



# GLOBAL ACADEMY OF TECHNOLOGY

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



Department: Mathematics		
Semester: III	Course Code: <b>BMATS24301</b>	Contact Hrs /week: 4
Course Description: Discrete Mathematics (Common for CSE/ISE/AI&DS/AI &ML/CS-AI&ML)		No. of Credits: 3 L : T : P : S = <b>2:2:0:0</b>
Course Category: <b>Basic Science Course (BSC)</b>		Total no. of Hours = 40
CIE: <b>50 Marks</b>	SEE: <b>50 Marks</b>	Exam Hours: <b>03</b>
<b>Course Pre-requisites:</b> 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 science, including algorithm analysis and data representation.	PO1, PO2, PO5	L3	WK1, WK2, WK3, WK6	8
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 and Functions: 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 Mc-Graw Hill Co	4 <sup>th</sup>
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## 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://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 3 tests + Assignment Marks

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
COs ↓											
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 →	PSO1	PSO2	PSO3
COs ↓			
CO1	-	-	-
CO2	-	-	-
CO3	-	-	-
CO4	-	-	-

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

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# GLOBAL ACADEMY OF TECHNOLOGY

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Department: <b>ARTIFICIAL INTELLIGENCE &amp; MACHINE LEARNING</b>		
Semester: <b>III</b>	Course Code: <b>BAML24302</b>	Contact Hrs /week: 3
Course Description: <b>OPERATING SYSTEM</b>		No. of Credits:3 L : T : P : S = 3:0:2:1
Course Category: <b>IPCC</b>		Total no. of Hours = 40+30+20
CIE: <b>50 Marks</b>	SEE: <b>50 Marks</b>	Exam Hours: <b>03</b>
Course Pre-requisites: <b>Basic Computer Knowledge, Computer Architecture.</b>		

## 1. PREAMBLE ABOUT THE COURSE

This course delves into the core components and functionalities of operating systems, emphasizing their role in ensuring efficient and secure computing environments. Topics include process management, memory management, file systems, input/output systems, and system security.

## 2. COURSE LEVEL OBJECTIVES

Sl. No	Course Learning Objectives (CLO)
CLO1	Understand the structure, functionalities, and components of operating systems, including system calls, process management, and multi-threading.
CLO2	Apply scheduling algorithms, concurrency mechanisms, and synchronization techniques to manage processes efficiently.
CLO3	Analyze deadlock situations, memory management strategies, and file system structures to ensure effective resource utilization.
CLO4	Design and implement modules for basic process scheduling, memory allocation, file systems, and disk management to simulate OS behavior.

## 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 fundamental concepts and functionalities of OS.	POs- 1,2,3,5 PSO -1	L3	WK 3,4	10

CO2	Apply and analyze the different concepts that are required to build OS.	<b>POs- 1,2,3,5,10 PSO -1</b>	L3	WK 2,6	10
CO3	Demonstrate the proficiency in understanding different concepts related to OS that are required to develop solutions	<b>POs- 1,2,3,5,10 PSO -1</b>	L3	WK 4,6	10
CO4	Develop and implement OS concepts using software platform	<b>PO- 1,2,3,5,10 PSO -1</b>	L4	WK 2,6	10
CO5	Collaborate in a group to build practical solutions using the OS concepts	<b>POs- 1,2,3,5 PSO -1</b>	L4	WK 7,8	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	<p><b>Introduction and System Structures:</b> Computer System Organization, Computer-System Architecture, Operating-System Structure, Operating System Functions, Operating System Services, User and Operating System Interface, System Calls, Types of System Calls, Operating System Design and Implementation.</p> <p><b>Process Management:</b> Process Concept, Process Scheduling, Operations on Processes, Interprocess Communication, Multi-threaded programming: Multi-core Programming, Multithreading Models.</p> <p><b>Text book 1: Ch 1.1 – 1.4, 2.1-2.6, 3.1-3.4, 4.1-4.2</b></p>	CO1	10
II	<p><b>Process Synchronization:</b> The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic Problems of Synchronization, Monitors.</p> <p><b>CPU Scheduling:</b> Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Multiple-Processor Scheduling.</p> <p><b>Text book 1 : Ch 5.2-5.8, 6.1-6.5</b></p>	CO2	10
III	<p><b>Deadlock:</b> System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.</p> <p><b>Memory Management:</b> Basic Hardware, Address Binding, Logical and Physical Address, Dynamic linking, and loading, Shared Libraries, Swapping, Contiguous Memory Allocation, Segmentation, Paging,</p>	CO3	10

	Structure of the Page Table, Virtual Memory Management: Demand Paging, Page Replacement, Allocation of Frames, Thrashing.  <b>Text book 1 : Ch 7.1-7.7, Text book : Ch 7</b>		
<b>IV</b>	<b>File Systems:</b> File Concept, Access Methods, Directory and Disk Structure, File-System Mounting, File Sharing, Protection, File- System Structure, File-System Implementation, Directory Implementation, Allocation Methods, and Free-Space Management.  <b>Text book 1: Ch 11, 12.1-12.5</b>	CO4	10
<b>V</b>	<b>Disk Management:</b> Mass Storage Structure, Disk Structure, Disk Attachment, Disk Scheduling, Disk Management, Swap-Space Management, RAID Structure.  <b>Text book 1: Ch 10</b>	CO5	10

### Practical Component of IPCC

Sl. No.	PROGRAMS
<b>1</b>	Overview of single user systems, network operating and multiuser system.
<b>2</b>	User administration in window sand Linux operating system.
<b>3</b>	Write a program for the simulation of following non-pre-emptive CPU scheduling algorithms to find turnaround time and waiting time. <ol style="list-style-type: none"> <li>1. FCFS</li> <li>2. SJF</li> <li>3. Round Robin(pre-emptive)</li> <li>4. Priority</li> </ol>
<b>4</b>	Write a program for the simulation of following file allocation strategies. <ol style="list-style-type: none"> <li>1. Sequential</li> <li>2. Indexed</li> <li>3. Linked</li> </ol>
<b>5</b>	Write a program for the simulation of following contiguous memory allocation techniques <ol style="list-style-type: none"> <li>1. Worst-fit</li> <li>2. Best-fit</li> <li>3. First-fit</li> </ol>
<b>6</b>	Write a program for the simulation of following file organization techniques <ol style="list-style-type: none"> <li>1. Single level directory</li> <li>2. Two level directory</li> <li>3. Hierarchical</li> </ol>
<b>7</b>	Write a program for the simulation of Bankers algorithm for the purpose of deadlock avoidance
<b>8</b>	Write a program for the simulation of following disk scheduling algorithms <ol style="list-style-type: none"> <li>1. FCFS</li> <li>2. SCAN</li> <li>3. C-SCAN</li> </ol>

<b>9</b>	Write a program for the simulation of following page replacement algorithms 1. FIFO 2. LRU 3. LFU
<b>10</b>	Write a program do the following: 1. Find the attribute of file. 2. To change the attribute of file. 3. Create the directory. 4. Delete the directory. 5. Create the file. 6. Delete the file 7. Find the size of Hard Disk, RAM, and VRAM, cache

### 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Operating System Concepts	Silberschatz A., Galvin B. P. and Gagne G	John Wiley & Sons Inc (2013)	9th edition	1,2,3,4,5
2	Operating Systems Internals and Design Principles	Stallings W.	Prentice Hall (2018)	9th edition	
3	Understanding the Linux Kernel	Bovet P. D., Cesati M.	O' Reilly Media (2006)	3rd Edition	
4	Introduction to Operating System Design and Implementation: The OSP 2 Approach	Kifer M., Smolka A. S.	Springer (2007).		

### 5. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE

- <https://www.cs.bilkent.edu.tr/~korpe/courses/cs342spring2018/references.html>
- <https://www.geeksforgeeks.org/operating-systems/>
- <https://www.techtarget.com/whatis/definition/operating-system-OS>

#### MOOCs:

- [https://onlinecourses.nptel.ac.in/noc21\\_cs88/preview](https://onlinecourses.nptel.ac.in/noc21_cs88/preview)
- <https://www.coursera.org/courses?query=operating%20system>
- [https://onlinecourses.swayam2.ac.in/ntr25\\_ed41/preview](https://onlinecourses.swayam2.ac.in/ntr25_ed41/preview)

### 6. EVALUATION METHODOLOGY

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

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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical evaluation pattern for regular courses is shown in Table 1:

### CIE Framework:

**Table 1: Evaluation Process**

	Component	Marks	Max Marks	Total Marks
CIE	CIE Test-1	30	<b>30</b>	50
	CIE Test-2	30		
	Lab Component	20		
SEE	Semester End Examination	100		50
	<b>Grand Total</b>			100

## 7. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 8. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

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

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

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Department: <b>ARTIFICIAL INTELLIGENCE &amp; MACHINE LEARNING</b>		
Semester: <b>III</b>	Course Code: <b>BAML24303</b>	Contact Hrs /week: 3
Course Description: <b>Digital Design &amp; Computer Organization</b>		No. of Credits:4 L : T : P : S = <b>3:0:2:2</b>
Course Category: IPCC		Total no. of Hours = 40+40+40
CIE: <b>50 Marks</b>	SEE: <b>50 Marks</b>	Exam Hours: <b>03</b>
Course Pre-requisites: Basic Mathematics: Proficiency in algebra and number systems. Programming: Familiarity with at least one programming language (e.g., C or Python). Basic Electronics: Knowledge of fundamental electronic components and circuits.		

## 1. PREAMBLE ABOUT THE COURSE

The **Digital Design and Computer Organization (DDCO)** course provides an in-depth exploration of the fundamental principles and practices that underpin modern computing systems. This course bridges the gap between theoretical digital logic design and practical computer architecture, equipping students with the knowledge and skills to design and understand the internal workings of digital computers.

## 2. COURSE LEVEL OBJECTIVES

Sl. No	Course Learning Objectives (CLO)
CLO1	Understand binary logic, Boolean algebra, digital gates, and apply techniques like Karnaugh maps and HDLs to design basic digital circuits.
CLO2	Design and implement combinational and sequential logic circuits using basic components and HDLs
CLO3	Describe I/O organization, interrupt handling, direct memory access, and cache memory systems
CLO4	Analyze register transfer operations, instruction execution, and pipelining concepts to assess their impact on processor performance.

## 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	<b>Apply</b> the K-Map techniques to simplify various Boolean expressions.	POs - 1,2,5,8,9 PSOs- 1	L2	WK 2,3	10
CO2	<b>Design</b> different types of	POs -			

	combinational and sequential circuits along with Verilog programs.	1,2,3,5,8,9,11 PSOs- 1	L3	WK 4,6	10
CO3	<b>Demonstrate</b> the fundamentals of machine instructions, addressing modes, Processor performance and various approaches involved in achieving communication between processor and I/O devices.	POs -1,2,11 PSOs- 1	L2	WK 4,6,7	10
CO4	<b>Illustrate</b> the approaches involved in achieving communication between processor and I/O devices.	POs -1,2,11 PSOs- 1	L2	WK 4,6,7	10
CO5	<b>Collaborate</b> with group to build practical solutions using digital circuits and software environment.	POs - 1,2,3,11 PSOs-1	L3	WK 6,7,9	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	<b>Introduction to Digital Design:</b> Binary Logic, Basic Theorems and Properties of Boolean Algebra, Boolean Functions, Digital Logic Gates, Introduction, The Map Method, Four-Variable Map, Don't-Care Conditions, NAND and NOR Implementation, Hardware Description Languages.  <b>Text book 1: Ch 1.9, 2.4, 2.5, 2.8, 3.1, 3.2, 3.3, 3.5, 3.6, 3.9</b>	CO1	10
II	<b>Combinational Logic:</b> Introduction, Combinational Circuits, Design Procedure, Binary Adder - Subtractor, Decoders, Encoders, Multiplexers. HDL Models of Combinational Circuits – Adder, Multiplexer, Encoder. Sequential Logic: Introduction, Sequential Circuits, Storage Elements: Latches, Flip-Flops.  <b>Text book 1: Ch 4.1, 4.2, 4.4, 4.5, 4.9, 4.10, 4.11, 4.12, 5.1, 5.2, 5.3, 5.4</b>	CO2	10

<b>III</b>	<p><b>Basic Structure of Computers:</b> Functional Units, Basic Operational Concepts, Bus structure, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement. Machine Instructions and Programs: Memory Location and Addresses, Memory Operations, Instruction and Instruction sequencing, Addressing Modes.</p> <p><b>Text book 2: Ch 1.2, 1.3, 1.4, 1.6, 2.2, 2.3, 2.4, 2.5</b></p>	CO3	10
<b>IV</b>	<p><b>Input/output Organization:</b> Accessing I/O Devices, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Direct Memory Access: Bus Arbitration, Speed, size and Cost of memory systems. Cache Memories – Mapping Functions.</p> <p><b>Text book 2: Ch 4.1, 4.2.1, 4.2.2, 4.2.3, 4.4, 5.4, 5.5.1</b></p>	CO4	10
<b>V</b>	<p><b>Basic Processing Unit:</b> Some Fundamental Concepts: Register Transfers, Performing ALU operations, fetching a word from Memory, Storing a word in memory. Execution of a Complete Instruction. Pipelining: Basic concepts, Role of Cache memory, Pipeline Performance.</p> <p><b>Text book 2: Ch 7.1, 7.2, 8.1</b></p>	CO5	10

### Practical Component of IPCC

Exp. No	Laboratory Experiments
1	Given a 4-variable logic expression, simplify it using appropriate technique and simulate the same using basic gates.
2	Design a 4 bit full adder and subtractor and simulate the same using basic gates.
3	Design Verilog HDL to implement simple circuits using structural, Data flow and Behavioral model.
4	Design Verilog HDL to implement Binary Adder-Subtractor – Half and Full Adder, Half and Full Subtractor.
5	Design Verilog HDL to implement Decimal adder.
6	Design Verilog program to implement Different types of multiplexer like 2:1, 4:1 and 8:1.
7	Design Verilog program to implement types of De-Multiplexer.
8	Design Verilog program for implementing various types of Flip-Flops such as SR, JK and D.
	<b>VIVA-VOCE for every experiment.</b>

## 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Digital Design with an Introduction to Verilog Design	M. Morris Mano & Michael D. Ciletti	Pearson Education, 2018.	5th Edition	1,2
2	Computer Organization	Carl Hamacher, Zvonko Vranesic, Safwat Zaky	Tata McGraw Hill, 2011	5th Edition	3,4,5
3	Computer Organization & Architecture	William Stallings	Pearson, 2015	9th Edition	

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

1. <https://cse11-iiith.vlabs.ac.in/>

### MOOCs:

- 1.
2. <https://www.classcentral.com/tag/computer-architecture>
3. [https://onlinecourses.nptel.ac.in/noc20\\_cs64/preview](https://onlinecourses.nptel.ac.in/noc20_cs64/preview)
4. <https://www.udemy.com/topic/COA/>

## 7. EVALUATION METHODOLOGY

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

### CIE Framework:

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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical evaluation pattern for regular courses is shown in Table 1:

**Table 1: Evaluation Process for CIE and SEE**

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

**Scheme of Examination (SEE):**

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module.

**8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING**

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

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

**9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING**

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

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

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Approved by UGC, AICTE and Govt of Karnataka



Department: <b>ARTIFICIAL INTELLIGENCE &amp; MACHINE LEARNING</b>		
Semester: <b>III</b>	Course Code: <b>BAML24304</b>	Contact Hrs /week: 3
Course Description: <b>DATA STRUCTURES</b>		No. of Credits:3 L : T : P : S = 3:0:0:2
Course Category: <b>PCC</b>		Total no. of Hours = 40+50
CIE: <b>50 Marks</b>	SEE: <b>50 Marks</b>	Exam Hours: <b>03</b>
Course Pre-requisites: Completion of introductory programming courses, particularly those covering C programming fundamentals.		

## 1. PREAMBLE ABOUT THE COURSE

This course provides an in-depth exploration of fundamental data structures and their implementation using the C/C++ programming language. Emphasizing both theoretical concepts and practical applications, students will develop a robust understanding of how to organize, manipulate, and optimize data for efficient problem-solving. Through hands-on programming exercises and collaborative projects, learners will gain the skills necessary to design and implement data structures that meet specific real-world requirements.

## 2. COURSE LEVEL OBJECTIVES

<b>CLO1</b>	To provide knowledge of basic data structures and their implementations
<b>CLO2</b>	To develop skills to apply appropriate data structures in problem solving
<b>CLO3</b>	To efficiently implement the different data structures and solutions for specific problems
<b>CLO4</b>	Create and use appropriate data structures in C programs for solving real life 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	Understand the fundamentals of data structures using C	POs - 1,2,3,5,10,11 PSOs - 1	L3	WK 2,3	08
CO2	Apply the knowledge of data structures to program for given requirements	POs - 1,2,3,5,10,11 PSOs - 1	L3	WK 4,5	08

CO3	Analyze, interpret and modify the output of a program to meet the requirements.	POs - 1,2,3,5,10,11 PSOs - 1	L3	WK 2,4	08
CO4	Design and simulate the algorithms based on the requirements using suitable software environment	POs - 1,2,3,5,10,11 PSOs - 1	L3	WK 2,4	08
CO5	Collaborate in group and demonstrate to develop practical solutions for the real-world problems	POs - 1,2,3,5,10,11 PSOs - 1	L3	WK 9	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	<p><b>Introduction:</b> Introduction to Data Structures, Review of Arrays, Types of Data Structures, Linear &amp; non-linear Data Structures.</p> <p><b>Stacks:</b> Stack definitions &amp; concepts, Representing stacks in C, Operations on stacks, Applications of Stacks: Infix to Postfix, Infix to Prefix, Postfix expression evaluation,</p> <p><b>Recursion:</b> Sample Programs.</p> <p><b>Text Book 1: Ch 1.1-1.3, 2.1-2.3,3.1-3.3</b></p>	CO1	08
II	<p><b>Queues:</b> Representation of queue, operations, circular queues. Application of Queues, Priority Queues.</p> <p><b>Dynamic Memory allocation:</b> malloc(), calloc(),free(), realloc().</p> <p><b>Linked Lists:</b> Definition and terminology, Singly Linked List (SLL), Various operations on SLL: insertion, deletion and display, Programming Examples Such as Polynomials and others., Header Node.</p> <p><b>Text Book 1: Ch 4.1-4.2</b></p>	CO2	08
III	<p><b>Circular Singly Linked List (CSLL):</b> Definition, Various operations, Application.</p> <p><b>Doubly Linked List (DLL)</b> Definition, Various operations Applications: Sparse matrix and others.</p> <p><b>Trees:</b> Definition, Terminology, Binary Trees (BT), Binary Search Trees (BST): Insertion, Deletion and Traversals: Preorder, Post order and In order.</p> <p><b>Text Book 1: Ch 4.3-4.5,5.1-5.5</b></p>	CO3	08
IV	<p><b>Expression Trees (ET):</b> Definition and Construction of Expression Tree.</p> <p><b>Threaded Binary Tree:</b> Types and application.</p> <p><b>Heap:</b> Definition, Construction, Applications of Heap: Priority Queue.</p>	CO4	08

	<b>Text Book 1: Ch 4.1,5.2</b>		
V	<b>Balanced tree:</b> AVL trees, B tree, B+ tree, Splay. <b>Graphs:</b> Introduction, Matrix and List Representation. <b>Hashing:</b> Open Hashing, Closed Hashing, Collision and Collision Resolution Strategies  <b>Text Book 1: Ch 7.2,7.3,7.4,8.1</b>	CO5	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 and Aaron M. Tenenbaum	PHI/Pearson,2009	2 <sup>nd</sup> Edition	1,2,3,4,5
2	Data Structures and Algorithm Analysis in C++	Mark Allen Weiss	Addison-Wesley, 2013, ISBN-13: 9780132847377	4th Revised Edition	
3	Data Structures Using C	Reema Thareja	Oxford Higher Education,2011	1 <sup>st</sup> Edition	
4	Fundamentals of Data Structures	Ellis Horowitz, Sartaj Sahni	Computer Science Press.	Illustrated Edition	

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

5. <https://ds1-iiith.vlabs.ac.in/List%20of%20experiments.html>

6. <https://ds2-iiith.vlabs.ac.in/List%20of%20experiments.html>

### MOOCs:

1. <https://archive.nptel.ac.in/courses/106/102/106102064/>

## 7. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks

b) Semester End Examination (SEE) = 50 marks

Total = 100 marks

### CIE Framework:

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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed

organizations/ any other.

Typical evaluation pattern for regular courses is shown in Table 1:

**Table 1: Evaluation Process for CIE and SEE**

	Component	Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	AAT	10	
SEE	Semester End Examination	100	50
<b>Grand Total</b>			100

**Scheme of Examination (SEE):**

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying 20 marks each.
3. There will be two full questions (with a maximum of four sub questions) from each module.
4. The students will have to answer five full questions, selecting one full question from each module.

**8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING**

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

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

**9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING**

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

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

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# GLOBAL ACADEMY OF TECHNOLOGY

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



Department: <b>ARTIFICIAL INTELLIGENCE &amp; MACHINE LEARNING</b>		
Semester: <b>III</b>	Course Code: <b>AMLL24305</b>	Contact Hrs /week: 2
Course Description: <b>DATA STRUCTURES LABORATORY</b>		No. of Credits:1 L : T : P : S = 0:0:2:2
Course Category: <b>PCCL</b>		Total no. of Hours = 15+15
CIE: <b>50 Marks</b>	SEE: <b>50 Marks</b>	Exam Hours: <b>03</b>
Course Pre-requisites: C programming.		

## 1. PREAMBLE ABOUT THE COURSE

In the realm of computer science and engineering, the efficient organization and manipulation of data are paramount. The course on **Data Structures and Algorithms** is designed to provide students with a deep understanding of how data can be systematically organized and processed to solve complex problems effectively.

## 2. COURSE LEVEL OBJECTIVES

The course will enable students to:

<b>CLO1</b>	Understand elementary data structures with an emphasis on problem-solving.
<b>CLO2</b>	Develop skills to design and analyze simple linear and non-linear data structures.
<b>CLO3</b>	Strengthen the ability of the students to identify and apply the suitable data structure for the given real-world problem.
<b>CLO4</b>	Enables 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	Understand the fundamental data structures concepts in software environment	POs- 1,2,3,5,7,9,11 PSOs- 1		WK 2,3,4	4
CO2	Apply and implement advanced data structures for the requirements and simulate.	POs- 1,2,3,5,7,9,11 PSOs- 1		WK 5,6	4
CO3	Analyze the algorithm flow for the given requirements and demonstrate changes required.	POs- 1,2,3,5,7,9,11 PSOs- 1		WK 3,4	4

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

#### 4. SYLLABUS

Sl. No.	PROGRAMS
1	<p>Develop a menu driven Program for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX)</p> <ol style="list-style-type: none"> <li>1. Push an Element on to Stack</li> <li>2. Pop an Element from Stack</li> <li>3. Demonstrate Overflow and Underflow situations on Stack</li> <li>4. Display the status of Stack</li> <li>5. Exit</li> </ol> <p>Support the program with appropriate functions for each of the above operations</p>
2	<p>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</p>
3	<p>Develop and Implement a Program for evaluation of Stack Suffix expression with single digit operands and operators: +, -, *, /, %, ^.</p>
4	<p>Develop recursive program to</p> <ol style="list-style-type: none"> <li>1. To Find GCD of 2 numbers</li> </ol> <p>To Solve the Tower of Hanoi Problem.</p>
5	<p>Develop a menu driven Program for the following operations on QUEUE of Characters (Array Implementation of QUEUE with maximum size MAX)</p> <ol style="list-style-type: none"> <li>1. Enqueue an Element on to Queue</li> <li>2. Dequeue an Element from Queue</li> <li>3. Demonstrate Overflow and Underflow situations on Queue</li> <li>4. Display the status of Queue</li> <li>5. Exit</li> </ol> <p>Support the program with appropriate functions for each of the above operations.</p>
6	<p>Implement a program to multiply two polynomials using singly linked list.</p>
7	<p>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.</p>
8	<p>Write a program to create Binary Tree and to traverse the tree using In-order, Preorder and Post order.</p>
9	<p>Write a program to implement priority queue using Heap.</p>
10	<p>Write a program to implement Hashing using Linear probing. Implement insertion, deletion, search and display.</p>

#### 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Fundamentals of Data Structures in C	Ellis Horowitz, Sartaz Sahni	University press, 2008, Reprinted 2016	Second Edition	All programs covered
2	Data Structures with C	Seymour Lipschutz, Schaum's Outlines	McGraw Hill, Thirteenth Reprint 2015.	Special Indian Edition	
3	Data Structures using C	Aaron Tanenbaum, Yedidyah Langsam and Moshe Augenstein	Pearson, Thirteenth Impression, 2014. ISBN:978-81-317-0229-1	--	

4	Data Structures A Pseudo code approach with C	Richard F. Gilberg and Behrouz A. Forouzan	Thomson, 2005. ISBN:978-81-315- 0314-0	--	
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## 6. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks

b) Semester End Examination (SEE) = 50 marks

Total = 100 marks

ASSESSMENT AND EVALUATION PATTERN		
	CIE	SEE
<b>WEIGHTAGE</b>	<b>50%</b>	<b>50%</b>
Record	10	<b>50</b>
Test	20	
Experiential Learning (Mini Project)	20	NIL
<b>Total Marks for The Course</b>	<b>50</b>	<b>50</b>

## 7. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 8. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
<b>CO1</b>	2	
<b>CO2</b>	2	
<b>CO3</b>	2	

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

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# GLOBAL ACADEMY OF TECHNOLOGY

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



<b>Department: ARTIFICIAL INTELLIGENCE &amp; MACHINE LEARNING</b>		
<b>Semester: III</b>	<b>Course Code: BAML24306A</b>	<b>Contact Hrs /week: 3</b>
<b>Course Description: SOFTWARE ENGINEERING</b>		<b>No. of Credits:3</b> <b>L : T : P : S = 3:0:0:2</b>
<b>Course Category: ETC</b>		<b>Total no. of Hours = 40+50</b>
<b>CIE: 50 Marks</b>	<b>SEE: 50 Marks</b>	<b>Exam Hours: 03</b>
<b>Course Pre-requisites: Basic Programming Skills, Problem-Solving Skills</b>		

## 1. PREAMBLE ABOUT THE COURSE

This course offers a comprehensive exploration of the Software Development Life Cycle (SDLC), emphasizing the methodologies, tools, and collaborative practices essential for developing high-quality software systems. Students will delve into various SDLC models—including Waterfall, V-Model, Spiral, Iterative, and Agile—to understand their applications and suitability for different project requirements. The course covers key aspects such as software evolution, project planning, testing strategies, and process management, equipping students with the skills to navigate the complexities of modern software development. Through practical assignments and group projects, learners will gain hands-on experience in designing, implementing, and deploying robust software solutions that meet real-world needs. Emphasizing effective communication and teamwork, the course prepares students to collaborate efficiently in diverse development environments, ensuring the delivery of software that is both functional and sustainable.

## 2. COURSE LEVEL OBJECTIVES

<b>Sl. No</b>	<b>Course Learning Objectives (CLO)</b>
1	Outline software engineering principles and activities involved in building large software programs. Identify ethical and professional issues and explain why they are of concern to software engineers.
2	Explain the fundamentals of object-oriented concepts
3	Describe the process of requirements gathering, requirements classification, requirements specification and requirements validation.
4	Discuss the distinctions between validation testing and defect testing.
5	Recognize the importance of software maintenance and describe the intricacies involved in software evolution. Apply estimation techniques, schedule project activities and compute pricing.

### 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 software development life cycle and different model required for developing software.	POs- 1,2,3,5,11 PSOs- 1	L3	WK 2,3,4	8
CO2	Apply concepts of Software evolution, Project Planning, Testing and software process.	POs- 1,2,3,5,11 PSOs- 1	L3	WK 5,6	8
CO3	Analyze the different tools required to assist in software development activities	POs- 1,2,3,5,11 PSOs- 1	L3	WK 6	8
CO4	Develop correct and robust software design from requirement gathering to implement and deploy.	POs- 1,2,3,5,9,11 PSOs- 1	L3	WK 4,5	8
CO5	Collaborate with group to implement/design software required for lifetime and develop proficiency to communicate either orally or in the form of reports.	POs- 1,2,3,5,9,11 PSOs- 1	L3	WK 9	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	<p><b>Introduction:</b> Introduction. Professional Software Development, Software Engineering Ethics. Case Studies.</p> <p><b>Software Processes:</b> Models: Waterfall Model, Incremental Model and Spiral Model. Process activities, the rational unified process.</p> <p><b>Requirements Engineering:</b> Requirements Engineering Processes. Requirements Elicitation and Analysis. Functional and non-functional requirements. The software Requirements Document. Requirements Specification. Requirements validation.</p> <p><b>Textbook 1: Ch 1.1-1.3, 2.1-2.4, 4.1-4.6.</b></p>	CO1	8
II	<p><b>OOP Introduction:</b> What is Object orientation? What is OO development? OO Themes; Evidence for usefulness of OO development</p> <p><b>Modeling as a design Technique:</b> Modelling; abstraction; The Three models.</p>	CO2	8

	<p><b>Class modeling:</b> Object and Class Concept; Link and associations concepts; Generalization and Inheritance, A Sample Class Model, Navigation of class models.</p> <p><b>Textbook 2: Ch 1.1-1.4,2.1-2.3, 3.1-3.5</b></p>		
III	<p><b>System Models:</b> Context models. Interaction models. Structural models. Behavioral models. Model-driven engineering. Object-oriented design using UML. Design patterns. Implementation issues. Open-source development.</p> <p><b>Textbook 1: Ch 5.1-5.5, 7.1-7.4</b></p>	CO3	8
IV	<p><b>Software Testing:</b> Development testing, Test-driven development, Release testing, User testing. <b>Software Evolution:</b> Evolution processes. Program evolution dynamics. Software maintenance. Legacy system management.</p> <p><b>Textbook 1: Ch 8.1-8.4,9.1-9.4.</b></p>	CO4	8
V	<p><b>Project Planning:</b> Software pricing. Plan-driven development. Project scheduling, Estimation techniques. Quality management: Software quality. Reviews and inspections. Software measurement and metrics. Software standards.</p> <p><b>Textbook 1: Ch 23.1-23.5, 24.1-24.4.</b></p>	CO5	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	Pearson Education, 2012	9th Edition	1,3,4,5
2	Object Oriented Modelling and Design with UML	Michael Blaha, James Rumbaugh	Pearson Education,2005	2nd Edition	2
3	Software Engineering-A Practitioners approach	Roger S. Pressman	Tata McGraw Hill	7th Edition	
4	An Integrated Approach to Software Engineering	Pankaj Jalote	Wiley India		

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

1. [https://onlinecourses.nptel.ac.in/noc24\\_cs119/preview](https://onlinecourses.nptel.ac.in/noc24_cs119/preview)
2. [https://onlinecourses.swayam2.ac.in/cec20\\_cs07/preview](https://onlinecourses.swayam2.ac.in/cec20_cs07/preview)

## 7. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks

b) Semester End Examination (SEE) = 50 marks

Total = 100 marks

### CIE Framework:

#### Scheme of Examination (CIE):

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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical evaluation pattern for regular courses is shown in Table 1:

**Table 1: Evaluation Process for CIE and SEE**

	Component	Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	AAT	10	
SEE	Semester End Examination	100	50
<b>Grand Total</b>			<b>100</b>

#### Scheme of Examination (SEE):

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying 20 marks each.
3. There will be two full questions (with a maximum of four sub questions) from each module.
4. The students will have to answer five full questions, selecting one full question from each module.

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

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

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

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<b>Department: ARTIFICIAL INTELLIGENCE &amp; MACHINE LEARNING</b>		
<b>Semester: III</b>	<b>Course Code: BAML24306B</b>	<b>Contact Hrs /week: 3</b>
<b>Course Description: Introduction to Internet of Things</b>		<b>No. of Credits: L : T : P : S = 3:0:0:2</b>
<b>Course Category: ETC</b>		<b>Total no. of Hours = 40+50</b>
<b>CIE: 50 Marks</b>	<b>SEE: 50 Marks</b>	<b>Exam Hours: 03</b>
<b>Course Pre-requisites: Fundamentals of Electronics, Computer Networking Basics</b>		

### 1. PREAMBLE ABOUT THE COURSE

The Internet of Things (IoT) represents a transformative paradigm in which everyday physical objects are interconnected through the internet, enabling them to collect, exchange, and act upon data. This course delves into the fundamental concepts and components of IoT technology, providing students with a robust understanding of its architecture, protocols, and real-world applications.

### 2. COURSE LEVEL OBJECTIVES

Sl. No	Course Learning Objectives (CLO)
1	Understand the different networking models that are essential for IoT
2	Interpret the cryptography and network security fundamentals for IoT
3	Explain the concepts of cloud computing and basics of IoT
4	Demonstrate the proficiency in learning the future paradigm of IoT

### 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 fundamental concepts and components of the Internet of Things (IoT) technology	POs-1,2,3,5 PSOs-1	L1	WK 2,4	8
CO2	Apply various protocols for IoT devices and identify some real-world applications for IoT	POs-1,2,3,5 PSOs-1	L2	WK 5,6	8

CO3	Analyze and compare the different computing paradigms to develop better IoT solutions	POs-1,2,3,5 PSOs-1	L3	WK 3,4	8
CO4	Demonstrate proficiency in IoT and related technologies using modern tools through oral presentations and reports	POs-1,2,3,5,9,10 PSOs-1	L3	WK 6,9	8
CO5	Collaborate with a group to build IoT solutions for the benefit of society	POs-1,2,3,5,9,10 PSOs-1	L3	WK 7,9	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	<p><b>Basics of Networking:</b> Introduction, Network Types, Connection types, Physical topology, Network reachability, Layered Network Models, OSI Model, Internet protocol suite, Addressing, Data link layer addressing, Network layer addressing, TCP/IP Transport layer, Connectionless service, Connection-oriented service. <b>Text book 1: Ch 1.1 to 1.5</b></p>	CO1	8
II	<p><b>Basics of Network Security:</b> Introduction, Security, Network Confidentiality, Cryptography, Symmetric key cryptography, Asymmetric key cryptography, Message Integrity and Authenticity, Digital signatures, Key Management, Internet Security, Network layer security, Transport layer security, Application layer security, Firewall. <b>Text book 1: Ch 2.1 to 2.8</b></p>	CO2	8
III	<p><b>Predecessors of IoT:</b> Introduction, Wireless Sensor Networks, Architectural components of WSN, Machine-to-Machine Communications, Architectural components of M2M, Cyber Physical Systems, Architectural components of CPS. <b>Emergence of IoT:</b> Evolution of IoT, Enabling IoT and complex interdependence Technologies, IoT Networking Components, Addressing strategies <b>Text book 1: Ch: 3.1 to 3.4 and 4.2 to 4.5</b></p>	CO3	8
IV	<p><b>Cloud Computing:</b> Introduction, Virtualization, Advantages of virtualization, Types of virtualization, Cloud Models, Service-Level Agreement in Cloud Computing, Importance of SLA, Metrics for SLA, Cloud Implementation, Cloud simulation, An open-source cloud: OpenStack, A commercial cloud: Amazon web services (AWS), Sensor-Cloud: Sensors-as-a-Service, Importance of sensor-cloud, Architecture of a sensor-cloud platform. <b>Textbook 1: Ch 10.1 to 10.6</b></p>	CO4	8

V	<p><b>Paradigms, Challenges, and the Future in IoT:</b> Introduction, Evolution of New IoT Paradigms, Internet of battlefield things (IoBT), Internet of vehicles (IoV), Internet of underwater things (IoUT), Internet of drones (IoD), Internet of space (IoSpace), Internet of services (IoS), Internet of people (IoP), Internet of nano things (IoNT), Internet of everything (IoE), Challenges Associated with IoT, Mobility, Addressing, Power, Heterogeneous connectivity, Communication range, Security, Device size, Interoperability, Emerging Pillars of IoT, Big data, Cloud/fog/edge computing, 5G and beyond, Artificial intelligence (AI)/Machine learning (ML), Cognitive communication networks, Network function virtualization (NFV), Software-defined networks (SDN), Phantom networks.</p> <p><b>Text book 1: Ch15.1 to 15.4</b></p>	CO5	8
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### 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Introduction to IoT	Sudip Misra, Anandarup Mukherjee and Arijit Roy	Cambridge University Press, 2020, ISBN 978- 1-108-84295-2	1 <sup>st</sup>	1,2,3,4,5
2	Programming for the Internet of Things	Dawid Borycki	PHI Learning Pvt.Ltd, Microsoft Press,2019, ISBN-10: 9387472558	--	--
3	Edge Computing: Fundamentals, Advances and Applications	K. Anitha Kumari, G. Sudha Sadasivam D. Dharani, M. Niranjana murthy	CRC Press, ISBN: 978-1-032-12608-1,	1 <sup>st</sup>	--
4	Designing the Internet of Things	Adrian McEwen, Hakim Cassimally	Wiley, ISBN-10: 111843062X	1 <sup>st</sup>	--

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

#### NPTEL Course:

1. [https://onlinecourses.nptel.ac.in/noc22\\_cs53/preview](https://onlinecourses.nptel.ac.in/noc22_cs53/preview)

### 7. EVALUATION METHODOLOGY

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

#### CIE Framework:

#### Scheme of Examination (CIE):

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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical evaluation pattern for regular courses is shown in Table 1:

	Component	Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	AAT	10	
SEE	Semester End Examination	100	50
	<b>Grand Total</b>		100

### Scheme of Examination (SEE):

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module.

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

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

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

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# GLOBAL ACADEMY OF TECHNOLOGY

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



Department: Artificial Intelligence and Machine Learning		
Semester: <b>III</b>	Course Code: <b>BAML24306C</b>	Contact Hrs /week: <b>03</b>
Course Description: <b>PROGRAMMING WITH C++</b>		No. of Credits: L : T : P : S = <b>3:0:0:2</b>
Course Category: <b>ETC</b>		Total no. of Hours = <b>40L+50S</b>
CIE: <b>50 Marks</b>	SEE: <b>50 Marks</b>	Exam Hours: <b>03</b>
Course Pre-requisites: <b>Programming Concepts</b>		

## 1. PREAMBLE ABOUT THE COURSE

This course introduces students to the **fundamentals of C++ programming**, focusing on both procedural and object-oriented concepts. It covers core topics like control **structures, functions, classes, inheritance, polymorphism, and file handling**. The course aims to develop problem-solving skills and the ability to build efficient, modular, and reusable code using C++.

## 2. COURSE LEVEL OBJECTIVES

Sl. No	Course Learning Objectives (CLO)
<b>CLO1</b>	To understand object-oriented programming using C++ and Gain knowledge about the capability to store information together in an object.
<b>CLO2</b>	To illustrate the capability of a class to rely upon another class and functions.
<b>CLO3</b>	To Create and process data in files using file I/O functions
<b>CLO4</b>	To understand the generic programming features of C++ including Exception handling

## 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 Object-Oriented Programming (OOP) concepts in software environment.	PO1, PO2, PO3, PO5, PO8, PO11, PSO1	L2	WK-2,4,6	10

CO2	Apply C++ syntax to develop efficient and structured programs.	PO1, PO2, PO3, PO5, PO8, PO11, PSO1	L3	WK-2,4,6	10
CO3	Implement various concepts in C++ to create efficient, reusable, and maintainable program.	PO1, PO2, PO3, PO5, PO8, PO11, PSO1	L3	WK-2,4,7	10
CO4	Illustrate data through file operations and exception handling.	PO1, PO2, PO3, PO5, PO8, PO11, PSO1	L4	WK-2,4,7	10
CO5	Design and build real-world applications using C++.	PO1, PO2, PO3, PO5, PO8, PO11, PSO1	L4	WK-2,4,7	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	<b>Introduction to Object Oriented Programming:</b> Computer programming background- C++ overview First C++ Program - Basic C++ syntax, Object Oriented Programming: What is an object, Classes, methods and messages, abstraction and encapsulation, inheritance, abstract classes, polymorphism.  <b>Textbook 1: Ch 1.1-1.8</b>	CO1, CO2	8
II	<b>Functions in C++:</b> Tokens – Keywords – Identifiers and constants – Operators in C++ – Scope resolution operator – Expressions and their types – Special assignment expressions – Function prototyping – Call by reference – Return by reference – Inline functions -Default arguments – Function overloading.  <b>Textbook 2: Ch 3.2,3.3,3.4,3.13,3.14,3.19,3.20 &amp; 4.3,4.4,4.5,4.6,4.7,4.9</b>	CO2, CO3	8
III	<b>Inheritance &amp; Polymorphism:</b> Derived class Constructors, destructors-Types of Inheritance- Defining Derived classes, Single Inheritance, Multiple, Hierarchical Inheritance, Hybrid Inheritance.  <b>Textbook 2: Ch 6.2, 6.11, 8.1-8.8</b>	CO3	8
IV	I/O Streams: C++ Class Hierarchy- File Stream-Text File Handling- Binary File Handling during file operations.	CO4	8

	<b>Textbook 1: Ch 12.5, 13.6,13.7</b>		
V	<b>Exception Handling:</b> Introduction to Exception - Benefits of Exception handling- Try and catch block, Throw statement- Pre- defined exceptions in C++.	CO5	8
	<b>Textbook 2: Ch 13.2-13.6</b>		

## 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Programming with ANSI C++	Bhushan Trivedi	Oxford Press	Second Edition.	1,4
2	Object Oriented Programming with C++	Balagurusamy E	Tata McGraw Hill Education Pvt.Ltd	Fourth Edition 2010.	2,3,5
3	Object Oriented Programming With C++	Bhave	Pearson Education	2004	References
4	Exploring C++ : The programmer's introduction to C++	Ray Lischner	apress,	2010	References

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

1. Basics of C++ - <https://www.youtube.com/watch?v=BCIS40yzssA>
2. Functions of C++ - <https://www.youtube.com/watch?v=p8ehAjZWjPw>
3. [https://www.w3schools.com/cpp/cpp\\_intro.asp](https://www.w3schools.com/cpp/cpp_intro.asp)
4. <https://www.edx.org/course/introduction-to-c-3>

### NPTEL COURSES:

1. [https://onlinecourses.nptel.ac.in/noc21\\_cs02/preview](https://onlinecourses.nptel.ac.in/noc21_cs02/preview)

## 7. EVALUATION METHODOLOGY

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

### CIE Framework:

#### Scheme of Examination (CIE):

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/ concept videos/ partial reproduction of research

work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a- thon/ make-a-thon/ code-a-thon.

	Component	Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	AAT	10	
SEE	Semester End Examination	100	50
	<b>Grand Total</b>		100

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

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

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

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# GLOBAL ACADEMY OF TECHNOLOGY

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



Department: Artificial Intelligence and Machine Learning		
Semester: <b>III</b>	Course Code: <b>BAML24306D</b>	Contact Hrs /week: <b>03</b>
Course Description: <b>WEB APPLICATION FRAMEWORKS</b>		No. of Credits: L : T : P : S = <b>3:0:0:2</b>
Course Category: <b>ETC</b>		Total no. of Hours = <b>40(L)+50(S)</b>
CIE: <b>50 Marks</b>	SEE: <b>50 Marks</b>	Exam Hours: <b>03</b>
Course Pre-requisites: <b>Programming Concepts</b>		

## 1. PREAMBLE ABOUT THE COURSE

This course introduces students to modern web application frameworks used for building **dynamic, scalable, and responsive web applications**. It covers both frontend and backend frameworks, focusing on efficient development practices, MVC architecture, routing, database integration, and security. Students will gain hands-on experience in developing full- stack web applications using industry-standard tools and frameworks.

## 2. COURSE LEVEL OBJECTIVES

Sl. No	Course Learning Objectives (CLO)
1.	<b>Understand</b> the fundamental concepts of HTML5, including semantic markup, document structure, tables, and forms.
2.	<b>Understand</b> the core principles of CSS, including syntax, selectors, the cascade mechanism, box model, and text styling techniques.
3.	<b>Apply</b> JavaScript to enhance web pages with client-side scripting, manipulate the DOM, and handle events and form interactions.
4.	<b>Create</b> modern, responsive single-page applications using the React library, including styling and deployment techniques.

## 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 basic structure, syntax, and semantics of HTML5, and explain the creation of accessible web pages using tables and forms.	PO1, PO2, PO3, PO11, PSO1	L3	WK-2,4,6	10

CO2	Implement the principles of CSS styling, including selectors, cascade rules, box model, and text formatting to design structured and visually appealing web pages.	PO1, PO2 ,PO3, PO11, PSO1	L3	WK-2,4,6	10
CO3	Apply JavaScript syntax, document object model (DOM) manipulation, event handling, and form validation to build interactive web pages.	PO1, PO2 ,PO3, PO11, PSO1	L3	WK-2,4,6	10
CO4	Analyze the role of advanced JavaScript techniques, pseudo-classes, jQuery foundations, AJAX, and animation to enhance user experience in web applications.	PO1, PO2, PO3, PO5, PO8,PO11, PSO1	L3	WK-2,4,6	10
CO5	Create modern single-page applications using React fundamentals, including component design, styling integration, and deployment strategies.	PO1, PO2, PO3, PO5, PO8,PO11, PSO1	L3	WK-2,4,6	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 HTML: Introduction to HTML, What is HTML and Where did it come from?, HTML Syntax, Semantic Markup, Structure of HTML Documents, Quick Tour of HTML Elements, HTML5 Semantic Structure Elements, HTML Tables and Forms, Introducing Tables: Tables, Styling Tables, Introducing Forms, Form Control Elements, Table and Form Accessibility. <b>Textbook 1: Ch 2, Ch 4</b>	CO1	8
II	Cascade Style Sheet: Introduction to CSS, what is CSS, CSS Syntax, Location of Styles, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling. Advanced CSS: Layout, Normal Flow, Positioning Elements, Floating Elements, CSS Frameworks. <b>Text book1: Ch 3, Ch 5</b>	CO2	8
III	JavaScript: Client-Side Scripting, what is JavaScript and What can it do? JavaScript Design Principles, where does JavaScript Go? Syntax, JavaScript Objects, The Document Object Model (DOM), JavaScript Events, Forms. <b>Text book 1: Ch 6</b>	CO3	8

IV	Advanced JavaScript & jQuery: JavaScript Pseudo-Classes, jQuery Foundations, AJAX, Asynchronous File Transmission, Animation. <b>Text book 1: Ch 15.1-15.5</b>	CO4	8
V	React Library: Fundamentals of React (till React DOM), Styling in React: CSS in React, deploying a React Application. <b>Text book 2: Ch 1, Ch 3, Ch 6</b>	CO5	8

## 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S.No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Fundamentals of Web Development	Randy Connolly, Ricardo Hoar,	Pearson Education India.	Second Edition	1,2,3,4
2	The Road to React	Robin Wieruch	Lean Publishing	Fourth Edition 2020.	5
3	JavaScript Absolute Beginner's Guide	Kirupa Chinnathambi	Que Publishing	First Edition	References
4	Learning React, Functional Web Development with React and Redux	Alex Banks and EvePorcello	O'Reilly Media	Second Edition May 2017	References

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

- [https://sd.blackball.lv/library/the\\_road\\_to\\_react\\_\(2020\).pdf](https://sd.blackball.lv/library/the_road_to_react_(2020).pdf)
- [https://sajtr.ga/Neumesceno/mega/FRI-UNI-Zapiski/3.%20LETNIK%2020142015/3.%20letnik/Razvoj%20programske%20opreme/SP/Literatura/programming%20the\\_%20world%20wide%20web%20-%20sebesta\\_%20robert%20w\\_2.pdf](https://sajtr.ga/Neumesceno/mega/FRI-UNI-Zapiski/3.%20LETNIK%2020142015/3.%20letnik/Razvoj%20programske%20opreme/SP/Literatura/programming%20the_%20world%20wide%20web%20-%20sebesta_%20robert%20w_2.pdf)

### MOOCs COURSES:

- <https://www.udemy.com/course/the-web-developer-bootcamp/>
- <https://www.udemy.com/course/the-complete-web-developer-zero-to-mastery/>

## 7. EVALUATION METHODOLOGY

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

### CIE Framework:

#### Scheme of Examination (CIE):

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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

	Component	Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	AAT	10	
SEE	Semester End Examination	100	50
	<b>Grand Total</b>		100

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

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

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

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# GLOBAL ACADEMY OF TECHNOLOGY

Autonomous Institution Affiliated to Visveswaraya Technological University

Approved by UGC, AICTE and Govt of Karnataka



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

## 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	<b>Plantation and adoption of a tree:</b> 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	<b>Heritage walk and crafts corner:</b> 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	<b>Organic farming and waste management:</b> Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus - Objectives, Visit, case study, report, outcomes.
IV	<b>Water conservation:</b> 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	<b>Food walk:</b> City's culinary practices, food lore, and indigenous materials of the region used in cooking - Objectives, Visit, case study, report, outcomes.

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# GLOBAL ACADEMY OF TECHNOLOGY

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



Department: Artificial Intelligence and Machine Learning		
Semester: III	Course Code: <b>BAML24358A</b>	Contact Hrs /week: 2
Course Description: <b>UNIX SHELL PROGRAMMING</b>		No. of Credits: <b>01</b> L : T : P : S = <b>0:0:2:2</b>
Course Category: <b>AEC</b>		Total no. of Hours = <b>15+15</b>
CIE: <b>50 Marks</b>	SEE: <b>50 Marks</b>	Exam Hours: <b>03</b>
Course Pre-requisites: <b>Programming Concepts, UNIX SHELL COMMANDS</b>		

## 1. PREAMBLE ABOUT THE COURSE

This course is designed to introduce students to the powerful world of Unix shell programming. Shell scripting is a vital skill for system administrators, developers, and power users. Students will learn how to automate tasks, manage system resources, and create robust scripts to handle daily administrative and development activities. By mastering shell programming, students gain deeper insight into the Unix operating system and develop the ability to build efficient, scalable solutions directly at the command line. The course provides hands-on experience, guiding learners from basic scripting to advanced shell utilities, enabling them to work confidently in real-world Unix environments.

## 2. COURSE LEVEL OBJECTIVES

Sl. No	Course Learning Objectives (CLO)
1	To understand the structure, commands, and utilities of the UNIX operating system.
2	To develop shell scripts using variables, control structures, loops, and functions.
3	To apply shell scripting techniques for automating tasks and managing system operations.

## 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 fundamental UNIX and shell programming concepts in software environment.	PO1, PO2, PO8, PO11, PSO1	L3	WK- 3,4,5,6	8
CO2	Apply and implement advanced UNIX and shell programming for the requirements and simulate.	PO1,PO2,PO 8,PO11,PSO1	L3	WK- 3,4,5,6	8
CO3	Analyze the algorithm flow for the given requirements and demonstrate changes required.	PO1,PO2,PO 3,PO8,PO11, PSO1	L4	WK- 3,4,5,6	8

CO4	Develop and debug shell scripts for performance, correctness, and security in a UNIX environment.	PO1,PO2,PO3,PO8,PO11,PSO1	L4	WK-3,4,5,6	8
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*WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9*

#### 4. SYLLABUS

Sl.no.	Laboratory Experiments
1	Use of basic Unix Shell Commands: ls, mkdir, rmdir, cd, cat, banner, touch, file, wc, sort, cut, grep, dd, dfspace, du, ulimit.
2	Commands related to inode, I/O redirection, piping, process control commands, mails.
3	Shell Programming: shell script exercise based on following: <ol style="list-style-type: none"> <li>1. Interactive shell script</li> <li>2. Positional parameters</li> <li>3. Arithmetic</li> <li>4. If-then-fi, if-then-else-fi, nested if-else</li> <li>5. Logical operators</li> <li>6. Else + if equals elif, case structure</li> <li>7. While, for loop</li> <li>8. Meta characters</li> </ol>
4	Write a shell script to create a file in \$USER /class/batch directory. Follow the Instructions <ol style="list-style-type: none"> <li>1. Input a page profile to yourself, copy it into other</li> <li>2. existing file</li> <li>3. Start printing file at certain line</li> </ol> Print all the difference between two file, copy the two files at \$USER/CSC/2007 directory.
5	Write shell script for <ol style="list-style-type: none"> <li>1. Showing the count of users logged in</li> <li>2. Printing Column list of files in your home directory.</li> <li>3. Listing your job with below normal priority</li> </ol> Continue running your job after logging out
6	Write a shell script to change date format. Show the time taken in execution of this script.
7	Write a shell script to print file names in directory showing date of creation & serial no. of file.
8	Write a shell script to count lines, words & characters in its input. (do not use wc).
9	Write a shell script to print end of a Glossary file in reverse order using array.
10	Write a shell script to check whether Ram logged in, continue checking further after every 30 seconds till success.
11	Write a shell script to find whether a given number is prime.

## 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Unix Concepts & Applications	Sumitabha Das,	Tata McGraw Hill	Fourth Edition	Referred for all programs

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

1. <https://www.youtube.com/watch?v=ffYUfAqEamY>
2. <https://www.youtube.com/watch?v=Q05NZiYFcD0>
3. <https://www.youtube.com/watch?v=8GdT53KDIyY>
4. <https://www.youtube.com/watch?app=desktop&v=3Pga3v7rCgo>

## 7. EVALUATION METHODOLOGY

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

### CIE Framework:

### Scheme of Examination (CIE):

### Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Exam) taken together.

### Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The Split-up of CIE marks for record/journal and test are in the ratio **60:40**

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

<b>PSOs</b> →	<b>PSO1</b>	<b>PSO2</b>
<b>COs ↓</b>		
<b>CO1</b>	2	
<b>CO2</b>	2	

<b>CO3</b>	2	
<b>CO4</b>	3	
<b>CO5</b>	3	

*Correlation Weightage: 1 – Low, 2 – Moderate, 3 - High*  
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# GLOBAL ACADEMY OF TECHNOLOGY

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



Department: <b>Artificial intelligence and machine learning</b>		
Semester: <b>III</b>	Course Code: <b>BAML24358B</b>	Contact Hrs /week: <b>1</b>
Course Description: <b>ETHICS AND PUBLIC POLICY FOR AI</b>		No. of Credits: <b>01</b> L : T : P : S = <b>1:0:0:1</b>
Course Category: <b>AEC</b>		Total no. of Hours = <b>15(L)+15(S)</b>
CIE: <b>50 Marks</b>	SEE: <b>50 Marks</b>	Exam Hours: <b>03</b>
Course Pre-requisites: <b>Basic understanding of Artificial Intelligence, ethics, public policy, and strong critical thinking skills.</b>		

## 1. PREAMBLE ABOUT THE COURSE

This course, *Ethics and Public Policy for AI*, introduces students to the ethical frameworks, public policies, and governance practices essential for developing trustworthy and socially beneficial AI systems. It covers key principles, tools, and real-world applications to address risks, ensure fairness, and promote responsible innovation. Through case studies and critical analysis, students will learn to align AI technologies with societal values and ethical standards for a better and more inclusive future.

## 2. COURSE LEVEL OBJECTIVES

Sl.No	Course Learning Objectives (CLO)
1	To understand Ethical Framework for a Good AI Society, establishing Rules for trustworthy AI
2	To adopt good ethics for society
3	To familiar with Tools, methods and practices for designing AI for social good
4	To familiar with Innovation and future AI
5	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	Demonstrate ethical frameworks for building trustworthy AI.	PO1,PO2,PO5, PO9,PO11, PSO2	L2	WK-4,5,6	4

CO2	Apply ethics for a socially beneficial AI society.	PO1,PO2,PO5, PO9,PO11,PS O2	L2	WK-4,5,6	4
CO3	Analyze tools and practices for designing AI for social good.	PO1,PO2,PO5, PO9,PO11,PS O2	L3	WK-4,5,6	4
CO4	Develop future AI trends and ethical governance in healthcare.	PO1,PO2,PO5, PO9,PO11,PS O2	L3	WK-4,5,6	4
CO5	Progress and Ethics, Regulation and Governance of AI Ethics	PO1,PO2,PO5, PO9,PO11,PS O2	L3	WK-4,5,6	4

*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 <b>Textbook1: Ch 3, 4</b>	CO1	4
II	Translating principles into practices of digital ethics: five risks of being Unethical the Ethics of Algorithms: Key problems and Solution How to Design AI for Social Good: Seven Essential Factors. <b>Textbook1: Ch 6, 8, 9</b>	CO2	4
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 <b>Textbook1: Ch 9,10</b>	CO3	4
IV	Innovating with Confidence: Embedding AI Governance and fairness in financial Services Risk management framework, What the near future of AI could be. <b>Textbook1: Ch 20, 22</b>	CO4	4
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 <b>Textbook 2 : Ch 5, 8, 9</b>	CO4,CO5	4

## 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Ethics, governance and Policies in Artificial Intelligence	Luciano Floridi, Springer	Springer	First Edition	MODULE 1,2,3,4,&5
2	Ethics and AI: Navigating the Moral Landscape of Digital Age	Aaron Aboagye			References

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

- [1. https://www.coursera.org/learn/ethics-of-artificial-intelligence](https://www.coursera.org/learn/ethics-of-artificial-intelligence)
- [2. https://www.futurelearn.com/courses/ai-ethics-law-and-policy](https://www.futurelearn.com/courses/ai-ethics-law-and-policy)
- [3. https://nanoschool.in/ai-courses/aipg/ai-ethics-and-policy-development-program/](https://nanoschool.in/ai-courses/aipg/ai-ethics-and-policy-development-program/)

## 7. EVALUATION METHODOLOGY

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

### CIE Framework:

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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

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

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

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# GLOBAL ACADEMY OF TECHNOLOGY

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



Department: Artificial Intelligence and Machine Learning		
Semester: <b>III</b>	Course Code: <b>BAML24358C</b>	Contact Hrs /week: <b>02</b>
Course Description: <b>PROJECT MANAGEMENT WITH GIT</b>		No. of Credits: <b>01</b> L : T : P : S = <b>0:0:2:2</b>
Course Category: <b>AEC</b>		Total no. of Hours = <b>15+15</b>
CIE: <b>50 Marks</b>	SEE: <b>50 Marks</b>	Exam Hours: <b>03</b>
Course Pre-requisites: <b>Programming Concepts, Git Environment Set Up</b>		

## 1. PREAMBLE ABOUT THE COURSE

This course introduces the fundamentals of project management using Git, empowering learners to track changes, collaborate effectively, and maintain organized, version-controlled codebases. Through hands-on practice, you'll gain the skills needed to manage software projects efficiently in real-world development environments.

## 2. COURSE LEVEL OBJECTIVES

Sl. No	Course Learning Objectives (CLO)
1	To familiar with basic command of Git
2	To create and manage branches
3	To understand how to collaborate and work with Remote Repositories
4	To familiar with various controlling commands

## 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 the basics commands related to git repository	PO1, PSO2	L3	WK-3,4,5,6	8
CO2	Create and manage the branches	PO1, PSO2	L3	WK-3,4,5,6	8

CO3	Apply commands related to Collaboration and Remote Repositories	PO1,PO2, PSO2	L4	WK-3,4,5,6	8
CO4	Use commands related to Git Tags, Releases and advanced git operations	PO1,PO2, PO3,PO8, PO11,PSO2	L4	WK-3,4,5,6	8
CO5	Analyze and change the git history	PO1,PO2, PO3,PO8, PO11,PSO2	L4	WK-3,4,5,6	8

#### 4. SYLLABUS

Sl. No	PROGRAMS
1	<b>Setting Up and Basic Commands</b> 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	<b>Creating and Managing Branches</b> Create a new branch named "feature-branch." Switch to the "master" branch. Merge the "feature-branch" into "master."
3	<b>Creating and Managing Branches</b> Write the commands to stash your changes, switch branches, and then apply the Stashed changes.
4	<b>Collaboration and Remote Repositories</b> Clone a remote Git repository to your local machine.
5	<b>Collaboration and Remote Repositories</b> Fetch the latest changes from a remote repository and rebase your local branch onto The updated remote branch.
6	<b>Collaboration and Remote Repositories</b> Write the command to merge "feature-branch" into "master" while providing a custom commit message for the merge.
7	<b>Git Tags and Releases</b> Write the command to create a lightweight Git tag named "v1.0" for a commit in your local repository.
8	<b>Advanced Git Operations</b> Write the command to cherry-pick a range of commits from "source-branch" to the current branch.
9	<b>Analysing and Changing Git History</b> 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	<b>Analysing and Changing Git History</b> Write the command to list all commits made by the author "JohnDoe" between "2023-01-01" and "2023-12-31."
11	<b>Analysing and Changing Git History</b> Write the command to display the last five commits in the repository's history.
12	<b>Analysing and Changing Git History</b> 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	Modules Covered
1	Version Control with Git	Prem Kumar & Ponuthorai, Jon Loeliger	O'Reilly Media, Inc.	3rd Edition	Referred for all programs
2	Pro Git book, <a href="https://git-scm.com/book/en/v2">https://git-scm.com/book/en/v2</a>	Scott Chacon and Ben Straub	Apress		

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

1. <https://git-scm.com/book/en/v2>
2. [https://infyspringboard.onwingspan.com/web/en/app/toc/lex\\_auth\\_0130944433473699842782\\_shared/overview](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0130944433473699842782_shared/overview)
3. [https://infyspringboard.onwingspan.com/web/en/app/toc/lex\\_auth\\_01330134712177459211926\\_share\\_d/overview](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01330134712177459211926_share_d/overview)

## 7. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks

b) Semester End Examination (SEE) = 50 marks

Total = 100 marks

**CIE Framework:**

### Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE

(Semester End Exam) taken together.

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The Split-up of CIE marks for record/journal and test are in the ratio **60:40**

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

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

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

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# GLOBAL ACADEMY OF TECHNOLOGY

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



Department: <b>Artificial Intelligence and Machine Learning</b>		
Semester: <b>III</b>	Course Code: <b>BAML24358D</b>	Contact Hrs /week: <b>02</b>
Course Description: <b>DATA ANALYTICS WITH R</b>		No. of Credits: <b>01</b> L : T : P : S = <b>0:0:2:2</b>
Course Category: <b>AEC</b>		Total no. of Hours = <b>15+15</b>
CIE: <b>50 Marks</b>	SEE: <b>50 Marks</b>	Exam Hours: <b>03</b>
Course Pre-requisites: <b>Programming Concepts, proficiency in R programming for data analysis.</b>		

## 1. PREAMBLE ABOUT THE COURSE

The course "Data Analytics with R" equips students with the skills to analyze and visualize data using R, covering key techniques such as statistical analysis, data manipulation, and graphical representation to derive meaningful insights for decision-making.

## 2. COURSE LEVEL OBJECTIVES

The course will enable students to:

<b>CLO1</b>	To explore and understand how R and R Studio interactive environment.
<b>CLO2</b>	To understand the different data Structures, data types in R.
<b>CLO3</b>	To learn and practice programming techniques using R programming.
<b>CLO4</b>	To import data into R from various data sources and generate visualizations.
<b>CLO5</b>	To draw insights from datasets using data analytics techniques.

## 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 fundamental syntax of R data types, expressions and the usage of the R-Studio IDE	PO1, PO2,PO3, PO5,PO8,PO11, PSO2	L3	WK- 3,4,5, 6	8
CO2	Develop a program in R with programming constructs: conditionals, looping and functions.	PO1, PO2,PO3, PO5,PO8,PO11, PSO2	L3	WK- 3,4,5, 6	8

CO3	Apply the list and data frame structure of the R programming language.	PO1,PO2, PO3, PO5, PO8,PO11, PSO2	L4	WK-3,4,5, 6	8
CO4	Use visualization packages and file handlers for data analysis.	PO1, PO2, PO3, PO5,PO8,PO11, PSO2	L4	WK-3,4,5, 6	8

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

#### 4. SYLLABUS

Sl.no.	Laboratory Experiments
1	<p>Demonstrate the steps for installation of R and R Studio. Perform the following:</p> <ol style="list-style-type: none"> <li>1. Assign different type of values to variables and display the type of variable. Assign different types such as Double, Integer, Logical, Complex and Character and understand the difference between each data type.</li> <li>2. Demonstrate Arithmetic and Logical Operations with simple examples.</li> <li>3. Demonstrate generation of sequences and creation of vectors.</li> <li>4. Demonstrate Creation of Matrices</li> <li>5. Demonstrate the Creation of Matrices from Vectors using Binding Function.</li> <li>6. Demonstrate element extraction from vectors, matrices and arrays</li> </ol> <p><b>Suggested Reading</b> – Text Book 1 – Chapter 1 (What is R, Installing R, Choosing an IDE – R Studio, How to Get Help in R, Installing Extra Related Software), Chapter 2 (Mathematical Operations and Vectors, Assigning Variables, Special Numbers, Logical Vectors), Chapter 3 (Classes, Different Types of Numbers, Other Common Classes, Checking and Changing Classes, Examining Variables )</p>
2	<p>Assess the Financial Statement of an Organization being supplied with 2 vectors of data: Monthly Revenue and Monthly Expenses for the Financial Year. You can create your own sample data vector for this experiment) Calculate the following financial metrics:</p> <ol style="list-style-type: none"> <li>1. Profit for each month.</li> <li>2. Profit after tax for each month (Tax Rate is 30%).</li> <li>3. Profit margin for each month equals to profit after tax divided by revenue.</li> <li>4. Good Months – where the profit after tax was greater than the mean for the year.</li> <li>5. Bad Months – where the profit after tax was less than the mean for the year.</li> <li>6. The best month – where the profit after tax was max for the year.</li> <li>7. The worst month – where the profit after tax was min for the year.</li> </ol> <p><b>Note:</b></p> <ol style="list-style-type: none"> <li>1. All Results need to be presented as vectors</li> <li>2. Results for Dollar values need to be calculated with \$0.01 precision, but need to be presented in Units of \$1000 (i.e 1k) with no decimal points</li> <li>3. Results for the profit margin ratio need to be presented in units of % with no decimal point.</li> <li>4. It is okay for tax to be negative for any given month (deferred tax asset)</li> <li>5. Generate CSV file for the data.</li> </ol> <p><b>Suggested Reading</b> – Text Book 1 – Chapter 4 (Vectors, Combining Matrices)</p>
3	<p>Develop a program to create two 3 X 3 matrices A and B and perform the following operations a) Transpose of the matrix b) addition c) subtraction d) multiplication</p> <p><b>Suggested Reading</b> – Text Book 1 – Chapter 4 (Matrices and Arrays – Array Arithmetic)</p>

4	Develop a program to find the factorial of given number using recursive function calls. <b>Suggested Reading</b> – Reference Book 1 – Chapter 5 (5.5 – Recursive Programming) Text Book 1 – Chapter 8 (Flow Control and Loops – If and Else, Vectorized If, while loops, for loops), Chapter 6 (Creating and Calling Functions, Passing Functions to and from other functions)																		
5	Develop an R Program using functions to find all the prime numbers up to a specified number by the method of Sieve of Eratosthenes. <b>Suggested Reading</b> – Reference Book Text Book 1 - Chapter 5 (5.5 – Recursive Programming), Chapter 8 (Flow Control and Loops – If and Else, Vectorized If, while loops, for loops), Chapter 6 (Creating and Calling Functions, Passing Functions to and from other functions)																		
6	The built-in data set mammals contain data on body weight versus brain weight. Develop R commands to: 1. Find the Pearson and Spearman correlation coefficients. Are they similar? 2. Plot the data using the plot command. 3. Plot the logarithm (log) of each variable and see if that makes a difference. <b>Suggested Reading</b> – Text Book 1 –Chapter 12 – (Built-in Datasets) Chapter 14 – (Scatterplots) Reference Book 2 – 13.2.5 (Covariance and Correlation)																		
7	Develop R program to create a Data Frame with following details and do the following operations.																		
	<table border="1"> <thead> <tr> <th>Item Code</th> <th>Item Category</th> <th>Item Price</th> </tr> </thead> <tbody> <tr> <td>1001</td> <td>Electronics</td> <td>700</td> </tr> <tr> <td>1002</td> <td>Desktop Supplies</td> <td>300</td> </tr> <tr> <td>1003</td> <td>Office Supplies</td> <td>350</td> </tr> <tr> <td>1004</td> <td>USB</td> <td>400</td> </tr> <tr> <td>1005</td> <td>CD Drive</td> <td>800</td> </tr> </tbody> </table>	Item Code	Item Category	Item Price	1001	Electronics	700	1002	Desktop Supplies	300	1003	Office Supplies	350	1004	USB	400	1005	CD Drive	800
	Item Code	Item Category	Item Price																
	1001	Electronics	700																
	1002	Desktop Supplies	300																
	1003	Office Supplies	350																
	1004	USB	400																
1005	CD Drive	800																	
1. Subset the Data frame and display the details of only those items whose price is greater than or equal to.																			
2. Subset the Data frame and display only the items where the category is either —Office Supplies or Desktop Supplies.																			
3. Create another Data Frame called —item-details with three different fields item Code, Item Qt and Item Reorder Lvl and merge the two frames.																			
<b>Suggested Reading</b> –Textbook 1: Chapter 5 (Lists and Data Frames)																			
8	Let us use the built-in dataset air quality which has Daily air quality measurements in New York, May to September 1973. Develop R program to generate histogram by using appropriate arguments for the following statements. 1. Assigning names, using the air quality data set. 2. Change colors of the Histogram 3. Remove Axis and Add labels to Histogram 4. Change Axis limits of a Histogram 5. Add Density curve to the histogram <b>Suggested Reading</b> –Reference Book 2 – Chapter 7 (7.4 – The ggplot2 Package), Chapter 24 (Smoothing and Shading )																		
9	Design a data frame in R for storing about 20 employee details. Create a CSV file named input.csv that defines all the required information about the employee such as id, name, salary, start date, dept. Import into R and do the following analysis. 1. Find the total number rows & columns 2. Find the maximum salary																		

	<p>3. Retrieve the details of the employee with maximum salary Retrieve all the employees working in the IT Department. Retrieve the employees in the IT Department whose salary is greater than 20000 and write these details into another file —output.csv <b>Suggested Reading</b> – Text Book 1 – Chapter 12(CSV and Tab Delimited Files)</p>
10	<p>Using the built in dataset mtcars which is a popular dataset consisting of the design and fuel consumption patterns of 32 different automobiles. The data was extracted from the 1974 Motor Trend US magazine, and comprises fuel consumption and 10 aspects of automobile design and performance for 32 automobiles (1973-74 models). Format A data frame with 32 observations on 11 variables : [1] mpg Miles/(US) gallon,[2] cyl Number of cylinders [3] disp Displacement (cu.in.), [4] hp Gross horsepower [5] drat Rear axle ratio,[6] wt Weight (lb/1000) [7] qsec 1/4 mile time, [8] vs V/S, [9] am Transmission (0 = automatic, 1 = manual), [10] gear Number of forward gears, [11] carb Number of carburetors Develop R program, to solve the following:</p> <ol style="list-style-type: none"> <li>1. What is the total number of observations and variables in the dataset?</li> <li>2. Find the car with the largest hp and the least hp using suitable functions</li> <li>3. Plot histogram / density for each variable and determine whether continuous variables are normally distributed or not. If not, what is their skewness?</li> <li>4. What is the average difference of gross horse power(hp) between automobiles with 3 and 4 number of cylinders(cyl)? Also determine the difference in their standard deviations.</li> <li>5. Which pair of variables has the highest Pearson correlation?</li> </ol> <p><b>References (Web links):</b></p> <ol style="list-style-type: none"> <li>1. <a href="https://cran.r-project.org/web/packages/explore/vignettes/explore_mtcars.html">https://cran.r-project.org/web/packages/explore/vignettes/explore_mtcars.html</a></li> <li>2. <a href="https://www.w3schools.com/r/r_stat_data_set.asp">https://www.w3schools.com/r/r_stat_data_set.asp</a> <a href="https://rpubs.com/BillB/217355">https://rpubs.com/BillB/217355</a></li> </ol>
11	<p>Demonstrate the progression of salary with years of experience using a suitable data set (You can create your own dataset). Plot the graph visualizing the best fit line on the plot of the given data points. Plot a curve of Actual Values vs. Predicted values to show their correlation and performance of the model. Interpret the meaning of the slope and y-intercept of the line with respect to the given data. Implement using lm function. Save the graphs and coefficients in files. Attach the predicted values of salaries as a new column to the original data set and save the data as a new CSV file. <b>Suggested Reading</b> – Reference Book 2 – Chapter 20 (General Concepts, Statistical Inference, Prediction)</p>

## 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S.No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Learning R: A Step by Step Function Guide to Data Analysis.	Cotton, R.	O'Reilly Media Inc.	First Edition (2013).	Referred for all programs
2	A First Course in Programming and Statistics	Davies, T.M.	No Starch Press	--	--

## 6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE]

1. <https://www.datacamp.com/courses/free-introduction-to-r>
2. <https://www.w3schools.com/r/>
3. <https://www.kaggle.com/learn/r>

## 7. EVALUATION METHODOLOGY

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

### CIE Framework:

#### Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Exam) taken together.

#### Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The Split-up of CIE marks for record/journal and test are in the ratio **60:40**

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
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



<b>Department: Science and Humanities</b>		
<b>Semester: III/VI</b>	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
<b>Course Category: MC</b>		Total no. of Hours =
<b>CIE: 100 Marks</b>	SEE:	Exam Hours:

### 3. 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.

### 4. 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*

## 5. SYLLABUS

Module No.	Module Description
I	<p><b>National Service Scheme (NSS) – Contents</b></p> <ol style="list-style-type: none"> <li>1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.</li> <li>2. Waste management– Public, Private and Govt organization, 5 R's.</li> <li>3. Setting of the information imparting club for women leading to contribution in social and economic issues.</li> <li>4. Water conservation techniques – Role of different stakeholders– Implementation.</li> <li>5. Preparing an actionable business proposal for enhancing the village income and approach for implementation.</li> <li>6. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.</li> <li>7. Developing Sustainable Water management system for rural areas and implementation approaches.</li> <li>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.</li> <li>9. Spreading public awareness under rural outreach programs. (minimum 5 programs).</li> <li>10. Social connect and responsibilities.</li> <li>11. Plantation and adoption of plants. Know your plants.</li> <li>12. Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).</li> <li>13. Govt. school Rejuvenation and helping them to achieve good infrastructure.</li> </ol>

## 6. 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.	

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

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

## 1. SYLLABUS

Course Title	Content
Introduction of Yoga, Aim and Objectives 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 practitioner.
Misconceptions of yoga	Yoga its misconceptions
Suryanamaskara	Suryanamaskar prayer and its meaning, Need, importance 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. Ardhalasana	Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits.



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<b>Department: Science and Humanities</b>		
<b>Semester: III to VI</b>	Course Code: BMUK359/459/559/658	Contact Hrs /week: 2
<b>Course Description: MUSIC</b>		No. of Credits: 0 L : T : P : S = 0:0:2:0
<b>Course Category: MC</b>		Total no. of Hours = 24
<b>CIE: 100 Marks</b>	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	Discuss 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
<b>I</b>	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
<b>II</b>	Compositions: Introduction to the types of composition in Carnatic Music Swarajathi, Varna, Krithi, and Thillana, Notation System.	3
<b>III</b>	Composers: Biography and Contributions of Purandaradasa, Thyagaraja.	3
<b>IV</b>	Music Instruments: Classification and construction of string instruments, percussion instruments, Idiophones (Ghana Vaadya), Examples of each class of Instruments.	3
<b>V</b>	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 Subramaniam	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

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Department: Mathematics		
Semester: IV	Course Code: BMATS401	Contact Hrs /week: 4
Course Description: Statistics, Probability and Graph Theory (Common for CSE/ISE/AI&DS/AI & ML/CS-AI & ML)		No. of Credits: 3 L : T : P : S = 2:2:0:0
Course Category: <b>Basic Science Course (BSC)</b>		Total no. of Hours = 40
CIE: <b>50 Marks</b>	SEE: <b>50 Marks</b>	Exam Hours: <b>03</b>
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 Outcome	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	PO1, PO2, PO5	L3	WK1, WK2, WK3, WK6	8

	systems and support probabilistic algorithm design.				
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, $\chi^2$ , 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*

### 3. 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

### 4. 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	44 <sup>th</sup>
2	Higher Engineering Mathematics	B.V. Ramana	Tata McGraw-Hill	
3	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10 <sup>th</sup>
4	A Textbook of Engineering Mathematics	N.P.Bali and Manish Goyal	Laxmi Publications	6 <sup>th</sup>

5	Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks	T Veerarajan	Tata Mc-Graw Hill Co	4 <sup>th</sup>
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## 6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE

<https://nptel.ac.in/courses>  
<https://swayam.gov.in/nptelonlinecourses.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 3 tests + Assignment Marks

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
COs ↓											
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 →	PSO1	PSO2	PSO3
COs ↓			
CO1	-	-	-
CO2	-	-	-
CO3	-	-	-
CO4	-	-	-

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





# GLOBAL ACADEMY OF TECHNOLOGY

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Department: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: <b>IV</b>	Course Code: <b>BAML24402</b>	Contact Hrs. /week: <b>03</b>
Course Description: <b>DESIGN AND ANALYSIS OF ALGORITHMS</b>		No. of Credits: <b>04</b> L : T : P : S = <b>3:0:0:2</b>
Course Category: <b>IPCC</b>		Total no. of Hours = <b>120</b>
CIE: <b>50 Marks</b>	SEE: <b>50 Marks</b>	Exam Hours: <b>03</b>
Course Pre-requisites: Programming languages, Data structures and mathematical concepts		

## 1. PREAMBLE ABOUT THE COURSE

The Design and Analysis of Algorithms course is a fundamental pillar of computer science, shaping the way problems are solved efficiently. Algorithms form the backbone of software systems, influencing everything from database management to artificial intelligence. This course equips learners with the ability to evaluate, optimize, and develop algorithms that drive technological innovation.

## 2. COURSE LEVEL OBJECTIVES

CLO1	To learn mathematical background for analysis of algorithm
CLO2	Analyze the asymptotic performance of algorithms.
CLO3	To understand the concept of designing an algorithm.
CLO4	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 and explore the asymptotic runtime complexity of algorithms by using mathematical relations.	POs-1,2,3,5,8,9,11 PSOs-1	L3	WK-2,3,4	10
CO2	Analyze a problem and identify the computing requirements appropriate for a solution	POs-1,2,3,5,8,9,11 PSOs-1	L3	WK-2,4	10
CO3	Apply mathematical foundations, algorithmic principles, and computer science theory to the modeling, and evaluation of computer-based solutions.	POs-1,2,3,5,8,9,11 PSOs-1	L3	WK-2,3,4,5	10
CO4	Investigate and apply optimal design, development principles, skills and tools in the construction of software solutions of varying complexity.	POs-1,2,3,5,8,9,11 PSOs-1	L3	WK-2,3,4,5	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	<p><b>Introduction:</b> 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.</p> <p><b>Brute Force:</b> Selection Sort and Bubble Sort.</p> <p><b>Text Book 1: Ch 1.1,1.2,2.1-2.4,3.1</b></p>	1,3	10
II	<p><b>Divide and Conquer:</b> Merge sort, Quicksort, Multiplication of long integers, Strassen 's Matrix multiplication, Max-Min Problem</p> <p><b>Decrease and Conquer:</b> Insertion Sort, Depth First Search, Breadth First Search, Topological Sorting, Applications of DFS and BFS.</p> <p><b>Text Book 1:Ch 5.1,5.2,5.4,3.5,4.2.</b></p>	2,3	10
III	<p><b>Transform and Conquer:</b> Presorting, Heapsort, Problem reduction.</p> <p><b>Space and Time Tradeoffs:</b> Sorting by Counting, Naive String Matching, Input Enhancement in String Matching: Horspool's and Boyer-Moore algorithm.</p> <p><b>Text Book 1: Ch 6.1,6.4,6.6.</b></p>	3	10
IV	<p><b>Dynamic Programming:</b> Computing a Binomial Coefficient, Warshall's and Floyd's Algorithms.</p> <p><b>Greedy Technique:</b> Prim 's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees and codes.</p> <p><b>Text Book 1:Ch 8.1,8.2,8.4,9.1-9.4</b></p>	3,4	10
V	<p><b>Backtracking:</b> N-Queen 's Problem, Sum of Subset Problem.</p> <p><b>Branch-and-Bound:</b> Travelling Sales Person problem, 0/1 Knapsack problem</p> <p><b>NP and NP-Complete Problems:</b> Basic concepts, nondeterministic algorithms, P, NP, NP- Complete, and NP-Hard classes</p> <p><b>Text Book 1:Ch 12.1,12.2,12.3</b></p>	4	10

SL.No	Programs
1	<p>a. Implement naïve String matching algorithm using Brute Force Approach</p> <p>b. Implement and analyze iterative and recursive binary search algorithm using divide and conquer method.</p>
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	<p>a. Incorporate the array data structure and demonstrate whether a given un-weighted graph is connected or not using DFS method.</p> <p>b. Implement the graph traversal technique using BFS method to print all the nodes</p>

	reachable from a given starting node in an un-weighted 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 Floyd's 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 Prim's 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	Modules Covered
1	Introduction to the Design and Analysis of Algorithms	Anany Levitin	Pearson	3 <sup>rd</sup>	All
2	Computer Algorithms	Horowitz E., Sahani S., Rajasekharan S	Galgotia Publications,	2 <sup>nd</sup>	All
3	Introduction to Algorithms	Cormen T.H., Leiserson C.E., Rivest R.L., Stein C	PHI	3 <sup>rd</sup> , 2010	All

## 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>

## 7. MOOCs:

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

## 8. EVALUATION METHODOLOGY

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

### CIE Framework:

### Scheme of Examination (CIE):

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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

### Semester End Exam (SEE):

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module. The students will have to answer five full questions, selecting one full question from each module.

	Component	Marks	Max Marks	Total Marks
CIE	CIE Test-1	30	<b>30</b>	50
	CIE Test-2	30		
	Lab Component	20		
SEE	Semester End Examination	100		50
	<b>Grand Total</b>			100

## 9. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 10. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
<b>CO1</b>	3	
<b>CO2</b>	3	
<b>CO3</b>	3	
<b>CO4</b>	3	

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

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Department: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: <b>IV</b>	Course Code: <b>BAML24403</b>	Contact Hrs. /week: <b>3</b>
Course Description: <b>Machine Learning Foundations &amp; Techniques</b>		No. of Credits:3 L : T : P : S = <b>3:0:0:0</b>
Course Category: <b>PCC</b>		Total no. of Hours = <b>40+50</b>
CIE: <b>50 Marks</b>	SEE: <b>50 Marks</b>	Exam Hours: <b>03</b>
Course Pre-requisites: <b>Probability and Linear Algebra</b>		

## 1. PREAMBLE ABOUT THE COURSE

This course equips learners with essential machine learning skills, starting from linear algebra concepts like SVD and PCA for data optimization. It covers unsupervised techniques such as K-means and GMM for pattern discovery, and supervised models like SVM, Decision Trees, and K- NN for prediction tasks. Students will also design and train neural networks using scikit-learn to solve real-world problems effectively.

## 2. COURSE LEVEL OBJECTIVES

Sl. No	Course Learning Objectives (CLO)
CLO1	<b>To Master Linear Algebra for Machine Learning:</b> Apply concepts like symmetric matrices, singular value decomposition (SVD), and Principal Component Analysis (PCA) to optimize data representation and dimensionality reduction.
CLO2	<b>To Implement Unsupervised Learning Algorithms:</b> Analyze and implement unsupervised learning techniques, including K-means, Kernel K-means, and Gaussian Mixture Models, for clustering and pattern discovery.
CLO3	<b>To Develop and Evaluate Supervised Models:</b> Build regression and classification models using Least Squares, K-NN, Decision Trees, and SVM, assessing performance with metrics like accuracy, precision, recall, F1 score, and ROC-AUC.
CLO4	<b>To Design and Train Neural Networks:</b> Construct and train neural network models, including MLP Classifiers and Regressors, using scikit-learn to solve real-world problems effectively.

## 3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSO's	Cognitive Level	WK	Class Hours

CO1	<b>Understand and Apply Linear Algebra Concepts:</b> Demonstrate an understanding of symmetric matrices, singular value decomposition (SVD), and Principal Component Analysis (PCA)	PO1,PO2,PO3,PO5,PO10,PO11, PSOs-2	L3	WK-2,3	8
CO2	<b>Implement Unsupervised Learning Techniques:</b> Analyze and implement unsupervised learning algorithms, including K- means, Kernel K-means, and Gaussian Mixture Models	PO1,PO2,PO3,PO5,PO10,PO11, PSOs-2	L3	WK- 2,4,6,8	
CO3	<b>Develop and Evaluate Supervised Learning Models:</b> Develop supervised learning models using techniques like Least Squares, K-NN, evaluating performance with accuracy, precision, recall, F1 score, and ROC-AUC.	PO1,PO2,PO3,PO5,PO10,PO11, PSOs-2	L3	WK- 2,4,6,8	
CO4	<b>Design and Train Neural Network Models:</b> Design, implement, and evaluate neural network models like MLP using scikit-learn to solve real-world problems.	PO1,PO2,PO3,PO5,PO10,PO11, PSOs- 2	L3	WK- 2,4,6,8	

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	<p>Linear Algebra - Symmetric matrices: Introduction to Symmetric Matrices, Properties of Symmetric Matrices, Computation with Symmetric Matrices, Linear Algebra - Singular value decomposition: Introduction to Singular Value Decomposition, Properties and Interpretation of SVD, Applications of SVD.</p> <p>Principal Component Analysis in Image Processing: Introduction to Principal Component Analysis, Steps in PCA, PCA for Image Processing</p> <p>Implementation: Using Python libraries (NumPy, SciPy) for computations with symmetric matrices, SVD</p> <p><b>Textbook 1: Ch 4.1,4.2,4.3,4.4,4.5,10.4,10.5,10.6</b>  <b>Textbook 3: Ch 12.1</b></p>	1,2	8

II	<p>Unsupervised Learning - Clustering - K-means/Kernel K-means. Unsupervised Learning - Estimation - Recap of MLE + Bayesian estimation, Gaussian Mixture Model - EM algorithm.</p> <p>Implementation using Python (NumPy, scikit-learn), Visualization of clustering results, Case study: K-means applied to customer segmentation</p> <p><b>Textbook 2: Ch10.3,10.4,10.5.1,10.5.2</b>  <b>Textbook 3: Ch 9.2,9.4</b>  <b>Textbook 1 : Ch11.1,11.2,11.3</b></p>	2	8
III	<p>Supervised Learning - Regression - Least Squares; Bayesian view. Supervised Learning - Regression - Ridge/LASSO. Supervised Learning - Classification - K-NN. Supervised Learning - Classification - Generative Models.</p> <p>Implementation using Python (scikit-learn) supervised learning models for regression (Least Squares, Ridge/LASSO) and classification (K-NN, Generative Models)</p> <p><b>Textbook 3: Ch 3.1,3.2,3.3,3.4,3.6,4.1,4.2</b></p>	3	8
IV	<p>Introduction to Linear Discriminative Functions, Decision surfaces, Generalized Linear Discriminant Functions, The Two-category Linearly separable case. Minimizing the perceptron criterion Function. SVM. Examples of probabilistic models in machine learning problems: Model Assessment and Evaluation-Metrics for evaluating models: accuracy, precision, recall, F1 score, ROC curves and AUC, Cross-validation and model selection.</p> <p>Implementation using Python libraries (scikit-learn, Tensor Flow Probability) discriminative models like Perceptron and SVM. Evaluate model performance with accuracy, precision, recall, F1 score, ROC-AUC, and apply cross-validation for model selection.</p> <p><b>Textbook 2: Ch 5.1,5.2,5.3,5.4,5.5.1,5.5.2,5.11</b></p>	3,4	8
V	<p>Neural networks models in scikit-learn: History and development of neural networks, Biological inspiration and artificial neurons, Basic concepts: Neurons, layers, activation functions, Single-layer, multi-layer, Multi-layer Perceptron (MLP), Training Neural Networks, Evaluating Neural Network Models</p> <p>Implementation using Python Libraries: Practical implementation of neural networks using scikit-learn, focusing on Multi-layer Perceptron (MLP) Classifier and Regressor.</p> <p><b>Textbook 4: Ch 6.1,6.2,6.3,6.4,6.5.1 to 6.5.7</b></p>	4	8

## 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 (2020)	2020	1 & 2
2	Pattern classification	Richard O. Duda, Peter E. Hart, David G. Stork	Wiley	2001	2&4
3	Pattern Recognition and Machine Learning	Christopher M. Bishop	Springer Science & Business Media, LLC	2006	1,2 & 3
4	Deep Learning	Ian Goodfellow, Yoshua Bengio, and Aaron Courville	MIT Press	2016	4

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

1. <https://analyticsindiamag.com/optimisation-machine-learning-methods-gradient-descent/>
2. <https://serokell.io/blog/ml-optimization>
3. <https://machinelearningmastery.com/why-optimization-is-important-in-machine-learning/>

## 7. MOOCs:

1. Deep Learning specialization in Coursera.
2. <https://nptel.ac.in/courses/106106184>
3. <https://www.udemy.com/topic/deep-learning/>

## 8. EVALUATION METHODOLOGY

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

### CIE Framework:

**Scheme of Examination (CIEg bnm):** 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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

### Scheme of Examination (SEE):

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.

- The students will have to answer five full questions, selecting one full question from each module.

	Component	Marks	Max Marks	Total Marks
CIE	CIE Test-1	40	40	50
	CIE Test-2	40		
	AAT	10	10	
SEE	Semester End Examination	100		50
	<b>Grand Total</b>			100

## 1. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 2. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

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

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

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Department: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: <b>IV</b>	Course Code: <b>BAML24404</b>	Contact Hrs /week: <b>03</b>
Course Description: <b>DATABASE MANAGEMENT SYSTEMS</b>		No. of Credits: <b>03</b> L : T : P : S = <b>3:0:0:2</b>
Course Category: <b>PCC</b>		Total no. of Hours = 40+50
CIE: <b>50 Marks</b>	SEE: <b>50 Marks</b>	Exam Hours: <b>03</b>
Course Pre-requisites: <b>Basic programming skills</b>		

## 1. PREAMBLE ABOUT THE COURSE

Data is the backbone of modern technology, driving everything from business intelligence to artificial intelligence. The **Database Management Systems (DBMS)** course provides a structured approach to managing, organizing, and retrieving data efficiently. It equips learners with the theoretical foundations and practical skills needed to design, implement, and optimize databases for diverse applications. Understanding DBMS principles is essential for careers in software development, data science, cybersecurity, and cloud computing.

## 2. COURSE LEVEL OBJECTIVES

Sl. No	Course Learning Objectives (CLO)
1	Understand database concepts and structured query language (SQL)
2	Understand the fundamentals of Entity Relationship model and designing of ER model
3	Design and build a database system for various use cases.
4	Apply PL/SQL programming techniques using advanced concepts of RDBMS.

## 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 fundamental concepts of database systems, including data models, database architecture and the role of DBMS in managing data.	POs- 1,3,4,11 PSOs-2	2,3	1,2	10
CO2	Design and model databases using Entity-Relationship (ER) diagrams and translate them into relational schemas.	POs- 1,2,3,4,5,10,1 1 PSOs-2	3	3,4	10
CO3	Apply relational algebra and SQL queries to retrieve, update, and manage data effectively in a relational database.	POs- 1,2,3,4,11 PSOs-	3	3,4	10
CO4	Demonstrate normalization techniques to design efficient and redundancy-free relational databases.	POs- 1,2,3,4,5,10,1 1 PSOs-2	3	4,5,6	10

CO5	Describe and implement transaction management, concurrency control, and recovery techniques to ensure database consistency and reliability	POs- 1,2,3,4,5.1 1 PSOs-2	3	3,4,5,6	10
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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	<p><b>Basics of Database</b> Introduction and applications of DBMS, Purpose of database, View of Data, Database Languages, Database architecture, Database users and DBA</p> <p><b>Relational Model</b> Structure of Relational Databases, Database Schema, Keys, Relational Operations and Relational Algebra</p> <p><b>Textbook 1: Ch 1.1-1.5, 1.9,1.12, 2.1-2.6</b></p>	1,2	10
II	<p><b>Entity Relationship Model</b> Basic Concepts and definitions, Constraints, Entity Relationship Diagram, Weak Entity Sets, Extended E-R Features, Conversion of ER diagram into relations</p> <p><b>SQL</b> Introduction to SQL, Data Definition of SQL, Basic structure of SQL queries, Basic SQL operations (rename, string operations, order by, where clause), Set operations, Null values, Aggregate functions, Nested Subqueries, Modification of Database, JOIN expressions, Views, Integrity constraints, Data types and Schemas, Authorization</p> <p><b>Textbook 1: Ch 7.1-7.9, 3.1-3.9, 4.1-4.6</b></p>	2,3	10
III	<p><b>Relational Database Design</b> First Normal Form, Decomposition, Desirable Properties of Decomposition, Functional Dependencies, Second and Third Normal Form and Boyce-Codd Normal Form</p> <p><b>Advanced SQL</b> Introduction, Cursors, Stored Procedures, Stored Functions, Triggers, Partitioning</p> <p><b>Indexing and Hashing</b> Basic concepts, Ordered Indices, Hash Based Indexing, Tree based Indexing</p> <p><b>Textbook 1: Ch 8.1-8.9, 5.1-5.6, 11.1-11.7</b></p>	4	10
IV	<p><b>Transaction Management and concurrency</b> Transaction concepts, properties of transactions, serializability, testing for serializability, Transaction Isolation and Atomicity, Transaction isolation levels, Implementation of isolation levels, Lock based protocols, Deadlock handling, Timestamp based protocols, two- phase locking protocol</p> <p><b>Textbook 1: Ch 14.1-14.10, 15.1-15.7</b></p>	5	10
V	<p><b>Recovery System and database-system architecture</b> Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, Buffer Management, Failure with Loss of Nonvolatile Storage, Early Lock Release and Logical Undo Operations ,Centralized and Client –Server, Architectures, Server System</p>	5	10

	Architectures, Parallel Systems, Distributed Systems		
	<b>Textbook 1: Ch 16.1-16.7, 17.1-17.4</b>		

## 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Database System Concepts	Silberschatz, Abraham, Henry F. Korth, and S. Sudarshan	McGraw-Hill, 2011	6th ed.	All
2	Fundamentals of Database Systems.	Elmasri, Ramez, and Shamkant B. Navathe	Addison-Wesley, 2010	6th ed.,	All
3	Database Systems: The Complete Book.	Garcia-Molina, Hector, Jeffrey D. Ullman, and Jennifer Widom.	Pearson, 2008.	2nd ed.,	All

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

### E-Books / Web References:

1. <https://www.geeksforgeeks.org/dbms/>

### MOOCs:

2. [https://onlinecourses.nptel.ac.in/noc19\\_cs46/preview](https://onlinecourses.nptel.ac.in/noc19_cs46/preview)

## 7. EVALUATION METHODOLOGY

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

### CIE Framework:

#### Scheme of Examination (CIE):

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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

#### Scheme of Examination (SEE):

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module.

	Component	Marks	Max Marks	Total Marks
CIE	CIE Test-1	40	40	50
	CIE Test-2	40		
	AAT	10	10	
SEE	Semester End Examination	100		50
	<b>Grand Total</b>			100

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

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

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

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Department: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: <b>IV</b>	Course Code: <b>BAMLL24405</b>	Contact Hrs /week: <b>2</b>
Course Description: <b>DATABASE MANAGEMENT SYSTEMS LAB</b>		No. of Credits: 1 L : T : P : S = <b>0:0:2:0</b>
Course Category: <b>PCCL</b>		Total no. of Hours = <b>30</b>
CIE: <b>50 Marks</b>	SEE: <b>50 Marks</b>	Exam Hours: <b>03</b>
Course Pre-requisites: <b>Basic Programming languages.</b>		

## 1. PREAMBLE ABOUT THE COURSE

The Database Management System (DBMS) Lab is designed to provide hands-on experience in designing, implementing, and managing databases efficiently. This practical course complements theoretical knowledge by allowing students to apply data modeling techniques, query optimization, transaction management, and indexing mechanisms in real-world scenarios.

## 2. COURSE LEVEL OBJECTIVES

Sl. No	Course Learning Objectives (CLO)
1	Foundation knowledge in database concepts, technology and practice to groom students into well-informed database application developers.
2	Strong practice in SQL programming through a variety of database problems.
3	Develop database applications using front-end tools and back-end DBMS.

## 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 and implement relational database concepts by creating schemas, populating data, and applying constraints using SQL commands.	POs-1,2,3,5,7,9,11 PSOs-1	3	3,4,5	4
CO2	Apply SQL queries to retrieve, manipulate, and manage data efficiently using selection, joins, nested queries, views, and partitioning techniques.	POs-1,2,3,5,7,9,11 PSOs-1	3,4	5,6	4
CO3	Develop and demonstrate the use of advanced SQL concepts such as aggregate functions, groupings, and sub-queries for solving complex business problems.	POs-1,2,3,5,7,9,11 PSOs-1	4	4,5,6	4
CO4	Design and implement PL/SQL procedures to solve real-world scenarios and perform update operations reflecting data integrity and consistency.	POs-1,2,3,5,7,9,11 PSOs-1	4	6,8,9	4

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

## 4. SYLLABUS

Module/ program No.	Module Description	Mapped COs	No. of Hours
<b>PART-A: SQL Programming (Max. Exam Marks. 50)</b> 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.			
<b>I</b>	<p>Aim: Demonstrating creation of tables, applying the view concepts on the tables.</p> <p>Program Consider the following schema for a Library Database: <b>BOOK (Book_id, Title, Publisher_Name, Pub_Year)</b> <b>BOOK_AUTHORS (Book_id, Author_Name)</b> <b>PUBLISHER(Name, Address, Phone)</b> <b>BOOK_COPIES(Book_id, Programme_id, No-of_Copies)</b> <b>BOOK_LENDING(Book_id, Programme_id, Card_No, Date_Out, Due_Date)</b> <b>LIBRARY_PROGRAMME(Programme_id, Programme_Name, Address)</b></p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> <li>Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each Programme, etc.</li> <li>Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun 2017.</li> <li>Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation.</li> <li>Partition the BOOK table based on year of publication. Demonstrate its working with a simple query.</li> <li>Create a view of all books and its number of copies that are currently available in the Library.</li> </ol> <p>Reference: <a href="https://www.youtube.com/watch?v=AaSUAoguls">https://www.youtube.com/watch?v=AaSUAoguls</a> <a href="https://www.youtube.com/watch?v=-EwEvJxS-Fw">https://www.youtube.com/watch?v=-EwEvJxS-Fw</a></p>	1,2	4
<b>II</b>	<p>Aim: Discuss the various concepts on constraints and update operations.</p> <p>Program: Consider the following schema for Order Database: <b>SALESMAN (Salesman_id, Name, City, Commission)</b> <b>CUSTOMER(Customer_id, Cust_Name, City, Grade, Salesman_id)</b> <b>ORDERS(Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id)</b></p> <p>Write SQL queries to</p> <p>Count the customers with grades above Bangalore 's average.</p> <ol style="list-style-type: none"> <li>Find the name and numbers of all salesman who had more than one customer.</li> <li>List all the salesman and indicate those who have and don't have customers in their cities (Use UNION operation.)</li> <li>Create a view that finds the salesman who has the customer with the highest order of a day.</li> <li>Demonstrate the DELETE operation by removing</li> </ol>		

	<p>salesman with id 1000. All his orders must also be deleted.</p> <p>Reference:  <a href="https://www.youtube.com/watch?v=AA-KL1jbMeY">https://www.youtube.com/watch?v=AA-KL1jbMeY</a></p>		
III	<p>Aim: Demonstrate the concepts of JOIN operations. Program: Consider the schema for Movie Database:</p> <p><b>ACTOR(Act_id, Act_Name, Act_Gender)</b>  <b>DIRECTOR(Dir_id, Dir_Name, Dir_Phone)</b>  <b>MOVIES(Mov_id, Mov_Title, Mov_Year, Mov_Lang, Dir_id)</b> <b>MOVIE_CAST(Act_id, Mov_id, Role)</b> <b>RATING(Mov_id, Rev_Stars)</b></p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> <li>1. List the titles of all movies directed by <u>Hitchcock</u> ‘.</li> <li>2. Find the movie names where one or more actors acted in two or more movies.</li> <li>3. List all actors who acted in a movie before 2000 and also in a movie after 2015(use JOIN operation).</li> <li>4. Find the title of movies and number of stars for each movie that has at least one rating and find the highest number of stars that movie received. Sort the result by movie title.</li> <li>5. Update rating of all movies directed by <u>Steven Spielberg</u> ‘to 5.</li> </ol> <p>Reference:  <a href="https://www.youtube.com/watch?v=hSiCUNVKJAo">https://www.youtube.com/watch?v=hSiCUNVKJAo</a>  <a href="https://www.youtube.com/watch?v=Eod3aQkFz84">https://www.youtube.com/watch?v=Eod3aQkFz84</a></p>	3	4
IV	<p>Aim: Introduce concepts of PLSQL and usage on the table. Program: Consider the schema for College Database: STUDENT (USN, SName, Address, Phone, Gender) SEMSEC (SSID, Sem, Sec) CLASS (USN, SSID) COURSE (Subcode, Title, Sem, Credits) IAMARKS (USN, Subcode, SSID, Test1, Test2, Test3, FinalIA) Write SQL queries to</p> <ol style="list-style-type: none"> <li>1. List all the student details studying in fourth semester <u>C</u> ‘section.</li> <li>2. Compute the total number of male and female students in each semester and in each section.</li> <li>3. Create a view of Test1 marks of student USN <u>1BI15CS101</u> ‘ in all Courses.</li> <li>4. Calculate the FinalIA (average of best two test marks) and update the corresponding table for all students.</li> <li>5. Categorize students based on the following criterion:  If FinalIA = 17 to 20 then CAT = <u>Outstanding</u> ‘  If FinalIA = 12 to 16 then CAT = <u>Average</u> ‘ If FinalIA &lt; 12 then CAT = <u>Weak</u> ‘</li> </ol> <p>Give these details only for 8th semester A, B, and C section students.</p> <p>Reference:  <a href="https://www.youtube.com/watch?v=horURQewW9c">https://www.youtube.com/watch?v=horURQewW9c</a>  <a href="https://www.youtube.com/watch?v=P7-wKbKrAhk">https://www.youtube.com/watch?v=P7-wKbKrAhk</a></p>	3,4	4

V	<p>Aim: Demonstrate the core concepts on table like nested and correlated nesting queries and also EXISTS and NOT EXISTS keywords.</p> <p>Program: Consider the schema for Company Database:  <b>EMPLOYEE(SSN, Name, Address, Sex, Salary, SuperSSN, DNo) DEPARTMENT(DNo, DName, MgrSSN, MgrStartDate) DLOCATION(DNo,DLoc)</b>  <b>PROJECT(PNo, PName, PLocation, DNo)</b>  <b>WORKS_ON(SSN, PNo, Hours)</b></p> <p>Write SQL queries to Make a list of all project numbers for projects that involve an employee whose last name is <u>Scott</u>, either as a worker or as a manager of the department that controls the project.</p> <p>Show the resulting salaries if every employee working on the <u>IoT</u> project is given a 10 percent raise.</p> <p>Find the sum of the salaries of all employees of the <u>Accounts</u> department, as well as the maximum salary, the minimum salary, and the average salary in this department</p> <p>Retrieve the name of each employee who works on all the projects controlled by department number 5 (use NOT EXISTS operator).</p> <p>For each department that has more than five employees, retrieve the department number and the number of its employees who are making more than Rs.6,00,000.</p> <p>Reference:  <a href="https://www.youtube.com/watch?v=Dk8f3ejqKts">https://www.youtube.com/watch?v=Dk8f3ejqKts</a></p>	3,4	4
<b>PART B</b>			
<p><b>Mini project:</b> For any problem selected, make sure that the application should have five or more tables. Indicative areas include: Organization, health care, Ecommerce etc.</p>			

## 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Database System Concepts	Silberschatz, Abraham, Henry F. Korth, and S. Sudarshan	McGraw-Hill, 2011	6th ed.	All
2	Fundamentals of Database Systems.	Elmasri, Ramez, and Shamkant B. Navathe	Addison-Wesley, 2010	6th ed.,	All

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

- <https://www.geeksforgeeks.org/dbms/>

## 7. EVALUATION METHODOLOGY

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

<b>ASSESSMENT AND EVALUATION PATTERN</b>		
	<b>CIE</b>	<b>SEE</b>
<b>WEIGHTAGE</b>	<b>50%</b>	<b>50%</b>
Record	10	<b>50</b>
Test	20	
Experiential Learning (Mini Project)	20	NIL
<b>Total Marks for The Course</b>	<b>50</b>	<b>50</b>

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs →	P01	P02	P03	P04	P05	P06	P07	P08	P09	PO10	PO11
COs ↓											
CO1	3	3	3	-	2	-	2	-	2	-	2
CO2	3	3	2	-	2	-	2	-	2	-	2
CO3	3	3	2	-	2	-	2	-	2	-	2
CO4	3	3	2	-	2	-	2	-	2	-	2

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

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

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

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# GLOBAL ACADEMY OF TECHNOLOGY

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



Department: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: <b>IV</b>	Course Code: <b>BAML24406A</b>	Contact Hrs /week: <b>3</b>
Course Description: <b>OPTIMIZATION TECHNIQUES</b>		No. of Credits: L : T : P : S = <b>3:0:0:0</b>
Course Category: <b>ETC</b>		Total no. of Hours = <b>50</b>
CIE: <b>50 Marks</b>	SEE: <b>50 Marks</b>	Exam Hours: <b>03</b>
Course Pre-requisites: Algorithmic and Programming skills , Mathematical Foundations		

## 1. PREAMBLE ABOUT THE COURSE

Optimization techniques are at the heart of computational efficiency and problem-solving, helping engineers, data scientists, and decision-makers find the best possible solutions within given constraints. This course provides a structured approach to understanding and implementing mathematical, algorithmic, and heuristic optimization methods across various domains.

## 2. COURSE LEVEL OBJECTIVES

Sl. No.	Course Learning Objectives (CLO)
1	Appreciate the importance of linear algebra in computer science and allied engineering science.
2	Gain the knowledge of linear algebra tools and concepts to implement them in their core domain.
3	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	Apply the concepts of vector calculus to solve the given problem.	PO1, PO2, PO3, PSOs-2	L3	3,4	8
CO2	Apply the concepts of partial differentiation in machine learning and deep neural networks.	PO2, PO3, PO4, PO5, PO11 PSOs-2	L3	3,4	8
CO3	Analyze the convex optimization algorithms and their importance in computer science & engineering.	PO1, PO2, PO3, PO4, PO5, PO11, PSOs-2	L3	5,6,7	8
CO4	Apply the optimization algorithms to solve the problem.	PO1,PO2,PO3, PO4,PO5,PO11 PSOs-2	L3	3,4	8
CO5	Analyze the advanced optimization algorithms for machine learning	PO3,PO4,PO5, PO11 PSOs-2	L3	3,4,5,6	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	<b>Vector Calculus:</b> 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.  <b>Textbook 1:</b> Ch 5.1,5.2,5.3,5.4,5.5,5.8.	1	8
II	<b>Vector Calculus:</b> Backpropagation and automatic differentiation, Higher- Order Derivative <b>Probability and Distributions:</b> construction of a Probability Space, Discrete and Continuous Probabilities, Sum Rule, Product Rule, and Bayes 'Theorem  <b>Textbook 1:</b> Ch 5.6,5.7, 6 -6.1,6.2,6.3	2	8
III	<b>Continuous Optimization:</b> Optimization Using Gradient Descent, constrained Optimization and Lagrange Multipliers <b>Convex Optimization:</b> Local and global optima, convex sets and functions separating hyperplanes.  <b>Textbook 1:</b> Ch – 7.1,7.2,7.3, 12.1	3	8
IV	<b>Convex optimization in finite dimension:</b> Dual Support Vector Machines, Kernels, the center of gravity method, the ellipsoid method, Vaidya 's cutting plane method, Conjugate gradient method.  <b>Textbook 1:</b> Ch 12.1,12.2,12.3, 2	4	8
V	<b>Dimension-free convex optimization:</b> Projected sub gradient descent for Lipschitz functions, Gradient descent for smooth functions, Conditional gradient descent, Strong convexity.  <b>Textbook 1:</b> Ch 3.1,3.2,3.3,3.4	5	8

#### 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	2020	All
2	Convex Optimization: Algorithms and Complexity, Foundations and Trends in Optimization,	S. Bubeck	Now Publisher	2015.	

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

##### Books / Web References:

- <https://ocw.mit.edu/courses/mathematics/18-06sc-linear-algebra-fall-2011/index.html>
- <https://www.math.ucdavis.edu/~linear/linear.pdf>

3. <https://www.coursera.org/learn/linear-algebra-machine-learning>
4. <https://nptel.ac.in/syllabus/111106051/>
5. [https://github.com/epfml/OptML\\_course](https://github.com/epfml/OptML_course)
6. <https://www.youtube.com/playlist?list=PL4O4bXkI-fAeYrsBqTUYn2xMjJAqlFQzX>

## 7. EVALUATION METHODOLOGY

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

### CIE Framework: Scheme of Examination (CIE):

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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

### Scheme of Examination (SEE):

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module. The students will have to answer five full questions, selecting one full question from each module.

	Component	Marks	Max Marks	Total Marks
CIE	CIE Test-1	40	40	50
	CIE Test-2	40		
	AAT	10	10	
SEE	Semester End Examination	100		50
	<b>Grand Total</b>			100

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

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

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

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# GLOBAL ACADEMY OF TECHNOLOGY

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



Department: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: <b>IV</b>	Course Code: <b>BAML24406B</b>	Contact Hrs /week: <b>03</b>
Course Description: <b>FOUNDATION OF DATA SCIENCE</b>		No. of Credits: <b>3</b> L : T : P : S = <b>3:0:0:0</b>
Course Category: <b>ETC</b>		Total no. of Hours = <b>50</b>
CIE: <b>50 Marks</b>	SEE: <b>50 Marks</b>	Exam Hours: <b>03</b>
Course Pre-requisites: <i>Probability and Linear Algebra, programming skills</i>		

## 1. PREAMBLE ABOUT THE COURSE

Data has become the driving force behind decision-making, innovation, and problem-solving across industries. The Foundations of Data Science course equips learners with the essential tools, techniques, and theoretical principles required to analyze, interpret, and leverage data effectively. This course introduces core statistical concepts, data wrangling techniques, machine learning basics, and computational methods that form the backbone of modern data-driven applications

## 2. COURSE LEVEL OBJECTIVES

Sl No.	Course Learning Objectives (CLO)
1	To provide fundamental knowledge on data science with quering and analytics required for the field of data science.
2	To understand the process of handling heterogeneous data, pre-process and visualize them for better understanding
3	To gain the fundamental knowledge on data science tools and gain basic skill set to solve real-time data science 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	Use fundamental knowledge of data science.	PO1, PO2, PO3, PO9, PO11, PSOs-2	L2	2,3	8
CO2	Demonstrate proficiency in data analytics	PO2, PO3, PO5, PO11, PSOs-2	L2	3,4,5	8
CO3	Formulate insights from data through statistical inferences	PO1, PO2, PO3, PO5, PO9, PO11 PSOs-2	L3	5,6	8
CO4	Apply advanced tools to work on dimensionality reduction and mathematical operations.	PO1,PO2,PO3,PO PO4,PO5,PO9,PO 11 PSOs-2	L3	8.9	8

CO5	Demonstrate numerous open-source data science tools to solve real-world problems through industrial case studies	PO3,PO4, PO5,PO9,PO 11 PSOs-2	L3	8,9	8
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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	<p><b>Data Science Introduction:</b> Need or Data Science –What is Data Science – Data Science Process, Business Intelligence and Data Science, Prerequisite for Data Scientist, Components of Data Science, Tools and Skills Need</p> <p><b>Data:</b> Introduction, Data Types, Data Collections, Data Pre-processing.</p> <p><b>Textbook 1:</b> Ch 1,2</p>	1	8
II	<p><b>Platform for Data Science:</b> Python for Data Science- Python Libraries – Data Frame Manipulation with NumPy and pandas – Exploration Data Analysis – Time Series Dataset – Clustering with Python – Dimensionality Reduction.</p> <p><b>Textbook 1:</b> Ch 7.1-7.7</p>	2,3	8
III	<p><b>Data Modelling and Analytics:</b> Analytics for Data Science, Data Analytics Examples, Data Analytics Life Cycle, Data Discovery, Data preparation, Model Planning, Model Building, Communicate Results, Operationalization</p> <p><b>Data Analytics and Text Mining:</b> Text Mining, Major Text Mining Areas</p> <p><b>Textbook 1:</b> Ch 4(FULL),6 -6.1,6.2</p>	2,3	8
IV	<p><b>Data Analytics and Text Mining:</b> Text Analytics, Text Analysis Subtasks, Basic Text Analysis Steps.</p> <p><b>Data Science Tool: Python:</b> Python for Machine Learning, Algorithms: KNN, Decision Tree, Random Forest, SVM, Python IDEs for Data Science</p> <p><b>Textbook 1:</b> Ch 4, 6 -6 .2, 7 -7.8,7.9,7.10</p>	4	8
V	<p><b>Data Science Methods and Machine learning:</b> Regression Analysis, Linear Regression, Logistic Regression, Machine Learning</p> <p><b>Data Visualization using Tableau:</b> Introduction to Data Visualization, Tableau Basics, Dimensions, Measures and Descriptive Statistics, Basic Charts.</p> <p><b>Textbook 1:</b> Ch 5 (FULL), 11.1,11.2, 11.3,11.4</p>	5	8

## 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Fundamentals of Data Science	Sanjeev Wagh, Manish Bhende, Anuradha Thakare,	CRC Press	1st, 2022	All
2	Modern Data Science with R	Benjamin S Baumer, Daniel T, Kaplan and Nicholas J Horton	Chapman and Hall/ CRC	2021	--
3	Practical Data Science with R	John Mount, And Nina Zumel	Wiley	2 <sup>nd</sup>	--

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

1. [https://onlinecourses.nptel.ac.in/noc24\\_cs68/preview](https://onlinecourses.nptel.ac.in/noc24_cs68/preview)
2. [https://onlinecourses.nptel.ac.in/noc24\\_cs53/preview](https://onlinecourses.nptel.ac.in/noc24_cs53/preview)

## 7. EVALUATION METHODOLOGY

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

### CIE Framework: Scheme Examination (CIE):

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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

### Scheme of Examination (SEE):

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module. The students will have to answer five full questions, selecting one full question from each module.

	Component	Marks	Max Marks	Total Marks
CIE	CIE Test-1	40	40	50
	CIE Test-2	40		
	AAT	10	10	
SEE	Semester End Examination	100		50
	<b>Grand Total</b>			100

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

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

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

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# GLOBAL ACADEMY OF TECHNOLOGY

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



Department: Artificial Intelligence and Machine Learning		
Semester: <b>IV</b>	Course Code: <b>BAML24406C</b>	Contact Hrs /week: <b>03</b>
Course Description: <b>OBJECT ORIENTED PROGRAMMING USING JAVA</b>		No. of Credits: L : T : P : S = <b>3:0:0:2</b>
Course Category: <b>ETC</b>		Total no. of Hours = <b>40+50</b>
CIE: <b>50 Marks</b>	SEE: <b>50 Marks</b>	Exam Hours: <b>03</b>
Course Pre-requisites: <b>Programming Concepts</b>		

## 1. PREAMBLE ABOUT THE COURSE

The course emphasizes the core principles of object-oriented design, including encapsulation, inheritance, polymorphism, and abstraction and is designed to introduce students to the fundamental concepts of object-oriented programming (OOP) through the Java programming language. Java is a widely-used, versatile, and platform-independent language that provides a strong foundation for understanding modern software development practices. This course. Students will learn to structure software solutions using classes and objects, apply design principles, and develop robust, maintainable applications.

## 2. COURSE LEVEL OBJECTIVES

Sl. No	Course Learning Objectives (CLO)
1	Understand fundamental features of object-oriented language and JAVA
2	Set up Java JDK environment to create, debug and run simple Java programs
3	Understand object-oriented concepts using programming techniques
4	Apply the importing of packages, exception handling mechanism, threads and swings concepts to build applications.

## 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	Develop Java programs by using different Object Oriented concepts like inheritance, polymorphism, Nested classes, Constructors, Destructors.	PO1, PO2, PO3, PO5, PO8, PO9, PO10, PO11, PSOs - 1	L3	2,4,6	10

CO2	Analyze and understand the basic Object Oriented concepts using Java with the help of Data types, variables and arrays, Operators, Control Statements.	PO1, PO2, PO3, PO5, PO8, PO9, PO10, PO11, PSOs - 1	L3	2,4,6	10
CO3	Inspect inheritances, exceptions, packages concepts and exception handling using JAVA.	PO1, PO2, PO3, PO5, PO8, PO9, PO10, PO11, PSOs - 1	L3	2,4,6	10
CO4	Utilize the concept of Threading and multi-thread programming in real time applications.	PO1, PO2, PO3, PO5, PO8, PO9, PO10, PO11, PSOs - 1	L3	2,4,6	10
CO5	Design and develop user interface using Swings and its components.	PO1, PO2, PO3, PO5, PO8, PO9, PO10, PO11, PSOs - 1	L3	2,4,6	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	<p><b>Introduction to Object Oriented Concepts:</b> The History and Evolution of Java, Java's Lineage, The Creation of Java, How Java changed the Internet</p> <p><b>Introduction to Java:</b> Java's magic: the Byte code, Java Development Kit (JDK), The Java Buzzwords, The Three OOP Principles, Simple Java programs, and primitive data types.</p> <p><b>Textbook 1:</b> Ch 1.1 to 1.8`</p>	1,2	10
II	<p><b>An Overview of Java,</b> Literals, Type Conversion and Casting, Automatic type Promotion, and arrays, Operators, Control Statements, Selection statement, Iteration statement, Jump statements, Strings and string methods.</p> <p><b>Textbook 1:</b> Ch 2, 3, 4, 5, 16</p>	1,2,	10
III	<p><b>Class and Objects:</b> Introduction, member functions and data, objects and functions, objects and arrays, Namespaces, Nested classes, Constructors, Destructors</p> <p><b>Classes, Inheritance, Exceptions, Packages and Interfaces:</b> Classes: Classes fundamentals; Declaring objects; Constructors, Interface.</p> <p><b>Inheritance:</b> Inheritance basics, using super, creating multi-level hierarchy, method overriding and overloading.</p> <p><b>Textbook 1:</b> Ch 6,8, 9</p>	2,3	10
IV	<p><b>Exception handling:</b> Exception handling in Java. Packages, Access Protection, Importing Packages, Interfaces.</p> <p><b>Multi-Threaded Programming:</b> Multi-Threaded Programming: What are threads? How to make the classes threadable; Extending threads; Implementing runnable; Synchronization; Changing state of the thread; Bounded buffer problems, read write problem, producer consumer problems.</p>	3,4	10

	<b>Textbook 1: Ch 10,11</b>		
V	<b>Swings:</b> Window Fundamentals, The origins of Swing; Two key Swing features; Components and Containers; The Swing Packages; A simple Swing Application, textbox, buttons, labels, radio button Checkbox. Two event handling mechanisms, Event listener interfaces.  <b>Textbook 1: Ch 24, 25, 31</b>	3,4	<b>10</b>

## 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Java: The Complete Reference	Schildt, Herbert	New York: McGraw- Hill, 2011	8th	1,2,3,4&5
2	Object Oriented Programming with C++	Sourav Sahay	Oxford University Press,2006	2nd	1,2,3,4&5
3	Programming with Java	Balagurusamy	McGraw Hill	6th, 2019	1,2,3,4&5

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

### Books / Web References:

1. <https://www.javatpoint.com/java-tutorial>
2. [https://onlinecourses.nptel.ac.in/noc22\\_cs102/](https://onlinecourses.nptel.ac.in/noc22_cs102/)
3. <https://www.geeksforgeeks.org>
4. <https://devfreebooks.github.io/java/>
5. <https://www.codejava.net/books/4-best-free-java-e-books-for-beginners>

### MOOCs:

1. <https://in.coursera.org/specializations/java-programming>
2. [https://infyspringboard.onwingspan.com/web/en/app/toc/lex\\_auth\\_013788171933728768154\\_shared/overview](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013788171933728768154_shared/overview)

## 7. EVALUATION METHODOLOGY

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

### CIE Framework:

### Scheme of Examination (CIE):

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/ concept videos/ partial reproduction of research work/ oral presentation of

research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

	Components	Marks	Total
CIE	CIE TEST 1	40	50
	CIE TEST 2	40	
	AAT	10	
SEE	SEE	Semester End Exam	50
Grand Total			100

#### Scheme of Examination (SEE):

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module.

### 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

### 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

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

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

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# GLOBAL ACADEMY OF TECHNOLOGY

Autonomous Institution Affiliated to Visveswaraya Technological University

Approved by UGC, AICTE and Govt of Karnataka



Department: Artificial Intelligence and Machine Learning		
Semester: <b>IV</b>	Course Code: <b>BAML24406D</b>	Contact Hrs /week: <b>03</b>
Course Description: <b>ALGORITHMIC GAME THEORY</b>		No. of Credits: L : T : P : S = <b>3:0:0:2</b>
Course Category: <b>ETC</b>		Total no. of Hours = <b>50+40</b>
CIE: <b>50 Marks</b>	SEE: <b>50 Marks</b>	Exam Hours: <b>03</b>
Course Pre-requisites: <b>Problem Solving skills</b>		

## 1. PREAMBLE ABOUT THE COURSE

This course introduces fundamental concepts in both game theory and algorithm design, including Nash equilibria, auctions, pricing mechanisms, congestion games, complexity of equilibria, and incentive compatibility.

## 2. COURSE LEVEL OBJECTIVES

Sl. No.	Course Learning Objectives (CLO)
1	Comprehend the basics of strategic gaming and mixed strategic equilibrium.
2	Enable students to develop skills on extensive gaming strategies.
3	Analyze and discuss various gaming models.
4	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	Understand the foundational concepts of game theory including rational choice, strategic games, and Nash equilibrium, and analyze classic examples such as the Prisoner's Dilemma and Matching Pennies.	PO1, PO2, PO3 PSO - 1	L3	3,4,5,6	10
CO2	Analyze strategic games involving mixed strategies, dominated actions, and equilibrium in randomized environments, with applications to diagnostic and population games.	PO2,PO3, PO4,PO5, PO11 PSO-2	L3	3,4,5,6	10

CO3	Apply game-theoretic concepts to extensive games with perfect information using backward induction and identify sub- game perfect equilibria in multi-stage decision scenarios.	PO1,PO2, PO3,PO4, PO5,PO11 PSO-2	L3	3,4,5,6	10
CO4	Examine Bayesian games and analyze strategic interactions under incomplete information through examples including Cournot competition and public goods provision.	PO1,PO2, PO3,PO4, PO5,PO11 PSO-2	L3	3,4,5,6	10
CO5	Evaluate outcomes in strictly competitive and repeated games, including finitely and infinitely repeated Prisoner 's Dilemma, and determine Nash equilibria and payoff structures.	PO3,PO4, PO5,PO11 PSO-2	L3	3,4,5,6	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	<b>Introduction to Strategic Games:</b> 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.  <b>Textbook 1 Ch 1.1,1.2 Chapter 2 – 2.1,2.2,2.3,2.4,2.6,2.7,2.8,2.9</b>	1,2,3	8
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.  <b>Textbook 1: Ch 4.2,4.3,4.4,4.5,4.6,4.6</b>	1,2,3,4,5	8
III	Extensive games with perfect information; Strategies and outcomes; Nash equilibrium; Sub- game perfect equilibrium; Finding sub-game perfect equilibria of finite horizon games: Backward induction; Illustrations: The ultimatum game, Stackelberg's model of duopoly. <b>Textbook 1: Ch 5.2,5.3,5.4,5.5,5.6 Chapter 6 – 6.2,6.3</b>	1,2,3,4,5	8
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 valuation  <b>Textbook 1: Ch 9.2,9.3,9.4,9.5,9.6, 9.7</b>	1,2,3,4,5	8

V	<p><b>Competitive Games:</b> Strictly competitive games and maximization. <b>Repeated games:</b> 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.</p> <p><b>Textbook 1: Ch 11 14.1, 14.2,14.3,14.4,14.5</b></p>	1,2,3,4 ,5	8
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## 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 Osbore	Oxford University Press 7 <sup>th</sup> impression, ISBN – 0195128958	First Indian Edition, 2009	ALL
2	Analysis of Conflict Game Theory	Roger B. Myerson	Harvard University Press, 2008, ISBN – 978-0674341166	Re-print Edition	-
3	Introduction to Operations Research, Concepts and Cases	Frederick S. Hillier and Gerald J. Lieberman	Tata McGraw Hill, 2010, ISBN – 0073376299	9 <sup>th</sup> Edition	-
4	An Introduction to Game Theory Strategy	Joel Watson	W.W. Norton &Company, 2007, ISBN – 9780393929348	2 <sup>nd</sup> Edition	-

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

### Books / Web References:

1. <http://nptel.ac.in/courses.php?disciplineID=111>
2. [http://www.class-central.com/subject/math\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))
3. <http://academicearth.org/>
4. VTU e-Shikshana Program
5. VTU EDUSAT Program.

## 7. EVALUATION METHODOLOGY

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

### CIE Framework: Scheme of Examination (CIE):

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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a- thon conducted by reputed organizations/ any other.

Typical evaluation pattern for regular courses is shown in Table 1:

	Component	Marks	Max Marks	Total Marks
CIE	CIE Test-1	40	40	50
	CIE Test-2	40		
	AAT	10		
SEE	Semester End Examination	100		50
	<b>Grand Total</b>			100

#### Scheme of Examination (SEE):

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module.

### 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

### 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

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

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

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# GLOBAL ACADEMY OF TECHNOLOGY

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



Department: <b>Artificial Intelligence and Machine Learning</b>		
Semester: <b>IV</b>	Course Code: <b>BAML24457A</b>	Contact Hrs /week: <b>02</b>
Course Description: <b>AI TOOLS, FRAMEWORKS &amp; ITS APPLICATIONS-I</b>		No. of Credits: L : T : P : S = <b>0:0:2:2</b>
Course Category: <b>AEC</b>		Total no. of Hours = <b>30+30</b>
CIE: <b>50 Marks</b>	SEE: <b>50 Marks</b>	Exam Hours: <b>03</b>
Course Pre-requisites: <b>Programming Concepts</b>		

## 1. PREAMBLE ABOUT THE COURSE

The course is designed to provide students with a comprehensive understanding of the practical ecosystem surrounding Artificial Intelligence (AI). As AI continues to transform industries and redefine the way we interact with technology, this course equips learners with hands-on experience in using popular tools and frameworks essential for building intelligent systems.

## 2. COURSE LEVEL OBJECTIVES

Sl. No	Course Learning Objectives (CLO)
1	Understand the fundamental principles of AI and IoT technologies as applied to agriculture.
2	Describe the role of AI and IoT in addressing sustainability challenges in urban environments.
3	Investigate various AI and IoT applications in smart city initiatives.
4	Develop the techniques of text preprocessing and data cleaning for natural language processing (NLP).

## 3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PS Os	Cognitive Level	WK	Class Hours
CO1	Understand the usage of AI and IoT's impact on Agricultural Innovation with AI and IoT.	PO1,PO2,PO3, PO5,PO9, PO10,PO11 PSO-2	L3	2,3,4, 5	8

CO2	Understand AI and IoT's role in Smart Solutions for Sustainable Urban Living.	PO1,PO2,PO3, PO5,PO9, PO10,PO11 PSO-2	L4	2,3,4, 5	8
CO3	Apply text preprocessing, neural networks for sentiment analysis, and interpreting sentiment scores.	PO1,PO2,PO3, PO5,PO9, PO10,PO11 PSO-2	L4	2,3,4, 5	8
CO4	Evaluate AI's importance in diagnosing medical conditions.	PO1,PO2,PO3, PO5,PO9, PO10,PO11 PSO-2	L5	2,3,4, 5	8

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

#### 4. SYLLABUS

Sl.NO	PROGRAMS
<b>PART A</b>	
1	Simulate to measure the light intensity using Thinkercad
2	Simulate an ultrasonic distance sensor to detect the distance from the object
3	Simulate a DC motor with specified input that runs continuously and vary with the DC motor speed.
4	Simulate door sensor for smart homes using IoT sensor
5	Installation of NLTK Library and working with Basic commands
6	Write a python code for Tokenizing and count word Frequency
7	Write a python code NLTK word stemming and Lemmatizing words using WordNet
<b>PART B</b>	
1	<b>AI in Agriculture</b> <b>Smart Irrigation System</b> Build a smart irrigation system using Arduino or Raspberry Pi that incorporates soil moisture sensors and weather data. They will develop an AI algorithm to optimize irrigation based on real-time conditions.
2	<b>AI in Smart Cities</b> <b>Smart Street Lighting with IoT</b> Design a smart street lighting system using Arduino or Raspberry Pi and IoT sensors to detect light levels and motion. They will develop an AI algorithm to optimize street lighting based on real-time conditions.
3	<b>AI in Education</b> <b>Recommendation System for Online Courses</b> Create a basic recommendation system using collaborative filtering with TensorFlow. Use it to recommend online courses to students based on their previous choices.
4	<b>AI in Healthcare</b> <b>Predicting Disease Outcomes from Patient Data</b> Build a predictive model using TensorFlow to estimate the progression of a specific disease (e.g., diabetes) based on patient data such as age, BMI, and blood sugar levels.

## 5. EVALUATION METHODOLOGY

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

### CIE Framework:

#### Conduct of Practical Examination:

1. All laboratory experiments are to be included for practical examination.
2. Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered by the examiners.
3. Students can pick one experiment from the questions lot prepared by the examiners.
4. Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

#### Mini Project

1. Develop a mini project using the languages and concepts learnt in the theory and exercises listed in part A with a good look and feel effects.
2. You can use any technologies and frameworks and databases.
3. However, during the examination, each student must demonstrate the project individually.

#### Scheme of Examination (CIE):

In order to encourage innovative methods while driving the course, this subject is treated as lab-oriented subject and the CIE is evaluated for 50 Marks and SEE for 50 Marks.

## 6. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 7. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

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

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

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# GLOBAL ACADEMY OF TECHNOLOGY

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



Department: Artificial Intelligence and Machine Learning		
Semester: <b>IV</b>	Course Code: <b>BAML24457B</b>	Contact Hrs /week: <b>02</b>
Course Description: <b>PROGRAMMING WITH SCALA</b>		No. of Credits: L : T : P : S = <b>0:0:2:2</b>
Course Category: <b>AEC</b>		Total no. of Hours = <b>30+30</b>
CIE: <b>50 Marks</b>	SEE: <b>50 Marks</b>	Exam Hours: <b>02</b>
Course Pre-requisites: <b>Programming Concepts, DBMS</b>		

## 1. PREAMBLE ABOUT THE COURSE

This course provides a foundation in Scala syntax, type system, pattern matching, higher- order functions, collections, immutability, and concurrency models such as Actors and Futures. Students will also learn how Scala enhances productivity and code expressiveness while maintaining compatibility with Java.

## 2. COURSE LEVEL OBJECTIVES

Sl. No	Course Learning Objectives (CLO)
1	Model data using algebraic data types, represented in Scala as families of sealed traits and case classes.
2	Use structural recursion and pattern matching to traverse and transform data.
3	Learn programming with the common data structures of Scala
4	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	Get familiar with the Scala syntax and object-oriented principles	PO1,PO2,PO3, PO5,PO9, PO10,PO11 PSO - 2	L2	2,3,4	10
CO2	Learn advanced concepts - loops, expressions, inheritance, pattern matching	PO1,PO2,PO3, PO5,PO9, PO10,PO11 PSO - 2	L3	2,3,4	10
CO3	Learn to write clean and functional Scala codes and test it	PO1,PO2,PO3, PO5,PO9, PO10,PO11 PSO - 2	L3	2,3,4	10

CO4	Learn functional programming using Scala	PO1,PO2,PO3, PO5,PO9,PO10,PO11 PSO - 2	L3	2,3,4	10
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*Wks are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9*

#### 4. SYLLABUS

Sl. NO	Laboratory Experiments
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 Contact Info with properties name, email, and address. Create a class Customer that includes a Contact Info 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 ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE]

### Suggested Learning Resources:

- Programming Scala, Third Edition, O'Reilly Media.
- Paul Chiusano, Rúnar Bjarnason, Functional Programming in Scala 1st Edition, Manning Publications
- <https://www.javatpoint.com/scala-tutorial>

<https://docs.scala-lang.org/tutorials/scala-for-java-programmers.html>

## 6. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks

b) Semester End Examination (SEE) = 50 marks

Total = 100 marks

### CIE Framework:

#### Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Exam) taken together.

#### Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The Split-up of CIE marks for record/journal and test are in the ratio **60:40**.

## 7. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 8. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

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

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

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# GLOBAL ACADEMY OF TECHNOLOGY

Autonomous Institution Affiliated to Visveswaraya Technological University

Approved by UGC, AICTE and Govt of Karnataka



Department: Artificial Intelligence and Machine Learning		
Semester: <b>IV</b>	Course Code: <b>BAML24457C</b>	Contact Hrs /week: <b>02</b>
Course Description: <b>PHP PROGRAMMING</b>		No. of Credits: L : T : P : S = <b>0:0:2:2</b>
Course Category: <b>AEC</b>		Total no. of Hours = <b>30+30</b>
CIE: <b>50 Marks</b>	SEE: <b>50 Marks</b>	Exam Hours: <b>02</b>
Course Pre-requisites: <b>Programming concepts, DBMS</b>		

## 1. PREAMBLE ABOUT THE COURSE

This course focuses on the fundamental concepts of PHP, including syntax, data types, control structures, functions, form handling, session management, and file operations. Students will also explore how PHP interacts with databases (especially MySQL) to create full-featured, data-driven web applications. Students will gain practical experience in designing and developing responsive and secure web pages, integrating HTML, CSS, and JavaScript with PHP to create robust and user-friendly interfaces.

## 2. COURSE LEVEL OBJECTIVES

Sl. No	Course Learning Objectives (CLO)
1	To introduce the PHP syntax, elements, and control structures
2	To make use of PHP Functions and File handling
3	To illustrate the concept of PHP arrays and OOPs

## 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 concepts of PHP to develop web	PO1,PO2,PO3,PO5,PO9,PO10,PO11, POS - 2	L3	3,4,5,6	8
CO2	Develop programs in PHP involving control structures	PO1,PO2,PO3,PO5,PO9,PO10,PO11, POS - 2	L4	3,4,5,6	8
CO3	Develop programs to handle structured data(object) and data items(array)	PO1,PO2,PO3,PO5,PO9,PO10,PO11, POS - 2	L4	3,4,5,6	8
CO4	Develop programs to access and manipulate contents of files	PO1,PO2,PO3,PO5,PO9,PO10,PO11, POS - 2	L4	3,4,5,6	8

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

#### 4. SYLLABUS

Sl. No	Laboratory Experiments
1.	a. Install and configure PHP, web server, MYSQL b. Write a program to print —Welcome to PHP! c. Write a simple PHP program using expressions and operators.
2.	a. Write a PHP program to calculate areas of Triangle and Rectangle. b. Write a PHP program to calculate Compound Interest.
3.	Demonstrate the various forms to concatenate multiple strings Develop program to demonstrate concatenation of string: a. String represented with literals (single quote or double quote) b. Strings as variables c. Multiple strings represented with literals (single quote or double quote) and variables d. Strings and string variables containing single quotes as part string contents Strings containing HTML segments having elements with attributes.
4.	a. Write a PHP program(s) to check given number: i) Odd or even ii) Divisible by given Number (N) iii) Square of a number b. Write a PHP Program to compute the roots of the Quadratic equation by accepting the coefficients. Print the appropriate message.
5.	a. Develop a PHP program to find the square root of a number by using the newton 's algorithm. b. Develop a PHP program to generate Floyd's triangle.
6.	a. Develop a PHP program to demonstrate the date () with different parameter options. b. Develop a PHP program to generate the Fibonacci series using a recursive function.
7.	a. Develop a PHP program to accept the file and perform the following i) Print the first N lines of a file ii) Update/Add the content of a file.
8.	Write a PHP program to read the content of the file and print frequency of occurrence of the word accepted by the user in the file.
9.	a. Develop a PHP program to count the occurrences of Aadhar numbers present in a text. b. Develop a PHP program to find the occurrences of a given pattern and replace them with a text.
10.	Develop a PHP program that illustrates the concept of classes and objects by reading and printing employee data, including Emp_Name, Emp_ID< Emp_Salary and Emp_DOJ.
11.	Develop a PHP program to filter the elements of an array with key names. Sample input data: 1 <sup>st</sup> array: {_c1'=>'Red', 'c2'=>'Green', 'c3'=>'White', c4=>'Black'} 2 <sup>nd</sup> array: {_c2', 'c4'} Output: Array { [c1]=>Red [c3]=>White }
12	Develop a PHP program to read the contents of a HTML form and display the contents on a browser.

## 5. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE

### Suggested Learning Resources:

1. BOOK: Programming in HTML and PHP (Coding for Scientists and Engineers, By DEVID R

BROOKS, Springer International Publishing AG 2017

2. PHP TUTORIALS: [<https://www.w3schools.com/php/>]
3. PHP TUTORIALS: [<https://www.tutorialspoint.com/php/index.htm>]
4. HTML TUTORIALS: [<https://www.w3schools.com/html/>]

## 6. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks

b) Semester End Examination (SEE) = 50 marks

Total = 100 marks

### CIE Framework:

#### Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Exam) taken together.

#### Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The Split-up of CIE marks for record/journal and test are in the ratio **60:40**

## 7. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 8. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

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

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

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# GLOBAL ACADEMY OF TECHNOLOGY

Autonomous Institution Affiliated to Visveswaraya Technological University

Approved by UGC, AICTE and Govt of Karnataka



Department: Artificial Intelligence and Machine Learning		
Semester: IV	Course Code: <b>BAML24457D</b>	Contact Hrs /week: <b>02</b>
Course Description: <b>FULL STACK DEVELOPMENT USING MERN</b>		No. of Credits: L : T : P : S = <b>0:0:2:2</b>
Course Category: <b>AEC</b>		Total no. of Hours = <b>30+30</b>
CIE: <b>50 Marks</b>	SEE: <b>50 Marks</b>	Exam Hours: <b>02</b>
Course Pre-requisites: <b>Programming concepts, DBMS</b>		

## 1. PREAMBLE ABOUT THE COURSE

The course is designed to provide learners with comprehensive knowledge and hands-on experience in building dynamic, scalable, and modern web applications using the **MERN stack—MongoDB, Express.js, React.js, and Node.js**. This course emphasizes on creating interactive user interfaces using **React.js**, while the backend component covers building RESTful APIs and server-side logic using **Node.js** and **Express.js**. **MongoDB**, a NoSQL database, is used for efficient and flexible data storage.

## 2. COURSE LEVEL OBJECTIVES

Sl. No	Course Learning Objectives (CLO)
1	Understand and apply critical web development languages and tools to create dynamic and responsive web applications.
2	To build server-side applications using Node.js and Express
3	Develop user interfaces with React.js,
4	Manage data using MongoDB, and integrate these technologies to create full stack apps
5	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	Apply the fundamentals of MongoDB, such as data modelling, CRUD operations, and basic queries to solve given problem.	PO1,PO2,PO3,PO5, PO9,PO10,PO11, PSO-2	L3	2,3,4,5	8

CO2	Use constructs of Express.js, including routing, software and constructing RESTful APIs to solve real world problems.	PO1,PO2,PO3, PO5,PO9,PO10,PO11, PSO-2	L3	2,3,4,5	8
CO3	Develop scalable and efficient RESTful APIs using NodeJS.	PO1,PO2,PO3,PO5,PO9,PO10,PO11, PSO-2	L3	2,3,4,5	8
CO4	Develop applications using React, including components, state, props, and JSX syntax.	PO1,PO2,PO3,PO5,PO9,PO10,PO11, PSO-2	L3	2,3,4,5	8

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

#### 4. SYLLABUS

Sl.NO	Experiments
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 Mongoddb.
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) write 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 mongoddb b) For a partial name given in node js, search all the names from mongoddb 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 ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE

##### Suggested Learning Resources:

1. Vasan Subramanian Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node, Apress; 1st ed. edition (1 April 2017)
2. Eddy Wilson Iriarte Koroliova, MERN Quick Start Guide, Packt Publishing (31 May 2018),
3. <https://www.geeksforgeeks.org/mernstack/>
4. <https://blog.logrocket.com/mern-stack-tutorial/>

## 6. EVALUATION METHODOLOGY

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

### CIE Framework: Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Exam) taken together.

### Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The Split-up of CIE marks for record/journal and test are in the ratio **60:40**

## 7. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 8. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

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

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

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# GLOBAL ACADEMY OF TECHNOLOGY

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



Department: <b>DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE</b>		
Semester: 4	Course Code: <b>BBOK24407</b>	Contact Hrs /week: 2
Course Description: <b>BIOLOGY FOR ENGINEERS</b>		No. of Credits: <b>1</b> L : T : P : S = <b>1:0:0:0</b>
Course Category: <b>BSC</b>		Total no. of Hours = 15
CIE: <b>50 Marks</b>	SEE: <b>50 Marks</b>	Exam Hours: <b>03</b>
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, for exploring novel bioengineering projects.	PO1,PO2, PO7, PSO1,PSO2	L3	WK1, WK3, WK3	5
CO3	Understand and apply biological concepts and emerging technologies such as tissue engineering, bioprinting, biosensing, and	PO1,PO2, PO7, PSO1,PSO2	L3	WK1, WK3, WK3	5

	AI for solving real-world engineering problems.				
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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	<b>Cell Basic Unit of Life</b> 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	<b>Adaptation of Anatomical Principles for Bioengineering Design</b> 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	<b>Trends In Bioengineering:</b> 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., Thilagaraj W., Barathi S., and Jaganthan M.K.,	Tata McGraw-Hill, New Delhi, 2012		All Modules
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://freevidelectures.com/course/4877/nptel-biology-engineers-other-non-biologists>
- <https://ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-design-spring-2009>

4. <https://ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring-2006>
  5. <https://www.coursera.org/courses?query=biology>
  6. [https://onlinecourses.nptel.ac.in/noc19\\_ge31/preview](https://onlinecourses.nptel.ac.in/noc19_ge31/preview)
  7. <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 →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
COs ↓											
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 →	PSO1	PSO2
COs ↓		
CO1	2	2
CO2	2	2
CO3	2	2
CO4	2	2
CO5	2	2

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

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# 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: BUHK408	Contact Hrs /week:
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.

## 4. SYLLABUS

Module No.	Module Description	No. of Hours
I	<b>Introduction to Value Education</b> Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)	3

	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	<b>Harmony in the Human Being</b> 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	<b>Harmony in the Family and Society</b> 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	<b>Harmony in the Nature/Existence</b> 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	<b>Implications of the Holistic Understanding – a Look at Professional Ethics</b> 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 kantik		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		

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# 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 = -
CIE: 100 Marks	SEE: -	Exam Hours: -

## 1. 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.

## 2. 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*

### 3. SYLLABUS

Module No.	Module Description
I	<p><b>National Service Scheme (NSS) – Contents</b></p> <ol style="list-style-type: none"> <li>1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.</li> <li>2. Waste management– Public, Private and Govt organization, 5 R's.</li> <li>3. Setting of the information imparting club for women leading to contribution in social and economic issues.</li> <li>4. Water conservation techniques – Role of different stakeholders– Implementation.</li> <li>5. Preparing an actionable business proposal for enhancing the village income and approach for implementation.</li> <li>6. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.</li> <li>7. Developing Sustainable Water management system for rural areas and implementation approaches.</li> <li>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.</li> <li>9. Spreading public awareness under rural outreach programs.(minimum 5 programs).</li> <li>10. Social connect and responsibilities.</li> <li>11. Plantation and adoption of plants. Know your plants.</li> <li>12. Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).</li> <li>13. Govt. school Rejuvenation and helping them to achieve good infrastructure.</li> </ol>

### 4. 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.	



# 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: 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

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# 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. PREAMBLE ABOUT THE COURSE

Course Title	Content
Patanjali' s Ashtanga Yoga 1. 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 1. Sukhasana 2. Paschimottanas ana b. Standing 1. Ardhakati Chakrasana 2. Parshva Chakrasana c. Prone line 1. 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

Department: Science and Humanities		
Semester: III to VI	Course Code: BMUK359/459/559/658	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	Discuss 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

5.

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

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Department: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: V	Course Code: BAML24501	Contact Hrs. /week: 3
Course Description: Engineering Economics & Management		No. of Credits:4 L : T : P : S = 3:0:0:0
Course Category: HSMC		Total no. of Hours = 40+80
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Nil		

## 1. PREAMBLE ABOUT THE COURSE

Engineering Economics & Management is a multidisciplinary course that introduces students to the fundamental concepts of economics, management, and entrepreneurship relevant to engineering applications. The course provides knowledge on economic decision-making, business organizations, planning, leadership, resource management, and entrepreneurial practices, enabling students to develop managerial and analytical skills required for effective professional and organizational growth

## 2. COURSE LEVEL OBJECTIVES

Sl. No	Course Learning Objectives (CLO)
1	Understand the basic principles, scope and the applications of Engineering Economics
2	Understand the basic principles, scope and the applications of Engineering Economics
3	Understand the various management concepts and thoughts and using for better resource management.
4	Apply the knowledge of demand forecasting to make effective demand forecast.

## 3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSO's	Cognitive Level	WK	Class Hours
CO1	Understand needs, functions, roles, scope and evolution of Management	PO1, PO2, PO3, PO7, PSO1	L2	WK1, WK2	10
CO2	Understand importance, purpose of Planning and hierarchy of planning and also analyze its types	PO1, PO2, PO3, PO5, PSO1, PSO2	L3	WK2, WK4	10
CO3	Discuss Decision making, Organizing, Staffing, Directing and Controlling	PO1, PO2, PO3, PO5, PSO1, PSO2	L3	WK2, WK4	10
CO4	Understand various interest rate methods and implement the suitable one	PO1, PO2, PO3, PO4, PO5, PO6, PSO1, PSO2	L3	WK3, WK4	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	Fundamentals of Economics: Wealth, Welfare and Scarce Definitions of Economics; Micro and Macro Economics; Demand- Law of Demand, Elasticity of Demand, Types of Elasticity and Factors determining price elasticity of Demand: Utility- Law of Diminishing Marginal Utility, its limitations and exceptions.	CO1	8
II	Forms of Business Organizations: Features, merits and demerits of Sole Proprietorship, Partnership and Joint Stock Company- Public Enterprises and their types.	CO2	8
III	Introduction - Meaning, nature and characteristics of management, scope and Functional areas of management, goals of management, levels of management, brief overview of evolution of management theories,. Planning- Nature, importance, types of plans, steps in planning, Organizing- nature and purpose, types of Organization, Staffing- meaning, process of recruitment and selection	CO3	8
IV	Directing and controlling- meaning and nature of directing, leadership styles, motivation Theories, Communication- Meaning and importance, Coordination meaning and importance, Controlling- meaning, steps in controlling, methods of establishing control	CO3	8
V	Entrepreneur – meaning of entrepreneur, characteristics of entrepreneurs, classification and types of entrepreneurs, various stages in entrepreneurial process, role of entrepreneurs in economic development, entrepreneurship in India and barriers to entrepreneurship. Identification of business opportunities, market feasibility study, technical feasibility study, financial feasibility study and social feasibility study.	CO4	8

## 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Principles of Management	Tripathy and Reddy	-		1,2&3
2	Engineering Economics	R.Paneerselvam	PHI publication.		4&5

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

1. "Engineering Economy" by Leland Blank and Anthony Tarquin
2. "Engineering Management: Challenges in the New Millennium" by C. M. Chang

## 7. MOOCs:

- 1) <https://learn.saylor.org/course/CS402>
- 2) <https://www.coursera.org/specializations/computer-communications>

## 8. EVALUATION METHODOLOGY

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

## CIE Framework:

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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical evaluation pattern for regular courses is shown in Table 1:

**Table 1: Evaluation Process for CIE and SEE**

	Component	Marks	Total Marks
CIE	CIE Test-1	50	30
	CIE Test-2	50	
	AAT	20	20
SEE	Semester End Examination	100	50
<b>Grand Total</b>			100

## Scheme of Examination (SEE):

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying 20 marks each.
3. There will be two full questions (with a maximum of four sub questions) from each module.
4. The students will have to answer five full questions, selecting one full question from each module.

## 9. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 10. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
CO1	1	1
CO2	3	2
CO3	3	2
CO4	3	3
AVG	3	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: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: V	Course Code: BAML24502	Contact Hrs. /week: 3
Course Description: Machine Learning Practices		No. of Credits:4 L : T : P : S = 3:0:2:0
Course Category: IPCC		Total no. of Hours = 40+20+60
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Machine Learning Foundations & Techniques		

## 1. PREAMBLE ABOUT THE COURSE

This course aims to build a strong foundation in machine learning concepts and practical implementation using scikit-learn. It focuses on developing skills in regression, classification, and ensemble methods, emphasizing data preprocessing and model evaluation. Participants will explore polynomial and logistic regression along with regularization techniques for effective model tuning. The course also introduces neural network development using TensorFlow and Keras. Learners will address practical issues in deep learning model training and optimization. Overall, the program prepares participants to design and implement end-to-end ML solutions confidently.

## 2. COURSE LEVEL OBJECTIVES

Sl. No	Course Learning Objectives (CLO)
CLO1	To understand the fundamental concepts of machine learning and the scikit-learn library for implementing end-to-end ML projects.
CLO2	To develop practical skills in regression, classification, and ensemble methods using scikit-learn, with a focus on data preprocessing and model evaluation.
CLO3	To explore polynomial and logistic regression techniques, along with regularization methods, for effective model tuning and selection.
CLO4	To gain proficiency in building and training neural networks using TensorFlow and Keras, addressing practical issues in deep learning models.

## 3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSO's	Cognitive Level	WK	Class Hours
CO1	Apply scikit-learn tools to design and implement end-to-end machine learning projects, including data preprocessing, feature selection, and model evaluation.	PO1, PO2, PO3, PO5, PO10, PO11, PSOs-2	L3	WK-2,3	12
CO2	Develop regression and classification models, utilizing techniques like gradient descent, k-NN, and Naïve Bayes, and assess their performance using appropriate metrics.	PO1, PO2, PO3, PO5, PO10, PO11, PSOs-2	L3	WK-2,4,6	13
	Implement polynomial and logistic regression models, integrate	PO1, PO2, P O3,	L3		

CO3	regularization methods (Lasso, Ridge, Elastic Net), and fine-tune hyperparameters using cross-validation.	PO5, PO 10, PO11, PSOs-2		WK-2,4,6	12
CO4	Construct and train artificial neural networks for multiclass classification, using backpropagation and optimization strategies to address training challenges.	PO1, PO2, PO 3, PO5, PO10, PO11, PSOs- 2	L3	WK-2,4,6	13

*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	<p>End-to-end machine learning project on scikit-learn: Introduction to scikit-learn and Project Planning, Project Planning and Workflow, Data Exploration and Preprocessing, Feature Engineering and Selection, Model Selection and Training, Model Evaluation and Interpretation.</p> <p><b>Practical Implementation: Use scikit-learn to load a dataset (e.g., Iris or Boston Housing), preprocess data (handling missing values, scaling), and engineer features.</b></p> <p><b>Implement model selection, training, and evaluation using pipelines, cross-validation, and performance metrics (accuracy, RMSE).</b></p> <p>TEXT 2: Chapter 1 (Scikit-learn Introduction) TEXT 1: Chapter 2</p>	1,2	10
II	<p>Linear regression Gradient descent - batch and stochastic: Overview of regression analysis, Classification and Regression on scikit-learn: k-NN, Linear Models, Ordinary Least Squares (OLS) method, Naïve Bayes Classifiers.</p> <p><b>Practical Implementation: Use scikit-learn to build linear regression models, applying batch and stochastic gradient descent, and evaluate using mean squared error (MSE).</b></p> <p><b>Implement k-NN, OLS, and Naïve Bayes classifiers to predict labels on datasets like Iris, using cross-validation to assess accuracy.</b></p> <p>TEXT 1: Chapter 4(Pg. No. 115 to Pg. No. 130) TEXT 2: Chapter 2(Pg. No. 25 to Pg. No. 70)</p>	2	10
III	<p>Polynomial regression using scikit-learn: Introduction to polynomial regression, need for polynomial regression (handling non-linearity), Polynomial feature generation, fitting polynomial regression models, evaluating polynomial regression models, Regularized models: Introduction to over fitting and under fitting, Need for regularization, Types of regularization: L1 regularization (Lasso), L2 regularization (Ridge), Elastic Net (combination of L1 and L2), Early Stopping. Logistic regression: Estimating Probabilities, Training and cost function, Decision Boundaries, SoftMax regression.</p> <p><b>Implementing regularized models using scikit-learn-Using Ridge, Lasso, and Elastic Net classes, Hyper parameter tuning (alpha parameter), Cross-validation techniques for model selection.</b></p> <p>TEXT 1: Chapter 4(Pg. No. 132 to Pg. No. 151)</p>	3	10

IV	<p>Classifications on scikit-learn - Binary classifier &amp; Multiclass classifier, Decision Trees, Ensemble learning and Random Forests, Types of ensemble methods: Bagging and Boosting: Bootstrap Aggregating, Boosting: Adaboost, Gradient Boosting.</p> <p><b>Case study: Bagging for improved stability and accuracy, Boosting for difficult classification tasks</b></p> <p>TEXT 1: Chapter 6(Pg. No. 179 to Pg. No. 190) TEXT 1: Chapter 6(Pg. No. 193 to Pg. No. 212)</p>	3,4	10
V	<p>Introduction to Neural networks: Basic Architecture of Neural Networks, Multilayer Neural Networks, Multilayer Network as a Computational Graph, Training Neural Networks with Backpropagation, Practical issues in Neural Network Training.</p> <p><b>Practical Implementation: Use TensorFlow and Keras to build a simple multilayer neural network, defining input, hidden, and output layers as a computational graph.</b></p> <p><b>Train the network using backpropagation, address practical issues like vanishing</b></p> <p>TEXT 3: Chapter 1(1.1,1.2,1.3,1.4.1,1.4.2,1.4.3)</p>	4	10

SI NO	PRACTICAL COMPONENT-IPC LAB
1	<p>End-to-End Project Implementation Case Study: Predictive Modeling</p> <ul style="list-style-type: none"> <li>• Step-by-step implementation of an end-to-end machine learning project</li> <li>• Dataset selection and preprocessing</li> <li>• Model training, evaluation, and deployment</li> </ul>
2	<p>Implementation of linear regression using scikit-learn</p> <p>Evaluating model performance (R-squared, Mean Absolute Error, Mean Squared Error, Root Mean Squared Error)</p>
3	<p>Practical Implementation Using Python and scikit-learn</p> <ul style="list-style-type: none"> <li>• Implementing linear regression using scikit-learn</li> <li>• Implementing gradient descent algorithms from scratch</li> <li>• Visualizing data and regression results using Matplotlib and Seaborn</li> <li>• Best practices for building and evaluating regression models</li> <li>• Hands-on exercises and coding assignments.</li> </ul>
4	Applying regression techniques to real-world datasets.
5	Binary classification on medical diagnosis dataset.
6	Multiclass classification for handwritten digit recognition.
7	End-to-end machine learning project including data preprocessing, model building, evaluation, and visualization.

## 5. LIST OF RECOMMENDED REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow	Aurélien Géron	3rd Edition, ISBN-13 978-9355421982, Publisher: O'Reilly	2022	1,2,3&4

2	Introduction to Machine Learning with Python	Andreas C. Müller and Sarah Guido	Published by O'Reilly Media @ 2017, First Edition.	2017	1&2
3	Neural networks and Deep Learning: A Textbook	Charu C. Aggarwal (Second Edition)	Springer, July 2023, ISBN 978-3-319-94463-0 (eBook)	2023	1

## 6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE]

- Scikit-learn documentation
- Tutorials and articles on medium, towards data science, and other blogs
- Scikit-learn documentation: <https://scikit-learn.org/stable/documentation.html>
- Online tutorials and courses on platforms like Coursera, edX, and Udacity

## 7. MOOCs:

- Coursera: "Applied Machine Learning in Python" by the University of Michigan
- edX: "Machine Learning with Python" by IBM

## 8. EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 50 marks

b) Semester End Examination (SEE) = 50 marks

Total = 100 marks

### CIE Framework:

**Scheme of Examination (CIE):** 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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create- a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

### Examination Scheme (SEE):

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module.

	Component	Marks	Max Marks	Total Marks
CIE	CIE Test-1	50	25	50
	CIE Test-2	50		
	AAT	10	10	
	LAB	30	15	
SEE	Semester End Examination	100		50
	<b>Grand Total</b>			100

## 11. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 12. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

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

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

Department: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: V	Course Code: BAML24503	Contact Hrs /week: 3
Course Description: BIG DATA ANALYTICS		No. of Credits:3 L : T : P : S = 3:0:0:0
Course Category: PCC		Total no. of Hours = 40+50
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: <b>03</b>
Course Pre-requisites: Unix Commands, Unix Operating System, Python, Java		

## 1. PREAMBLE ABOUT THE COURSE

Big Data Analytics has emerged as a critical technology for handling massive volumes of structured and unstructured data generated from diverse sources. This course provides fundamental and practical knowledge of big data storage, processing, and analysis using distributed computing frameworks. It introduces Hadoop ecosystem tools such as HDFS, MapReduce, NoSQL databases, and Spark for large-scale data processing. The course emphasizes scalable architectures, parallel processing, and performance evaluation of big data platforms. Students will gain hands-on exposure to modern big data tools to solve real-world data-driven problems efficiently.

## 2. COURSE LEVEL OBJECTIVES

1	Understand the importance of big data technologies used for storage, analysis, and manipulation of data.
2	Analyze and explore the Hadoop framework and Hadoop Distributed File system
3	Understand various tools like Hive and Pig for Big Data Analytics.
4	Provide insights into Hadoop framework and management functionalities.
5	Provide exposure to Hadoop ecosystem tools and techniques for big data processing.

## 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 Big Data analytics	PO1, PO2, PSO1	L2	WK1	08
CO2	Apply the concept of HDFS, Map reduce for storing and processing of big data	PO2, PO3, PO5, PSO1	L3	WK3	08
CO3	Demonstrate the use of any modern Hadoop tool in team or individually to perform the data analytics	PO3, PO5, PO9, PSO1	L3	WK4	08
CO4	Evaluate the performance and efficiency of the installed tools and platform	PO4, PO5, PO6, PSO1	L3	WK4	08
CO5	Develop advanced Big Data programs that solve specific data processing challenges.	PO3, PO5, PO11, PSO1	L3	WK5	08

#### 4. SYLLABUS

Module No.	Module Description	Mapped Cos	No. of Hours
I	<b>Introduction to Big Data Analytics:</b> Big Data, Scalability and Parallel Processing, Designing Data Architecture, Data Sources, Quality, Pre-Processing and Storing, Data Storage and Analysis.  SLT: Applications of Big Data in the real world.	CO1	8
II	<b>Introduction to Hadoop:</b> Introduction, Hadoop and its Ecosystem, Hadoop Distributed File System, MapReduce Framework and Programming Model, Hadoop Yarn, Hadoop Ecosystem Tools. <b>Hadoop Distributed File System Basics:</b> HDFS Design Features, Components  SLT: HDFS User Commands.	CO2	8
III	<b>NoSQL Big Data Management, MongoDB and Cassandra:</b> Introduction, NoSQL Data Store, NoSQL Data Architecture Patterns, NoSQL to Manage Big Data, Shared-Nothing Architecture for Big Data Tasks, MongoDB, Databases.  SLT: Cassandra Databases.	CO3	8
IV	<b>NoSQL Big Data Management, MongoDB and Cassandra:</b> Introduction, NoSQL Data Store, NoSQL Data Architecture Patterns, NoSQL to Manage Big Data, Shared-Nothing Architecture for Big Data Tasks, MongoDB, Databases.  SLT: Cassandra Databases.	CO3, CO4	8
V	<b>Spark:</b> Installing Spark, An Example: Spark Applications, Jobs, Stages, and Tasks, A Scala Standalone Application, A Java Example, A Python Example, Resilient Distributed Datasets: Creation, Transformations and Actions, Persistence, Serialization, Shared Variables: Broadcast Variables, Accumulators, Anatomy of a Spark Job: Run: Job Submission, DAG Construction. <b>SLT:</b> Task Scheduling, Task Execution. <b>Textbook 2:</b> Ch: 1	CO5	8

#### 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Big Data Analytics	Raj Kamal, Preeti Saxena	McGraw Hill	2019	I, II
2	Hadoop: The Definitive Guide	Tom White	O'Reilly	4th Edition	II, IV
3	Big Data: Black Book, DT Editorial Services	DT Editorial Services	Wiley India	2016	I, III
4	Big Data Analytics: A Hands-On Approach	Arshdeep Bahga, Vijay Madiseti	VPT Publications	1st Edition	V

## 6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE]

### MOOCs:

1. Big Data Computing, IIT Patna, <https://nptel.ac.in/courses/106104189>
2. <https://apps.cognitiveclass.ai/learning/course/course-v1:BDU+BD0133EN+v1/home>
3. <https://www.udemy.com/course/the-ultimate-hands-on-hadoop-tame-your-big-data/>

## 7. EVALUATION METHODOLOGY

- d) Continuous Internal Evaluation (CIE) = 50 marks
- e) Semester End Examination (SEE) = 50 marks
- f) Total = 100 marks

### CIE Framework:

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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical evaluation pattern for regular courses is shown in Table 1:

**Table 1: Evaluation Process for CIE and SEE**

	Component	Marks	Total Marks
CIE	CIE Test-1	50	30
	CIE Test-2	50	
	AAT	20	20
SEE	Semester End Examination	100	50
<b>Grand Total</b>			<b>100</b>

### Scheme of Examination (SEE):

5. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
6. The question paper will have ten full questions carrying 20 marks each.
7. There will be two full questions (with a maximum of four sub questions) from each module.
8. The students will have to answer five full questions, selecting one full question from each module.

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## **9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING**

<b>PSOs →</b>	<b>PSO1</b>	<b>PSO2</b>
<b>COs ↓</b>		
<b>CO1</b>	2	1
<b>CO2</b>	2	1
<b>CO3</b>	2	1
<b>CO4</b>	2	1
<b>CO5</b>	2	1
<b>Average</b>	2	1

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

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Department: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: V	Course Code: BAMLL23504	Contact Hrs /week: 2
Course Description: BIG DATA ANALYTICS LAB		No. of Credits:1 L : T : P : S = 0:0:2:0
Course Category: PCCL		Total no. of Hours = 15+15
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Unix Commands, Unix Operating System, Python		

## 1. PREAMBLE ABOUT THE COURSE

The Big Data Analytics Lab provides hands-on experience in implementing big data storage, processing, and analysis techniques using modern distributed computing frameworks. This laboratory course enables students to work with tools such as Hadoop, HDFS, MapReduce, NoSQL databases, and Apache Spark to handle large-scale datasets. Students gain practical exposure to data ingestion, processing, querying, and performance evaluation in a distributed environment. The course emphasizes real-time problem solving, collaborative learning, and tool-based implementation of big data solutions. It prepares students to design and deploy scalable data analytics applications for real-world scenarios.

## 2. COURSE LEVEL OBJECTIVES

The course will enable students to:

CLO1	Familiarization and working with different big data frameworks and platform.
CLO2	Execution of map-reduce program using java and python
CLO3	Implementation of a Machine learning algorithm in Spark.

## 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 fundamental data structures concepts in software environment	POs- 1,2,3,5,7,9,11 PSOs- 1	L2	WK 2,3,4	5
CO2	Apply and implement advanced data structures for the requirements and simulate.	POs- 1,2,3,5,7,9,11 PSOs- 1	L3	WK 5,6	5
CO3	Analyze the algorithm flow for the given requirements and demonstrate changes required.	POs- 1,2,3,5,7,9,11 PSOs- 1	L3	WK 3,4	5

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

#### 4. SYLLABUS

SL. No.	Experiments
1	Implement a map reduce for word count from a given input text file
2	Execute a Map-reduce python program for printing average salary for a given input file.
3	Execute a Map reduce python program for printing maximum salary for a given input file
4	Execute a python program to implement map reduce concepts for printing year wise sales from a given csv file.
5	Execute a python program to implement map reduce for inverted index of a given data set.
6	Execute a python program to implement word count using spark cell
7	Develop a program to Agglomerative Hierarchical clustering
8	Develop a program to implement OPTICS algorithms
9	Implement DBSCAN algorithm using appropriate Data sets.
10	Implement multiple data visualization method using plotly

#### 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Big Data Analytics	Raj Kamal, Preeti Saxena	McGraw Hill	2019	I, II
2	Hadoop: The Definitive Guide	Tom White	O'Reilly	4th Edition	II, IV
3	Big Data: Black Book, DT Editorial Services	DT Editorial Services	Wiley India	2016	I, III
4	Big Data Analytics: A Hands-On Approach	Arshdeep Bahga, Vijay Madisetti	VPT Publications	1st Edition	V

## 6. EVALUATION METHODOLOGY

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

ASSESSMENT AND EVALUATION PATTERN		
	CIE	SEE
<b>WEIGHTAGE</b>	<b>50%</b>	<b>50%</b>
Record	10	<b>50</b>
Test	20	
Experiential Learning (Mini Project)	20	NIL
<b>Total Marks for The Course</b>	<b>50</b>	<b>50</b>

## 7. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
<b>CO1</b>	3	3	1	1	3				1		1	2	1
<b>CO2</b>	3	3	1	1	3				1		1	2	1
<b>CO3</b>	3	3	1	1	3				1		1	2	1
<b>AVG</b>	3	3	1	1	3				1		1	2	1

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

## 8. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
<b>CO1</b>		2
<b>CO2</b>		2
<b>CO3</b>		2
<b>AVG</b>		2

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

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Department: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: V	Course Code: BAML24505A	Contact Hrs /week: 3
Course Description: CLOUD COMPUTING		No. of Credits: 3 L:T:P:S= 3:0:0:0
Course Category: PEC		Total no. of Hours = 40+50
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: DBMS, Operating Systems, Computer Networks and Security, Computer Organization.		

## 1. PREAMBLE ABOUT THE COURSE

Cloud Computing is a transformative paradigm that enables on-demand access to a shared pool of configurable computing resources such as servers, storage, applications, and services over the Internet. It eliminates the need for organizations to invest heavily in physical infrastructure, offering scalability, flexibility, and cost efficiency. This course introduces students to the fundamental concepts, architecture, and service models of cloud computing. They will gain an understanding of cloud deployment models, virtualization technologies, cloud storage, networking, and security considerations. Through hands-on exposure to leading cloud platforms such as AWS, Microsoft Azure, and Google Cloud, students will learn how to design, deploy, and manage cloud-based solutions. The course also emphasizes cloud automation, resource provisioning, and cost optimization techniques. By the end of this course, students will be equipped with the knowledge and practical skills required to implement cloud solutions in real-world environments.

## 2. COURSE LEVEL OBJECTIVES

Sl.No	Course Objectives (CLO)
1	Introduce the rationale behind the cloud computing revolution and the business drivers
2	Understand various models, types and challenges of cloud computing.
3	Understand the design of cloud native applications, the necessary tools and the design tradeoffs.

## 3. COURSE OUTCOMES (COs) & COMPETENCIES

Upon successful completion of this course, students will be able to

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Describe various cloud computing platforms and service providers.	POs- 1,7 PSO-1	L2	WK 1,2,3	8
CO2	Illustrate the significance of various types of virtualization.	POs- 1,2,3,7 PSO- 1	L2	WK 1,2,4	8
CO3	Identify the architecture, delivery models and industrial platforms for cloud computing based applications	POs- 1,2,3,5,7 PSO- 1	L4	WK 1,2,3,4	8
CO4	Analyze the role of security aspects in cloud computing.	POs- 1,2,3,5,6 PSO- 1	L3	WK 1,2,3	8
CO5	Demonstrate cloud applications in various fields using suitable cloud platforms.	PO- 1,2,3,5,6,7 PSOs- 1 PSO-1	L3	WK 1,2,6,7	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	Distributed System Models and Enabling Technologies: Scalable Computing Over the Internet, Technologies for Network Based Systems, System Models for Distributed and Cloud Computing, Software Environments for Distributed Systems and Clouds, Performance, Security and Energy Efficiency.  <b>Textbook 1:</b> Chapter 1: 1.1 to 1.5	CO1	8
II	Virtual Machines and Virtualization of Clusters and Data Centers: Implementation Levels of Virtualization, Virtualization Structure/Tools and Mechanisms, Virtualization of CPU/Memory and I/O devices, Virtual Clusters and Resource Management, Virtualization for Data Center Automation.  <b>Textbook 1:</b> Chapter 3: 3.1 to 3.5	CO2	8
III	Cloud Platform Architecture over Virtualized Datacenters: Cloud Computing and Service Models, Data Center Design and Interconnection Networks, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms: GAE, AWS and Azure, Inter-Cloud Resource Management.  <b>Textbook 1:</b> Chapter 4: 4.1 to 4.5	CO3	8
IV	Cloud Security: Top concern for cloud users, Risks, Privacy Impact Assessment, Cloud Data Encryption, Security of Database Services, OS security, VM Security, Security Risks Posed by Shared Images and Management OS, XOAR, A Trusted Hypervisor, Mobile Devices and Cloud Security. Cloud Security and Trust Management: Cloud Security Defense Strategies, Distributed Intrusion/Anomaly Detection, Data and Software Protection Techniques, Reputation-Guided Protection of Data Centers.  <b>Textbook 2:</b> Chapter 11: 11.1 to 11.3, 11.5 to 11.8, 11.10 to 11.14 <b>Textbook 1:</b> Chapter 4: 4.6	CO4	8
V	Cloud Programming and Software Environments: Features of Cloud and Grid Platforms, Parallel and Distributed Computing Paradigms, Programming Support for Google App Engine, Programming on Amazon AWS and Microsoft, Emerging Cloud Software Environments.  <b>Textbook 1:</b> Chapter 6: 6.1 to 6.5	CO5	8

#### 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Distributed and Cloud Computing	Kai Hwang, Geoffrey C Fox, and Jack J Dongarra,	Morgan Kaufmann, Elsevier 2012		1,2,3,4,5
2	Cloud Computing Theory and Practice	Dan C. Marinescu,	Morgan Kaufmann, Elsevier 2018	2nd Edition,	1,2,3,4,5
3	Mastering Cloud Computing	Rajkumar Buyya, Christian Vecchiola, SThamaraiSelvi	McGrawHill Education, , 2017	1st Edition	
4	Cloud Computing: A Practical Approach	Toby Velte, Anthony Velte	McGraw-Hill Education, 2017		

## 6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE]

1. <https://freevidelectures.com/course/4639/npTEL-cloud-computing/>
2. <https://www.youtube.com/playlist?list=PLShJJCRzJWxhz7SfG4hpaBD5bKOloWx9J>
3. [https://www.youtube.com/watch?v=EN4fEbcFZ\\_E](https://www.youtube.com/watch?v=EN4fEbcFZ_E)
4. <https://www.youtube.com/watch?v=RWgW-CgdIk0>
5. <https://www.geeksforgeeks.org/virtualization-cloud-computing-types/>
6. <https://www.javatpoint.com/cloud-service-provider-companies>

### Case Studies/ Practical Based learning

- Installation of virtualization software (Virtual box, Xen etc..) and run applications with different OS. - 10 Marks
- Implement cloud applications using GAE, AWS, Azure/simulate cloud applications using Cloudsim/ Greencloud/ Cloud Analyst etc... - 15 Marks

## 7. EVALUATION METHODOLOGY

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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical evaluation pattern for regular courses is shown in Table 1:

	Component	Marks	Total Marks
CIE	CIE Test-1	50	30
	CIE Test-2	50	
	AAT	20	20
SEE	Semester End Examination	100	50
<b>Grand Total</b>			100

### Scheme of Examination (SEE):

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying 20 marks each. ‘
- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module.

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3						1				
CO2	3	2	3								
CO3	3	2	2		1		1				
CO4	3	3	3		2	1					
CO5	3	3	3		2	1	1				
Average	3	2	3		2	1	1				

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

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

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

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# GLOBAL ACADEMY OF TECHNOLOGY

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



Department: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: V	Course Code: BAML24505B	Contact Hrs /week: 3
Course Description: Computer Networks and Security		No. of Credits:3 L : T : P : S = 3:0:0:0
Course Category: PEC		Total no. of Hours = 40+50
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites:		

## 1. PREAMBLE ABOUT THE COURSE

The course “Computer Networks and Security” provides a comprehensive understanding of the fundamental concepts, architecture, and protocols involved in modern computer networks, along with the essential principles of network and information security.

## 2. COURSE LEARNING OBJECTIVES

Sl. No	Course Learning Objectives (CLO)
CLO1	To understand the fundamental concepts of networking standards, protocols and technologies
CLO2	To learn different techniques for framing, error control, flow control and routing
CLO3	To learn different layer protocols in the protocol stacks
CLO4	To understand modern network architecture with respect to design and performance
CLO4	To learn the fundamental concepts of Information Security

## 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	Understanding the fundamental concepts of Computer Networks, architectures, protocols and technologies	POs - 1,3,4,5,6,11 PSOs- 1,2	L2	WK 2,3	10
CO2	Analyze the working of different layer's protocols and mechanisms.	POs - 1,2,3,4,5,7,10 PSOs- 1,2	L3	WK 4,6	10
CO3	Implement different layer's protocols.	POs -1,2,3,4,5 PSOs- 1,2	L3	WK 4,6,7	10
CO4	Comprehend the basics of Network Security	POs - 1,2,3,4,5,9,11 PSOs- 1,2	L3	WK 4,6,7	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 Computer Networks : Definition, Types of Networks: Local area networks (LAN), Metropolitan area networks (MAN), Wide area networks (WAN), Wireless networks, Networks Software, Protocol, Design issues for the Network layers. Network Models: The OSI Reference Model, TCP/IP Model, Network Topologies, Types of Transmission Medium. Network Architectures: Client-Server, Peer To Peer, Hybrid. Network Devices: Bridge, Switch, Router, Gateway, Access Point. Line Coding Schemes: Manchester and Differential Manchester Encodings, Frequency Hopping (FHSS) and Direct Sequence Spread Spectrum (DSSS). Case study: Study of Campus wide networking.	1,2,3	08
II	Introduction: Data link layer services to Network layer, MAC sub layer, Functions of Network layer. Switching Techniques: Circuit switching, Message Switching, Packet Switching. IP Protocol: Classes of IP (Network addressing), IPv4 , IPv6, Network Address Translation, Sub-netting , CIDR. Network layer Protocols: ARP, RARP, ICMP, IGMP. Network Routing and Algorithms: Static Routing, Dynamic Routing, Distance Vector Routing, Link State Routing, Path Vector. Routing Protocols: RIP, OSPF, BGP, MPLS. Routing in MANET: AODV, DSR, Mobile IP. Case study: Demonstration of DLL and Routing Protocols on simulator.	1,2,3	08
III	Process to Process Delivery, Services, Socket Programming. Elements of Transport Layer Protocols: Addressing, Connection establishment, Connection release, Flow control and buffering, Multiplexing, Congestion Control. Transport Layer Protocols: TCP and UDP, SCTP, RTP, Congestion control and Quality of Service (QoS), Differentiated services, TCP and UDP for Wireless networks. Case study: Demonstration of Transport layer protocols on Simulator.	1,2,3	08
IV	Introduction, Web and HTTP, Web Caching, DNS, Email: SMTP, MIME, POP3, Webmail, FTP, TELNET, DHCP, SNMP. Case study: Study of Application Layer protocols using network protocol analyzer. e.g. Wireshark	1,2,3	08
V	Introduction, Security services, Need of Security, Key Principles of Security, Threats and Vulnerabilities, Types of Attacks, ITU-T X.800 Security Architecture for OSI, Security Policy and mechanisms, Operational Model of Network Security, Symmetric and Asymmetric Key Cryptography. Security in Network, Transport and Application: Introduction of IPSec, SSL, HTTPS, S/MIME, Overview of IDS and Firewalls. Case study: Study of security protocols in Network, Transport and Application Layer using network protocol analyzer. e.g. Wireshark	1,2,3,4	08

#### Assignments

No	
1	Using a suitable network simulation tool (e.g., NS2/NS3/NetSim) to set up a small point-to-point network, vary bandwidth/queue size, measure packets dropped.
2	Implementing an Ethernet LAN simulation with multiple nodes, multiple traffic sources, and

	analyzing congestion or throughput.
3	Writing a program for error detecting codes (e.g., CRC-CCITT) at data link layer.
4	Writing a sliding window protocol simulator for data link layer.
5	Using TCP/IP sockets: a client-server program to request and receive file contents.
6	For security side: experiments like packet capture/analysis using tools like Wireshark; network scanning with Nmap; cryptanalysis with Cryptool; phishing simulation.

## 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Data and Communications and Networking	Behrouz A Forouzan	McGraw Hill, Indian Edition	5th Edition	1,2,3,4,5
2	Computer Networks, fifth edition, Pearson	Andrew S Tanenbaum,	Pearson	5th Edition	
3	Computer Networking, A Top-Down Approach	James F Kurose and Keith W Ross	Pearson Education, 2017.	6th Edition	
4	Computer and Communication Networks	Nader F Mir	Pearson, 2014	2 <sup>nd</sup> Edition	

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

### e-Books

- <https://people.cs.clemson.edu/~jmarty/courses/kurose/KuroseCh1-2.pdf>
- [http://eti2506.elimu.net/Introduction/Books/Data Communications and Networking By Behrouz A.Forouzan.pdf](http://eti2506.elimu.net/Introduction/Books/Data%20Communications%20and%20Networking%20By%20Behrouz%20A.%20Forouzan.pdf)
- <http://intronetworks.cs.luc.edu/current/ComputerNetworks.pdf>
- [https://www.tutorialspoint.com/data\\_communication\\_computer\\_network/data\\_communication\\_computer\\_network\\_tutorial.pdf](https://www.tutorialspoint.com/data_communication_computer_network/data_communication_computer_network_tutorial.pdf)

### MOOCs:

- [nptel.ac.in/courses/106/105/106105183](https://nptel.ac.in/courses/106/105/106105183)
- [nptel.ac.in/courses/106/105/106105080](https://nptel.ac.in/courses/106/105/106105080)
- [nptel.ac.in/courses/106/105/106105081](https://nptel.ac.in/courses/106/105/106105081)
- [nptel.ac.in/courses/106/106/106106091](https://nptel.ac.in/courses/106/106/106106091)
- [nptel.ac.in/courses/106/105/106105031](https://nptel.ac.in/courses/106/105/106105031)
- <https://www.mooc-list.com/tags/computer-networking>
- <https://www.coursera.org/courses?query=computer%20network>

### Case study:

- <https://slideplayer.com/slide/6106945>
- [http://www.worldcolleges.info/sites/default/files/Cisco - Ccie Fundamental Network Design And Case Studies.PDF](http://www.worldcolleges.info/sites/default/files/Cisco%20-%20Ccie%20Fundamental%20Network%20Design%20And%20Case%20Studies.PDF)
- [http://vlabs.iitb.ac.in/vlabs-dev/labs\\_local/computer-networks/labs/explist.php](http://vlabs.iitb.ac.in/vlabs-dev/labs_local/computer-networks/labs/explist.php)

## 7. EVALUATION METHODOLOGY

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

### CIE Framework:

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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical evaluation pattern for regular courses is shown in Table 1:

**Table 1: Evaluation Process for CIE and SEE**

	Component	Marks	Total Marks
CIE	CIE Test-1	50	30
	CIE Test-2	50	
	AAT	20	20
SEE	Semester End Examination	100	50
<b>Grand Total</b>			100

**Scheme of Examination (SEE):**

- The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
- The question paper will have ten full questions carrying 20 marks each.
- There will be two full questions (with a maximum of four sub questions) from each module.
- The students will have to answer five full questions, selecting one full question from each module.

**8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING**

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

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

**9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING**

PSOs →	PSO1	PSO2
COs ↓	PSO1	PSO2
CO1	1	1
CO2	1	1
CO3	2	1
CO4	2	1
<b>AVG</b>	2	1

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

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Department: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: 5	Course Code: BAML24505C	Contact Hrs /week: 3
Course Description: TIME SERIES ANALYSIS		No. of Credits:3 L : T : P : S = 3:0:0:0
Course Category: PEC		Total no. of Hours = 40+50
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Basic knowledge of calculus and difference equations, Introductory knowledge of statistical data analysis and regression.		

### 1. PREAMBLE ABOUT THE COURSE

This course introduces the statistical analysis and modeling of time-dependent data, focusing on stationary and non-stationary processes. It covers core concepts such as autocorrelation, spectral analysis, ARIMA models, along with model identification, parameter estimation, diagnostic checking, and forecasting techniques. The course equips students with strong analytical skills to model, interpret, and forecast real-world time series data across domains such as economics, finance, engineering, and data science.

### 2. COURSE LEVEL OBJECTIVES

<b>CLO1</b>	Learn the importance of time series analysis on the data.
<b>CLO2</b>	Identify approaches to handle linear stationary and non stationary models.
<b>CLO3</b>	Analyse ways of model building and parameter estimation.
<b>CLO4</b>	Recognize methods to handle multivariate time series data.

### 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 basic concepts and nature of time series data.	POs - 1,2 PSOs – 1,2	L3	WK 2,3	10
CO2	Model time series data using appropriate stochastic approaches.	POs - 1,2,3,4,5 PSOs – 1,2	L3	WK 4,5	10
CO3	Apply forecasting, identification, and estimation techniques to time series problems.	POs - 1,2,3,4,5 PSOs – 1,2	L3	WK 2,4	10
CO4	Analyze seasonal and multivariate time series models and evaluate their performance.	POs - 1,2,3,4,5,11 PSOs – 1,2	L3	WK 2,4	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	<p>Introduction, Five Important Practical Problems, Autocorrelation Function and Spectrum of Stationary Processes: Autocorrelation Properties of Stationary Models, Spectral Properties of Stationary Models, Linear Stationary Models: General Linear Process, Autoregressive Processes, Moving Average Processes, Mixed Autoregressive--Moving Average Processes.</p> <p><b>Ch. 1.1, Ch. 2.1,2.2 Ch. 3.1,3.2,3.3,3.4</b></p>	CO1-4	08
II	<p><b>Linear Nonstationary Models:</b> Autoregressive Integrated Moving Average Processes, Three Explicit Forms for the ARIMA Model, Integrated Moving Average Processes.</p> <p><b>Forecasting :</b> Minimum Mean Square Error Forecasts and Their Properties, Calculating Forecasts and Probability Limits, Examples of Forecast Functions and Their Updating, Use of State-Space Model Formulation for Exact Forecasting</p> <p><b>Ch. 4.1,4.2,4.3, Ch. 5.1,5.2,5.3,5.4,5.5.</b></p>	CO1-4	08
III	<p><b>Model Identification:</b> Objectives of Identification, Identification Techniques, Initial Estimates for the Parameters, Model Multiplicity.</p> <p><b>Parameter Estimation:</b> Study of the Likelihood and Sum-of-Squares Functions, Nonlinear Estimation, Some Estimation Results for Specific Models, Likelihood Function Based on the State-Space Model, Estimation Using Bayes' Theorem</p> <p><b>Ch. 6.1,6.2,6.3,6.4 Ch. 7.1,7.2,7.3,7.4,7.5.</b></p>	CO1-4	08
IV	<p><b>Model Diagnostic Checking:</b> Checking the Stochastic Model, Overfitting, Diagnostic Checks Applied to Residuals, Use of Residuals to Modify the Model.</p> <p><b>Analysis of Seasonal Time Series:</b> Parsimonious Models for Seasonal Time Series, Some Aspects of More General Seasonal ARIMA Models, Structural Component Models and Deterministic Seasonal Components, Regression Models with Time Series Error Terms.</p> <p><b>Ch. 8.1,8.2,8.3 Ch. 9.1,9.2,9.3,9.4,9.5</b></p>	CO1-4	08
V	<p><b>Multivariate Time Series Analysis:</b> Stationary Multivariate Time Series, Vector Autoregressive Models, Vector Moving Average Models, Vector Autoregressive--Moving Average Models, Forecasting for Vector Autoregressive--Moving Average Processes, StateSpace Form of the VARMA Model, Nonstationary and Cointegration</p> <p><b>Ch. 14.1,14.2,14.3,14.4,14.5,14.6,14.8</b></p>	CO1-4	08

## 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	“Time Series Analysis – Forecasting and Control”,	George E. P. Box, Gwilym M. Jenkins, Gregory C. Reinsel, Greta M. Ljung,	Wiley Publications , 2016.	5th Edition	1,2,3,4,5
2	Introductory Time Series with R,	Paul S.P. Cowpertwait and Andrew V. Metcalfe	Springer Verlag, New York, 2009.		Reference
3	Forecasting: Principles and Practice,	Rob J. Hyndman and George Athanasopoulos	Open Access Textbooks.		Reference

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

1. <https://nptel.ac.in/courses/103106123>
2. <https://www.youtube.com/watch?v=GE3JOFwTWVM>
3. <https://www.youtube.com/watch?v=tepxdcepTbY>
4. <https://www.youtube.com/watch?v=rDwczdWBITA>

## 7. EVALUATION METHODOLOGY

- g) Continuous Internal Evaluation (CIE) = 50 marks
- h) Semester End Examination (SEE) = 50 marks
- i) Total = 100 marks

### CIE Framework:

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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical evaluation pattern for regular courses is shown in Table 1:

**Table 1: Evaluation Process for CIE and SEE**

	Component	Marks	Total Marks
CIE	CIE Test-1	50	30
	CIE Test-2	50	
	AAT	20	20
SEE	Semester End Examination	100	50
<b>Grand Total</b>			<b>100</b>

### Scheme of Examination (SEE):

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying 20 marks each.
3. There will be two full questions (with a maximum of four sub questions) from each module.
4. The students will have to answer five full questions, selecting one full question from each module.

### 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

Pos →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
Cos ↓											
CO1	3	2	-	-	-	-	-	-	-	-	-
CO2	3	3	2	2	1	-	-	-	-	-	-
CO3	2	3	3	2	2	-	-	-	-	-	-
CO4	2	3	3	3	2	-	-	-	-	-	1
AVG	3	3	3	2	2	-	-	-	-	-	1

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

### 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
Cos ↓		
CO1	2	1
CO2	3	2
CO3	3	3
CO4	3	3
AVG	3	2

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

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Department: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: V	Course Code: BAML24505D	Contact Hrs /week: 3
Course Description: Sensors and System		No. of Credits:3 L : T : P : S = 3:0:0:0
Course Category: PEC		Total no. of Hours = 40+50
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Engineering Physics, Basic Electronics, Mathematics		

## 1. PREAMBLE ABOUT THE COURSE

This course introduces the principles, types, and characteristics of sensors along with their interfacing techniques and system-level applications. It emphasizes understanding sensor behavior, calibration, and interfacing it to systems to develop application. Through analytical and practical learning, students will develop the competence to design, implement, and evaluate sensor-based systems for real-world engineering problems, fostering innovation for automation and intelligent AI systems.

## 2. COURSE LEVEL OBJECTIVES

<b>CLO1</b>	To understand the fundamental principles, types, and operating characteristics of sensors used in engineering and mechatronic systems.
<b>CLO2</b>	To explore MEMS and multi-sensor systems including wireless sensor technologies and sensor fusion applications.
<b>CLO3</b>	To analyze the characteristics and measurement principles of temperature, humidity, strain, optical, and infrared sensors.
<b>CLO4</b>	To learn the architecture and functioning of processing units including microcontrollers, instruction set architectures, and ARM Cortex-M processors used in embedded systems

## 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 fundamental concepts of sensors and embedded controllers.	POs - 1,2 PSOs - 1	L1, L2	WK 2,3	08
CO2	Analyze the characteristics of sensors to build AI applications	POs - 1,2 PSOs - 1	L1, L2	WK 4,5	08
CO3	Develop and interface different types of sensors to embedded controllers	POs - 1,2,3,5 PSOs - 1	L2, L3	WK 2,4	08
CO4	Collaborate and build a complete sensor and system for AI applications	POs - 1,2,3,5,11 PSOs - 1	L3	WK 2,4	08
CO5	Demonstrate the use of modern tools to build AI applications using sensors and controller and communicate through oral or poster presentation	POs - 1,2,3,5,9,10,11 PSOs - 1,2	L3	WK 9	08

**4. SYLLABUS:**

Module No.	Module Description	Mapped COs	No. of Hours
I	<p><b>Sensor system in Engineering:</b> Role of sensor and systems, Application scenarios. Mechatronic engineering.</p> <p><b>MEMS and Multi-sensor system:</b> Introduction to MEMS, Wireless sensor system, sensor fusion and applications.</p> <p><b>Strain gauge:</b> Theory, Types, applications and problems. Thermistor, RTD: Theory, applications and problems.</p> <p><b>Thermocouple:</b> Measurement of thermocouple output, compensating circuits, lead compensation, advantages and disadvantages of thermocouple.</p> <p><b>Case Studies related to each sensors and its applications</b></p> <p><b>Text 1: Chapter 1.1, 1.2, chapter 11</b></p>	CO1-4	08
II	<p><b>Humidity Sensors and Moisture Sensors:</b> Concept of humidity, Electrical Conductivity Sensors, Thermal Conductivity Sensors, Optical Hygrometer, Oscillating Hygrometer.</p> <p><b>IR Sensors:</b> Golay cells, Thermopile, pyroelectric sensor, bolometers, Active Far-Infrared Sensors, Gas flame detectors</p> <p><b>Case Studies related to each sensors and its applications</b></p> <p><b>Text 2: chapter 5</b></p>	CO1-4	08
III	<p><b>Miscellaneous sensors:</b> optical sensors and lasers, fiber optic sensor, light sensor, sensor technologies, Thermo-fluid sensor, sensor for water quality measurement- a case study.</p> <p><b>Photo sensors:</b> Photo resistor, Photodiode, Phototransistor, Photocell, Photo-FET, Charge coupled device.</p> <p><b>Case Studies related to each sensors and its applications</b></p> <p><b>Text 2: chapter 8, Text 1 : Chapter 10</b></p>	CO1-4	08
IV	<p><b>Introduction to Processing Units</b> Computer System, Processor, Block diagram, Processor logic unit, Control unit, Instruction format, Assembly language, High level language, Embedded computing applications, Microcontroller, Instruction set architectures (CISC, RISC), Harvard and Von Neumann.</p> <p><b>Case Studies related to each sensors and its applications</b></p> <p><b>Text 3: chapter 1</b></p>	CO1-4	08
V	<p><b>Cortex M Architecture:</b></p> <p>Advantages of Cortex M CPUs, Programmer's model: Operation modes &amp; states, Registers, Special Registers, APSR, Memory System, Low power modes, Instruction Set: Memory access instructions, Arithmetic, Logical, Shift, Program flow control instructions, Programming examples.</p> <p><b>Case Studies related to each sensors and its applications</b></p> <p><b>Text 3: chapter 4</b></p>	CO1-4	08

## CASE STUDIES PROGRAMS

Sl. No.	PROGRAMS
1	Data Transfer Programs: 1. Block Moves & Exchange (With & Without Overlap) with & without String Instructions. 2. Arithmetic Operations: Addition, Multiplication & Division on 32-Bit Data. 3. Search for a Key in an Array of Elements using Linear Search, Binary Search 4. Logical shift- rotate, II. Interfacing: 1. Wave generation 2. DC motor 3. Stepper motor 4. ADC and DAC
2	Open Ended Experiments: Interfacing sensors to ARM controllers.

## 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Sensors and systems fundamentals and applications	Clarence D silva	Taylor and francis CRC press, 2017, ISBN: 9781498716246.	2 <sup>nd</sup> Edition	1
2	Sensors and Actuators: Control systems Instrumentation	Clarence W.de Silva,	CRC Press, 2013 Edition, ISBN: 978-1-4200-4483-6.	4 <sup>th</sup> Revised Edition	2,3
3	The Definitive Guide to the ARM Cortex-M3& M4 Processors	Joseph Yiu	Newness (Elsevier), 2014, ISBN:978-93-5107-175-4	3 <sup>rd</sup> Edition	4,5

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

1. <https://archive.nptel.ac.in/courses/106/105/106105193/>

## 7. EVALUATION METHODOLOGY

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

### CIE Framework:

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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical evaluation pattern for regular courses is shown in Table 1:

**Table 1: Evaluation Process for CIE and SEE**

	Component	Marks	Total Marks
CIE	CIE Test-1	50	30
	CIE Test-2	50	
	AAT	20	20
SEE	Semester End Examination	100	50
<b>Grand Total</b>			100

#### Scheme of Examination (SEE):

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying 20 marks each.
3. There will be two full questions (with a maximum of four sub questions) from each module.
4. The students will have to answer five full questions, selecting one full question from each module.

### 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11
<b>CO1</b>	3	2									
<b>CO2</b>	2	2									
<b>CO3</b>	3	2			2						
<b>CO4</b>	3	2	3		2						2
<b>CO5</b>	3	3	3		3				3	3	2
<b>Average</b>	3	2	3		3					3	2

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

### 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
<b>CO1</b>	2	
<b>CO2</b>	2	
<b>CO3</b>	2	
<b>CO4</b>	3	
<b>CO5</b>	2	1
<b>AVG</b>	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: Artificial Intelligence and Machine Learning		
Semester: V	Course Code: BAML24556A	Contact Hrs /week: 2
Course Description: UI/UX		No. of Credits: 01 L : T : P : S = 0:0:2:0
Course Category: AEC		Total no. of Hours = <b>15+15</b>
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: <b>03</b>
Course Pre-requisites: Basic Web Concepts		

## 1. PREAMBLE ABOUT THE COURSE

This course introduces students to the fundamental concepts of UI/UX design, wireframing, and prototyping with a strong hands-on approach. Students will learn to analyze user requirements, design effective user interfaces, and create interactive prototypes using modern design tools such as Figma. The course emphasizes practical exposure through real-world design scenarios including mobile apps, dashboards, websites, and e-commerce platforms. By the end of the course, students will be able to understand, apply, and analyze UI/UX principles to design visually appealing and user-friendly digital interfaces, preparing them for industry-relevant design and development roles.

## 2. COURSE LEVEL OBJECTIVES

Sl. No	Course Learning Objectives (CLO)
1	To explore and understand the aspects of User Experience and User Interface.
2	To gain mastery over the usage of Figma for designing and prototyping UI/UX.
3	To understand user requirement and translate it into UI/UX prototype.
4	To analyze apps and websites and understand how they can be continually improved.
5	To understand the UI components and interactions being used in different apps and websites.

## 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 fundamental concepts of wireframing and UI/UX principles used in designing apps and websites.	PO1, PO12, PSO1	L2	WK1, WK2	8
CO2	Use wireframing techniques to convert user requirements into functional UI/UX design prototypes.	PO2, PO3, PSO1	L3	WK3, WK4	8
CO3	Apply Figma tools to design and prototype UI/UX interfaces for different types of apps and websites.	PO3, PO5, PSO1	L3	WK4, WK5	8

CO4	Analyze user requirements and existing app or website designs to identify improvements in usability and functionality.	PO2, PO4, PO11, PSO1	L4	WK4, WK6	8
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Wks are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

#### 4. SYLLABUS

Sl.No.	Laboratory Experiments (Designing and Prototyping using Figma)
1	<b>Chat App Redesign:</b> Create a Wireframe and redesign any popular chat app.
2	<b>Food App:</b> Create a wireframe, Design and Prototype the UI Pages for the food application.
3	<b>Social Media App:</b> Create a wireframe, Design and Prototype social media photo sharing app.
4	<b>Product Website:</b> Design and prototype a product website page. Create web pages and rollovers for the web pages.
5	<b>Travel Agency Website:</b> Create a wireframe, Design and prototype the UI for the website including design for a Home Page with search bar, Activities page, Client Testimonial Page, Image Gallery.
6	<b>UI/UX Designer Portfolio:</b> Create a wireframe, Design and prototype a UI for a portfolio including design for About page, Work showcase page, Blog page, contact page.
7	<b>Dashboard Design:</b> Create a wireframe, Design and Prototype Dashboard UI page, add some Dashboard details, statistics and graphs, Add dropdown options for some dashboard details.
8	<b>E-Commerce Website:</b> Create a wireframe, Design and prototype Web pages including product category pages (example: mobiles, gaming consoles, Speakers), product pages in each category, buy now page, add to cart page.
9	<b>Educational Website:</b> Create a wireframe, Design and Prototype the UI for an educational website – Include a Homepage with footer, About Us Page, Programs page, Instructors page, Pricing page, Payment's page with radial buttons. Design dropdowns for programs button.
10	<b>Music Player App:</b> Create a wireframe, Design and prototype the pages with a background and a Rollover button, Song selection Page with a Home Rollover button. The third page may include animated play and pause button, play music animation, timer animation.

#### 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Don't Make Me Think: A Common Sense Approach to Web Usability	Steve Krug	New Riders	3rd Edition	UI/UX fundamentals, wireframing concepts, usability principles – <b>Experiments 1–10</b>
2	The Design of Everyday Things	Don Norman	Basic Books	Revised & Expanded Edition	User-centered design, interaction design, usability analysis – <b>Experiments 1–10</b>
3	About Face: The Essentials of Interaction Design	Alan Cooper et al.	Wiley	4th Edition	Personas, interaction flows, application design – <b>Experiments 1–8</b>
4	Figma for UI Designers	Marc Andrew	Packt Publishing	1st Edition	Figma tools, wireframes, prototyping, animations – <b>Experiments 1–10</b>

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

- i. <https://www.figma.com/>
- ii. UX Programming for Beginners, August, 2022
- iii. <https://www.udemy.com/course/learn-figma-web-design>
- iv. <https://www.udemy.com/course/figma-2023-master-class-realtime-uiux-web-projects>

## 7. EVALUATION METHODOLOGY

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

### CIE Framework:

### Scheme of Examination (CIE):

### Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum of the CIE (Continuous Internal Evaluation) and SEE (Semester End Exam) taken together.

### Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The Split-up of CIE marks for record/journal and test are in the ratio **60:40**.

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
CO1	2	
CO2	2	
CO3	2	
CO4	2	
AVG	2	

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

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# GLOBAL ACADEMY OF TECHNOLOGY

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



Department: Artificial Intelligence and Machine Learning		
Semester: V	Course Code: BAML24556B	Contact Hrs /week: 2
Course Description: Mongo DB		No. of Credits: 01 L : T : P : S = 0:0:2:0
Course Category: AEC		Total no. of Hours = 15+15
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Basic knowledge of databases and SQL queries, Familiarity with Python or Java programming		

## 1. PREAMBLE ABOUT THE COURSE

The course MongoDB focuses on understanding NoSQL database concepts and developing proficiency in document-oriented data management. MongoDB is a widely used NoSQL database designed for scalability, flexibility, and performance. This course provides practical exposure to CRUD operations, aggregation frameworks, indexing, and text search functionalities. Students will learn how to model, query, and optimize unstructured data, enabling them to handle modern data-driven applications in AI and Machine Learning domains. By the end of this course, students will be able to efficiently design and query MongoDB databases for real-world applications.

## 2. COURSE LEVEL OBJECTIVES

Sl. No	Course Learning Objectives (CLO)
1	Understand basic MongoDB functions, operators and types of operations in MongoDB.
2	Demonstrate the use of Indexing, Advanced Indexing in MongoDB.
3	Apply the aggregation and Map Reduction in MongoDB.
4	Demonstrate text searching on collections in MongoDB.

## 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	Make use of MangoDB commands and queries.	PO1, PO2, PO5, PO9, PO11	L3	WK3, WK4, WK5, WK6	8
CO2	Illustrate the role of aggregate pipelines to extract data.	PO1, PO2, PO3, PO4, PO5, PO9, PO11	L3	WK3, WK4, WK5, WK6	8
CO3	Demonstrate optimization of queries by creating indexes.	PO1, PO3, PO5, PO6, PO9, PO11	L3	WK3, WK4, WK5, WK6	8
CO4	Develop aggregate pipelines for text search in collections.	PO1, PO3, PO5, PO6, PO8, PO9, PO10, PO11	L4	WK3, WK4, WK5, WK6, WK8	8

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

#### 4. SYLLABUS

Sl.No.	Laboratory Experiments
1	<p>a. Illustration of Where Clause, AND,OR operations in MongoDB.</p> <p>b. Execute the Commands of MongoDB and operations in MongoDB : Insert, Query, Update, Delete and Projection. (Note: use any collection) [Refer: Book 1 chapter 4].</p>
2	<p>a. Develop a MongoDB query to select certain fields and ignore some fields of the documents from any collection.</p> <p>b. Develop a MongoDB query to display the first 5 documents from the results obtained in a. [use of limit and find] [Refer: Book 1 Chapter 4, book 2: chapter 5]</p>
3	<p>a. Execute query selectors (comparison selectors, logical selectors) and list out the results on any collection.</p> <p>b. Execute query selectors (Geospatial selectors, Bitwise selectors) and list out the results on any collection. [Refer: Book 3 Chapter 13]</p>
4	<p>Create and demonstrate how projection operators (\$, \$elemMatch and \$slice) would be used in the MongoDB. [Refer: Book 3 Chapter 14]</p>
5	<p>Execute Aggregation operations (\$avg, \$min,\$max, \$push, \$addToSet etc.). students encourage to execute several queries to demonstrate various aggregation operators) [Refer: Book 3 Chapter 15]</p>
6	<p>Execute Aggregation Pipeline and its operations (pipeline must contain \$match, \$group, \$sort, \$project, \$skip etc. students encourage to execute several queries to demonstrate various aggregation operators)[refer book 2: chapter 6 ]</p>
7	<p>a. Find all listings with listing_url, name, address, host_picture_url in the listings And Reviews collection that have a host with a picture url.</p> <p>b. Using E-commerce collection write a query to display reviews summary.[refer Book 2: chapter 6]</p>
8	<p>a. Demonstrate creation of different types of indexes on collection (unique, sparse, compound and multikey indexes)</p> <p>b. Demonstrate optimization of queries using indexes. Refer: Book 2: Chapter 8 and Book 3: Chapter 12]</p>
9	<p>a. Develop a query to demonstrate Text search using catalog data collection for a given word.</p> <p>b. Develop queries to illustrate excluding documents with certain words and phrases Refer: Book 2: Chapter 9]</p>
10	<p>Develop an aggregation pipeline to illustrate Text search on Catalog data collection. Refer: Book 2 :Chapter 9]</p>

#### 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	MongoDB: The Definitive Guide	Kristina chodorow	O'REILLY	2 <sup>nd</sup> Edition	Exp 1,2
2	MongoDB in Action	KYLE BANKER	Manning publication,	2 <sup>nd</sup> Edition	Exp 3,4,5,8

			2016		
3	MongoDB Complete Guide	Manu Sharma	bpb publication, 2023	1 <sup>st</sup> Edition	Exp 6,7,9,10

## 6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE]

1. Installation of MongoDB Video: <https://www.youtube.com/watch?v=dEm2AS5amyA>
2. Video on Aggregation: <https://www.youtube.com/watch?v=vx1C8EyTa7Y>
3. MongoDB in action book Code download URL: <https://www.manning.com/downloads/529>
4. MongoDB Exercise URL: <https://www.w3resource.com/mongodb-exercises/>

## 7. EVALUATION METHODOLOGY

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

### CIE Framework:

#### Scheme of Examination (CIE):

#### Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum of the CIE (Continuous Internal Evaluation) and SEE (Semester End Exam) taken together.

#### Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The Split-up of CIE marks for record/journal and test are in the ratio **60:40**.

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
CO1	2	
CO2	2	
CO3	2	
CO4	2	
AVG	2	

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

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# GLOBAL ACADEMY OF TECHNOLOGY

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



Department: Artificial Intelligence and Machine Learning		
Semester: V	Course Code: BAML24556C	Contact Hrs /week: 2
Course Description: Mobile Application Development		No. of Credits: 01 L : T : P : S = 0:0:2:0
Course Category: AEC		Total no. of Hours = 15+15
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Basic programming knowledge in Java, Familiarity with Object-Oriented Programming (OOPs) concepts, Basic understanding of databases and SQL.		

## 1. PREAMBLE ABOUT THE COURSE

The course Mobile Application Development introduces students to the fundamentals of building Android applications. It focuses on developing skills for designing user-friendly interfaces, handling data storage, using sensors, and integrating device-specific features like GPS, notifications, and multimedia. Students will gain hands-on experience with Android Studio, activity lifecycle management, and basic networking operations. By the end of the course, learners will be capable of creating functional mobile applications that can be extended with AI and data-driven features.

## 2. COURSE LEVEL OBJECTIVES

Sl. No	Course Learning Objectives (CLO)
1	To introduce the fundamentals of Android application development using Java or Kotlin.
2	To design and implement interactive and data-driven mobile applications using Android Studio.
3	To integrate advanced functionalities such as databases, notifications, and GPS in mobile applications.

## 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	Design and develop basic Android applications using GUI components and event handling.	PO1, PO2, PO5, PO9, PO11, PSO1	L3	WK3, WK4, WK5, WK6	8
CO2	Implement applications that use data storage, databases, and background processing.	PO1, PO2, PO3, PO4, PO5, PO9, PO11, PSO1	L4	WK3, WK4, WK5, WK6	8
CO3	Develop mobile applications that integrate sensors, GPS, notifications, and external services.	PO1, PO3, PO5, PO6, PO8, PO9, PO10, PO11, PSO1	L4	WK3, WK4, WK5, WK6, WK8	8

CO4	Design a mini-project demonstrating the integration of multiple features in a real-world mobile app.	PO1, PO3, PO5, PO6, PO8, PO9, PO10, PO11, PSO1	L4	WK4, WK5, WK6, WK7, WK8, WK9	8
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Wks are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9

#### 4. SYLLABUS

Sl.No.	Laboratory Experiments
1	Develop an application that uses GUI components, Font and Colours.
2	Develop an application that uses Layout Managers and event listeners.
3	Write an application that draws basic graphical primitives on the screen.
4	Develop an application that makes use of databases.
5	Develop an application that makes use of Notification Manager.
6	Implement an application that uses Multi-threading.
7	Develop a native application that uses GPS location information
8	Implement an application that creates an alert upon receiving a message
9	Develop a mobile application to send an email.
10	Develop a Mobile application for simple needs (Mini Project)

#### 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Android Programming: The Big Nerd Ranch Guide	Bill Phillips, Chris Stewart, Kristin Marsicano	Big Nerd Ranch	4th Edition, 2023	All modules
2	Head First Android Development	Dawn Griffiths, David Griffiths	O'Reilly Media	3rd Edition, 2021	Basics of Android and UI design
3	Android Application Development for Java Programmers	James C. Sheusi	Cengage Learning	2nd Edition, 2017	Layouts, intents, and database apps
4	Professional Android	Reto Meier, Ian Lake	Wrox	5th Edition, 2022	Advanced Android concepts, sensors, and GPS

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

1. <https://nptel.ac.in/courses/106105224>
2. <https://www.coursera.org/specializations/android-app-development>
3. <https://www.edx.org/course/mobile-computing>
4. <https://developer.android.com/codelabs>
5. <https://www.youtube.com/@AndroidDevelopers>

## 7. EVALUATION METHODOLOGY

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

### CIE Framework:

#### Scheme of Examination (CIE):

#### Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum of the CIE (Continuous Internal Evaluation) and SEE (Semester End Exam) taken together.

#### Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The Split-up of CIE marks for record/journal and test are in the ratio **60:40**.

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
CO1	2	
CO2	2	
CO3	2	
CO4	2	
AVG	2	

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

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# GLOBAL ACADEMY OF TECHNOLOGY

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



Department: Artificial Intelligence and Machine Learning		
Semester: V	Course Code: BAML24556D	Contact Hrs /week: 2
Course Description: Data Visualization using Tableau		No. of Credits: 01 L : T : P : S = 0:0:2:0
Course Category: AEC		Total no. of Hours = 15+15
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Basic knowledge of Python or R programming, Understanding of database systems and SQL queries, Fundamentals of data analysis		

## 1. PREAMBLE ABOUT THE COURSE

The course Data Visualization using Tableau introduces students to the essential tools and techniques for visual analytics. Tableau is a leading platform for creating interactive, shareable dashboards that reveal patterns, trends, and insights in data. This course aims to develop students' ability to connect various data sources, perform data transformations, and represent data effectively using charts, maps, and dashboards. Students will gain practical experience in using Tableau for real-world datasets, enabling them to communicate data insights clearly and make informed business or analytical decisions.

## 2. COURSE LEVEL OBJECTIVES

Sl. No	Course Learning Objectives (CLO)
1	To understand how Tableau works.
2	Learn to analyze data using visualization techniques.
3	Apply the advanced features of tableaus like maps and dashboard.

## 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 the features and interface of Tableau for data visualization.	PO1, PO2, PO5, PO9, PO11	L3	WK3, WK4, WK5, WK6	8
CO2	Analyze and visualize datasets using Tableau functions, parameters, and calculated fields.	PO1, PO2, PO3, PO4, PO5, PO9, PO11	L4	WK3, WK4, WK5, WK6	8
CO3	Build interactive dashboards and storytelling reports on real-time case studies.	PO1, PO3, PO5, PO6, PO8, PO9, PO10, PO11	L5	WK3, WK4, WK5, WK6, WK8	8

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

#### 4. SYLLABUS

Sl.No.	Laboratory Experiments
1	Demonstrate Tableau measure names and measure values on the given dataset.
2	Demonstrate Calculated Fields on the given dataset using Tableau.
3	Illustrate the concept of Parameters on the given dataset using Tableau.
4	Illustrate Joins and Data Extract on the given dataset using Tableau
5	Demonstrate Data Filtering on the given dataset using Tableau
6	Demonstrate Grouping, Alias and Sets on the given dataset using Tableau.
7	Illustrate plotting pie charts on Map using Tableau
8	Illustrate Reference line, Trend line, and Forecasting on the given dataset using Tableau.
9	Illustrate clustering on the given dataset using Tableau.
10	Demonstrate Building Dashboards and dashboard actions using Tableau.

#### 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Learning Tableau: Tools for Business Intelligence, Data Prep, and Visual Analytics	Joshua N. Milligan	Packt Publishing	5th Edition, 2022	All modules
2	Getting Started with Tableau 2022	Tristan Guillevin	Packt Publishing	2022	Visualization basics and dashboard design
3	Tableau Your Data!: Fast and Easy Visual Analysis with Tableau Software	Daniel G. Murray	Wiley	2nd Edition, 2016	Data analysis, charts, and dashboards
4	Storytelling with Data: A Data Visualization Guide for Business Professionals	Cole Nussbaumer Knaflic	Wiley	2nd Edition, 2021	Communication and storytelling with dashboards

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

1. <https://nptel.ac.in/courses/106106183>
2. <https://www.coursera.org/learn/data-visualization-tableau>
3. <https://www.tableau.com/learn/training>

#### 7. EVALUATION METHODOLOGY

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

**CIE Framework:****Scheme of Examination (CIE):****Assessment Details (both CIE and SEE):**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum of the CIE (Continuous Internal Evaluation) and SEE (Semester End Exam) taken together.

**Continuous Internal Evaluation (CIE):**

CIE marks for the practical course are **50 Marks**.

The Split-up of CIE marks for record/journal and test are in the ratio **60:40**.

**8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING**

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

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

**9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING**

PSOs →	PSO1	PSO2
COs ↓		
CO1		2
CO2		2
CO3		2
AVG		2

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

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# GLOBAL ACADEMY OF TECHNOLOGY

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



Department: Artificial Intelligence and Machine Learning		
Semester: V	Course Code: BAML P54507	Contact Hrs /week: 3
Course Description: Mini Project		No. of Credits: 02 L : T : P : S = 0:0:4:0
Course Category: PROJ		Total no. of Hours = 15+15
CIE: 100 Marks	SEE:--	Exam Hours: 03

**Mini-project work:** Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.

## CIE procedure for Mini-Project:

a. Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

b. Interdisciplinary: Continuous Internal Evaluation shall be group wise at the college level with the participation of all the guides of the college. The CIE marks awarded for the Mini- Project shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

## EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 100 marks

b) Semester End Examination (SEE) = Nil

Total = 100 marks

Table : Distribution of weightage for CIE & SEE

	Component	Marks	Total Marks
CIE	Review-I	50	100
	Review-2	50	
SEE	Semester End Exam	--	--
Grand Total			100

Department: Artificial Intelligence and Machine Learning		
Semester: V	Course Code: BRMK24557	Contact Hrs /week: 03
Course Description: Research Methodology and IPR		No. of Credits:03 L : T : P : S = 3:0:0:0
Course Category: PC		Total no. of Hours = 40+50
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Prerequisites: Basics of Engineering Mathematics and Logical Reasoning		

## 1. PREAMBLE ABOUT THE COURSE

This course introduces research methodology and intellectual property rights for engineering students. Students explore the foundations of research including types, approaches, significance, and research processes. Literature review techniques, research design, experimental designs, and sampling methods are studied. Data collection approaches covering primary and secondary data sources, measurement and scaling are examined. Statistical hypothesis testing including tests for mean, proportion, and variance, and interpretation and report writing skills are developed. The course concludes with intellectual property rights including patents, copyrights, trademarks, and emerging IPR challenges, equipping students with research skills and legal framework awareness.

## 2. COURSE LEVEL OBJECTIVES

1. To make the student understand the foundations of Research and problem solution.
2. Knowledge in Research design, Qualitative and Quantitative Research.
3. Knowledge to analyze data using statistical methods and develop critical thinking skills.
4. To understand the different types of Intellectual Property Rights (IPR).

## 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 fundamental research methodology concepts, including types, processes, and problem formulation, to initiate a research study.	PO1	L2	WK1,3,7,8,9	8
CO2	Use appropriate techniques to conduct literature reviews and develop theoretical/conceptual frameworks in line with academic standards.	PO2	L3	WK1,3,7,8,9	8
CO3	Investigate research problems using proper sampling, data collection, and hypothesis testing procedures	PO4	L3	WK1,3,7,8,9	8
CO4	Present a structured review manuscript while adhering to IPR, ethical standards, and teamwork principles.	PO8, PO9, PO11	L2	WK1,3,7,8,9	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	<p><b>Research Methodology:</b> Introduction, Meaning of Research, Objectives of Research, Types of Research, Research Approaches, Significance of Research, Research and Scientific Method, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India.</p> <p><b>Defining the Research Problem:</b> Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration.</p> <p>Textbook 3: Chapter 1, Chapter 2</p>	CO1	8
II	<p><b>Reviewing the Literature:</b> Place of the literature review in research, bringing clarity and focus to research problem, improving research methodology, broadening knowledge base in research area, enabling contextual findings, Review of the literature, searching the existing literature, reviewing the selected literature, developing a theoretical framework, developing a conceptual framework, writing about the literature reviewed.</p> <p><b>Research Design:</b> Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs.</p> <p>Textbook 3: Chapter 3, Chapter 4</p>	CO2	8
III	<p><b>Design of Sample Surveys:</b> Introduction, Sample Design, Sampling and Non-Sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs.</p> <p><b>Measurement and Scaling:</b> Qualitative and Quantitative Data.</p> <p><b>Data Collection:</b> Introduction, Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method.</p> <p>Textbook 3: Chapter 5, Chapter 6, Chapter 7</p>	CO2	8
IV	<p><b>Testing of Hypotheses:</b> Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis.</p> <p><b>Interpretation and Report Writing:</b> Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.</p> <p>Textbook 3: Chapter 9, Chapter 13</p>	CO3,CO4	8
V	<p><b>Intellectual Property:</b> Principles of IPR, Kinds of IPR, Patent – Concepts, Novelty, Utility, Inventiveness/Non-obviousness, Procedure for granting and obtaining patents; Copyright – conditions for grant of copyright, Copyright in</p>	CO4	8

	Literary, Dramatic and Musical Works, Sound Recording, Cinematograph Films, Copyright in Computer Programme, Author Special Rights, Right of Broadcasting and performers; Trademark Law and Practices – Procedure of registration of trademark; Emerging Issues and Challenges; Future Aspects of Intellectual Property Rights. Textbook 4: Chapter 1, Chapter 2, Chapter 3		
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## 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Business Research Methods	Donald Cooper and Pamela Schindler	Tata McGraw Hill.	9 <sup>th</sup> Edition	1-4
2	Research Methodology: Methods and Techniques	Kothari, C.R	New Age International	1990	1-4
3	Intellectual Property Law	Lionel Bently and Brad Sherman		3rd Edition	5

## 6. EVALUATION METHODOLOGY

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

## AAT - Research-based learning activity – SELF STUDY

Phase	Weeks	Activity	Mode
Phase 1 – Orientation & Topic Selection	1–2	Kick-off workshop (research methods, literature review, trends)	Instructor-led
	1–2	Brainstorm & choose topic	Group work
	2	Draft research problem & objectives	Instructor-guided
Phase 2 – Literature Search & Review	3	Library / database training (Google Scholar, Scopus, Web of Science)	Instructor/library staff
	3–4	Independent literature search & build literature matrix (10–20 papers)	Self-study
	4	Group discussion & synthesis	Group work
	4	Develop theoretical & conceptual framework	Instructor-guided
	5–6	Write intro & literature review sections	Self-study
Phase 3 – Drafting & Analysis	6	Peer feedback session	Group/instructor
	6–7	Write methodology & discussion sections	Self-study
	7	Session on IPR (patents, copyright)	Instructor-led
Phase 4 – Hypotheses & Revision	8	Workshop: hypothesis building & testing	Instructor-led
	8	Group work to refine hypotheses	Group
	8–9	Revise paper, integrate IPR &	Self-study

		hypothesis	
Phase 5 – Writing & Finalizing	10	Workshop on report writing, references, plagiarism	Instructor-led
	10	Write conclusion & future scope	Self-study
	10	Draft abstract & keywords	Self-study
Phase 6 – Presentation & Submission	11	Prepare PPT slides	Self-study
	11	Trial presentation & peer feedback	Group
	12	Final presentation to faculty panel	Instructor/panel
	12	Final editing & submission	Self-study

### Detailed Rubric (100 Marks)

Criteria	Excellent (8-10)	Good (6-7)	Fair (3-5)	Poor (1-2)
Topic & research problem (10)	Clear, original, focused	Clear but common	Vague focus	Unclear topic
Depth of literature review (20)	Comprehensive & critical	Good coverage	Basic summary	Few sources
Frameworks & hypotheses (10)	Well-developed & logical	Adequate frameworks	Limited framework	No framework
Analysis & discussion (20)	Deep synthesis & critical	Some synthesis	Mostly descriptive	Minimal analysis
IPR awareness (5)	Insightful discussion	Basic discussion	Mentioned only	Missing
Structure & writing (15)	Clear, coherent, error-free	Mostly clear	Some issues	Poorly written
References & ethics (5)	Correct citation, plagiarism-free	Few issues	Several issues	Major plagiarism
Presentation (10)	Confident, engaging	Clear	Basic slides	Unprepared
Teamwork & reflection (5)	Strong collaboration	Good collaboration	Uneven	Poor teamwork

Typical Evaluation pattern for courses is shown in the Table below

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

### 7. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 8. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

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

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

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Department: Science and Humanities		
Semester: V	Course Code: BCSK24508	Contact Hrs /week: 01
Course Description: Environmental Studies		No. of Credits:01 L : T : P : S = 1:0:0:0
Course Category: MC		Total no. of Hours = 15
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 01

## 1. PREAMBLE ABOUT THE COURSE

This course explores key environmental issues and e-waste management practices. It promotes awareness of sustainability, pollution control, and resource conservation, preparing students to contribute to a cleaner and healthier environment.

## 2. COURSE LEVEL OBJECTIVES

- Identify the major challenges of environmental issues
- Develop skills, critical thinking and demonstrate socio-economic skills for Environmental protection
- Analyze the impact of issues with respect to waste management

## 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	Analyze ecosystem dynamics to formulate strategies for addressing sustainability challenges and implementing the SDGs	PO1, PO6,	U	WK1	5
CO2	Evaluate energy technologies to design effective resource management strategies.	PO1	U	-	5
CO3	Evaluate the impacts of pollution to develop effective waste management strategies.	PO1, PO2, PO6	U	-	5
CO4	Evaluate global environmental issues to design solutions for sustainable management				
CO5	Interpret environmental laws and regulations for sustainable management practices	PO1, PO2, PO6	U	-	5
CO6	Understand e-waste management in a global scenario.	PO1, PO2, PO6	U	-	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	Ecosystem and Sustainability: Ecosystem: Structure of Ecosystem, Types: Forest, Desert, Wetlands, Riverine, Oceanic ecosystems. Sustainability: 17SDG targets and possible actions. Self-Study Component (SSC): Components of the environment. Textbook 1: CH- 3, e-resource:1	CO1	3

II	<p>Natural resources and Energy:  Natural Resources: Water resources – Availability &amp; Quality aspects, Water borne diseases &amp; water induced diseases, Fluoride problem in drinking water.  Energy: Different types of energy, Conventional sources &amp; Non - Conventional sources of Energy, Solarenergy, Wind Energy, Hydrogen as an alternative energy  Self-Study Component (SSC): Alternative Energy sources  Textbook 1: CH- 2</p>	CO1	3
III	<p>Environmental Pollution:  Environmental Pollution: Water Pollution, Noise pollution, Air pollution (Sources, Impacts, Preventive measures and Public Health Aspects.  Self-Study Component (SSC): Case studies of air pollution episodes  Textbook 1: CH- 5</p>	CO1, CO2	3
IV	<p>Waste management:  Waste management: Solid Waste Management , types and sources, functional elements of SWM, Biomedical Waste Management - Sources, Characteristics  Environmental Legislation: Solid Waste Management Rules,2016, Biomedical Waste Management Rules, 2016. Self-Study Component (SSC): Case studies on waste management options  Textbook 1: CH- 6, e-resource:2</p>	CO2, CO3	3
V	<p>E - Waste Management  E- waste; composition and generation. Global context in e- waste; E-waste pollutants, E waste hazardous properties, Effects of pollutant (E- waste) on human health and surrounding environment, domestic e-waste disposal, Basic principles of E waste management, Component of E waste management.E-waste (Management and Handling) Rules, 2011; and E-Waste (Management) Rules, 2022 - Salient Features and its implications.  Self-Study Component (SSC): E-Waste (Management) Amendment Rules, 2023, 2024  Textbook 1: CH- 6, Textbook 2: CH-2, e-resource:3</p>	CO3	3

## 6. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	“Environmental Studies”	S M Prakash	Elite Publishing House, Mangalore	3rd Edition, 2018.	1-5
2	Electronic Waste Management. Science	Hester R.E., and Harrison R.M		2009	5
3	“Environmental Studies- From Crisis to Cure”	R. Rajagopalan,	Oxford university press, New Delhi	2nd Edition, 2013	1-4
4	“Principles of Environmental Science and Engineering”,	Raman Sivakumar,	Cengage learning Singapur	2nd edition, 2005	2-4
5	“Environmental Studies”	Benny Joseph	Tata McGraw – Hill Publishing Company Limited	2005	1-4

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

1. <https://cpcb.nic.in>
2. <https://moef.gov.in>
3. <https://sdgs.un.org/goals>
4. <https://nptel.ac.in/>
5. <https://nptel.ac.in>

## 7. EVALUATION METHODOLOGY

- a) Continuous Internal Evaluation (CIE) = 50 marks
  - b) Semester End Examination (SEE) = 50 marks
- Total = 100 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 →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
COs ↓											
CO1	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2	PSO3
COs ↓			
CO1	-	-	-
CO2	-	-	-
CO3	-	-	-
CO4	-	-	-
CO5	-	-	-
CO6	-	-	-

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

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Department: Science and Humanities		
Semester: III/VI	Course Code: BNSK24559	Contact Hrs /week: 1
Course Description: National Service Scheme (NSS)		No. of Credits: L : T : P : S = 1
Course Category: MC		Total no. of Hours = 12
CIE: 100 Marks	SEE:	Exam Hours:

## 1. PREAMBLE ABOUT THE COURSE

The National Service Scheme (NSS) offers students a unique opportunity to participate in nation-building and community development through voluntary social service. This course fosters a spirit of civic engagement, leadership, and social responsibility by enabling students to interact directly with communities. Through participation in outreach activities such as environmental conservation, rural development, and disaster relief, students develop practical life skills and empathy, preparing them to be proactive and responsible citizens.

## 2. COURSE LEVEL OBJECTIVES

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

## 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 importance of his / her responsibilities towards society.	PO6, PO7	L2	WK6	2
CO2	Analyse the environmental and societal problems/issues and will be able to design solutions for the same.	PO2, PO5	L4	WK4	2
CO3	Evaluate the existing system and to propose practical solutions for the same for sustainable development.	PO3, PO7	L4	WK5	2
CO4	Implement government or self-driven projects effectively in the field.	PO4, PO9	L3	WK6	3
CO5	Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.	PO8, PO11	L3	WK2	3

*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	Developing Sustainable Water management system for rural areas and implementation approaches.	CO2, CO3	3
II	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.	CO4	3
III	Spreading public awareness under rural outreach programs.(minimum5 programs).	CO5	3
IV	Social connect and responsibilities.	CO5	3

#### 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	NSS Course Manual	-	Published by NSS Cell, VTU Belagavi	Latest	All
2	Government of Karnataka, NSS cell, activities reports and its manual.	-	Karnataka NSS Cell	Latest	All
3	Government of India, nss cell, Activities reports and its manual.	-	Ministry of Youth Affairs & Sports	Latest	All

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

1. Community Engagement and Social Responsibility: <https://swayam.gov.in/>
2. Official Guidelines and Activities: <https://nss.gov.in>
3. Environmental and Social Sustainability: <https://nptel.ac.in>

#### 7. EVALUATION METHODOLOGY

Continuous Internal Evaluation (CIE) = 50 marks

#### 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2	PSO3
COs ↓			
CO1	-	-	-
CO2	-	-	-
CO3	-	-	-
CO4	-	-	-
CO5	-	-	-

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

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

Sl No	Topic	Group size	Location	Activity execution	Reporting	Evaluation Of the Topic
1.	Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.	May be individual or team	Farmers land/Villages/ roadside/ community area/ College campus etc.....	Site selection /proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
2.	Waste management– Public, Private and Govt organization, 5 R's.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/G overnment Schemes officers/ campus etc.....	Site selection /proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
3.	Setting of the information imparting club for women leading to contribution in social and economic issues.	May be individual or team	Women empowerment groups/ Consulting NGOs & Govt Teams / College campus etc.....	Group selection/prop er consultation/C ontinuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
4.	Water conservation techniques – Role of different stakeholders– Implementation.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/G overnment Schemes officers/ campus etc.....	site selection / proper consultation/C ontinuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
5.	Preparing an actionable business proposal for enhancing the village income and approach for implementation.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/G overnment Schemes officers/ campus etc.....	Group selection/prop er consultation/C ontinuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer





# GLOBAL ACADEMY OF TECHNOLOGY

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



Department: Science and Humanities		
Semester: V	Course Code: BPEK24559	Contact Hrs /week: 1
Course Description: PHYSICAL EDUCATION (SPORTS & ATHLETICS) – I		No. of Credits:0 L : T : P : S = 1
Course Category: MC		Total no. of Hours = 12
CIE: 100 Marks	SEE:	Exam Hours:

## 1. PREAMBLE ABOUT THE COURSE

This course, the third in the Physical Education series, focuses on enhancing students' awareness of health, food, nutrition, and physical fitness. It promotes the development of agility, flexibility, endurance, and coordination through practical sessions and scientific fitness assessments. Students will also be introduced to the basic skills and techniques in games such as Badminton and Basketball, and athletic throwing events. The course builds a strong foundation for personal fitness and professional development in sports and wellness fields.

## 2. COURSE LEVEL OBJECTIVES

- To understand key aspects of food, nutrition, and their impact on fitness and health.
- To practice and evaluate fitness through standardized tests and performance assessments.
- To develop motor skills and tactical knowledge in selected indoor and outdoor games.
- To foster teamwork, discipline, and sportsmanship through active participation.
- To strengthen foundational knowledge required for careers in physical education and coaching.

## 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 fundamental concepts and skills of Physical Education, Health, Food, Nutrition and general fitness	-	-	-	-
CO2	Familiarization of health-related Exercises, Sports for overall growth and development	-	-	-	-
CO3	Create a foundation for the professionals in Physical Education and Sports	-	-	-	-
CO4	Participate in the competition at regional/state / national / international levels.	-	-	-	-
CO5	Understand and practice of specific games and athletic throwing events.	-	-	-	-

*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	A. Fitness B. Food & Nutrition	-	4
II	A. Agility – Shuttle Run B. Flexibility – Sit and Reach C. Cardiovascular Endurance – Harvard step Test	-	4
III	1. Badminton (Fore hand low/high service, back hand service, smash, drop) 2. Basketball (Dribbling, passing, shooting etc.) 3. Athletics (Field events – Throws)	-	16

#### 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Foundations of Physical Education	Charles A. Bucher	McGraw Hill	Latest	All
2	Health and Physical Education	Dr. V.K. Sharma	Khel Sahitya Kendra	Latest	All

#### 7. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE]

- Physical Education and Sports : <https://nptel.ac.in/>

#### 8. EVALUATION METHODOLOGY

Continuous Internal Evaluation (CIE) = 50 marks

#### 9. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

#### 10. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →			
COs ↓	PSO1	PSO2	PSO3
CO1	-	-	-
CO2	-	-	-
CO3	-	-	-
CO4	-	-	-
CO5	-	-	-

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

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Department: Science and Humanities		
Semester: V	Course Code: BLAK24559	Contact Hrs /week: 1
Course Description: MUSIC		No. of Credits: 0 L : T : P : S = 0:0:1:0
Course Category: MC		Total no. of Hours = 15
CIE: 100 Marks	SEE:	Exam Hours:

## 1. PREAMBLE ABOUT THE COURSE

This course offers students a hands-on musical experience through vocal exercises and foundational compositions in Carnatic music. It aims to develop analytical, creative, and intuitive musical abilities by immersing students in swara patterns, tala structures, and geethe forms. Through listening, singing, and notation practice, learners cultivate musical discipline, cultural appreciation, and performance confidence.

## 2. COURSE LEVEL OBJECTIVES

1. To sing and notate foundational Carnatic music exercises like Sarale Varase and Geethe.
2. To identify the structure and form of compositions in Malahari and Mayamalavagowla ragas.
3. To practice vocal discipline and understand the connection between melody, rhythm, and emotion.
4. To build a foundation for traditional vocal performance through repertoire learning.
5. To enhance listening and pattern recognition skills in Indian classical music.

## 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	Discuss the Indian system of music and relate it to other genres (Cognitive Domain)	PO6, PO7	L2	-	5
CO2	Experience the emotions of composer and develop empathy (Affective Domain)	PO8, PO11	L3	-	5
CO3	Respond to queries on various patterns in a composition (Psycho Motor Domain)	PO2, PO3	L4	-	5

## 4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
1	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.	CO1,CO2,CO3	15

## 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

Sl. No.	Name of the Book	Author(s)	Publisher	Edition
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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 Subramaniam	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

## 6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE]

1. Appreciation of Indian Classical Music: <https://swayam.gov.in>
2. NPTEL Carnatic Music Series by Experts: <https://youtube.com>
3. Digital Archives of Indian Classical Music: <https://ignca.gov.in>

## 7. EVALUATION METHODOLOGY

Continuous Internal Evaluation (CIE) = 100 marks

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
CO1	-	-
CO2	-	-
CO3	-	-

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

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Department: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: 6	Course Code: BAML24601	Contact Hrs /week: 3
Course Description: NATURAL LANGUAGE PROCESSING		No. of Credits:4 L : T : P : S = 3:0:2:0
Course Category: IPCC		Total no. of Hours = 40+50
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Basic knowledge of Python programming, probability, and machine learning concepts is required.		

## 1. PREAMBLE ABOUT THE COURSE

Natural Language Processing (NLP) is a branch of Artificial Intelligence that focuses on enabling computers to understand and process human language. This course introduces core NLP concepts and techniques such as text preprocessing, language modeling, part-of-speech tagging, parsing, and semantic analysis, along with practical applications including information retrieval, question answering, and sentiment analysis.

## 2. COURSE LEVEL OBJECTIVES

<b>CLO1</b>	Understand and explain core NLP concepts
<b>CLO2</b>	Apply text processing and representation techniques
<b>CLO3</b>	Construct and evaluate statistical language models and POS taggers
<b>CLO4</b>	Design and Implement NLP Applications for Text Classification and Question Answering

## 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 core NLP concepts such as language modeling, tokenization, and vector semantics.	POs - 1,2 PSOs - 1	L2	WK 2,3	12
CO2	Apply NLP techniques including n-grams, POS tagging, and text classification.	POs - 1,2,3 PSOs - 1	L3	WK 4,5	13
CO3	Develop NLP models using embeddings, probabilistic methods, and similarity measures.	POs - 1,2,3,4 PSOs - 1	L3	WK 2,4	12
CO4	Evaluate NLP systems for information retrieval, question answering, sentiment analysis, and RAG.	POs - 1,2,3,4,6,7,8 PSOs - 1	L3	WK 2,4	13

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	<p><b>Overview and Language Modeling:</b> Overview: Origins and challenges of NLP-Language and Grammar-Processing Indian Languages- NLP Applications-Information Retrieval.</p> <p>Language Modeling: Various Grammar-based Language Models, Statistical Language Model.</p> <p><b>Textbook 2: Ch. 1, Ch. 2</b></p>	CO1-4	10
II	<p><b>Regular Expressions, Tokenization, Edit Distance:</b> Regular Expressions, Words, Corpora, Simple Unix Tools for Word Tokenization, Word and Subword Tokenization, Word Normalization, Lemmatization and Stemming, Sentence Segmentation, Minimum Edit Distance</p> <p><b>Vector Semantics and Embeddings:</b> Lexical Semantics, Vector Semantics, Words and Vectors, Cosine for measuring similarity, TF-IDF: Weighing terms in the vector, Word2vec</p> <p><b>Textbook 1: Ch. 2, Ch. 6</b></p>	CO1-4	10
III	<p><b>N-gram Language Models:</b> N-Grams, Evaluating Language Models: Training and Test Sets, Evaluating Language Models: Perplexity, Sampling sentences from a language model, Generalizing vs. overfitting the training set, Smoothing, Interpolation, and Backoff.</p> <p><b>Parts of Speech tagging:</b> English word classes, Tagsets for English, Parts of speech tagging, Rules based Parts of speech tagging, HMM Parts of speech tagging.</p> <p><b>Textbook 1: Ch. 3, Ch. 17</b></p>	CO1-4	10
IV	<p><b>Naive Bayes, Text Classification and Sentiment:</b> Naive Bayes Classifiers, Training the Naive Bayes Classifier, Worked Example, Optimizing for Sentiment Analysis, Naive Bayes for Other Text Classification Tasks, Naive Bayes as a Language Model.</p> <p><b>Textbook 1: Appendix B</b></p>	CO1-4	10
V	<p><b>Question Answering, Information Retrieval, and RAG:</b> Information Retrieval, Information Retrieval with Dense Vectors, Answering Questions with RAG, Question Answering Datasets, Evaluating Question Answering</p> <p><b>Textbook 1: Ch. 11</b></p>	CO1-4	10

## PRACTICAL COMPONENT OF IPCC

Sl.No.	Experiments
1	<p>Write a Python program for the following preprocessing of text in NLP:</p> <ul style="list-style-type: none"> <li>● Tokenization</li> <li>● Filtration</li> <li>● Script Validation</li> <li>● Stop Word Removal</li> <li>● Stemming</li> </ul>
2	Demonstrate the N-gram modeling to analyze and establish the probability

	distribution across sentences and explore the utilization of unigrams, bigrams, and trigrams in diverse English sentences to illustrate the impact of varying n-gram orders on the calculated probabilities.
3	Investigate the Minimum Edit Distance (MED) algorithm and its application in string comparison and the goal is to understand how the algorithm efficiently computes the minimum number of edit operations required to transform one string into another. <ul style="list-style-type: none"> <li>● Test the algorithm on strings with different type of variations (e.g., typos, substitutions, insertions, deletions)</li> <li>● Evaluate its adaptability to different types of input variations</li> </ul>
4	Develop a python program for word embedding using Word2Vec for a given word corpus.
5	Given the following short movie reviews, each labeled with a genre, either comedy or action: <ul style="list-style-type: none"> <li>● fun, couple, love, love comedy</li> <li>● fast, furious, shoot action</li> <li>● couple, fly, fast, fun, fun comedy</li> <li>● furious, shoot, shoot, fun action</li> <li>● fly, fast, shoot, love action and</li> </ul> A new document D: fast, couple, shoot, fly Compute the most likely class for D. Assume a Naive Bayes classifier and use add-1 smoothing for the likelihoods.
6	Demonstrate the following using appropriate programming tool which illustrates the use of information retrieval in NLP: <ul style="list-style-type: none"> <li>● Study the various Corpus – Brown, Inaugural, Reuters, udhr with various methods like fields, raw, words, sents, categories 3</li> <li>● Create and use your own corpora (plaintext, categorical)</li> <li>● Study Conditional frequency distributions</li> <li>● Study of tagged corpora with methods like tagged_sents, tagged_words</li> <li>● Write a program to find the most frequent noun tags</li> <li>● Map Words to Properties Using Python Dictionaries</li> <li>● Study Rule based tagger, Unigram Tagger</li> </ul> Find different words from a given plain text without any space by comparing this text with a given corpus of words. Also find the score of words.
7	Write a Python program to find synonyms and antonyms of the word "active" using WordNet.
8	Develop a simple Question Answering (QA) system using Natural Language Processing techniques that can answer fact-based questions from a given text corpus.

## 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Speech and Language Processing, An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition	Daniel Jurafsky, James H. Martin	Pearson Education, 2023	3rd Edition	2,3,4,5
2	Natural Language Processing and Information Retrieval	Tanveer Siddiqui, U.S. Tiwary	Oxford University Press		1
3	Natural Language Processing with Python	Steven Bird, Ewan Klein, and Edward Loper	O'Reilly, 2009		Reference
4	Understanding Natural Language Processing – Machine Learning and Deep Learning Perspectives	T V Geetha	Pearson, 2024.		Reference
5	Information Storage and Retrieval system	Gerald J. Kowalski and Mark.T. Maybury	Kluwer Academic Publishers.		Reference

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

1. <https://www.youtube.com/watch?v=M7SWr5xObkA>
2. <https://youtu.be/02QWRAhGc7g>

### MOOCs:

1. [https://onlinecourses.nptel.ac.in/noc23\\_cs45/preview](https://onlinecourses.nptel.ac.in/noc23_cs45/preview)
2. <https://www.udemy.com/share/10dm7R/>

## 7. EVALUATION METHODOLOGY

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

### CIE Framework:

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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical evaluation pattern for regular courses is shown in Table 1:

**Table 1: Evaluation Process for CIE and SEE**

	Component	Marks	Max Marks	Total Marks
CIE	CIE Test-1	50	25	50
	CIE Test-2	50		
	AAT	10	10	
	LAB	30	15	
SEE	Semester End Examination	100		50
<b>Grand Total</b>				100

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

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

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

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# GLOBAL ACADEMY OF TECHNOLOGY

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



Department: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: VI	Course Code: BAML24602	Contact Hrs. /week: 3
Course Description: Deep Learning Principles & Practices		No. of Credits:3 L : T : P : S = 3:0:0:0
Course Category: PCC		Total no. of Hours = 40+50
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Machine Learning Foundations & Techniques and Machine Learning Practices		

## 1. PREAMBLE ABOUT THE COURSE

This course introduces the fundamental concepts and architectures of deep learning that form the backbone of modern artificial intelligence systems. It explores the working principles of neural networks, from basic perceptron to advanced deep architectures. Students will gain hands-on experience in building, training, and optimizing deep learning models for diverse applications. The course emphasizes understanding convolutional and recurrent neural networks for image and sequence-based tasks. Advanced topics such as transformers, attention mechanisms, and generative adversarial networks are included. By the end of the course, students will be equipped to design and apply deep learning solutions to real-world problems.

## 2. COURSE LEVEL OBJECTIVES

Sl. No	Course Learning Objectives (CLO)
CLO1	Understand the fundamental concepts of deep feedforward networks, including multilayer perceptron, gradient-based learning, and the back-propagation algorithm
CLO2	Apply deep feed forward networks to practical problems by designing network architectures and hidden units, with a focus on learning the XOR problem as an example
CLO3	Analyze convolutional networks, including the convolution operation, pooling, and their role as strong priors in image processing, while exploring efficient convolution algorithms
CLO4	Investigate auto encoders and their various types, such as under complete, denoising, and contractive auto encoders, along with practical applications

## 3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSO's	Cognitive Level	WK	Class Hours
CO1	Understand and Analyse the fundamentals that drive deep learning networks	PO1, PO2, PO10, PSO's-2	L3	WK-1,2	10
CO2	Build, train and apply fully connected neural networks	PO1, PO3, PO5, PO10, PSO's-2	L3	WK- 2,3,5	10

<b>CO3</b>	Analyse convolutional networks and their role in image processing.	PO1, PO2, PO3, PO5, PO9, PO10, PSOs-2	L3	WK- 2,3,5	10
<b>CO4</b>	Implementation of deep learning techniques to solve real-world problems.	PO2, PO 3, PO4, PO5, PO9, PO10, PO11, PSOs- 2	L3	WK- 3,4,5,6	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
<b>I</b>	<b>Fundamentals of Neural Networks:</b> Introduction, Understanding the Biological Neuron. Exploring the Artificial Neurons, Early Implementation of ANN, Types of Activation Function. Architectures of Neural Networks, Learning process in ANN. <b>Text 1:</b> Chapter 4	1,2	8
<b>II</b>	<b>Training Deep Neural Networks:</b> Introduction, Mathematics Behind Backpropagation, Deep L-layer Neural Network, Understanding the notion of forward and backward propagation, Initializing weights in Neural Network, Batch, Mini-batch and stochastic Gradient Descent. <b>Text 1:</b> Chapter 5	2	8
<b>III</b>	<b>Convolutional Neural Networks:</b> How computers see the world, Challenges faced by Traditional ANN to work with Image Data, building blocks of CNN, Building a CNN, Popular CNN architectures. <b>Text 1:</b> Chapter 6	3	8
<b>IV</b>	<b>Sequence-based Models:</b> Introduction to Sequence Data, Recurrent Neural Networks, Long Short-term Memory, Gated Recurrent Units, Bi-directional Models. <b>Text 1:</b> Chapter 8	3,4	8
<b>V</b>	Encoder-Decoder Architecture, Attention Mechanism, Transformer Architecture, Generative Adversarial Networks. <b>Text 1:</b> Chapter 9	4	8

#### 5. LIST OF RECOMMENDED REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Deep Learning	Amit kumar das, Saptarsi goswami, Pabitra mitra, Amlan	1st edition, Pearson.	2024	1,2,3,4&5

2	Deep Learning	Ian Goodfellow, Yoshua Bengio and Aaron Courville,	MIT Press	2017	1&2
3	Deep Learning: A Practitioner's Approach	Josh Patterson, Adam Gibson	O'Reilly Media, 2017	2017	1

## 6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE]

- <https://github.com/janishar/mit-deep-learning-book-pdf>
- <https://www.cse.iitk.ac.in/users/sigml/lec/DeepLearningLib.pdf>

## 7. MOOCs:

- <https://www.simplilearn.com/introduction-to-deep-learning-free-course-skillup>
- <https://www.udemy.com/course/the-complete-deep-learning-course/>

## 8. EVALUATION METHODOLOGY

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

### CIE Framework:

**Scheme of Examination (CIE):** 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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic toolbox for problem solving/ report based on participation in create- a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

**Table 1: Evaluation Process for CIE and SEE**

	Component	Marks	Total Marks
CIE	CIE Test-1	50	30
	CIE Test-2	50	
	AAT	20	20
SEE	Semester End Examination	100	50
<b>Grand Total</b>			100

## 9. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 10. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

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

*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: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: VI	Course Code: BAML24603	Contact Hrs /week: 3
Course Description: AI and its Applications		No. of Credits:3 L : T : P : S = 3:0:0:0
Course Category: PCC		Total no. of Hours = 40+50
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Nil		

## 1. PREAMBLE ABOUT THE COURSE

Artificial Intelligence (AI) is a rapidly growing field that enables machines to mimic human intelligence. This course introduces the fundamental concepts, techniques, and tools used in AI systems. Students will learn about problem-solving, machine learning, and intelligent decision-making. The course highlights real-world applications of AI across various industries. It also emphasizes ethical and responsible use of AI technologies.

## 2. COURSE LEVEL OBJECTIVES

<b>CLO1</b>	To impart artificial intelligence principles, techniques and its history.
<b>CLO2</b>	To assess the applicability, strengths, and weaknesses of the basic knowledge representation, problem solving, and learning methods in solving engineering problems
<b>CLO3</b>	To develop intelligent systems by assembling solutions to concrete computational 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	Evaluate Artificial Intelligence (AI) methods and describe their foundations.	PO1, PO2, PSO2	L2	WK1	10
CO2	Apply basic principles of AI in solutions that require problem-solving, inference, perception, knowledge representation and learning.	PO2, PO3, PO5, PSO1, PSO2	L3	WK2	10
CO3	Demonstrate knowledge of reasoning, uncertainty, and knowledge representation for solving real-world problems.	PO2, PO4, PO6, PSO2	L3	WK3	10
CO4	Analyse and illustrate how search algorithms play a vital role in problem-solving.	PO2, PO3, PO5, PSO1	L3	WK4	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- Evolution of AI, State of Art -Different Types of Artificial Intelligence Applications of AI- Subfields of AI- Intelligent Agents- Structure of Intelligent Agents Environments	CO1-4	08
II	Introduction to Problem Solving by searching Methods-State Space search, Uninformed Search Methods – Uniform Cost Search, Breadth First Search- Depth First Search-Depth limited search, Iterative deepening depth-first, Informed Search Methods- Best First Search, A* Search.	CO1-4	08
III	Local Search algorithms – Hill-climbing search, Simulated annealing, Genetic Algorithm, Adversarial Search: Game Trees and Minimax Evaluation, Elementary two-players games: tic-tac-toe, Minimax with Alpha-Beta Pruning.	CO1-4	08
IV	Introduction to Logic and Reasoning -Propositional Logic-First Order Logic-Inference in First Order Logic- Unification, Forward Chaining, Backward Chaining, Resolution.	CO1-4	08
V	Communication-Fundamentals of Language -Probabilistic Language Processing -Information Retrieval- Information Extraction-Perception-Image Formation- Object Recognition.	CO1-4	08

#### 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Artificial Intelligence - A Modern Approach	Russell, S. and Norvig, P. 2015	Prentice Hall, 2015	3rd Edition	1,2,3,4,5
2	Fundamentals of Artificial Intelligence	K R Chowdhary	Springer 2020	-	-
3	Introduction to Machine Learning	Alpaydin, E	MIT Press, 2010	2nd Edition	-

#### 6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE]

1. *Introduction to Artificial Intelligence* – Prof. Deepak Khemani (IIT Madras)
2. *Artificial Intelligence: Search Methods for Problem Solving* – IIT Kharagpur
3. *Machine Learning* – Prof. P. B. Mahesh (IIT Hyderabad)

#### MOOCs:

1. *AI for Everyone* – Andrew Ng (Coursera)
2. *Artificial Intelligence Basics* – edX
3. *Machine Learning with Python* – Udemy

## WEB RESOURCES:

1. Google AI Blog – <https://ai.googleblog.com>
2. IBM AI Learning Hub – <https://www.ibm.com/artificial-intelligence>
3. Towards Data Science – <https://towardsdatascience.com>

## 7. EVALUATION METHODOLOGY

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

### CIE Framework:

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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical evaluation pattern for regular courses is shown in Table 1:

**Table 1: Evaluation Process for CIE and SEE**

	Component	Marks	Total Marks
CIE	CIE Test-1	50	30
	CIE Test-2	50	
	AAT	20	20
SEE	Semester End Examination	100	50
<b>Grand Total</b>			<b>100</b>

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

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

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

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Department: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: VI	Course Code: BAML24604A	Contact Hrs /week: 3
Course Description: PARALLEL AND DISTRIBUTED COMPUTING		No. of Credits:3 L : T : P = 3:0:0:0
Course Category: PEC		Total no. of Hours = 40+50
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: C/C++, Python, Data Structures and Algorithms, Computer Organization.		

## 1. PREAMBLE ABOUT THE COURSE

The growing demand for high-performance and scalable computing solutions has made Parallel and Distributed Computing (PDC) an essential area of study in modern computer science and engineering. This course introduces students to the fundamental concepts, models, and techniques used to design and analyze systems that perform multiple computations simultaneously or across interconnected computing resources. The course explores the principles of parallelism, including task decomposition, synchronization, load balancing, and communication between concurrent processes. It also covers the distributed computing paradigm, where computation is executed across multiple networked systems to achieve scalability, reliability, and fault tolerance.

## 2. COURSE LEVEL OBJECTIVES

Sl.No	Course Learning Objectives (CLO)
1	To understand the scope, applications, and challenges of parallel and distributed computing.
2	To analyze parallel architectures, programming platforms, and communication mechanisms.
3	To solve matrix, graph, and discrete optimization problems using parallel computing techniques.

## 3. COURSE OUTCOMES (COs) & COMPETENCIES

Upon successful completion of this course, students will be able to

Course Outcome	Description	Mapped POs/PSO	Cognitive Level	WK	Class Hours
CO1	Comprehend and articulate the fundamental concepts, architectures, and real-world applications of parallel and distributed computing.	POs- 1,2,3,4,10 PSOs- 2	L2	WK 1,2	10
CO2	Design efficient parallel and distributed solutions by applying appropriate decomposition, mapping, and load balancing techniques.	POs- 1,2,3,4,10 PSOs- 2	L3	WK 1,2,3,5	10
CO3	Analyze and evaluate the performance, scalability, and cost-effectiveness of	POs- 1,2,3,4,10	L4	WK 1,2,3,5,6	10

	parallel programs using appropriate metrics and models.	PSOs- 2			
CO4	Implement and optimize parallel algorithms for matrix, graph, and search problems using modern parallel programming platforms and tools. parallel programs	POs- 1,2,3,4,10 PSOs- 2	L4	WK 1,2,3,5,6	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	<b>Introduction:</b> Scope , issues, applications and challenges of Parallel and Distributed Computing <b>Parallel Programming Platforms:</b> Implicit Parallelism: Trends in Microprocessor Architectures, Dichotomy of Parallel Computing Platforms, Physical Organization, Communication Costs in Parallel Machines, Routing Mechanisms for Interconnection Networks, GPU, co-processing. T1 Chapters 3–4	CO1	08
II	<b>Principles of Parallel Algorithm Design:</b> Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing. <b>CUDA programming model:</b> Overview of CUDA, Isolating data to be used by parallelized code, API function to allocate memory on parallel computing device, to transfer data, Concepts of Threads, Blocks, Grids, Developing a kernel function to be executed by individual threads, Execution of kernel function by parallel threads, transferring data back to host processor with API function. T1 Chapters 3–4	CO 2	08
III	<b>Analytical Modeling of Parallel Programs:</b> Sources of Overhead in Parallel Programs, Performance Metrics for Parallel Systems, The Effect of Granularity on Performance, Scalability of Parallel Systems, Minimum Execution Time and Minimum Cost Optimal Execution Time <b>Dense Matrix Algorithms:</b> Matrix-Vector Multiplication, Matrix-Matrix Multiplication, Issues in Sorting on Parallel Computers, Bubble Sort and Variants, Quick Sort, Other Sorting Algorithms T1 Chapters 5,6	CO 3	08
IV	<b>Graph Algorithms:</b> Minimum Spanning Tree: Prim's Algorithm, Single-Source Shortest Paths: Dijkstra's Algorithm, All-Pairs Shortest Paths, Transitive Closure, Connected Components, Algorithms for Sparse Graph T1 Chapters 10,11	CO 4	08
V	<b>Search Algorithms for Discrete Optimization Problems:</b> Sequential Search Algorithms, Parallel Depth-First Search, Parallel Best-First Search, Speedup Anomalies in Parallel Search Algorithms T1 Chapters 11	CO 5	08

## 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	<i>Introduction to Parallel Computing</i>	Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar	Pearson, 2003	2 <sup>nd</sup> Edition	1,2,3,4,5
2	Intel Xeon Phi Coprocessor High-Performance Programming	J Jeffers, J Reinders	Morgan Kaufmann Publishing and Elsevier, 2013		Reference
3	<i>Mastering Cloud and Distributed Computing</i>	Rajkumar Buyya	McGraw-Hill, 2015	1 <sup>st</sup> Edition	Reference
4	Patterns for Parallel Programming	Mattson, B Sanders, B Massingill	AddisonWesley Professional, 2004.		Reference

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

- [https://nptel.ac.in/courses/106106107?utm\\_source](https://nptel.ac.in/courses/106106107?utm_source)
- [https://onlinecourses.nptel.ac.in/noc24\\_cs63/preview?utm\\_source](https://onlinecourses.nptel.ac.in/noc24_cs63/preview?utm_source)
- [https://www.coursera.org/specializations/pcdp?utm\\_source](https://www.coursera.org/specializations/pcdp?utm_source)

## 7. EVALUATION METHODOLOGY

### CIE Framework:

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/ conceptvideos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

**Typical evaluation pattern for regular courses is shown in Table 1:**

	Component	Marks	Total Marks
CIE	CIE Test-1	50	30
	CIE Test-2	50	
	AAT	20	20
SEE	Semester End Examination	100	50
<b>Grand Total</b>			100

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

### **9.COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING**

PSOs →	PSO1	PSO2
COs ↓		
<b>CO1</b>		2
<b>CO2</b>		2
<b>CO3</b>		2
<b>CO4</b>		2

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

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Department: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: VI	Course Code: BAML24604B	Contact Hrs /week: 3
Course Description: CRYPTOGRAPHY		No. of Credits:3 L : T : P = 3:0:0:0
Course Category: PEC		Total no. of Hours = 40+50
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: <b>03</b>
Course Pre-requisites: Proficiency in basic discrete mathematics. Understanding of network protocols, data transmission, and network security concepts.		

## 1. PREAMBLE ABOUT THE COURSE

This course emphasizes on principles and practice of modern applied cryptography: classical systems, symmetric block ciphers like DES, AES and public-key cryptography algorithms. The course discusses the inner workings of cryptographic systems and how to correctly use them in real-world applications.

## 2. COURSE LEVEL OBJECTIVES

Sl.No	Course Learning Objectives (CLO)
CLO1	To understand basic cryptographic concepts and methods.
CLO2	To deeply understand how modern cryptographic schemes work and necessary mathematical concepts involved.
CLO3	Illustrate the structure and working principle of DES & AES Algorithms
CLO4	Demonstrate the working of public key cryptosystem

## 3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSO	Cognitive Level	WK	Class Hours
CO1	Understand core cryptographic principles and mathematical foundations.	POs - 1,2,11 PSOs- 1,2	L2	WK 2,3	10
CO2	Design, implement, and evaluate cryptographic algorithms and protocols.	POs-1,2,3,5,11 PSOs- 1,2	L3	WK 4,6	10
CO3	Assess security of cryptographic systems.	POs -1,2,3,4,5 PSOs- 1,2	L3	WK 4,6,7	10
CO4	Apply cryptanalysis techniques.	PO-1,2,3,4,5,11 PSOs- 1,2	L4	WK 4,6,7	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	<p>Introduction to Cryptography and Data Security: Overview of Cryptology, Symmetric Cryptography, Cryptanalysis, Modular Arithmetic and More Historical Ciphers SLT: Key Bits.</p> <p>Textbook 1:Ch.1.1-1.4  <b>Case Study:</b> Securing Patient Records in a Small Clinic</p>	1,2,3,4	08
II	<p>The Data Encryption Standard (DES): Introduction to DES, Overview of the DES Algorithm, Internal Structure of DES, Decryption, Security of DES SLT: Analytical Attacks.</p> <p>Textbook 1: Ch.3.1-3.5  <b>Case Study:</b> Evaluating DES in a Legacy Banking System</p>	1,2,3,4	08
III	<p>The Advanced Encryption Standard (AES): Introduction, Overview of the AES Algorithm, A Brief Introduction to Galois Fields, Internal Structure of AES, Decryption SLT: Multiplication, Inversion in GF.</p> <p>Textbook 1: Ch.4.1-4.5  <b>Case Study:</b> Implementing AES for Cloud Data Storage</p>	1,2,3,4	08
IV	<p>Introduction to Public-Key Cryptography, The RSA Cryptosystem: Symmetric vs. Asymmetric Cryptography , Practical Aspects of Public-Key Cryptography, Essential Number Theory for Public-Key Algorithms The RSA Cryptosystem: Introduction , Encryption and Decryption, Key Generation and Proof of Correctness, Encryption and Decryption SLT: Euclidean, Extended Euclidean Algorithm.</p> <p>Textbook 1: Ch. 6.1-6.3, 7.1-7.4  <b>Case Study:</b> Secure Online Examination System Using RSA</p>	1,2,3,4	08
V	<p>Public-Key Cryptosystems Based on the Discrete Logarithm Problem: Diffie– Hellman Key Exchange , The Discrete Logarithm Problem, Security of the Diffie–Hellman Key Exchange ,The Elgamal Encryption Scheme SLT: Security of the Diffie–Hellman Key Exchange.</p> <p>Textbook 1: Ch. 8.1, 8.3, 8.4, 8.5  <b>Case Study:</b> Secure Key Exchange in a Messaging Application</p>	1,2,3,4	08

## 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

Sl.No	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Understanding Cryptography, A Textbook for Students and Practitioners	Christof Paar, Jan Pelzl	Springer-Verlag Berlin Heidelberg 2014	1 <sup>st</sup> Edition	1,2, 3,4,5
2	Computer Networking, A Top-Down Approach	James F Kurose and Keith W Ross,	Pearson,2017	6 <sup>th</sup> Edition	
3	Computer Networks – A Systems Approach	Larry L. Peterson and Bruce S. Davie	Elsevier, 2019	4 <sup>th</sup> Edition	

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

1. <https://nptel.ac.in/courses/106106221>

### MOOCs:

1. <https://www.coursera.org/learn/crypto>
2. <https://www.udemy.com/course/cryptography-for-beginners/>  
<https://www.khanacademy.org/computing/computer-science/cryptography>

## 7. EVALUATION METHODOLOGY

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

### CIE Framework:

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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical evaluation pattern for regular courses is shown in Table 1:

	Component	Marks	Total Marks
CIE	CIE Test-1	50	30
	CIE Test-2	50	
	AAT	20	20
SEE	Semester End Examination	100	50
<b>Grand Total</b>			100

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
<b>CO1</b>	2	
<b>CO2</b>	3	
<b>CO3</b>	2	1
<b>CO4</b>	2	1

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

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# GLOBAL ACADEMY OF TECHNOLOGY

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



Department: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: 6	Course Code: BAML24604C	Contact Hrs /week: 3
Course Description: LARGE LANGUAGE MODEL		No. of Credits:3 L : T : P : S = 3:0:0:0
Course Category: PEC		Total no. of Hours = 40+50
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Basics of Machine Learning and Deep Learning, Introduction to Natural Language Processing, Fundamentals of Python programming		

## 1. PREAMBLE ABOUT THE COURSE

This course introduces the fundamentals of Large Language Models, focusing on transformer architectures, attention mechanisms, and practical techniques for building and customizing LLM-based applications.

## 2. COURSE LEVEL OBJECTIVES

<b>CLO1</b>	Introduce the fundamentals, architecture, and lifecycle of Large Language Models and Transformers.
<b>CLO2</b>	Develop skills to preprocess text data, create embeddings, and encode positional information for LLMs.
<b>CLO3</b>	Explain attention mechanisms and their role in modeling long-range dependencies in language.
<b>CLO4</b>	Enable learners to customize, prompt, and deploy LLM-based applications using modern frameworks.

## 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 LLM architectures, including GPT and Transformer-based models, and their real-world applications.	POs - 1,2,5 PSOs – 1	L2	WK 2,3	10
CO2	Apply tokenization, embedding, and attention techniques to build and analyze LLM pipelines.	POs - 1,2,3,4,5 PSOs – 1	L3	WK 4,5	10
CO3	Design and implement LLM-powered applications using frameworks such as LangChain.	POs - 1,2,3,4,5 PSOs – 1	L3	WK 2,4	10
CO4	Evaluate LLM behavior through fine-tuning and advanced prompt engineering techniques.	POs - 1,2,3,4,5,10 PSOs – 1	L3	WK 2,4	10

#### 4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
I	<b>Understanding large language models:</b> What is an LLM?, Applications of LLMs, Stages of building and using LLMs, Introducing the transformer architecture, Utilizing large datasets, A closer look at the GPT architecture, Building a large language model. <b>Textbook 1: Ch. 1</b>	CO1-4	08
II	<b>Working with text data:</b> Understanding word embeddings, Tokenizing text, Converting tokens into token IDs, Adding special context tokens, Byte pair encoding, Data sampling with a sliding window, Creating token embeddings, Encoding word positions <b>Textbook 1: Ch. 2</b>	CO1-4	08
III	<b>Coding attention mechanisms:</b> The problem with modeling long sequences, Capturing data dependencies with attention mechanisms, Attending to different parts of the input with self-attention, Implementing self-attention with trainable weights, Hiding future words with causal attention, Extending single-head attention to multi-head attention <b>Textbook 1: Ch. 3</b>	CO1-4	08
IV	<b>LangChain for LLM Apps:</b> Going beyond stochastic parrots, What is LangChain?, Exploring key components of LangChain, How does LangChain work?, Comparing LangChain with other frameworks <b>Getting Started with LangChain:</b> How to set up the dependencies for this book?, Exploring API model integrations, Exploring local models, Building an application for customer service <b>Textbook 2: Ch. 2, Ch. 3</b>	CO1-4	08
V	<b>Customizing LLMs and Their Output:</b> Conditioning LLMs -Methods for conditioning, Fine-tuning- Setup for fine-tuning, Open-source models, Commercial models, Prompt engineering - Prompt techniques - Zero-shot prompting, Few-shot learning, Chain-of-thought prompting, Self-consistency, Tree-of-thought. <b>Textbook 2: Ch. 8</b>	CO1-4	08

#### 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Build a Large Language Model (From Scratch)	Sebastian Raschka	Manning Publications	September 2024	1,2,3

2	Generative AI with LangChain	Ben Auffarth	Packt		4,5
3	Hands on Large Language Models	Jay Alammar, Maarten Grootendorst	Shroff Publishers		Reference
4	Introduction to Large Language Models	Tanmoy Chakraborty	Wiley Publications		Reference

## 6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE]

- <https://github.com/HandsOnLLM/Hands-On-Large-Language-Models>

### MOOCs:

- NPTEL Course: Introduction to Large Language Modeling

## 7. EVALUATION METHODOLOGY

- Continuous Internal Evaluation (CIE) = 50 marks
- Semester End Examination (SEE) = 50 marks

Total = 100 marks

### CIE Framework:

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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical evaluation pattern for regular courses is shown in Table 1:

**Table 1: Evaluation Process for CIE and SEE**

	Component	Marks	Total Marks
CIE	CIE Test-1	50	30
	CIE Test-2	50	
	AAT	20	20
SEE	Semester End Examination	100	50
	<b>Grand Total</b>		100

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

<b>PSOs</b> →	<b>PSO1</b>	<b>PSO2</b>
<b>COs ↓</b>		
CO1	-	1
CO2	-	2
CO3	-	3
CO4	-	2

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

Department: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: VI	Course Code: BAML24604D	Contact Hrs /week: 3
Course Description: Augmented Reality and Virtual Reality		No. of Credits:3 L : T : P : S = 3:0:0:0
Course Category: PEC		Total no. of Hours = 40+50
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Data Structures, C, C#		

## 1. PREAMBLE ABOUT THE COURSE

This course introduces the foundational principles, hardware, and software components of AR and VR systems. It emphasizes understanding the underlying technologies such as sensors, displays, tracking systems, and human-computer interaction techniques. Through hands-on learning and application-driven projects, students will gain practical experience in designing immersive environments and developing interactive simulations. The course aims to foster creativity, technical skills, and interdisciplinary thinking essential for innovation in next-generation interactive systems.

## 2. COURSE LEVEL OBJECTIVES

<b>CLO1</b>	To provide knowledge on fundamentals of AR/VR
<b>CLO2</b>	To highlight the various concepts related to AR/VR and XR
<b>CLO3</b>	Learning the modern tools for demonstrating various AR/VR applications
<b>CLO4</b>	To provide knowledge on concepts of Mixed reality

## 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 concepts of extended Reality (XR-VR/AR/MR) and its applications	POs - 1,2,3 PSOs - 1	L1, L2	WK 2,3	08
CO2	Apply the XR concepts to storyboard the application requirements	POs - 1,2,3 PSOs - 1	L3	WK 4,5	08
CO3	Design the application with the appropriate setups to experience the XR Content	POs - 1,2,3 PSOs - 1	L3	WK 2,4	08
CO4	Analyze and interpret the appropriate XR technology for Application under consideration	POs - 1,2,3 PSOs - 1	L3	WK 2,4	08
CO5	Collaborate and build AR/VR applications using modern tool and communicate through oral or poster presentation	POs - 1,2,3,5,9,10,11 PSOs - 1	L3	WK 9	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	<p><b>Introduction to Virtual Reality:</b> Defining Virtual Reality, Four Key Elements of Virtual Reality Experience, A History of VR.</p> <p><b>VR The Medium:</b> Communicating Through a Medium, Common Issues of Human Communication Media, Narrative, Immobile Versus Interactive. The Difference between Virtual reality and Augmented Reality, Applications versus Game, Type of VR Experiences.</p> <p><b>Text 1: Chapter 1</b></p>	CO1-4	08
II	<p><b>Content, Objects, Scale:</b> Getting started with Unity, Creating Simple Diorama, Measurement Tools. Build and Run- Meta Oculus, Android, PC, Menu and UI, Material and Textures, Prefabs, First Person Controller and Third Person Controller, Asset Store, Animation and Animator, Object Tracking- Ray Tracing, Effects.</p> <p><b>Text 1 : Chapter 2</b></p>	CO1-4	08
III	<p><b>Augmented Reality:</b> Terminology, Simple Augmented Reality, Marker-based tracking-Marker detection, Marker pose.</p> <p><b>Marker types and identification:</b> Template markers, Template matching, Imperceptible markers, Build and Run-Vuforia.</p> <p><b>Text 2: Chapter 4</b></p>	CO1-4	08
IV	<p><b>Marker less Tracking with AR Foundation:</b> Project Setup, architecture, Features, XR Simulation, AR Foundation Debug menu, implement a provider, Build and Run.</p> <p><b>Text 2: Chapter 5</b></p>	CO1-4	08
V	<p><b>Mixed Reality:</b> Introduction to mixed reality, MRTK, Project Setup, Configure Unity for Windows Mixed Reality. Interaction Model- Hands and Motion Controllers model, Hands-free model, Gaze and Commit.</p> <p><b>WebXR using Unity:</b> Introduction to WebXR, set up the environment, Plugin.</p> <p><b>Text 1: Chapter 17.</b></p>	CO1-4	08

#### 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Complete Virtual Reality and Augmented Reality Development with Unity	Jesse Glover and Jonathan Linowes	Packt Publishing, ISBN:9781838644864, 1838644865. 17 April 2019, ISBN:9781838644864, 1838644865.	1 <sup>st</sup> Edition	1,2,5
2	Theory and applications of marker-based augmented reality	Sanni Siltanen	Julkaisija – Utgivare – publisher ISBN 978-951-38-7449-0 (soft back ed.), ISSN 2242-119	1 <sup>st</sup> Edition	3,4

3	,Virtual and Augmented Reality: An Educational Hand Book, Cambridge Scholars	Zeynep Tacgin	Oxford Higher Education,2011 ISBN(13): 98-1-5275-4813-8, 4.	1 <sup>st</sup> Edition	
4	Creating Augmented and Virtual Realities	Erin Pangilinan, Steve Lukes and Vasanth Mohan	O'Relly Media Inc., 2019, ISBN: 978-1-492-04419-2	2 <sup>nd</sup> Edition	

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

1. <https://elearn.nptel.ac.in/shop/iit-workshops/completed/foundation-course-on-virtual-reality-and-augmented-reality/?v=c86ee0d9d7ed>

## 7. EVALUATION METHODOLOGY

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

### CIE Framework:

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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical evaluation pattern for regular courses is shown in Table 1:

**Table 1: Evaluation Process for CIE and SEE**

	Component	Marks	Total Marks
CIE	CIE Test-1	50	30
	CIE Test-2	50	
	AAT	20	20
SEE	Semester End Examination	100	50
<b>Grand Total</b>			<b>100</b>

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
<b>CO1</b>	2	2									
<b>CO2</b>	2	2									
<b>CO3</b>	3	2									
<b>CO4</b>	3	2	3								
<b>CO5</b>	3	3	3		3				3	3	2
<b>Average</b>	3	2	3		3				3	3	2

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

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

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

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# GLOBAL ACADEMY OF TECHNOLOGY

Autonomous Institution Affiliated to Visveswaraya Technological University

Approved by UGC, AICTE and Govt of Karnataka



Department: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: VI	Course Code: BAML24605A	Contact Hrs /week: 3
Course Description: Next-Gen Database Technology using MongoDB		No. of Credits:3 L : T : P : S = 3:0:0:0
Course Category: OEC		Total no. of Hours = 40+50
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: SQL, Hadoop, Python fundamentals, Web development		

## 1. PREAMBLE ABOUT THE COURSE

This course is designed to introduce learners to the fundamentals of MongoDB, empowering them to build, query, and manage databases using real-world scenarios. In today's data-driven world, the ability to manage and manipulate large volumes of unstructured data is a critical skill. MongoDB, a leading NoSQL database, offers a flexible, scalable, and high-performance solution for modern applications.

## 2. COURSE LEVEL OBJECTIVES

CLO1	Understand the foundations of NoSQL databases and their advantages compared to relational databases (SQL) for specific data models.
CLO2	Advance the fundamentals of MongoDB, including data structures, document organization, and schema design principles.
CLO3	Explore data manipulation techniques (CRUD) and advanced functionalities of MongoDB indexes.
CLO4	Develop practical skills in building simple web applications with Node.js that leverage MongoDB for data persistence and retrieval.

## 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 features and architecture of NoSQL databases like MongoDB with traditional relational databases.	POs – 1,2,4 PSOs - 1	L2	WK 1,2	08
CO2	Implement document schema for a MongoDB database considering factors like reference and embedded data models.	POs – 1,3 PSOs – 1,2	L3	WK 1,4,7	08
CO3	Perform CRUD operations (Create, Read, Update, Delete) on documents within a MongoDB database using the Mongo Shell.	POs – 1,3,5 PSOs -1,2	L3	WK 1,4,7	08

CO4	Construct queries using operators, filters, and regular expressions to retrieve specific data from a MongoDB collection.	POs –1,2,5 PSOs - 1	L3	WK 1,4,7	08
CO5	Develop a simple web application using Node.js that interacts with a MongoDB database for data persistence.	POs – 1,3,5 PSOs - 1	L3	WK 1,4,7	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	<p><b>Introduction to NoSQL:</b> why NoSQL – value of relational databases, Impedence Mismatch, Attack of the Clusters, The Emergence of NoSQL, Aggregate Data Models: Key-Value and Document Data Models, Column-Family Stores , Graph Databases, Schema-less Databases, Materialized Views, Modeling for Data Access, Distribution Models- Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication</p> <p><b>Textbook 1: chapter 1,2,3, and 4</b></p>	CO1	08
II	<p><b>MongoDB :</b> Introduction - Ease of Use, Designed to Scale, Rich with Features, Without Sacrificing Speed, Getting Started - Documents,</p> <p>Collections, Databases, Getting and Starting MongoDB, Introduction to the MongoDB Shell, Data Types, Using the MongoDB Shell.</p> <p><b>Use cases:</b> Explore MongoDB database</p> <p><b>Textbook 2: Chapter 1 and 2</b></p>	CO2	08
III	<p><b>Creating, Updating, and Deleting Documents:</b> Inserting Documents, Removing Documents, Updating Documents.</p> <p><b>Case study:</b> CRUD operations using MongoDB</p> <p><b>Textbook 2: Chapter 3</b></p>	CO3	08
IV	<p><b>Querying:</b> Introduction to find, Query Criteria, Type-Specific Queries, \$where Queries, Cursors: Limits, Skips, and Sorts, Introduction to Indexes- Creating an Index, Introduction to Compound Indexes, How MongoDB Selects an Index</p> <p><b>Textbook 2: Chapter 4</b></p>	CO4	08

<b>V</b>	<p><b>Web Application with Node.js and MongoDB:</b> Installing Node.js, Testing that Node.js is installed properly ,Installing MongoDB, Confirming successful MongoDB installation, Writing your first app, Adding the application code, Node and MongoDB Basics-A JavaScript primer: Syntax basics, Understanding the scope of variables, Data types, Operators and flows Understanding, objects Understanding arrays, Understanding functions Anonymous, functions and callbacks JSON, The basics of Node.js, Installing modules using npm, The basics of MongoDB: The Mongo shell: Inserting data, Querying, Updating data, Deleting data.</p> <p><b>Textbook 3: Chapter 2 and 3</b></p>	CO5	08
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## 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	NoSQL Distilled -A Brief Guide to the Emerging World of Polyglot Persistence	Pramod J. Sadalage, Martin Fowler	Addison - Wesley	1 <sup>st</sup> Edition	1
2	MongoDB: The Definitive Guide	Shannon Bradshaw, Eoin Brazil, Kristina Chodorow	O'Reilly Media, Inc.	3 <sup>rd</sup> Edition	2,3,4
3	Web Development with MongoDB and Node	Bruno Joseph D'mello Mithun Satheesh Jason Krol	Packt Publishing Ltd,	3 <sup>rd</sup> Edition	5
4	The Definitive Guide to MongoDB A complete guide to dealing with Big Data using MongoDB	David Hows Peter Membrey Eelco Plugge Tim Hawkins	Apress	3 <sup>rd</sup> Edition	-
5.	MongoDB Cookbook	Cyrus Dasadia Amol Nayak.	Packt Publishing	2 <sup>nd</sup> Edition	-

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

1. <https://learn.mongodb.com/courses/start-here-introduction-to-mongodb>
2. <https://www.w3schools.com/mongodb/>

### MOOCs:

1. <https://www.coursera.org/courses?query=mongodb.>
2. <https://learn.mongodb.com/>

## 7. EVALUATION METHODOLOGY

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

### CIE Framework:

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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other. Typical evaluation pattern for regular courses is shown in Table 1:

**Table 1: Evaluation Process for CIE and SEE**

	Component	Marks	Total Marks
CIE	CIE Test-1	50	30
	CIE Test-2	50	
	AAT	20	20
SEE	Semester End Examination	100	50
<b>Grand Total</b>			100

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

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

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

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# GLOBAL ACADEMY OF TECHNOLOGY

Autonomous Institution Affiliated to Visveswaraya Technological University

Approved by UGC, AICTE and Govt of Karnataka



Department: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: VI	Course Code: BAML24605B	Contact Hrs /week: 3
Course Description: Foundation of Data Science		No. of Credits:3 L : T : P : S = 3:0:0:0
Course Category: OEC		Total no. of Hours = 40+50
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Basic knowledge of mathematics, statistics, and programming.		

## 1. PREAMBLE ABOUT THE COURSE

Data has become the driving force behind decision-making, innovation, and problem- solving across industries. The Foundations of Data Science course equips learners with the essential tools, techniques, and theoretical principles required to analyze, interpret, and leverage data effectively. This course introduces core statistical concepts, data wrangling techniques, machine learning basics, and computational methods that form the backbone of modern data-driven applications.

## 2. COURSE LEVEL OBJECTIVES

1	To provide fundamental knowledge on data science with quering and analytics required for the field of data science.
2	To understand the process of handling heterogeneous data, pre-process and visualize them for better understanding
3	To gain the fundamental knowledge on data science tools and gain basic skill set to solve real-time data science 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	Use fundamental knowledge of data science.	PO 1, 2, 3, 9, 11, PSOs-2	L2	2,3	8
CO2	Demonstrate proficiency in data analytics	PO 2,3,5, 11 PSOs-2	L2	3,4,5	8
CO3	Formulate insights from data through statistical inferences	PO 1,2, 3, 5, 9, 11 PSOs-2	L3	5,6	8
CO4	Apply advanced tools to work on dimensionality reduction and mathematical operations.	PO 1,2,3, 4,5,9, 11 PSOs-2	L3	8,9	8
CO5	Demonstrate numerous open-source data science tools to solve real-world problems through industrial case studies	PO 3,4, 5,9, 11 PSOs-2	L3	8,9	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	<p><b>Data Science Introduction:</b> Need or Data Science –What is Data Science – Data Science Process, Business Intelligence and Data Science, Prerequisite for Data Scientist, Components of Data Science, Tools and Skills Need</p> <p><b>Data:</b> Introduction, Data Types, Data Collections, Data Pre-processing.</p> <p><b>Textbook 1:</b> Ch 1,2</p>	CO1	8
II	<p><b>Platform for Data Science:</b> Python for Data Science- Python Libraries – Data Frame Manipulation with NumPy and pandas – Exploration Data Analysis – Time Series Dataset – Clustering with Python – Dimensionality Reduction.</p> <p><b>Textbook 1:</b> Ch 7.1-7.7</p>	CO2,3	8
III	<p><b>Data Modelling and Analytics:</b> Analytics for Data Science, Data Analytics Examples, Data Analytics Life Cycle, Data Discovery, Data preparation, Model Planning, Model Building, Communicate Results, Operationalization</p> <p><b>Data Analytics and Text Mining:</b> Text Mining, Major Text Mining Areas.</p> <p><b>Textbook 1:</b> Ch 4(FULL),6 -6.1,6.2</p>	CO2,3	8
IV	<p><b>Data Analytics and Text Mining:</b> Text Analytics, Text Analysis Subtasks, Basic Text Analysis Steps.</p> <p><b>Data Science Tool: Python:</b> Python for Machine Learning, Algorithms: KNN, Decision Tree, Random Forest, SVM, Python IDEs for Data Science.</p> <p><b>Textbook 1:</b> Ch 4, 6 -6 .2, 7 -7.8,7.9,7.10</p>	CO4	8
V	<p><b>Data Science Methods and Machine learning:</b> Regression Analysis, Linear Regression, Logistic Regression, Machine Learning</p> <p><b>Data Visualization using Tableau:</b> Introduction to Data Visualization, Tableau Basics, Dimensions, Measures and Descriptive Statistics, Basic Charts.</p> <p><b>Textbook 1:</b> Ch 5 (FULL), 11.1,11.2, 11.3,11.4</p>	CO5	8

## 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Fundamentals of Data Science	Sanjeev Wagh, Manish Bhende, Anuradha Thakare,	CRC Press	1st, 2022	All
2	Modern Data Science with R	Benjamin S Baumer, Daniel T, Kaplan and Nicholas J Horton	Chapman and Hall/ CRC	2021	--
3	Practical Data Science with R	John Mount and Nina Zumel	Wiley	2 <sup>nd</sup>	--

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

1. [Foundation of Data Science – NPTEL Course](#)
2. [Data Science for Engineers - NPTEL Course](#)
3. [Introduction to Data Science | Coursera](#)

## 7. EVALUATION METHODOLOGY

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

### CIE Framework:

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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical evaluation pattern for regular courses is shown in Table 1:

**Table 1: Evaluation Process for CIE and SEE**

	Component	Marks	Total Marks
CIE	CIE Test-1	50	30
	CIE Test-2	50	
	AAT	20	20
SEE	Semester End Examination	100	50
	<b>Grand Total</b>		100

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

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

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

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# GLOBAL ACADEMY OF TECHNOLOGY

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



Department: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: VI	Course Code: BAML24605C	Contact Hrs /week: 3
Course Description: Introduction to Machine Learning		No. of Credits:3 L : T: P : S = 3:0:0:0
Course Category: OEC		Total no. of Hours = 40+50
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Basic Python programming, elementary linear algebra & statistics		

## 1. PREAMBLE ABOUT THE COURSE

This course introduces Python libraries used in Artificial Intelligence and Machine Learning, focusing on data handling, analysis, model building, and visualization using NumPy, Pandas, Matplotlib, Seaborn, and Scikit-learn. It covers data preprocessing, feature engineering, model development, and evaluation through hands-on practice, with a brief overview of deep learning frameworks such as Keras and TensorFlow, providing a foundation for real-world AI and ML applications.

## 2. COURSE LEVEL OBJECTIVES

<b>CLO1</b>	Understand and use core Python libraries (NumPy, Pandas, Matplotlib/Seaborn).
<b>CLO2</b>	Preprocess and explore real datasets and implement classical ML algorithms with scikit-learn.
<b>CLO3</b>	Build and evaluate simple neural networks using TensorFlow/Keras and complete a mini project.

## 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 Python programming and essential libraries used in Artificial Intelligence and Machine Learning.	POs - 1,2,5 PSOs – 1,	L1, L2	WK 2,3	10
CO2	Demonstrate data analysis and visualization using NumPy, Pandas, Matplotlib, and Seaborn to gain insights.	POs - 1,2,3,5 PSOs – 1	L2	WK 4,5	10
CO3	Apply basic machine learning operations using Scikit-learn and evaluate model performance.	POs - 1,2,3,5,9,11 PSOs – 1,2	L3	WK 2,4	10

CO4	Develop simple AI/ML-based applications integrating multiple Python libraries.	POs - 1,2,3,4,5,9,10,11 PSOs – 1,2	L3	WK 9	10
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*Wks are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9*

#### 4. SYLLABUS

Module No.	Module Description	CO's MAPPED	No. of Hours
I	<p>Definition and importance of Machine Learning. Applications in various domains – Healthcare, Banking, Agriculture, and Robotics. Types of Machine Learning – Supervised, Unsupervised, and Reinforcement Learning.</p> <p><b>Steps in a Machine Learning project:</b> Problem definition, Data collection, Data preprocessing, Model building, Evaluation, and Deployment.</p> <p><b>Overview of tools and libraries</b> – NumPy, Pandas, Matplotlib, and Scikit-learn</p> <p><b>Text 1: Chapter 1</b></p>	CO1, CO2	08
II	<p>Data types, data collection, and cleaning. Handling missing values, encoding categorical data, feature scaling, and splitting datasets. Exploratory Data Analysis (EDA) – summarizing data, mean, median, mode, correlation.</p> <p>Visualization using Matplotlib and Seaborn – line plot, bar plot, scatter plot, histogram, and boxplot.</p> <p><b>Text 1: Chapter 10, 11</b></p>	CO2	08
III	<p>Concept of supervised learning. <b>Regression:</b> Simple Linear Regression and Multiple Linear Regression. <b>Classification:</b> Logistic Regression, k-Nearest Neighbors (k-NN), and Decision Tree classifier. <b>Evaluation metrics for classification</b> – accuracy, precision, recall, f1 score, AUC-ROC curve, confusion matrix.</p> <p><b>Regression:</b> MAE, MSE, RMSE, R2</p> <p><b>Text 2: Chapter 2, 3</b></p>	CO3	08
IV	<p><b>Introduction to unsupervised learning.</b> Clustering – K-Means and Hierarchical clustering. Dimensionality reduction overview – concept of PCA (no mathematical depth). Model performance evaluation: training/testing split, cross-validation basics, and avoiding overfitting/underfitting.</p> <p><b>Case Study:</b> Product Recommendation System (E-Commerce)</p> <p><b>Text 2: Chapter 4, 5</b></p>	CO3	08

<b>V</b>	<p>Practical applications of Machine Learning in real-world scenarios. Mini case studies using Scikit-learn and Panda's datasets.</p> <p><b>case study:</b> AI &amp; ML integration – recommendation systems, image recognition, and sentiment analysis. Future trends and ethical considerations in AI &amp; ML.</p> <p><b>Text 2: Chapter 6</b></p>	CO4	08
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## 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython	Wes McKinney	O'Reilly Media, 2017, ISBN: 978-1-4919-5766-0.	2nd Edition	1
2	Introduction to Machine Learning with Python: A Guide for Data Scientists	Andreas C. Müller and Sarah Guido	O'Reilly Media, 2016, ISBN: 978-1-4493-9924-6	1st Edition	2,3,4,5

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

1. Python for Data Analysis (PDF) – Wes McKinney
2. Python Data Science Handbook – Jake VanderPlas (Free eBook)
3. Scikit-learn Documentation
4. NumPy Official Documentation
5. Pandas Official Documentation
6. Matplotlib & Seaborn Tutorials – GeeksforGeeks / W3Schools
7. Kaggle Learn: Python and Machine Learning

## 7. EVALUATION METHODOLOGY

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

### **CIE Framework:**

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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical evaluation pattern for regular courses is shown in Table 1:

**Table 1: Evaluation Process for CIE and SEE**

	<b>Component</b>	<b>Marks</b>	<b>Total Marks</b>
CIE	CIE Test-1	50	30
	CIE Test-2	50	
	AAT	20	20
SEE	Semester End Examination	100	50
<b>Grand Total</b>			100

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11
<b>CO1</b>	3	2	-	-	2	-	-	-	-	-	-
<b>CO2</b>	3	2	2	-	3	-	-	-	-	-	-
<b>CO3</b>	3	2	3	-	3	-	-	2	-	-	-
<b>CO4</b>	3	2	3	2	3	-	-	2	2	-	-
<b>Average</b>	3	2	3	2	3	-	-	2	2	-	-

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

<b>PSOs</b>		
→	<b>PSO1</b>	<b>PSO2</b>
<b>COs ↓</b>		
<b>CO1</b>		2
<b>CO2</b>		2
<b>CO3</b>		2
<b>CO4</b>		2

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

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# GLOBAL ACADEMY OF TECHNOLOGY

Autonomous Institution Affiliated to Visveswaraya Technological University

Approved by UGC, AICTE and Govt of Karnataka



Department: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: VI	Course Code: BAML24605D	Contact Hrs /week: 3
Course Description: JavaScript Programming		No. of Credits:3 L : T : P : S = 3:0:0:0
Course Category: OEC		Total no. of Hours = 40+50
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Programming Languages , HTML & CSS Fundamentals		

## 1. PREAMBLE ABOUT THE COURSE

JavaScript is the cornerstone of modern web development, enabling dynamic, interactive, and responsive user experiences across platforms. This course introduces students to the foundational and advanced concepts of JavaScript, empowering them to build client-side applications, manipulate web documents, and implement modular and asynchronous logic.

## 2. COURSE LEVEL OBJECTIVES

<b>CLO1</b>	To enable students to the fundamentals of JavaScript, including its syntax, data types, Functions and operators.
<b>CLO2</b>	To develop proficiency in using object properties, methods, and array operations for structured programming.
<b>CLO3</b>	To build scalable and maintainable JavaScript applications using modular and asynchronous techniques.
<b>CLO4</b>	To explore the Document Object Model (DOM) and its role in dynamic web page manipulation and events.

## 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	Design and style structured web pages using HTML5 and CSS	POs – 1,2,3 PSOs - 1	L3	WK 1,3,4	10
CO2	Apply JavaScript fundamentals for interactive web applications	POs – 1,2,5 PSOs - 1	L3	WK 1,2,3	10
CO3	Implement OOP principles in JavaScript with objects, arrays, classes, and JSON.	POs – 2,3,5 PSOs - 1	L3	WK 1,3,4,5	10
CO4	Develop modern web applications using modules, async JS, DOM, and events.	POs –3,5 PSOs -1	L3	WK 3,4,5	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	<p><b>HTML and CSS:</b> What is HTML and Where did it come from?, HTML Syntax, Semantic Markup, Structure of HTML Documents, Quick Tour of HTML Elements, HTML5 Semantic Structure Elements, HTML Tables and Forms, Introducing Tables: Tables, Styling Tables, Introducing Forms, Form Control Elements, Table and Form Accessibility. Introduction to CSS: What is CSS, CSS Syntax, Location of Styles, Selectors, The Cascade: How Styles Interact, The Box Model, CSS Text Styling.</p> <p><b>Textbook 1: Chapter 3, 4, 5</b></p>	CO1	08
II	<p><b>Introduction:</b> What is JavaScript?, Values, Types, and Operators: Values, Types, and Operators : Numbers, Strings, Unary operators, Boolean values , Empty values. , Automatic type conversion , program structure : Expressions and statements: Bindings,Controlflow, Conditional execution, while and do loops, forloops , switch , Functions: Defining a function, Bindings and scopes, Nested scope, Functions as values, Declaration notation, Arrow functions, The call stack</p> <p><b>Text Book 2: chapter 1,2, 3</b></p>	CO2	08
III	<p><b>Objects and Arrays :</b> Datasets, Properties, Methods, Objects, Mutability, Computing correlation, Array loops, Strings and their properties, JSON, Abstract Data Types ,Prototypes,Classes, PrivateProperties, Overriding derived properties, Polymorphism ,Getters,setters,and statics, Symbols, The iterator interface ,Inheritance, The instanceof operator.</p> <p><b>Text Book 2: Chapter 4,6</b></p>	CO3	08
IV	<p><b>Modules and Asynchronous JavaScript:</b></p> <p>Modules: Modules with Classes, Objects, and Closures, Modules in Node, Modules in ES6, Asynchronous JavaScript : Asynchronous Programming with Callbacks, Promises, async and await, Asynchronous Iteration</p> <p><b>Text Book 3: Chapter 10 , 13</b></p>	CO4	08
V	<p><b>Web Programming Basics</b> - JavaScript in HTML &lt;script&gt; tags, The Document Object Model, The Global Object in Web Browsers, Execution of JavaScript Programs, Program Input and Output, Events - Event Categories, Registering Event Handlers, Event Handler Invocation, Event Propagation, Event Cancellation, Dispatching Custom Events, Scripting Documents</p> <p><b>Case studies:</b> Explore tools React / Node.js / Vue.js</p> <p><b>Text Book 3: Chapter 15.1,15.2,15.3</b></p>	CO4	08

## 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS:

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Fundamentals of Web Development	Randy Connolly, Ricardo Hoar,	Pearson Education India.	Second Edition	1
2	Eloquent JavaScript	Marijn Haverbeke	No Starch press	4 <sup>th</sup> edition	2
3	Javascript - The definitive guide	David Flanagan	O'Reily	7 <sup>th</sup>	3,4,5

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

1. Programming with JavaScript | Coursera
2. Web-designing and multimedia Technology – NPTEL Course

## 7. EVALUATION METHODOLOGY

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

### CIE Framework:

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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical evaluation pattern for regular courses is shown in Table 1:

**Table 1: Evaluation Process for CIE and SEE**

	Component	Marks	Total Marks
CIE	CIE Test-1	50	30
	CIE Test-2	50	
	AAT	20	20
SEE	Semester End Examination	100	50
	<b>Grand Total</b>		100

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

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

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

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Department: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: VI	Course Code: BAML24606	Contact Hrs. /week: 2
Course Description: Major Project Phase-I		No. of Credits:1 L : T : P : S = 0:0:4:0
Course Category: PROJ		Total no. of Hours = 42
CIE: 100 Marks	SEE: Nil	Exam Hours: 03
Course Pre-requisites: Programming and Presentation Skills		

### Project work phase - 1:

Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary project can be assigned to an individual student or to a group having not more than 4 students.

### CIE procedure for Project Work Phase - 1:

**a. Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the project work phase -1, shall be based on the evaluation of the project work phase -1 Report (covering Literature Survey, Problem identification, Objectives and Methodology) using Rubrics, project presentation skill and question and answer session. The marks awarded for the Project report shall be the same for all the batch mates.

**b. Interdisciplinary:** Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work phase -1, shall be based on the evaluation of project work phase -1 Report (covering Literature Survey, Problem identification, Objectives and Methodology), project presentation skill and question and answer session. The marks awarded for the project report shall be the same for all the batch mates as per Rubrics covering all Program Outcomes.

### EVALUATION METHODOLOGY

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

**Table 1: Evaluation Process for CIE and SEE**

	Component	Marks	Total Marks
CIE	Review-1	50	100
	Review -2	50	
SEE	Semester End Examination	-	-
<b>Grand Total</b>			<b>100</b>



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Department: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: VI	Course Code: BAMLL24607	Contact Hrs. /week: 2
Course Description: Deep Learning Lab		No. of Credits:1 L : T : P : S = 0:0:2:0
Course Category: PCCL		Total no. of Hours = 24
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Deep Learning Principles & Practices		

## 1. PREAMBLE ABOUT THE COURSE

The Deep Learning Laboratory provides hands-on experience in building and training neural network models for real-world applications. Students learn to design and implement ANN, CNN, RNN, and LSTM architectures using Python and Keras. The lab emphasizes understanding model design, training, and performance evaluation techniques. Experiments cover both foundational neural networks and advanced applications like object detection, sentiment analysis, and GANs. It bridges theoretical deep learning concepts with practical problem-solving skills. This course prepares students for research and innovation in AI and Machine Learning domains.

## 2. COURSE LEVEL OBJECTIVES

Sl. No	Course Learning Objectives (CLO)
CLO1	To provide hands-on experience in implementing Artificial Neural Networks and Deep Learning architectures using Python.
CLO2	To develop skills in designing, training, and evaluating CNN, RNN, and LSTM-based models for real-world applications.
CLO3	To apply advanced concepts like transfer learning and generative models for creative AI tasks.
CLO4	To cultivate problem-solving and analytical abilities by developing end-to-end AI models aligned with industry standards.

## 3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSO's	Cognitive Level	WK	Class Hours
CO1	Understand and apply the concepts of ANN, CNN, RNN, and LSTM in solving real-world problems.	PO1 (3), PO2 (2), PO3 (3)	L3	WK3, WK4	6
CO2	Design, implement, and optimize deep learning models using Python and Keras.	PO2 (3), PO3 (3), PO5 (2)	L3	WK4, WK5	6
CO3	Analyze model performance and interpret results using standard metrics and visualization tools.	PO4 (3), PO5 (2), PO11 (1)	L3	WK5	6
CO4	Demonstrate problem-solving, teamwork, and innovation skills through mini projects in CNN, RNN, and GAN applications.	PO6 (2), PO8 (2), PO10 (3), PO11 (3)	L3	WK6	6

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

#### 4. SYLLABUS

Program No.	Programs	Mapped COs	No. of Hours
1	Implementation of Artificial neural network for classification: Design Neural network model from scratch without Libraries	CO1	2
2	Implementation of Artificial neural network for classification: Design Neural network model with Keras Libraries	CO2	2
3	Implementation of Artificial neural network for classification: Design Neural network model with Keras Libraries	CO2, CO3	2
4	Develop a baseline neural network model for the regression problem. (for Boston house price dataset)	CO2, CO3	2
5	Apply deep feedforward networks to practical problems by designing network architectures and hidden units, with a focus on learning the XOR problem as an example.	CO1, CO2	2
6	Build an Artificial Neural Network by implementing the Backpropagation algorithm and testing the same using appropriate data sets.	CO1, CO2, CO3	2
7	Convolutional Neural Networks Best Practices To Develop a deep learning model to achieve near state-of-the-art performance on the MNIST handwritten digit recognition task in Python using the Keras deep learning library	CO2, CO3	2
8	Design and implement an image classification model using Convolutional Neural Networks (CNN) in Python.	CO2, CO3	2
9	Design and implement an object detection and localization system using CNN-based architectures.	CO3, CO4	2
	<b>Additional Programs</b>		
10	Perform Sentiment Analysis in network graph using RNN	CO1, CO2, CO3	2
11	Image Captioning using Deep Learning	CO3, CO4	2
12	Generating cifar-10 fake images using Deep Convolutional Generative Adversarial Networks (DCGAN)	CO4	2

#### 5. LIST OF RECOMMENDED REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Deep Learning	Amit kumar das, Saptarsi goswami, Pabitra mitra, Amlan,	1st edition, Pearson.	2024	All programs covered
2	Deep Learning	Ian Goodfellow, Yoshua Bengio and Aaron Courville,	MIT Press	2017	
3	Neural networks and Deep Learning: A Textbook	Charu C. Aggarwal (Second Edition) Springer	ISBN 978-3-319-94463-0 (eBook)	2023	

## 6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE]

- Scikit-learn documentation
- Tutorials and articles on medium, towards data science, and other blogs
- Scikit-learn documentation: <https://scikit-learn.org/stable/documentation.html>
- <https://github.com/janishar/mit-deep-learning-book-pdf>
- <https://www.cse.iitk.ac.in/users/sigml/lec/DeepLearningLib.pdf>

### MOOCs:

- Coursera: "Applied Machine Learning in Python" by the University of Michigan
- edX: "Machine Learning with Python" by IBM

## 7. EVALUATION METHODOLOGY

1. Continuous Internal Evaluation (CIE) = 50 marks
2. Semester End Examination (SEE) = 50 marks

Total = 100 marks

ASSESSMENT AND EVALUATION PATTERN		
	CIE	SEE
<b>WEIGHTAGE</b>	<b>50%</b>	<b>50%</b>
Record	10	<b>50</b>
Test	20	
Experiential Learning (Mini Project)	20	NIL
<b>Total Marks for The Course</b>	<b>50</b>	<b>50</b>

Component	Criteria	Excellent (3)	Good (2)	Satisfactory (1)	Weightage
<b>Record (10 Marks)</b>	<b>Documentation Quality</b>	Clearly written, well-organized report with all programs, outputs, and interpretations	Minor errors in formatting or explanation	Incomplete records or missing details	4
	<b>Code Quality and Implementation</b>	Efficient, modular, and well-commented code executed without errors	Functional code with few inefficiencies	Code lacks structure or partial implementation	4
	<b>Timeliness &amp; Neatness</b>	Submitted on time, clean and properly formatted	Minor delay or formatting issues	Late submission or poorly formatted record	2
<b>Total for Record</b>					<b>10</b>
<b>Test (20 Marks)</b>	<b>Conceptual Understanding</b>	Demonstrates deep understanding of ANN, CNN, RNN, LSTM concepts and architecture design	Understands basic theory but lacks analytical clarity	Limited understanding of underlying principles	6
	<b>Model Design and Execution</b>	Model designed logically with appropriate parameters and optimization	Model designed correctly with few tuning errors	Model partially implemented or lacks proper training	8

	<b>Evaluation and Result Interpretation</b>	Correctly analyses performance metrics (accuracy, loss, etc.)	Partial interpretation of results	Minimal or incorrect evaluation	6
<b>Total for Test</b>					<b>20</b>
<b>Experiential Learning (Mini Project)</b>	<b>Problem Definition &amp; Innovation</b>	Original idea with well-defined problem statement linked to real-world AI application	Moderate innovation with partial linkage to real-world problems	Simple replication of existing models	5
	<b>Model Design and Implementation</b>	Model demonstrates creativity, accuracy, and optimal design choices	Model works correctly with minor issues	Basic implementation with limited accuracy	7
	<b>Result Analysis &amp; Presentation</b>	Results clearly analysed, visualized, and explained using metrics	Results interpreted but visualization or analysis incomplete	Limited analysis or missing explanation	5
	<b>Teamwork &amp; Contribution</b>	Equitable contribution and effective collaboration	Uneven participation among members	Minimal or no collaboration	3
<b>Total for Experiential Learning</b>					<b>20</b>

## 9. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 10. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
<b>CO1</b>		3
<b>CO2</b>		3
<b>CO3</b>		2
<b>CO4</b>		3
<b>AVG</b>		3

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

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# GLOBAL ACADEMY OF TECHNOLOGY

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



Department: Artificial Intelligence and Machine Learning		
Semester: VI	Course Code: BAML24657A	Contact Hrs /week: 2
Course Description: AI Tools, frameworks & its Application -II		No. of Credits: 01 L : T : P : S = 0:0:2:0
Course Category: AEC		Total no. of Hours = 24
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Basic knowledge of Python programming, probability and statistics, fundamentals of machine learning, and data preprocessing using Python libraries.		

## 1. PREAMBLE ABOUT THE COURSE

The course AI Tools & Frameworks for Artificial Intelligence and Machine Learning is designed to provide students with practical exposure to the diverse ecosystem of tools, libraries, and platforms that empower AI and ML applications. It emphasizes the implementation of machine learning models, data processing pipelines, and natural language processing systems using popular frameworks such as Scikit-learn, TensorFlow, and NLTK. Students will gain hands-on experience in feature engineering, model training, and evaluation, bridging the gap between theoretical AI concepts and their industrial applications. By the end of the course, students will be equipped to select, apply, and integrate appropriate AI tools for solving real-world problems in domains like healthcare, education, and business intelligence.

## 2. COURSE LEVEL OBJECTIVES

Sl. No	Course Learning Objectives (CLO)
1	Use and analyze the concept of text mining
2	Explore and Apply NLP libraries like NLTK
3	Apply SKLearn library for disease prediction
4	Use and Apply data exploration and feature 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	Extraction of meaning insights using Natural Language processing	PO1,PO2, PO9	L3	WK- 3,4,5,6	8
CO2	Measure the information content using Natural Language processing	PO1, PO2, PO3, PO9	L3	WK- 3,4,5,6	8
CO3	Recommendations using Natural Language processing	PO1, PO2, PO3, PO9	L4	WK- 3,4,5,6	8

Wks are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK

#### 4. SYLLABUS

Sl.No.	Laboratory Experiments
	<b>PART A</b>
1	Installation of NLTK Library and working with Basic commands
2	Write a python code for Tokenizing and count word frequency.
3	Write a python code NLTK word stemming and Lemmatizing words using WordNet.
4	Write a python code for healthcare data exploration
5	Perform feature engineering for healthcare dataset.
6	Built a training/validation/test sample model for healthcare dataset.
	<b>PART B</b>
	<b>Mini Project</b>
	1. Clinical decision making on healthcare domain using SkLearn 2. Design and build a model for AI Education using NLP libraries.

#### 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Natural Language Processing with Python – Analyzing Text with the Natural Language Toolkit	Steven Bird, Ewan Klein, Edward Loper	O’Reilly Media	2nd Edition, 2023	Covers installation and use of NLTK, tokenization, stemming, lemmatization, and word frequency analysis.
2	Python Machine Learning	Sebastian Raschka, Vahid Mirjalili	Packt Publishing	3rd Edition, 2020	Provides implementation of Scikit-learn models, data preprocessing, and model training/testing pipeline.

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

1. <https://www.nltk.org/>
2. [https://scikit-learn.org/stable/user\\_guide.html](https://scikit-learn.org/stable/user_guide.html)
3. <https://www.kaggle.com/datasets>
4. <https://nptel.ac.in/courses/106105158>

#### 7. EVALUATION METHODOLOGY

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

##### CIE Framework:

##### Scheme of Examination (CIE):

##### Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Exam) taken together.

### Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The Split-up of CIE marks for record/journal and test are in the ratio **60:40**

### 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

### 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
CO1		3
CO2		3
CO3		3

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

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# GLOBAL ACADEMY OF TECHNOLOGY

Autonomous Institution Affiliated to Visveswaraya Technological University

Approved by UGC, AICTE and Govt of Karnataka



Department: Artificial Intelligence and Machine Learning		
Semester: VI	Course Code: BAML24657B	Contact Hrs /week: 2
Course Description: Explainable AI		No. of Credits: 01 L : T : P : S = 0:0:2:0
Course Category: AEC		Total no. of Hours = 24
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Basic understanding of Machine Learning and Deep Learning concepts, Knowledge of Python programming and Foundational understanding of data preprocessing and visualization.		

## 1. PREAMBLE ABOUT THE COURSE

The course Explainable Artificial Intelligence (XAI) aims to bridge the gap between complex AI models and human interpretability. As modern AI systems, particularly deep learning models, become more opaque, there is a growing need to ensure transparency, trust, and accountability in AI-driven decisions. This course introduces students to the key concepts, frameworks, and tools that make AI systems interpretable and trustworthy. Through practical exercises involving LIME, SHAP, Grad-CAM, and counterfactual analysis, students will gain hands-on experience in explaining model behaviour, visualizing decision factors, and addressing fairness and bias issues. By the end of the course, learners will be equipped with the skills to analyze and communicate the reasoning behind AI model predictions responsibly and effectively.

## 2. COURSE LEVEL OBJECTIVES

Sl. No	Course Learning Objectives (CLO)
1	Understand the need for explainability in AI systems.
2	Explore various methods and tools for explaining the decisions made by AI/ML models.
3	Implement and analyze explainability techniques for different AI models.
4	Develop skills to evaluate and interpret AI models from a fairness, accountability, and transparency perspective.

## 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	Gain hands-on experience in explaining AI models using various tools and techniques.	PO1, PO2, PO5, PO9, PO11, PSO2	L3	WK3, WK4, WK5, WK6	6
CO2	Understand the trade-offs between model accuracy and interpretability.	PO1, PO2, PO3, PO9, PO11, PSO2	L4	WK3, WK4, WK5, WK6	6
CO3	Be equipped with the skills to analyze and interpret the decisions made by black-box AI models.	PO1, PO2, PO3, PO4, PO5, PO9, PO11, PSO2	L4	WK3, WK4, WK5, WK6	6

CO4	Understand the ethical considerations in building explainable and fair AI systems.	PO1, PO6, PO7, PO8, PO10, PO11, PSO2	L5	WK7, WK8, WK9	6
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*WKs are Washington Accord's Knowledge & Attitude Profiles ranging from WK1 to WK9*

#### 4. SYLLABUS

Sl.no.	Laboratory Experiments
1	<p><b>Introduction to Explainable AI</b> To understand the concept of explainability in AI, its importance, and use cases.</p> <p><b>Tasks:</b></p> <ol style="list-style-type: none"> <li>1. Overview of XAI.</li> <li>2. Study examples of opaque models (e.g., deep neural networks) and interpretable models (e.g., decision trees).</li> </ol> <p>Setup of basic tools (Python, <code>sklearn</code>, and <code>XAI</code> libraries).</p>
2	<p><b>Visualizing Model Predictions with Feature Importance (Using Decision Trees)</b> To analyze feature importance in Decision Trees.</p> <p><b>Tasks:</b></p> <ol style="list-style-type: none"> <li>1. Train a Decision Tree on a dataset (e.g., Titanic dataset).</li> <li>2. Visualize the tree structure and feature importance using <code>sklearn</code> and <code>matplotlib</code>.</li> </ol> <p>Interpret how feature importance affects predictions.</p>
3	<p><b>Explainability of Black Box Models using LIME (Local Interpretable Model-Agnostic Explanations)</b> Apply LIME to explain predictions of black-box models.</p> <p><b>Tasks:</b></p> <ol style="list-style-type: none"> <li>1. Train a black-box model (e.g., Random Forest or Neural Network) on a dataset.</li> <li>2. Use the <code>LIME</code> package to explain individual predictions.</li> </ol> <p>Visualize and analyze the explanations.</p>
4	<p><b>Global Interpretability with SHAP (SHapley Additive exPlanations)</b> Use SHAP to provide global interpretability for machine learning models.</p> <p><b>Tasks:</b></p> <ol style="list-style-type: none"> <li>1. Train a Random Forest or XGBoost model.</li> <li>2. Use the <code>SHAP</code> package to compute SHAP values for the dataset.</li> </ol> <p>Analyze the SHAP summary plot and dependence plots for feature importance.</p>
5	<p><b>Visualizing CNN Filters and Activations (Explainability in Convolutional Neural Networks)</b> Understand how Convolutional Neural Networks (CNNs) interpret images.</p> <p><b>Tasks:</b></p> <p>Train a CNN model (e.g., on CIFAR-10 or MNIST dataset).</p> <p>Visualize the filters and activations of convolutional layers using <code>tensorflow/keras</code>.</p> <p>Interpret how the network processes visual data through different layers.</p>
6	<p><b>Saliency Maps and Grad-CAM for CNN Model Explanations</b> Apply Saliency Maps and Grad-CAM to visualize the important regions in an image for CNN predictions.</p> <p><b>Tasks:</b></p> <ol style="list-style-type: none"> <li>1. Implement Saliency Maps to highlight important pixels.</li> <li>2. Apply Grad-CAM to localize the regions in the image responsible for a classification decision.</li> </ol> <p>Analyze and compare the results.</p>
7	<p><b>Counterfactual Explanations in AI Systems</b> Explore counterfactual explanations and how they explain model predictions.</p>

	<p><b>Tasks:</b></p> <ol style="list-style-type: none"> <li>1. Train a classifier (e.g., logistic regression) on a dataset.</li> <li>2. Generate counterfactual explanations for incorrect or critical predictions using <code>alibi</code> library.</li> </ol> <p>Discuss how these explanations provide insights into what minimal changes would alter the outcome.</p>
8	<p><b>Fairness and Bias Detection in AI Models</b></p> <p>Detect and mitigate bias in AI models.</p> <p><b>Tasks:</b></p> <ol style="list-style-type: none"> <li>1. Train a model on a biased dataset (e.g., a dataset with gender or racial bias).</li> <li>2. Use fairness metrics (such as disparate impact or equal opportunity) to evaluate the model.</li> </ol> <p>Apply bias mitigation techniques (e.g., reweighing or adversarial debiasing).</p>
9	<p><b>Model Transparency through Rule-Based Models</b></p> <p>Interpret black-box models using surrogate rule-based models.</p> <p><b>Tasks:</b></p> <ol style="list-style-type: none"> <li>1. Train a complex model (e.g., Random Forest).</li> <li>2. Create a simpler surrogate rule-based model (e.g., decision rules or decision trees) to mimic the black-box model.</li> </ol> <p>Use the rule-based model to explain the behavior of the original model.</p>
10	<p><b>Case Study – Explainability in Healthcare AI</b></p> <p>Apply XAI techniques to a real-world healthcare dataset.</p> <p><b>Tasks:</b></p> <ol style="list-style-type: none"> <li>1. Use a healthcare-related dataset (e.g., predicting heart disease).</li> <li>2. Train a complex model (e.g., neural network or ensemble model).</li> <li>3. Apply LIME, SHAP, and counterfactual explanations to explain the predictions made for high-risk patients.</li> <li>4. Discuss the ethical implications of explainability in AI systems used for healthcare.</li> </ol>

## 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Interpretable Machine Learning	Christoph Molnar	Leanpub	2nd Edition, 2022	All modules – Core reference for LIME, SHAP, and interpretability.
2	Explainable AI: Interpreting, Explaining and Visualizing Deep Learning	Ankur Taly, Christoph Molnar, Wojciech Samek	Springer	2021	Covers visualization methods like Grad-CAM, SHAP, and saliency maps.
3	Responsible Machine Learning: Explainable, Fair and Transparent AI Models	Patrick Hall, Navdeep Gill	O'Reilly Media	2023	Ethics, fairness, and bias detection modules.
4	Python Machine Learning	Sebastian Raschka, Vahid Mirjalili	Packt Publishing	3rd Edition, 2020	Practical foundation for model development and XAI tool implementation.

## 6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE]

1. <https://nptel.ac.in/courses/106105283>
2. <https://cloud.google.com/explainable-ai>
3. <https://github.com/shap/shap>
4. <https://github.com/marcotcr/lime>
5. <https://www.coursera.org/specializations/explainable-artificial-intelligence-xai>

## 7. EVALUATION METHODOLOGY

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

### CIE Framework:

#### Scheme of Examination (CIE):

#### Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum of the CIE (Continuous Internal Evaluation) and SEE (Semester End Exam) taken together.

#### Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The Split-up of CIE marks for record/journal and test are in the ratio **60:40**.

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

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

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

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# GLOBAL ACADEMY OF TECHNOLOGY

Autonomous Institution Affiliated to Visveswaraya Technological University

Approved by UGC, AICTE and Govt of Karnataka



Department: Artificial Intelligence and Machine Learning		
Semester: VI	Course Code: BAML24657C	Contact Hrs /week: 2
Course Description: Business Intelligence using Power BI		No. of Credits: 01 L : T : P : S = 0:0:2:0
Course Category: AEC		Total no. of Hours = 24
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Basic knowledge of databases and SQL, Fundamentals of Data Analytics and Machine Learning		

## 1. PREAMBLE ABOUT THE COURSE

The course Business Intelligence using Power BI aims to equip students with practical skills to analyze, visualize, and present data-driven insights using Microsoft Power BI. It focuses on enabling students to convert raw data into interactive dashboards and reports that support strategic business decisions. Through hands-on sessions, students learn how to connect various data sources, perform data cleaning and transformation, and apply visualization principles to communicate insights effectively. By the end of the course, learners will be capable of designing intuitive dashboards, understanding key performance indicators (KPIs), and leveraging data visualization for business problem-solving in diverse domains.

## 2. COURSE LEVEL OBJECTIVES

Sl. No	Course Learning Objectives (CLO)
1	Understand the Importance of data Visualization for business intelligence and decision making.
2	Learn different approaches to understand the importance of visual perception.
3	Learn different data visualization techniques.
4	Gain knowledge of effective data visuals to solve workplace 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	Design the experiment to create basic charts and graphs using Power BI.	PO1, PO2, PO5, PO9, PO11, PSO2	L3	WK3, WK4, WK5, WK6	8
CO2	Develop the solution for the given real world problem.	PO1, PO2, PO3, PO4, PO5, PO9, PO11, PSO2	L4	WK3, WK4, WK5, WK6	8
CO3	Analyze the results and produce substantial written documentation.	PO1, PO2, PO3, PO5, PO8, PO9, PO10, PO11, PSO2	L5	WK3, WK4, WK5, WK6, WK8	8

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

## 4. SYLLABUS

Sl.No.	Laboratory Experiments
	<b>PART A</b>
1	Introducing Power BI –Components and the flow of work. Power BI Desktop Interface-The Report has five main areas.
2	Querying Data from CSV - Query Editor Connecting the data from the Excel Source, Clean, Transform the data
3	Creating Reports & Visualizations - Different types of charts, Formatting charts with Title, Colors.
4	Dashboards - Filters in Power BI
5	Formatting dashboards in Power BI
6	Building Dashboard in Power BI.
7	<p>Analysis of revenue in sales dataset:</p> <ol style="list-style-type: none"> <li>1. Create a choropleth map (fill the map) to spot the special trends to show the state which has the highest revenue.</li> <li>2. Create a line chart to show the revenue based on the month of the year.</li> <li>3. Create a bin of size 10 for the age measure to create a new dimension to show the revenue.</li> <li>4. Create a donut chart view to show the percentage of revenue per region by creating zero access in the calculated field.</li> <li>5. Create a butterfly chart by reversing the bar chart to compare female &amp; male revenue based on product category.</li> <li>6. Create a calculated field to show the average revenue per state &amp; display profitable &amp; non-profitable state.</li> <li>7. Build a dashboard.</li> </ol>
8	<p>Analysis of GDP dataset:</p> <ol style="list-style-type: none"> <li>1. Visualize the countries data given in the dataset with respect to latitude and longitude along with country name using symbol maps.</li> <li>2. Create a bar graph to compare GDP of Belgium between 2006 – 2026.</li> <li>3. Using pie chart, visualize the GDP of India, Nepal, Romania, South Asia, Singapore by the year 2010.</li> <li>4. Visualize the countries Bhutan &amp; Costa Rica competing in terms of GDP.</li> <li>5. Create a scatter plot or circle views of GDP of Mexico, Algeria, Fiji, Estonia from 2004 to 2006.</li> <li>6. Build an interactive dashboard</li> </ol>
9	<p>Analysis of HR Dataset:</p> <ol style="list-style-type: none"> <li>1. Create KPI to show employee count, attrition count, attrition rate, attrition count, active employees, and average age.</li> <li>2. Create a Lollipop Chart to show the attrition rate based on gender category.</li> <li>3. Create a pie chart to show the attrition percentage based on Department Category- Drag department into colours and change automatic to pie. Entire view, Drag attrition count to angle. Label attrition count, change to percent, add total also, edit label.</li> <li>4. Create a bar chart to display the number of employees by Age group,</li> <li>5. Create a highlight table to show the Job Satisfaction Rating for each job role based on employee count.</li> <li>6. Create a horizontal bar chart to show the attrition count for each Education field Education field wise attrition – drag education field to rows, sum attrition count to col,</li> <li>7. Create multiple donut chart to show the Attrition Rate by Gender for different Age group.</li> </ol>
10	<p>Analysis of Amazon Prime Dataset:</p> <ol style="list-style-type: none"> <li>1. Create a Donut chart to show the percentage of movie and tv shows</li> <li>2. Create a area chart to shows by release year and type</li> <li>3. Create a horizontal bar chart to show Top 10 genre</li> </ol>

4. Create a map to display total shows by country
5. Create a text sheet to show the description of any movie/movies.
6. Build an interactive Dashboard.

## 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Mastering Microsoft Power BI: Expert Techniques for Effective Data Analytics and Business Intelligence	Brett Powell	Packt Publishing	2nd Edition, 2022	All modules – Dashboard design and BI concepts
2	Pro PowerBI Desktop	Adam Aspin	Apress	4th Edition, 2021	Power BI modeling and advanced visualizations
3	Data Visualization with Microsoft Power BI Cookbook	Dmitry Anoshin	Packt Publishing	2nd Edition, 2020	Visualization techniques and data storytelling
4	Storytelling with Data: A Data Visualization Guide for Business Professionals	Cole Nussbaumer Knaflic	Wiley	2nd Edition, 2021	Visual perception and business storytelling

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

1. <https://nptel.ac.in/courses/110106182>
2. <https://learn.microsoft.com/en-us/training/powerplatform/power-bi>
3. <https://www.coursera.org/learn/power-bi-data-visualization>
4. <https://www.edx.org/course/business-intelligence>
5. <https://www.youtube.com/@powerbi>

## 7. EVALUATION METHODOLOGY

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

### CIE Framework:

### Scheme of Examination (CIE):

### Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum of the CIE (Continuous Internal Evaluation) and SEE (Semester End Exam) taken together.

### Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The Split-up of CIE marks for record/journal and test are in the ratio **60:40**.

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

POs →	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
COs ↓											
<b>CO1</b>	3	2	2	1	3			2	3	–	3
<b>CO2</b>	3	3	3	2	3			2	3	1	3
<b>CO3</b>	3	3	3	2	3	1	1	3	3	1	3
<b>Average</b>	3	3	3	2	3	1	1	2	3	1	3

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
<b>CO1</b>		3
<b>CO2</b>		3
<b>CO3</b>		3

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

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# GLOBAL ACADEMY OF TECHNOLOGY

Autonomous Institution Affiliated to Visveswaraya Technological University

Approved by UGC, AICTE and Govt of Karnataka



Department: Artificial Intelligence and Machine Learning		
Semester: VI	Course Code: BAML24657D	Contact Hrs /week: 2
Course Description: Generative AI		No. of Credits: 01 L : T : P : S = 0:0:2:0
Course Category: AEC		Total no. of Hours = 24
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Fundamental knowledge of Python programming, Basic understanding of Machine Learning and Deep Learning and Familiarity with TensorFlow / Keras.		

## 1. PREAMBLE ABOUT THE COURSE

The course Generative Artificial Intelligence (Generative AI) introduces students to the rapidly evolving field of AI systems capable of creating new and original content, such as text, images, audio, and video. It focuses on understanding and implementing generative models like Generative Adversarial Networks (GANs), Variational Autoencoders (VAEs), LSTM networks, and Transformer-based models (like GPT). Students will gain hands-on experience using TensorFlow to build, train, and fine-tune these models for creative applications, such as image synthesis, text generation, and music composition. By the end of the course, learners will be equipped to design and deploy AI systems that generate innovative and contextually rich outputs, demonstrating the creative potential of artificial intelligence.

## 2. COURSE LEVEL OBJECTIVES

Sl. No	Course Learning Objectives (CLO)
1	To learn Python and TensorFlow skills for Generative AI.
2	To study techniques for cleaning and preparing data for Generative AI tasks.
3	To implement generative AI models
4	To develop innovative applications using generative AI tools and techniques.

## 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 Python and TensorFlow basics, including data handling and preprocessing techniques.	PO1, PO2, PO5, PO9, PO11, PSO2	L3	WK3, WK4, WK5, WK6	6
CO2	Implement Generative AI models such as GANs, VAEs, LSTM networks, and Transformer models for image, text, and music generation tasks.	PO1, PO2, PO3, PO4, PO5, PO9, PO11, PSO2	L4	WK3, WK4, WK5, WK6	6

CO3	Evaluate model performance and experiment with hyperparameters and optimization techniques to enhance Generative AI outcomes.	PO1, PO2, PO3, PO5, PO9, PO11, PSO2	L4	WK3, WK4, WK5, WK6	6
CO4	Develop innovative applications in image, text, and music generation, showcasing practical skills.	PO1, PO3, PO5, PO6, PO7, PO8, PO9, PO10, PO11, PSO2	L5	WK6, WK7, WK8, WK9	6

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

#### 4. SYLLABUS

Sl.No.	Laboratory Experiments
	<b>PART A</b>
1	Write Python scripts to implement basic operations and TensorFlow 2 tensors.
2	Preprocess and clean datasets for Generative AI applications using Python libraries such as Pandas and NumPy. Handle missing data, normalize features, and encode categorical variables.
3	Use Matplotlib or Seaborn to visualize data distributions and patterns in Generative AI datasets. Plot histograms, scatter plots, and heatmaps to analyze data characteristics.
4	Implement a Generative Adversarial Network (GAN) architecture using TensorFlow 2. Train the GAN model on a dataset such as MNIST or CIFAR-10 for image generation tasks.
5	Train a GAN model on a custom dataset for image generation. Experiment with hyperparameters, loss functions, and optimization techniques to optimize GAN training.
6	Explore advanced techniques such as Wasserstein GANs, Progressive GANs, or StyleGANs for image generation. Implement and compare these techniques for generating high-quality images.
7	Develop applications for image and video generation using trained Generative AI models. Use the models to generate art, create deep fakes, or synthesize video content.
8	<b>Text Generation:</b> Implement a Long Short-Term Memory (LSTM) network using TensorFlow 2 for text generation tasks. Train the LSTM model on a dataset of text sequences and generate new text samples.
9	<b>Text generation:</b> Implement a Transformer-based language model (e.g., GPT) using TensorFlow 2 for text generation. Fine-tune the model on a text corpus and generate coherent and contextually relevant text.
10	<b>Music Generation:</b> Preprocess music data and represent it in a suitable format for music generation tasks. Explore MIDI or audio representations for training Generative AI models.
	<b>PART B</b>
	<b>Mini Project</b>
	<ol style="list-style-type: none"> <li>1. Music Generation: Implement a Long Short-Term Memory (LSTM) network using TensorFlow 2 for music generation. Train the LSTM model on a dataset of music sequences and generate new musical compositions.</li> <li>2. Generate Novel Music Compositions: Transformer-based Music Generation: Implement a Transformer-based architecture (e.g., MusicBERT, MusicGPT) using TensorFlow 2 for music generation. Fine-tune the model on a music dataset and generate novel music compositions.</li> </ol>

## 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play	David Foster	O'Reilly Media	2nd Edition, 2022	All modules – GANs, VAEs, Transformers
2	Deep Learning with Python	François Chollet	Manning Publications	2nd Edition, 2021	TensorFlow and Keras implementation
3	Hands-On Generative Adversarial Networks with Keras	Rafael Valle	Packt Publishing	1st Edition, 2019	GAN implementation and experiments
4	Applied Deep Learning: A Case-Based Approach to Understanding Deep Neural Networks	Umberto Michelucci	Apress	2020	LSTM, GAN, and transformer-based models

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

1. <https://nptel.ac.in/courses/106106184>
2. <https://www.coursera.org/specializations/generative-adversarial-networks-gans>
3. <https://www.tensorflow.org/tutorials/generative>
4. <https://ai.googleblog.com>
5. <https://www.youtube.com/c/sentdex>

## 7. EVALUATION METHODOLOGY

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

### CIE Framework:

### Scheme of Examination (CIE):

### Assessment Details (both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum of the CIE (Continuous Internal Evaluation) and SEE (Semester End Exam) taken together.

### Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The Split-up of CIE marks for record/journal and test are in the ratio **60:40**.

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

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

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

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# GLOBAL ACADEMY OF TECHNOLOGY

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



Department: Science and Humanities		
Semester: VI	Course Code: BIKS24608	Contact Hrs /week: 01
Course Description: Indian Knowledge Systems		No. of Credits: 0 L : T : P : S = 1:0:0:0
Course Category: IKS		Total no. of Hours = 12
CIE: 100	SEE:	Exam Hours:

## 1. PREAMBLE ABOUT THE COURSE

The **Indian Knowledge System (IKS)** course introduces students to India's rich heritage of intellectual traditions, scientific thought, cultural practices, and sustainable innovations. By exploring traditional Indian frameworks in science, engineering, arts, wellness, and governance, this course aims to sensitize learners to indigenous wisdom and its modern-day relevance. It bridges ancient knowledge with contemporary applications, fostering cultural rootedness and global competence.

## 2. COURSE LEVEL OBJECTIVES

1. To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.
2. To make the students understand the traditional knowledge and analyse it and apply it to their day-to-day life.

## 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	Provide an overview of the concept of the Indian Knowledge System and its importance.	PO1, PO12	L2	WK1	3
CO2	Appreciate the need and importance of protecting traditional knowledge.	PO6, PO8, PO12	L2	WK5	3
CO3	Recognize the relevance of Traditional knowledge in different domains.	PO5, PO6, PO7, PSO1	L2	WK2, WK7	3
CO4	Establish the significance of Indian Knowledge systems in the contemporary world.	PO6, PO10, PO11, PO12	L3	WK5, WK6	3

*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	<b>Introduction to Indian Knowledge Systems (IKS):</b> Overview, Vedic Corpus, Philosophy, Character scope and importance, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge vs. western knowledge.	CO1, CO2	4
II	<b>Traditional Knowledge in Humanities and Sciences:</b> Linguistics, Number and measurements- Mathematics, Chemistry, Physics, Art, Astronomy, Astrology, Crafts and Trade in India and Engineering and Technology.	CO3	4
III	<b>Traditional Knowledge in Professional domain:</b> Town planning and architecture- Construction, Health, wellness and Psychology-Medicine, Agriculture, Governance and public administration, United Nations Sustainable development goals.	CO3, CO4	4

## 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition
1	Introduction to Indian Knowledge System- concepts and applications	B Mahadevan, Vinayak Rajat Bhat Nagendra Pavana R N	PHI Learning Private Ltd, ISBN-978-93-91818-21-0	2022
2	Knowledge Traditions and Practices of India	Kapil Kapoor, Avadesh Kumar Singh	DK Print World (P) Ltd., ISBN 81-246-0334	Vol. 1, 2005
3	Traditional Knowledge System in India	Amit Jha,	Atlantic Publishers and Distributors (P) Ltd., ISBN-13: 978-8126912230,	2009

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

- <https://swayam.gov.in/explorer?category=Humanities&subcategory=Indian%20Knowledge%20Systems>
- <https://ignca.gov.in>
- <https://ravdelhi.nic.in/>
- <https://sanskritpromotion.in/>

## 7. EVALUATION METHODOLOGY

- Continuous Internal Evaluation (CIE) = 50 marks
  - Semester End Examination (SEE) = 50 marks
- Total = 100 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
<b>Grand Total</b>			<b>100</b>

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2	PSO3
COs ↓			
CO1	-	-	-
CO2	-	-	-
CO3	-	-	-
CO4	-	-	-
CO5	-	-	-

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

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# GLOBAL ACADEMY OF TECHNOLOGY

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



Department: Science and Humanities		
Semester: VI	Course Code: BNSK24659	Contact Hrs /week: 1
Course Description: National Service Scheme (NSS)		No. of Credits: 0 L : T : P : S = 1:0:0:0
Course Category: MC		Total no. of Hours = 12
CIE: 100 Marks	SEE:	Exam Hours:

## 1. PREAMBLE ABOUT THE COURSE

The National Service Scheme (NSS) empower students through hands-on social service and leadership engagement. Focused on sustainable community development, the course aims to deepen understanding of real-world rural and urban challenges while instilling a sense of civic duty. Topics such as water conservation, village entrepreneurship, and support for educational institutions are addressed, helping students gain skills in planning, implementation, and social entrepreneurship for nation-building.

## 2. COURSE LEVEL OBJECTIVES

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

## 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 importance of his / her responsibilities towards society.	PO6, PO7	L2	WK6	2
CO2	Analyse the environmental and societal problems/issues and will be able to design solutions for the same.	PO2, PO5	L4	WK4	2
CO3	Evaluate the existing system and to propose practical solutions for the same for sustainable development.	PO3, PO7	L4	WK5	2
CO4	Implement government or self-driven projects effectively in the field.	PO4, PO9	L3	WK6	3

CO5	Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.	PO8, PO11	L3	WK2	3
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*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	Plantation and adoption of plants. Know your plants.	CO2	4
II	Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).	CO4	4
III	Govt. school Rejuvenation and helping them to achieve good infrastructure	CO4	4

#### 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	NSS Course Manual	-	Published by NSS Cell, VTU Belagavi	Latest	All
2	Government of Karnataka, NSS cell, activities reports and its manual.	-	Karnataka NSS Cell	Latest	All
3	Government of India, nss cell, Activities reports and its manual.	-	Ministry of Youth Affairs & Sports	Latest	All

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

1. Community Engagement and Social Responsibility: <https://swayam.gov.in/>
2. Official Guidelines and Activities: <https://nss.gov.in>
3. Environmental and Social Sustainability: <https://nptel.ac.in>

#### 7. EVALUATION METHODOLOGY

Continuous Internal Evaluation (CIE) = 50 marks

#### 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2	PSO3
COs ↓			
CO1	-	-	-
CO2	-	-	-
CO3	-	-	-
CO4	-	-	-
CO5	-	-	-

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

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

Sl No	Topic	Group size	Location	Activity execution	Reporting	Evaluation Of the Topic
1.	Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.	May be individual or team	Farmers land/Villages/ roadside/ community area/ College campus etc.....	Site selection /proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
2.	Waste management– Public, Private and Govt organization, 5 R's.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc.....	Site selection /proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
3.	Setting of the information imparting club for women leading to contribution in social and economic issues.	May be individual or team	Women empowerment groups/ Consulting NGOs & Govt Teams / College campus etc.....	Group selection/proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
4.	Water conservation techniques – Role of different stakeholders– Implementation.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc.....	site selection / proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
5.	Preparing an actionable business proposal for enhancing the village income and approach for implementation.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc.....	Group selection/proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer





# GLOBAL ACADEMY OF TECHNOLOGY

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Department: Science and Humanities		
Semester: VI	Course Code: BPEK24659	Contact Hrs /week: 1
Course Description: PHYSICAL EDUCATION (SPORTS & ATHLETICS) – II		No. of Credits: L : T : P : S = 1
Course Category: MC		Total no. of Hours = 12
CIE: 100 Marks	SEE:	Exam Hours:

## 1. PREAMBLE ABOUT THE COURSE

This course aims to enhance students' physical competence and mental well-being by integrating practical sessions with theory-based insights on postural health and stress management. With a focus on sports participation, jumping events in athletics, and aerobic fitness, the course helps students gain discipline, agility, and endurance while also encouraging psychological resilience through sport. It fosters a well-rounded approach to lifelong fitness and sports professionalism.

## 2. COURSE LEVEL OBJECTIVES

- To educate students about common postural deformities and methods of correction.
- To promote effective stress management strategies through physical activity.
- To enhance students' skills in Throw Ball, Table Tennis, and athletic jumps.
- To encourage fitness through aerobic routines.
- To support student participation in competitions and develop sportsmanship.

## 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 Postural deformities and Stress management in sports and athletics	-	-	-	-
CO2	Participate in the competition at regional/state / national / international levels.	-	-	-	-
CO3	Understand and practice of specific games and athletic Jumping events.	-	-	-	-
CO4	Understand and practice of Aerobics.	-	-	-	-

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

#### 4. SYLLABUS

Module No.	Module Description	Mapped COs	No. of Hours
IV	1. Postural deformities. 2. Stress management	-	4
V	1. Throw ball 2. Table Tennis 3. Athletics (Field Events- Jumps) – Any event as per availability of Ground.	-	16
VI	Aerobics	-	4

#### 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Foundations of Physical Education	Charles A. Bucher	McGraw Hill	Latest	All
2	Health and Physical Education	Dr. V.K. Sharma	Khel Sahitya Kendra	Latest	All

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

1. Physical Education and Sports : <https://nptel.ac.in/>

#### 7. EVALUATION METHODOLOGY

Continuous Internal Evaluation (CIE) = 50 marks

#### 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

#### 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2	PSO3
COs ↓			
CO1	-	-	-
CO2	-	-	-
CO3	-	-	-
CO4	-	-	-
CO5	-	-	-

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

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# GLOBAL ACADEMY OF TECHNOLOGY

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



Department: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: VII	Course Code: BAML24701	Contact Hrs. /week: 3
Course Description: Image Analytics with Computer Vision		No. of Credits:4 L : T : P : S = 3:0:2:0
Course Category: IPCC		Total no. of Hours= 40+20+60
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Deep Learning		

## 1. PREAMBLE ABOUT THE COURSE

This course aims to build a strong foundation in machine learning concepts and practical implementation using scikit-learn. It focuses on developing skills in regression, classification, and ensemble methods, emphasizing data preprocessing and model evaluation. Participants will explore polynomial and logistic regression along with regularization techniques for effective model tuning. The course also introduces neural network development using TensorFlow and Keras. Learners will address practical issues in deep learning model training and optimization. Overall, the program prepares participants to design and implement end-to-end ML solutions confidently.

## 2. COURSE LEVEL OBJECTIVES

Sl. No	Course Learning Objectives (CLO)
CLO1	To impart the fundamentals of image formation, the major ideas, methods, and techniques of computer vision and pattern recognition
CLO2	To understand the workings of Generative AI and the diffusion models.
CLO3	To develop an appreciation for various techniques of Computer Vision for Object detection and Face Recognition systems
CLO4	To provide the student with programming experience from implementing computer vision and object recognition applications.

## 3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/ PSO's	Cognitive Level	WK	Class Hours
CO1	Understand and analyze the fundamentals of Digital Image Processing and its foundational concepts such as sampling, quantization, pixel	PO1,2,5,10 PSO2	L2	Wk1	12

	relationships, and image enhancement techniques.				
CO2	Apply spatial and frequency domain filtering, intensity transformations, and segmentation techniques for effective image representation and description.	PO1,2,3,5,9,10 PSO2	L3	Wk2	13
CO3	Implement image preprocessing and feature extraction techniques using OpenCV, PIL, and Keras for building basic computer vision pipelines.	PO2,3,4,5,9,10,11 PSO2	L3,4	Wk3	12
CO4	Analyze and apply deep learning-based object detection and face recognition models such as R-CNN, YOLO, VGGFace2, and FaceNet, and evaluate their performance using IoU and mAP metrics.	PO2,3,5,6,9,10,11 PSO2	L3,4	Wk4	13

*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	Digital Image Fundamentals: What is Digital Image Processing? Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships between Pixels, Linear and Nonlinear Operations. Text1: Chapter 1 and Chapter 2: Sections 2.1 to 2.5, 2.6.2	1,2	10
II	Spatial Domain: Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering,- Smoothing Spatial Filters, Sharpening Spatial Filters Frequency Domain: Preliminary Concepts, The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-D DFT, Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters, and Selective Filtering. Text1: Chapter 3 & 4.	2	10

III	Image Representation and Description: Representation schemes, Boundary descriptors, Region descriptors Binary Machine Vision: Thresholding, Segmentation, Connected component labeling, Hierarchical segmentation, Spatial clustering, Split& merge, Rule-based Segmentation, Motion-based segmentation. Area Extraction: Concepts, Data-structures, Edge, Line-Linking, Hough transform, Line fitting, Curve fitting (Least-square fitting). Text1: Chapter 5 & 6.	3	10
IV	Introduction to Computer Vision: Basic concepts: pixel representation of an image, Image in frequency domain, different color models, and their transformation, Filtering and Convolution, Image preprocessing using PIL/Pillow, OpenCV, and Keras: reading multiple images from a directory, plotting, enhancement, filtering, re-scaling, morphological operations and image data augmentation. Text1: Chapter 7 & 8.	3,4	10
V	Basic concepts: bounding box representation, sliding window methods, anchor boxes, grid cells, and non-maximum suppression (NMS). State-of-the-art architecture: R-CNN and YOLO. Evaluation metrics: Intersection over Union (IoU) and Mean Average Precision (mAP), Practical use case. Face Detection: Face identification & verification using VGGFace2, Face Net, Eigen faces. Text1: Chapter 9-12.	4	10

Sl. No.	Program Title	Bloom's Level
1	Implement Image Acquisition, Sampling, Quantization, and Basic Pixel Operations on Different Real-World Image Datasets	L3
2	Develop an Image Enhancement System using Intensity Transformations and Histogram Processing Techniques	L3
3	Perform Spatial Domain Filtering for Image Smoothing and Sharpening using Different Filter Kernels	L3
4	Design and Compare Linear and Nonlinear Filtering Techniques for Noise Removal in Images	L3
5	Implement Image Segmentation Techniques using Thresholding, Clustering, Split-and-Merge, and Connected Component Labeling	L4
6	Develop a Boundary and Region-Based Image Representation and Description System for Object Analysis	L3
7	Perform Image Preprocessing and Augmentation using OpenCV, PIL/Pillow, and Keras on Custom Image Datasets	L3
8	Build a Computer Vision Pipeline for Object Detection using Bounding Boxes, Sliding Windows, Anchor Boxes, and Non-Maximum Suppression	L4

9	Implement and Compare Deep Learning-Based Object Detection Models such as R-CNN and YOLO for Real-Time Applications	L4
10	Develop a Face Detection and Recognition System using VGGFace2, FaceNet, and Eigenfaces on Different Real-World Scenarios	L4

## 5. LIST OF RECOMMENDED REFERENCE TEXTBOOKS

Sl. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Deep learning for Computer Vision	Jason Brownlee.	<a href="#">Machine Learning Mastery</a>	2020	1,2,3,4 &5
2	Computer Vision: Algorithms and Applications	<a href="#">Richard Szeliski</a>	Springer	2022	Reference Book

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

- <https://analyticsindiamag.com/optimisation-machine-learning-methods-gradient-descent/>
- <https://serokell.io/blog/ml-optimization>
- <https://machinelearningmastery.com/why-optimization-is-important-in-machine-learning/>

## 7. MOOCs:

- edX Image and Video Processing(<https://www.edx.org/course/fundamentals-of-digital-image-and-video-processing>)
- OpenCV Image Processing([https://docs.opencv.org/4.x/d4/d13/tutorial\\_py\\_filtering.html](https://docs.opencv.org/4.x/d4/d13/tutorial_py_filtering.html))
- Digital Image Processing - MIT](<https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-341-discrete-time-signal-processing-fall-2005/lecture-notes/chapter10.pdf>)
- MIT Frequency Domain Concepts](<https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-341-discrete-time-signal-processing-fall-2005/lecture-notes/chapter10.pdf>)

## 8. EVALUATION METHODOLOGY

### CIE Framework:

**Scheme of Examination (CIE):** 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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/

developing a generic tool-box for problem solving/ report based on participation in create- a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

**Table 1: Evaluation Process for CIE and SEE**

	Component	Marks	Max Marks	Total Marks
CIE	CIE Test-1	50	25	50
	CIE Test-2	50		
	AAT	10	10	
	LAB	30	15	
SEE	Semester End Examination	100		50
	<b>Grand Total</b>			100

## 9. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 10. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

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

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

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Department: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: 7	Course Code: BAML24702	Contact Hrs /week: 3
Course Description: ADVANCE NATURAL LANGUAGE PROCESSING		No. of Credits:4 L : T : P : S = 3:0:2:0
Course Category: IPCC		Total no. of Hours = 40+20+60
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Fundamental understanding of NLP concepts, Python programming, and machine learning techniques is required.		

## 1. PREAMBLE ABOUT THE COURSE

This course explores advanced applications of Natural Language Processing, focusing on how language technologies drive real-world systems such as machine translation, chatbots, and information extraction. It enables students to apply NLP techniques for semantic understanding, word sense disambiguation, and knowledge representation using tools like WordNet and knowledge graphs.

## 2. COURSE LEVEL OBJECTIVES

CLO1	Understand core techniques in information extraction, word sense processing, and machine translation.
CLO2	Analyze and design NLP systems such as dialogue systems and knowledge graph-based applications.
CLO3	Apply lexical resources, neural models, and evaluation methods to real-world language tasks.
CLO4	Examine evaluation methods and promote responsible development of NLP systems across diverse applications.

## 3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Cours Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Understand key NLP concepts including named entity recognition, word sense disambiguation, and machine translation.	POs - 1,2 PSOs – 2	L2	WK 2,3	12

CO2	Apply NLP techniques to extract entities, relations, events, and build dialogue or translation systems.	POs - 1,2,3,4,5 PSOs – 2	L3	WK 4,5	13
CO3	Develop and evaluate NLP solutions using WordNet, encoder–decoder models, and knowledge graphs.	POs - 1,2,3,4,5,11 PSOs – 2	L3	WK 2,4	12
CO4	Evaluate NLP systems using appropriate metrics and analyze their limitations and impact in real-world applications.	POs - 1,2,3,4,6,7,8,9, 11 PSOs – 2	L3	WK 2,4	13

*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	Information Extraction: Named Entities and Named Entity Tagging, Named Entity Recognition, Relation Extraction, Extracting Events and Time: Temporal Ordering of Events Textbook1: Ch. 17	CO1-4	10
II	Machine Translation: Language Divergences and Typology, Machine Translation using Encoder-Decoder, Details of the Encoder-Decoder Model, Decoding in MT: Beam Search, Translating in low-resource situations, MT Evaluation, Bias and Ethical Issues. Textbook 1: Ch. 12	CO1-4	10
III	Word Senses and WordNet: Word Senses, Relation between Senses, WordNet: A Database of Lexical relations, Word Sense disambiguation, Alternate WSD algorithms and Tasks, Word Sense Induction Textbook 1: Appendix I	CO1-4	10
IV	Chatbots and Dialogue Systems: Properties of Human Conversation, Chatbots, GUS: Simple Frame-based Dialogue Systems, The Dialogue-State Architecture, Evaluating Dialogue Systems, Dialogue System Design. Textbook 1: Ch. 24	CO1-4	10

V	<p>Knowledge Graphs: Introduction: What Is a Knowledge Graph? - Introduction, A Conceptual Definition of Knowledge Graphs, An Empirical Definition of Knowledge Graphs.</p> <p>How to Build Knowledge Graph? - Introduction, Merging AI and Internet, Knowledge Access Layer, Open and Service-Oriented Dialog Systems , Why we need Knowledge Graphs? : Applications – Introduction, The Market, Motivation and Solution, Touristic Use Cases, Energy Use Cases, Further verticals.</p> <p>Textbook 2: Ch. 1,3,4</p>	CO1-4	10
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## PRACTICAL COMPONENT OF IPCC

Sl.No.	Experiments
1	<p>Design an NLP-based Information Extraction system that automatically:</p> <ul style="list-style-type: none"> <li>• Identifies <b>named entities</b> (people, organizations, locations)</li> <li>• Extracts <b>relations</b> between entities</li> <li>• Detects <b>events and their timelines</b> from unstructured news articles.</li> </ul> <p><b>Dataset</b></p> <ul style="list-style-type: none"> <li>• Online news articles (politics, business, disasters)</li> </ul>
2	<p>Design a machine translation system to translate English public service announcements into multiple Indian languages, addressing linguistic diversity, low-resource constraints, and ethical concerns.</p> <p><b>Dataset</b></p> <ul style="list-style-type: none"> <li>• English Public Service Announcements</li> </ul>
3	<p>Design an NLP-based search system with a user-friendly interface that uses WordNet and WSD techniques to correctly identify word meanings in user queries and deliver semantically relevant search results.</p> <p><b>Datasets and Resources Used</b></p> <ul style="list-style-type: none"> <li>• <b>WordNet:</b> Sense inventory and semantic relations</li> <li>• <b>SemCor:</b> Sense-annotated corpus for supervised WSD</li> <li>• <b>Senseval / SemEval:</b> Evaluation datasets</li> <li>• <b>User Query Dataset:</b> Real or synthetic ambiguous search queries</li> </ul>
4	<p>Design a dialogue system (chatbot) that can interact with students in a natural manner, understand user intent, manage conversation flow, and provide accurate responses.</p> <p>The chatbot is designed as a task-oriented dialogue system to assist students with:</p> <ul style="list-style-type: none"> <li>• Course information</li> <li>• Exam schedules</li> <li>• Fee details</li> <li>• Department contacts</li> </ul>
5	<p>Design a question-answering system using the Neo4j Sandbox Movie Knowledge Graph to answer natural-language queries about movies, actors, genres, and relationships by translating user questions into Cypher queries.</p>

## 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

Sl. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Speech and Language Processing, An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition	Daniel Jurafsky, James H. Martin	Pearson Education, 2023	3rd Edition	1,2,3,4
2	Knowledge Graphs Methodology, Tools and Selected Use Cases	Dieter Fensel , Umutcan Şimşek, Kevin Angele, Elwin Huaman, Elias Kärle , Oleksandra Panasiuk , Ioan Toma, Jürgen Umbrich, and Alexander Wahler	Springer 2019	--	5
3	Neural Machine Translation	Philipp Koehn, Johns Hopkins University	2017		Reference
4	Natural Language Toolkit.	Bird and Loper, and other developers.	Available for free at:- <a href="http://www.nltk.org/">http://www.nltk.org/</a>		Reference

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

- <https://www.youtube.com/watch?v=Mrnod3almvQ>
- <https://www.youtube.com/watch?v=IxQtK2SjWWM>
- <https://www.youtube.com/watch?v=sZRA4j3d0c8&list=PL9HI4pk2FsvVLtbHf1ygw-XHEOhvMxtIo>

### MOOCs:

- [https://infyspringboard.onwingspan.com/web/en/app/toc/lex\\_auth\\_0138417434432471042867\\_shared/overview](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_0138417434432471042867_shared/overview)
- [https://infyspringboard.onwingspan.com/web/en/app/toc/lex\\_auth\\_01381723702506291215/overview](https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_01381723702506291215/overview)

## 7. EVALUATION METHODOLOGY

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

### CIE Framework:

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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical evaluation pattern for regular courses is shown in Table 1:

**Table 1: Evaluation Process for CIE and SEE**

	Component	Marks	Total Marks
CIE	CIE Test-1	50	30
	CIE Test-2	50	
	AAT	20	20
SEE	Semester End Examination	100	50
<b>Grand Total</b>			<b>100</b>

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
CO1	-	1
CO2	-	2
CO3	-	3
CO4	-	2
AVG	-	2

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



Department: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: VII	Course Code: BAML24703	Contact Hrs. /week: 3
Course Description: QUANTUM COMPUTING		No. of Credits:3 L : T : P : S = 3:0:0:0
Course Category: PCC		Total no. of Hours = 40+50
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Linear Algebra (vector spaces, matrices, eigenvalues, tensor products)		

## 1. PREAMBLE ABOUT THE COURSE

This course introduces the fundamental principles of quantum computation and quantum information, integrating concepts from quantum mechanics, linear algebra, and computational theory. It explores the quantum circuit model, quantum gates, measurement theory, and advanced quantum algorithms such as Quantum Phase Estimation and Shor's algorithm. The course emphasizes the mathematical formulation of quantum systems and demonstrates how quantum computation achieves computational advantages over classical approaches. This course prepares students to understand emerging quantum technologies and their applications in secure communication and computational complexity.

## 2. COURSE LEVEL OBJECTIVES

Sl. No	Course Learning Objectives (CLO)
CLO1	To Understand the theoretical foundations of quantum computation and its relationship with classical computation models and the mathematical framework of quantum mechanics relevant to computation.
CLO2	To Model and represent quantum systems using linear algebraic formulations.
CLO3	To Construct and analyze quantum circuits using quantum gates and controlled operations.
CLO4	To Interpret and evaluate quantum algorithms that provide computational speed-up over classical approaches.

## 3. COURSE OUTCOMES (COs) & COMPETENCIES

After completing the course, Students would be able to:

Course Outcome	Description	Mapped POs/PSO's	Cognitive Level	WK	Class Hours
CO1	Understand the foundations of quantum computation, including the circuit model, reversible computation, and the Strong Church–Turing Thesis..	PO1, PO2, PSO-2	L2	WK-1,2,3	10
CO2	Apply the principles of quantum mechanics to model qubits, composite systems, time evolution, and measurement.	PO1, PO2, PO3, PO11, PSO-2	L3	WK-1,2,3	10
CO3	Design and analyze quantum circuits using quantum gates, controlled operations, and universal gate sets.	PO2, PO3, PO5, PO11, PSO-2	L3	WK- 3,4	10
CO4	Analyze quantum algorithms such as Quantum Phase Estimation, QFT, and Shor's algorithm to evaluate their computational advantages.	PO1, PO2, PO3, PO5, PO11, PSO-2	L3	WK- 3,4	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: Overview, Computers and the Strong Church–Turing Thesis, The Circuit Model of Computation, A Linear Algebra Formulation of the Circuit Model, Reversible Computation, A Preview of Quantum Physics, Quantum Physics and Computation Chapter 1 (1.1–1.4), Chapter 2.1	CO1	8
II	Qubits And The Framework Of Quantum Mechanics: The State of a Quantum System, Time-Evolution of a Closed System, Composite Systems, Measurement, Mixed States and General Quantum Operations Chapter 2 (2.1–2.6)	CO2	8
III	A Quantum Model Of Computation: The Quantum Circuit Model, Quantum Gates, 1-Qubit Gates, Controlled-U Gates, Universal Sets of Quantum Gates, Chapter 3 (3.1–3.4)	CO3	8
IV	Efficiency of Approximating Unitary Transformations, Implementing Measurements with Quantum Circuits. Superdense Coding And Quantum Teleportation: Superdense Coding, Quantum Teleportation, An Application of Quantum Teleportation	CO3, CO4	8

	Chapter 3.5, Chapter 4 (4.1–4.3)		
V	Algorithms With Superpolynomial Speed-Up: Quantum Phase Estimation and the Quantum Fourier Transform, Finding-Orders, The Order-Finding Problem, Some Mathematical Preliminaries, The Eigenvalue Estimation Approach to Order Finding, Shor’s Approach to Order Finding Chapter 5 (5.1–5.3), Chapter 6 (Shor’s Algorithm sections)	CO4	8

## 5. LIST OF RECOMMENDED REFERENCE TEXTBOOKS

SL. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	<b>TEXT BOOK:</b> An Introduction to Quantum Computing	Phillip Kaye, Raymond Laflamme, Michele Mosca:	Oxford University Press,	2007	M1,M2,M3, M4,M5
2	<b>REFERENCE BOOK:</b> Quantum Computation and Quantum Information	M. A. Nielsen and I. L. Chuang.	Cambridge University Press	2000	
3	Quantum Theory: Concepts and Methods	Peres, Asher	New York, NY: Springer	1993. ISBN: 9780792325499.	

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

- [https://ocw.mit.edu/courses/mas-865j-quantum-information-science-spring-2006/resources/lecture\\_8/?utm\\_source=chatgpt.com](https://ocw.mit.edu/courses/mas-865j-quantum-information-science-spring-2006/resources/lecture_8/?utm_source=chatgpt.com) Tutorials and articles on medium, towards data science, and other blogs
- [https://opencourse.inf.ed.ac.uk/iqc/?utm\\_source=chatgpt.com](https://opencourse.inf.ed.ac.uk/iqc/?utm_source=chatgpt.com)
- [https://www.easytutorguide.com/courses/Quantum-Computing/quantum-computing.html?utm\\_source=chatgpt.com](https://www.easytutorguide.com/courses/Quantum-Computing/quantum-computing.html?utm_source=chatgpt.com)
- [https://qosf.org/learn\\_quantum/?utm\\_source=chatgpt.com](https://qosf.org/learn_quantum/?utm_source=chatgpt.com)

## 7. MOOCs:

- [https://alison.com/course/introduction-to-quantum-computing?utm\\_source=chatgpt.com](https://alison.com/course/introduction-to-quantum-computing?utm_source=chatgpt.com)
- [https://www.futurelearn.com/courses/intro-to-quantum-computing?utm\\_source=chatgpt.com](https://www.futurelearn.com/courses/intro-to-quantum-computing?utm_source=chatgpt.com)
- [https://online-learning.tudelft.nl/courses/fundamentals-of-quantum-information/?utm\\_source=chatgpt.com](https://online-learning.tudelft.nl/courses/fundamentals-of-quantum-information/?utm_source=chatgpt.com)

## 8. EVALUATION METHODOLOGY

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

## CIE Framework:

**Scheme of Examination (CIE):** 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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create- a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

	Component	Marks	Total Marks
CIE	CIE Test-1	50	30
	CIE Test-2	50	
	AAT	20	20
SEE	Semester End Examination	100	50
<b>Grand Total</b>			100

## 9. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 10. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

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

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

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# GLOBAL ACADEMY OF TECHNOLOGY

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



Department: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: VII	Course Code: BAML24704A	Contact Hrs /week: 3
Course Description: DATA MINING & DATA WAREHOUSING		No. of Credits:3 L : T : P : S = 3:0:0:0
Course Category: PEC		Total no. of Hours = 40+50
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites:Data Structures and Algorithms, Mathematics and Linear Algebra.		

## 1. PREAMBLE ABOUT THE COURSE

In the era of information explosion, organizations generate and collect vast amounts of data from various sources. The challenge lies in transforming this raw data into meaningful knowledge that supports effective decision-making. The Data Mining and Data Warehousing (DM & DW) course addresses this need by equipping students with the concepts, tools, and techniques required to store, manage, and analyse large datasets efficiently. The course introduces the **architecture and design of data warehouses**, focusing on data modelling, ETL (Extract-Transform-Load) processes, and OLAP (Online Analytical Processing) operations. It further explores **data mining techniques** such as classification, clustering, association rule mining, and prediction to extract hidden patterns and insights from complex data.

## 2. COURSE LEVEL OBJECTIVES

Sl.No	Course Objectives (CLO)
1	Introduction to general issues of Data Warehouse and Data Mining.
2	Understanding of the different architectures and mining techniques
3	The role and functions of Data Warehouse and Data Mining
4	Explain the stages and process different data mining techniques
5	Learn mining and warehouse techniques through the use of different tools

## 3. COURSE OUTCOMES (COs) & COMPETENCIES

Upon successful completion of this course, student will be able to

Course Outcome	Description	Mapped POs/PSOs	Cognitive Level	WK	Class Hours
CO1	Apply basic, intermediate and advanced	POs- 1,2,3,11	L2	WK	8

	techniques to mine the data.	PSOs- 1,2		1,2	
CO2	Analyze the output generated by the process of data mining.	POs- ,2,3,11 PSOs- 1,2	L2	WK 1,2,3,5	8
CO3	Explore the hidden patterns in the data.	POs- ,2,3,4,11 PSOs- 1,2	L4	WK 1,2,3,5	8
CO4	Adapt to new data mining tools.	POs- ,2,3,4,11 PSOs- 1,2	L3	WK 1,2,3,5,6	8
CO5	Optimize the mining process by choosing best data mining technique.	POs- ,2,3,4,11 PSOs- 1,2	L3	WK 1,2,3,5,6	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	Data Warehousing & modeling: Basic Concepts: Data Warehousing: A multitier Architecture, Data warehouse models: Enterprise warehouse, Data mart and virtual warehouse, Extraction, Transformation and loading, Data Cube: A multidimensional data model, Stars, Snowflakes and Fact constellations: Schemas for multidimensional Data models, Dimensions: The role of concept Hierarchies, Measures: Their Categorization and computation, Typical OLAP Operations. T2: Ch.4.1,4.2	CO1	08
II	Data warehouse implementation & Data mining: Efficient Data Cube computation: An overview, Indexing OLAP Data: Bitmap index and join index, Efficient processing of OLAP Queries, OLAP server Architecture ROLAP versus MOLAP Versus HOLAP.: Introduction: What is data mining, Challenges, Data Mining Tasks, Data: Types of Data, Data Quality, Data Preprocessing, Measures of Similarity and Dissimilarity T2: Ch.4.4 T1: Ch.1.1,1.2,1.4, 2.1 to 2.4	CO2	08
III	Association Analysis: Association Analysis: Problem Definition, Frequent Item set Generation, Rule generation. Alternative Methods for Generating Frequent Item sets, FP-Growth Algorithm, Evaluation of Association Patterns. T1: Ch 6.1,6.2,6.3, 6.5, 6.6 and 6.7	CO3	08
IV	Classification: Decision Trees Induction, Method for Comparing Classifiers, Rule Based Classifiers, Nearest Neighbor Classifiers, Bayesian Classifiers T1: Ch 4.3,4.6,5.1,5.2,5.3	CO4	08
V	Clustering Analysis: Overview, K-Means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation, Density-Based Clustering, Graph Based Clustering, Scalable Clustering Algorithms T1: Ch 8.1 to 8.5, 9.3 to 9.5	CO5	08

## 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Edition	Modules Covered
1	Introduction to Data Mining	Pang-Ning Tan, Michael Steinbach, Vipin Kumar:	First impression,2014	2,3,4,5
2	Data Mining - Concepts and Techniques	Jiawei Han, Micheline Kamber, Jian Pei	3rd Edition, Morgan Kaufmann Publisher, 2012	1,2
3	Data Mining Techniques	Arun K Pujari	3rd Edition, Universities Press.	
4	Data Ware Housing Fundamentals	Pualraj Ponnaiah	Wiley Student Edition	

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

### E-books/Reference:

1. <https://nptel.ac.in/courses/106/106/106106093/>
2. <https://nptel.ac.in/courses/110/107/110107092/>
3. <https://nptel.ac.in/courses/106/105/106105174/>
4. VTU e-Shikshana Program 5. VTU EDUSAT Program

### MOOC Courses:

1. <https://www.udemy.com/course/data-warehouse-fundamentals-for-beginners/>
2. <https://www.udemy.com/course/data-warehouse-the-ultimate-guide/>
3. <https://www.udemy.com/course/data-mining-fundamentals-for-beginners/>
4. [https://onlinecourses.nptel.ac.in/noc21\\_cs06/preview](https://onlinecourses.nptel.ac.in/noc21_cs06/preview)

## 7. EVALUATION METHODOLOGY

### CIE Framework:

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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical evaluation pattern for regular courses is shown in Table 1:

	Component	Marks	Total Marks
CIE	CIE Test-1	50	30
	CIE Test-2	50	
	AAT	20	20
SEE	Semester End Examination	100	50
<b>Grand Total</b>			100

### 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING-recheck the mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
<b>CO1</b>	3	3	2	2				1	1	1	2
<b>CO2</b>	3	3	2	2				1	1	1	2
<b>CO3</b>	3	3	2	2				1	1	1	2
<b>CO4</b>	3	3	2	2				1	1	1	2
<b>CO5</b>	3	3	2	2				1	1	1	2
<b>Average</b>	3	3	2	2				1	1	1	2

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

### 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
<b>CO1</b>	2	1
<b>CO2</b>	2	1
<b>CO3</b>	2	1
<b>CO4</b>	2	1
<b>CO5</b>	2	1
<b>Average</b>	2	1

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

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Department: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: VII	Course Code: BAML24704B	Contact Hrs /week: 3
Course Description: Data Security and Privacy		No. of Credits:3 L : T : P : S = 3:0:0:0
Course Category: PEC		Total no. of Hours = 40+50
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Familiarity with Computer Organization and Operating Systems. Basic understanding of networking concepts.		

## 1. PREAMBLE ABOUT THE COURSE

The course introduces the fundamental concepts of information security, cryptography, and privacy preservation. It covers various cryptographic techniques such as symmetric and asymmetric encryption, hashing, and digital signatures that form the backbone of secure communication. Students will also explore key management, network security protocols, IP and web security mechanisms, and the privacy issues arising in online systems and social media platforms.

## 2. COURSE LEARNING OBJECTIVES

Sl. No	Course Learning Objectives (CLO)
CLO1	Understand the basics of, Security, its principle and Cryptography
CLO2	To study various symmetric and asymmetric cryptographic Algorithm
CLO3	Apply the knowledge of Cryptography to various fields
CLO4	Study the key management system
CLO5	Understand the necessity of data security

## 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 classical and modern symmetric cryptographic techniques to ensure data confidentiality.	POs - 1,2,11 PSOs- 1,2	L2	WK 2,3	10
CO2	Design and evaluate public-key cryptosystems, PRNGs, and secure key exchange protocols.	POs-1,2,3,4,5,9 PSOs- 1,2	L3	WK 4,6	10

CO3	Analyze and implement key management and PKI mechanisms for secure systems.	POs - 1,2,3,4,5,11 PSOs- 1,2	L3	WK 4,6,7	10
CO4	Evaluate network security protocols and data hiding techniques considering ethical and societal aspects.	POs - 1,2,3,5,6,8,10,11 PSOs- 1,2	L3	WK 4,6,7	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	A model for Network Security, Classical encryption techniques: Symmetric cipher model, Substitution ciphers-Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Ciphers, One time pad, Steganography Block Ciphers and Data Encryption Standards: Traditional Block Cipher structures, data Encryption Standard (DES), A DES Example, The strength of DES, Block cipher design principles Text book 1: Chapter 1: 1.8 Chapter 3: 3.1, 3.2, 3.5 Chapter 4: 4.1, 4.2, 4.3, 4.4, 4.5 Case Study: Protecting Confidential Corporate Emails	1,2,3,4	08
II	Pseudorandom number Generators: Linear Congruential Generators, Blum Blum Shub Generator Public key cryptography and RSA: Principles of public key cryptosystems-Public key cryptosystems, Applications for public key cryptosystems, Requirements for public key cryptography, Public key Cryptanalysis, The RSA algorithm: Description of the Algorithm, Computational aspects, The Security of RSA Diffie-Hellman key exchange: The Algorithm, Key exchange Protocols, Man-in-the-middle Attack, Elliptic Curve Cryptography: Analog of Diffie-Hellman key Exchange, Elliptic Curve Encryption/Decryption, Security of Elliptic Curve Cryptography Text book 1: Chapter 8: 8.2 Chapter 9: 9.1, 9.2 Chapter 10: 10.1, 10.4 Case Study: Secure Online Banking Communication	1,2,3,4	08
III	Key management fundamentals, Key lengths and lifetimes, Key generation, Key establishment, Key storage, Key usage, Governing key management. Public-Key Management: Certification of public keys, The certificate lifecycle, Public-key management models, Alternative approaches. Text book 2: Chapter 10, Chapter 11 Case Study: Key Management for a Cloud Service Provider	1,2,3,4	08

IV	Web security consideration, Transport layer security. IP Security: IP Security overview, IP Security Policy, Encapsulating Security Payload, Combining security associations, Internet key exchange. Text book1: Chapter 17: 17.1, 17.2 Chapter 20: 20.1, 20.2, 20.3 20.4, 20.5 Case Study 4: Securing an E-Commerce Platform	1,2,3,4	08
V	Data Security: Data hiding in Text-Basic features, Applications of data hiding, Watermarking, Intuitive Methods, Simple Digital methods, Data hiding in Text, Innocuous Text, Mimic Functions. Data hiding in Images: LSB encoding, BPCS Steganography, Lossless data hiding Textbook 3: Chapter 10: 10.1, 10.2, 10.3, 10.4, 10.5, 10.6, 10.7, 10.8 Chapter 11: 11.1, 11.2, 11.3 Case Study: Covert Communication Using Digital Media	1,2,3,4	08

## 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

SL. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Cryptography and Network Security	William Stallings	Pearson Publication	7 <sup>th</sup> Edition	1,2,4
2	Everyday Cryptography: Fundamental Principles and Applications	Keith M. Martin	Oxford Scholarship	Online: December 2013.	3
3	Data Privacy and Security	Salomon, David	Springer, 2003.	1 <sup>st</sup> Edition	5

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

1. [https://onlinecourses.nptel.ac.in/noc23\\_cs13/preview](https://onlinecourses.nptel.ac.in/noc23_cs13/preview)

### MOOCs:

1. <https://harvardonline.harvard.edu/course/data-privacy-technology>
2. <https://www.coursera.org/learn/data-security-privacy>
3. <https://www.mooc-list.com/tags/data-protection>

## 7. EVALUATION METHODOLOGY

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

## CIE Framework:

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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical evaluation pattern for regular courses is shown in Table 1:

**Table 1: Evaluation Process for CIE and SEE**

	Component	Marks	Total Marks
CIE	CIE Test-1	50	30
	CIE Test-2	50	
	AAT	20	20
SEE	Semester End Examination	100	50
	<b>Grand Total</b>		100

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
CO1	2	1
CO2	2	3
CO3	1	2
CO4	1	2
Avg	2	2

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

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# GLOBAL ACADEMY OF TECHNOLOGY

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



Department: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: 7	Course Code: BAML24704C	Contact Hrs /week: 3
Course Description: REINFORCEMENT LEARNING		No. of Credits:3 L : T : P : S = 3:0:0:0
Course Category: PEC		Total no. of Hours = 40+50
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: foundational understanding of machine learning concepts, probability, and linear algebra, along with proficiency in Python programming for implementing algorithms.		

## 1. PREAMBLE ABOUT THE COURSE

Reinforcement Learning (RL) is a core area of Artificial Intelligence that focuses on training agents to make sequential decisions through interaction with their environment. This course introduces the fundamental principles, algorithms, and applications of RL, bridging concepts from machine learning, optimization, and control to enable autonomous and intelligent behavior in dynamic systems.

## 2. COURSE LEVEL OBJECTIVES

<b>CLO1</b>	Explain the core concepts, components, and applications of reinforcement learning.
<b>CLO2</b>	Apply value-based and policy-based methods to solve decision-making problems.
<b>CLO3</b>	Implement and evaluate algorithms such as Dynamic Programming, Monte Carlo, and Temporal-Difference learning.
<b>CLO4</b>	Design reinforcement learning solutions using policy gradient and actor-critic approaches for complex environments.

## 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 fundamental principles, concepts, and scope of Reinforcement Learning and its application to sequential decision-making problems.	POs - 1,2,3,10 PSOs - 1	L3	WK 2,3	10

CO2	Apply appropriate agent–environment frameworks and evaluate policies and value functions for decision making.	POs - 1,2,3,5,10 PSOs - 1	L3	WK 4,5	10
CO3	Analyze different learning strategies to predict outcomes and improve decision-making performance in episodic and continuing environments.	POs - 1,2,3,4,5,10 PSOs – 1	L3	WK 2,4	10
CO4	Design scalable learning approaches to address complex and real-world decision-making problems.	POs - 1,2,3,4,5,10 PSOs – 1	L3	WK 2,4	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 REINFORCEMENT LEARNING: Introduction: Reinforcement Learning-Examples, Early History of Reinforcement Learning, Elements of Reinforcement Learning. Limitations and Scope, An Extended Example: Tic-Tac-Toe. Case Study: Learning to Play Tic-Tac-Toe Textbook 1: Ch. 1	CO1-4	08
II	MULTI-ARMED BANDITS: A k-armed Bandit Problem, Action-Value Methods, Incremental Implementation, Tracking a Nonstationary Problem, Optimistic Initial Values, Upper- Confidence-Bound Action Selection, Gradient Bandit Algorithm. Case Study: Online Advertisement Selection Textbook 1: Ch. 2	CO1-4	08
III	FINITE MARKOV DECISION PROCESSES: The Agent–Environment Interface, Goals and Rewards -Returns and Episodes, Unified Notation for Episodic and Continuing Tasks, Policies and Value Functions, Optimal Policies and Optimal Value Functions, Optimality and Approximation. DYNAMIC PROGRAMMING-Policy Evaluation (Prediction), Policy Improvement, Policy Iteration, Value Iteration Case Study: Robot Navigation in a Grid World Textbook 1: Ch. 3, Ch.4	CO1-4	08
IV	MONTE CARLO METHODS: Monte Carlo Prediction, Monte Carlo Estimation of Action Values, Monte Carlo Control, Monte Carlo Control without Exploring Starts, Off-policy Prediction via Importance Sampling, Incremental Implementation, Off-policy Monte Carlo Control. TEMPORAL-DIFFERENCE LEARNING:	CO1-4	08

	TD Prediction, Advantages of TD Prediction Methods, Optimality of TD (0), Sarsa: On-policy TD Control, Q-learning: Off-policy TD Control Case Study: Game Outcome Prediction and Strategy Improvement Textbook 1: Ch. 5, Ch.6		
V	APPROXIMATE SOLUTION METHODS: Policy Gradient Methods: Policy Approximation and its Advantages, The Policy Gradient Theorem, REINFORCE: Monte Carlo Policy Gradient, REINFORCE with Baseline -Actor-Critic Methods, Policy Gradient for Continuing Problems, Policy Parameterization for Continuous Actions. Case Study: Autonomous Vehicle Speed Control Textbook 1: Ch. 13	CO1-4	08

## 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

SL. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Reinforcement Learning: An Introduction	Richard S. Sutton and Andrew G. Barto	The MIT Press Cambridge, Massachusetts London, England, 2018	2nd Edition	1,2,3,4,5
2	Reinforcement Learning and Stochastic Optimization	Warren B. Powell	Wiley		Reference
3	Algorithms for Reinforcement Learning	Csaba Szepesvari	Morgan & Claypool, 2010		Reference

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

- <https://youtu.be/AhyznRSDjw8?si=cdb3pm-y-cto8P6T>
- [https://youtu.be/BThQIMlrcd4?si=l\\_WsmrFyNDoM66ZH](https://youtu.be/BThQIMlrcd4?si=l_WsmrFyNDoM66ZH)

### MOOCs:

- <https://nptel.ac.in/courses/106106143>
- <https://www.coursera.org/specializations/reinforcement-learning>

## 7. EVALUATION METHODOLOGY

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

## CIE Framework:

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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical evaluation pattern for regular courses is shown in Table 1:

**Table 1: Evaluation Process for CIE and SEE**

	Component	Marks	Total Marks
CIE	CIE Test-1	50	30
	CIE Test-2	50	
	AAT	20	20
SEE	Semester End Examination	100	50
<b>Grand Total</b>			100

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

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

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
CO1	-	1
CO2	-	2
CO3	-	3
CO4	-	3
AVG	-	2

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

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Department: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: VII	Course Code: BAML24704D	Contact Hrs /week: 3
Course Description: Robotics		No. of Credits:3 L : T : P : S = 3:0:0:0
Course Category: PEC-III		Total no. of Hours = 40+50
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Engineering Mathematics, Sensors and systems		

## 1. PREAMBLE ABOUT THE COURSE

This course provides a comprehensive understanding of the fundamentals of robotic systems, including kinematics, dynamics, control, sensors, actuators, and path planning. It emphasizes both theoretical concepts and practical implementations to equip students with the skills necessary for robot design, programming, and integration. Through hands-on projects and simulations, learners will develop problem-solving abilities and innovative thinking to create efficient and intelligent robotic systems that address real-world challenges and contribute to the growth of automation and smart manufacturing.

## 2. COURSE LEVEL OBJECTIVES

CLO1	To provide insights of history and classification of robotics and its subsystems
CLO2	Identify suitable sensors with its principle and operations for robotic applications
CLO3	To provide knowledge on applying engineering mathematical principles to kinematics and dynamics of robotic systems
CLO4	To Give an insight into the different types of programming methods and automating the robotic process

## 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 generic technology and principles associated with robotics	POs - 1,2,3 PSOs - 1	L1, L2	WK 2,3	08

CO2	Apply the principles and operations of different sensors, vision and electronics used for robotic applications.	POs - 1,2,3 PSOs - 1	L2,L3	WK 4,5	08
CO3	Analyze the sensor working, kinematics, dynamics, trajectory and programming aspects of robotic system.	POs - 1,2,3 PSOs - 1	L3	WK 2,4	08
CO4	Develop the necessary skill base to explore, solve and implement practical robotic systems.	POs - 1,2,3 PSOs - 1	L3	WK 2,4	08
CO5	Collaborate and build robotic applications and communicate through oral or poster presentation	POs - 1,2,3,5,9 ,10,11 PSOs - 1	L3	WK 9	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 robotics: History, laws of robotics, Thumbs rule for robotics, Applications, Robot subsystems- Motion subsystem, Recognition subsystem, Control subsystem, Classification of robots, Industrial applications. Text 1: Chapter 1 and 2	CO1-4	08
II	Robot sensors: Characteristics of sensor, Classification of sensors, Internal sensors, potentiometers, LVDT, Synchros and resolver, Velocity sensors, force sensors, External sensors, Torque sensors, Visible light and infrared sensors. Robot vision: introduction to techniques, image acquisition and processing Numerical examples. Text 1: Chapter 4, Text 3: Chapter 10	CO1-4	08
III	Robotic Vision and electronics: Elements in vision system, Lighting techniques, Steps in vision systems, Image processing, Hierarchy in vision system, Signal conditioning, ADC-DAC, filters, Numerical examples. Text 1: Chapter 4	CO1-4	08
IV	Robot kinematics: Rotation matrix, homogenous transformation matrix, Denavit-Hartenberg convention, Euler angles RPY representation, Direct and inverse kinematics for industrial robots for position and orientation. Introduction to dynamics and trajectories in robots, Numerical examples Text 2: Chapter 2	CO1-4	08

V	Robotprogramming, Modular components and Robotic Process Automation (RPA): Methods, requirements of robot in industry, specifications of robot, modular robot components, Wrist mechanism, Numerical examples, RPA: Components of RPA, UiPath, Record and play, Downloading and installing Uipath studio, step by step examples.  Text 4: Chapter 3	CO1-4	08
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## 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

SL.No	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Introduction to Robotics,	S.K Saha	Tata McGraw-Hill Education, ISBN 13: 9789332902800. 2nd Edition, 2014	2 <sup>nd</sup> Edition	1,2,3
2	Robotics control sensing Vision and Intelligence	K.S.Fu, R.C.Gonzalez, C.S.G. Lee	Mcgraw-Hill College, ISBN 13: 9780070226258. 2013	1 <sup>st</sup> Edition	2,4
3	Introduction to Robotics- Analysis, control and applications	Saeed B NIKU	John Wiley, ISBN 9781119527596.	3 <sup>rd</sup> Edition	2
4	Robotics	Appukuttan K	dreamtech publishers, ISBN:978-93-89583-28-1.	2 <sup>nd</sup> Edition	5

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

1. [https://onlinecourses.nptel.ac.in/noc21\\_me76/preview](https://onlinecourses.nptel.ac.in/noc21_me76/preview)

## 7. EVALUATION METHODOLOGY

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

### CIE Framework:

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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic

tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

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**Table 1: Evaluation Process for CIE and SEE**

	Component	Marks	Total Marks
CIE	CIE Test-1	50	30
	CIE Test-2	50	
	AAT	20	20
SEE	Semester End Examination	100	50
<b>Grand Total</b>			<b>100</b>

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11
<b>CO1</b>	2	2	2								
<b>CO2</b>	2	2	2								
<b>CO3</b>	3	2	3								
<b>CO4</b>	3	2	3								
<b>CO5</b>	3	3	3		3				3	3	3
<b>Average</b>	3	2	3		3				3	3	2

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

PSOs →	PSO1	PSO2
COs ↓		
<b>CO1</b>	2	
<b>CO2</b>	2	
<b>CO3</b>	2	
<b>CO4</b>	3	
<b>CO5</b>	2	
<b>AVG</b>	2	

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



Department: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: VII	Course Code: BAML24705A	Contact Hrs /week: 3
Course Description: Python Libraries for AI&ML		No. of Credits:3 L : T : P : S = 3:0:0:0
Course Category: OEC		Total no. of Hours = 40+50
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: <b>03</b>
Course Pre-requisites: Basic knowledge of Python programming, statistics, linear algebra, and fundamental machine learning concepts.		

## 1. PREAMBLE ABOUT THE COURSE

This course introduces the fundamental concepts and practical applications of Python libraries used in Artificial Intelligence (AI) and Machine Learning (ML). It focuses on developing skills to efficiently handle data, perform analysis, build models, and visualize results using libraries such as NumPy, Pandas, Matplotlib, Seaborn, and Scikit-learn. Students will learn data preprocessing, feature engineering, model development, and evaluation techniques through hands-on exercises. The course also provides an overview of deep learning frameworks like Keras and TensorFlow, enabling learners to design basic neural network models. By integrating theoretical understanding with practical implementation, this course lays a strong foundation for applying Python in real-world AI and ML problem-solving.

## 2. COURSE LEVEL OBJECTIVES

CLO1	Understand and use core Python libraries (NumPy, Pandas, Matplotlib/Seaborn).
CLO2	Preprocess and explore real datasets and implement classical ML algorithms with scikit-learn.
CLO3	Build and evaluate simple neural networks using TensorFlow/Keras and complete a mini project.

## 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 Python programming and essential libraries used in Artificial Intelligence and Machine Learning.	POs - 1,2 PSOs – 1,2	L1, L2	WK 2,3	10

CO2	Demonstrate data manipulation, analysis, and visualization using NumPy, Pandas, Matplotlib, and Seaborn to extract meaningful insights.	POs - 1,2 PSOs – 1,2	L1, L2	WK 4,5	10
CO3	Apply classical machine learning techniques using Scikit-learn and evaluate model performance using appropriate metrics.	POs - 1,2 PSOs – 1,2	L2, L3	WK 2,4	10
CO4	Develop and deploy simple AI/ML-based applications by integrating multiple Python libraries	POs - 1,2,6,8,11 PSOs – 1,2	L3	WK 2,4	10

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

#### 4. SYLLABUS

Module No.	Module Description	CO's Mapped	No. of Hours
I	<p>Introduction to Python Libraries for AI &amp; ML: Overview of NumPy, Pandas, and Matplotlib.</p> <p>NumPy: Arrays, array creation, indexing, slicing, broadcasting, mathematical operations, and linear algebra operations.</p> <p>Pandas: Series and Data Frames, data import/export (CSV, Excel, JSON), data cleaning, handling missing values, grouping, merging, and basic data manipulation.</p> <p>Matplotlib &amp; Seaborn: Basic plots – line, bar, histogram, boxplot, and scatter plots. Visualizing distributions and relationships between variables using Seaborn.</p> <p>Exploratory Data Analysis (EDA): Basic descriptive statistics, data summarization, and correlation analysis.</p> <p>Case Study: Analysis and visualization of student performance data using NumPy, Pandas, Matplotlib, and Seaborn.</p> <p>Text 1: Chapter 1,2 Chapter 10,11</p>	CO1	08
II	<p>Data Pre-processing and Feature Engineering</p> <p>Handling missing data, duplicates, and outliers. Encoding categorical variables, feature scaling and normalization, feature extraction and selection. Splitting datasets into training/testing sets, basic cross-validation concepts. Creating data pipelines with scikit-learn.</p> <p>Practical exercises with datasets from Kaggle or UCI repository</p> <p>Text 2: chapter 3,4</p>	CO2	08

III	<p>Classical Machine Learning using scikit-learn Supervised learning: Linear Regression, Logistic Regression, Decision Trees, k-Nearest Neighbors (kNN). Unsupervised learning: K-Means clustering, Hierarchical clustering, Principal Component Analysis (PCA). Model evaluation metrics: accuracy, precision, recall, F1-score, ROC/AUC. Model validation: cross-validation, confusion matrix, train/test split. Case Study: Loan approval prediction using supervised and unsupervised machine learning models with performance evaluation. Text 2: chapter 1,2,3,8</p>	CO3	08
IV	<p>Introduction to Deep Learning with Kera's / TensorFlow Basics of neural networks: perceptron, activation functions, loss functions, optimizers. Building and training simple feed-forward neural networks using Kera's. Regularization: dropout, early stopping, batch normalization. Model saving/loading, evaluation of neural network performance. Overview: Convolutional Neural Networks (CNNs). Text 2: Chapter 10,11,14</p>	CO4	08
V	<p>Introduction to Natural Language Processing (NLP): tokenization, Bag-of-Words, TF-IDF using scikit-learn. Basic sentiment classification using Naïve Bayes / Logistic Regression. Model persistence using joblib and model deployment overview (Flask / Streamlit). Mini Project: Apply learned libraries to a real-world dataset data preprocessing, model training, evaluation, and report. Discussion on ethical use of AI &amp; ML and emerging trends in Python libraries. Case Study: Sentiment analysis of customer reviews with NLP techniques and deployment using Flask or Streamlit Text 2: Chapter 10</p>	CO4	08

## 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

Sl. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython	Wes McKinney	O'Reilly Media, 2017, ISBN: 978-1-4919-5766-0.	2nd Edition	1
2	Introduction to Machine Learning with Python: A Guide for Data Scientists	Andreas C. Müller and Sarah Guido	O'Reilly Media, 2016, ISBN: 978-1-4493-9924-6	1st Edition	2,3,4,5

## 6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE]

1. Python for Data Analysis (PDF) – Wes McKinney
2. Python Data Science Handbook – Jake VanderPlas (Free eBook)
3. Scikit-learn Documentation
4. NumPy Official Documentation
5. Pandas Official Documentation
6. Matplotlib & Seaborn Tutorials – GeeksforGeeks / W3Schools
7. Kaggle Learn: Python and Machine Learning

## 7. EVALUATION METHODOLOGY

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

### CIE Framework:

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.

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**Table 1: Evaluation Process for CIE and SEE**

	<b>Component</b>	<b>Marks</b>	<b>Total Marks</b>
CIE	CIE Test-1	50	30
	CIE Test-2	50	
	AAT	20	20
SEE	Semester End Examination	100	50
	<b>Grand Total</b>		100

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11
<b>CO1</b>	3							1			
<b>CO2</b>	3	1						1			
<b>CO3</b>	2	1						1			
<b>CO4</b>	2	2				1		1			2
<b>Average</b>	3	2	3			1		1			2

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

<b>PSOs →</b>	<b>PSO1</b>	<b>PSO2</b>
<b>COs ↓</b>		
<b>CO1</b>		2
<b>CO2</b>		2
<b>CO3</b>		2
<b>CO4</b>		2
<b>AVG</b>		2

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

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# GLOBAL ACADEMY OF TECHNOLOGY

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



Department: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: VII	Course Code: BAML24705B	Contact Hrs /week: 3
Course Description: Web Designing Tools & Frameworks		No. of Credits:3 L : T : P : S = 3:0:0:0
Course Category: OEC		Total no. of Hours = 40+50
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Basic knowledge of computers, programming logic, familiarity with HTML and CSS is desirable.		

## 1. PREAMBLE ABOUT THE COURSE

This course introduces modern web design and development using HTML5, CSS3, JavaScript, and contemporary frameworks. It focuses on responsive design, UI aesthetics, and W3C standards, enabling students to build interactive, accessible, and visually appealing web applications with tools like Bootstrap, React.js, and design platforms, along with deployment and integration concepts.

## 2. COURSE LEVEL OBJECTIVES

CLO1	Understand the fundamental principles and concepts of web design, including layout, colour theory, typography, and user interface (UI) design principle.
CLO2	Apply HTML, CSS, and responsive design techniques to create structured, accessible, and visually appealing web pages.
CLO3	Develop interactive and dynamic web applications using client-side scripting and front-end frameworks.
CLO4	Explore and utilize modern web design tools, frameworks, and libraries to enhance development efficiency and maintain design consistency.
CLO5	Demonstrate the ability to plan, design, and deploy a complete website or web application adhering to web standards and usability principles.

## 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 fundamental principles, structure, and aesthetics of effective web design.	POs - 1,2 PSOs - 1	L1, L2	WK 2,3	10
CO2	Apply HTML5, CSS3, and responsive design techniques to create structured and accessible web pages.	POs - 1,2,4 PSOs - 1	L1, L2	WK 4,5	10
CO3	Implement interactive and dynamic web applications using JavaScript and modern front-end frameworks.	POs - 1,2,3,4 PSOs – 1,2	L2, L3	WK 2,4	10
CO4	Design, develop, and deploy complete web applications using modern tools and frameworks while adhering to web standards.	POs - 1,2,3,5,9,11 PSOs – 1,2	L3, L4	WK 9	10

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

#### 4. SYLLABUS

Module No.	Module Description	CO's mapped	No. of Hours
I	Web Design Principles & Fundamentals: Basic principles of website design – Planning process – Design aesthetics and colour theory – Layouts and navigation structures – Five golden rules of web design – Responsive design concept – Web standards and accessibility guidelines (W3C). Case Study: Analysis of well-designed websites (e.g., Google, Apple, Government portals) focusing on layout, colour theory, typography, accessibility, and UI principles. Text 1: Chapter 1, 2, 11	CO1	08
II	HTML5 and CSS3 for Web Design: HTML5 elements, tags, forms, multimedia, and semantic structure – CSS3 selectors, properties, and layouts – Flexbox and Grid – Styling text, images, tables, and navigation – Responsive and adaptive web design – Introduction to web fonts and animations. Case Study: Design and development of a responsive college department website using HTML5, CSS3, media queries, and semantic elements. Text 1: Chapter 4, 5, 6	CO2	08

III	Client-Side Scripting with JavaScript: JavaScript syntax, variables, functions, and control structures – DOM manipulation and events – Form validation – Introduction to ES6 features – JSON and AJAX basics – Integrating APIs into web pages. Text 1: Chapter 7, 8, 10	CO3	08
IV	Web Design Frameworks & Tools: Introduction to frameworks – Bootstrap, Tailwind CSS, and Materialize – Responsive layouts and components – Introduction to front-end JS frameworks: React.js / Vue.js basics – Using design tools (Figma, Canva, Adobe XD) for prototyping and UI design. Text 2: Chapter 11	CO4	08
V	Web Application Development & Deployment Introduction to Node.js and Express basics – Connecting front-end and back-end – Managing state using local storage and APIs – Hosting static and dynamic sites – Version control using Git & GitHub – Deployment using Netlify / Vercel – Mini project development and presentation. Text 3: Chapter 15	CO5	08

## 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

Sl. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Web Design with HTML, CSS, JavaScript and jQuery Set	Jon Duckett	John Wiley & Sons, 2014, ISBN: 978-1-118-90377-2.	1st Edition	1, 2, 3
2	Learning Web Design: a Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics	Jennifer Niederst Robbins	O'Reilly Media, 2018, ISBN: 978-1-4919-5589-7	5th Edition	1, 2, 4
3	Web Development with Bootstrap and React	David Cochran, Ian Whitley	Apress, 2021, ISBN: 978-1-4842-7032-1	2nd Edition	4, 5

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

1. **Web Technology** – URL: [https://onlinecourses.swayam2.ac.in/nou24\\_cs09/preview](https://onlinecourses.swayam2.ac.in/nou24_cs09/preview)
2. <https://developer.mozilla.org/en-US/docs/Learn> — MDN Web Docs: Learn Web Development
3. <https://www.w3schools.com> — W3Schools: Tutorials for HTML, CSS, JavaScript, and Web Frameworks
4. <https://www.freecodecamp.org/learn/> — FreeCodeCamp: Responsive Web Design and Front-End Development

## 7. EVALUATION METHODOLOGY

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

### CIE Framework:

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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical evaluation pattern for regular courses is shown in Table 1:

**Table 1: Evaluation Process for CIE and SEE**

	Component	Marks	Total Marks
CIE	CIE Test-1	50	30
	CIE Test-2	50	
	AAT	20	20
SEE	Semester End Examination	100	50
<b>Grand Total</b>			100

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11
<b>CO1</b>	3	2									
<b>CO2</b>	2	2		2							
<b>CO3</b>	3	2	2	2							
<b>CO4</b>	3	3	3	2	3				2		2
<b>Average</b>	3	2	3	2	3				2	3	2

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

<b>PSOs</b> →	<b>PSO1</b>	<b>PSO2</b>
<b>COs ↓</b>		
<b>CO1</b>	2	
<b>CO2</b>	2	
<b>CO3</b>	3	2
<b>CO4</b>	3	3
<b>AVG</b>	3	3

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

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Department: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: VII	Course Code: BAML24705C	Contact Hrs /week: 3
Course Description: Introduction to Sensors and IoT		No. of Credits:3 L : T : P : S = 3:0:0:0
Course Category: OEC		Total no. of Hours = 40+50
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Pre-requisites: Basic knowledge of electronics, microcontrollers, programming (C/Python), and signal processing concepts.		

## 1. PREAMBLE ABOUT THE COURSE

This course introduces the fundamentals of sensors, their characteristics, calibration, and interfacing techniques, along with system-level applications. It also provides an overview of the Internet of Things (IoT), highlighting the integration of sensors, devices, and networks to enable smart monitoring, automation, and intelligent decision-making.

## 2. COURSE LEVEL OBJECTIVES

CLO1	To understand the fundamental principles, types, and operating characteristics of sensors used in engineering and mechatronic systems.
CLO2	To explore MEMS and multi-sensor systems including wireless sensor technologies and sensor fusion applications.
CLO3	To analyse the characteristics and measurement principles of temperature, humidity, strain, optical, and infrared sensors.
CLO4	To develop proficiency to integrate the sensor data to cloud platform using dedicated controllers.

## 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 sensors, their characteristics, and IoT paradigms along with associated challenges.	POs - 1,2 PSOs - 1	L1, L2	WK 2,3	10

CO2	Analyse and select appropriate sensors for various IoT-based applications.	POs - 1,2 PSOs - 1	L2	WK 4,5	10
CO3	Develop and interface different types of sensors with embedded controllers and cloud platforms for IoT applications.	POs - 1,2,3,5 PSOs - 1	L2, L3	WK 2,4	10
CO4	Design, integrate, and demonstrate a complete sensor-based system for AI/IoT applications using modern tools and present results effectively.	POs 1, 2, 3, 5, 9, 10, 11 PSOs - 1	L3	WK 2,4	10

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

#### 4. SYLLABUS

Module No.	Module Description	CO's Mapped	No. of Hours
I	Sensor system in Engineering: Role of sensor and systems, MEMS and multi-sensor system: Introduction to MEMS, Wireless sensor system, sensor fusion and applications. Strain gauge: Theory, Types, applications and problems. Thermistor, RTD: Theory, applications and problems. Thermocouple: Measurement of thermocouple output, compensating circuits, lead compensation, advantages and disadvantages of thermocouple. Case Study: AI-based structural health monitoring using MEMS and strain gauge sensors for predicting stress, deformation, and early failure in civil structures. Text 1: Chapter 1.1, 1.2, chapter 11	CO1	08
II	Humidity Sensors and Moisture Sensors: Concept of humidity, Electrical Conductivity Sensors, Thermal Conductivity Sensors, Optical Hygrometer, Oscillating Hygrometer. IR Sensors: Golay cells, Thermopile, pyroelectric sensor, bolometers, Active Far-Infrared Sensors, Gas flame detectors Text 2: chapter 5	CO2	08
III	Miscellaneous sensors: optical sensors and lasers, Fiber optic sensor, light sensor, Thermo-fluid sensor, sensor for water quality measurement- a case study. Photo sensors: Photo resistor, Photodiode, Phototransistor, Photocell, Photo-FET, Charge coupled device. Text 2: chapter 8, Text 1 : Chapter 10	CO3	08

IV	<p>Predecessors of IoT: Introduction, Wireless Sensor Networks, Architectural components of WSN, Machine-to-Machine Communications, Architectural components of M2M, Cyber Physical Systems, Architectural components of CPS.</p> <p>Emergence of IoT: Evolution of IoT, Enabling IoT and complex interdependence Technologies, IoT Networking Components, Addressing strategies.</p> <p>Case Study: AI-driven smart agriculture system using wireless sensor networks for intelligent irrigation and crop yield optimization.</p> <p>Text 4: Chapter 3 and 4: 3.1 to 3.4 and 4.2 to 4.5</p>	CO3, CO4	08
V	<p>Paradigms, Challenges, and the Future in IoT:</p> <p>Introduction, Evolution of New IoT Paradigms, Internet of battlefield things (IoBT), Internet of vehicles (IoV), Internet of underwater things (IoUT), Internet of drones (IoD), Internet of space (IoSpace), Challenges Associated with IoT, Mobility, Addressing, Power, Heterogeneous connectivity, Communication range, Security, Device size, Interoperability, Emerging Pillars of IoT, Cloud/fog/edge computing, 5G and beyond, Artificial intelligence (AI)/Machine learning (ML), Cognitive communication networks</p> <p>Case Study: AI-based intelligent traffic management system (IoV) using IoT-enabled vehicles and roadside sensors for congestion prediction and signal optimization.</p> <p>Text 4: Chapter 15: 15.1 to 15.4</p>	CO4	08

## 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

S. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Sensors and systems fundamentals and applications	Clarence D silva	Taylor and francis CRC press, 2017, ISBN: 9781498716246.	2 <sup>nd</sup> Edition	1
2	Sensors and Actuators: Control systems Instrumentation	Clarence W.de Silva,	CRC Press, 2013 Edition, ISBN: 978-1-4200-4483-6.	4th Revised Edition	2,3
3	Introduction to IoT	Sudip Misra, Anandarup Mukherjee and Arijit Roy	Cambridge University Press, 2020, ISBN 978-1-108-84295-2, ISBN 978-1-108-95974-2. 2	1 <sup>st</sup> Edition	4,5

4	The Definitive Guide to the ARM Cortex-M3&M4 Processors	Joseph Yiu	Newness (Elsevier), 2014, ISBN:978-93-5107-175-4	3 <sup>rd</sup> Edition	REFERENCE
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## 6. LIST OF ONLINE RESOURCES [NPTEL/SWAYAM/MOOCs/WEB RESOURCE]

1. <https://archive.nptel.ac.in/courses/106/105/106105193/>
2. [https://onlinecourses.nptel.ac.in/noc22\\_cs53/preview](https://onlinecourses.nptel.ac.in/noc22_cs53/preview)

## 7. EVALUATION METHODOLOGY

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

### CIE Framework:

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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic toolbox for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical evaluation pattern for regular courses is shown in Table 1:

**Table 1: Evaluation Process for CIE and SEE**

	Component	Marks	Total Marks
CIE	CIE Test-1	50	30
	CIE Test-2	50	
	AAT	20	20
SEE	Semester End Examination	100	50
	<b>Grand Total</b>		100

## 8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11
<b>CO1</b>	3	2	-	-	-	-	-	-	-	-	-
<b>CO2</b>	2	2	-	-	-	-	-	-	-	-	-
<b>CO3</b>	3	2	2	-	2	-	-	-	-	-	-
<b>CO4</b>	3	2	3	-	2	-	-	-	2	2	2
<b>Average</b>	3	2	3	-	2	-	-	-	2	2	2

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

## 9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING

<b>PSOs</b>		
→	<b>PSO1</b>	<b>PSO2</b>
<b>COs ↓</b>		
<b>CO1</b>	2	
<b>CO2</b>	2	
<b>CO3</b>	2	
<b>CO4</b>	3	2
<b>AVG</b>	2	2

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

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Department: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: VII	Course Code: BAML24705D	Contact Hrs /week: 3
Course Description: Information Security		No. of Credits:3 L : T : P : S = 3:0:0:0
Course Category: OEC		Total no. of Hours = 40+50
CIE: 50 Marks	SEE: 50 Marks	Exam Hours: 03
Course Pre-requisites: Basic understanding of computer systems, networks, operating systems, and programming concepts.		

## 1. PREAMBLE ABOUT THE COURSE

This course on Information Security is designed to equip learners with the foundational principles, technical skills, and strategic mindset required to safeguard digital assets against evolving threats. Through a comprehensive exploration of security concepts, technologies, and practices, students will gain insight into the mechanisms that ensure confidentiality, integrity, and availability of information.

## 2. COURSE LEVEL OBJECTIVES

CLO1	Understand the foundational principles of information security, including threats, vulnerabilities, and risk models.
CLO2	Apply identification, authentication, and access control mechanisms to secure systems and data.
CLO3	Analyze auditing, accountability, and cryptographic techniques for protecting information in various states.
CLO4	Utilize compliance frameworks, laws, and regulations relevant to information security governance.
CLO5	Implement operational, network, OS, and application-level security controls to defend against cyber threats.

## 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 fundamental concepts of information security, attack models, and compliance frameworks.	POs – 1,2,3,5,6,8,10,11 PSOs – 1,2	L2	WK 1	10
CO2	Demonstrate authentication, authorization, and access control mechanisms.	POs – 1,2,3,4,5,6,8,9,10,11 PSOs – 1,2	L3	WK 2	10
CO3	Analyze cryptographic techniques and auditing/accountability mechanisms.	POs – 1,2,3,4,6,8,10,11 PSOs – 1,2	L3	WK 3	10
CO4	Design and implement security solutions for networks, operating systems, and applications.	POs – 1,2,3,4,5,6,8,9,10,11 PSOs – 1,2	L3	WK 3	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: What is information security? Defining information security, when are you secure? Models for discussing security issues, Attacks. Textbook: Chapter 1	CO1	08
II	Identification and Authentication: Identification, Authentication, Common Identification and Authentication Methods. Authorization and Access Controls: What Are Access Controls? Implementing Access Controls, Access Control Models. Textbook: Chapter 2 and 3	CO2	08
III	Auditing And Accountability: Accountability, Security Benefits of Accountability, Auditing. Cryptography: The History of Cryptography, Modern Cryptographic Tools, Protecting Data at Rest, in Motion, and in Use Textbook: Chapter 4 and 5	CO3	08
IV	Compliance, Laws, And Regulations: What Is Compliance? Achieving Compliance with Controls, Maintaining Compliance, Laws and Information Security, Adopting Frameworks for Compliance, Compliance amid Technological Changes Textbook: Chapter 6	CO1	08

V	Operations Security: The Operations Security Process, Laws of Operations Security, Network Security: Protecting Networks, Protecting Network Traffic, Network Security tools, Operating System Security: Operating System Hardening, Protecting Against Malware, Application Security: Software Development Vulnerabilities, Web Security, Database Security. Textbook: Chapter 7,10,11,13	CO4	08
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## 5. LIST OF RECOMMENDED AND REFERENCE TEXTBOOKS

Sl. No.	Name of the Book	Author(s)	Publisher	Edition	Modules Covered
1	Foundations Of Information Security	Jason Andress	No Starch Press, Inc.	1st Edition	1-5
2	Principles of Information Security	M. Whitman and H. Mattord	Cengage	7 <sup>th</sup> Edition	Reference
3	Information Security— The complete reference	Mark Rhodes	McGraw-Hill	2nd	Reference

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

1. [Information Security - NPTEL Course](#)
2. [Introduction to Cyber Security | Coursera](#)
3. [Google Cybersecurity Professional Certificate | Coursera](#)

## 7. EVALUATION METHODOLOGY

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

### CIE Framework:

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/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Typical evaluation pattern for regular courses is shown in Table 1:

**Table 1: Evaluation Process for CIE and SEE**

	Component	Marks	Total Marks
CIE	CIE Test-1	50	30
	CIE Test-2	50	
	AAT	20	20
SEE	Semester End Examination	100	50
<b>Grand Total</b>			<b>100</b>

**8. COURSE OUTCOMES & PROGRAM OUTCOMES MAPPING**

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

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

**9. COURSE OUTCOMES & PROGRAM SPECIFIC OUTCOMES MAPPING**

PSOs →	PSO1	PSO2
COs ↓		
<b>CO1</b>	2	1
<b>CO2</b>	2	2
<b>CO3</b>	2	2
<b>CO4</b>	3	3
<b>AVG</b>	2	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: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING		
Semester: VII	Course Code: BAML P24706	Contact Hrs. /week: 2
Course Description: Major Project Phase-II		No. of Credits:1 L : T : P : S = 0:0:14:0
Course Category: PROJ		Total no. of Hours = 42
CIE: 100 Marks	SEE: Nil	Exam Hours: 03
Course Pre-requisites: Programming and Presentation Skills		

## Project work phase - II:

Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary project can be assigned to an individual student or to a group having not more than 4 students.

## CIE procedure for Project Work Phase - II:

**a. Single discipline:** The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the project work phase -I, shall be based on the evaluation of the project work phase -II Report (covering Literature Survey, Problem identification, Objectives and Methodology) using Rubrics, project presentation skill and question and answer session. The marks awarded for the Project report shall be the same for all the batch mates.

**b. Interdisciplinary:** Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work phase -II, shall be based on the evaluation of project work phase -II Report (covering Literature Survey, Problem identification, Objectives and Methodology), project presentation skill and question and answer session. The marks awarded for the project report shall be the same for all the batch mates as per Rubrics covering all Program Outcomes.

## SEE for Project Work Phase - II:

**Single discipline:** Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted at the department.

**Interdisciplinary:** Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belong.

## EVALUATION METHODOLOGY

a) Continuous Internal Evaluation (CIE) = 100 marks

b) Semester End Examination (SEE) = 100 marks

Total = 100 marks

**Table 1: Evaluation Process for CIE and SEE**

	<b>Component</b>	<b>Marks</b>	<b>Total Marks</b>
CIE	Review-1	50	100
	Review -2	50	
SEE	Semester End Examination	100	100
	<b>Grand Total</b>		<b>200</b>