range of algorithms used for efficient and effective optimization. By the end of this course, students will be equipped with the theoretical understanding and practical skills required to apply optimization methods in real-world AI and machine learning scenarios.

2. COURSE LEVEL OBJECTIVES

- Appreciate the importance of linear algebra in computer science and allied engineering science
- Gain the knowledge of linear algebra tools and concepts to implement them in their core domain.
- Improve their mathematical thinking and acquire skills required for sustained lifelong learning.

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Explain concepts of vector calculus and gradient computation for multivariable functions.	PO1,PO2, PO4,PSO1	L2	WK1,WK2, WK3,WK4,WK8	08

CO2	Apply gradient-based methods and backpropagation to optimize cost functions in deep networks.	PO1,PO2, PO3,PO4, PSO1	L3	WK1,WK2, WK3,WK4, WK5,WK8	08
CO3	Analyze convex optimization problems using gradient descent, Hessians, and search methods.	PO1,PO2, PO3,PO4, PSO1	L4	WK1,WK2, WK3,WK4, WK5,WK8	08
CO4	Experiment with advanced optimization algorithms for convex and non-convex problems.	PO1,PO2, PO3,PO4, PSO1	L4	WK1,WK2, WK3,WK4, WK5,WK8	08

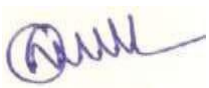
WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
I	**VECTOR CALCULUS**: Functions of several variables, Differentiation and partial differentials, gradients of vector-valued functions, gradients of matrices, useful identities for computing gradients, linearization and multivariate Taylor series.	CO1	08
II	**APPLICATIONS OF VECTOR CALCULUS:** Back-propagation and automatic differentiation, gradients in a deep network, The Gradient of Quadratic Cost, Descending the Gradient of Cost, The Gradient of Mean Squared Error.	CO1, CO2	08
III	**CONVEX OPTIMIZATION-1**: Local and global optima, convex sets and functions separating hyperplanes, application of Hessian matrix in optimization, Optimization using gradient descent, Sequential search 3- point search and Fibonacci search.	CO3	08
IV	**CONVEX OPTIMIZATION-2:** Unconstrained optimization -Method of steepest ascent/descent, NR method, Gradient descent, Mini batch gradient descent, Stochastic gradient descent.	CO3	08
V	**ADVANCED OPTIMIZATION:** Momentum-based gradient descent methods: Adagrad, RMSprop and Adam. Non-Convex Optimization: Convergence to Critical Points, Saddle-Point methods.	CO4	08

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered



1	Mathematics for Machine Learning	Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong	Cambridge University Press	1st Edition (2020)	1,2
2	Convex Optimization: Algorithms and Complexity	Sébastien Bubeck	Foundations and Trends in Optimization	1st Edition (2015)	3,4
3	Distributed Optimization and Statistical Learning via the Alternating Direction Method of Multipliers	Stephen Boyd, Neal Parikh, Eric Chu	Foundations and Trends in Machine Learning, Now Publishers Inc.	1st Edition	5
4	Linear Algebra and Optimization for Machine Learning	Charu C. Aggarwal	Springer	1st Edition (2020)	All modules
5	First-Order Methods in Optimization	Amir Beck	MOS-SIAM Series on Optimization	1st Edition (2017)	All modules

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCS/WEB RESOURCE

1. https://ocw.mit.edu/courses/18-06sc-linear-algebra-fall-2011/
2. https://www.math.ucdavis.edu/~linear/linear.pdf
3. https://www.math.ucdavis.edu/~linear/linear.pdf
4. https://www.coursera.org/learn/linear-algebra-machine-learning

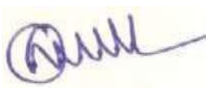
7. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks
b) Semester End Examination (SEE) = 50 marks
Total = 100 marks

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

CIE Framework:



Two tests are to be conducted for 40 marks each. Average of all two tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

Table: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	AAT	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs → / **COs ↓**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	2	2		1							
CO2	2	2	2	2							
CO3	2	2	2	3							
CO4	2	2	2	3							

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs → / **COs ↓**	**PSO1**	**PSO2**
CO1	1	
CO2	1	
CO3	1	
CO4	1	

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

*****

Department: **Computer Science and Engineering (AI & ML)**		
Semester: **III**	Course Code: **BCI24306D**	Contact Hrs /week: **3**
Course Description: **Algorithmic Game Theory**		No. of Credits: **3** L : T : P : S = **3:0:0:0**
Course Category: **ETC/PLC**		Total no. of Hours = 40
CIE: **50 Marks**	SEE: **50 Marks**	Exam Hours: **03**
Course Pre-requisites: Discrete Mathematics, Data Structures		

1. PREAMBLE ABOUT THE COURSE

Algorithmic Game Theory provides a crucial foundation for understanding strategic interactions among intelligent agents, making it highly relevant for CSE-AIML students. This course introduces key concepts such as strategic games, Nash equilibrium, extensive and Bayesian games, and competitive scenarios, with applications in artificial intelligence, machine learning, and economic systems. Through models like the Prisoner's Dilemma, auctions, and duopoly games, students will explore how agents make rational decisions, adapt strategies, and learn in multi-agent environments. Emphasizing both theoretical insights and algorithmic techniques, the course equips students with the analytical tools needed to model and solve real-world problems involving competition, cooperation, and uncertainty in intelligent systems.

2. COURSE LEVEL OBJECTIVES

- Comprehend the basics of strategic gaming and mixed strategic equilibrium.
- Enable students to develop skills on extensive gaming strategies.
- Analyze and discuss various gaming models.
- Illustrate some real-time situations.

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Describe fundamental concepts of game theory and demonstrate understanding of rational choice, strategies, and equilibria.	PO1,PO2,PSO1	L2	WK1,WK2, WK3,WK4	08

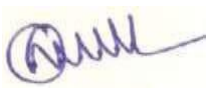
CO2	Apply equilibrium concepts to solve and interpret strategic interactions in different game settings.	PO1,PO2, PO3,PO4,PSO1	L3	WK1,WK2, WK3,WK4. WK5,WK8	08
CO3	Implement mathematical reasoning and logical frameworks to develop strategies in complex strategic games	PO1,PO2, PO3,PO4,PSO1	L3	WK1,WK2, WK3,WK4. WK5,WK8	08
CO4	Utilize optimal strategies for competitive and cooperative decision-making scenarios.	PO1,PO2, PO3,PO4,PSO1	L3	WK1,WK2, WK3,WK4. WK5,WK8	08

WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description	Mapped Cos	No. of Hours
I	Introduction to Strategic Games: What is game theory? The theory of rational choice, Strategic games; Examples: The prisoner's dilemma, Bach or Stravinsky, Matching pennies; Nash equilibrium; Examples of Nash equilibrium; Best response functions; Dominated actions.	CO1	08
II	Introduction: Strategic games in which players may randomize; Mixed strategy Nash equilibrium; Dominated actions; Pure equilibrium when randomization is allowed. Illustration: Expert Diagnosis; Equilibrium in a single population.	CO1	08
III	Extensive games with perfect information; Strategies and outcomes; Nash equilibrium; Subgame perfect equilibrium; Finding sub-game perfect equilibria of finite horizon games: Backward induction; Illustrations: The ultimatum game, Stackelberg's model of duopoly.	CO2	08
IV	Bayesian Games, Motivational examples; General definitions; Two examples concerning information; Illustrations: Cournot's duopoly game with imperfect information, Providing a public good; Auctions: Auctions with an arbitrary distribution of valuations.	CO2, CO3	08
V	Competitive Games: Strictly competitive games and maximization. Repeated games: The main idea; Preferences; Repeated games; Finitely and infinitely repeated Prisoner's dilemma; Strategies in an infinitely repeated Prisoner's dilemma; Nash equilibrium of an infinitely repeated Prisoner's dilemma, Nash equilibrium payoffs of an infinitely repeated Prisoner's dilemma.	CO2, CO3, CO4	08

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS



S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	An Introduction to Game Theory	Martin Osborne	Oxford University Press	1st Indian Edition (2009), 7th Impression	1, 2, 3, 4, 5
2	Analysis of Conflict Game Theory	Roger B. Myerson	Harvard University Press	Reprint Edition (2008)	All modules
3	Introduction to Operations Research, Concepts and Cases	Frederick S. Hillier, Gerald J. Lieberman	Tata McGraw Hill	9th Edition (2010)	All modules
4	An Introduction to Game Theory – Strategy	Joel Watson	W.W. Norton & Company	2nd Edition (2007)	All modules

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCS/WEB RESOURCE

1. http://www.class-central.com/subject/math(MOOCs)
2. http://academicearth.org/
3. https://online.vtu.ac.in/course-details/game-theory

7. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks
b) Semester End Examination (SEE) = 50 marks
Total = 100 marks

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

CIE Framework:

Two tests are to be conducted for 40 marks each. Average of all two tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

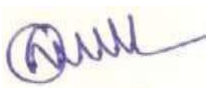


Table: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	AAT	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs → / **COs ↓**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2									
CO2	3	3	2	2							
CO3	3	3	2	3							
CO4	3	3	3	3							

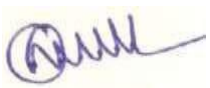
Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs → / **COs ↓**	**PSO1**	**PSO2**
CO1	1	
CO2	1	
CO3	1	
CO4	1	

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

*****



GLOBAL ACADEMY OF TECHNOLOGY

Autonomous Institution Affiliated to Visveswaraya Technological University
Approved by UGC, AICTE and Govt of Karnataka

Department: **Science & Humanities**		
Semester: **III**	Course Code: **BSCK24307**	Contact Hrs /week:2
Course Description: **Social Connect & Responsibility**		No. of Credits:01 L : T : P : S = 0:0:2:0
Course Category: **UHV**		Total no. of Hours = 15
CIE: **100 Marks**	SEE:	Exam Hours:

1. PREAMBLE ABOUT THE COURSE

The *Social Connect & Responsibility* course aims to nurture social awareness, civic responsibility, and environmental sensitivity among students. Through activities like tree plantation, heritage walks, organic farming, and community engagement, students gain hands-on experience in understanding societal needs and contributing to sustainable solutions. The course fosters empathy, teamwork, and leadership, encouraging students to connect classroom learning with real-world impact.

2. COURSE LEVEL OBJECTIVES

CLO1	Provide a formal platform for students to communicate and connect to the surrounding.
CLO2	Create a responsible connection with the society.
CLO3	Understand the community in general in which they work.
CLO4	Identify the needs and problems of the community and involve them in problem – solving.
CLO5	Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
CLO6	Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description
CO1	Communicate and connect to the surrounding.
CO2	Create a responsible connection with the society.
CO3	Involve in the community in general in which they work.

CO4	Notice the needs and problems of the community and involve them in problem – solving.
CO5	Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
CO6	Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description
I	**Plantation and adoption of a tree:** Plantation of a tree that will be adopted for four years by a group of BE / B.Tech students. (ONE STUDENT ONE TREE) They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, its appearance in folklore and literature - – Objectives, Visit, case study, report, outcomes.
II	**Heritage walk and crafts corner:** Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms - – Objectives,Visit, case study, report, outcomes.
III	**Organic farming and waste management:** Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus – Objectives,Visit, case study, report, outcomes.
IV	**Water conservation:** Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photoblog presenting the current practices – Objectives, Visit, case study, report, outcomes.
V	**Food walk:** City's culinary practices, food lore, and indigenous materials of the region used in cooking – Objectives, Visit, case study, report, outcomes.

*****

Department: **Computer Science and Engineering (AI & ML)**		
Semester: **III**	Course Code: **BCI24358A**	Contact Hrs /week: **2**
Course Description: **Scala Programming**		No. of Credits:**1** L : T : P : S = **0:0:2:0**
Course Category: **AEC**		Total no. of Hours = 26
CIE: **50 Marks**	SEE: **50 Marks**	Exam Hours: **02**
Course Pre-requisites: Programming in C / Python		

1. PREAMBLE ABOUT THE COURSE

Scala is a modern, high-level programming language that combines object-oriented and functional programming paradigms, making it ideal for building scalable, robust, and concise applications. This course introduces students to the core features of Scala, including its expressive syntax, strong static type system, and functional constructs such as higher-order functions, pattern matching, and immutability. With a focus on practical development and real-world applications, especially in areas like data processing, concurrent programming, and machine learning, the course enables students to write clean, efficient, and scalable code. Designed for CSE-AIML students, the course also explores how Scala integrates with big data tools like Apache Spark, preparing learners for advanced roles in data science and intelligent systems development.

2. COURSE LEVEL OBJECTIVES

- Model data using algebraic data types, represented in Scala as families of sealed traits and case classes.
- Use structural recursion and pattern matching to traverse and transform data.
- Learn programming with the common data structures of Scala
- Learn object-oriented programming in Scala

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

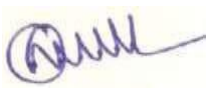
Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Identify the use of Scala's syntax and OOP principles .	PO1,PO2, PO3,PO5, PSO1	L3	WK1,WK2, WK3,WK4,WK6	05

CO2	Apply advanced concepts loops, expressions, inheritance, pattern matching	PO1,PO2, PO3,PO5, PSO1	L3	WK1,WK2, WK3,WK4,WK6	05
CO3	Develop clean and functional Scala codes and test it	PO1,PO2, PO3,PO5, PSO1	L3	WK1,WK2, WK3,WK4,WK6	05
CO4	Apply functional programming concepts in Scala to implement the encoding of non-unique elements in a tuple.	PO1,PO2, PO3,PO5, PSO1	L3	WK1,WK2, WK3,WK4,WK6	06

WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

SL.NO	Lab Programs
1	a. Write a Scala program to compute the sum of the two given integer values. If the two values are the same, then return triples their sum. b. Write a Scala program to check two given integers, and return true if one of them is 22 or if their sum is 32.
2	a. Write a Scala program to remove the character in a given position of a given string. The given position will be in the range 0...string length -1 inclusive. b. Write a Scala program to create a new string taking the first 5 characters of a given string and return the string with the 5 characters added at both the front and back.
3	a. Write a Scala program to print the multiplication table of a given number using a for loop. b. Write a Scala program to find the largest element in an array using pattern matching
4	a. Write a Scala function to calculate the product of digits in a given number b. Write a Scala function to check if a given number is a perfect square
5	a. Write a Scala program that creates a subclass Student that extends the Person class. Add a property called grade and implement methods to get and set it. b. Write a Scala program that creates a class Triangle with properties side1, side2, and side3. Implement a method is Equilateral to check if the triangle is equilateral.
6	a. Write a Scala program that creates an enum class Color with values for different colors. Use the enum class to represent an object's color. b. Write a Scala program that creates a class ContactInfo with properties name, email, and address. Create a class Customer that includes a ContactInfo object.
7	a. Write a Scala program to create a set and find the difference and intersection between two sets.



	b. Write a Scala program to create a set and find the second largest element in the set.
8	a. Write a Scala program to create a list in different ways. Note: Use Lisp style, Java style, Range list, Uniform list, Tabulate list b. Write a Scala program to flatten a given List of Lists, nested list structure.
9	a. Write a Scala program to add each element n times to a given list of integers. b. Write a Scala program to split a given list into two lists.
10	a. Write a Scala program to swap the elements of a tuple Further print no swapping required if elements are same. b. Write a Scala program to find non-unique elements in a tuple

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Programs Covered
1	Programming Scala .	Dean Wampler	O'Reilly Media, Inc	3rd Edition (May 2021)	All Programs

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCS/WEB RESOURCE

1. https://www.coursera.org/learn/scala-functional-programming
2. https://www.javatpoint.com/scala-tutorial

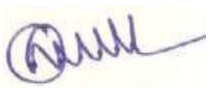
7. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks
b) Semester End Examination (SEE) = 50 marks
Total = 100 marks

CIE Framework:

ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
WEIGHTAGE	**50%**	**50%**
Continuous Evaluation	30	**50**
Test	20	
Total Marks for The Course	**50**	**50**

8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING



POs → / COs ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	3		3						
CO2	3	2	3		3						
CO3	3	2	3		3						
CO4	3	2	3		3						

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs → / COs ↓	PSO1	PSO2
CO1	1	
CO2	1	
CO3	1	
CO4	1	

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

*****

Department: **Computer Science and Engineering (AI & ML)**		
Semester: **III**	Course Code: **BCI24358B**	Contact Hrs /week**: 2**
Course Description: **Project Management with Git**		No. of Credits:**1** L : T : P : S = **0:0:2:0**
Course Category: **AEC**		Total no. of Hours = 26
CIE: **50 Marks**	SEE: **50 Marks**	Exam Hours: **02**
Course Pre-requisites: Basic Software development concepts		

1. PREAMBLE ABOUT THE COURSE

In today's fast-paced software development environment, effective project management and version control are essential for successful collaboration and delivery. This course on **Project Management with Git** equips students with the foundational and advanced skills needed to manage coding projects efficiently using Git and GitHub. Students will learn key concepts such as branching, merging, conflict resolution, and collaborative workflows, along with practical exposure to issue tracking, pull requests, CI/CD pipelines, and agile project tracking tools. The course emphasizes real-world team collaboration and best practices, enabling students to handle industry-scale software development with clarity, control, and confidence.

2. COURSE LEVEL OBJECTIVES

- To familiar with basic command of Git
- To create and manage branches
- To understand how to collaborate and work with Remote Repositories
- To familiar with vision controlling commands

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

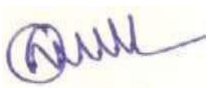
Course Out-come	Description	Mapped POs/PSOs	Cogni-tive Level	WK	Class Hours
CO1	Construct basic Git repository commands to create, switch, and manage branches for version control in a project.	PO1,PO3, PO5,PSO1	L3	WK2,WK4, WK5,WK6,WK8	07
CO2	Apply commands related to Collaboration	PO1,PO3, PO5,PSO1	L3	WK2,WK4, WK5,WK6,WK8	07

	and Remote Repositories				
CO3	Analyse commands related to Git Tags, Releases and advanced git operations.	PO1,PO3, PO5,PSO1	L4	WK2,WK4, WK5,WK6,WK8	06
CO4	Analyse and change the git history.	PO1,PO3, PO5,PSO1	L4	WK2,WK4, WK5,WK6,WK8	06

WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

SL.NO	Lab Programs
1	Setting Up and Basic Commands Initialize a new Git repository in a directory. Create a new file and add it to the staging area and commit the changes with an appropriate commit message.
2	Creating and Managing Branches Create a new branch named "feature-branch." Switch to the "master" branch. Merge the "feature-branch" into "master."
3	Creating and Managing Branches Write the commands to stash your changes, switch branches, and then apply the stashed changes
4	Collaboration and Remote Repositories Clone a remote Git repository to your local machine.
5	Collaboration and Remote Repositories Fetch the latest changes from a remote repository and rebase your local branch onto the updated remote branch.
6	Collaboration and Remote Repositories Write the command to merge "feature-branch" into "master" while providing a custom commit message for the merge.
7	Git Tags and Releases Write the command to create a lightweight Git tag named "v1.0" for a commit in your local repository.
8	Advanced Git Operations Write the command to cherry-pick a range of commits from "source-branch" to the current branch.
9	Analysing and Changing Git History



	Given a commit ID, how would you use Git to view the details of that specific commit, including the author, date, and commit message?
10	Analysing and Changing Git History Write the command to list all commits made by the author "JohnDoe" between "2023-01-01" and "2023-12-31."
11	Analysing and Changing Git History Write the command to display the last five commits in the repository's hist
12	Analysing and Changing Git History Write the command to undo the changes introduced by the commit with the ID "abc123".

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Programs Covered
1	Data Analysis with Microsoft® Excel: Updated for Office 2007®	Berk & Carey	Brooks/Cole, Cengage Learning	3rd Edition (2010)	All Programs
2	Microsoft Excel 2019: Data Analysis And Business Modeling	Wayne L. Winston	PHI Learning	Excel 2019 6th Edition	All Programs

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCS/WEB RESOURCE

1.https://www.simplilearn.com/tutorials/excel-tutorial/data-analysis-excel

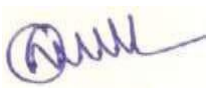
2.Coursera: https://www.coursera.org/learn/introduction-git-github

3.Udemy:https://www.udemy.com/course/getting-started-with-git-repositories-for-project-management/?srsltid=AfmBOorLlvX1wkwy0I4w3b_tNPECzD89bl9i-FWJRdnBerqXCgsmdgGR&couponCode=LEARNNOWPLANS

7. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks
b) Semester End Examination (SEE) = 50 marks
Total = 100 marks

CIE Framework:



ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
WEIGHTAGE	**50%**	**50%**
Continuous Evaluation	30	**50**
Test	20	
Total Marks for The Course	**50**	**50**

8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs → / **COs ↓**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	**2**		**2**		**3**						
CO2	**2**		**2**		**3**						
CO3	**2**		**2**		**3**						
CO4	**2**		**2**		**3**						

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs → / **COs ↓**	**PSO1**	**PSO2**
CO1	**1**	
CO2	**1**	
CO3	**1**	
CO4	**1**	

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

*****

Department: **Computer Science and Engineering (AI & ML)**		
Semester: **III**	Course Code: **BCI24358C**	Contact Hrs /week: **1**
Course Description: **Ethics and Public Policy for AI**		No. of Credits:**1** L : T : P : S = **1:0:0:0**
Course Category: AEC		Total no. of Hours = 13
CIE: **50 Marks**	SEE: **50 Marks**	Exam Hours: **01**
Course Pre-requisites: Artificial Intelligence		

1. PREAMBLE ABOUT THE COURSE

As artificial intelligence continues to shape critical aspects of society, from healthcare and finance to education and governance, it becomes essential to understand the ethical implications and policy challenges that accompany its advancement. This course, *Ethics and Public Policy for AI*, is designed to equip students with a strong foundation in ethical reasoning, fairness, accountability, transparency, and social responsibility in the context of intelligent systems. It explores how AI systems can be aligned with human values and public interest while examining regulatory frameworks, bias mitigation, data privacy, and the societal impacts of automation. Tailored for CSE-AIML students, the course bridges technical knowledge with philosophical, legal, and societal perspectives—preparing learners to become responsible AI practitioners and contributors to the development of inclusive and sustainable AI-driven solutions.

2. COURSE LEVEL OBJECTIVES

- To understand Ethical Framework for a Good AI Society, establishing Rules for trustworthy AI
- To Designing ethics for good society
- To familiar with Tools, methods and practices for designing AI for social good
- To familiar with Innovation and future AI
- To understand the Case Study: Ai in health care, knowing Regulation and Governance of AI ethics

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Explain the ethical framework for building a good AI society and the principles of trustworthy AI.	PO6,PO7, PO9,PO11	L2	WK7, WK8	03

CO2	Describe the importance of ethics in AI-driven decision-making for a just and fair society.	PO6,PO7 ,PO9,PO11	L2	WK7, WK8	03
CO3	Illustrate tools, methods, and practices for designing AI that promotes social good	PO6,PO7, PO9,PO11	L2	WK7, WK8, WK9	02
CO4	Apply AI innovation trends to assess their impact on public policy and governance.	PO6,PO7, PO9,PO11	L3	WK7, WK8	02

WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
I	An Ethical Framework for a Good AI Society: opportunities, Risks, principles and Recommendations. Establishing the rules for building trustworthy AI Textbook1: Chapter 3,4	CO1	03
II	Translating principles into practices of digital ethics: five risks of being Unethical The Ethics of Algorithms: Key problems and Solution Textbook1: Chapter 6,8	CO2	03
III	How to design AI for social good: seven essential factors From What to How: An Initial Review of publicly available AI Ethics tools, Methods and Research to Translate principles into Practices Textbook1: Chapter 9, Chapter 10	CO1, CO3	02
IV	Innovating with Confidence: Embedding AI Governance and fairness in financial Services Riskmanagement framework, What the near future of AI could be. Textbook1: Chapter 20,22	CO2	02
V	Human-AI Relationship, AI and Workforce, Autonomous Machines and Moral Decisions, AI in HealthCare: balancing Progress and Ethics, Regulation and Governance of AI Ethics Textbook2 : Chapter 5,Chapter 8, Chapter 9	CO4	03

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Programs Covered

1	Ethics, Governance and Policies in Artificial Intelligence	Luciano Floridi (Editor)	Springer	1st Edition, 2021	1,2,3,4
2	Ethics and AI: Navigating the Moral Landscape of Digital Age	Aaron Aboagye	Independently published	1st Edition, 2023	5

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCS/WEB RESOURCE

1. Responsible & Safe AI Systems :- https://nptel.ac.in/courses/106106472
2. https://nptel.ac.in/courses/109106184

7. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks
b) Semester End Examination (SEE) = 50 marks
Total = 100 marks

CIE Framework:

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	AAT	**5**	
	AAT	**5**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs → / **COs ↓**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	1						3				2
CO2	1						3				2
CO3	1						3				2
CO4	1						3				2

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs → / COs ↓	PSO1	PSO2
CO1	1	
CO2	1	
CO3	1	
CO4	1	

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

*****

Department: **Computer Science and Engineering (AI & ML)**		
Semester: **III**	Course Code: **BCI24358D**	Contact Hrs /week: **2**
Course Description: **Web Technologies**		No. of Credits:**1** L : T : P : S = **0:0:2:0**
Course Category: **AEC**		Total no. of Hours = 26
CIE: **50 Marks**	SEE: **50 Marks**	Exam Hours: **02**
Course Pre-requisites: Basic Programming skills		

1. PREAMBLE ABOUT THE COURSE

The **Web Technologies** course is designed to provide hands-on experience in developing and managing dynamic, responsive web applications. The course focuses on core web technologies such as **HTML**, **CSS**, **JavaScript**, and **Bootstrap**, with an emphasis on building aesthetically pleasing and user-friendly interfaces. Students will learn to create multi-column layouts and responsive designs using **CSS** and **Bootstrap** for building modern web pages. The course also delves into client-side scripting using JavaScript, allowing students to enhance the interactivity and functionality of web pages. By working on real-world projects, students will gain practical skills in designing, implementing, and optimizing web applications, making them well-equipped to meet the demands of the fast-evolving field of web development.

2. COURSE LEVEL OBJECTIVES

- Illustrate the Semantic Structure of HTML and CSS
- Compose forms and tables using HTML and CSS
- Understand different approaches for creating page layouts
- To build dynamic web pages using JavaScript.
- Understand Responsive Web Design with the help of the Bootstrap framework

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Out-come	Description	Mapped POs/PSOs	Cogni-tive Level	WK	Class Hours
CO1	Apply HTML and CSS syntax and se-mantics to build web pages	PO1,PO3,PO5, PO11,PSO1	L3	WK1,WK2, WK3,WK4, WK6,WK8	06

CO2	Construct and visually format tables and forms using HTML and CSS	PO1,PO3, PO5,PSO1	L3	WK1,WK2, WK3,WK4,WK6	06
CO3	Build web pages using multicolumn layouts	PO1,PO3, PO5,PSO1	L3	WK1,WK2, WK3,WK4,WK6	04
CO4	Develop client side scripting using javascript and the Document Object Model	PO1,PO3, PO5,PSO1	L3	WK1,WK2, WK3,WK4,WK6	05
CO5	Analyse the responsive designs for web pages using Bootstrap	PO1,PO3, PO5,PO11,PSO1	L4	WK1,WK2, WK3,WK4,WK6	05

WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

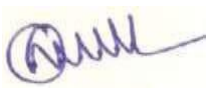
4. SYLLABUS

Sl.No	Lab Programs
1.	Design a webpage that gives information about travel experience using the following HTML5 Semantic tags- <article>, <aside>, <details>, <figcaption>,<figure>, <footer>, <header>, <main>, <mark>, <section> .
2.	Design a clean and organized layout for the webpage using HTML. a. Include a header section with the event title, date, and location. b. Create a navigation bar with links to sections like "About," "Speakers," "Agenda," "Registration," and "Contact." c. In the "About" section, provide a brief description of the conference's theme and purpose. d. Design a "Speakers" section that lists at least three keynote speakers with their names, titles, and photos. Note: Use semantic elements to structure this section and apply suitable CSS.
3.	Design a simple webpage layout containing text and an image using CSS selectors a. Apply CSS styles to change the font family, size, color, and line height of the text content. b. Use selectors to target specific headings and paragraphs. c. Select the image using an element selector and apply a border with a defined width and color. d. Implement a hover effect that slightly increases the image's size e. Use class selectors to adjust the text alignment and spacing within paragraphs. f. Apply margin and padding to create a balanced layout. g. Apply a background color to the entire layout using an element selector.
4	Develop an HTML table to display the weekly class timetable, spanning Monday

	through Friday. a. Populate the table with precise class information, including course codes b. Utilize colspan or rowspan to merge cells horizontally or vertically, creating space for breaks or gaps in the schedule. c. Implement distinct background colors for cells to differentiate between different subjects and breaks.
5	Design a student registration form a. Include fields for the student's name, USN, email id, address, radio button for gender and a checkbox for subject preferences (Web, Java, Python). b. option to upload photo and dropdown list for payment method c. Include a "Submit" button to process the registration
6	Design multicolumn layout using float element in HTML. Create an HTML structure that includes a main content area and a sidebar. Use CSS floats to position the main content on the left and the sidebar on the right. Populate the main content area with blog articles, including headings, images, and text. Populate the sidebar with widgets such as recent posts, categories, and social media links.
7	Write a JavaScript code that displays text "TEXT-GROWING" with increasing font size in the interval of 100ms in RED COLOR, when the font size reaches 50pt it displays "TEXT SHRINKING" in BLUE color. Then the font size decreases to 5pt.
8	Create a webpage containing 3 overlapping images using HTML, CSS and JS. Further when the mouse is over any image, it should be on the top and fully displayed.
9	Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient.
10	Design a portfolio webpage using bootstrap to showcase your skills and projects a. Design a header section with your name or a logo. b. Use Bootstrap's navbar component to create a simple navigation bar. c. Add a brief introduction about yourself or your work. d. Utilize Bootstrap's typography classes for consistent styling. e. Create a section to list your skills or areas of expertise. f. Use Bootstrap's card component to present each skill. g. Display a grid of project cards, each with a project name, image, and brief description.

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Programs Covered



1	Fundamentals of Web Development	Randy Connolly, Ricardo Hoar	Pearson Education India	4th Edition	Programs 1-9
2	Bootstrap: Responsive Web Development	Jake Spurlock	O'Reilly Media, Inc.	1st Edition	Program 10

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCS/WEB RESOURCE

1. NPTEL: https://nptel.ac.in/courses/106105084
2. Udemy: https://www.udemy.com/topic/web-app-development/

7. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks
b) Semester End Examination (SEE) = 50 marks
Total = 100 marks

CIE Framework:

ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
WEIGHTAGE	**50%**	**50%**
Continuous Evaluation	30	**50**
Test	20	
Total Marks for The Course	**50**	**50**

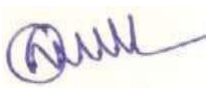
8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs → / **COs ↓**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3		2	-	3	-	-	-	-	-	1
CO2	3		2	-	3	-	-	-	-	-	
CO3	2		2	-	3	-	-	-	-	-	-
CO4	2		2	-	3	-	-	-	-	-	
CO5	1		2	-	3	-	-	-	-	-	2

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

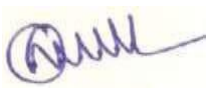
PSOs → / **COs ↓**	**PSO1**	**PSO2**
CO1	1	



CO2	1	
CO3	1	
CO4	1	
CO5	1	

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

*****



GLOBAL ACADEMY OF TECHNOLOGY

Autonomous Institution Affiliated to Visveswaraya Technological University
Approved by UGC, AICTE and Govt of Karnataka

Department: **Science and Humanities**		
Semester: **III/VI**	Course Code: **BNSK24359**	Contact Hrs /week: 1
Course Description: **National Service Scheme (NSS)**		No. of Credits: 0 L : T : P : S = 0:0:2:0
Course Category: MC		Total no. of Hours = 24
CIE: **100 Marks**	SEE:	Exam Hours:

COURSE LEVEL OBJECTIVES

CLO1	Understand the community in general in which they work.
CLO2	Identify the needs and problems of the community and involve them in problem – solving
CLO3	Develop among themselves a sense of social & civic responsibility & utilize their knowled in finding practical solutions to individual and community problems.
CLO4	Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.
CLO5	Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description
CO1	Understand the importance of his / her responsibilities towards society.
CO2	Analyse the environmental and societal problems/issues and will be able to design solutions for the same.
CO3	Evaluate the existing system and to propose practical solutions for the same for sustainable development.
CO4	Implement government or self-driven projects effectively in the field.
CO5	Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

SYLLABUS

Module No.	Module Description

I	**National Service Scheme (NSS) – Contents** 1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing. 2. Waste management– Public, Private and Govt organization, 5 R's. 3. Setting of the information imparting club for women leading to contribution in social and economic issues. 4. Water conservation techniques – Role of different stakeholders– Implementation. 5. Preparing an actionable business proposal for enhancing the village income and approach for implementation. 6. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education. 7. Developing Sustainable Water management system for rural areas and implementation approaches. 8. Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swatch Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc. 9.Spreading public awareness under rural outreach programs.(minimum5 programs). 10. Social connect and responsibilities. 11. Plantation and adoption of plants. Know your plants. 12. Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs). 13. Govt. school Rejuvenation and helping them to achieve good infrastructure.

LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Publisher
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.	

*****

Department: **Science and Humanities**		
Semester: **III**	Course Code: **BPEK24359**	Contact Hrs /week: 2
Course Description: **PHYSICAL EDUCATION (SPORTS & ATHLETICS) – I**		No. of Credits: 0 L : T : P : S = 0:0:2:0
Course Category: MC		Total no. of Hours = 24
CIE: **100 Marks**	SEE:	Exam Hours:

1. SYLLABUS

Module No.	Module Description	No. of Hours
I	A. Lifestyle B. Health & Wellness C. Pre-Fitness test.	4
II	A. Warming up (Free Hand exercises) B. Strength – Push-up / Pull-ups C. Speed – 30 Mtr Dash	4
III	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.	16

*****

GLOBAL ACADEMY OF TECHNOLOGY

Autonomous Institution Affiliated to Visveswaraya Technological University
Approved by UGC, AICTE and Govt of Karnataka

Department: **Science and Humanities**		
Semester: **III, IV,V &VI**	Course Code:**BYOK24359**	Contact Hrs /week: 02
Course Description: **Yoga**		No. of Credits: L : T : P : S = 0:0:2:0
Course Category: MC		Total no. of Hours = 24
CIE: 100	SEE:	Exam Hours:

1. SYLLABUS

Course Title	Content
lntroduction of Yoga, Aim and Objec-tives of yoga, Prayer	Yoga, its meaning, definitions. Different schools of yoga, importance of prayer
Brief introduction of yogic practices for common man	Yogic practices for common man to promote positive health.
Rules and regulations	Rules to be followed during yogic practices by prac-titioner.
Misconceptions of yoga	Yoga its misconceptions
Suryanamaskara	Suryanamaskar prayer and its meanitrg, Need, im-portance and benefits of Suryanamaskar 12 count, 2 rounds.
Different types of Asanas Sitting 1. Padmasana 2. Vajrasana Standing 1. Vrikshana 2. Trikonasana Prone line 1. Bhujangasana 2. Shalabhasana Supine line 1. utthitadvipadasana 2. Ardhahalasana	Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, pre-cautionary measures and benefits.

GLOBAL ACADEMY OF TECHNOLOGY

Autonomous Institution Affiliated to Visveswaraya Technological University
Approved by UGC, AICTE and Govt of Karnataka

Department: **Science and Humanities**		
Semester: **III to VI**	Course Code: **BMUK24359/459/559/658**	Contact Hrs /week: 2
Course Description: **MUSIC**		No. of Credits: 0 L : T : P : S = 0:0:2:0
Course Category: MC		Total no. of Hours = 24
CIE: **100 Marks**	SEE:	Exam Hours:

1. COURSE LEVEL OBJECTIVES

1. Identify the major traditions of Indian music, both 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.

2. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description
CO1	Discus the Indian system of music and relate it to other genres (Cognitive Do main)
CO2	Experience the emotions of composer and develop empathy (Affective Domain)
CO3	Respond to queries on various patterns in a composition (Psycho Motor Domain)

3. SYLLABUS

Module No.	Module Description	No. of Hours
I	Preamble: Contents of the curriculum intend to promote music as language to develop on analytical, Creative, and intuitive Understanding. For this the student through study and direct participation in improvisation. Origin of the Indian Music: Evolution of the Indian music system, Understanding of Shruthi, Nada, Swara. Laya, Raga, Tala, Mela.	3
II	Compositions: Introduction to the types of composition in Carnatic Music Swarajathi, Varna, Krithi, and Thillana, Notation System.	3

III	Composers: Biography and Contributions of Purandaradasa, Thyagaraja.	3
IV	Music Instruments: Classification and construction of string instruments, percussion instruments, Idiophones (Ghana Vaadya), Examples of each class of Instruments.	3
V	Abhyasa Gana: Singing the swara exercises (Sarale Varase Only), Botation writing for Sarale Varase and Suladi Saptha Tala (Only in Mayamalavagowla Raga), Singing 4 Geethe in Malahari, and one jathi Swara, One Krithi in a Mela raga.	4

4. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

Sl. No.	Name of the Book	Author(s)	Publisher	Edition
1	Theory of Music	Vidushi Vasantha Madhavi	Prism Publication	2007
2	Karnataka Sangeetha Dharpana	T Sachidevi and T Sharadha (Thirumalai Sisters)	Shreenivaas Prakaashana	Vol, 1 2018
3	Classical Music of India: A Practical Gulge	Lakshminarayana Subramaniam, Viji Subramanaim	Tranqueber	2018
4	History of South Indian (Carnatic) Music	R Rangaramanuja Ayyangar	Vipanci Charitable Trust,	Third edition 2019
5	The Story of Indian Music and Its Instruments: A Study of the Present and a Record of the Past	Ethel Rosenthal	Pilgrims Publishing	2007

*****

GLOBAL ACADEMY OF TECHNOLOGY

Autonomous Institution Affiliated to Visveswaraya Technological University
Approved by UGC, AICTE and Govt of Karnataka

Department: **Mathematics**		
Semester: **IV**	Course Code: **BMATS24401**	Contact Hrs /week: 3
Course Title: **Probability and Graph Theory** (Common for CSE/ISE/AI&DS/AI &ML/CS-AI &ML)		No. of Credits: 3 L : T : P : S = 3:0:0:0
Course Category: **Basic Science Course (BSC)**		Total no. of Hours = 40
CIE: **50 Marks**	SEE: **50 Marks**	Exam Hours: **03**
Course Pre-requisites: A fundamental understanding of calculus and linear algebra. Basic knowledge of set theory and matrix operations. Introductory familiarity with probability concepts and high school-level statistics.		

1.PREAMBLE ABOUT THE COURSE

This course is designed to equip students with essential tools from **statistics, probability theory, stochastic processes**, and **graph theory** that form the backbone of data analysis, decision-making, and computational modelling in engineering and scientific domains. The course begins with foundational techniques in data fitting and correlation, progresses through theoretical and applied probability models, and extends to stochastic behaviour analysis and hypothesis testing. The final module introduces students to key concepts in graph theory, enabling them to model complex structures like networks, circuits, and hierarchical data. By integrating classical mathematical techniques with modern applications, this course aims to prepare students to apply these tools in engineering contexts, research problems, and real-world systems modelling.

2.COURSE LEVEL OBJECTIVES

By the end of this course, students will be able to:

1. **Apply** statistical techniques such as least squares fitting, correlation, and regression to analyze and interpret data.
2. **Evaluate** probability models involving discrete and continuous random variables for a variety of engineering and scientific applications.
3. **Analyze** joint and conditional distributions, and understand the behaviour of stochastic processes and Markov chains.
4. **Conduct** statistical hypothesis testing using sampling theory and various test statistics (t, chi-square, F) to make informed decisions.
5. **Construct and examine** graphs and trees, including Euler and Hamiltonian paths, and use these tools in problems involving sorting, coding, and network structures.

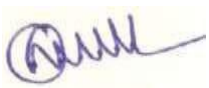
3. COURSE OUTCOMES (COs) & COMPETENCIES

Course Out-come	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Analyze and interpret data using statistical techniques such as curve fitting, correlation, regression, and error estimation to support decision-making in computing and data science.	PO1, PO2, PO5	L4	WK1, WK2, WK3,WK6	8
CO2	Apply discrete and continuous probability distributions to model uncertainty in computer systems and support probabilistic algorithm design.	PO1, PO2, PO5	L3	WK1, WK2, WK3,WK6	8
CO3	Evaluate joint, marginal, and conditional distributions, and model dynamic systems using stochastic processes and Markov chains in algorithmic contexts.	PO1, PO2, PO5	L3	WK1, WK2, WK3,WK6	8
CO4	Perform hypothesis testing using sampling distributions and statistical tests (t, χ^2, F) to draw conclusions from sample data in experimental and research applications.	PO1, PO2, PO5	L4	WK1, WK2, WK3,WK6.	8
CO5	Apply graph theory concepts including Euler and Hamiltonian paths, planar graphs, and tree structures to design and analyze efficient algorithms and data structures.	PO1, PO2, PO5	L3	WK1, WK2, WK3,WK6	8

WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
I	Statistics: Introduction, Principles of least squares, fitting of a straight line, second degree parabola, . Karl Pearson's coefficient of correlation, Regression analysis standard error of estimate, rank correlation	CO1	8



II	Random variable, Discrete and continuous random variables, Probability distributions: Binomial, Poisson, exponential, uniform and Normal distributions.	CO2	8
III	Joint distributions, Marginal and conditional distributions, Covariance, Correlation. Stochastic processes, probability vector, stochastic matrices, fixed points, regular stochastic matrices, Markov chains, higher transition probability.	CO3	8
IV	Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, student's t-distribution, chi-square distribution as a test of goodness of fit, F- test.	CO4	8
V	Graphs, Subgraphs, Complements, and Graph Isomorphism, Vertex Degree, Euler Trails and Circuits. Planar Graphs, Hamiltonian paths and Cycles. Trees, Rooted Trees, Trees and Sorting, Weighted Trees and Prefix Codes.	CO5	8

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition
1	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	44th
2	Higher Engineering Mathematics	B.V. Ramana	Tata McGraw-Hill	
3	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10th
4	A Textbook of Engineering Mathematics	N.P.Bali and Manish Goyal	Laxmi Publications	6th
5	Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks	T Veerarajan	Tata McGraw Hill Co	4th

6.LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCS/WEB RESOURCE

https://nptel.ac.in/courses

https //swayam.gov.in/nptel onlinecourses.nptel.ac.in/

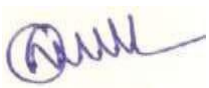
https://academicearth.org/online-college-courses/

https://elearning.vtu.ac.in/

7.EVALUATION METHODOLOGY

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from



each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

Continuous Internal Evaluation (CIE):

Components	Marks
Test 1	40 Marks
Test 2	40 Marks
Assignment	10 Marks
Final CIE Marks	Average of 2 tests + Assignment Marks

8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs → / COs ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	**1**	-	-	1	-	-	-	-	-	-
CO2	3	1	-	-	1	-	-	-	-	-	-
CO3	3	1	-	-	1	-	-	-	-	-	-
CO4	3	1	-	-	1	-	-	-	-	-	-

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs → / COs ↓	PSO1	PSO2	PSO3
CO1	-	-	-
CO2	-	-	-
CO3	-	-	-
CO4	-	-	-

Correlation Weightage: 1 – Low, 2 – Moderate, 3 – High

Department: **Computer Science and Engineering (AI & ML)**		
Semester: **IV**	Course Code: **BCI24402**	Contact Hrs./week:**3**
Course Description: **Database Management Systems**		No. of Credits: **4** L : T : P : S = **3:0:2:0**
Course Category: **IPCC**		Total no. of Hours = **50**
CIE: **50 Marks**	SEE: **50 Marks**	Exam Hours: **03**
Course Pre-requisites: Basic Programming skills, Discrete Mathematics		

1.PREAMBLE ABOUT THE COURSE

In today's data-driven world, effective management of information is essential for decision-making, operations, and innovation across all sectors. A **Database Management System (DBMS)** provides a structured and systematic way to store, retrieve, manage, and manipulate data, ensuring consistency, security, and accessibility.

2. COURSE LEVEL OBJECTIVES

- Outline a strong foundation in database concepts, technology, and practice.
- Identify a strong foundation on normalization techniques to design a database
- Demonstrate the use of concurrency and transactions in database
- Design and build database applications for real world problems

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Apply the fundamental database concepts, ER modeling techniques and relational algebra operations to design structured databases for solving real-world problems.	PO1,PO3, PSO1	L3	WK1, WK2, WK3, WK4	10
CO2	Use SQL queries including retrieval, insertion, deletion, updates, and schema modifications for effective data handling	PO1,PO3, PO5,PSO1	L3	WK1, WK2, WK3, WK4, WK6	10

CO3	Apply transaction management techniques and concurrency control strategies to ensure data integrity under multiple operations.	PO1,PO2, PO3,PSO1	L3	WK1, WK2, WK3, WK4	10
CO4	Analyze database schemas by identifying functional dependencies and normalizing up to BCNF to improve design quality	PO1,PO2, PO3,PSO1	L4	WK1, WK2, WK3, WK4	10
CO5	Design Database solutions for real time applications	PO1,PO2,PO3 ,PO4,PO5,PO 8,PO9,PSO1	L6	WK1, WK2, WK3, WK4, WK6	10

WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
I	**Introduction:** Introduction, An example, Characteristics of Database approach, Advantages of using DBMS approach, Data models, schemas and instances, Three- schema architecture and data independence **Entity-Relationship Model:** An Example Database Application, Entity Types, Entity Sets, Attributes and Keys, Relationship types, Relationship Sets, Roles and Structural Constraints, Weak Entity Types, Sample ER Diagrams. **Text Book1: Chapter 1.1-1.3, 1.6 , 2.1,2.2, 3.2-3.6**	CO1	10
II	**Relational Model and Relational Algebra:** Relational Model Concepts, Unary Relational Operations: SELECT and PROJECT, Relational Algebra Operations from Set Theory, Binary Relational Operations: JOIN and DIVISION, Examples of Queries in Relational Algebra. **Text Book1: Chapter 5.1, 8.1-8.3, 8.5**	CO1	10
III	**SQL:** SQL Data Definition and Data Types, Specifying basic constraints in SQL, Retrieval queries in SQL, Insert, Delete, Update statements in SQL. **SQL Advanced Queries:** More complex SQL Queries, Specifying Constraints as Assertions and Action Triggers, Views in SQL, Schema change statements in SQL. **Text Book1: Chapter 6.1-6.4, 7.1-7.4**	CO2, CO5	10
IV	**Database Design:** Informal Design Guidelines for Relation Schemas, Functional Dependencies, Normal Forms Based on Primary Keys, Second, Third and Boyce Codd Normal Forms.	CO4, CO5	10

	NoSQL Databases: What is it and Why you need it? Document-Based NOSQL Systems and MongoDB **Text Book1: Chapter 14.1-14.5,24.1,24.3**		
V	**Transactions Management:** Introduction to Transaction Processing, Transaction states, Desirable properties of Transactions, Characterizing Schedules based on recoverability, Characterizing Schedules based on Serializability. **Concurrency Control and Recovery System:** Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Shadow paging, ARIES recovery algorithm. **Text Book1: Chapter 20.1, 20.2.1, 20.3-20.5, 21.1, 21.2, 22.4, 22.5**	CO3, CO5	10

Lab Programs

Note:

- Design, develop, and implement the specified queries for the following problems using Oracle,MySQL, MS SQL Server, or any other DBMS under LINUX/Windows environment.
- Create Schema and insert at least 5 records for each table. Add appropriate database constraints.

List of Experiments

1. 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, Branch_id, No- of_Copies)

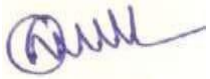
BOOK_LENDING (Book_id, Branch_id, Card_No, Date_Out, Due_Date)

LIBRARY_PROGRAMME (Branch_id, Branch_Name, Address)

CARD (Card_No)

Write SQL queries to

a. Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each Programme, etc.
b. Get the particulars of borrowers who have borrowed more than 2 books, in the year 2020.
c. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation.
d. Display the total number of books published by each Publisher.
e. Create a view of all books and its number of copies that are currently available in the Library.



2. Consider the schema for Company Database:
EMPLOYEE (SSN, FName, LName, Address, Gender, Salary, DNo)

DEPARTMENT (DNo, DName, MgrSSN,MgrStartDate)

DLOCATION (DNo,DLoc)

PROJECT (PNo, PName, PLocation, DNo)

WORKS_ON (SSN, PNo, Hours)

Write SQL queries to

a. Convert employee name into uppercase whenever an employee record is inserted or updated. Trigger to fire before the insert or update.
b. Make a list of all project numbers for projects that involve an employee whose last name is 'Scott', either as a worker or as a manager of the department that controls the project.
c. Show the resulting salaries if every employee working on the 'IoT' project is given a 10 percent raise.
d. Find the sum of the salaries of all employees of the 'Accounts' department, as well as the maximum salary, the minimum salary, and the average salary in this department.
e. Retrieve the name of each employee who works on all the projects controlled by department number 5.

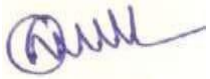
3. The commercial bank keeps track of the customer's account information. Each customer may have any number of accounts and account can be shared by any number of customers. The system willkeep track of the date of last transaction.
We store the following details.

- Account: unique account-number, type and balance
- Customer: unique customer-id, name and several addresses composed of street, city and state

Perform the following operations on the database:

a. Create necessary tables and insert few tuples to all the relations.
b. Add 5% interest to the customer who have less than 10000 balance.
c. List joint accounts involving more than three customers.
d. Find the total interest credited to each customer for a particular year.
e. Find the customer who has not done any transaction.

4. A database is to be designed for a college to monitor students' progress throughout their course of study.The students are reading for a degree (such as B.E.) within the framework of the modular system. The college provides a number of Subjects (Modules),



each being characterized by its code, title, credit value, module leader, teaching staff and the department they come from, prerequisite course. Department may be CSE, ISE etc. A Subject is co- ordinated by a module leader who shares teaching duties with one or more teachers. A Teacher may teach (and be a module leader for) more than one Subject. Students are free to choose any subject they wish. The database also contains some information about students including their Serial numbers, names, addresses, their past performance (i.e. subjects taken and Subject Examination Marks).

For this case study,

a. Analyze the data required, create the tables and insert the values.
b. Retrieve the Teacher names who are not Module leaders.
c. Display the department which offers the subject "Database Management System".
d. Display the number of Subjects taught by each Teacher.
e. Categorize students based on the following criterion: If Subject Examination Marks = 70 to 100 then CAT='Outstanding' If FinalIA = 40 to 69 then CAT='Average' If FinalIA<39 then CAT='Weak'

5. MINI PROJECT Use Java, C#, PHP, Python, or any other similar front-end tool. All applications must be demonstrated on desktop/laptop as a stand-alone or web-based application (Mobile apps on Android/IOS are not permitted.)

- For any problem selected, draw the ER Diagram, apply ER-mapping rules, normalize the relations, and follow the application development process.
- Make sure that the application should have five or more tables, at least one trigger and one stored procedure, using suitable front-end tool.
- Indicative areas include; health care, education, industry, transport, supply chain,etc.

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Fundamentals of database systems.	Elmasri, Ramez, and Sham Navathe	Pearson	Vol. 7., 2014.	Module 1 – Module5
2	Professional nosql	Tiwari, Shashank	John Wiley & Sons	2011.	Module 4
3	Database Management Systems	Raghurama Krishnan, Johannes Gehrke	TataMcGrawHill, New Delhi,India.	3rd edition	All modules

4	Database System Concepts	Silberschatz, Korth and Sudharshan	Mc-GrawHill, 2010.	6th Edition	All modules
5	An Introduction to Database Systems,	C.J. Date, A. Kannan, S. Swamynatham	Pearson Education, 2006.	8th Edition	All modules

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCS/WEB RESOURCE

1. http://www.mim.ac.mw/books/Elmasri-Navathe-Fundamentals-of-Database-Systems-5th- Editi.pdf
2. Procedures in SQL | SQL Stored Procedures | Edureka
3. Hashing in DBMS | 2 Main Types of Hashing Techniques in DBMS (educba.com)
4. Blog Theme - Details (oracle.com)
5. Bitmap Indexing in DBMS - GeeksforGeeks
6. GridFS ~~M~~ongoDB Manual

7. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks
b) Semester End Examination (SEE) = 50 marks
Total = 100 marks

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

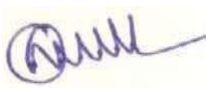
CIE Framework:

Two tests are to be conducted for 40 marks each. The average of the two tests are taken for computation of CIE on a scale of 30, the CIE would also include laboratory evaluation for 20 marks. The laboratory marks of 20 would comprise of 10 marks for regular laboratory assessment to include lab record and observation. 10 marks would be exclusive for laboratory internal assessment test to be conducted at the end of the semester.

Table: Distribution of weightage for CIE & SEE of Integrated courses

	Component	Marks	Total Marks
CIE	CIE Test-1	**30**	**50**
	CIE Test-2	**30**	
	Lab	**20**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING



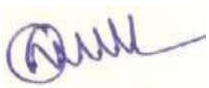
POs → / COs ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	-	2	-	-		-			-	-
CO2	1	-	2	-	2		-	-	-	-	-
CO3	3	3	2	-			-			-	-
CO4	3	3	2	-			-	-	-	-	-
CO5	1	1	3	2	3	2	-	2	2	-	-

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs → / COs ↓	PSO1	PSO2
CO1	1	
CO2	1	
CO3	2	
CO4	2	
CO5	2	

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High



Department: **Computer Science and Engineering (AI & ML)**		
Semester: **IV**	Course Code: **BCI24403**	Contact Hrs /week: **3**
Course Description: **Design and Analysis of Algorithms**		No. of Credits:**3** L : T : P : S = **3:0:0**
Course Category: **PCC**		Total no. of Hours = 40
CIE: **50 Marks**	SEE: **50 Marks**	Exam Hours: **03**
Course Pre-requisites: C Programming, Data Structures		

1. PREAMBLE ABOUT THE COURSE

The **Design and Analysis of Algorithms** is a fundamental area of study in computer science that focuses on developing efficient algorithms to solve problems and analysing their performance in terms of time and space complexity. It provides the necessary tools and techniques to design algorithms that are optimal in various problem-solving scenarios, while also evaluating their correctness, efficiency, and scalability.

2. COURSE LEVEL OBJECTIVES

- To learn mathematical background for analysis of algorithm
- Analyze the asymptotic performance of algorithms.
- To understand the concept of designing an algorithm.
- Synthesize efficient algorithms in common engineering design situations.

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Understand the fundamentals of algorithms, asymptotic notations, and efficiency analysis.	PO1,PO2, PO3,PO4, PO9,PO10, PSO1,PSO2	L2	WK2, WK3, WK4	08
CO2	Apply classical algorithmic techniques such as Divide & Conquer, Decrease & Conquer, and	PO1,PO2, PO3,PO4, PO5,PO9,	L3	WK2, WK3, WK4, WK5	08

	Transform & Conquer to solve computational problems.	PO10, PSO1,PSO2			
CO3	Analyze and implement advanced strategies including Dynamic Programming, Greedy methods, Backtracking, and Branch & Bound to solve optimization problems.	PO1,PO2, PO3,PO4, PO5,PO9, PO10, PSO1,PSO2	L4	WK2, WK3, WK4, WK5	08
CO4	Evaluate NP-complete problems and justify the use of exact, heuristic, and approximation algorithms for solving computationally hard problems.	PO1,PO2, PO3,PO4, PO5,PO9, PO10, PSO1,PSO2	L5	WK2, WK3, WK4, WK5, WK8	08
CO5	Implement and Evaluate algorithmic solutions using modern programming tools and effectively communicate their correctness and efficiency.	PO1,PO2, PO3,PO4, PO5,PO9, PO10, PSO1,PSO2	L5	WK3, WK4, WK5, WK7, WK8	08

WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description	Mapped Cos	No. of Hours
I	INTRODUCTION: Notion of algorithm, Fundamentals of Algorithmic Problem Solving, Fundamentals of the Analysis of Algorithmic Efficiency: Analysis frame work, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-recursive and Recursive Algorithms. BRUTE FORCE: Selection Sort and Bubble Sort.	CO1, CO2	8
II	Divide and Conquer: Merge sort, Quicksort, Multiplication of long integers, Strassen's Matrix multiplication, Max-Min Problem. Decrease and Conquer: Insertion Sort, Depth First Search, Breadth First Search, Topological Sorting, Applications of DFS and BFS.	CO2, CO5	8
III	Transform and Conquer: Presorting, Heapsort, Problem reduction. Space and Time Trade offs: Sorting by Counting, Naive String Matching, Input Enhancement in String Matching: Horspool's and Boyer-Moore algorithm.	CO2, CO4, CO5	8
IV	Dynamic Programming: Computing a Binomial Coefficient, Warshall's and Floyd's Algorithms, The Knapsack Problem	CO3, CO5	8

	and Memory Functions. Greedy Technique: Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees and codes.		
V	Backtracking: N-Queen's Problem, Sum of Subset Problem. Branch-and-Bound: Travelling Sales Person problem,0/1 Knapsack problem NP and NP-Complete Problems: Basic concepts, nondeterministic algorithms, P, NP, NP Complete, and NP-Hard classes.	CO4, CO5	8

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Introduction to the Design and Analysis of Algorithms	Anany Levitin, University,	Pearson	3rd Edition, 2011	1,2,3
2	Introduction to Algorithms	Cormen T.H., Leiserson C.E., Rivest R.L., Stein C.	PHI	3rd Edition,	4,5
3	Computer Algorithms	Horowitz E., Sahani S., Rajasekharan S.,	Galgotia Publications, ISBN:9780716783169.	2nd Edition,	All modules

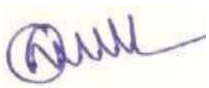
6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCS/WEB RESOURCE

1. http://www.facweb.iitkgp.ac.in/~sourav/daa.html
2. https://freevideolectures.com/course/2281/design-and-analysis-of-algorithms
3. https://nptel.ac.in/courses/106101060/
4. https://www.coursera.org/specializations/algorithms

7. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks
b) Semester End Examination (SEE) = 50 marks
Total = 100 marks

Semester End Examination (SEE):



SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

CIE Framework:

Two tests are to be conducted for 40 marks each. Average of all two tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

Table: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	AAT	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

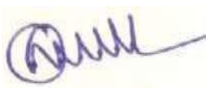
POs → / **COs ↓**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	2	1	-	-	-	-	1	1	-
CO2	3	3	3	2	2	-	-	-	1	2	-
CO3	3	3	3	3	2	-	-	-	2	2	-
CO4	3	3	2	3	2	-	-	-	2	2	-
CO5	3	2	3	2	3	-	-	-	2	3	-

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs → / **COs ↓**	**PSO1**	**PSO2**
CO1	3	2
CO2	3	3
CO3	3	3
CO4	3	2
CO5	3	3

Correlation Weightage: 1 – Low, 2 – Moderate, 3 – High



Department: **Computer Science and Engineering (AI & ML)**		
Semester: **IV**	Course Code: **BCI24404**	Contact Hrs /week: **3**
Course Description: **Software Engineering**		No. of Credits:**3** L : T : P : S = **3:0:0:0**
Course Category: **PCC**		Total no. of Hours = 40
CIE: **50 Marks**	SEE: **50 Marks**	Exam Hours: **03**
Course Pre-requisites: Basics of programming skills, Data Structures		

1. PREAMBLE ABOUT THE COURSE

The **Software Engineering** course is a fundamental component of computer science education, focusing on the systematic design, development, testing, and maintenance of software applications. This course emphasizes the application of engineering principles to software development, aiming to produce high-quality, reliable, and maintainable software systems. Students will explore various software development methodologies, including traditional and modern approaches, and learn to manage the complexities of software projects effectively. Students will be equipped with the knowledge and skills necessary to approach software development in a disciplined and structured manner, preparing them for careers in the ever-evolving field of software engineering.

2.COURSE LEVEL OBJECTIVES

- Outline software engineering principles and activities involved in building large software programs.
- Introduce Software design using UML tools and various system models.
- Introduce Agile Software development and Agile methods SCRUM.
- Introduce Software Testing and Software Evolution processes in detail.
- project Explain planning, Cost estimation techniques and Software quality, standards and metrics.

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours

CO1	Explain software engineering principles including processes, requirements, modeling with UML, agile practices, testing, project planning, and quality management.	PO1,PO2,PO3,PO4,PO5,PO9, PO11, PSO1, PSO2	L2	WK1, WK4, WK5, WK8	8
CO2	Apply software engineering principles by analyzing processes, requirements, and system modeling with UML to design foundational software solutions.	PO1,PO2,PO3, PO4,PO5,PO8, PO9, PO11, PSO1, PSO2	L3	WK2, WK4, WK5, WK8	8
CO3	Apply agile practices, testing strategies, and project planning with quality management to develop effective and reliable software systems.	PO1,PO2,PO3, PO4,PO5,PO7, PO8, PO9, PO10,PO11, PSO1, PSO2	L3	WK1, WK4, WK5, WK8	8
CO4	Analyze software engineering by examining processes, requirements, UML modeling, agile practices, testing, and project planning for effective software development.	PO1,PO2,PO3, PO4,PO5,PO6, PO7,PO8,PO9, PO10,PO11, PSO1, PSO2	L4	WK1, WK4, WK5, WK8	8

WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
I	**Introduction:** Professional Software Development - Software Engineering, Case Studies. **Software Processes:** Software process models, Software Process Activities. **Requirement Engineering:** Requirements Specification, Requirement elicitation and analysis, Requirements Validation, Requirements change, Functional Specification, and Non-Functional Requirements, The software requirements document. **Text book:T1 Chapters: 1.1-1.3,2.1-2.2,4.1-4.6**	CO1	8
II	**System Models:** Context models. Interaction models. Structural models. Behavioural models. Model-driven engineering. Software Design and Planning: **Object-oriented design concepts using UML tool:** Star UML application, Design	CO1, CO2	8

	patterns, Implementation issues, Open-Source Development. **Text book:T1 Chapters: 5.1-5.5,7.1-7.4**		
III	**Agile Software Development:** Agile methods, Plan-driven and agile development, Extreme programming, Agile project management, Scaling agile methods. **SCRUM** Methodology, SCRUM. **Text book:T1 & T2 Chapters: 3.1-3.4**	CO1, CO2, CO3, CO4	8
IV	**Software testing strategies:** A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional software, Test Strategies for Object-Oriented Software, Test Strategies for web apps, Validation Testing, and System Testing. **Testing Conventional Applications:** Software Testing Fundamentals, Internal and External views of Testing, White-Box Testing, Basic path Testing	CO1, CO2, CO3, CO4	8
V	**Project planning:** Software pricing, Plan-driven development, Project scheduling, Agile planning, and Estimation techniques. **Quality management:** Software quality, Software standards, Reviews and inspections, Software measurement, and metrics. **Text book:T1 Chapters: Chapters:23.1-23.5,24.1-24.3 & 24.5**	CO1, CO2, CO3, CO4	8

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Software Engineering,	Ian Sommerville	2016.	10th Edition	1,2,3
2	Software Engineering	A Practitioner's Approach, RogerS Pressman	Tata McGraw Hill, 2014	7th Edition	4,5
3	An integrated approach to software engineering	Pankaj Jalote	Springer US	3rd Edition, 2005.	Reference book
4	Object Oriented Modelling and Design with UML	Michael Blaha, James Rumbaugh	Pearson Education	2nd Edition, 2005.	Module 2
5	Fundamentals of Software Engineering	Rajib Mall,	PHI Learning Private	4th Edition,	All modules

			Lim- ited,2014.		

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCS/WEB RESOURCE

1. https://www.softwaretestingmaterial.com/category/agile/
2. https://www.atlassian.com/agile/kanban

7. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks
b) Semester End Examination (SEE) = 50 marks
Total = 100 marks

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

CIE Framework:

Two tests are to be conducted for 40 marks each. Average of all two tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

Table: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	AAT	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs → / COs ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	3	2	2				3		3
CO2	3	3	3	2	3			2	3		3
CO3	3	3	3	2	3		2	2	3	2	3
CO4	3	3	3	2	3	1	2	2	2	2	3

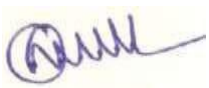
Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs → / COs ↓	PSO1	PSO2
CO1	3	2
CO2	3	2
CO3	3	2
CO4	3	2

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

*****



Department: **Computer Science and Engineering (AI & ML)**		
Semester: **IV**	Course Code: **BCIL24405**	Contact Hrs /week: **2**
Course Description: **Design and Analysis of Algorithms Laboratory**		No. of Credits:**1** L : T : P : S = **0:0:2:0**
Course Category: **PCCL**		Total no. of Hours = 26
CIE: **50 Marks**	SEE: **50 Marks**	Exam Hours: **03**
Course Pre-requisites: Programming in C, Data Structures		

1. PREAMBLE ABOUT THE COURSE

The Design and Analysis of Algorithms (DAA) course is a foundational component in computer science education, focusing on equipping students with the skills to develop efficient algorithms for solving computational problems. This course emphasizes the importance of algorithmic thinking, providing students with the tools to design algorithms that are not only correct but also optimal in terms of time and space complexity. By exploring various algorithm design techniques and analysing their performance, students gain a deep understanding of how to approach problem-solving in computer science. This course is typically offered to undergraduate students in computer science and engineering programs, often in the second or third year of study.

2.COURSE LEVEL OBJECTIVES

- Interpret the brute-force, divide-and-conquer paradigms
- Recognize the design techniques for graph traversal and String Matching problems using representative algorithms
- Demonstrate the greedy technique, dynamic programming paradigm as to when an algorithmic design situation calls for it.
- Illustrate the Backtracking algorithm design paradigms

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

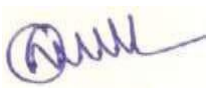
Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours

CO1	Implement and analyze classical searching and sorting algorithms using divide & conquer	PO1,PO2, PO3,PO4, PO5,PO6, PO9,PO10 PSO1,PSO2	L3	WK2, WK3, WK4, WK5, WK6, WK8	06
CO2	Apply graph traversal and shortest path algorithms for solving graph-related problems	PO1,PO2 PO3,PO4, PO5,PO6, PO9,PO10 PSO1,PSO2	L3	WK2, WK3, WK4, WK5, WK6, WK7, WK8	06
CO3	Implement advanced string matching techniques and evaluate their efficiency	PO1,PO2, PO3,PO4, PO5,PO9, PO10 PSO1,PSO2	L3	WK2, WK3, WK4, WK5, WK6, WK8	05
CO4	Anlyze and Solve optimization problems using greedy, dynamic programming, and backtracking approaches	PO1,PO2, PO3,PO4, PO5, PO9,PO10 PSO1,PSO2	L4	WK2, WK3, WK4, WK5, WK6, WK8	05
CO5	Analyze algorithm performance and apply appropriate algorithmic techniques to real-world problems	PO1,PO2, PO3,PO4, PO5,PO6, PO9,PO10 PSO1,PSO2	L4	WK2, WK3, WK4, WK5, WK6, WK8	04

WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

	Lab Programs
1.	a. Implement naïve String-matching algorithm using Brute Force Approach b. Implement and analyze iterative and recursive binary search algorithm using divide and conquer method.
2.	Sort a given set of n integer elements using Merge Sort method and compute its time complexity. Demonstrate this algorithm using Divide-and-Conquer method.
3.	Sort a given set of n integer elements using Quick Sort method and compute its time complexity. Demonstrate this algorithm using Divide-and-Conquer method.



4	a. Incorporate the array data structure and demonstrate whether a given unweighted graph is connected or not using DFS method. b. Implement the graph traversal technique using BFS method to print all the nodes reachable from a given starting node in an unweighted graph.
5	Demonstrate how to obtain the Topological ordering of vertices in a given digraph.
6	Implement Horspool's String matching algorithm.
7	Compute the Transitive Closure for a given directed graph using Warshall's algorithm.
8	For a given weighted graph, construct an All-Pairs Shortest Path using Floyds algorithm.
9	Implement 0/1 Knapsack problem using Dynamic Programming Memory Functions technique.
10	Find Minimum Cost Spanning Tree for a given weighted graph using Prims and Kruskal's algorithm.
11	From a given vertex in a weighted connected graph, determine the Single Source Shortest Paths using Dijkstra's algorithm.
12	Demonstrate the working of back tracking approach for solving N-Queen's problem.

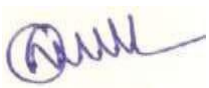
5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Programs Covered
1	Introduction to the Design and Analysis of Algorithms,	Anany Levitin, University	Pearson, ISBN 13: 978	3rd Edition,2012	All programs
2	Introduction to Algorithms	Cormen T.H., Leiserson C.E., Rivest R.L., Stein C.	PHI, ISBN:9780262033848	3rd Edition, 2010	All programs
3	Computer Algorithms	Horowitz E., Sahani S., Rajasekharan S.	Galgotia Publications, ISBN:9780716783169	2 nd Edition, 2006	All programs

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCS/WEB RESOURCE

1. https://nptel.ac.in/courses/106101060/
2. https://www.coursera.org/specializations/algorithms

7. EVALUATION METHODOLOGY



a) Continuous Internal Evaluation (CIE) = 50 marks
b) Semester End Examination (SEE) = 50 marks
Total = 100 marks

CIE Framework:

ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
WEIGHTAGE	**50%**	**50%**
Record	**10**	
Test	**20**	**50**
Experiential Learning (Mini Project)	**20**	NIL
Total Marks for the Course	**50**	**50**

8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs → / **COs ↓**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	3	2	3	2	1	-	-	2	2	-
CO2	3	3	2	3	2	1	-	-	2	2	-
CO3	3	2	3	2	2	-	-	-	1	2	-
CO4	3	3	3	3	2	-	-	-	2	2	-
CO5	3	3	3	3	3	1	-	-	3	3	-

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs → / **COs ↓**	**PSO1**	**PSO2**
CO1	3	2
CO2	3	3
CO3	3	2
CO4	3	3
CO5	3	3

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

*****

Department: **Computer Science and Engineering (AI & ML)**		
Semester: **IV**	Course Code: **BCI24406A**	Contact Hrs /week: **3**
Course Description: **Dot Net Framework**		No. of Credits:**3** L : T : P : S = **3:0:0**
Course Category: **ETC/PLC**		Total no. of Hours = 40
CIE: **50 Marks**	SEE: **50 Marks**	Exam Hours: **03**
Course Pre-requisites: Basic Programming Languages		

1. PREAMBLE ABOUT THE COURSE

The **.NET Framework** is a software development platform developed by **Microsoft**. It provides a **controlled environment** for developing and running applications, especially Windows-based applications.

2. COURSE LEVEL OBJECTIVES

- Learn the components of the .NET Framework and Framework Class Library.
- Learn the basics of C# and work with collections such as arrays and lists.
- Implement the object-oriented programming in C#
- Understand Delegates and Events in C#.
- Understand layout management in Windows Forms and WPF.

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Understand the fundamentals of C# programming and .NET Framework.	PO1,PO2,PO3 PSO1,PSO2	L2	WK1, WK3, WK4	8
CO2	Apply object-oriented concepts using C# and .NET Framework, utilizing data structures and collections for efficient software development and data manipulation.	PO1,PO2, PO3,PO5 PSO1,PSO2	L3	WK1, WK3, WK4	8

CO3	Handle events, exceptions, and errors effectively to implement reliable applications in C#.	PO1,PO2 ,PO3,PO5, PSO1,PSO2	L3	WK1, WK3, WK4	8
CO4	Design and develop Windows Forms and WPF desktop applications.	PO1,PO2,PO3, PO4,PO6, PO10 PSO1,PSO2	L4	WK1, WK3, WK4	8

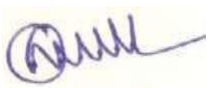
WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
I	Introducing C#, Understanding .NET, Overview of C#, Literals, Variables and Data Types, Operators and Expressions, Decision Making and Branching, Decision Making and Looping. **Text book:T1 Chapters: 1 to 7**	CO1	8
II	Methods in C#, Handling Arrays, Manipulating Strings, Structures and Enumerations. **Text book:T1 Chapters: 8 to 11**	CO1, CO2	8
III	Classes and Objects, Inheritance and Polymorphism, Interface: Multiple Inheritance, Operator Overloading. **Text book:T1 Chapters: 12 to 15**	CO1, CO2	8
IV	Delegates and Events, Managing Console I/O Operations, Managing Errors, and Exceptions. **Text book:T1 Chapters:16 to 18**	CO1, CO3, CO4	8
V	Multithreading in C#, Window Forms and Web-based Application Development on .NET. **Text book:T1 Chapters: 19 to 20**	CO1, CO4	8

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Programming in C#	E Balagurusamy	Tata McGraw Hill, 2015.	4th Edition	All programs
2	"C# 6 and .NET Core 1.0",	Christian Nagel	Wiley India Pvt Ltd, 2016.	1st Edition	All programs



3	"The Complete Reference: C# 4.0",	Herbert Schildt,	Tata McGraw Hill, 2012.	1st Edition	All programs
4	"Pro C# 2010 and the .NET 4 Platform,	Andrew Troelsen	A Press, 2010.	Fifth edition,	All programs
5	Microsoft Visual C# Step by Step,	John Sharp,	PHI Learning Pvt. Ltd. 2016	8th Edition	All programs

6.LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCS/WEB RESOURCE

1. https://download.microsoft.com/download/8/e/7/8e725d96-7ec3-498b-9fa7-86779aed101f/dotnet%20tutorial%20for%20beginners.pdf
2. https://dotnet.microsoft.com/en-us/learn/csharp
3. Introduction to C#: https://www.youtube.com/watch?v=ItoIFCT9P90
4. .NET FRAMEWORK: https://www.youtube.com/watch?v=h7huHkvPoEE
5. https://www.tutorialsteacher.com/csharp
6. https://www.javatpoint.com/net-framewok

7.EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks
b) Semester End Examination (SEE) = 50 marks
Total = 100 marks

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

CIE Framework:

Two tests are to be conducted for 40 marks each. Average of all two tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

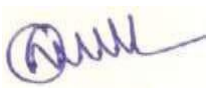


Table: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	AAT	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs → / **COs ↓**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	3	1								
CO2	3	2	3		3						
CO3	3	2	3		3						
CO4	1	1	3	3		3				3	

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs → / **COs ↓**	**PSO1**	**PSO2**
CO1	2	2
CO2	2	2
CO3	2	2
CO4	2	2

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

*****

Department: **Computer Science and Engineering (AI & ML)**		
Semester: **IV**	Course Code: **BCI24406B**	Contact Hrs /week: **3**
Course Description: **Theory of Computation**		No. of Credits:**3** L : T : P : S = **3:0:0**
Course Category: **ETC/PLC**		Total no. of Hours = 40
CIE: **50 Marks**	SEE: **50 Marks**	Exam Hours: **03**
Course Pre-requisites: Discrete Mathematics, Data Structures		

1. PREAMBLE ABOUT THE COURSE

The **Theory of Computation** is a fundamental branch of computer science that explores the nature of computation itself. It seeks to understand the **mathematical principles** underlying **what can be computed**, **how it can be computed**, and **how efficiently it can be done**. This field provides formal models of computation such as **finite automata**, **context-free grammars**, and **Turing machines**, which are used to classify problems based on their computational complexity and solvability.

2. COURSE LEVEL OBJECTIVES

- Introduce core concepts in Automata and Theory of Computation.
- Identify different Formal Language Classes and their Relationships.
- Learn concepts of Grammars and Recognizers for different formal languages.
- Prove or disprove theorems in automata theory using their properties.
- Determine the decidability and intractability of Computational problems

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Out-come	Description	Mapped POs/PSOs	Cogni-tive Level	WK	Class Hours
CO1	Understand the funda-mental concepts of theory of computations	PO1,PO2, PSO1,PSO2	L2	WK1,WK2, WK3,WK4	8

CO2	Apply the tools of finite automata to various fields of computer science.	PO1,PO2,PO3, PO4,PO5, PSO1,PSO2	L3	WK1,WK3, WK4	8
CO3	Develop solution model for complex problems, using the appropriate skills of automata theory for better results.	PO1,PO2, PO3,PO4, PO5,PSO1,PSO2	L3	WK1,WK3, WK4,WK5	8
CO4	Analyze automata skills in situations that describe computation effectively and efficiently	PO1,PO2, PO3,PO4, PO5, PSO1,PSO2	L3	WK1,WK3, WK4,WK5	8

WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
I	Introduction to Finite Automata, Structural Representations, Automata and Complexity. The Central Concepts of Automata Theory. Deterministic Finite Automata, Nondeterministic Finite Automata, An Application: Text Search, Finite Automata with Epsilon-Transitions. **Text Book:** Chapter 1.1, 1.5, 2.2,2.3,2.4,2.5	CO1	8
II	Regular Expressions, Finite Automata and Regular Expressions, Proving Languages not to be Regular. Closure Properties of Regular Languages, Equivalence and Minimization of Automata, Applications of Regular Expressions **Text Book**: Chapter 3.1, 3.2 (Except 3.2.1), 3.3, 4.1, 4.2, 4.4	CO2	8
III	Context-Free Grammars, Parse Trees, Ambiguity in Grammars and Languages, Ambiguity in Grammars and Languages, Definition of the Pushdown Automaton, The Languages of a PDA, Equivalence of PDA's and CFG's, Deterministic Pushdown Automata. **Text Book:** Chapter 5.1, 5.2, 5.4, 6.1,6.2,6.3.1,6.4	CO3	8
IV	Normal Forms for Context-Free Grammars, The Pumping Lemma for Context-Free Languages, Closure Properties of Context-Free Languages. **Text Book:** Chapter 7.1, 7.2, 7.3	CO3	8
V	Introduction to Turing Machines: Problems That Computers Cannot Solve, The Turing Machine, Programming Techniques for Turing Machines, Extensions to the Basic Turing Machine, Undecidability: A Language That Is Not Recursively Enumerable. **Text Book:** Chapter 8.1,8.2, 8.3,8.4, 9.1, 9.2	CO4	8

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Introduction to Automata Theory, Languages and Computation	John E Hopcroft, Rajeev Motwani, Jeffrey D. Ullman	Pearson.	Second Edition,	1,2,3,4,5
2	Automata,Computability and complexity	Elain Rich,	Pearson	1st Edition,	All programs
3	Theory of Computer Science	K.L.P Mishra, N Chandrashekaran	PHI,2012.	3rd Edition	All programs
4	An introduction to Formal Languages and Automata	Peter Linz	Narosa Publishers,1998.	3rd Edition	All programs
5	Introduction to the Theory of Computation,	Michael Sipser	Cengage learning,2013.	3rd edition,	All programs

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCS/WEB RESOURCE

1. https://www.udemy.com/course/complete-jdbc-programming-part-1/
2.https://www.coursera.org/learn/java-database-connectivity-introduction

7. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks
b) Semester End Examination (SEE) = 50 marks
Total = 100 marks

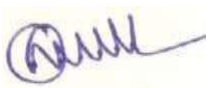
Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

CIE Framework:

Two tests are to be conducted for 40 marks each. Average of all two tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

Table: Distribution of weightage for CIE & SEE



	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	AAT	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs → / **COs ↓**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2	-	-	-	-	-	-	-	-	-
CO2	3	2	1	2	3	-	-	-	-	-	-
CO3	3	2	3	2	1	-	-	-	-	-	-
CO4	3	2	1	2	2	-	-	-	-	-	-

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs → / **COs ↓**	**PSO1**	**PSO2**
CO1	2	1
CO2	2	1
CO3	2	1
CO4	2	1

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

*****

Department: **Computer Science and Engineering (AI & ML)**		
Semester: **IV**	Course Code: **BCI24406C**	Contact Hrs /week: **3**
Course Description: **Object Oriented Programming with Java**		No. of Credits: **3** L : T : P : S = **3:0:0:0**
Course Category: **ETC/PLC**		Total no. of Hours =40
CIE: **50 Marks**	SEE: **50 Marks**	Exam Hours: **03**
Course Pre-requisites: Basic Programming Concepts		

1. PREAMBLE ABOUT THE COURSE

Object-Oriented Programming (OOP) is a programming paradigm centered around the concept of **"objects"**, which encapsulate **data** and the **methods** that operate on that data. Java, as a strongly object-oriented language, provides a robust and structured approach to software development through principles such as **encapsulation**, **inheritance**, **polymorphism**, and **abstraction**.

2. COURSE LEVEL OBJECTIVES

- Set up Java JDK environment to create, debug, and run simple Java programs.
- Learn object-oriented concepts using programming examples.
- Create multi-threaded programs and event-handling mechanisms.
- Learn string handling methods using programming examples.
- Create Interactive programs.

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Describe the fundamentals of Object -oriented concepts and apply features of object oriented programming of Java to solve real world problems	PO1,PO2, PSO1,PSO2	L2	WK1, WK2, WK3, WK4	8
CO2	Identify Classes and establish relationship among Classes for various applications from problem definition.	PO1,PO2,PO3, PO4,PO5, PSO1,PSO2	L2	WK1, WK3, WK4	8

CO3	Implement reliable object-oriented applications using Java features such as Exception Handling, Multi-threaded Programming	PO1,PO2, PO3,PO4, PO5,PSO1,PSO2	L3	WK1, WK3, WK4, WK5	8
CO4	Develop real world applications using Object Oriented concepts and Java programming	PO1,PO2, PO3,PO4, PO5, PSO1,PSO2	L3	WK1, WK3, WK4, WK5, WK8	8

WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
I	**Introduction to JAVA:** Java's magic, Features, the Byte code; Java Development Kit (JDK); the Java Buzzwords, Object-oriented programming; Simple Java programs' Data types, variables, Operators, and Control Statements. **Classes & Objects:** Classes fundamentals; Declaring objects; Constructors, this keyword, static keyword, and compile time polymorphism. **Textbook: 1** **Chapters: 1, 2, 3, 4, 5, 6, 7**	CO1, CO2, CO4	8
II	**Inheritance:** inheritance basics, uses of super keyword, run time polymorphism, Final and Abstract keywords. **Exception handling**: Fundamentals, Exception Types, Uncaught Exceptions, Exception Handlers, Java's Built-in Exceptions, Creating user-defined Exception Subclasses, Chained Exceptions. Textbook: 1 **Chapters: 8 and 10**	CO3, CO4	8
III	**Arrays:** Introduction, Declaration, and Initialization, Alternative Array Declaration Syntax, One-Dimensional, Multi-Dimensional Arrays and Array of Objects. **String:** The String Constructors, String Length, Special String Operations. String Literals, String Concatenation, String Concatenation with Other Data Types. String Conversion toString(). Character Extraction methods, String Comparison methods, Searching Strings, and Modifying a String. Data Conversion using valueOf(), Changing the Case of Characters Within a String. Jumping Strings, StringBuffer,	CO1, CO4	8

	StringBuffer Constructors, length() and capacity(). ensureCapacity(), setlength(), and setCharAl(), getChars(), append( ), insert(), reverse(), delete() and deleteCharAt(), replace( ). **Textbook: 1**		
IV	**Packages and Interfaces:** Packages, Access Protection, Import Packages, Interfaces. **Multi-Threaded Programming**: What are threads?; Ways of Creating a Thread, Main Thread, Thread States, Synchronization, isAlive(), Join(), Priority(); Inter-Thread Communication with Producer-Consumer Problem. **Textbook: 1** **Chapters: 9 and 11**	CO3, CO4	8
V	**Abstract Window Tool Kit Basics:** creating Frame, adding components like Buttons, labels, Textfield, Layouts, etc. and built-in functions. **Event Handling:** Two event handling mechanisms; The delegation event model; Event classes; Sources of events; Event listener interfaces, and Adapter Classes. Keyboard and Mouse Events. **Textbook: 1** **Chapters: 25, 26, and 10**	CO3, CO4	8

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Java Fundamentals – A Comprehensive Introduction	Herbert Schildt and Dale Skrien	McGraw Hill Education	First Edition , 2012	1,2,3,4,5
2	Programming with Java	Mahesh Bhave and Sunil Patekar	Pearson Education	First Edition	All Modules
3	Object-oriented Programming with java	Rajkumar Buyya,S Thamarasi selvi, xingchen chu	Tata McGraw Hill education private limited.	first edition	All Modules
4	CORE JAVA volume I-Fundamentals	Cay S Horstmann and Cary Gornell	Pearson	9th edition	All Modules
5	Java TM Design Patterns – A Tutorial	James W. Cooper	Addison-Wesley Publishers.	First Edition	All Modules

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCS/WEB RESOURCE

1. https://www.tutorialspoint.com/java/index.htm.
2. https://www.geeksforgeeks.org/java/
3. https://www.w3schools.com/java/
4. https://www.youtube.com/watch?v=VHbSop-Myc4M&list=PLBlnK6fEyqRjKA_NuK9mHmlk0dZzuP1P5

7. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks
b) Semester End Examination (SEE) = 50 marks
Total = 100 marks

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

CIE Framework:

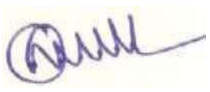
Two tests are to be conducted for 40 marks each. Average of all two tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

Table: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	AAT	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs → / **COs ↓**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	1	-	-	-	-	-	-	-	-	-



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

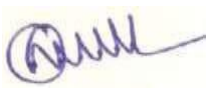
Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs → / **COs ↓**	**PSO1**	**PSO2**
CO1	2	1
CO2	2	1
CO3	2	1
CO4	2	1

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

*****



Department: **Computer Science and Engineering (AI & ML)**		
Semester: **IV**	Course Code: **BCI24406D**	Contact Hrs /week: **3**
Course Description: **System Software**		No. of Credits:**3** L : T : P : S = **3:0:0:0**
Course Category: **ETC/PLC**		Total no. of Hours = 40
CIE: **50 Marks**	SEE: **50 Marks**	Exam Hours: **03**
Course Pre-requisites: C programming, Operating Systems, Computer Organization		

1. PREAMBLE ABOUT THE COURSE

System Software is a foundational subject in computer science that delves into the design and implementation of software responsible for managing hardware resources and providing essential services for application programs. This course covers various components of system software, including machine architecture, assemblers, loaders, linkers, and macro processors, providing students with a comprehensive understanding of how software interacts with hardware.

2. COURSE LEVEL OBJECTIVES

- To understand the basic structure and components of a computer system relevant to system software development.
- To study the design and functioning of assemblers and understand the two-pass and single-pass assembler mechanisms.
- To learn the structure, purpose, and functioning of loaders and linkers in the software execution process.
- To understand macro definitions, expansion techniques, and the role of macro processors in assembly language programming.
- To explore various debugging tools and learn their application in software development and troubleshooting.

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

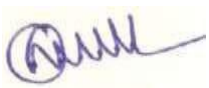
Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours

CO1	Apply knowledge of machine architecture and pass-2 assembler algorithms to analyze, implement, and manage code translation, relocation, and the functioning of system software.	PO1,PO2, PSO1,PSO2	L3	WK1,WK3, WK4	8
CO2	Demonstrate the working of loaders and linkers and apply concepts to resolve external references in program modules.	PO1,PO2, PO3,PO5, PSO1,PSO2	L3	WK1,WK3, WK4	8
CO3	Apply macroprocessor concepts and debugging tools to develop and correct assembly language programs.	PO1,PO2, PO3,PO5, PSO1,PSO2	L3	WK1,WK3, WK4	8
CO4	Develop and analyze the functioning of a simple assembler including symbol table creation and intermediate code generation.	PO1,PO2, PO3,PO5, PSO1,PSO2	L4	WK1,WK3, WK4	8

WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
I	**Machine Architecture:** Introduction, System Software and Machine Architecture, Simplified Instructional Computer (SIC) - SIC Machine Architecture, SIC/XE Machine Architecture, Traditional (CISC) Machines – Pentium Pro Architecture, RISC Machines – PowerPC Architecture. **Text book: T1 Chapters: 1.1, 1.2, 1.3.1, 1.3.2, 1.4.2, 1.5.2**	CO1	8
II	**Assemblers -1:** Basic Assembler Function - A Simple SIC Assembler, Assembler Algorithm and Data Structures, Machine Dependent Assembler Features - Instruction Formats & Addressing Modes, Program Relocation. **Text book: T1 Chapters: 2.1, 2.2, 2.2.1, 2.2.2**	CO1, CO4	8
III	**Assemblers -2:** Machine Independent Assembler Features – Literals, Symbol-Definition Statements, Expression, Program Blocks, Control Sections and Programming Linking, Assembler Design Operations - One-Pass Assembler, Multi-Pass Assembler, Implementation Examples – MASM Assembler. **Text book: T1 Chapters: 2.3, 2.4, 2.5.1**	CO1, CO4	8



IV	**Loaders and Linkers:** Basic Loader Functions - Design of an Absolute Loader, A Simple Bootstrap Loader, Machine-Dependent Loader Features – Relocation, Program Linking, Algorithm and Data Structures for a Linking Loader; Machine-Independent Loader Features - Automatic Library Search, Loader Options, Loader Design Options - Linkage Editor, Dynamic Linkage, Bootstrap Loaders, Implementation Examples - MS-DOS Linker. **Text book: T1 Chapters: 3.1, 3.2, 3.3, 3.4, 3.5.1**	CO1, CO2, CO4	8
V	**Macro Processor:** Basic Macro Processor Functions - Macro Definitions and Expansion, Macro Processor Algorithm and Data Structures. **Editors and Debugging Systems:** Text Editors - Overview of Editing Process, User Interface, Editor Structure, Interactive Debugging Systems - Debugging Functions and Capabilities, Relationship with Other Parts of the System, User-Interface Criteria. **Text book: T1 Chapters: 4.1, 7.2, 7.3**	CO1, CO3	8

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	System Software	Leland.L.Beck	Pearson Education	3rd Edition, 2017	1,2,3,4,5
2	System Programming and Operating Systems	D.M. Dhamdhere	Tata McGraw - Hill,	2nd Edition, 2011	All programs
3	Systems Programming	Srimanta Pal	Oxford University Press	2011	All programs

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCS/WEB RESOURCE

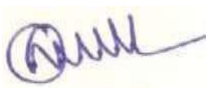
1. https://archive.nptel.ac.in/courses/106/101/106101234/

7. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks
b) Semester End Examination (SEE) = 50 marks
Total = 100 marks

Semester End Examination (SEE):

SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions)



from each module carrying 20 marks each. Students are required to answer any five full questions choosing at least one full question from each module.

CIE Framework:

Two tests are to be conducted for 40 marks each. Average of all two tests marks is added to the test component. In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices. Possible AATs are – seminar / assignments / term paper / open ended experiments / mini-projects/group activity or any other.

Table: Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	AAT	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs → / **COs ↓**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	2									
CO2	3	2	3		2						
CO3	3	2	3		2						
CO4	3	2	3		2						

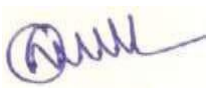
Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs → / **COs ↓**	**PSO1**	**PSO2**
CO1	3	2
CO2	3	2
CO3	3	2
CO4	3	2

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

*****



Department: **Computer Science and Engineering (AI & ML)**		
Semester: **IV**	Course Code: **BCI24457A**	Contact Hrs /week: **2**
Course Description: **Data Analytics with Excel**		No. of Credits: **1** L : T : P : S = **0:0:2:0**
Course Category: **AEC**		Total no. of Hours = 26
CIE: **50 Marks**	SEE: **50 Marks**	Exam Hours: **02**
Course Pre-requisites: Basic Computer Literacy, Mathematics		

1. PREAMBLE ABOUT THE COURSE

Data analytics with Excel involves using Excel's powerful tools and functions to collect, organize, analyze, and visualize data for better decision-making. Excel enables users to work with large datasets through features such as formulas, charts, pivot tables, conditional formatting, and data analysis tools like Power Query. It allows for efficient data cleaning, trend identification, and summary generation, making it an essential tool for both beginners and professionals. With its accessibility and wide application, Excel continues to be a foundational platform for gaining insights from data across various industries.

2. COURSE LEVEL OBJECTIVES

- Apply analysis techniques to datasets in Excel
- Learn how to use Pivot Tables and Pivot Charts to streamline your workflow in Excel
- Understand and Identify the principles of data analysis
- Become adept at using Excel functions and techniques for analysis
- Build presentation ready dashboards in Excel

3. COURSE OUTCOMES (COs) & COMPETENCIES

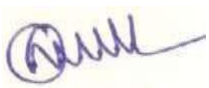
After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Use advanced functions and productivity tools to assist in developing worksheets.	PO1, PO2, PO3, PO5, PSO1	L2	WK2, WK6	06
CO2	Manipulate data lists using Outline and PivotTables.	PO1, PO2, PO3, PO4, PO5, PSO1	L3	WK2, WK6	05
CO3	Use Consolidation to summarise and report results from multiple worksheets	PO1, PO2, PO3, PO4, PO5, PO9, PSO1	L3	WK2, WK6	05
CO4	Apply Macros and Auto filter to solve the given real-world scenario.	PO1, PO2, PO3, PO4, PO5, PSO1	L3	WK2, WK6	05
CO5	Organize and analyse complex data sets across multiple sheets to generate summary and insight for decision-making.	PO1, PO2, PO3, PO4, PO5, PO9, PSO1	L4	WK2, WK6	05

WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

SL.NO	Experiments
1	Getting Started with Excel: Creation of spread sheets, Insertion of rows and columns, Drag & Fill, use of Aggregate functions.
2	Getting Started with Excel: Creation of spread sheets, Insertion of rows and columns, Drag & Fill, use of Aggregate functions.
3	Working with Data: Data Validation, Pivot Tables & Pivot Charts.
4	Data Analysis Process: Conditional Formatting, What-If Analysis, Data Tables, Charts & Graphs.
5	Cleaning Data with Text Functions: use of UPPER and LOWER, TRIM function, Concatenate.
6	Cleaning Data Containing Date and Time Values: use of DATEVALUE function, DATEADD and DATEDIF, TIMEVALUE functions.
7	Conditional Formatting: formatting, parsing, and highlighting data in spreadsheets during data analysis.
8	Working with Multiple Sheets: work with multiple sheets within a workbook is crucial for organizing and managing data, perform complex calculations and create comprehensive reports.



9	Create worksheet with following fields: Empno, Ename, Basic Pay(BP), Travelling Allowance(TA), Dearness Allowance(DA), House Rent Allowance(HRA), Income Tax(IT), Provident Fund(PF), Net Pay(NP). Use appropriate formulas to calculate the above scenario. Analyse the data using appropriate chart and report the data.
10	Create worksheet on Inventory Management: Sheet should contain Product code, Product name, Product type, MRP, Cost after % of discount, Date of purchase. Use appropriate formulas to calculate the above scenario. Analyse the data using appropriate chart and report the data.
11	Create worksheet on Sales analysis of Merchandise Store: data consisting of Order ID, Customer ID, Gender, age, date of order, month, online platform, Category of product, size, quantity, amount, shipping city and other details. Use of formula to segregate different categories and perform a comparative study using pivot tables and different sort of charts.
12	Generation of report & presentation using Autofilter &macro.

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Programs Covered
1	Data Analysis with Microsoft® Excel	Berk & Carey	Microsoft Excel: Updated for Office 2007	Third Edition	Program 1-12
2	Data Analysis and Business Modeling,	Wayne L.Winsto Microsoft Excel 2019	PHI	6th edition	All programs

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCS/WEB RESOURCE

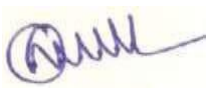
1. https://www.simplilearn.com/tutorials/excel-tutorial/data-analysis-excel

7. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks
b) Semester End Examination (SEE) = 50 marks
Total = 100 marks

CIE Framework:

ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
WEIGHTAGE	**50%**	**50%**
Continuous Evaluation	30	**50**
Test	20	
Total Marks for The Course	**50**	**50**



8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs → / COs ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	2		3						
CO2	2	3	2	2	3						
CO3	2	3	3	3	2				2		
CO4	2	3	3	3	3				2		
CO5	3	3	3	3	2				2		

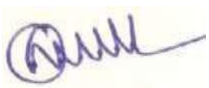
Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs → / COs ↓	PSO1	PSO2
CO1	2	
CO2	2	
CO3	2	
CO4	2	
CO5	2	

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

*****



Department: **Computer Science and Engineering (AI & ML)**		
Semester: **IV**	Course Code: **BCI24457B**	Contact Hrs /week: 2
Course Description: **Haskell Programming**		No. of Credits: **1** L : T : P : S = **0:0:2:0**
Course Category: **AEC**		Total no. of Hours = 26
CIE: **50 Marks**	SEE: **50 Marks**	Exam Hours: **02**
Course Pre-requisites: Basic Programming skills		

1. PREAMBLE ABOUT THE COURSE

The Haskell Programming course offers an introduction to functional programming through the use of Haskell, a language widely respected for its clarity, reliability, and expressive power. Designed to encourage a mathematical and declarative approach to coding, the course emphasizes writing clean, efficient, and maintainable software. Haskell's influence can be seen in many modern programming languages and is increasingly valued in industries focused on data analytics, finance, formal verification, and high-assurance systems. This course not only enhances problem-solving skills but also prepares students for roles where functional programming is becoming a critical part of the software development process.

2. COURSE LEVEL OBJECTIVES

- Understand the fundamentals of functional programming and Haskell's declarative paradigm.
- Explore recursion, pattern matching, and higher-order functions in solving problems.
- Apply functional programming techniques to implement operations on data structures and user input.
- Develop modular Haskell programs to solve computation-oriented and algorithmic problems.

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

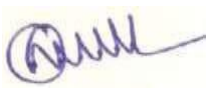
Course Out-come	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours

CO1	Apply functional programming principles to solve arithmetic and input/output problems using Haskell.	PO1, PO2,PO5, PO11,PSO1	L3	WK1, WK2, WK4	06
CO2	Construct recursive functions to process and analyse elements in lists and sequences.	PO1,PO2,PO5, PO11,PSO1	L3	WK1, WK2, WK4, WK6	05
CO3	Develop logic to handle number-based computations involving mathematical decision-making.	PO1,PO2,PO5, PO11,PSO1	L3	WK1, WK2, WK4, WK6	05
CO4	Implement data processing algorithms involving matrices and sorting techniques using functional logic.	PO1,PO2,PO3, PO5,PO11,PSO1	L3	WK1, WK2, WK5, WK6	05
CO5	Simulate linear and non-linear data structures using list-based representations.	PO1,PO2,PO3, PO5,PO11,PSO1	L3	WK1, WK2, WK3, WK5, WK6, WK8	05

WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

SL.NO	Experiments
1	a. Write a Haskell program to read two integers from the user, compute their sum, and classify the result as even or odd, positive or negative. b. Create a Haskell function that takes a list of integers and returns the maximum of the list using recursion. Also return the index of the maximum element
2	Implement a text-based calculator in Haskell that repeatedly prompts the user for two numbers and an operation (+, -, *, /, %) until the user chooses to quit. Include error handling (e.g., divide by zero).
3	Write a Haskell function for the following: - a. to check if a number is prime. Extend it to print all prime numbers in a given range (m to n) along with the count of primes found. b. to reverse the digits and check if its Palindrome or not
4	Write a Haskell function to: - a. To calculate GCD and LCM of 2 numbers b. To compute the factorial of a number. Also compute the sum of digits of the resulting factorial
5	Write a Haskell program that recursively generates the Fibonacci series up to n terms and displays the series along with the count of even and odd terms, the sum, and the average
6	Write Haskell program to:-



	a. Remove Duplicates from a List b. Count the Frequency of Elements in a List
7	Write Haskell program to perform addition, multiplication and transpose of 2 matrices.
8	Write Haskell function to perform selection sort and bubble sort.
9	Write a Haskell program to implement: a. Stack operations using lists b. Queue operations using lists
10	Write Haskell Program to Implement a Binary Search Tree with Insertion and Search operations.

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Programming in Haskell	Graham Hutton	Cambridge University Press	2nd Edition, 22016	All programs
2	Haskell: The Craft of Functional Programming	Simon Thompson	Pearson Education	Third Edition (2011)	All programs

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCS/WEB RESOURCE

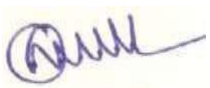
- https://archive.nptel.ac.in/courses/106/106/106106137/

7. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks
b) Semester End Examination (SEE) = 50 marks
Total = 100 marks

CIE Framework:

ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
WEIGHTAGE	**50%**	**50%**
Continuous Evaluation	30	**50**
Test	20	
Total Marks for The Course	**50**	**50**



8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs → / COs ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2			2						1
CO2	3	2			2						1
CO3	3	2			1						1
CO4	3	2	3		3						1
CO5	3	2	3		3						1

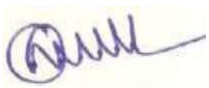
Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs → / COs ↓	PSO1	PSO2
CO1	1	
CO2	1	
CO3	1	
CO4	1	
CO5	1	

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

*****



Department: **Computer Science and Engineering (AI & ML)**		
Semester: **IV**	Course Code: **BCI24457C**	Contact Hrs /week: **2**
Course Description: **MERN Stack Development**		No. of Credits: **1** L : T : P : S = **0:0:2:0**
Course Category: AEC		Total no. of Hours = 26
CIE: **50 Marks**	SEE: **50 Marks**	Exam Hours: **02**
Course Pre-requisites: Basics of Web Technologies, DBMS		

1. PREAMBLE ABOUT THE COURSE

The MERN stack is a popular and powerful set of technologies used to build full-stack web applications, comprising **MongoDB**, **Express.js**, **React.js**, and **Node.js**. It offers a seamless development experience using JavaScript across both the client and server sides, enabling faster and more efficient coding. MongoDB handles the database operations with flexibility and scalability, Express.js serves as the lightweight web application framework, React.js manages the frontend user interface with dynamic rendering, and Node.js powers the backend server environment. This course explores the integration and functionality of each component in the MERN stack, demonstrating how they work together to develop responsive, modern, and high-performance web applications.

2. COURSE LEVEL OBJECTIVES

- Understand and apply critical web development languages and tools to create dynamic and responsive web applications.
- To build server-side applications using Node.js and Express
- Develop user interfaces with React.js,
- Manage data using MongoDB, and integrate these technologies to create full stack apps
- Understanding APIs and routing.

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

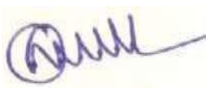
Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours

CO1	Demonstrate CRUD operations and query handling in MongoDB for efficient data storage and retrieval.	PO1,PO2, PO3,PO5, PO9,PO10, PO11	L3	WK3, WK4, WK5	05
CO2	Implement server-side programming with Node.js to manage data, handle requests, and perform file operations.	PO1,PO2, PO3,PO5, PO9,PO10, PO11	L3	WK3, WK4, WK5	05
CO3	Apply client-server communication concepts including Ajax, cookies, and HTTP request/response handling to build interactive systems.	PO1,PO2, PO3,PO5, PO9,PO10, PO11	L3	WK3, WK4, WK5, WK7	06
CO4	Design and develop web applications using Express.js with routing and authentication mechanisms.	PO1,PO2, PO3,PO5, PO9,PO10, PO11	L6	WK3, WK4, WK5, WK7	05
CO5	Design dynamic front-end applications using React with state management and REST API integration.	PO1,PO2, PO3,PO5, PO9,PO10, PO11	L6	WK3, WK4, WK5, WK7, WK8	05

WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

SL.NO	Lab Programs
1	Using MongoDB, create a collection called transactions in database user managed (drop if it already exists) and bulk load the data from a json file, transactions. json Upsert the record from the new file called transactions_upsert. json in MongoDB
2	Query MongoDB with Conditions: [Create appropriate collection with necessary documents to answer the query] a. Find any record where Name is Somu b. Find any record where total payment amount (Payment.Total) is 600. c. Find any record where price (Transaction.price) is between 300 to 500. d. Calculate the total transaction amount by adding up Payment. Total in all records
3	a. Write a program to check request header for cookies. b. writes node.js program to print the a car object properties, delete the second property and get length of the object.
4	a. Read the data of a student containing usn, name, sem, year_of_admission from node js and store it in the mongodb b. For a partial name given in node js, search all the names from mongodb student documents created in Question(a)



5	Implement all CRUD operations on a File System using Node JS
6	Develop the application that sends fruit name and price data from client side to Node.js server using Ajax
7	Develop an authentication mechanism with email_id and password using HTML and Express JS (POST method)
8	Develop two routes: find_prime_100 and find_cube_100 which prints prime numbers less than 100 and cubes less than 100 using Express JS routing mechanism
9	Develop a React code to build a simple search filter functionality to display a filtered list based on the search query entered by the user.
10	Develop a React code to collect data from rest API

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Programs Covered
1	Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node	Vasan Subramanian	Apress	2nd Edition (2019)	All programs
2	Full-Stack React Projects: Modern web development using React 18, Node, Express, and MongoDB	Shama Hoque	Packt Publishing	3rd Edition (2023)	All programs

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCS/WEB RESOURCE

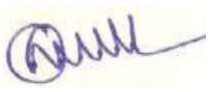
1. Eddy Wilson Iriarte Koroliova, MERN Quick Start Guide, Packt Publishing (31 May 2018),
2. https://www.geeksforgeeks.org/mern-stack/
3. https://blog.logrocket.com/mern-stack-tutorial/

7. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks
b) Semester End Examination (SEE) = 50 marks
Total = 100 marks

CIE Framework:

ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
WEIGHTAGE	**50%**	**50%**
Continuous Evaluation	30	**50**
Test	20	



Total Marks for The Course	**50**	**50**

8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs → / **COs ↓**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	3	2		2				1	2	2
CO2	3	3	2		2				2	2	2
CO3	3	2	2		3				2	3	2
CO4	3	3	2		3				2	3	3
CO5	3	3	2		3				2	3	3

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs → / **COs ↓**	**PSO1**	**PSO2**
CO1	-	-
CO2	-	-
CO3	-	-
CO4	-	-
CO5	-	-

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

*****

Department: **Computer Science and Engineering (AI & ML)**		
Semester: IV	Course Code: **BCI24457D**	Contact Hrs /week: **2**
Course Description: **Technical Writing Using Latex**		No. of Credits: **1** L : T : P : S = **0:0:2:0**
Course Category: **AEC**		Total no. of Hours = 26
CIE: **50 Marks**	SEE: **50 Marks**	Exam Hours: **02**
Course Pre-requisites: Basic Computer skills, Understanding document structure		

1. PREAMBLE ABOUT THE COURSE

The course *Technical Writing Using LaTeX* is designed to equip students with the skills necessary to produce high-quality technical documents using the LaTeX typesetting system. Emphasizing clarity, structure, and precision, the course introduces the fundamentals of LaTeX syntax and commands, enabling students to create well-formatted reports, theses, research papers, and presentations. Through hands-on practice, learners will gain proficiency in mathematical typesetting, referencing, table and figure management, and document customization. The course fosters professional documentation habits, which are essential in academic, scientific, and technical fields, empowering students to communicate complex ideas effectively and elegantly.

2. COURSE LEVEL OBJECTIVES

- To introduce the basic syntax and semantics of the LaTeX scripting language.
- To understand the presentation of tables and figures in the document.
- To illustrate the LaTeX syntax to represent the theorems and mathematical equations.
- To make use of the libraries (Tikz, algorithm) to design the diagram and algorithms in the document.

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Apply basic LaTeX command to develop simple document.	PO1,PO2,PO3, PO5,PO9,PSO1	L3	WK1,WK2, WK4,WK6	06
CO2	Develop LaTeX script to present the tables and figures in the document.	PO1,PO2,PO3, PO5,PO9,PSO1	L3	WK1,WK2, WK4,WK6	05
CO3	Build LaTeX script to present theorems and	PO1,PO2,PO3, PO5,PO9,PSO1	L3	WK1,WK2, WK4,WK6	05

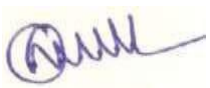
	mathematical equations in the document.				
CO4	Develop programs to generate the complete report with citations and a bibliography.	PO1,PO2,PO3, PO5,PO9,PSO1	L3	WK1,WK2, WK4,WK6	05
CO5	Analyze the use of Tikz and algorithm libraries to design graphics and algorithms in the document.	PO1,PO2,PO3, PO5,PO9,PSO1	L4	WK1,WK2, WK4,WK6	05

WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

SL.NO	Lab Programs
1	Develop a LaTeX script to create a simple document that consists of 2 sections [Section1, Section2], and a paragraph with dummy text in each section. And also include header [title of document] and footer [institute name, page number] in the document.
2	Develop a LaTeX script to create a document that displays the sample Abstract/Summary.
3	Develop a LaTeX script to create a simple title page of the VTU project Report [Use suitable Logos and text formatting].
4	Develop a LaTeX script to create the Certificate Page of the Report [Use suitable commands to leave the blank spaces for user entry].
5	Develop a LaTeX script to create a document that contains the following table with proper labels.
6	Develop a LaTeX script to include the side-by-side graphics/pictures/figures in the document by using the subgraph concept.
7	Develop a LaTeX script to demonstrate the presentation of Numbered theorems, definitions, corollaries, and lemmas in the document.
8	Develop a LaTeX script to create a document that consists of the following two mathematical equations.

S.No	USN	Student Name	Marks		
			Subject1	Subject2	Subject3
1	4XX22XX001	Name 1	89	60	90
2	4XX22XX002	Name 2	78	45	98
3	4XX22XX003	Name 3	67	55	59



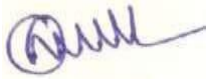
	$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$ $= \frac{-2 \pm \sqrt{2^2-4*(1)*(-8)}}{2*1}$ $= \frac{-2 \pm \sqrt{4+32}}{2}$	$\varphi_\sigma^\lambda A_t = \sum_{\pi \in C_t} \operatorname{sgn}(\pi) \varphi_\sigma^\lambda \varphi_\pi^\lambda$ $= \sum_{\tau \in C_{\sigma t}} \operatorname{sgn}(\sigma^{-1}\tau\sigma) \varphi_\sigma^\lambda \varphi_{\sigma^{-1}}^\lambda$ $= A_{\sigma t} \varphi_\sigma^\lambda$
9	Develop a LaTeX script to create a document that consists of two paragraphs with a minimum of 10 citations in it and display the reference in the section.	
10	Develop a LaTeX script to design a simple tree diagram or hierarchical structure in the document with appropriate labels using the Tikz library.	
11	Develop a LaTeX script to present an algorithm in the document using algorithm/algorithmic/algorithm2elibrary	
12	Develop a LaTeX script to create a simple report and article by using suitable commands and formats of user choice.	

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Programs Covered
1	LaTeX: Beginner's Guide	Stefan Kottwitz	Packt Publishing	1st Edition, 2011	All Programs
2	LaTeX: A Document Preparation System – User's Guide and Reference Manual	Leslie Lamport	Addison Wesley	2nd Edition,	All Programs
3	Formatting Information: A Beginner's Introduction to Typesetting with LaTeX	Peter Flynn	Comprehensive TeX Archive Network	1st Edition, 2005	All programs
4	A Short Introduction to LaTeX: A Book for Beginners	Firuza Karmali (Aibara)	Independently Published	1st Edition, 2019	All programs

6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCS/WEB RESOURCE

1. LaTeXCourses:https://www.udemy.com/topic/latex/?srsltid=AfmBOorX6wQj3xWdVaMr5RhWfIJ4c-Yq57gNybg_UHdjasU0QdmVFuHp



2. LaTeX Courses and Certifications: https://www.classcentral.com/subject/latex
3. ITBombayX: LaTeX for Students, Engineers, and Scientists: https://www.edx.org/learn/engineering/iitbombay-latex-for-students-engineers-and-scientists

7. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks
b) Semester End Examination (SEE) = 50 marks
Total = 100 marks

CIE Framework:

ASSESSMENT AND EVALUATION PATTERN		
	CIE	**SEE**
WEIGHTAGE	**50%**	**50%**
Continuous Evaluation	30	**50**
Test	20	
Total Marks for The Course	**50**	**50**

8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs → / **COs ↓**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	3	3	3		3				2		
CO2	3	3	3		3				2		
CO3	3	3	3		3				2		
CO4	3	3	3		3				2		
CO5	3	3	3		3				2		

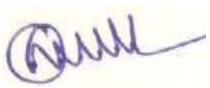
Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs → / **COs ↓**	**PSO1**	**PSO2**
CO1	2	
CO2	2	
CO3	2	
CO4	2	
CO5	2	

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

*****



GLOBAL ACADEMY OF TECHNOLOGY

Autonomous Institution Affiliated to Visveswaraya Technological University
Approved by UGC, AICTE and Govt of Karnataka

Department: **Science and Humanities**		
Semester: 4	Course Code: **BBOK24407**	Contact Hrs /week: 2
Course Description: **BIOLOGY FOR ENGINEERS**		No. of Credits:**1** L : T : P : S = **1:0:0:0**
Course Category: **BSC**		Total no. of Hours = 15
CIE: **50 Marks**	SEE: **50 Marks**	Exam Hours: **03**
Course Pre-requisites: Foundation in computer basics, including operating systems, and basic network concepts		

1. PREAMBLE ABOUT THE COURSE

Biology for Engineers bridges life sciences with engineering principles. It empowers students to apply biological concepts to innovate in technology and healthcare. Understanding biological systems enhances sustainable design and bio-inspired solutions. This course fosters interdisciplinary thinking for real-world problem-solving.

2. COURSE LEVEL OBJECTIVES

CLO1	To familiarize the students with the basic biological concepts and their engineering applications.
CLO2	To enable the students with an understanding of biodesign principles to create novel devices and structures.
CLO3	To provide the students an appreciation of how biological systems can be re-designed as substitute products for natural systems.
CLO4	To motivate the students to develop interdisciplinary vision of biological engineering.

3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Elucidate the basic biological concepts via relevant industrial applications and case studies.	PO1,PO2, PO7, PSO1,PSO2	L3	WK1, WK3, WK3	5
CO2	Evaluate the principles of design and development,	PO1,PO2, PO7, PSO1,PSO2	L3	WK1, WK3, WK3	5

	for exploring novel bioengineering projects.				
CO3	Understand and apply biological concepts and emerging technologies such as tissue engineering, bioprinting, biosensing, and AI for solving real-world engineering problems.	PO1,PO2, PO7, PSO1,PSO2	L3	WK1, WK3, WK3	5

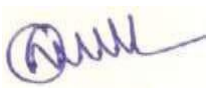
WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
I	**Cell Basic Unit of Life** Introduction. Structure and functions of a cell. Stem cells and their application. Biomolecules: Properties and functions of Carbohydrates, Nucleic acids, proteins, lipids. Importance of special biomolecules: Properties and functions of enzymes, vitamins and hormones.	CO1	5
II	**Adaptation of Anatomical Principles for Bioengineering Design** Brain as a CPU system. Eye as a Camera system. Heart as a pump system. Lungs as purification system. Kidney as a filtration system.	CO2	5
III	**Trends In Bioengineering:** Muscular and Skeletal Systems as scaffolds, scaffolds and tissue engineering, Bioprinting techniques and materials. Electrical tongue and electrical nose in food science, DNA origami and Biocomputing, Bioimaging and Artificial Intelligence for disease diagnosis. Bioconcrete. Bioremediation. Biomining.	CO3	5

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Biology for Engineers	Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A.,	Tata McGraw-Hill, New Delhi, 2012		All Modules



		Thilagaraj W., Barathi S., and Jaganthan M.K.,			
2	Human Physiology	Stuart Fox, Krista Rompolski	McGraw-Hill eBook	16th Edition, 2022	All Modules
3	Biology for Engineers	Arthur T. Johnson	CRC Press, Taylor and Francis, 2011		All Modules
4	Biology for Engineers	Sohini Singh and Tanu Allen,	Vayu Education of India, New Delhi, 2014		All Modules
	Biomimetics: Nature-Based Innovation	Yoseph Bar-Cohen	2012, CRC Press	1st edition	All Modules

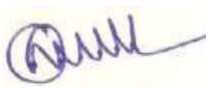
6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCS/WEB RESOURCE

- 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
- https://ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring-2006
- https://www.coursera.org/courses?query=biology
- https://onlinecourses.nptel.ac.in/noc19_ge31/preview
- https://www.classcentral.com/subject/biology
- https://www.futurelearn.com/courses/biology-basic-concepts

7. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks
b) Semester End Examination (SEE) = 50 marks
Total = 100 marks

CIE Framework:
Semester End Examination (SEE):
SEE Question paper is to be set for 100 marks and the marks scored will be proportionately reduced to 50. There will be two full questions (with a maximum of four sub questions) from each module carrying 20 marks each. Students are required to answer any **five full questions** choosing at least **one full question from each module.**



Continuous Internal Evaluation (CIE):
Two Tests are to be conducted for 30 marks each. The average of the two tests are taken for computation of CIE and Assignment carries 20 marks.

Typical Evaluation pattern for courses is shown in the Table below

Component		Marks	Total Marks
CIE	CIE Test-1	30	50
	CIE Test-2	30	
	Assignment	20	
SEE	Semester End Examination	50	50
Grand Total			100

8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs → / COs ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2					3				
CO2	3	2					3				
CO3	3	2					3				

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs → / COs ↓	PSO1	PSO2
CO1	2	2
CO2	2	2
CO3	2	2
CO4	2	2
CO5	2	2

Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High

*****

Department: **Science and Humanities**		
Semester: **IV**	Course Code: **BUHK24408**	Contact Hrs /week: 1
Course Description: **Universal Human Values (UHV)**		No. of Credits:01 L : T : P : S = 1:0:0:0
Course Category: **UHV**		Total no. of Hours = 15
CIE: **50 Marks**	SEE: **50 Marks**	Exam Hours: **03**

1. COURSE LEVEL OBJECTIVES

CLO1	To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
CLO2	To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
CLO3	To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.
CLO4	This course is intended to provide a much-needed orientation input in value education to the young enquiring minds.

2. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description
CO1	They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
CO2	They would have better critical ability.
CO3	They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
CO4	It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

3. SYLLABUS

Module No.	Module Description	No. of Hours
I	**Introduction to Value Education**	3

	Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations	
II	**Harmony in the Human Being** Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health	3
III	**Harmony in the Family and Society** Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order	3
IV	**Harmony in the Nature/Existence** Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence	3
V	**Implications of the Holistic Understanding – a Look at Professional Ethics** Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession	3

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition
1	The Textbook A Foundation Course in Human Values and Professional Ethics	R R Gaur, R Asthana, G P Bagaria	Excel Books, New Delhi, 2019. ISBN 978-93-87034- 47-1	2nd Revised Edition
2	The Teacher‟s Manual for A Foundation Course in Human Values and Professional Ethics	R R Gaur, R Asthana, G		
3	Jeevan Vidya: Ek Parichaya	A Nagaraj, Jeevan Vidya Prakashan Amar kantak		1999
4	Human Values New	A.N. Tripathi,	Age Intl. Publishers, New Delhi	2004
5	The Story of My Experiments with Truth	Mohandas Karamchand Gandhi		

*****

GLOBAL ACADEMY OF TECHNOLOGY

Autonomous Institution Affiliated to Visveswaraya Technological University
Approved by UGC, AICTE and Govt of Karnataka

Department: **Science and Humanities**		
Semester: **IV**	Course Code: **BNSK24459**	Contact Hrs /week: 1
Course Description: **National Service Scheme (NSS)**		No. of Credits: 0 L : T : P : S = 0:0:2:0
Course Category: MC		Total no. of Hours = 24
CIE: **100 Marks**	SEE:	Exam Hours:

COURSE LEVEL OBJECTIVES

CLO1	Understand the community in general in which they work.
CLO2	Identify the needs and problems of the community and involve them in problem – solving
CLO3	Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
CLO4	Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.
CLO5	Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description
CO1	Understand the importance of his / her responsibilities towards society.
CO2	Analyse the environmental and societal problems/issues and will be able to design solutions for the same.
CO3	Evaluate the existing system and to propose practical solutions for the same for sustainable development.
CO4	Implement government or self-driven projects effectively in the field.
CO5	Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

SYLLABUS

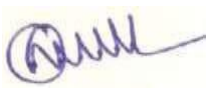
Module No.	Module Description

I	**National Service Scheme (NSS) – Contents** 1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing. 2. Waste management– Public, Private and Govt organization, 5 R's. 3. Setting of the information imparting club for women leading to contribution in social and economic issues. 4. Water conservation techniques – Role of different stakeholders– Implementation. 5. Preparing an actionable business proposal for enhancing the village income and approach for implementation. 6. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education. 7. Developing Sustainable Water management system for rural areas and implementation approaches. 8. Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swatch Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc. 9.Spreading public awareness under rural outreach programs.(minimum5 programs). 10. Social connect and responsibilities. 11. Plantation and adoption of plants. Know your plants. 12. Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs). 13. Govt. school Rejuvenation and helping them to achieve good infrastructure.

5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Publisher
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.	

*****



Department: **Science and Humanities**		
Semester: **IV**	Course Code: **BPEK24459**	Contact Hrs /week: 1
Course Description: **PHYSICAL EDUCATION (SPORTS & ATHLETICS) – II**		No. of Credits: L : T : P : S = 0:0:1:0
Course Category: MC		Total no. of Hours = 24
CIE: **100 Marks**	SEE:	Exam Hours:

1. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description
CO1	Understand the ethics and moral values in sports and athletics
CO2	Perform in the selected sports or athletics of student's choice.
CO3	Understand the roles and responsibilities of organisation and administration of sports and games.

2. SYLLABUS

Module No.	Module Description	No. of Hours
I	A. Ethics in Sports B. Moral Values in Sports and Games	4
II	A. Volleyball – Attack, Block, Service, Upper Hand Pass and Lower hand Pass. B. Athletics (Track Events) – Any event as per availability of Ground.	16
III	Role of Organisation and administration	4

*****

Department: **Science and Humanities**		
Semester: **IV**	Course Code:**BYOK24359**	Contact Hrs /week: 02
Course Description: **Yoga**		No. of Credits: L : T : P : S = 0:0:2:0
Course Category: **MC**		Total no. of Hours = 24
CIE: **100**	SEE:	Exam Hours:

1. PREAMBLE ABOUT THE COURSE

Course Title	Content
Patanjali' s Ashtanga Yoga l. Yama 2. Niyama	Patanjali' s Asht anga Yoga. Yama :Ahimsa, satya, asteya, brahm acarya, aparigraha Niyama : shoucha, santosh, tapa svaadhy ay a, E shv arapran idhan
Suryanamaskara	Suryanamaskar l2 count 4 rounds
Different types of Asanas a. Sitting l. Sukhasana 2. Paschimottanas ana b. Standing l. Ardhakati Chakrasana 2. Parshva Chakrasana c. Prone line l. Dhanurasana d. Supine line 1. Halasana 2. Karna Peedasana	Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits each asana
Kapalabhati	Meaning, importance and benefits of Kapalabhati. 40 strokes/min 3 rounds
Pranayama – 1. Suryanuloma -Viloma 2. Chandranuloma-Viloma 3. Suryabhedana 4. Chandra Bhedana 5. Nadishodh ana	Meaning, Need, importance of Pranayama. Di fferent types. Meaning by name, technique, precautionary measures and benefits of each Pranayama

GLOBAL ACADEMY OF TECHNOLOGY

Autonomous Institution Affiliated to Visveswaraya Technological University
Approved by UGC, AICTE and Govt of Karnataka

Department: **Science and Humanities**		
Semester: **III to VI**	Course Code: **BLAK24359/459/559/658**	Contact Hrs /week: 2
Course Description: **MUSIC**		No. of Credits: 0 L : T : P : S = 0:0:2:0
Course Category: **MC**		Total no. of Hours = 24
CIE: **100 Marks**	SEE:	Exam Hours:

1. COURSE LEVEL OBJECTIVES

1. Identify the major traditions of Indian music, both 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.

2. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description
CO1	Discus the Indian system of music and relate it to other genres (Cognitive Do main)
CO2	Experience the emotions of composer and develop empathy (Affective Domain)
CO3	Respond to queries on various patterns in a composition (Psycho Motor Domain)

3. SYLLABUS

Module No.	Module Description	No. of Hours
I	Preamble: Contents of the curriculum intend to promote music as language to develop on analytical, Creative, and intuitive Understanding. For this the student through study and direct participation in improvisation. Origin of the Indian Music: Evolution of the Indian music system, Understanding of Shruthi, Nada, Swara. Laya, Raga, Tala, Mela.	3
II	Compositions: Introduction to the types of composition in Carnatic Music Swarajathi, Varna, Krithi, and Thillana, Notation System.	3
III	Composers: Biography and Contributions of Purandaradasa, Thyagaraja.	3

IV	Music Instruments: Classification and construction of string instruments, percussion instruments, Idiophones (Ghana Vaadya), Examples of each class of Instruments.	3
V	Abhyasa Gana: Singing the swara exercises (Sarale Varase Only), Botation writing for Sarale Varase and Suladi Saptha Tala (Only in Mayamalavagowla Raga), Singing 4 Geethe in Malahari, and one jathi Swara, One Krithi in a Mela raga.	4

4. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

Sl. No.	Name of the Book	Author(s)	Publisher	Edition
1	Theory of Music	Vidushi Vasantha Madhavi	Prism Publication	2007
2	Karnataka Sangeetha Dharpana	T Sachidevi and T Sharadha (Thirumalai Sisters)	Shreenivaas Prakaashana	Vol, 1 2018
3	Classical Music of India: A Practical Gulge	Lakshminarayana Subramaniam, Viji Subramanaim	Tranqueber	2018
4	History of South Indian (Carnatic) Music	R Rangaramanuja Ayyangar	Vipanci Charitable Trust,	Third edition 2019
5	The Story of Indian Music and Its Instruments: A Study of the Present and a Record of the Past	Ethel Rosenthal	Pilgrims Publishing	2007

*****