

# B.N.M. Institute of Technology

An Autonomous Institution under VTU, Approved by AICTE

## Department of Mathematics

### Syllabus

Semester: III			
<b>Course: Fourier Transform, Fundamentals of logic and Linear Algebra</b>			
<b>Course Code: 22MAI131 (Common to CSE, ISE, AIML)</b>			
<b>L:T:P:J</b>	<b>2:2:0:0</b>	<b>CIA</b>	<b>: 50</b>
<b>Credits:</b>	<b>03</b>	<b>SEA</b>	<b>: 50</b>
<b>Hours:</b>	<b>40</b>	<b>SEA Duration</b>	<b>: 03 Hours</b>
<b>Course Learning Objectives:</b> The students will be able to <ul style="list-style-type: none"> <li>1 Have an insight into Fourier series, Fourier transforms.</li> <li>2 Develop knowledge of Fundamentals of logic and Relations, Vector Spaces &amp; Linear Transformation arising in engineering</li> </ul>			
<b>Module-1: Fourier Series &amp; Fourier Transforms</b>			<b>No. of hours</b>
<i>Examples from Engineering that require Fourier series and Fourier Transforms.</i> <b>Fourier series:</b> Periodic functions, Introduction to Fourier Series, Dirichlet's condition. Problems on Fourier series over $(-l, l)$ . <b>Fourier Transforms:</b> Introduction to infinite Fourier transform, Fourier sine and cosine transform and properties, problems on infinite Fourier transform, Discrete & Fast Fourier transform. <i>Experiential Learning component: Finding the Fourier series and Fourier Transform of a function</i>			<b>L : 04 T : 04</b>
<b>Module-2: Fundamentals of logic and Relations</b>			
<i>Examples from Engineering that require Fundamentals of logic and Relations.</i> <b>Fundamentals of logic:</b> Basic connectives and truth tables, logic equivalence - the laws of logic, logical implication- rules of inference <b>Relations:</b> First order linear recurrence relation, second order linear homogenous recurrence relation with constant coefficients. <i>Experiential Learning component: Finding the solution of recurrence relation</i>			<b>L : 04 T : 04</b>
<b>Module-3: Vector Spaces</b>			
<i>Examples from Engineering that require vector spaces</i> Recap of system of linear homogenous and non-homogeneous equation and solution sets. Vector spaces, subspaces, linearly independent and dependent, Linear span of a set, Basis and dimension, coordinate vectors. <i>Experiential Learning component: Problems on linearly independent and dependent vectors, basis and dimension of a vector space.</i>			<b>L : 04 T : 04</b>
<b>Module-4:Linear Transformation</b>			
<i>Examples from Engineering that require linear transformation.</i> Linear transformations, algebra of linear transformations, representation of transformations by matrices, Non-singular linear transformation, Inverse of a linear transformation, Range space, Null space and problems on Rank-nullity theorem. <i>Experiential Learning component: Problems on Inverse of a linear transformation and Rank-nullity theorem</i>			<b>L : 04 T : 04</b>
<b>Module-5: Inner Product Spaces</b>			
<i>Examples from Engineering that require Inner product spaces.</i> Inner products Inner product spaces, Orthogonal set, orthogonal projections, orthonormal bases, Gram-Schmidt process, QR-factorization, Recap of Eigen values and Eigen vectors, problems on Singular value decomposition. <i>Experiential Learning component: Problems on QR-factorization and singular value decomposition</i>			<b>L : 04 T : 04</b>

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

- CO 1: Apply Fourier series & transform concepts in data visualization and cryptography.
- CO 2: Communicate the basic concepts of logic and their relevance for computer science engineering.
- CO 3: Apply the knowledge of vector spaces for solving problems in arising in engineering field
- CO 4: Apply the knowledge of linear transform for solving problems in arising in image processing
- CO 5: Compute orthogonal and orthonormal bases vectors and decomposition of a symmetric matrix using standard technique.

#### Reference Books:

1. E. Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons, 10<sup>th</sup> Edition(Reprint), 2016.
2. B. S. Grewal: "Higher Engineering Mathematics", Khanna Publishers, 44<sup>th</sup> Ed., 2017.
3. H. K. Dass, " Advanced Engineering Mathematics" S. Chand publication.
4. C. Ray Wylie, Louis C. Barrett : "Advanced Engineering Mathematics", 6" Edition, 2. McGraw-Hill Book Co., New York, 1995.
5. James Stewart : "Calculus —Early Transcendentals", Cengage Learning India Private Ltd., 2017.
6. B. V. Ramana: "Higher Engineering Mathematics" 11<sup>th</sup> Edition, Tata McGraw-Hill, 2010.
7. Srimanta Pal & Subodh C Bhunia: "Engineering Mathematics", Oxford University Press, 3"Reprint, 2016.
8. David C. Lay, Steven R. Lay and J. J. McDonald "Linear Algebra and its applications", 3<sup>rd</sup> Edition, Pearson Education Ltd., 2017.
9. Ralph P. Grimaldi, " Discrete and Combinatorial Mathematics, 5<sup>th</sup> Edition, Pearson Education 2004.

#### Web links and Video Lectures:

1. <https://nptel.ac.in/courses/111106111>
2. <https://youtu.be/OynpZwylau8>
3. <https://archive.nptel.ac.in/courses/111/106/111106051/>
4. <https://www.youtube.com/watch?v=zvRdbPMEMUI>
5. <https://www.youtube.com/watch?v=cHNmT1-qurk>
6. [https://www.youtube.com/watch?v=ATqV\\_I8DCh0](https://www.youtube.com/watch?v=ATqV_I8DCh0)

#### ASSESSMENT STRUCTURE:

PCC	CIA	SEA	CIA (50)			<b>SEA Conduction: 100 M Reduced to: 50 M</b>	
				I	II		
Conduction	50	50	Written Test	50	50	Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module	
				Average of two tests – 25 Marks			
			Assignment	15			
			AAT	10			
			<b>Total – 50 marks</b>			<b>Total – 50 marks</b>	

##### i) CIA: 50%

IA Test: 2 IA tests - Each of 50 Marks	Average of 2 tests – scaled down to 25 M
Assignment – Two assignments – one for 10 marks and another for 5 marks	15 Marks
Additional Assessment Tools (AAT) – Oral /Online Quizzes, Presentations, Group discussions, Case studies, Term Paper, Open ended experiments, Mini industrial/social/rural Projects, Two-minute video on latest topic, Short MOOC courses, Practical Orientation on Design thinking, creativity & Innovation, Participatory & Industry integrated learning, Practical activities, Problem solving exercises, Participation in seminars/academic events/symposia and any other activity	10 Marks
	<b>Total</b> <b>50 Marks</b>

##### ii) SEA : 50%

Theory Exam	5 questions to answer each of 20 Marks 2 questions from each module with internal choice Student should answer one full question from each module	20 M x 5 = <b>100 M</b> <b>reduced to 50 M</b>
		<b>Total</b> <b>50 Marks</b>

# B.N.M. Institute of Technology

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## Department of Artificial Intelligence and Machine Learning

### SEMESTER – III

#### Computer Organization and Architecture (PCC)

Credit : 3

Course Code	22AML132	CIA Marks	50
Teaching Hours/Week (L: T: P: J)	3:0:0:0	SEA Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

#### Course Learning Objectives:

This course will enable students to

- Explain the basic sub systems of a computer, their organization, structure and operation.
- Illustrate the concept of programs as sequences of machine instructions.
- Demonstrate different ways of communicating with I/O devices and standard I/O interfaces.
- Describe memory hierarchy and concept of virtual memory.
- Describe arithmetic and logical operations with integer and floating-point operands.
- Illustrate organization of a simple processor, pipelined processor and other computing systems

	Number of Hours	Bloom's Level
<b>Module 1 : CENTRAL PROCESSING UNIT</b>		

#### Basic Structure of Computers:

Basic Operational Concepts, Bus Structures, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Instruction Set: CISC and RISC, Performance Measurement.

8

(CO1)  
Apply

#### Machine Instructions and Programs:

Memory Location and Addresses, Instructions and Instruction Sequencing, Addressing Modes

**Use case:** Convert High level language (C Language) to machine level language

#### Module 2 : COMPUTER ARITHMETIC

Numbers, Arithmetic Operations and Characters, Addition and Subtraction of Signed Numbers, Multiplication of Positive Numbers, Signed Operand Multiplication, Fast Multiplication, Integer Division

8

(CO2)  
Apply

**Use Case:** Data Representation and operations performed in Arithmetic Logical Unit (ALU) in computer hardware.

#### Module 3 : MEMORY ORGANIZATION

Basic Concepts, Semiconductor RAM Memories: Internal organization of memory chips, static memories, Asynchronous and synchronous DRAMs, Cache Memories – Mapping Functions.

8

(CO3)  
Apply

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<b>Use Case:</b> Helps in designing cost, space, time optimized applications <b>Prerequisite for:</b> Operating System- Memory Management		
<b>Module 4 : INPUT - OUTPUT ORGANIZATION</b>		
Accessing I/O Devices, Interrupts – Interrupt Hardware, Direct Memory Access, Buses, Interface Circuits <b>Use Case:</b> To build device drivers	8	(CO3) Apply
<b>Module 5 : BASIC PROCESSING UNIT</b>		
<b>Basic Processing Unit:</b> Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control <b>Pipelining:</b> Basic concepts of pipelining <b>Use Case:</b> Optimization of Processor speed	8	(CO1) Apply
<b>Course outcomes:</b> The students will be able to <ol style="list-style-type: none"> <li>Design assembly Language program for various problems.(Apply)</li> <li>Solve the various arithmetic operation in computer hardware (Apply)</li> <li>Estimate the processor time and CPU usage. (Apply)</li> <li>Design and analyze Memory devices (Analyze- for Assignment)</li> </ol>		
<b>Reference Books:</b> <ol style="list-style-type: none"> <li>Carl Hamacher, ZvonkoVranesic, SafwatZaky, Computer Organization, 5th Edition, Tata McGraw Hill, 2002.</li> <li>William Stallings: Computer Organization &amp; Architecture, 9th Edition, Pearson, 2015.</li> <li>M.Morris Mano, “Computer system Architecture”, 3rd Edition, Prentice-Hall Publishers, 2007.</li> </ol>		

### ASSESSMENT STRUCTURE:

PCC	CIA	SEA	CIA (50)			SEA Conduction: 100 M Reduced to: 50 M	
				I	II		
Conduction	50	50	Written Test	50	50	Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module	
				Average of two tests – 25 Marks			
			Assignment	15			
			AAT	10			
			<b>Total – 50 marks</b>			<b>Total – 50 marks</b>	

#### i) CIA: 50%

IA Test: 2 IA tests - Each of 50 Marks	Average of 2 tests – scaled down to 25 M
Assignment – Two assignments – one for 10 marks and another for 5 marks	15 Marks
Additional Assessment Tools (AAT) – Oral /Online Quizzes, Presentations, Group discussions, Case studies, Term Paper, Open ended experiments, Mini industrial/social/rural Projects, Two-minute video on latest topic, Short MOOC courses, Practical Orientation on Design thinking, creativity & Innovation, Participatory & Industry integrated learning,	10 Marks

Practical activities, Problem solving exercises, Participation in seminars/academic events/symposia and any other activity	<b>Total</b>	<b>50 Marks</b>
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**ii) SEA : 50%**

<b>Theory Exam</b>	5 questions to answer each of 20 Marks 2 questions from each module with internal choice Student should answer one full question from each module	<b>20 M x 5 = 100 M reduced to 50 M</b>
		<b>Total</b> <b>50 Marks</b>

# B.N.M. Institute of Technology

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## Department of Artificial Intelligence and Machine Learning

### SEMESTER – III

#### ARTIFICIAL INTELLIGENCE (PCI)

Credit : 3

Course Code	22AML133	CIA Marks	50
Teaching Hours/Week (L: T: P: J)	1:2:2:0	SEA Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

#### Course Learning Objectives:

This course will enable students to

- Become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.
- Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
- Learn the methods of solving problems using Artificial Intelligence.
- Learn the knowledge representation techniques, reasoning techniques and planning

	Number of Hours	Bloom's Level
	6+4	(CO1) Apply

#### Module-1 : Introduction

**Introduction to AI:** history, Intelligent systems, foundation and sub area of AI, applications, current trend and development of AI.

**Problem solving:** Production System, water jug problem, Missionaries and Cannibals Problem, 8-Puzzle problem, State space search, Control Strategies: Characteristics of Problem.

##### Practical:

1. Write a Program to Implement Tic-Tac-Toe game using Python.
2. Write a Program to implement 8-Puzzle problem using Python.
3. Write a Program to Implement Water Jug using Python.

6+4

(CO1)  
Apply

#### Module-2 : Problem solving-1

**Uninformed Search Strategies:** Breadth-First search, Uniform- Cost Search, Depth-first search, Depth-limited search, Iterative deepening depth-first search, Bidirectional search, comparing uninformed search strategies.

**Informed (Heuristic) Search strategies:** Best-first search, A\* algorithm, Memory-bounded Heuristic search-RBFS algorithm and SMA\* algorithm, AO\* algorithm

##### Practical:

1. Implement AO\* Search algorithm.
2. Write a Program to Implement Breadth First Search using Python.
3. Implement N-Queens problem

6+4

(CO2)  
Apply

#### Module-3 : Game Playing

<p><b>Adversarial Search:</b> Nim Game problem, minimax procedure, alpha-beta pruning.</p> <p><b>Constraint Satisfaction Problems:</b> Crypt-arithmetic problem</p> <p><b>Advanced problem solving paradigm:</b> Planning: types of planning system, block world problem, logic based planning, Linear planning using a goal stack, sussman anomaly problem in goal stack, Means-ends analysis, Nonlinear planning strategies, learning plans.</p> <p><b>Practical:</b></p> <ol style="list-style-type: none"> <li>1. Write a program to implement Missionaries and Cannibals.</li> <li>2. Write a program to implement Monkey and Bananas Problem</li> <li>3. Write a Program to Implement Tower of Hanoi</li> </ol>	<b>6+4</b>	<b>(CO2) Apply</b>
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#### Module-4 Logical Reasoning and planning

**Logical reasoning:** propositional calculus, propositional logic, Natural Deduction system, Axiomatic system, Semantic Tableau system in propositional logic, resolution refutation in propositional logic, predicate logic, logic programming, Unification algorithm, forward and backward chaining, conflict resolution.

<p><b>Practical:</b></p> <ol style="list-style-type: none"> <li>1. Implementation of the problem solving strategies: either using Forward Chaining or Backward Chaining.</li> <li>2. Write predicates to convert centigrade temperatures to Fahrenheit and check if temperature is below freezing.</li> </ol>	<b>6+4</b>	<b>(CO3) Apply</b>
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#### Module-5: Knowledge Representation & Expert Systems

**Knowledge Representation:** Approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR, Knowledge representation using Frames.

**Expert Systems:** Architecture of expert systems, Roles of expert systems - Knowledge Acquisition -Meta Knowledge. Typical expert systems - MYCIN, DART, XOOM.

<p><b>Practical:</b></p> <ol style="list-style-type: none"> <li>1. Implement MYCIN expert system</li> </ol>	<b>6+4</b>	<b>(CO4) Apply</b>
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#### Course outcomes:

The students will able to

1. Understand the concepts of AI, characteristics of problems and apply various techniques for problem solving.
2. Apply appropriate search techniques to solve AI problems.
3. Develop knowledge base sentences using propositional logic and first order logic for logical reasoning.
4. Apply AI techniques for knowledge representation using semantic networks and implement various expert systems.

#### Reference Books:

1. Staurt Russel, Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson Education, 3rd Edition, 2009
2. Elaine Rich, Kevin Knight, Artificial Intelligence, Tata McGraw Hill
3. George F Lugar, Artificial Intelligence Structure and strategies for complex, Pearson Education, 5th Edition, 2011
4. Saroj Kaushik, Artificial Intelligence, Cengage learning, 2014
5. Nils J. Nilsson, Principles of Artificial Intelligence, Elsevier, 1980

## ASSESSMENT STRUCTURE:

PCI	CIA	SEA	CIA (50)			SEA Conduction: 100 M Reduced to: 50 M	
				I	II		
Conduction	50	50	Written Test	50	50	Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module	
				Average of two tests – 50 marks scaled down to 15 marks			
			Assignment	Average of 2 Assignments – 10M			
			Practical	Weekly Assessment – 10 Marks IA test – 15 Marks (IA test to be conducted for 50 M and scaled down to 15M)			
<b>Total – 50 Marks</b>						<b>Total – 50 Marks</b>	

### i) CIA: 50%

Theory	IA Test (Theory): 2 IA tests - each of 50 Marks – Average of 2 tests scaled down to 15 Marks Assignment : 2 Assignments – each of 10 marks	25 Marks
Lab	Weekly Assessment – 10 Marks Practical test (1) - 15 marks	25 Marks
<b>Total</b>		<b>50 Marks</b>

### ii) SEA : 50%

#### Question Paper:

Theory Exam	5 questions to answer, each of 20 Marks 2 questions from each module with internal choice Student should answer one full question from each module	20 M x 5 = <b>100 M</b> <b>Reduced to 50 M</b>
<b>Total</b>		<b>50 Marks</b>

# B.N.M. Institute of Technology

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## Department of Artificial Intelligence and Machine Learning

### SEMESTER – III

#### Data Structures & Applications (PCI)

Credit: 4

Course Code	22AML134	CIA Marks	50
Teaching Hours/Week(L:T: P: J)	3:0:2:0	SEA Marks	50
Total Number of Lecture Hours	50	Exam Hours	03

#### Course Learning Objectives:

This course will enable students to

- Use and implement data structures to obtain solutions.
- Illustrate and implement data structures such as stack, queue and linked list and apply them for the given problem.
- Distinguish the conceptual and applicative differences in trees, binary trees and binary search trees.
- Create and use appropriate data structures in C programs for solving real life problems.

	Number of Hours	Bloom's Level
<b>Module 1: Stacks and Queues</b>		
Concept Learning: Data Structures: Classification (Primitive & Non-primitive), Operations, Pattern Matching Algorithms (Brute force, KMP) Stacks: Definition, Operations, Implementation using arrays, Applications of Stacks – Infix to Postfix Conversion and Postfix Expression Evaluation. Queues: Definition, Operations, Implementation, Applications, Circular Queue (Message queue using Circular queue), Doubly Ended Queue, Priority Queue.	6+4	(CO1, CO2, CO3) Apply
Practical: 1. Design, develop and Implement a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, % (Remainder), ^ (Power) and alpha numeric operands. 2. Design, Develop and Implement a Program in C to Evaluation of Suffix expression with single digit operands and operators: +, -, *, /, %, ^ using Stack. 3. Design, Develop and Implement a menu driven Program in C for the following operations on Circular QUEUE of Characters (Array Implementation of Queue with maximum size MAX) <ul style="list-style-type: none"> <li>• Insert an Element on to Circular QUEUE</li> <li>• Delete an Element from Circular QUEUE</li> <li>• Demonstrate Overflow and Underflow situations on Circular QUEUE</li> <li>• Display the status of Circular QUEUE</li> </ul> Support the program with appropriate functions for each of the above operations.		

#### Module 2: Linked List

Linked Lists: Definition, Create, Insert, Delete, Update, Traverse, and Position-	6+4	(CO1,
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<p>based Operations, Concatenate, Merge, and Reverse Lists, Doubly Linked List Implementation and Operations, Circular Linked List Implementation and Operations, Applications of Lists (Polynomial addition). Implementation of stacks and queues using Linked List</p> <p><b>Practical:</b></p> <ol style="list-style-type: none"> <li>Design, Develop and Implement a menu driven Program in C for the following operations on Singly Linked List (SLL) of Student Data with the fields: USN, Name, Branch, Sem, PhNo. <ul style="list-style-type: none"> <li>Create a SLL of N Students Data by using front insertion.</li> <li>Display the status of SLL and count the number of nodes in it</li> <li>Perform Insertion / Deletion at End of SLL</li> <li>Perform Insertion / Deletion at Front of SLL</li> </ul> </li> <li>Design, Develop and Implement a menu driven Program in C for the following operations on Doubly Linked List (DLL) of Employee Data with the fields: SSN, Name, Dept, Designation, Sal, PhNo <ul style="list-style-type: none"> <li>Create a DLL of N Employees Data by using end insertion.</li> <li>Display the status of DLL and count the number of nodes in it</li> <li>Perform Insertion and Deletion at End of DLL</li> <li>Perform Insertion and Deletion at Front of DLL</li> </ul> </li> </ol>		<b>CO2, CO3</b> <b>Apply</b>
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### Module 3: Trees

Concept Learning: Trees: General Tree Representation, Traversals, Applications.

Binary Trees: Definition, Properties, Traversals, Applications.

Binary Search Tree: Definition, Implementation, Search, Insert, Delete operations.

Building and Evaluating Binary Expression Tree.

**Practical:**

- Write a C program to find maximum depth or height and level of a full binary tree and complete binary tree.
- Write a C program to print all the path from root to left path for given binary tree.
- Write a C program to insert a new node as a left child in a threaded binary tree.
- Design, Develop and Implement a menu driven Program in C for the following operations on Binary Search Tree (BST) of Integers.
  - Create a BST of N Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2
  - Traverse the BST in Inorder, Preorder and Post Order
  - Search the BST for a given element (KEY) and report the appropriate message

**6+4**

**(CO1,  
CO2, CO3)  
Apply**

### Module 4: Advanced Trees & Hashing

Concept Learning: Heap Tree: Definition, Implementation, Insert, Delete, Peek operations. Hashing: Hash Table, Hash Functions, Collision Handling by Open Addressing, Chaining.

**Practical:**

- Write a C program to construct MAX-Heap.
- Write a C program to insert node AVL tree.

**6+4**

**(CO2,CO3,  
CO4)  
Apply**

### Module 5: Graphs

Concept Learning: Graphs: Disjoint sets, Representation of Graphs - Adjacency/ Cost Matrix, Adjacency Lists, and Traversal of Graphs (BFS and DFS)

**Practical:**

- Design, Develop and Implement a Program in C for the following

**6+4**

**(CO2,  
CO3, CO5)  
Apply**

<p>operations on Graph(G) of Cities</p> <ol style="list-style-type: none"> <li>2. Create a Graph of N cities using Adjacency Matrix.</li> <li>3. Print all the nodes reachable from a given starting node in a digraph using DFS/BFS</li> <li>4. Write a C Program to detect Cycle in a Directed Graph</li> <li>5. Write a C Program to find if there is a path between two vertices in a directed graph.</li> </ol>		
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### Course outcomes:

The students will able to

1. Apply fundamental data structures viz., Lists, Stacks, Queues, Linked Lists, Binary Trees from first principles
2. Identify the use of appropriate data structures for a given problem.
3. Design and implement solutions to basic practical problems using customized data structures.
4. Apply the advanced concepts like Heap & Hashing to solve problems.
5. Apply the concepts to solve graphical problems.

### Reference Books:

1. "Data Structures and Program Design in C", Robert Kruse, C L Tondo, Bruce Leung and Shashi Mogalla, PHI, 2nd Edition, 2015.
2. Y. Langasm, M. J. Augenstein, A. M. Tenenbaum (2001) Data Structures Using C and C++, Prentice Hall India, New Delhi, India.
3. T. H. Cormen, C. E. Leiserson and R. L. Rivest (1990) Introduction to Algorithms, Third Edition, MIT Press, MA.
4. Fundamentals of Data Structures in C -- by Horowitz, Sahni and Anderson-Freed (Silicon Press 2007).
5. Data Structures and Algorithm Analysis in C++, Mark Allen Weiss, 4th Revised edition; 2013, Addison-Wesley, ISBN-13: 978-8131714744
6. Data Structures Using C, Reema Thareja, 1st Edition, 2011, Oxford Higher Education, ISBN-13: 978-0198099307

### ASSESSMENT STRUCTURE:

PCI	CIA	SEA	CIA (50)			SEA Conduction: 100 M Reduced to: 50 M		
				I	II			
Conduction	50	50	IA Test	30	30	30 Marks	70 Marks	
				Average of two tests – 30 M				
		Continuous Assessment	Weekly Assessment -20 marks					
			<b>Total – 50 Marks</b>			<b>Total – 50 Marks</b>		

#### i) CIA: 50%

IA Test: 2 IA tests - each of 30 Marks	Average of 2 tests – 30 M
<b>Practical</b> Lab record – 10 Marks Performance – 05 Marks Viva – 05 Marks	20 Marks
	<b>Total 50 Marks</b>

**ii) SEA : 50%**

**Question Paper:**

<b>Theory part</b>	5 questions to answer each of 6 Marks 2 questions from each module with internal choice Student should answer one full question from each module	6 M x 5 = 30 Marks
<b>Execution part</b>	Write up - 20 Marks Conduction - 40 Marks Viva-Voce - 10 Marks	70 Marks
<b>Total</b>		<b>100 Marks</b> <b>Reduced to 50 M</b>

**Note:**

- No Assignment and AAT

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## Department of Artificial Intelligence and Machine Learning

### SEMESTER – III

#### MICROCONTROLLER AND EMBEDDED SYSTEMS (PCI)

Credit : 4

Course Code	22AML135	CIA Marks	50
Teaching Hours/Week (L: T: P: J)	3:0:2:0	SEA Marks	50
Total Number of Lecture Hours	50	Exam Hours	03

#### Course Learning Objectives:

This course will enable students to

- Illustrate the logic design concepts and combinational logic circuits
- Provide the student with the basic understanding of microcontroller and embedded systems design.
- Learn the addressing modes, instructions, and assembler directives and develop the ALP to solve problems.
- Develop embedded C programs for microcontrollers and run on the simulator, target board and various interfaced hardware devices.
- Integrate Hardware and Software to Implement the required embedded smart systems

	Number of Hours	Bloom's Level
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#### Module-1 Logic Design and Combinational Logic Circuits

**Logic Design & Applications:** Basic Logic gates.

**Combinational Logic Circuits:** Sum-of-Products Methods, Karnaugh Map simplifications, Don't – care Conditions, Product-of-Sums Simplifications, Simplification by Quine-McClusky Method, Map Entered Variable Method.

#### Practical:

Realize the following digital circuits using Digital Trainer kit.

1. Realization of Boolean expression:

$$Y = \bar{A}B\bar{C}D + A\bar{B}\bar{C}D + \bar{A}BC\bar{D} + \bar{A}B\bar{C}D + \bar{A}BC\bar{D} + A\bar{B}CD + AB\bar{C}D$$

2. Realize Half Adder, Full Adder, Half Subtractor and Full Subtractor using Logic Gates.
3. Realize Binary to Gray & Gray to Binary Code Converters using Logic Gates

**6+4**

**(CO1)  
Apply**

#### Module-2: ARM-32 bit Microcontroller

#### ARM-32bit Microcontroller:

Thumb-2 technology and applications of ARM, Architecture of ARM Cortex M3, Various Units in the architecture, debugging support, General Purpose Registers, Special Registers, exceptions, interrupts, stack operation, reset sequence.

#### Practical:

Conduct the following experiments on an ARM CORTEX M3 evaluation board to learn ALP and using evaluation version of Embedded 'C' & Keil uVision-4 tool/compiler.

**6+4**

**(CO2)  
Apply**

1. Write a program to multiply two 16 bit binary numbers.

2. Write a program to find the sum of first 10 integer numbers.

3. Write a program to find factorial of a number.

4. Write a program to add an array of 16 bit numbers and store the 32 bit result in memory location.

#### Module-3: ARM Cortex M3 Instruction Sets and Programming

<p><b>ARM Cortex M3 Instruction Sets and Programming:</b> Assembly basics, Instruction list and description, Special instructions, Useful instructions, Assembly and C language Programming</p> <p><b>Practical:</b> Conduct the following experiments on an ARM CORTEX M3 evaluation board to learn ALP and using evaluation version of Embedded 'C' &amp; Keil uVision-4 tool/compiler.</p> <ol style="list-style-type: none"> <li>1. Write a program to find the square of a number (1 to 10) using look-up table.</li> <li>2. Write a program to find the largest/smallest number in an array of 32 numbers.</li> <li>3. Write a program to arrange a series of 32-bit numbers in ascending/descending order.</li> <li>4. Write a program to count the number of ones and zeros in two consecutive memory locations.</li> </ol>	<b>6+4</b>	<b>(CO3) Apply</b>
<p><b>Module-4: Embedded System Components</b></p> <p><b>Embedded System Components:</b> Embedded Vs General computing system, History of embedded systems, Classification of Embedded systems, Major applications areas of embedded systems, purpose of embedded systems Core of an Embedded System, Memory, Sensors, Actuators, LED, 7 segment LED display, stepper motor, Keyboard, Communication Interfaces (I2C, SPI, IrDA, Bluetooth, Wi-Fi, Zigbee only).</p> <p><b>Practical:</b> Conduct the following experiments on an ARM CORTEX M3 evaluation board to learn ALP and using evaluation version of Embedded 'C' &amp; Keil uVision-4 tool/compiler.</p> <ol style="list-style-type: none"> <li>1. Display "Hello World" message using Internal UART.</li> <li>2. Interface and Control the speed of a DC Motor.</li> <li>3. Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction.</li> <li>4. Display the Hex digits 0 to F on a 7-segment LED interface, with an appropriate delay in between.</li> </ol>	<b>6+4</b>	<b>(CO4) Apply</b>
<p><b>Module-5: Programming with Arduino</b></p> <p><b>Programming with Arduino:</b> Understanding the ecosystem of Arduino, Pinout configuration, Digital input and output, Analog input and output, working with sensors and actuators, Arduino serial communication, Communication interfaces (SPI and I2C) communication.</p> <p><b>Practical:</b> Conduct the following experiments by writing program using Arduino Uno board and the required software tool.</p> <ol style="list-style-type: none"> <li>1. Interface a DHT11 sensor with Arduino Uno.</li> <li>2. Interface GPS module with Arduino Uno.</li> <li>3. Interface GSM module with Arduino Uno.</li> <li>4. Interface LCD module with Arduino Uno.</li> </ol>	<b>6+4</b>	<b>(CO5) Apply</b>
<p><b>Course outcomes:</b> The students will be able to</p> <ol style="list-style-type: none"> <li>1. Apply Karnaugh Map, Quine-McClusky Method and Map Entered Variable Method to simplify digital circuits. (Apply)</li> <li>2. Implement the architectural features and instructions of 32-bit microcontroller ARM CortexM3. (Apply)</li> <li>3. Apply the knowledge gained for Programming ARM Cortex M3 for different applications. (Apply)</li> <li>4. Apply the knowledge of basic hardware components and their selection method based on the characteristics and attributes of an embedded system. (Apply)</li> <li>5. Interfacing various sensor modules with Arduino UNO using Arduino sketch to program the devices. (Apply)</li> </ol>		
<p><b>Reference Books:</b></p> <ol style="list-style-type: none"> <li>1. M. Morris Mano, Digital Design, 4<sup>th</sup> Edition, Pearson Prentice Hall 2008</li> <li>2. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M3", 211d Edition, Newnes, (Elsevier), 2010.</li> </ol>		

3. Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited, 2<sup>nd</sup> Edition.  
 4. Exploring Arduino: Tools and Techniques for Engineering, Wizardry 1st Edition WILEY, ISBN-10: 1118549368, ISBN-13: 978-1118549360.

### ASSESSMENT STRUCTURE:

PCI	CIA	SEA	CIA (50)			<b>SEA Conduction: 100 M Reduced to: 50 M</b>	
				I	II		
Conduction	50	50	Written Test	50	50	Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module	
			Average of two tests – 50 marks scaled down to 15 marks				
			Assignment	Average of 2 Assignments – 10M			
			Practical	Weekly Assessment – 10 Marks IA test – 15 Marks (IA test to be conducted for 50 M and scaled down to 15M)			
<b>Total – 50 Marks</b>						<b>Total – 50 Marks</b>	

#### i) CIA: 50%

Theory	IA Test (Theory): 2 IA tests - each of 50 Marks – Average of 2 tests scaled down to 15 Marks <b>Assignment :</b> 2 Assignments – each of 10 marks	25 Marks
Lab	Weekly Assessment – 10 Marks <b>Practical test (1)</b> - 15 marks	25 Marks
<b>Total</b>		<b>50 Marks</b>

#### ii) SEA : 50%

##### Question Paper:

<b>Theory Exam</b>	5 questions to answer, each of 20 Marks 2 questions from each module with internal choice Student should answer one full question from each module	<b>20 M x 5 = 100 M Reduced to 50 M</b>
<b>Total</b>		<b>50 Marks</b>

# B.N.M. Institute of Technology

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## Department of Artificial Intelligence and Machine Learning

### SEMESTER – III

#### Object Oriented Programming Using JAVA

Credit: 2

Course Code	22AML136	CIA Marks	50
Teaching Hours/Week(L:T:P:J)	0:0:2:2	SEA Marks	50
Total Number of Lecture Hours	30	Exam Hours	03

#### Course Learning Objectives:

This course will enable students to

- Understand and apply the basic concepts of object-oriented programming.
- Implement java programs for establish interfaces and to develop reusable software components.
- Build software development skills using java programming for real-world applications.

	Number of Hours	Bloom's Level
<b>Task 1</b>  An Overview of Java, Data Types, Variables, and Arrays, Operators, Control Statements, Classes and Methods  1. Write a JAVA program to display message “Welcome to BNMIT”and “I am first batch of Autonomous” in two different lines. 2. Write a JAVA program to display at-least five student information by considering student USN, name, branch and semester. 3. Write a java program that prints all real solutions to the quadratic equation $ax^2 +bx+c=0$ . Read in a, b, c and use the quadratic formula. 4. Write a java program to create objects of class Students with studentUSN, name, branch and semester and display information. 5. Write a java program to create an abstract class named Shape that contains two integers and an empty method named print Area().	2	(CO1) Apply

<b>Task 2</b>  Method overloading, Inheritance, polymorphism, encapsulation  1. Calculate area of Rectangle, Triangle and Circle by using method overloading 2. Write a java program to create a class named Employee. Extend Faculty class from Employee class. Extend Professor Class from Faculty class. Access members of super class using super keyword. Create an instance to sub class called Professor and access members of both Faculty and Professor using instance. 3. Write a java program to develop a suitable hierarchy, classes for Point, Shape, Rectangle, Square, Circle, Ellipse, Triangle, Polygon, etc. Design a simple test application to demonstrate dynamic polymorphism. 4. Write a java program to create a class Car that inherits from base class Vehicle using private strings and getter/setter methods to achieve encapsulation.	2	(CO1) Apply
<b>Task 3</b>		

Multithreaded Programming		
<ol style="list-style-type: none"> <li>Write a java program for multithread in which user thread and thread started from main method invoked at a time each thread sleep for 1 sec.</li> <li>Write a java program that implements a multi-thread application that has three threads. First thread generates random integer every 1 second and if the value is even, second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of cube of the number.</li> <li>Write an application that executes two threads. One thread displays “A” every 1000 milliseconds and other displays “B” every 3000 milliseconds. Create the threads by extending the Thread class.</li> </ol>	2	(CO2) Apply

#### Task 4

##### Enumerations, Strings

- Write a java program to create an enum of restaurants that can be used to pick user choice restaurant.
- Given an input string, you are expected to extract either all vowels, or all non-vowels from the string and return the result as all lowercase or uppercase, based on the options specified.
  - input1 represents the input string.
  - input2 represents the extraction option. 0 for extraction of all non-vowels. 1 for extraction of all vowels.
  - input3 represents the output case option. 0 for all lowercase letters. 1 for all UPPERCASE letters.
- Write a java program to find the duplicate words and their number of occurrences in a string.
- Write a Java program to replace each substring of a given string that matches the given regular expression with the given replacement.

2

(CO1)  
Apply

#### Task 5

##### Collections

- Write a Java program to create a new array list, add some colors (string) and print out the collection.
- Write a Java program to iterate through all elements in a linked list starting at the specified position.
- Write a Java program to append the specified element to the end of a hash set.
- Write a Java program to create a new tree set, add some colors (string) and print out the tree set.
- Write a Java program to create a new priority queue, add some colors (string) and print out the elements of the priority queue.

2

(CO1)  
Apply

#### Task 6

##### Collections

- Write a Java program to associate the specified value with the specified key in a Tree Map.
- Write a Java program for the following: i) Create a doubly linked list of elements. ii) Delete a given element from the above list. iii) Display the contents of the list after deletion.
- Write a Java program to store content in Hash table and use enumeration to display contents of Hash Table.
- Write a Java program to create a vector of n elements and perform the following operations: Adding elements, Removing elements and Display elements.

2

(CO1)  
Apply

Write a program to add elements to the HashMap given the key and value data type is string, get size of HashMap, and check if HashMap is empty.

<b>Task 7</b>		
Event Handling		
1. Write a Java program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields, Num1 and Num2. The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a Number Format Exception. If Num2 were Zero, the program would throw an Arithmetic Exception. Display the exception in a message dialog box.	2	(CO2) Apply
<b>Task 8</b>		
Event Handling		
1. Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired.	2	(CO2) Apply
<b>Task 9</b>		
Event Handling		
1. Write a java program that simulates a traffic light. The program lets the user select one of three lights: Red, Yellow or Green with radio buttons. On selecting a button an appropriate message with "STOP" or "READY" or "GO" should appear above the buttons in selected color. Initially, there is no message shown. 2. Write a java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +,-,*, % operations. Add a text field to display the result. Handle any possible exception like divided by zero.	2	(CO2) Apply
<b>Task 10</b>		
Event Handling		
1. Write a java program to create a frame that contains two buttons and one text field. 2. Write a java program to handle the button click events by implementing ActionListener Interface. 3. Write a java program to create two textfields to display single line text string and one TextArea that is used to display multiple-line text string. Both should be editable in nature. 4. Write a java program to create a drop-down menu of choices. When a user selects a particular item from the drop-down then it is shown on the top of the menu.	2	(CO2) Apply
<b>Task 11</b>		
Exception Handling		
1. Write a java program to represent a list of items together and popupmenu to display some message. One or more than one item can be selected from the list. 2. Write a program in java if number is less than 10 and greater than 50 it generates the exception out of range. Else it displays the square of number. 3. Write a program in java to enter the number through command line argument. If first and second number is not entered then it will generate the exception. Also divide the first number with second number and generate the arithmetic exception.	2	(CO2) Apply
<b>Task 12</b>		

Java Script	<ol style="list-style-type: none"> <li>1. Write a program to Swap Two Variables.</li> <li>2. Write a program to Generate a Random Number.</li> <li>3. Write a program to Check the Number of Occurrences of aCharacter in the String.</li> <li>4. Write a program to Count the Number of Vowels in a String.</li> <li>5. Write a java script program to pass a 'javascript function' as parameter.</li> </ol>	2	(CO3) Apply
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### Task 13

#### File handling

1. Write a java program that reads a file name from the user, and then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file and the length of the file in bytes.
2. Write a java program that displays the number of characters, lines and words in a text file.

2

(CO2)  
Apply

### Task 14

#### File handling

1. Write a java program that reads a file and displays the file on the screen with line number before each line.
2. Write a java program in which data is read from one file and should be written in another file. Name of both file is given through command line arguments.
3. Write a java program in which data is read from one file and should be written in another file line by line.

2

(CO2)  
Apply

### Task 15

#### Mini-Project

- Develop real world application using graphical user interface and object-orient concept for selected problem statement.
- The problem statement can be selected from the following title but not limited to the same.
  1. Electricity bill generation
  2. Currency converter / Distance converter / Time converter
  3. Pay slip generation
  4. Online book store
  5. Airline reservation system
  6. Designing of simple calculator

(CO4)  
Create

#### Course Outcomes:

The students will be able to

1. Develop Java application programs to implement basic Object Oriented concepts. (Apply)
2. Apply the concepts of Multithreading, Exception handling, event and file handling to develop efficient and error free codes. (Apply)
3. Design event driven GUI and web related applications which mimic the real word scenarios. (Apply)
4. Design, implement, test, and debug graphical user interfaces to solve real time applications.(Create-for Mini project).

#### Reference Books:

1. Herbert Schildt, "Java, The complete Reference", Tata McGraw-Hill, 7<sup>th</sup> Edition.
2. P. J. Deitel, H. M. Deitel, "Java for Programmers", Pearson Education, PHI, 4th Edition, 2007.
3. P. Radha Krishna, "Object Oriented Programming through Java", Universities Press, 2nd Edition, 2007
4. Bruce Eckel, "Thinking in Java", Pearson Education, 4th Edition, 2006.
5. Sachin Malhotra, Saurabh Chaudhary, "Programming in Java", Oxford University Press, 5th Edition, 2010.

### **Assessment Structure:**

PBL	CIA	SEA	CIA (50)			SEA Conduction: 100 M Reduced to: 50 M	
Conduction	50	50	Theory	I IA	II IA	Project Assessed for 100 marks reduced to 50 Marks	
				25	25		
			Average of 2 tests – 25 M				
			Practical	Weekly Assessment (Record/Project) – 10 Marks Lab IA test – 15 Marks			
			<b>Total – 50 Marks</b>			<b>Total – 50 Marks</b>	

#### **i) CIA: 50%**

Theory - 2 IA tests - Each of 25 Marks	25 Marks
<b>Practical</b> <b>Weekly Assessment</b> - Lab record/Project – 10 Marks <b>Lab IA test</b> – 15 Marks	25 Marks
	<b>Total</b> <b>50 Marks</b>

#### **ii) SEA : 50%**

Project	Write up – 10 Marks Project report – 25 Marks Presentation & Demonstration - 50 Marks Viva-Voce – 15 Marks	100 Marks Reduced to 50 Marks
		<b>Total</b> <b>50 Marks</b>

# B.N.M. Institute of Technology

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Semester: III		
COURSE: Soft Skill-1		
<b>Course Code:</b> 22SFT138	<b>L:T:P:J:</b> 0:0:2:0	<b>CIA Marks:</b> 50
<b>Credits:</b>	<b>1</b>	<b>SEA Marks:</b> 50
<b>Hours:</b>	<b>24 hrs</b>	<b>SEA Duration:</b> 2Hrs
<b>Course Learning Objectives:</b> The students will be able		
1	To help students understand their strengths and weakness.	
2	To develop analytical and creative ability to solve problems individually or as a team.	
3	To make students industry ready through practice of corporate etiquettes.	
4	To enhance public speaking and presentation skills.	

Module No.	Contents of the Module	Hour s	Cos
1	<b>Module-1 Understanding and Managing Self</b> Self-Awareness, Self-Management, Anger Management, Time management, Change management. Vision and goal setting - Diff between vision and goal, smart, stretched goal concept, case studies Knowledge, Skill, Attitude Personality analysis using Big 5 personality test Critical Thinking, Problem solving, Creativity and innovation Integrity, ethics, values	8	<b>1 &amp; 2</b>
2	<b>Module -2 Corporate etiquettes and Mannerism</b> Introduction to Etiquette and Mannerism, Personal Etiquette, Grooming etiquettes- professional styling, Body & personality styling, Video Interview Etiquettes, Personal Interview EtiquettesEffective meeting skills. Workplace behavior, Personal interview	6	<b>3</b>
3	<b>Module -3 Public Speaking and presentation skills</b> Introduction to public speaking, making ideas, illustrating and delivering ideas, overcoming fear of public speaking and developing great delivery. Advanced Business presentation skills, PowerPoint presentation, Group discussion	6	<b>4</b>
4	<b>Module -4 Team Work</b> Interpersonal skills, group work vs team work	4	<b>5</b>

**Course Outcomes: At the end of the course the student will be able to:**

<b>CO1</b>	Understand their strength and weaknesses.
<b>CO2</b>	Develop analytical and creative ability to solve problems.
<b>CO3</b>	Identify themselves as industry ready through the practice of corporate etiquettes.
<b>CO4</b>	Enhance public speaking and presentation skills.
<b>CO5</b>	Build team collaboration by working towards shared goals.

**Mapping of Course Outcomes with Programme Outcomes:**

COs	PO8	PO9	PO10	PO11
CO1	3	3		
CO2		3		3
CO3	3	3		3
CO4		3	3	
CO5			3	3

**MOOC Course:**

**Communicate with impact** - <https://www.coursera.org/learn/communicate-with-impact>

**Leading Diverse Teams** - <https://www.coursera.org/learn/leading-diverse-teams>

**Practical component:**

1. Mock GD and interview may be conducted at the end of the course to check their confidence. Students can prepare their SWOT analysis and present the same.
2. The students are to be involved in various activities and games such as Just a Minute or Pick and speak to demonstrate each topic.

### **Class Internal Assessment – 50 Marks**

**1. Video Assignment -30Marks**

**2. Weekly Assessment -20Marks**

**Rubrics for evaluation: (TOTAL - 30 Marks)**

<b>SL no.</b>	<b>Assessment</b>	<b>COs</b>	<b>Marks</b>
1	Creativity	CO 2	5M
2	Approach and flow	CO 2	5M
3	Time Management (duration of video and deadline)	CO 1	5M
4	Individual presentation in the video	CO 4	5M
5	Report- Brief about the topic and Contribution of team members	CO 5	5M
6	Report- Reflections (learnings from the activity)	CO 2 & CO 5	5M

### **Semester End Assessment – 50 Marks**

**PPT - 10 Marks**

**Communication (Clarity and English) - 10 Marks**

**Body Language - 10 Marks**

**Viva (Q and A) - 10 Marks**

**Project Report - 10 Marks**

**Final Marks = CIA + SEA = 50+50 = 100 Marks**

# B.N.M. Institute of Technology

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## Department of Mathematics

### Syllabus

Semester: IV

#### Course: Statistics, Probability and Graph theory

Course Code: 22MAI141 (Common to CSE, ISE, AIML)

<b>L:T:P:J</b>	<b>2:2:0:0</b>	<b>CIA: 50</b>
<b>Credits:</b>	<b>03</b>	<b>SEA: 50</b>
<b>Hours:</b>	<b>40</b>	<b>SEA Duration: 03 Hours</b>

**Course Learning Objectives:** The students will be able to

- Provide an insight into applications of Graph Theory, Curve fitting & Statistical methods.
- Develop the knowledge of probability, joint probability distribution and Queuing theory occurring in digital signal processing, design engineering and micro wave engineering.

#### Module-1: Curve fitting & Statistical methods

*Examples from Engineering that require curve fitting and statistical methods.*

**Curve Fitting:** Curve fitting by the method of least squares-fitting the curves of the form:

$$y = ax + b, \quad y = ax^b \text{ and } y = ax^2 + bx + c.$$

**Statistical methods:** Introduction to Moments, Skewness, Kurtosis and problems. Karl Pearson's coefficient of correlation and lines of regression.

*Experiential Learning component: Problems on curve fitting and statistical methods*

#### Module-2: Probability distributions & Joint probability distribution

*Examples from Engineering that require Probability and Joint probability distribution*

**Probability distributions:** Review of basic probability theory. Discrete and continuous Random variables, probability mass/density functions (definitions only). Binomial, Poisson, exponential and normal distributions (without proof).

**Joint probability distribution:** Joint Probability distribution for two discrete random variables, expectation, covariance and correlation.

*Experiential Learning component: Problems on Binomial, Poisson, Exponential and Normal distributions*

#### Module-3:Markov chain & Sampling theory

*Examples from Engineering that require Markov Chain and Sampling Theory*

**Markov chain:** Introduction to Stochastic process, Probability vectors, Stochastic matrices, Regular stochastic matrices, Markov Chains, Higher transition probabilities, Stationary distribution of Regular Markov chains and absorbing states, Markovian processes.

**Sampling theory:** Introduction to sampling theory, testing of hypothesis, level of significance, confidence limits, test of significance of mean and difference of means for large samples-z-test, test of significance of small Samples-Student's t- distribution, Goodness of fit-Chi-Square test.

*Experiential Learning component: Problems on Markovian processes and, Sampling Theory*

#### Module-4: Queuing theory

*Examples from Engineering that require queuing theory*

Introduction, birth and death process, Kendall's Notation, Symbolic representation of a queuing model, single server Poisson queuing model with infinite capacity (M/M/1:  $\infty$ /FCFS), when  $\lambda_n = \lambda$  and  $\mu_n = \mu (\lambda < \mu)$ , Multiple server Poisson queuing model with infinite capacity (M/M/S:  $\infty$  / FCFS), when  $\lambda_n = \lambda$  for all  $n$ , ( $\lambda > S\mu$ ),

*Experiential Learning component: Problems on (M/M/1:  $\infty$ /FCFS) and (M/M/S:  $\infty$  / FCFS) queuing models*

#### Module-5: Graph theory

*Examples from Engineering that require graph theory*

Basic concepts, types of graphs, order and size of a graph, in-degree and out-degree, bipartite-graphs, connected and disconnected graphs, Eulerian graph, Hamiltonian graphs, sub-graphs, isomorphic graphs. Matrix representation of graphs, adjacency matrix, incidence matrix. Planar graphs: definition, characterization of planar graphs, Kuratowski's theorem, Euler's formula and consequences.

*Experiential Learning component: Problems on detection of planar and non-planar graphs*

No. of hours  
Blooms cognitive Levels

L: 04  
T: 04  
Apply

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

- CO 1: Make use of correlation and regression analysis to fit a suitable mathematical model for the statistical data.
- CO 2: Apply discrete and continuous probability and joint probability distributions in analyzing the probability models arising in engineering field.
- CO 3: Use Markov chain in prediction of future events and demonstrate the validity of testing the hypothesis.
- CO 4: Acquire skills in analyzing queuing models.
- CO 5: Apply the knowledge of Graph Theory in Network modeling, electrical network and computational algorithms.

**Reference Books:**

- E. Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons, 10<sup>th</sup> Edition(Reprint), 2016.
- B. S. Grewal: "Higher Engineering Mathematics", Khanna Publishers, 44<sup>th</sup> Edition, 2017.
- S. D. Sharma : "Operations Research", Kedar Nath Ram Nath & Co. Meerut, 2014.
- T. Veerarajan : Probability, Statistics and Random processes, McGraw Hill Education(India) Private Limited, Third edition, Nineteenth reprint 2017.
- C. Ray Wylie, Louis C. Barrett : "Advanced Engineering Mathematics", 6<sup>th</sup> Edition, McGraw-Hill Book Co., New York, 1995.
- James Stewart : Calculus-Early Transcendental, Cengage Learning India Private Ltd., 2017.
- B. V. Ramana: "Higher Engineering Mathematics" 11<sup>th</sup> Edition, Tata McGraw-Hill, 2010.
- Srimanta Pal & Subodh C. Bhunia: "Engineering Mathematics", Oxford University Press, 3<sup>rd</sup> Reprint, 2016.
- Narsingh Deo, "Graph Theory with Applications to Engineering and Computer Science", Prentice Hall of India, 2000.

**Web links and Video Lectures:**

- <https://nptel.ac.in/courses/111104098>
- <https://www.youtube.com/watch?v=1YkfeR05YXY>
- <https://archive.nptel.ac.in/courses/111/104/111104079/>
- <https://www.youtube.com/watch?v=xGkpXk-AnWU>
- <https://archive.nptel.ac.in/courses/106/104/106104170/>

**ASSESSMENT STRUCTURE:**

PCC	CIA	SEA	CIA (50)			<b>SEA Conduction: 100 M Reduced to: 50 M</b>	
				I	II		
Conduction	50	50	Written Test	50	50	Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module	
				Average of two tests – 25 Marks			
			Assignment	15			
			AAT	10			
			<b>Total – 50 marks</b>		<b>Total – 50 marks</b>		

**i) CIA: 50%**

<b>IA Test:</b> 2 IA tests - Each of 50 Marks	Average of 2 tests – scaled down to 25 M
<b>Assignment</b> – Two assignments – one for 10 marks and another for 5 marks	15 Marks
<b>Additional Assessment Tools</b> (AAT) – Oral /Online Quizzes, Presentations, Group discussions, Case studies, Term Paper, Open ended experiments, Mini industrial/social/rural Projects, Two-minute video on latest topic, Short MOOC courses, Practical Orientation on Design thinking, creativity & Innovation, Participatory & Industry integrated learning, Practical activities, Problem solving exercises, Participation in seminars/academic events/symposia and any other activity	10 Marks
	<b>Total</b> <b>50 Marks</b>

**ii) SEA : 50%**

<b>Theory Exam</b>	5 questions to answer each of 20 Marks 2 questions from each module with internal choice Student should answer one full question from each module	<b>20 M x 5 = 100 M reduced to 50 M</b>
<b>Total</b>	<b>50 Marks</b>	

# B.N.M. Institute of Technology

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## Department of Artificial Intelligence and Machine Learning

### Operating Systems (PCC)

#### SEMESTER-IV

Subject Code: 22AML142	L:T:P:J: 2:1:1:0	CIA Marks:	50
Credits:	3	SEA Marks:	50
Total Number of Lecture Hours	40	SEA Duration:	3 Hours

#### Course Objectives:

- Introduce concepts and terminology used in OS
- Explain threading and multithreaded systems
- Illustrate process synchronization and concept of Deadlock
- Introduce to Unix File Systems

Module 1: Introduction to Operating System & Process Management	Teaching Hours	Blooms cognitive Levels
<b>Fundamental Concepts of Operating System:</b> Introduction to Operating systems, Operating system functions and services, historical evolution of operating systems, System boot.	8	(CO1) Apply
<b>Process Management:</b> Process abstraction, process address space, process management, system calls, threads.	8	(CO2) Apply
<b>CPU Scheduling:</b> Levels of scheduling, comparative study of scheduling algorithms, Multilevel Queue Scheduling, Multilevel Feedback Queue Scheduling, Multi-processor scheduling.	8	(CO2) Apply
Module 2: Process Synchronization and Deadlocks		
<b>Concurrent Processes:</b> Critical section problem, semaphores, Classical problems of synchronization, monitors, inter-process communication, message passing mechanisms.	8	(CO2) Apply
<b>Deadlocks:</b> Characterization, prevention and avoidance, deadlock detection and recovery.	8	(CO2) Apply
Module 3: Memory Management		
<b>Memory Management:</b> Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation, virtual memory concept, demand paging, page replacement algorithms, thrashing, Disk Scheduling.	8	(CO3) Apply
<b>Solid State Drives-SSD</b> Architecture, Flash Controller, Garbage Collection, Bad Block Management.	8	(CO3) Apply
Module 4: UNIX file system		
<b>Unix files:</b> UNIX Architecture, Naming files. Basic file types/categories. Organization of files. Hidden files. Standard directories. Parent child relationship. The home directory and the HOME variable. Reaching required files- the PATH variable, manipulating the PATH, Relative and absolute pathnames. Directory commands – pwd, cd, mkdir, rmdir commands. The dot (.) and double dots (..) notations to represent present and parent directories and their usage in relative path names. File related commands – cat, mv, rm, cp, wc and od commands.	8	(CO4) Apply
<b>Practical component:</b> Execution of UNIX Shell Commands		
Module5: File attributes and Shell programming		
<b>File attributes and permissions:</b> The ls command with options. Changing file	8	(CO5) Apply

permissions: the relative and absolute permissions changing methods. Recursively changing file permissions. Directory permissions.

The shells interpretive cycle: Wild cards. Removing the special meanings of wild cards. Three standard files and redirection. **Connecting commands:** Pipe, grep, egrep.

**Shell programming:** Ordinary and environment variables. Read and read-only commands. Command line arguments. exit and exit status of a command. Logical operators for conditional execution. The test command and its shortcut. The if, while, for and case control statements. The set and shift commands and handling positional parameters. The here (<>) document. Simple shell program examples.

**Practical component:** Execution of Wildcards & UNIX Shell Programs

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

1. Apply the concepts of process scheduling to improve CPU utilization and identify various multi-threading models
2. Identify the need of policies, protection required in managing deadlock, main and virtual memory & various techniques in managing concurrent processes.
3. Apply the concept of paging & segmentation for effective memory management.
4. Apply the concepts of Unix system and file commands to perform various tasks in files and system.
5. Analyze the concepts of Wildcards and Shell Programming to write basic shell scripts and formulating regular expressions for Pattern matching

### Reference Books:

1. Sumitabha Das., Unix Concepts and Applications., 4th Edition., Tata McGraw Hill.
2. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 7th edition, Wiley-India, 2006
3. William Stallings, Operating System: Internals and Design Principles, Prentice Hall, 9<sup>th</sup> Edition, 2018.
3. W. Richard Stevens: Advanced Programming in the UNIX Environment, 2nd Edition, Pearson Education, 2005
4. Unix System Programming Using C++ - Terrence Chan, PHI, 1999.

### Web links and Video Lectures:

1. <https://academicearth.org/>
2. <https://archive.nptel.ac.in/courses/106/105/106105214/>

### ASSESSMENT STRUCTURE:

PCC	CIA	SEA	CIA (50)			<b>SEA Conduction: 100 M Reduced to: 50 M</b>	
				I	II		
Conduction	50	50	Written Test	50	50	Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module	
				Average of two tests – 25 Marks			
			Assignment	15			
			AAT	10			
			<b>Total – 50 marks</b>			<b>Total – 50 marks</b>	

#### i) CIA: 50%

<b>IA Test:</b> 2 IA tests - Each of 50 Marks	Average of 2 tests – scaled down to 25 M
<b>Assignment</b> – Two assignments – one for 10 marks and another for 5 marks	15 Marks
<b>Additional Assessment Tools (AAT)</b> – Oral /Online Quizzes, Presentations, Group discussions, Case studies, Term Paper, Open	10 Marks

ended experiments, Mini industrial/social/rural Projects, Two-minute video on latest topic, Short MOOC courses, Practical Orientation on Design thinking, creativity & Innovation, Participatory & Industry integrated learning, Practical activities, Problem solving exercises, Participation in seminars/academic events/symposia and any other activity	<b>Total</b>	<b>50 Marks</b>
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**ii) SEA : 50%**

<b>Theory Exam</b>	5 questions to answer each of 20 Marks 2 questions from each module with internal choice Student should answer one full question from each module	<b>20 M x 5 = 100 M reduced to 50 M</b>
		<b>Total</b>

# B.N.M. Institute of Technology

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## Department of Artificial Intelligence and Machine Learning

Semester: IV

**Database Management System (PCI)**

Credit: 3

<b>Course Code:</b>	22AML143	<b>CIA Marks:</b> 50
<b>Credits:</b>	<b>3:0:1:1</b>	<b>SEA Marks:</b> 50
<b>Total Number of Lecture Hours</b>	<b>50</b>	<b>SEA Duration:</b> 03

### Course Learning Objectives: The students will be able to

Understand fundamental concepts, terminology and application of databases, SQL and NoSQL

Design concepts and creation of relational databases using relation algebra.

Practice SQL programming through a variety of database problems.

Demonstrate the use of Normalization, concurrency and transactions in database.

<b>Module-1: Database System Concepts, Data Modeling</b>	<b>No. of Hours</b>	<b>Blooms cognitive Levels</b>
<p>Databases and Databases Users: Characteristics of database Approach, Advantages of using the DBMS Approach.</p> <p>Database System Concepts and Architecture: Data Models-Schemas and Instances, Three-Schema Architecture and Data Independence, Database Languages and Interfaces.</p> <p>Data Modeling Using the Entity-Relationship (ER) Model: Entity Types-Entity sets- Attributes and Keys, Relationship types – Relationship Sets – Roles and structural Constraints, Weak Entity Types.</p> <p><b>Practical component:</b> Draw ER Diagram for the following Databases using GitMind software. Order Database Library Database Bank Database</p>	10	<b>Understand CO1</b>

<b>Module-2: Relational Data Model and Relational Algebra</b>		
<p>Concept of relations, schema-instance distinction, keys, referential integrity and foreign keys, relational algebra operators: selection, projection, cross product, various types of joins, division, example queries, tuple relation calculus, domain relational calculus, converting the database specification in E/R notation to the relational schema</p> <p><b>Practical component:</b> Create Schema, insert at least 5 records in each table and add appropriate constraints for the following Library Database using ORACLE or MySQL DBMS under LINUX/Windows environment BOOK (Book_id, Title, Publisher_Name, Pub_Year) BOOK_AUTHORS (Book_id, Author_Name)</p>	10	<b>Apply CO2</b>

<p>PUBLISHER (Name, Address, Phone)          BOOK_COPIES (Book_id, Branch_id, No-of_Copies)          BOOK_LENDING (Book_id, Br_id, Card_No, Date_Out, Due_Date)          LIBRARY_BRANCH (Branch_id, Branch_Name, Address)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> <li>1. Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each branch, etc.</li> <li>2. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2020 to Jun 2022.</li> </ol> <p>Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation.</p>		
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<p><b>Module-3: SQL</b></p> <p><b>Basic SQL:</b> SQL Data Definition and Data Types, Specifying Constraints in SQL, Basic Retrieval Queries in SQL, INSERT – DELETE and UPDATE Statements in SQL, Additional features in SQL</p> <p><b>More SQL:</b> Complex Queries, Triggers, Views and Schema Modification: Complex SQL Retrieval Queries, Specifying Constraints as Assertions and actions as Triggers, Views (Virtual Tables) in SQL.</p> <p><b>Practical component:</b></p> <p>Create Schema, insert at least 5 records for each table and add appropriate constraints for the following Order Database using ORACLE or MySQL DBMS under LINUX/Windows environment.</p> <p>SALESMAN (Salesman_id, Name, City, Commission)          CUSTOMER (C_id, Cust_Name, City, Grade, Salesman_id)          ORDERS (Ord_No, Purchase_Amt, Ord_Date, C_id, S_id)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> <li>1. Count the customers with grades above Bangalore's average.</li> <li>2. Find the name and numbers of all salesman who had more than one customer.</li> <li>3. List all the salesman and indicate those who have and don't have customers in their cities (Use UNION operation.)</li> </ol> <p>Create a view that finds the salesman who has the customer with the highest order.</p>	10	Apply CO3
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<p><b>Module-4: Functional Dependencies and Normalization</b></p> <p>Basics of Functional Dependencies and Normalization for Relational Database: Functional Dependencies, Armstrong's axioms for FD's, Equivalent Decompositions, closure of a set of FDs, minimal covers, Normal forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce- Codd Normal Forms [BCNF]</p> <p><b>Practical component:</b></p> <p>Create Schema, insert at least 5 records for each table and add appropriate constraints for the following Company Database using ORACLE or MySQL DBMS under LINUX/Windows environment.</p> <p>EMPLOYEE (SSN, Name, Address, Sex, Salary, Super SSN, D No)          DEPARTMENT (D No, D Name, Mgr. SSN, Mgr. Start Date)          DLOCATION(D No, D Loc)</p>	10	Analyze CO4
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<p>PROJECT (P No, P Name, P Location, D No) WORKS_ON(SSN, P No, Hours)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> <li>1. Make a list of all project numbers for projects that involve an employee whose last name is ‘Scott’, either as a worker or as a manager of the department that controls the project.</li> <li>2. Show the resulting salaries if every employee working on the ‘IoT’ project is given a 10 percent raise.</li> </ol> <p>Find the sum of the salaries of all employees of the ‘Accounts’ department, as well as the maximum salary and the average salary in this department.</p>		
<b>Module-5: Transaction Processing, Concurrency Control, NoSQL</b>		
<p><b>Introduction to Transaction Processing</b> –Introduction to Transaction Processing, Desirable Properties on Transactions (ACID)</p>		
<p><b>Concurrency Control Techniques:</b> Transactions and Schedules, Serializability, Precedence Graphs, Concurrency, Lock Based Protocols: 2PL, Strict 2PL Protocols, Deadlocks - Detection and Prevention</p>	10	Analyze CO5
<p><b>NoSQL:</b> SQL v/s NoSQL, The Emergence of NoSQL, BASE Properties, Data Models: Relationships, Graph Database, Schema less Database.</p>		

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

1. Understand the Database System Concepts along with Data Modeling Using the Entity-Relationship (ER) Model
2. Apply the concepts of relations on RDBMS, constraints, joints using relational algebra operators.
3. Apply Structured Query Language for database manipulation.
4. Analyze functional dependencies to normalize relations of relational database.
5. Analyze transactions processing, schedules protocols, serializability issues, deadlocks in DBMS and concepts of NoSQL with its advantages

#### References:

1. Ramez Elmasari, Shamkant B Navathe “Fundamentals of Database Systems”, Pearson, Seventh Edition 2017.
2. “Database System Concepts”, Silberschatz, H Korth, S Sudarshan, 6th Edition, McGraw-Hill, 2010
3. Pramod J Sadalage, Martin Fowler, “NOSQL Distilled”, Pearson, 2013

## ASSESSMENT STRUCTURE:

PCI	CIA	SEA	CIA (50)			SEA Conduction: 100 M Reduced to: 50 M	
				I	II		
Conduction	50	50	Written Test	50	50	Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module	
				Average of two tests – 50 marks scaled down to 15 marks			
			Assignment	Average of 2 Assignments – 10M			
			Practical	Weekly Assessment – 10 Marks IA test – 15 Marks (IA test to be conducted for 50 M and scaled down to 15M)			
<b>Total – 50 Marks</b>					<b>Total – 50 Marks</b>		

### i) CIA: 50%

Theory	IA Test (Theory): 2 IA tests - each of 50 Marks – Average of 2 tests scaled down to 15 Marks <b>Assignment :</b> 2 Assignments – each of 10 marks	25 Marks
Lab	Weekly Assessment – 10 Marks <b>Practical test (1)</b> - 15 marks	25 Marks
<b>Total</b>		<b>Marks</b>

### ii) SEA : 50%

#### Question Paper:

Theory Exam	5 questions to answer, each of 20 Marks 2 questions from each module with internal choice Student should answer one full question from each module	20 M x 5 = <b>100 M</b> <b>Reduced to 50 M</b>
<b>Total</b>		<b>50 Marks</b>

# B.N.M. Institute of Technology

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## Department of Artificial Intelligence and Machine Learning

### SEMESTER – IV

#### DESIGN AND ANALYSIS OF ALGORITHMS

Credit : 4

Course Code	22AML144	CIA Marks	50
Teaching Hours/Week (L: T: P: J)	3:0:2:0	SEA Marks	50
Total Number of Lecture Hours	50	Exam Hours	03

#### Course Learning Objectives:

This course will enable students to

- Explain various computational problem solving techniques.
- Apply appropriate method to solve a given problem.
- Describe various methods of algorithm analysis.

	Number of Hours	Bloom's Level

#### Module-1: Introduction

**Introduction:** Notion of algorithm, Fundamentals of Algorithmic Problem Solving, Fundamentals

of the Analysis of Algorithmic Efficiency: Analysis frame work, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-recursive and Recursive Algorithms.

#### Practical:

1. Implement Coin Changing problem method and find the time required.
2. Write a program to find maximum profit using Knapsack technique.
3. Implement Job Sequence problem using Greedy method. Apply brute force/divide and conquer technique to recursively implement the following concepts:
  - a. Linear Search or Binary Search.
  - b. To find the maximum and minimum from a given list of n elements using Brute Force Method.
4. There are 5 books in the shelf, find the number of ways to select 3 books from 5 books on the shelf using the NCR with recursion.
5. Find the next three terms of the sequence 15, 23, 38, 61, ... Fibonacci series of the given number using recursion.
6. Demonstrate through a program how a sequence of characters is taken and checked for the possibility of the presence of the required string. If the possibility is found then, character matching is performed else no using Rabin Karp method.

6+4

(CO1)  
Apply

#### Module-2: Brute Force

**Brute Force:** Selection Sort and Bubble Sort, Sequential Search and Brute

<p>Force String Matching</p> <p>Divide and Conquer: General method, Binary search, Recurrence equation for divide and conquer, Finding the Maximum and Minimum, Merge sort, Quick sort, Strassen's matrix multiplication. Decrease and Conquer Approach: Topological Sort.</p> <p><b>Practical:</b></p> <ol style="list-style-type: none"> <li>1. Implement the Selection sort algorithm.</li> <li>2. Implement Bubble sort algorithm.</li> <li>3. Implement the Sequential Search algorithm.</li> <li>4. Implement the String Matching algorithm.</li> <li>5. Write a program to search a key in a given set of elements using Binary search method and find the time required to find the key.</li> <li>6. Write a program to find Maximum and Minimum using divide and conquer technique and find the time required to find the elements.</li> <li>7. Sort a given set of elements using Merge Sort method and determine the time required sort the elements. Plot a graph of number of elements versus time taken. Specify the time efficiency class of this algorithm.</li> <li>8. Sort a given set of elements using Quick Sort method and determine the time required sort the elements. Plot a graph of number of elements versus time taken. Specify the time efficiency class of this algorithm.</li> <li>9. Implement Topological sort using source removal method find the time required to sort the elements.</li> </ol>	<b>6+4</b>	<b>(CO1)</b> <b>Apply</b>
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### Module-3: Greedy Method

<p>Greedy Method: General method, Coin Change Problem, Knapsack Problem, Job sequencing with deadlines. Minimum cost spanning trees: Prim's Algorithm, Kruskal's Algorithm. Single source shortest paths: Dijkstra's Algorithm. Optimal Tree problem: Huffman Trees and Codes.</p> <p><b>Practical:</b></p> <ol style="list-style-type: none"> <li>1. Implement Coin Changing problem method and find the time required.</li> <li>2. Write a program to find maximum profit using Knapsack technique.</li> <li>3. Implement Job Sequence problem using Greedy method.</li> <li>4. Implement Prim's algorithm and Find Minimum Cost Spanning Tree of a given connected undirected graph.</li> <li>5. Implement Kruskal's algorithm and Find Minimum Cost Spanning Tree of a given connected undirected graph.</li> <li>6. Implement Dijkstra's algorithm find shortest paths to other vertices from a given vertex in a weighted connected graph.</li> </ol>	<b>6+4</b>	<b>(CO2)</b> <b>Apply</b>
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<b>Module-4: Dynamic Programming</b>		
<b>Dynamic Programming:</b> General method with Examples, Multistage Graphs. Transitive Closure: Warshall's Algorithm, All Pairs Shortest Paths: Floyd's Algorithm, Optimal Binary Search Trees, Knapsack problem, Bellman-Ford Algorithm, Travelling Sales Person problem, Reliability design.	<b>6+4</b>	<b>(CO2) Apply</b>
<b>Practical:</b>		
<ol style="list-style-type: none"> <li>1. Implement all-pairs shortest paths problem using Floyd's algorithm.</li> <li>2. Implement all-pairs shortest paths problem using Warshal's algorithm.</li> <li>3. Implement 0/1 Knapsack using Dynamic Programming.</li> <li>4. Implementation of Bellman Ford Algorithm using a directed graph.</li> <li>5. Implement Travelling Sales man problem using Dynamic Programming.</li> </ol>		
<b>Module-5: Backtracking</b>		
<b>Backtracking:</b> General method (T2:7.1), N-Queens problem, Sum of subsets problem, Graph coloring, Hamiltonian cycles. Programme and Bound: Assignment Problem, Travelling Sales Person problem, 0/1 Knapsack problem: LC Programme and Bound solution, FIFO Programme and Bound solution. NP- Complete and NP-Hard problems: Basic concepts, nondeterministic algorithms, P, NP, NP-Complete and NP-Hard classes	<b>6+4</b>	<b>(CO2) Apply</b>
<b>Practical:</b>		
<ol style="list-style-type: none"> <li>1. Implementation of N Queen Problem using Backtracking technique.</li> <li>2. Implementation of SUM-SUBSET Problem.</li> <li>3. Design and implement to find all Hamiltonian Cycles in a connected undirected Graph G of n vertices using the backtracking principle.</li> <li>4. Implementation Assignment Problem using Backtracking technique.</li> <li>5. Implementation of Travelling Sales Man Problem using Branch and Bound method.</li> <li>6. Implementation of Knapsack problem using Branch and Bound method.</li> </ol>		
<b>Course outcomes:</b>		
The students will able to		
<ol style="list-style-type: none"> <li>1. Understand the fundamentals of algorithms and develop an algorithm using appropriate design strategies for problem solving (Apply)</li> <li>2. Use various design techniques such as dynamic programming, greedy algorithm and back tracking to design algorithms for more complex problems and analyze their performance. (Apply)</li> <li>3. Estimate the computational complexity of different algorithms. (Apply)</li> <li>4. Analyze computational complexity of an algorithm to increase efficiency. (Analyze)</li> </ol>		
<b>Reference Books:</b>		
<ol style="list-style-type: none"> <li>1. Anany Levitin, Introduction to the Design and Analysis of Algorithms, Pearson, 2<sup>nd</sup> Edition, 2009]</li> </ol>		

- |   |
|---|
| 2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Introduction to Algorithms, PHI, 3rd Edition |
| 3. Ellis Horowitz, Satraj Sahni and Rajasekaran, Computer Algorithms/C++, Universities Press, 2nd Edition, 2014.          |

### **ASSESSMENT STRUCTURE:**

PCI	CIA	SEA	CIA (50)			SEA Conduction: 100 M Reduced to: 50 M		
				I	II	PART A	PART B	
Conduction	50	50	IA Test	30	30			
				Average of two tests – 30 M		30 Marks	70 Marks	
			Continuous Assessment	Weekly Assessment -20 marks				
				Total – 50 Marks		Total – 50 Marks		

#### **i) CIA: 50%**

<b>Test:</b> 2 IA tests - each of 30 Marks	Average of 2 tests – 30 M
<b>Practical</b> Lab record – 10 Marks Performance – 05 Marks Viva – 05 Marks	20 Marks
<b>Total 50 Marks</b>	

#### **ii) SEA : 50%**

##### **Question Paper:**

<b>Theory part</b>	5 questions to answer each of 6 Marks 2 questions from each module with internal choice Student should answer one full question from each module	6 M x 5 = 30 Marks
<b>Execution part</b>	Write up - 20 Marks Conduction - 40 Marks Viva-Voce - 10 Marks	70 Marks
<b>Total</b>		<b>100 Marks Reduced to 50 M</b>

##### **Note:**

- No Assignment and AAT

# B.N.M. Institute of Technology

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## Department of Artificial Intelligence and Machine Learning

### SEMESTER – IV

#### MACHINE LEARNING (PCI)

Credit: 3

Course Code	<b>22AML145</b>	CIA Marks	50
Teaching Hours/Week (L: T: P: J)	1:2:2:0	SEA Marks	50
Total Number of Lecture Hours	50	Exam Hours	03

#### Course Learning Objectives:

This course will enable students to

- Define Machine learning and understand the basic theory underlying machine learning.
- Differentiate supervised and unsupervised learning
- Understand the Linear Models for Regression and Classification
- Understand the basic concepts of learning and decision trees.
- Understand Bayesian techniques for problems appear in machine learning.

	Number of Hours	Bloom's Level

#### Module-1

**Machine learning Landscape:** ML Concepts, Uses of ML, Types of ML, Main challenges of ML

**End to end Machine learning Project:** Working with real data, look at the Big picture, Get the data, Discover and visualize the data, Prepare the data for ML Algorithm, Select and train the model, Fine tune your model.

#### Practical:

1. Demonstrate Preprocessing (Data Cleaning, Integration and Transformation) activity on suitable data: For example: Identify and Delete Rows that Contain Duplicate Data by considering an appropriate dataset. Identify and Delete Columns That Contain a Single Value by considering an appropriate dataset.

**10**

(CO1)  
Apply

#### Module-2

**Concept learning and Learning Problems:** Concept Learning Task – Find S - Version Spaces and Candidate Elimination Algorithm.

**Classification:** MNIST, training a Binary classifier, performance measure, multiclass classification, error analysis, multi label classification, multi output classification.

#### Practical:

1. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm. Output a description of the set of all hypotheses consistent with the training examples.
2. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file and show the output for test cases. Develop an interactive program by comparing the result by implementing LIST THEN ELIMINATE algorithm.

**10**

(CO2)  
Apply

<b>Module-3</b>		
<b>Linear Models for Regression:</b> Linear Regression, Polynomial Regression, Logistic Regression <b>Linear Models for Classification:</b> Training a Binary Classifier, Performance Measures, Measuring Accuracy Using Cross-Validation, Confusion Matrix, Precision and Recall, Tradeoff.	<b>10</b>	(CO3) Apply
<b>Practical:</b>		
1. Write a python program to predict home prices using Linear Regression. 2. Write a python program to predict the weather using parameters with Linear Regression		
<b>Module-4</b>		
<b>Decision Tree Learning:</b> Introduction, Decision Tree Representation, Appropriate Problem for Decision Tree Learning, The basic Decision Tree Learning Algorithm, Hypothesis Space Search in Decision Tree Learning, Issues in Decision Tree Learning <b>Ensemble learning and Random Forest</b> Voting Classifiers, Bagging and Pasting, Random Patches, Random Forests, Boosting, Stacking.	<b>10</b>	(CO5) Apply
<b>Practical:</b>		
1. Implement an automated customer information system to direct the customer to correct department based on preference using Decision Trees 2. Write a python program to decide whether the budget of a company is exceeding or not with decision trees, with a sample dataset		
<b>Module-5</b>		
<b>Bayesian Learning:</b> Introduction, Bayes theorem, Bayes theorem and Concept Learning, Naïve Bays Classifier, Bayesian Belief Network, EM Algorithm.		
<b>Practical:</b>		
1. Implement Bayes' Theorem for the following problem statement: In XYZ University, admissions for the departments IT, CSE, AIML are 75%, 85%, and 90% respectively in the previous year. In the total of their output 5, 3, 2 percent are slow learner's students. A student is taken at random from the department and is found to be slow learners. What are the probabilities that it was from the department IT, CSE, AIML?	<b>10</b>	(CO5) Apply
<b>Course outcomes:</b>		
The students will able to:		
1. Apply the concepts of Machine Learning and theory underlying machine learning. (Apply) 2. Apply the data to understand the distribution of the data. (Apply) 3. Apply Linear Models for Regression and Classification to classify the data. (Apply) 4. Demonstrate the working of various algorithms with respect to training and test data sets. (Apply) 5. Analyze the problems on Decision tree, Bayesian and Instant learning techniques. (Apply)		
<b>Reference Books:</b>		
1. Aurelien Geron, "Hands-on Machine Learning with Scikit-Learn, Keras and TensorFlow", O'Reilly 2019. 2. Tom M. Mitchell, "Machine Learning", McGraw Hill Education (India) Edition, 2013.		

## ASSESSMENT STRUCTURE:

PCI	CIA	SEA	CIA (50)			SEA Conduction: 100 M Reduced to: 50 M	
				I	II		
Conduction	50	50	Written Test	50	50	Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module	
			Average of two tests – 50 marks scaled down to 15 marks				
			Assignment	Average of 2 Assignments – 10M			
			Practical	Weekly Assessment – 10 Marks IA test – 15 Marks (IA test to be conducted for 50 M and scaled down to 15M)			
<b>Total – 50 Marks</b>						<b>Total – 50 Marks</b>	

### i) CIA: 50%

Theory	<b>IA Test (Theory):</b> 2 IA tests - each of 50 Marks – Average of 2 tests scaled down to 15 Marks <b>Assignment :</b> 2 Assignments – each of 10 marks	25 Marks
Lab	<b>Weekly Assessment</b> – 10 Marks <b>Practical test (1)</b> - 15 marks	25 Marks
<b>Total</b>		<b>50 Marks</b>

### ii) SEA : 50%

#### Question Paper:

<b>Theory Exam</b>	5 questions to answer, each of 20 Marks 2 questions from each module with internal choice Student should answer one full question from each module	20 M x 5 = <b>100 M</b> <b>Reduced to 50 M</b>
<b>Total</b>		<b>50 Marks</b>

# B.N.M. Institute of Technology

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## Department of Artificial Intelligence and Machine Learning

### SEMESTER – IV

#### Python Programming and Applications (PBL)

Credit: 2

Course Code	22AML146	CIA Marks	50
Teaching Hours/Week (L: T: P: J)	0:0:2:2	SEA Marks	50
Total Number of Lecture Hours	30	Exam Hours	03

#### Course Learning Objectives:

This course will enable students to

1. Acquire knowledge and programming skills in python to solve problems in various domains using different tools.
2. Understand the representation and use of primitive data types, operators, control structure, and built-in data structures.
3. Develop the ability to write database applications and perform file handling, exception handling and using Python.
4. Develop Graphical user interfaces and develop application to read/write data from/to files in python.

	Number of Hours	Bloom's Level

#### Task – 1

##### Python introduction, data types, operators, flow control and exception handling in Python

- Write a program to demonstrate different number datatypes in python.
- Write a program to perform different arithmetic operations on numbers in python.
- Write a python program to find the square root.
- Write a python program to calculate the area of a triangle.
- Write a python program to generate a random number.
- Write a python program to find largest of three numbers.
- Write a python program to print a number is positive/negative using if-else.

2

(CO1)  
Apply

#### Task – 2

##### Functions, passing parameters and return values

- Write a python program to find factorial of a given number using functions
- Write a program to double a given number and add two numbers using lambda()
- Defined as a function F as  $F_n = F_{n-1} + F_{n-2}$ . Write a Python program

2

(CO1)  
Apply

<p>which accepts a value for N (where N &gt;0) as input and pass this value to the function. Display suitable error message if the condition for input value is not followed.</p> <ul style="list-style-type: none"> <li>• Develop a python program to convert binary to decimal, octal to hexadecimal using functions.</li> </ul>		
<b>Task – 3</b>		
<b>String Related Operations</b>		
<ul style="list-style-type: none"> <li>• Write a python program to create, concatenate and print a string</li> <li>• Write a Python program to print substring from a given string.</li> <li>• Write a Python program that accepts a sentence and find the number of words, digits, uppercase letters and lowercase letters.</li> <li>• Write a Python program to find the string similarity between two given strings</li> </ul>	2	<b>(CO1) Apply</b>
<b>Task – 4</b>		
<b>Lists, List Processing, Tuples, and Dictionaries.</b>		
<ol style="list-style-type: none"> <li>a. Write a python program to print duplicates from a list of integers and remove them from the list.</li> <li>b. Write a python program to create a list and perform the following methods 1) insert() 2) remove() 3) append() 4) len() 5) pop() 6) clear().</li> <li>c. Write a python program to create a tuple and perform the following methods 1) Add items 2) len() 3) check for item in tuple 4) Access items</li> <li>d. Write a python program to create a dictionary and apply the following methods 1) Print the dictionary items 2) access items 3) use get() 4) change values 5) use len()</li> <li>e. Write a python program that takes two lists and returns True if they are equal otherwise false</li> </ol>	4	<b>(CO2) Apply</b>
<b>Task – 5</b>		
<b>Pattern Matching with Regular Expression</b>		
<ul style="list-style-type: none"> <li>• Write a function called isphonenumber () to recognize a pattern 415-555-4242 without using regular expression and also write the code to recognize the same pattern using regular expression.</li> <li>• Develop a python program that could search the text in a file for phone numbers (+919900889977) and email addresses (<a href="mailto:sample@gmail.com">sample@gmail.com</a>)</li> <li>• Write a python program to match parenthesis in the given equation.</li> <li>• Write a Python program to match string using regular expression.</li> </ul>	2	<b>(CO3) Apply</b>
<b>Task – 6</b>		
<b>File Handling</b>		
<ul style="list-style-type: none"> <li>• Write a python program to open and write “hello world” into a file?</li> <li>• Write a program to count frequency of characters in a given file. Can you use character frequency to tell whether the given file is a Python program file, C program file or a text file?</li> <li>• Write a python program to open a file and check what are the access permissions acquired by that file using os module?</li> <li>• Write a script named copyfile.py. This script should prompt the user for the names of two text files. The contents of the first the second file.</li> </ul>	4	<b>(CO3) Apply</b>

<ul style="list-style-type: none"> <li>Write a program that inputs a text file. The program should print all of the unique words in the file in alphabetical order</li> </ul>		
<b>Task – 7</b>		
<b>Classes, methods, objects, inheritance, polymorphism, overriding</b> <ul style="list-style-type: none"> <li>By using the concept of inheritance write a python program to find the area of triangle, circle and rectangle.</li> <li>Write a python program by creating a class called Employee to store the details of Name, Employee_ID, Department and Salary, and implement a method to update salary of employees belonging to a given department.</li> <li>Write a python program to find the whether the given input is palindrome or not (for both string and integer) using the concept of polymorphism and inheritance.</li> </ul>	4	(CO4) Apply
<b>Task – 8</b>		
<b>Working with excel spreadsheets and web scraping</b> <ul style="list-style-type: none"> <li>Demonstrate python program to read the data from the spreadsheet and write the data in to the spreadsheet</li> <li>Write a Program to append data into spreadsheet.</li> <li>Write a python program to download the all XKCD comics</li> </ul>	4	(CO5) Apply
<b>Task – 9</b>		
<b>Working with PDF, word and JSON files, Sending Email and Text Messages</b> <ul style="list-style-type: none"> <li>Write a python program to combine select pages from many PDFs</li> <li>Write a python program to fetch current weather data from the JSON file.</li> <li>Write a Python program to send e-mail,</li> <li>Write a Python program to send message updates.</li> </ul>	4	(CO5) Apply
<b>Task – 10</b>		
<b>Image Processing</b> <ul style="list-style-type: none"> <li>Write a python program to perform open(), show(), rotate() and convert to grayscale image by processing any image.</li> <li>Write a python program to print thumbnails, resize() the image by processing any image.</li> <li>Write a python program to convert an image to ASCII image in Python.</li> <li>Write a python program to plot solar image and flipping any image.</li> <li>Write a python program to load an image in grayscale mode. By grayscale mode, convert this image to a black &amp; white image composing by shades of gray and count white dots on a black background.</li> </ul>	2	(CO5) Apply
<b>Mini Project</b>		
<ul style="list-style-type: none"> <li>Develop real world application using Python for selected problem statement.</li> <li>The problem statement can be selected from the following title but not limited to the same.</li> </ul> <p>Temperature converter tool</p>		

Stock investment tracker Election simulator High-scores tracker Dice Rolling Simulator	
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**Course outcomes:**

The students will be able to

1. Demonstrate proficiency in handling of loops and creation of functions.
2. Identify the methods to create and manipulate lists, tuples and dictionaries.
3. Discover the commonly used operations involving regular expressions and file system.
4. Interpret the concepts of Object-Oriented Programming as used in Python.
5. Determine the need for scraping websites and working with PDF, JSON and other file formats.

**Reference Books:**

1. Al Sweigart, "Automate the Boring Stuff with Python", 1st Edition, No Starch Press, 2015
2. Reema Thareja "Python Programming Using Problem Solving Approach" Oxford University Press.
3. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Green Tea Press, 2015.
4. Guido van Rossum and the Python development team, Python Tutorial Release 3.7.0, September 02, 2018.
5. Wesley J. Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education, 2016

**Assessment Structure:**

PBL	CIA	SEA	CIA (50)			SEA Conduction: 100 M Reduced to: 50 M
Conduction	50	50	Theory I IA 25 Average of 2 tests – 25 M Practical Weekly Assessment (Record/Project) – 10 Marks Lab IA test – 15 Marks	II IA 25	Total – 50 Marks	Project Assessed for 100 marks reduced to 50 Marks

**i) CIA: 50%**

Theory - 2 IA tests - Each of 25 Marks	25 Marks
Practical	
Weekly Assessment - Lab record/Project – 10 Marks Lab IA test – 15 Marks	25 Marks
	Total – 50 Marks

**ii) SEA : 50%**

Project	Write up – 10 Marks Project report – 25 Marks Presentation & Demonstration - 50 Marks Viva-Voce – 15 Marks	100 Marks Reduced to 50 Marks
		Total – 50 Marks



# B.N.M. Institute of Technology

An Autonomous Institution under VTU

Semester: III / IV		
<b>COURSE: CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS</b>		
<b>Course Code:</b> 22CIP147	<b>L:T:P:J:</b> 1:0:0:0	<b>CIA Marks:</b> 50
<b>Credits:</b>	1	<b>SEA Marks:</b> 5 0
<b>Hours:</b>	15 hrs	<b>SEA Duration:</b> 2Hrs
<b>Course Learning Objectives:</b> The students will be able to		
1	know the fundamental political codes, structure, procedures, powers, and duties of Indian government institutions, fundamental rights, directive principles, and the duties of citizens	
2	know the Indian top civil service positions and the exams conducted by UPSC and SPSC for the same	
3	Understand engineering ethics and their responsibilities; identify their individual roles and ethical responsibilities towards society.	
<b>MODULE 1: Introduction to Indian Constitution</b>		<b>RBT</b>
The Necessity of the Constitution, Introduction to Indian Constitution, The Making of the Constitution, Role of Constituent Assembly, Preamble and Salient features of the Constitution of India, Fundamental Rights and its Restriction and limitations in different complex situations, Directive Principles of State Policy, Fundamental Duties.		1,2,3
<b>MODULE 2: System of Government, Central Government, State Government</b>		<b>RBT</b>
System of Government-Parliamentary System, Federal System. Central Government-Basic details, Powers and Functions of Union Executive. Parliament- LS and RS (Composition, Duration, Membership and Presiding officers of Parliament and their functions). Leaders in Parliament (Leader of the House and Leader of the Opposition). Sessions of Parliament (Summoning, Adjournment, Adjournment Sine Die, Prorogation, Dissolution). Quorum of House, Language in Parliament, Joint sitting of two Houses. State Government-Basic details, Powers and Functions of State Executive. State Legislature (Composition, Duration, Membership and Presiding officers of Parliament and their functions).		1,2,3
<b>MODULE 3: Judiciary, Amendments and Emergency Provisions</b>		<b>RBT</b>
Supreme Court, High Court, Judicial Review, Judicial Activism. Methods in Constitutional Amendments (How and Why). Types of Emergencies and its Consequences, Recent Amendments to the Constitution.		1,2,3
<b>MODULE 4: Elections, Constitutional and Non Constitutional Bodies</b>		<b>RBT</b>
Elections- Election Commission of India, Electoral Process. Constitutional Bodies- Election Commission, Union Public Service Commission, State Public Service Commission, Goods and Service Tax Council. Non Constitutional Bodies- Central Information Commission, State Information Commission.		1,2,3

<b>MODULE 5: Professional Ethics</b>	<b>RBT</b>	<b>Hrs</b>
Scope & Aims of Engineering & Professional Ethics, Positive and Negative Faces of Engineering Ethics, Responsibilities in Engineering, the impediments to Responsibility. Trust and Reliability in Engineering, Risks, Safety and liability in Engineering, Clash of Ethics, IPRs (Intellectual Property Rights)	1,2,3	3

**Course outcome:** On completion of this course, students will be able to,

CO1: Have constitutional knowledge and legal literacy.

CO2: Have knowledge on All India Services and State Civil Services.

CO3: Understand Engineering and Professional Ethics and responsibilities of Engineers.

### **Reference Books**

#### **Suggested Learning Resources:**

##### **1. Title of the Book - Indian Polity**

Name of the Author - M Lakshmikanth

Name of the Publisher-Mc Graw Hill Education

Edition and Year- 2019

##### **2. Title of the Book - Engineering Ethics**

Name of the Authors - M. Govindarajan, S.Natarajan, V.S. Senthilkumar

Name of the Publisher- Prentice-Hall

Edition and Year-2004

##### **3. Durga Das Basu (DD Basu):** “Introduction to the Constitution on India”, (Students Edition.)

Prentice –Hall EEE, 19th / 20th Edn., (Latest Edition) or 2008.

##### **4. Shubham Singles, Charles E. Haries, and Et al :** “Constitution of India and Professional Ethics” by Cengage Learning India Private Limited, Latest Edition – 2018.

##### **5. M.Govindarajan, S.Natarajan, V.S.Senthilkumar,** “Engineering Ethics”, Prentice –Hall of IndiaPvt. Ltd. New Delhi, 2004

##### **6. M.V.Pylee,** “An Introduction to Constitution of India”, Vikas Publishing, 2002.

##### **7. Latest Publications of NHRC - Indian Institute of Human Rights,** New Delhi.

### **Web Links and Video Lectures**

[www.unacademy.com/lesson/future-perfect-tense/YQ9NSNQZ](http://www.unacademy.com/lesson/future-perfect-tense/YQ9NSNQZ) <https://successesacademy>

### **Question paper pattern for SEA and CIA.**

- The SEA question paper will be set for 50 marks and the pattern of the question paper will be objective type (MCQ).
- The CIA question paper will be set for 50 marks and the pattern of the question paper will be objective type (MCQ).

**Final Marks = CIA + SEA = 50+50 = 100 Marks**

## **Class Internal Assessment**

IA1	Objective type questions 50Marks	Average of 2 IA will be taken 50Marks
IA2	Objective type questions 50Marks	
	<b>Total CIA</b>	<b>50 Marks</b>

## **Semester End Assessment**

Semester end Exam	Objective type questions 50Marks	50 Marks
	<b>Total SEA</b>	<b>50 Marks</b>

**Final Marks = CIA + SEA = 50+50 = 100 Marks**

*BNM Institute of Technology*

**Syllabus for Softskills-2**

**SEMESTER – IV**

<b>Subject Name</b>	Softskills-2 (Aptitude Quantitative & Logical)	<b>Weekly Assignments</b>	20
<b>Subject Code</b>	22SFT148	<b>Written / Online Test</b>	30
<b>Number of Contact Hours/Week</b>	3	<b>Final Assessment</b>	50
<b>Total Number of Contact Hours</b>	36	<b>Credits</b>	1
<b>Module 1 (Quantitative Aptitude - 1)</b>	<b>Number System</b> - Classification of Numbers, Multiple and factors, Divisibility Rules		
	<b>HCF &amp; LCM</b> , Squares and Cubes.		
	<b>Profit &amp; Loss</b> - Concepts of SP, CP, Profit, Loss, Gain or Loss %.		
	<b>Profit &amp; Loss</b> - Marked Price & Discount problems, Successive Discount.		
	<b>Percentages</b> – Percent To Decimal Or Fraction Conversion, Inverse Case – Value From Percentage, relative Percentage		
	<b>Averages</b> - Understanding Averages & solving problems.		
<b>Module 2 (Quantitative Aptitude - 2)</b>	<b>Ratios</b> - Duplicate and Triplicate Ratio, Direct and Indirect variation		
	<b>Proportion</b> - Direct Indirect proportion and relation.		
	<b>Simple Interest</b> - Simple Interest, Basic Difference b/w both the Interests		
	<b>Compound Interest</b> - CI with a Fractional Rate, to find Instalments.		

<b>Module 3</b> <b>(Quantitative Aptitude - 3)</b>	<b>Speed Time &amp; Distance</b> - Important formulas, Relative Speed.
	<b>Speed Time &amp; Distance</b> - Understanding Units & Conversion of units
	<b>Time &amp; Work</b> - Introduction and Concept, Important Time and Work Formula, Work Done
	<b>Time &amp; Work</b> - Rate of Work, Time Taken, If a piece of work is done in x number of days
	<b>Data Interpretation</b> - Bar Graph, Tabular Form, Line Chart, case let Form
	<b>Data Interpretation</b> - Pie Chart, Radar/Web, and Missing Data Interpretation.
	<b>Probability</b> – Understanding concepts and important formulas.
<b>Module 4</b> <b>(Logical - 1)</b>	<b>Probability</b> – Understanding types of problems on probability
	Problems on Syllogisms
	Problems on Assumptions
	<b>Logical Puzzles</b> - K-level thinking
	<b>Logical Puzzles</b> - Arithmetic Puzzles
	Stick Puzzles
	<b>Series Completion</b> - Basics of Next no, Missing no and Wrong no and problems on that.
<b>Module 5</b> <b>(Logical - 2)</b>	Solving various types of Letter series and understanding different types.
	<b>Problem on Ages</b> - Understanding concepts and basic formula along with solving different types of problems.
	<b>Problem on Ages</b> - Tips and Tricks to Solve Problems on Ages

<b>Module 6 (Logical - 3)</b>	<b>Blood Relation</b> - Generation Tree, Family Tree Problems.
	<b>Blood Relation</b> - Statement Based Questions, Coded Blood Relation Question.
	<b>Coding &amp; Decoding</b> - Concept of EJOTY, Opposite Letter, Reversing the alphabets.
	<b>Coding &amp; Decoding</b> - Jumbling of Letter, Finding Codes of Derivatives.
	<b>Clocks</b> – Understanding concepts and basic formula along with solving different types of problems.
	<b>Calendar</b> - Understanding concepts and basic formula along with solving different types of problems.
	<b>Image Analysis</b> - Paper cutting & Folding, Mirror & Water Image, Cubes and Dice, Analogy, Find the odd one out, Rule Detection
	<b>Odd Man Out</b> - Following certain patterns and groups.
	Identifying the errors/odd one in the group.

**Evaluation Methodology:**

	<b>Components</b>	<b>Description</b>	<b>Maximum Marks to be Scored</b>	<b>Minimum Marks to be Scored</b>
<b>CIA (100)</b>	Weekly Assignments	Weekly assignments should be conducted on the topics completed every week	20	8
	Written / Online Test	Minimum of 15 practice tests to be conducted on vendor platform	30	12
	Final Assessment	Final MCQ's Test conducted in College during final IA for 70 Questions. <i>Students have to answer 50 Questions</i>	50	20
	<b>Total Marks for the Course</b>		<b>100</b>	<b>40</b>

# B.N.M. Institute of Technology

An Autonomous Institution under VTU, Approved by AICTE

## Department of Artificial Intelligence and Machine Learning

### SEMESTER – V

#### Software Engineering, Project Management and Finance (PCC)

Credit : 3

Course Code	22AML151	CIA Marks	50
Teaching Hours/Week (L: T: P: J)	3:0:0:0	SEA Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

#### Course Learning Objectives:

This course will enable students to

- Identify ethical and professional issues and explain why they are of concern to software engineers.
- Recognize the importance of software maintenance and describe the intricacies involved in software evolution.
- Apply estimation techniques, schedule project activities and compute pricing.
- Identify software quality parameters and quantify software using measurements and metrics.
- Recognize the need for agile software development, describe agile methods, apply agile practices and plan for agility.

	Number of Hours	Bloom's Level

#### Module-1: Introduction

**Introduction:** Software Crisis, Need for Software Engineering. Professional Software Development, Software Engineering Ethics. Case Studies.

**Software Processes:** Models: Waterfall Model, Incremental Model and Spiral Model, Process activities.

**Requirements Engineering:** Requirements Engineering Processes, Functional and non-functional requirements.

The software Requirements Document, Requirements Specification, Requirements validation, Requirements Management

8

(CO1)  
Apply

#### Module-2: System Models, Design and Implementation, Software Testing

**System Models:** Structural models, Behavioral models, UML modeling using StarUML tool.

8

(CO2)  
Apply

**Design and Implementation:** Introduction to RUP, Design Principles

**Software Testing:** Development testing, Test-driven development, Release testing, User testing.

#### Module-3: Project management, Project Planning, Quality management

**Project management:** Risk management, Managing People, Teamwork.

8

(CO3)  
Apply

**Project Planning:** Software pricing, Plan-driven development, Project scheduling: Estimation techniques,

**Quality management:** Software quality, Reviews and inspections, Software measurement and metrics, Software standards

<b>Module-4: Agile Software Development</b>		
<b>Agile Software Development:</b> Coping with Change, The Agile Manifesto: Values and Principles. Agile methods: SCRUM (Ref —The SCRUM Primer, Ver 20.) and Extreme Programming. Plan-driven and agile development. Agile project management, Scaling agile methods.	8	(CO4) Apply
<b>Module-5: Managing Project Finances</b>		
<b>How to Manage Project Finances</b> -Cost estimating: Work Breakdown Structure, Cost budgeting: Cost Aggregation, Reserve Analysis, Parametric estimating, Infrastructure and overheads, Cost control: Change Control, Resource Management <b>Performance Measurement and Analysis</b> - Cost Variance, Earned Value, Schedule Variance, Cost Performance Index, Schedule Performance Index. Forecasting, Introduction of Tools to manage project Finances-TouchBase Project Financials	8	(CO5) Apply
<b>Course outcomes:</b> <ol style="list-style-type: none"> <li>Understand the activities involved in software engineering and identify the role of various process models.</li> <li>Design a software system, component, or process to meet desired needs within realistic constraints and describe various software testing methods</li> <li>Illustrate the role of project planning and quality management in software development.</li> <li>Describe agile project management and benefits of using agile approaches.</li> <li>Understanding financial concepts and apply it to control Project Costs.</li> </ol>		
<b>Reference Books:</b> <ol style="list-style-type: none"> <li>Software Engineering Ian Sommerville Pearson Education 9th Edition, 2012</li> <li>Software Engineering-A Practitioner approach Roger S. Pressman Tata McGraw Hil 7th Edition</li> <li>An Integrated Approach to Software Engineering Pankaj Jalote Wiley India</li> <li>A guide to the project Management body of knowledge- PMBOK guide , 7<sup>th</sup> edition</li> </ol>		

### ASSESSMENT STRUCTURE:

PCC	CIA	SEA	CIA (50)				SEA Conduction: 100 M Reduced to: 50 M	
				I	II	III		
Conduction	50	50	Written Test	30	30	30	Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module	
				Average of 3 tests – 30 Marks				
			Assignment	10				
			AAT	10				
			Total – 50 marks					
							Total – 50 marks	

#### i) CIA: 50%

IA Test: 3 IA tests - Each of 30 Marks	Average of 3 tests
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<b>Assignment</b> – One assignments – for 10 marks	10 Marks
<b>Additional Assessment Tools (AAT)</b> – Oral /Online Quizzes, Presentations, Group discussions, Case studies, Term Paper, Open ended experiments, Mini industrial/social/rural Projects, Two-minute video on latest topic, Short MOOC courses, Practical Orientation on Design thinking, creativity & Innovation, Participatory & Industry integrated learning, Practical activities, Problem solving exercises, Participation in seminars/academic events/symposia and any other activity	10 Marks
<b>Total</b>	<b>50 Marks</b>

**ii) SEA : 50%**

<b>Theory Exam</b>	5 questions to answer each of 20 Marks 2 questions from each module with internal choice Student should answer one full question from each module	<b>20 M x 5 = 100 M reduced to 50 M</b>
		<b>Total</b> <b>50 Marks</b>

# B.N.M. Institute of Technology

An Autonomous Institution under VTU, Approved by AICTE

## Department of Artificial Intelligence and Machine Learning

### SEMESTER – V

#### Automata Theory and Computations (PCC)

Credit : 3

Course Code	22AML152	CIA Marks	50
Teaching Hours/Week (L: T: P: J)	2:1:1:0	SEA Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

#### Course Learning Objectives:

This course will enable students to

- Introduce core concepts in automata and theory of computation.
- Identify different formal language classes and their relationships.
- Design grammars and recognizers for different formal languages.
- Prove or disprove theorems in automata theorem using their properties.
- Determine the decidability and intractability of Computational problems.
- Design and develop lexical analyzers and parsers.

	Number of Hours	Bloom's Level

#### Module-1: Introduction

Why study the Theory of Computation, Languages and Strings: Strings, Languages. A Language Hierarchy, Computation, Finite State Machines (FSM): Deterministic FSM, Regular languages, Designing FSM, Nondeterministic FSMs, Minimizing FSMs, Canonical form of Regular languages, Finite State Transducers, Bidirectional Transducers.

**Use Case:** Construct different kinds of FSM using JFLAP

- Python program to construct a DFA which accept the language  $L = \{anbm \mid n \bmod 2=0, m \geq 1\}$
- Python program to construct nfa for the language nfa  $(a|b)^*abb$

8 (CO1)  
Apply

#### Module-2: Regular Expressions & Languages

Regular Expressions (RE): Introduction to RE, Kleene's theorem, Applications of REs, Manipulating and Simplifying REs. Regular Grammars: Definition, Regular Grammars and Regular languages. Regular Languages (RL) and Non regular Languages: How many RLs, To show that a language is regular, Closure properties of RLs, to show some languages are not RLs.

**Use Case:** Develop regular grammars and check closure properties using JFLAP

- Python program for matching a Regular Expression.
- Python program for Regular Grammar.

8 (CO1)  
Apply

<b>Module-3: Context-Free Grammars &amp; Pushdown Automata</b>		
<b>Context-Free Grammars(CFG):</b> Introduction to Rewrite Systems and Grammars, CFGs and languages, designing CFGs, simplifying CFGs, proving that a Grammar is correct, Derivation and Parse trees, Ambiguity, Normal Forms.	8	(CO2) Apply
<b>Pushdown Automata (PDA):</b> Definition of non-deterministic PDA, Deterministic and Non-deterministic PDAs, Non determinism and Halting, alternative equivalent definitions of a PDA, alternatives that are not equivalent to PDA.		
<b>Use Case:</b> Construct PDA for the context free grammar using JFLAP <ul style="list-style-type: none"> <li>Derive a parse tree using python programming</li> <li>Construct a PDA using python programming for a set of languages</li> </ul>		
<b>Module-4: Turing Machine</b>		
<b>Turing Machine:</b> Turing machine model, Representation, Language acceptability by TM, design of TM, Techniques for TM construction. Variants of Turing Machines (TM), The model of Linear Bounded automata. <b>Decidability:</b> Definition of an algorithm, decidability, decidable languages, Undecidable languages, halting problem of TM, Post correspondence problem. <b>Complexity:</b> Growth rate of functions, the classes of P and NP, Quantum Computation: quantum computers, Church-Turing thesis. Applications: G.1 Defining syntax of programming language.	8	(CO3) Apply
<b>Use Case:</b> Construct Turing machine and check decidability and undecidability of languages using JFLAP <ul style="list-style-type: none"> <li>Construct a DTM which matches all strings beginning with '0's, and followed by the same number of '1's</li> <li>Turing machine for the language <math>L = \{a^m b^n a^m b^n \mid m, n \geq 0\}</math></li> </ul>		
<b>Module-5: Lexical Analysis &amp; Syntax Analysis</b>		
<b>Lexical Analysis:</b> role of lexical analyzer, input buffering, specification of tokens, recognition of tokens, language for specifying lexical analyzers, from Regular expression to NFA, design of lexical analyzer generator.	8	(CO4) Apply
<b>Syntax analysis:</b> role of parser, top down parsing, bottom up parsing, operator precedence parsing, LR parsers, parser generators		
<b>Use Case:</b> Apply Automata concepts to check syntax of programming language. <ul style="list-style-type: none"> <li>Implement lexical analyzer using python</li> </ul>		
<b>Course outcomes:</b> The students will be able to: <ol style="list-style-type: none"> <li>Apply the core concepts of Automata Theory and Computation and convert different automata models, Regular Expressions to FSM. (Apply)</li> <li>Develop Grammars and Automata for different language classes. (Apply)</li> <li>Apply the concept of Turing machine, decidability and undecidability on the grammar (Apply)</li> <li>Design and develop lexical analyzers and parsers. (Apply)</li> <li>Analyze different type for models using simulators (Analyze)</li> </ol>		

**Reference Books:**

1. Elaine Rich, Automata, Computability and Complexity, 1<sup>st</sup> Edition, Pearson education, 2012/2013
2. K L P Mishra, N Chandrasekaran , 3rd Edition, Theory of Computer Science, PHI, 2012.
3. John E Hopcroft, Rajeev Motwani, Jeffery D Ullman, Introduction to Automata Theory, Languages, and Computation, 3rd Edition, Pearson Education, 2013
4. Alfred V Aho, Monica S Lam, Ravi Sethi, Jeffrey D. Ullman, Compilers-Principles, Techniques and Tools, Pearson, 2<sup>nd</sup> Edition, 2007.

**ASSESSMENT STRUCTURE:**

PCC	CIA	SEA	CIA (50)				SEA Conduction: 100 M Reduced to: 50 M	
				I	II	III		
Conduction	50	50	Written Test	30	30	30	Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module	
				Average of 3 tests – 30 Marks				
			Assignment	10				
			AAT	10				
Total – 50 marks				Total – 50 marks				

**i) CIA: 50%**

IA Test: 3 IA tests - Each of 30 Marks	Average of 3 tests
Assignment – One assignments – for 10 marks	10 Marks
Additional Assessment Tools (AAT) – Oral /Online Quizzes, Presentations, Group discussions, Case studies, Term Paper, Open ended experiments, Mini industrial/social/rural Projects, Two-minute video on latest topic, Short MOOC courses, Practical Orientation on Design thinking, creativity & Innovation, Participatory & Industry integrated learning, Practical activities, Problem solving exercises, Participation in seminars/academic events/symposia and any other activity	10 Marks
Total	50 Marks

**ii) SEA : 50%**

<b>Theory Exam</b>	5 questions to answer each of 20 Marks 2 questions from each module with internal choice Student should answer one full question from each module	<b>20 M x 5 = 100 M reduced to 50 M</b>
	<b>Total</b>	<b>50 Marks</b>

# B.N.M. Institute of Technology

An Autonomous Institution under VTU

## Department of Artificial Intelligence and Machine Learning

### Computer Networks and Security (PCI)

Credit: 4

#### SEMESTER– V

Course Code	22AML153	CIE Marks:	50
Teaching Hours/Week (L: T: P: J)	3:0:2:0	SEE Marks:	50
Total Number of Lecture Hours	50	SEE Duration:	3 Hours

#### Course Learning Objectives:

This course will enable students to

- Apply the networking components, models, topologies to solve various real time problems.
- Describe and apply the physical layer, data link layer, network layer, transport layer and application layer architectures, protocols and services Provided by each layer for networking.
- Identify the security threats, vulnerabilities and services along with applying cryptographic solutions for it.
- Analyze a data transmission at different layer and parameter measures for real time network using simulation tools.

Module 1: Introduction	Number of Hours	Bloom's Level
<b>Data communication:</b> Components, Data representation, Data flow, Networks: Network criteria, Physical Structures, Network types: LAN, WAN, Switching, The Internet. TCP/IP PROTOCOL SUITE, Layered Architecture, Layers in the TCP/IP Protocol Suite, Description of Each Layer, Encapsulation and De-capsulation, Addressing, Multiplexing and De-multiplexing, OSI versus TCP/IP. <b>Physical Layer:</b> Data and Signals, Periodic analog signals, digital signals, Transmission impairment.	6+4	(CO1) Apply
<b>Practical Component using NS2:</b> <ol style="list-style-type: none"> <li>1. Implement three nodes point – to – point network with duplex links between them.</li> <li>2. Implement the following topologies: Bus, Star, Ring</li> </ol>		

Module 2 : Data Link Layer		
<b>Data-Link Layer:</b> Nodes and Links, Services, Two Categories' of link, Sublayers, Link Layer addressing: Types of addresses, ARP. Data Link Control (DLC) services: Framing, Flow and Error Control, Data Link Layer Protocols: Simple Protocol, Stop and Wait protocol, Wired and Wireless LANs: Ethernet Protocol, Standard Ethernet. <b>Practical Component using NS2:</b> <ol style="list-style-type: none"> <li>1. Implement transmission of ping messages/trace route over a network topology consisting of 6 nodes and find the number of packets dropped due to congestion.</li> <li>2. Implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.</li> </ol>	6+4	(CO2) Apply
Module 3: Network Layer		

<p><b>Network Layer:</b> Introduction, Network Layer services: Packetizing, Routing and Forwarding, Packet Switching: Datagram Approach, Virtual Circuit Approach.</p> <p>IPV4 Addresses: Address Space, Classful Addressing, Classless Addressing, DHCP, Network Address Resolution, Distance Vector Routing, Link State Routing, Path vector routing.</p> <p><b>Practical Component using NS2:</b></p> <ol style="list-style-type: none"> <li>1. Simulation of distance vector routing algorithm.</li> <li>2. Simulation of link state routing algorithm</li> </ol>	<b>6+4</b>	<b>(CO3)</b> <b>Apply</b>
<b>Module 4: Transport and Application Layer</b>		
<p><b>Transport Layer:</b> Introduction: Transport Layer Services, Connectionless and Connection-oriented Protocols, Transport Layer Protocols: Simple protocol, Stop and wait protocol, Go-Back-N Protocol, Transport-Layer Protocols in the Internet: User Datagram Protocol: User Datagram, UDP Services, Transmission Control Protocol: TCP Services, TCP Features.</p>	<b>6+4</b>	
<p><b>Application Layer:</b> Introduction: providing services, Application- layer paradigms, Standard Client -Server Protocols: World wide web, Hyper Text Transfer Protocol, FTP: Domain Name system.</p>		
<p><b>Practical Component using NS2:</b></p> <ol style="list-style-type: none"> <li>1. Implement Transport Control Protocol in sensor network</li> <li>2. Implement User Datagram protocol in sensor network</li> <li>3. Simulation of stop and wait protocol and sliding window protocol</li> </ol> <p><b>Cisco Packet Tracer:</b></p> <ol style="list-style-type: none"> <li>4. Configuration of TELNET protocols on router for remote access.</li> </ol>		
<b>Module 5: Network Security</b>		
<p><b>Security Introduction,</b> Attacks, Services, Mechanism, network security, Cryptography, DES, AES, Public-Key Cryptography: RSA, Hash and MAC Algorithms: Secure Hash Algorithm (SHA), Digital Signatures.</p>	<b>6+4</b>	<b>(CO4)</b> <b>Apply</b>
<p><b>Practical Component using JAVA:</b></p> <ol style="list-style-type: none"> <li>1. Write a Java program to implement the DES algorithm logic</li> <li>2. Write a Java program to implement RSA Algorithm</li> <li>3. Calculate the message digest of a text using the SHA-1 algorithm in JAVA.</li> <li>4. Basic lab Program using POSTMAN API.</li> </ol>		
<b>Course Outcomes:</b>		
<p>At the end of the course, the students will be able to:</p> <ol style="list-style-type: none"> <li>1. Apply the concepts of networking and data transmission to solve various real time problems.</li> <li>2. Apply the various services and protocols of data link layer.</li> <li>3. Apply and analyze the various networking architectures, protocols and services of network and transport layers for real time networking.</li> <li>4. Identify the networks security, threats, and vulnerabilities and Apply the different cryptographic operations.</li> </ol>		

## Reference Books

1. Behrouz A Forouzan, "Data Communications and Networking", 5th Edition, McGraw Hill, 2013, ISBN: 1-25-906475-3.
2. Cryptography and Network Security Principles and Practice Fourth Edition, William Stallings, Pearson Education
3. James J Kurose, Keith W Ross, "Computer Networks", Pearson Education.
4. Andrew S Tanenbaum, "Computer Networks", Prentice Hall.
5. Modern Cryptography: Theory and Practice, by Wenbo Mao, Prentice Hall PTR
6. Network Security Essentials: Applications and Standards, by William Stallings. Prentice Hall

## ASSESSMENT STRUCTURE:

PCI	CIA	SEA	CIA (50)				SEA Conduction: 100 M Reduced to: 50 M	
				I	II	III		
Conduction	50	50	Written Test	30	30	30	Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module	
				Average of 3 tests – 30 marks				
			Continuous Assessment	10M				
			Practical Test (2)	10M				
<b>Total – 50 Marks</b>						<b>Total – 50 Marks</b>		

### i) CIA: 50%

Theory	IA Test (Theory): 3 IA tests - each of 30 Marks – Average of 3 tests	30 Marks
Lab	Weekly Assessment – 10 Marks Practical test (2) - 10 marks	20 Marks
<b>Total</b>		<b>50 Marks</b>

### ii) SEA: 50%

#### Question Paper:

Theory Exam	5 questions to answer, each of 20 Marks 2 questions from each module with internal choice Student should answer one full question from each module	20 M x 5 = <b>100 M</b> <b>Reduced to 50 M</b>
<b>Total</b>		<b>50 Marks</b>

# B.N.M. Institute of Technology

An Autonomous Institution under VTU

## Department of Artificial Intelligence and Machine Learning

### Advanced Machine Learning (PCI)

Credit: 4

SEMESTER– V

Course Code	22AML154	CIE Marks:	50
Teaching Hours/Week (L: T: P: J)	3:0:1:1	SEE Marks:	50
Total Number of Lecture Hours	50	SEE Duration:	3 Hours

#### Course Learning Objectives:

This course will enable students to

- Understand concerns related to dimensionality and various approaches for efficient model training and data visualization,
- Understand unsupervised learning techniques, and perform clustering and anomaly detection,
- Understand the fundamentals of time-series and perform modeling to forecast over time-series data,
- Understand various approaches towards instance- or memory-based learning and build models, and
- Learn the concept and implementation of brain inspired artificial neural networks.

Module 1: Dimensionality Reduction	Number of Hours	Bloom's Level
<p>Curse of Dimensionality, Main Approaches for Dimensionality Reduction – Projection and Manifold Learning, Principal Component Analysis (PCA), Random Projection, Locally Linear Embedding, Other Dimensionality Reduction Techniques – <math>t</math>-Distributed Stochastic Neighbor Embedding (t-SNE), Linear Discriminant Analysis (LDA)</p> <p><b>Practical:</b></p> <ol style="list-style-type: none"> <li>1. Apply PCA to reduce an appropriate dataset preserving a given explained variance.</li> <li>2. Consider the same or an appropriate dataset to experiment with data decompression and incremental PCA.</li> </ol>	6+4	Apply [CO1]

Module 2 : Clustering		
<p><math>k</math>-Means – The <math>k</math>-Means algorithm, Centroid initialization methods, Accelerated <math>k</math>-Means and mini-batch <math>k</math>-Means, Finding the optimal number of clusters; Limits of <math>k</math>-Means, Clustering for Semi-Supervised Learning; DBScan; Other Clustering Algorithms</p> <p>Gaussian Mixtures – Gaussian Mixtures for Anomaly Detection, Selecting the Number of Clusters, Bayesian Gaussian Mixture Models, Other Algorithms for Association Rule, Anomaly and Novelty Detection</p> <p><b>Practical:</b></p> <ol style="list-style-type: none"> <li>1. Develop a program to apply <math>k</math>-Means algorithm to cluster a set of instances on an appropriate dataset.</li> <li>2. Develop a program to train a Gaussian mixture model on an appropriate dataset. Use the model to generate some new samples and visualize them.</li> </ol>	6+4	Apply [CO2]

### Module 3: Time-series Forecasting

<p><b>Fundamentals:</b> Components and decomposition, understanding time-series forecasting and project lifecycle, differentiating time-series forecasting from regression, Building baseline forecasting models, Random walk</p> <p><b>Models:</b> Moving average, Autoregression and Autoregressive Models – Autoregressive Moving Average (ARMA), Auto Regressive Integrated Moving Average (ARIMA), Seasonal ARIMA (SARIMA)</p> <p><b>Practical:</b></p> <ol style="list-style-type: none"> <li>1. Consider an appropriate time-series dataset and forecast using a base model, moving average model</li> <li>2. Consider the same time-series dataset and perform prediction using ARMA model and ARIMA model, and then do a comparative study between these models and the base and moving average models on their forecasting performances.</li> </ol>	6+4	Apply [CO3]
<p><b>Module 4: Instance-based Learning</b></p> <p><i>k</i>-Nearest Neighbor Learning - Distance-Weighted Nearest Neighbor Algorithm and remarks; Locally Weighted Regression - Locally Weighted Linear Regression and remarks; Radial Basis Function; Cased-based Reasoning; Remarks on Lazy and Eager Learning</p> <p><b>Practical:</b></p> <ol style="list-style-type: none"> <li>1. Write a program to implement <i>k</i>-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions.</li> <li>2. Implement the non-parametric locally weighted regression algorithm to fit data points in an appropriate data set.</li> </ol>	6+4	Apply [CO4]
<p><b>Module 5: Artificial Neural Networks</b></p> <p><b>From Biological to Artificial Neurons:</b> Biological Neurons, Logical Computations with Neurons, The Perceptron, Multilayer Perceptron (MLP) and Backpropagation, Regression &amp; Classification MLPs</p> <p><b>Implementing MLPs with Keras:</b> Classification and Regression MLPs Using the Sequential API, Complex Models Using the Functional API, Callbacks, TensorBoard, Fine-Tuning Neural Network Hyperparameters</p> <p><b>Practical:</b></p> <ol style="list-style-type: none"> <li>1. Use Scikit-Learn to build an MLP, train on appropriate dataset for a regression task, perform predictions and then measure performance.</li> <li>2. Use Keras sequential API to build and train a multiclass image classifier model, perform classification, and then evaluate performance.</li> </ol>	6+4	Apply [CO5]
<p><b>Course Outcomes:</b></p> <p>At the end of the course, the students will be able to:</p> <ol style="list-style-type: none"> <li>1. Apply dimensionality reduction techniques for efficient model training and data visualization</li> <li>2. Apply clustering, and detect abnormal (anomaly) and unusual (novelty) observations,</li> <li>3. Perform forecasting by implementing appropriate models over time-series data,</li> <li>4. Implement appropriate instance-based learning algorithms to solve relevant prediction tasks, and</li> <li>5. Implement regression and classification using MLPs.</li> </ol>		
<p><b>Reference Books</b></p> <ol style="list-style-type: none"> <li>1. Aurélien Géron. <i>Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow</i>, Third Edition, O'Reilly, 2022</li> <li>2. Marco Peixeiro. <i>Time Series Forecasting in Python</i>, Manning, 2022</li> <li>3. Tom M. Mitchell, <i>Machine Learning</i>, McGraw-Hill Education, 2013</li> </ol>		

## ASSESSMENT STRUCTURE:

PCI	CIA	SEA	CIA (50)				SEA Conduction: 100 M Reduced to: 50 M	
				I	II	III		
Conduction	50	50	Written Test	30	30	30	Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module	
				Average of 3 tests – 30 marks				
			Continuous Assessment	10M				
			Practical Test (2)	10M				
<b>Total – 50 Marks</b>						<b>Total – 50 Marks</b>		

### i) CIA: 50%

Theory	IA Test (Theory): 3 IA tests - each of 30 Marks – Average of 3 tests	30 Marks
Lab	Weekly Assessment – 10 Marks Practical test (2) - 10 marks	20 Marks
<b>Total</b>		<b>50 Marks</b>

### ii) SEA: 50%

#### Question Paper:

Theory Exam	5 questions to answer, each of 20 Marks 2 questions from each module with internal choice Student should answer one full question from each module	20 M x 5 = 100 M Reduced to 50 M
<b>Total</b>		<b>50 Marks</b>

# B.N.M. Institute of Technology

An Autonomous Institution under VTU, Approved by AICTE

## Department of Artificial Intelligence and Machine Learning

### SEMESTER - V

#### Virtual Reality and Augmented Reality(PBL)

Credit 2

Course Code	22AML155	CIA Marks	50
Teaching Hours/Week (L:T:P:J)	0:0:2:2	SEA Marks	50
Total Number of Hours	30	Exam Hours	03

#### Course Learning Objectives:

- Experience the fundamental Computer Vision, Computer Graphics and Human-Computer interaction Techniques related to VR/AR
- Demonstrate the Geometric Modelling Techniques Review the Virtual Environment
- Develop VR/AR Technologies Simulate and Apply Virtual/Augmented Reality to varieties of Applications.

	Number of Hours	Bloom's Level
Task – 1		

<b>Blender Introduction</b>		
<ul style="list-style-type: none"> <li>• Demonstrate Blender Interface, Overlay Reference, Position on Overlay, Managing Layouts, Camera Overlay</li> <li>• Demonstrate Scene view navigation, Scene view camera, Game View.</li> <li>• Project Creation, Plane creation, cube creation, Explanation of cube camera and position, Material Selection, and class file same, adding motion to the script, Run.</li> <li>• Understanding different 3D projectiles</li> </ul>	4+ 2(Project)	Apply

<b>Task – 2</b>		
<b>Blender Programming</b>		
<ul style="list-style-type: none"> <li>• Show the use of blender for Creating, loading and saving the scenes.</li> <li>• Demonstrate the Transforms, Components, 3D objects, creating components, Saving the work.</li> <li>• Demonstrate the Layers, Constraints, Editor Feature 3d mode, Preferences, Build settings, Sculpting, preference add Ons</li> <li>• Installation of XR device, Viewing through the XR.</li> <li>• Introduction to Unity</li> </ul>	4+ 2(Project)	Apply

<b>Task – 3</b>		
<b>Graphics</b>		
<ul style="list-style-type: none"> <li>• Demonstrate the use of Render Pipelines, Cameras, lighting, models, mirroring objects</li> <li>• Demonstrate the use of Meshes, Textures, shaders, materials, Image Textures</li> <li>• Demonstrate the concept Visual effects, sky, colour for suitable example.</li> <li>• Demonstrate the concept of World Building, Terrain, tree Editor for suitable example.</li> </ul>	4+ 2(Project)	Apply

<ul style="list-style-type: none"> <li>• Demonstrate XR Plug-in Management, Installation of packages.</li> <li>• Demonstrate Creation of left-hand, left-hand Controller and right-hand controller.</li> <li>• Setting up the unity and programming using Unity.</li> </ul>		
<b>Task 4</b>		
<b>Scripting, Audio Video and Animation</b>	<b>4+ 2(Project)</b>	<b>Apply</b>
<ul style="list-style-type: none"> <li>• Demonstrate the Setting up scripting Environment.</li> <li>• Apply the concepts for Creating frames, creating .mkv files, namespaces, attributes</li> <li>• audio files, tracker Modules, Audio Group inspector.</li> <li>• Demonstrate for suitable example to create Animation, Rotation in animation, animation clips, Humanoid avatars, Animation.</li> <li>• Bone movement and animation</li> <li>• Using Unity development of Animations : This work is done using programming.</li> </ul>		
<b>Task - 5</b>		
<b>Augmented reality</b>	<b>4+ 2(Project)</b>	<b>Apply</b>
<ul style="list-style-type: none"> <li>• Program to show augmented reality.</li> <li>• Program to show The Relationship Between Augmented Reality and Other Technologies-Media, Technologies.</li> <li>• Program to show Spectrum Between Real and Virtual Worlds, applications of augmented reality Augmented. C# Programming of pivot object in unity</li> </ul>		
<b>Mini project</b>		
<ul style="list-style-type: none"> <li>• Using VR exploring the human body level by level, including cell level.</li> <li>• Using VR describing how medicine and body cures the illness.</li> <li>• Touchless ATM Using Augmented Reality.</li> <li>• Augmented Reality Controlled Hologram.</li> <li>• Augmented Reality House devices.</li> <li>• Augmented Reality Agriculture Field.</li> <li>• Augmented Reality and Medical devices.</li> <li>• VR Game Development.</li> <li>• VR Application Development.</li> <li>• Development of AI controlled VR Device, that accurately work to keep the clarity very good and using technology keep the eye healthy.</li> <li>• Development of Cardboard VR device as activity.</li> <li>• Improvising the quality of the VR Device and determining the accuracy.</li> <li>• Development of Satellite with the capability of VR Camera and more features.</li> <li>• Ability to view the Solar system using the VR Device using compatible camera sent through the satellite.</li> <li>• Upgrading the ARVR device</li> </ul>		

### **Course Outcomes:**

The students will be able to

1. Demonstrate proficiency in handling Unity using C# in using the graphics to develop a model, Interface, Navigation, and scenes.
2. Apply the working of different Real-world models, Meshes, Textures
3. Apply the skills in developing Humanoid, and the basic models of Augmented Reality  
Develop the real time projects to solve complex problems and see the results in visual effects.

### **References:**

1. Virtual Reality Technology, Second Edition, Gregory C. Burdea & Philippe Coiffet, John Wiley & Sons.
2. Allan Fowler-AR Game Development, 1st Edition, A press Publications, 2018, ISBN 978-1484236178
3. Allan Fowler- Beginning iOS AR Game Development Developing Augmented Reality Apps with Unity and C#, 1st Edition, Apress Publications, 2018, ISBN 978-1484236178
4. Donald Hearn & Pauline Baker: Computer Graphics with OpenGL Version,3rd / 4th Edition, Pearson Education,2011
5. <https://docs.unity3d.com/2023.2/Documentation/Manual/ScriptingSection.html>
6. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016
7. Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002

### **Assessment Structure:**

PBL	CIA	SEA	CIA (50)	SEA Conduction: 100 M Reduced to: 50 M															
Conduction	50	50	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td rowspan="3" style="width: 20%;">IA test</td> <td style="width: 40%; text-align: center;"><b>I</b> <b>20 (T) + 20 (E)</b></td> <td style="width: 40%; text-align: center;"><b>II</b> <b>20 (T) + 20 (E)</b></td> <td rowspan="3" style="width: 20%; vertical-align: middle; text-align: center;">Write-up: 10marks Project Report: 25marks Presentation &amp; Demonstration: 50marks Viva: 15m</td> </tr> <tr> <td style="text-align: center;">40</td> <td style="text-align: center;">40</td> </tr> <tr> <td colspan="2" style="text-align: center;">Average of 2 tests – 40 M</td> </tr> <tr> <td style="text-align: center;">Continuous Assessment</td> <td colspan="2" style="text-align: center;">Weekly Assessment (Record/Project) – 10 Marks</td> <td></td> </tr> <tr> <td colspan="3" style="text-align: center;"><b>Total – 50 Marks</b></td> <td style="text-align: center;"><b>Total – 50 Marks</b></td> </tr> </table>	IA test	<b>I</b> <b>20 (T) + 20 (E)</b>	<b>II</b> <b>20 (T) + 20 (E)</b>	Write-up: 10marks Project Report: 25marks Presentation & Demonstration: 50marks Viva: 15m	40	40	Average of 2 tests – 40 M		Continuous Assessment	Weekly Assessment (Record/Project) – 10 Marks			<b>Total – 50 Marks</b>			<b>Total – 50 Marks</b>
IA test	<b>I</b> <b>20 (T) + 20 (E)</b>	<b>II</b> <b>20 (T) + 20 (E)</b>	Write-up: 10marks Project Report: 25marks Presentation & Demonstration: 50marks Viva: 15m																
	40	40																	
	Average of 2 tests – 40 M																		
Continuous Assessment	Weekly Assessment (Record/Project) – 10 Marks																		
<b>Total – 50 Marks</b>			<b>Total – 50 Marks</b>																

#### i) CIA: 50%

IA test - 2 IA tests - Each of 40 Marks	40 Marks
Weekly Assessment (Record/Project) – 10 Marks	10 Marks
<b>Total</b>	<b>50 Marks</b>

#### ii) SEA: 50%

<b>Project</b>	Write up – 10 Marks Project report – 25 Marks Presentation & Demonstration - 50 Marks Viva-Voce – 15 Marks	100 Marks Reduced to 50 Marks
	<b>Total</b>	<b>50 Marks</b>

# B.N.M. Institute of Technology

An Autonomous Institution under VTU, Approved by AICTE

## Department of Artificial Intelligence and Machine Learning

### SEMESTER – V

#### Introduction to Machine Learning (Open Elective)

Credit: 03

Course Code	22AML1561	CIA Marks	50
Teaching Hours/Week (L: T: P: J)	3:0:0:0	SEA Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

#### Course Learning Objectives:

This course will enable students to

1. Define machine learning and understand the basic theory underlying machine learning.
2. Differentiate supervised, unsupervised and reinforcement learning
3. Understand the basic concepts of learning and decision trees.
4. Understand Bayesian techniques for problems appear in machine learning
5. Perform statistical analysis of machine learning techniques.

	Number of Hours	Bloom's Level
<b>Module-1: Introduction</b>		

**Machine learning Landscape:** Introduction, Types of ML, Main challenges of ML

**End to end Machine learning Project:** Working with real data, Look at the Big picture, Get the data, Discover and visualize the data, Prepare the data for ML Algorithm, Select and train the model, Fine tune your model.

**8**

**Apply**

#### Module-2: Concept learning

**Concept learning and Learning Problems:** Concept Learning Task – Find S - Version Spaces and Candidate Elimination Algorithm.

**Classification:** MNIST, training a Binary classifier, performance measure, multiclass classification, error analysis, multi label classification, multi output classification

**8**

**Apply**

#### Module-3: Decision Tree

**Decision Tree Learning:** Introduction, Decision Tree Representation, Appropriate Problem for Decision Tree Learning, The Basic Decision Tree Learning Algorithm, Hypothesis Space Search in Decision Tree Learning.

**8**

**Apply**

#### Module-4: Bayesian Learning

**Bayesian Learning:** Introduction, Bayes theorem, Bayes theorem and Concept Learning, Maximum Likelihood and Least Square Error Hypotheses, Naïve Bayes Classifier.

**8**

**Apply**

#### Module-5: Instance Based Learning

**Instance Based Learning:** Introduction, k-Nearest Neighbor Learning, Locally Weighted Regression, Radial Basis Functions, Case Based Reasoning

**8**

**Apply**

#### Course outcomes:

The students will be able to

1. Understand the concepts of Machine Learning
2. Analyze the data to understand the distribution of the data
3. Apply the classification techniques to classify the data.
4. Demonstrate the working of various algorithms with respect to training and test data sets.
5. Analyze the problems on Decision tree, Bayesian and Instant learning techniques

**Text Books /Reference Books:**

1. Aurelien Geron, "Hands-on Machine Learning with Scikit-Learn, Keras and TensorFlow", O'Reilly 2019.
2. Tom M. Mitchell, "Machine Learning", McGraw Hill Education (India) Edition, 2013.

**ASSESSMENT STRUCTURE:**

PCC	CIA	SEA	CIA (50)			SEA Conduction: 100 M Reduced to: 50 M	
				I	II		
Conduction	50	50	Written Test	50	50	Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module	
				Average of two tests – 25 Marks			
			Assignment	15			
			AAT	10			
			Total – 50 marks			Total – 50 marks	

**i) CIA: 50%**

IA Test: 2 IA tests - Each of 50 Marks	Average of 2 tests – scaled down to 25 M
Assignment – Two assignments – one for 10 marks and another for 5 marks	15 Marks
Additional Assessment Tools (AAT) – Oral /Online Quizzes, Presentations, Group discussions, Case studies, Term Paper, Open ended experiments, Mini industrial/social/rural Projects, Two-minute video on latest topic, Short MOOC courses, Practical Orientation on Design thinking, creativity & Innovation, Participatory & Industry integrated learning, Practical activities, Problem solving exercises, Participation in seminars/academic events/symposia and any other activity	10 Marks
	<b>Total 50 Marks</b>

**ii) SEA : 50%**

Theory Exam	5 questions to answer each of 20 Marks 2 questions from each module with internal choice Student should answer one full question from each module	20 M x 5 = 100 M reduced to 50 M
		<b>Total 50 Marks</b>

# B.N.M. Institute of Technology

An Autonomous Institution under VTU, Approved by AICTE

## Department of Artificial Intelligence and Machine Learning

### SEMESTER – V

#### Introduction to Artificial Intelligence (Open Elective)

Credit : 3

Course Code	22AML1562	CIA Marks	50
Teaching Hours/Week (L: T: P: J)	3:0:0:0	SEA Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

#### Course Learning Objectives:

This course will enable students to

- Become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.
- Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks and other machine learning models.
- Learn the methods of solving problems using Artificial Intelligence.
- Learn the knowledge representation techniques, reasoning techniques and planning.

	Number of Hours	Bloom's Level

#### Module-1 : Introduction

**Introduction to AI:** history, Intelligent systems, foundation and sub area of AI, applications, current trend and development of AI.

**Problem solving:** Production System, water jug problem, Missionaries and Cannibals Problem, 8-Puzzle problem, State space search, Control Strategies: Characteristics of Problem.

**8**

**Apply**

#### Module-2 : Problem solving

**Uninformed Search Strategies:** Breadth-First search, Uniform- Cost Search, Depth-first search, Depth-limited search, Iterative deepening depth-first search, Bidirectional search, comparing uninformed search strategies.

**8**

**Apply**

**Informed (Heuristic) Search strategies:** Best-first search, A\* algorithm, AO\* algorithm

#### Module-3 : Game Playing

**Adversarial Search:** Nim Game problem, minimax procedure, alpha-beta pruning.

**Constraint Satisfaction Problems:** Crypt-arithmetic problem

**Advanced problem solving paradigm:** Planning: types of planning system, block world problem, logic based planning, Linear planning using a goal stack, Means-ends analysis, Nonlinear planning strategies, learning plans.

**8**

**Apply**

#### Module-4 Logical Reasoning and planning

**Logical reasoning:** propositional calculus, propositional logic, Natural Deduction system, Semantic Tableau system in propositional logic, resolution

**8**

**Apply**

refutation in propositional logic, predicate logic, logic programming, Unification algorithm, forward and backward chaining, conflict resolution.		
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### Module-5: Knowledge Representation & Expert Systems

**Knowledge Representation:** Approaches to knowledge representation, knowledge representation using semantic network, extended semantic networks for KR, Knowledge representation using Frames.

**8**

**Apply**

#### Course outcomes:

The students will able to

- Understand the concepts of AI, characteristics of problems and apply various techniques for problem solving.
- Apply appropriate search techniques to solve AI problems.
- Develop knowledge base sentences using propositional logic and first order logic for logical reasoning.
- Apply AI techniques for knowledge representation using semantic networks and implement various expert systems.

#### Reference Books:

- Staurt Russel, Peter Norvig, Artificial Intelligence: A Modern Approach, Pearson Education, 3rd Edition, 2009
- Elaine Rich, Kevin Knight, Artificial Intelligence, Tata McGraw Hill
- George F Lugar, Artificial Intelligence Structure and strategies for complex, Pearson Education, 5th Edition, 2011
- Saroj Kaushik, Artificial Intelligence, Cengage learning, 2014
- Nils J. Nilsson, Principles of Artificial Intelligence, Elsevier, 1980

#### ASSESSMENT STRUCTURE:

PCC	CIA	SEA	CIA (50)			<b>SEA Conduction: 100 M Reduced to: 50 M</b>				
				I	II					
Conduction	50	50	Written Test	50	50	Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module				
				Average of two tests – 25 Marks						
			Assignment	15						
			AAT	10						
			<b>Total – 50 marks</b>							
			<b>Total – 50 marks</b>							

#### i) CIA: 50%

IA Test: 2 IA tests - Each of 50 Marks	Average of 2 tests – scaled down to 25 M
Assignment – Two assignments – one for 10 marks and another for 5 marks	15 Marks
Additional Assessment Tools (AAT) – Oral /Online Quizzes,	10 Marks

Presentations, Group discussions, Case studies, Term Paper, Open ended experiments, Mini industrial/social/rural Projects, Two-minute video on latest topic, Short MOOC courses, Practical Orientation on Design thinking, creativity & Innovation, Participatory & Industry integrated learning, Practical activities, Problem solving exercises, Participation in seminars/academic events/symposia and any other activity	
	<b>Total</b> <b>50 Marks</b>

**ii) SEA : 50%**

<b>Theory Exam</b>	5 questions to answer each of 20 Marks 2 questions from each module with internal choice Student should answer one full question from each module	20 M x 5 = <b>100 M</b> <b>reduced to 50 M</b>
		<b>Total</b> <b>50 Marks</b>

# B.N.M. Institute of Technology

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## Department of Artificial Intelligence and Machine Learning

### Data Driven Decision Making (Open Elective)

#### SEMESTER– V

Course Code	22AML1563	CIE Marks:	50
Teaching Hours/Week (L: T: P: J)	3:0:0:0	SEE Marks:	50
Total Number of Lecture Hours	40	SEE Duration:	3 Hours

#### Course Learning Objectives:

This course will enable students to

- Enable to learn the foundational concepts for data science.
- Explore the fundamentals of Supervised Machine Learning and Prediction.
- Explore key areas of Data Science that are highly applicable to business and decision-making.

Module 1: Foundations of Data Science	Number of Hours	Bloom's Level
<b>Foundations of Data Science</b> Python for Data Science: Numpy, Pandas, Data Visualization, Statistics for Data Science: Descriptive Statistics, Inferential Statistics	08	Apply
Module 2: Making Sense of Unstructured Data		
<b>Making Sense of Unstructured Data</b> What is unsupervised learning, and why is it challenging? Examples unsupervised learning:	08	Apply
Module 3: Classification		
<b>Classification</b> Introduction, Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Bayes Theorem, Naïve Bayesian Classification, Classification by Backpropagation, A Multilayer Feed-Forward Neural Network, Defining a Network Topology,	08	Apply
Module 4: Clustering		
<b>Clustering</b> Introduction to Cluster Analysis, Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Classical Partitioning Methods: k-Means and k-Medoids, Partitioning Methods in Large Databases: From k-Medoids to CLARANS, Hierarchical Methods, Agglomerative and Divisive Hierarchical Clustering, Density-Based Methods,	08	Apply
Module 5: Deep Learning		
<b>Deep Learning</b> Introduction to Deep Learning, Learning mechanisms, Types of neural network, Artificial Neural networks Convolutional Neural Networks, Recurrent neural Networks	08	Apply

#### Course Outcomes:

At the end of the course, the students will be able to:

1. Identify the data to solve the real time problem.
2. Prepare data to make it AI/ML ready.
3. Apply the classification mechanisms for decision making.

4. Apply the clustering mechanisms for decision making.
5. Apply Neural Nets and Deep Learning to perform decision making.

### Reference Books

1. Ian H. Witten and Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques (Second Edition), Morgan Kaufmann, 2005, ISBN: 0-12-088407-0.
2. Introduction to Data Mining, Tan, Steinbach and Vipin Kumar, Pearson Education, 2016
3. Data Mining: Concepts and Techniques, Pei, Han and Kamber, Elsevier, 2011
4. Deep Learning- Ian Goodfellow, Yoshua Benjio, Aaron Courville, The MIT Press

### ASSESSMENT STRUCTURE:

PCC	CIA	SEA	CIA (50)			SEA Conduction: 100 M Reduced to: 50 M	
				I	II		
Conduction	50	50	Written Test	50	50	Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module	
				Average of two tests – 25 Marks			
			Assignment	15			
			AAT	10			
			Total – 50 marks			Total – 50 marks	

#### i) CIA: 50%

IA Test: 2 IA tests - Each of 50 Marks	Average of 2 tests – scaled down to 25 M
Assignment – Two assignments – one for 10 marks and another for 5 marks	15 Marks
Additional Assessment Tools (AAT) – Oral /Online Quizzes, Presentations, Group discussions, Case studies, Term Paper, Open ended experiments, Mini industrial/social/rural Projects, Two-minute video on latest topic, Short MOOC courses, Practical Orientation on Design thinking, creativity & Innovation, Participatory & Industry integrated learning, Practical activities, Problem solving exercises, Participation in seminars/academic events/symposia and any other activity	10 Marks
Total	50 Marks

#### ii) SEA : 50%

<b>Theory Exam</b>	<p>5 questions to answer each of 20 Marks</p> <p>2 questions from each module with internal choice</p> <p>Student should answer one full question from each module</p>	<p><b>20 M x 5 = 100 M</b></p> <p><b>reduced to 50 M</b></p>
	<b>Total</b>	<b>50 Marks</b>

# B.N.M. Institute of Technology

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## Department of Artificial Intelligence and Machine Learning

SEMESTER – V

### SENSORS AND ROBOTICS (Open Elective)

Credit: 3

<b>Course Code</b>	22AML1564	<b>CIA Marks</b>	50
Teaching Hours/Week (L: T: P: J)	3:0:0:0	<b>SEA Marks</b>	50
<b>Total Number of Contact Hours</b>	40	<b>Exam Hours</b>	03

#### Course Learning Objectives:

This course will enable students to:

- Understand the concepts of Use gauges and transducers to measure pressure, direction and distance.
- Understand the use of light transducers and other devices used for the measurement of electromagnetic radiations.
- Understand the working of different temperature sensing devices.
- Understand the fundamentals of Translation and simulation of a real time activity using modern tools and discuss the Benefits of automation.
- Understand the suitable automation hardware for the given application.

<b>Module-1: Strain, Pressure, Position, direction, distance, and motion</b>	<b>Contact Hours.</b>	<b>Bloom's Level</b>
<b>Strain and Pressure:</b> Mechanical strain, Interferometry, Fibre optic methods, pressure gauges, low gas pressures, Ionization gauges, Transducer use.	8	Apply
<b>Position, direction, distance, and motion:</b> Position, Direction, Distance measurement, Distance travelled, Accelerometer systems, Rotation.		
<b>Module-2: Light and associated radiation</b>		
<b>Light and associated radiation:</b> Nature of light, Colour temperature, Light flux, Photosensors, Photoresistors and photoconductors, Photodiodes, Phototransistors, Photovoltaic devices, Fibre – optic applications, Light transducers, Solid-state transducers, Liquid crystal displays (LCD), Light valves, Image transducers, Radio waves.	8	Apply
<b>Module-3: Temperature sensors and thermal transducers</b>		
<b>Temperature sensors and thermal transducers:</b> Heat and temperature, The bimetallic strip, Liquid and gas expansion, Thermocouples, Metal – resistance sensors, Thermistors, Radiant heat energy sensing, Pyroelectric detectors, Thermal transducers, Thermal to electrical transducers.	8	Apply
<b>Module-4: Industrial Robotics</b>		
<b>Industrial Robotics:</b> Robotic configuration, robot anatomy and related attributes, robot control systems, end effectors, sensors in robotics, industrial robot applications, robot accuracy and repeatability, different types of robots.	8	Apply
<b>Module-5: Robot programming</b>		
<b>Robot programming:</b> Introduction, levels of robot programming, requirements of robot programming language, problems pertaining to robot programming languages, offline programming systems, central issues in OLP systems.	8	Apply

**Course Outcomes:**

At the end of the course the student will be able to:

1. Use gauges and transducers to measure pressure, direction and distance.
2. Discuss the use of light transducers and other devices used for the measurement of electromagnetic radiations.
3. Explain the working of different temperature sensing devices.
4. Explain the basic principles of Robotic technology, configurations, control and Programming of Robots.
5. Explain the basic principles of programming and apply it for typical Pick & place, Loading & unloading and palletizing applications

**Reference Books:**

1. Sensors and Transducers Ian R. Sinclair Newnes 3 rd Edition, 2001
2. Introduction to robotics mechanics and control John J. Craig Pearson 3rd edition, 2009
3. Computer Integrated Manufacturing Mikell P. Groover Pearson 3rd edition, 2009

**ASSESSMENT STRUCTURE:**

PCC	CIA	SEA	CIA (50)			<b>SEA Conduction: 100 M Reduced to: 50 M</b>	
				I	II		
Conduction	50	50	Written Test	50	50	Five questions with each of 20 marks (with internal choice). Student should answer one full question from each module	
				Average of two tests – 25 Marks			
			Assignment	15			
			AAT	10			
			<b>Total – 50 marks</b>			<b>Total – 50 marks</b>	

**i) CIA: 50%**

<b>IA Test:</b> 2 IA tests - Each of 50 Marks	Average of 2 tests – scaled down to 25 M
<b>Assignment</b> – Two assignments – one for 10 marks and another for 5 marks	15 Marks
<b>Additional Assessment Tools (AAT)</b> – Oral /Online Quizzes, Presentations, Group discussions, Case studies, Term Paper, Open ended experiments, Mini industrial/social/rural Projects, Two-minute video on latest topic, Short MOOC courses, Practical Orientation on Design thinking, creativity & Innovation, Participatory & Industry integrated learning, Practical activities, Problem solving exercises, Participation in seminars/academic events/symposia and any other activity	10 Marks
	<b>Total</b> <b>50 Marks</b>

**ii) SEA : 50%**

<b>Theory Exam</b>	5 questions to answer each of 20 Marks 2 questions from each module with internal choice Student should answer one full question from each module	<b>20 M x 5 = 100 M reduced to 50 M</b>
		<b>Total</b> <b>50 Marks</b>

# B N M Institute of Technology

## Syllabus for Employability Skills-1 SEMESTER – V

<b>Subject Name</b>	Employability Skills-1 (Technical)	<b>Weekly Assignments (6 tests)</b>	Max 10 Min 4
<b>Subject Code</b>	22XXX157	<b>Company Simulation Tests (6 tests)</b>	Max 15 Min 6
<b>Number of Contact Hours/Week</b>	2	<ul style="list-style-type: none"> <li>• <b><u>Domain Specific, Programming &amp; Coding - 90 minutes</u></b></li> <li>▪ 40 marks of MCQ's which should include Technical &amp; Programming Questions (60 questions each of 1 mark. Students can answer any 40)</li> <li>▪ 10 Marks of Coding Test (<i>on coding platform</i>) 2 programs given. Student must answer one question. Marks 50, Reduced to 25</li> </ul>	Max 25 Min 10
<b>Total Number of Contact Hours</b>	24	<b>Credits</b>	1

<b>Module</b>	<b>Topics to be covered</b>
<b>General Technical Training (12 hrs) (All Branches)</b>	<p><b><u>Programming Languages</u></b> C, Java, Python (Platforms to be used Hacker Rank, Leet Code and Github)</p>
<b>Technical Training (12 hrs)</b>	<p><b><u>CSE, ISE &amp; AIML</u></b> Algorithms, Data Structures, DBMS, Computer Organisation, Computer Networks, Network Security, Operating Systems, UI/UX, Web technologies &amp; AIML.</p> <p><b><u>ECE, EEE &amp; ME</u></b> Introduction to the following IT topics : Computer Organisation, Data Structures, Operating Systems, DBMS, Computer Networks, Network Security, AIML</p>

<b>Domain Specific Training to be given by Departments</b>	<b>Electronics &amp; Communication Engineering</b> MATLAB, SCADA, System Verilog, VLSI, & Embedded Systems,
	<b>Electrical &amp; Electronics &amp; Engineering</b> Power Electronics, Power Systems, Introduction to Robotic Process Automation (RPA) & EV Vehicles.
	<b>Mechanical Engineering</b> Thermodynamics, Aerodynamics, Automobile & Engines, Solidworks, Ansys, Industrial Automation, Mechatronics, & EV Vehicles



29/02

# B.N.M. Institute of Technology

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## Department of Artificial Intelligence and Machine Learning

### SEMESTER – VI

#### Deep Learning

Credit: 3

Course Code	22AML161	CIA Marks	50
Teaching Hours/Week(L:T: P: J)	2:0:2:0	SEA Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

#### Course Learning Objectives:

This course will enable students to

- learn the various training aspects of a neural network,
- learn the need for convolutional neural network for visual tasks,
- learn the working of recurrent and convolutional neural network for sequence processing,
- learn approaches for natural language tasks using recurrent neural networks and attention mechanism, and
- learn the working on autoencoders to learn latent representations of input data to be used for various tasks.

	Number of Hours	Bloom's Level
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#### Module-1: Deep Neural Networks Training

The Vanishing/Exploding Gradients Problems, Reusing Pretrained Layers, Faster Optimizers, Learning Rate Scheduling, Avoiding Overfitting Through Regularization

#### Practical:

1. Build a neural network of appropriate depth on CIFAR10 dataset with *He* initialization, Swish activation function, Nadam optimizer and early stopping. Compare this model's learning curve on its convergence, performance and training time with another model with batch normalization layer added.

6+4	(CO1) Apply
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#### Module-2: Convolutional Neural Networks

Architecture of the Visual Cortex, Convolutional Layers, Pooling Layers, Convolutional Neural Network (CNN) Architectures, Pretrained Models from Keras, Pretrained Models for Transfer Learning, Classification and Localization, Object Detection, Object Tracking, Semantic Segmentation

#### Practical:

1. Build a CNN from scratch and try achieving the highest possible accuracy on MNIST.
2. Build an image classifier using a pretrained *Xception* model on TensorFlow flower dataset.

6+4	(CO2) Apply
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<p><b>Module-3: Sequence Processing</b></p> <p>Recurrent Neurons and Layers – Memory Cells, Input and Output Sequences; Training RNNs, Forecasting a Time Series, Handling Long Sequences - Unstable Gradients Problem, Short-Term Memory Problem</p> <p><b>Practical:</b></p> <ol style="list-style-type: none"> <li>1. Train a model on Bach chorales dataset to predict the next time step (four notes), given a sequence of time steps from a chorale. Use this model to generate Bach-like music, one note at a time: giving the model the start of a chorale and asking it to predict the next time step, then appending these time steps to the input sequence and asking the model for the next note, and so on.</li> </ol>	<b>6+4</b>	<b>(CO2) Apply</b>
<p><b>Module-4: Text Processing</b></p> <p>Generating Text using Character RNN; Sentiment Analysis – Masking, Reusing Pretrained Embeddings and Language Models; Encoder–Decoder Network for Neural Machine Translation - Bidirectional RNNs, Beam Search, Attention Mechanisms - Transformer Architecture and models; Vision Transformers; Hugging Face’s Transformers Library</p> <p><b>Practical:</b></p> <ol style="list-style-type: none"> <li>1. Train a model on IMDb reviews dataset to classify sentiment of a movie review using pretrained embeddings.</li> <li>2. Use the Hugging Face Transformers library to download a pretrained language model capable of generating text, and try generating more convincing Shakespearean text by calling model’s generate() method.</li> </ol>	<b>6+4</b>	<b>(CO3) Apply</b>
<p><b>Module-5: Representation Learning</b></p> <p><b>Representation Learning:</b> Efficient Data Representations, Performing PCA with an Undercomplete Linear Autoencoder, Stacked Autoencoders, Convolutional Autoencoders, Denoising Autoencoders, Sparse Autoencoders, Variational Autoencoders</p> <p><b>Practical:</b></p> <ol style="list-style-type: none"> <li>1. Consider an appropriate image dataset to pretrain an image classifier using a denoising autoencoder and then <ul style="list-style-type: none"> <li>a. check if the images are well reconstructed, and</li> <li>b. build a classifier reusing the lower layers of the autoencoder and then train it using only fractional number of total images from the training set. Then check if it performs better with or without pretraining.</li> </ul> </li> <li>2. Train a variational autoencoder on the appropriate image dataset and use it to generate images.</li> </ol>	<b>6+4</b>	<b>(CO4) Apply</b>
<p><b>Course outcomes:</b></p> <p>The students will able to</p> <ol style="list-style-type: none"> <li>1. use pretrained layers, choose appropriate optimizer and learning rate, and avoid model overfitting,</li> <li>2. design appropriate CNN architectures, apply transfer learning, use pretrained models, and perform various image tasks,</li> </ol>		

- |   |
|---|
| <ul style="list-style-type: none"><li>3. apply RNN and CNN in various sequence processing tasks,</li><li>4. apply pretrained embedding and transformer models for natural language tasks, and</li><li>5. apply autoencoders and PCA in various unsupervised machine learning tasks.</li></ul> |
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**Reference Books:**

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| <ul style="list-style-type: none"><li>1. Aurélien Géron. <i>Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow</i>, Third Edition, O'Reilly, 2022</li><li>2. Charu C. Aggarwal. <i>Neural Networks and Deep Learning</i>, Second Edition, Springer, 2023</li><li>3. François Chollet. <i>Deep Learning with Python</i>, Second Edition, Manning, 2021</li><li>4. Ian Goodfellow, Yoshua Bengio and Aaron Courville. <i>Deep Learning</i>, MIT Press, 2016</li><li>5. Michael Nielsen. <i>Neural Networks and Deep Learning</i>, 2019</li></ul> |
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# B.N.M. Institute of Technology

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## Department of Artificial Intelligence and Machine Learning

### SEMESTER – VI

#### Natural Language Processing (PCI)

Credit: 3

Course Code	22AML162	CIA Marks	50
Teaching Hours/Week(L:T: P: J)	2:0:2:0	SEA Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

#### Course Learning Objectives:

This course will enable students to

- Understand, Natural Language Processing Concepts and its Applications.
- Analysis of regular expression, parsing.
- Semantic Analysis of meaning representation.
- Design of information retrieval models.

	Number of Hours	Bloom's Level
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#### Module-1: Introduction

Introduction: Introduction to Natural Language Processing, Stages in natural language Processing, NLP Pipeline, Origins and challenges of NLP , Applications of NLP ,Language and Grammar-Processing Indian Languages, Introduction to the corpus, elements in the balanced corpus, Successful early NLP Systems.

#### Practical:

1. Tokenizing -Design a Python program to splitting up a larger body of text into smaller lines, words or even create words for a non-English language.
2. Corpus- Design a Python program to illustrate corpus.
3. Lemmatizing- Design a Python program to group together the different inflected forms of a word so they can be analyzed as a single item.
4. Process-Implement a python program to process the given text.

**6+4**

**(CO1)  
Apply**

#### Module-2: Word level Analysis

Word level Analysis: Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction. Part-of-Speech Tagging- Rule based tagger, Stochastic tagger, Hybrid Taggers, Unknown words

#### Practical:

1. Getting text to analyze- Design a Python program to analyze the given text.
2. POS Tagger- Design python program to perform part-of-speech tagging on the text scraped from a website.
3. Default Tagger- Design python program to illustrate default tagger.
4. Chunking- Design a python program to group similar words together based on the nature of the word.
5. Chinking- Design a Python program to remove a sequence of tokens from a chunk.

**6+4**

**(CO2)  
Apply**

<b>Module-3: N-Grams</b>		
N-Grams: Simple N-grams, Smoothing- Laplace smoothing, Good Turing Discounting, Backoff, Entropy, Morphology: Inflectional morphology, Derivational morphology.	<b>6+4</b>	(CO2) Apply
<b>Practical:</b>		
<ol style="list-style-type: none"> <li>1. N grams- Implement a Python program to implement N-Gram</li> <li>2. Smoothing-Design a Python program to perform smoothing using various methods in Python.</li> <li>3. Good turing- Develop a Python program to calculate good turing frequency.</li> </ol>		
<b>Module-4: Lexical Semantics</b>		
Semantic: Meaning Representation, Lexical Semantics, Ambiguity, Word Sense Disambiguation –Selectional Restriction-based word sense disambiguation, context-based word sense disambiguation Approaches, Knowledge source in WSD, Applications of WSD.	<b>6+4</b>	(CO3) Apply
<b>Practical:</b>		
<ol style="list-style-type: none"> <li>1. Lexical Semantics- Design Python program to do text classification.</li> <li>2. Meaning Representation- Implement a Python program to represent the meaning of the given text.</li> <li>3. Disambiguity-Design the lek algorithm in Python to handle word sense disambiguation.</li> </ol>		
<b>Module-5: Information Retrieval</b>		
Information Retrieval-Introduction, Design features of information retrieval systems- Indexing, eliminating stop words, Stemming, Classical information retrieval Models- Boolean model, Probabilistic model, Vector space model. Application: Information extraction, Automatic text summarization, topic modelling, Question –Answer System	<b>6+4</b>	(CO4) Apply
<b>Practical:</b>		
<ol style="list-style-type: none"> <li>1. Information Extraction- Design Python programs to extract structured information from unstructured information.</li> <li>2. Filtering Stop Words- Implement a python program to filtering stop words.</li> <li>3. Stemming- Design a Python program to reduce an inflected word down to its word stem.</li> <li>4. Question Answering System- Design a questioning answer system using Python.</li> </ol>		
<b>Course outcomes:</b>		
The students will able to		
<ol style="list-style-type: none"> <li>1. Apply the Natural Language processing concepts to the different applications of Corpus.</li> <li>2. Solve the given regular expressions and N grams.</li> <li>3. Design of meaning representation and word sense disambiguation models.</li> <li>4. Design of NLP models-Information retrieval, text summarization and topic modeling</li> </ol>		
<b>Reference Books:</b>		
<ol style="list-style-type: none"> <li>1. Siddiqui T., Tiwary U. S. Natural language processing and Information retrieval, OUP, 2008.</li> <li>2. Daniel Jurafsky and James H Martin, “Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics, and 2SpeechRecognition”, 2nd Edition, Prentice Hall, 2008.</li> <li>3.R. Kibble Introduction to natural language processing CO3354 2013.</li> <li>4. James A.. Natural language Understanding 2e, Pearson Education, 1994</li> </ol>		

5. Bharati A., Sangal R., Chaitanya V. Natural language processing: a Paninian perspective, PHI, 2000.

# B.N.M. Institute of Technology

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## Department of Artificial Intelligence and Machine Learning

SEMESTER – VI

### Image Processing and Computer Vision (PCI)

Credit: 4

<b>Course Code</b>	22AML163	<b>CIA Marks</b>		50
Teaching Hours/Week (L: T: P: J)	3:0:1:1	<b>SEA Marks</b>		50
<b>Total Number of Contact Hours</b>	50	<b>Exam Hours</b>		03

#### Course Learning Objectives:

This course will enable students to:

- Understand the fundamentals of image processing
- Understand the image transform, restoration techniques and methods used in digital image processing
- Understand the image enhancement techniques, Morphological Operations and Segmentation used in digital image processing
- Understand the various techniques used in computer vision
- Understand the image data compression and motion analysis of computer vision

<b>Module-1: Digital Image Fundamentals</b>	<b>Number of Hours</b>	<b>Bloom's Level</b>
<b>Digital Image Fundamentals:</b> Fundamentals of 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.	<b>6+4</b>	<b>(CO1) Apply</b>

<b>Module-2: Spatial Domain, Frequency Domain, Image Restoration and Reconstruction</b>		
<b>Spatial Domain:</b> Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering -Smoothing Spatial Filters, Sharpening Spatial Filters. <b>Frequency Domain:</b> Preliminary Concepts, The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-D DFT. <b>Image Restoration and Reconstruction:</b> A model of the Image Degradation/Restoration Process, Noise Models, Restoration in the presence of Noise only- Special Filtering. <b>Practical using MATLAB</b>		

1. Write a Program to read various formats of digital image and apply image sampling and quantization techniques.
  2. Write a Program to read a digital image. Split and display image into 4 quadrants, up, down, right and left.
  3. Write a Program to convert color image into gray scale image.
1. Write a program to show rotation, scaling, and translation of an image.
  2. Write a Program to Read an image and extract and display low-level features such as edges, textures using filtering techniques
  3. Write a Program to Image Enhancement-Spatial filtering and frequency domain filtering
  4. Write a Program to restore and reconstruct the image using special filtering

<b>Module-3: Color Image Processing, Morphological Image Processing, and Image Segmentation</b>		
<b>Color Image Processing:</b> Color Fundamentals, Color Models- RGB Color Model, CMY and CMYK Color model and HSI Color Model.		
<b>Morphological Image Processing:</b> Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transforms.		
<b>Image Segmentation:</b> Fundamentals, Edge detection, Region Segmentation using Clustering and Super pixels.	<b>6+4</b>	<b>(CO3) Apply</b>
<b>Practical using MATLAB</b> <ul style="list-style-type: none"> <li>1. Write a Program to analysis of images with different color models.</li> <li>2. Write a Program to Image segmentation – Edge detection, line detection and point detection</li> <li>3. Write a Program to Region based segmentation - clustering technique.</li> </ul>		
<b>Module-4: Introduction to Computer Vision and 3D Vision Geometry</b>		
<b>Introduction to Computer Vision:</b> Image representation and Image analysis task, Cameras: An Overview- Photo sensitive sensors, A monochromatic camera, A color camera.		
<b>3D Vision Geometry:</b> 3D Vision tasks: Marr's theory, Basics projective geometry: Points and Hyperplanes in projective space, Homography, A single perspective camera: Camera model.	<b>6+4</b>	<b>(CO4) Apply</b>
<b>Practical using MATLAB</b> <ul style="list-style-type: none"> <li>1. Write a Program on Image Compression algorithm</li> <li>2. Write a Program for human face detection using webcam.</li> <li>3. Write a Program for detect the object.</li> <li>4. Write a program to analysis of images with different color models.</li> </ul>		
<b>Module-5: Image Data Compression and Motion Analysis</b>		
<b>Image Data Compression:</b> Image data properties, Predictive compression Methods, Hierarchical and Progressive Compression Methods, Coding. JPEG and MPEG Image Compression.		
<b>Motion Analysis:</b> Differential motion analysis methods, Optical flow: Optical flow computation, Optical flow in motion analysis, Detection of specific motion pattern, Video tracking: background modeling, Kernel based object tracking.		
<b>Practical using MATLAB</b> <ul style="list-style-type: none"> <li>1. Write a Program to demonstrate enhancing and segmenting low contrast 2D images</li> <li>2. Write a Program to extract the human facial features Eye, Nose, Mouth of an image.</li> <li>3. Write a Program to detect the motion of an object in an input video.</li> <li>4. Write a Program to apply Histogram Processing to the video</li> </ul>	<b>6+4</b>	<b>(CO5) Apply</b>
<b>Course Outcomes:</b> At the end of the course students should be able to:		
1. Understand, Ascertain and describe the basics of image processing concepts through mathematical interpretation.		
2. Apply image processing techniques in both the spatial and frequency (Fourier) domains.		
3. Demonstrate image enhancement techniques, Morphological Operations and Segmentation used in digital image processing.		
4. Conduct independent study and analysis of Image Enhancement techniques.		
5. Apply computer vision techniques in image data compression and motion analysis of computer vision		
<b>Reference Books:</b>		
1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, Third Ed., Prentice Hall, 2008.		

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| 2. Sonka, Hlavac, Boyle, Digital Image Processing and Computer Vision, India Edition,        |
| 3. Digital Image Processing- S.Jayaraman, S.Esakkirajan, T.Veerakumar, TataMcGraw Hill 2014. |
| 4. Fundamentals of Digital Image Processing-A. K. Jain, Pearson 2004.                        |

- 2. Sonka, Hlavac, Boyle, Digital Image Processing and Computer Vision, India Edition,
- 3. Digital Image Processing- S.Jayaraman, S.Esakkirajan, T.Veerakumar, TataMcGraw Hill 2014.
- 4. Fundamentals of Digital Image Processing-A. K. Jain, Pearson 2004.

# B.N.M. Institute of Technology

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## Department of Artificial Intelligence and Machine Learning

### SEMESTER – VI

#### Big Data Analytics (PBL)

Credit: 2

Course Code	22AML164	CIA Marks	50
Teaching Hours/Week (L: T: P: J)	0:0:2:2	SEA Marks	50
Total Number of Lecture Hours	30	Exam Hours	03

#### Course Learning Objectives:

This course will enable students to

- Get familiar with Hadoop distributions, configuring Hadoop and performing File management tasks
- Develop map-reduce analytics using Hadoop and related tools
- Understand various big data technologies like Hadoop MapReduce, Pig, Hive, Hbase and No-SQL. Apply tools and techniques to analyze Big Data.
- Use Machine Learning algorithms for real world big data.
- Analyze web contents and Social Networks to provide analytics with relevant visualization tools.

Tasks	Number of Hours	CO's	Bloom's Level
<b>Task – 1</b>			
Hadoop/PySpark Installation.	2	1	Apply
<b>Task – 2</b>			
File Management tasks in Hadoop/PySpark <ul style="list-style-type: none"> <li>Create a directory in HDFS at given path(s).</li> <li>List the contents of a directory.</li> <li>Upload and download a file in HDFS.</li> <li>See contents of a file.</li> <li>Copy a file from source to destination.</li> <li>Copy a file from/To Local file system to HDFS.</li> <li>Move file from source to destination.</li> <li>Remove a file or directory in HDFS.</li> <li>Display last few lines of a file.</li> <li>Display the aggregate length of a file.</li> </ul>	2	1	Apply
<b>Task – 3</b>			
1. Word Count Map Reduce program. 2. Implementing Matrix Multiplication with Hadoop/PySpark Map Reduce.	2	2	Apply
<b>Task – 4</b>			
1. Implement Searching with Hadoop/PySpark Map Reduce. 2. Implement Sorting with Hadoop/PySpark Map Reduce.	2	2	Apply
<b>Task – 5</b>			
1. Install and Configure MongoDB to execute NoSQL Commands. 2. Create and drop a database. 3. Implementation of Insert(), save(), update(), remove() and find() methods.	2	3	Apply
<b>Task – 6</b>			
1. Installation of PIG. 2. Write Pig Latin scripts sort, group, join, project, and filter your data.	2	3	Apply
<b>Task – 7</b>			
1. Run the Pig Latin Scripts to find Word Count. 2. Run the Pig Latin Scripts to find a max temp for each and every year.	2	3	Apply

<b>Task – 8</b>	1. Implementing Database Operations on Hive. 2. Hive Commands : Data Definition Language (DDL ) CREATE, DROP, TRUNCATE, ALTER, SHOW, DESCRIBE Statements.	2	3	Apply
<b>Task – 9</b>	1. Data Manipulation Language (DML ) LOAD, INSERT Statements. 2. Aggregation, GroupBy and Having in Hive	2	3	Apply
<b>Task – 10</b>	1.Data visualization using python plotting library <ul style="list-style-type: none"><li>• Plot a pie chart of color transparency that can visualize the distribution of non-transparent and transparent colors.</li><li>• Display a scatter graph on 50 random data points generated between (1,1) and (10,10)</li></ul> 2. Implement the SVM classifier which classifies the input dataset on the basis of transparency of the colors.	2	4	Apply
<b>Task – 11</b>	1 Develop a Random forest classifier model for Big data applications. 2. Develop a Decision tree classifier model for Big data application.	2	4	Apply
<b>Task – 12</b>	Implement Page Rank Algorithm using Map-Reduce.	2	5	Apply
<b>Task – 13</b>	Web scraping using beautifulsoup.	2	5	Apply
<b>Task – 14</b>	Write a program to get Rank of page in google search results using BeautifulSoup.	2	5	Apply
<b>Task – 15</b>	Frequent Itemset Mining (find patterns/regularities in customer's shopping behavior) Using MapReduce on Hadoop.	2	5	Apply
<b>Mini Project</b>				Create
<b>Course outcomes:</b>	The students will be able to			
	<ol style="list-style-type: none"> <li>1. Interview Hadoop framework and Hadoop Distributed File system</li> <li>2. Model the Map-Reduce programming to process the big data</li> <li>3. Experiment with various big data technologies like Hadoop Pig and Hive.0</li> <li>4. Make use of Machine Learning algorithms for real world big data applications.</li> <li>5. Utilize visualization tools to analyze web contents and Social Networks.</li> </ol>			
<b>Reference Books:</b>	<ol style="list-style-type: none"> <li>1. Raj Kamal and Preeti Saxena, "Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning", McGraw Hill Education, 2018 ISBN: 9789353164966, 9353164966</li> <li>2. Seema Acharya, SubhasiniChellappan, "Big Data and Analytics", Wiley Publications, 2015.</li> <li>3. Hadoop: The Definitive Guide, Tom White, Third Edition, O'Reilley, 2012.</li> <li>4. Big data analytics with R and Hadoop, Vignesh Prajapati, SPD 2013.</li> </ol>			

# B.N.M. Institute of Technology

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**Department of Artificial Intelligence and Machine Learning**

## SEMESTER – VI

### **Recommender Systems (Professional Elective I)** **Credit : 3**

Course Code	22AML165X	CIA Marks	50
Teaching Hours/Week (L: T: P: J)	3:0:0:0	SEA Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

#### **Course Learning Objectives:**

This course will enable students to

- To introduce the concept of recommender systems
- To be aware of various issues related to Personalization and Recommendations.
- To be aware of design space, trade-offs and its application in various domain
- To review basic approaches to building recommendations.

	<b>Number of Hours</b>	<b>Bloom's Level</b>
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### **Module-1**

#### **An Introduction to Recommender System:**

Introduction, Goals of Recommender Systems, Basic Models of Recommender Systems, Domain-Specific Challenges in Recommender Systems, Advanced Topics and Applications.

**RB1: Ch1**

**8**

**Understand (CO1)**

### **Module-2**

#### **Neighborhood-Based Collaborative Filtering:**

Introduction, Key Properties of Ratings Matrices, Predicting Ratings with Neighborhood-Based Methods, Clustering and Neighborhood-Based Methods, Dimensionality Reduction and Neighborhood Methods, A Regression Modeling View of Neighborhood Methods, Graph Models for Neighborhood-Based Methods

**RB1: Ch2**

**8**

**Analyze (CO2)**

### **Module-3**

#### **Model-Based Collaborative Filtering:**

Introduction, Decision and Regression Trees, Rule-Based Collaborative Filtering, Naive Bayes Collaborative Filtering, Latent Factor Models

**RB1: Ch3**

**8**

**Analyze (CO2, CO3)**

### **Module-4**

#### **Content-Based Recommender Systems:**

Introduction, Basic Components of Content-Based Systems, Preprocessing and Feature Extraction, Learning User Profiles and Filtering, Content-Based Versus Collaborative Recommendations, Using Content-Based Models for Collaborative Filtering

**RB 1: Ch4**

**8**

**Analyze (CO2)**

### **Module-5**

<p><b>Knowledge-Based Recommender Systems</b>          Introduction, Constraint-Based Recommender Systems, Case-based Recommender Systems</p> <p><b>Evaluating Recommender Systems</b>          Introduction, Evaluation Paradigms, General Goals of Evaluation Design, Design Issues in Offline Recommender Evaluation, Accuracy Metrics in Offline Evaluation, Limitations of Evaluation Measures</p> <p><b>RB 2: Ch. 5.1,5.2,5.3,7</b></p>	8	Analyze (CO2, CO4)
<p><b>Course outcomes:</b></p> <p>The students will be able to</p> <ol style="list-style-type: none"> <li>1. Understand the basic concepts of recommender systems</li> <li>2. Solve mathematical optimization problems pertaining to recommender systems</li> <li>3. Analyze the different approaches towards recommendation</li> <li>4. Carry out performance evaluation of recommender systems based on various metrics</li> </ol>		
<p><b>Reference Books:</b></p> <ol style="list-style-type: none"> <li>1. Charu C. Aggarwal, Recommender Systems: The Textbook, Springer, 2016.</li> <li>2. Dietmar Jannach , Markus Zanker , Alexander Felfernig and Gerhard Friedrich , Recommender Systems: An Introduction, Cambridge University Press (2011), 1st ed.</li> <li>3. Francesco Ricci , Lior Rokach , Bracha Shapira , Recommender Systems Handbook, 1st ed, Springer (2011)</li> </ol>		

# B.N.M. Institute of Technology

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## Department of Artificial Intelligence and Machine Learning

SEMESTER – VI

### EMBEDDED SYSTEMS (Professional Elective)

Credit: 3

<b>Course Code</b>	<b>22AML165X</b>	<b>CIA Marks</b>	<b>50</b>
Teaching Hours/Week (L: T: P: J)	3:0:0:0	<b>SEA Marks</b>	<b>50</b>
<b>Total Number of Contact Hours</b>	<b>40</b>	<b>Exam Hours</b>	<b>03</b>

**CREDITS –3**

#### Course Learning Objectives:

This course will enable students to:

- Understand the basic hardware components and Classification of Embedded systems, Major applications and purpose of ES.
- Develop the hardware software co-design and Sensors, Actuators, Optocoupler, Communication Interfaces
- Understand Operating System basics and Types of operating systems.
- Explain the need of real time operating system for embedded system applications.
- Understand the Integration and testing of Embedded hardware and firmware and Embedded system Development Environment

<b>Module-1: Embedded System Components</b>	<b>Contact Hours.</b>	<b>Bloom's Level</b>
<b>Embedded System Components:</b> Embedded Vs General computing system, Classification of Embedded systems, Major applications and purpose of ES. Elements of an Embedded System (Block diagram and explanation),	8	Apply
<b>Module-2: Sensors and Actuators &amp; Embedded System Design Concepts:</b>		
<b>Sensors and Actuators:</b> Differences between RISC and CISC, Harvard and Princeton-, Big- and Little-Endian formats, Memory (ROM and RAM types), Sensors, Actuators, Optocoupler, Communication Interfaces (12C, SPI, IrDA, Bluetooth, Wi-Fi, Zigbee only)	8	Apply
<b>Embedded System Design Concepts:</b> Characteristics and Quality Attributes of Embedded Systems, Operational and non-operational quality attributes, Embedded Systems-Application and Domain specific,		
<b>Module-3: Embedded Firmware Design &amp; Operating System</b>		
<b>Embedded Firmware Design:</b> Hardware Software Co Design and Program Modeling (excluding UML), Embedded firmware design and development (excluding C language). <b>Operating System:</b> Operating System basics, Types of operating systems, Task, process and threads (Only POSIX Threads with an example program), Thread preemption.	8	Apply
<b>Module-4: RTOS and IDE for Embedded System Design</b>		
<b>RTOS and IDE for Embedded System Design :</b>		

Preemptive Task scheduling techniques, Task Communication, Task synchronization issues - Racing and Deadlock, Concept of Binary and counting semaphores (Mutex example without any program), How to choose an RTOS.	8	<b>Apply</b>
<b>Module-5: Integration and testing of Embedded hardware and firmware:</b>		
<b>Integration and testing of Embedded hardware and firmware:</b> Integration and testing of Embedded hardware and firmware, Embedded system Development Environment- Block diagram (excluding Keil), Disassembler/decompiler, simulator, emulator and debugging techniques.	8	<b>Apply</b>
<b>Course Outcomes:</b>		
After studying this course, students will be able to:		
<ol style="list-style-type: none"> <li>Understand the basic hardware components and Classification of Embedded systems, Major applications and purpose of ES.</li> <li>Develop the hardware software co-design and Sensors, Actuators, Optocoupler, Communication Interfaces</li> <li>Understand Operating System basics and Types of operating systems.</li> <li>Explain the need of real time operating system for embedded system applications.</li> <li>Understand the Integration and testing of Embedded hardware and firmware and Embedded system Development Environment</li> </ol>		
<b>Reference Books:</b>		
<ol style="list-style-type: none"> <li>Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited, 2<sup>nd</sup> Edition.</li> <li>K.V. KPrasad, Embedded Real Time Systems, Dreamtech publications, 2003.</li> <li>Rajkamal, Embedded Systems, 211d Edition, McGraw hill Publications, 2010.</li> </ol>		

# B.N.M. Institute of Technology

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**Department of Artificial Intelligence and Machine Learning**

## SEMESTER VI

### Computer Graphics and Application (Professional Elective) Credit : 3

Course Code	22AML165X	CIA Marks	50
Teaching Hours/Week (L:T:P:J)	3:0:0:0	SEA Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

#### Course Learning Objectives:

- Explain hardware, software and OpenGL Graphics Primitives and Illustrate interactive computer graphics using OpenGL.
- Design and implementation of algorithms for 2D graphics Primitives and attributes.
- Demonstrate Geometric transformations, viewing on both 2D and 3D objects.
- Infer the representation of curves, surfaces, Colour, and Illumination model.
- Development of complex Graphical Models.

	Number of Hours	Bloom's Level
<b>Module – 1</b>		

#### Overview:

Computer Graphics Software , OpenGL: Introduction to OpenGL, coordinate reference frames, specifying two-dimensional world coordinate reference frames in OpenGL, OpenGL point functions, OpenGL line functions, point attributes, line attributes, curve attributes, OpenGL point attribute functions, OpenGL line attribute functions. Fill area Primitives, 2D Geometric Transformations and 2D viewing: Fill area Primitives: Polygon fill-areas, OpenGL polygon fill area functions, fill area attributes, general scan line polygon fill algorithm, OpenGL fill-area attribute functions. 2DGeometric Transformations: Basic 2D Geometric Transformations, matrix representations and homogeneous coordinates.

8                      Apply

#### Module – 2

Inverse transformations, 2DComposite transformations, other 2D transformations, raster methods for geometric transformations, OpenGL raster transformations, OpenGL geometric transformations function, 2D viewing: 2D viewing pipeline, OpenGL 2D viewing functions. Clipping,3D Geometric Transformations, Color and Illumination Models: Clipping: clipping window, normalization and viewport transformations, clipping algorithms,2D point clipping, 2D line clipping algorithms: cohen-sutherland line clipping only - polygon fill area clipping: Sutherland-Hodgeman polygon clipping algorithm3DGeometric Transformations: 3D translation, rotation, scaling, composite 3D transformations, other 3D transformations, affine transformations, OpenGL

8                      Apply

geometric transformations functions.		
<b>Module – 3</b>		
Color Models: Properties of light, color models, RGB and CMY color models. Illumination Models: Light sources, basic illumination models-Ambient light, diffuse reflection, specular and phong model, Corresponding openGL functions. 3D Viewing and Visible Surface Detection: 3DViewing:3D viewing concepts, 3D viewing10 pipeline, 3D viewing coordinate parameters , Transformation from world to viewing coordinates, Projection transformation, orthogonal projections, perspective projections, The viewport transformation and 3D screen coordinates.	8	Apply
<b>Module – 4</b>		
input& interaction, Curves and Computer Animation: Input and Interaction: Input devices, clients and servers, Display Lists, Display Lists and Modelling, Programming Event Driven Input, Menus Picking, Building Interactive Models, Animating Interactive programs, Design of Interactive programs, Logic operations .Curved surfaces, quadric surfaces, OpenGL Quadric-Surface and Cubic-Surface Functions, Bezier Spline Curves, Bezier surfaces, OpenGL curve functions. Corresponding openGL functions.	8	Apply
<b>Module – 5</b>		
Using OpenGL development of Recursive generation of Sierpinsi Gasket, Double Buffering Program: The program uses the mouse buttons to start and stop the spinning motion of the square, Rotating Cube Program : Rotating cube with color interpolation : This program demonstrates the use of homogeneus co-ordinate transformations and simple data structure for representing cube, Rotating the cube using vertex Arrays : Colors are assigned to the vertices ,cube is cantered at origin .Moving Viewer : Use the look at function in the display callback to point the viewer, whose position can be altered by z,X,y,Y,z,Z keys,The prospective view is set in the reshape callback.Rotating the cube with texture, Scene graph program,Particle system Program, any three programs using Bezier Curves	8	Apply
<b>Course outcomes:</b>		
<ul style="list-style-type: none"> <li>• Design and implement algorithms for 2D graphics primitives and attributes.</li> <li>• Illustrate Geometric transformations on both 2D and 3D objects.</li> <li>• Apply concepts of clipping and visible surface detection in 2D and 3D viewing, and Illumination Models.</li> <li>• Decide suitable hardware and software for developing graphics packages using OpenGL.</li> <li>• Apply Open Gl and Computer Graphics to develop Graphical Designs and Animation</li> </ul>		

**Reference Books:**

1. Donald Hearn & Pauline Baker: Computer Graphics with OpenGL Version,3rd / 4th Edition, Pearson Education,2011
2. Edward Angel: Interactive Computer Graphics- A Top Down approach with OpenGL, 5th edition. Pearson Education, 200

# B.N.M. Institute of Technology

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## Department of Artificial Intelligence and Machine Learning

### Cryptography (Professional Elective I)

#### SEMESTER- VI

Course Code	22AML165X	CIE Marks:	50
Teaching Hours/Week (L: T: P: J)	3:0:0:0	SEE Marks:	50
Total Number of Lecture Hours	40	SEE Duration:	3 Hours

#### Course Learning Objectives:

This course will enable students to

- Enable to learn the fundamental concepts of network security, cryptography and utilize these techniques in computing systems.
- Discuss about various encryption techniques.
- Understand the concept of public key Cryptography.
- Introduce and demonstrate message authentication, hash function, wireless security and internet security protocols.

Module 1: BACKGROUND	Number of Hours	Bloom's Level
<b>Computer, Network Security and Cryptography concepts:</b> Computer Security Concepts The OSI Security Architecture, Security Attacks, Security Services, Security Mechanisms, Fundamental Security Design Principles , Attack Surfaces and Attack Trees, A Model for Network Security, Standards. Classical Ciphers: Introduction to cryptography, cryptanalysis, and cryptology, Overview of cryptography	08	Apply
Module 2: SYMMETRIC CIPHERS		
<b>SYMMETRIC CIPHERS Advanced Encryption Standard:</b> Finite Field Arithmetic, AES Structure, AES Transformation Functions ,AES Key Expansion , An AES Example, AES Implementation, <b>Block Cipher Operation :</b> Multiple Encryption and Triple DES , Electronic Codebook ,Cipher Block Chaining Format-Preserving Encryption ,Stream Ciphers.	08	Apply
Module 3: ASYMMETRIC CIPHERS		
<b>Public-Key Cryptography and RSA :</b> Principles of Public-Key Cryptosystems : The RSA Algorithm <b>Other Public-Key Cryptosystems :</b> Diffie-Hellman Key Exchange ,Elgamal Cryptographic System ,Elliptic Curve, Elliptic Curve Cryptography, Pseudorandom Number Generation Based on an Asymmetric Cipher	08	Apply
Module 4: CRYPTOGRAPHIC DATA INTEGRITY ALGORITHMS		
<b>Cryptographic Hash Functions:</b> Applications of Cryptographic Hash Functions ,Two Simple Hash Functions, Requirements and Security ,Hash Functions Based on Cipher Block Chaining ,Secure Hash Algorithm (SHA) ,SHA-3 . <b>Message</b>	08	Apply

<b>Authentication Codes</b> :Message Authentication Requirements message Authentication Functions, Requirements for Message Authentication Codes , <b>Digital Signatures</b> : Digital Signatures ,Elgamal Digital Signature Scheme , Elliptic Curve Digital Signature Algorithm.		
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### **Module 5: NETWORK AND INTERNET SECURITY**

Cloud Computing, Cloud Security Risks and Countermeasures, Data Protection in the Cloud, Cloud Security as a Service Addressing Cloud Computing Security Concerns

**Wireless Network Security:** Wireless Security, Mobile Device Security,

**Electronic Mail Security:** Email Threats and Comprehensive Email Security, S/MIME

**IP Security :**IP Security Overview, IP Security Policy , Internet Key Exchange

#### **Course Outcomes:**

At the end of the course, the students will be able to:

1. Identify the cryptographic solutions for the problems.
2. Classify and apply the symmetric encryption techniques to solve the problems.
3. Apply and illustrate various public key cryptographic techniques to solve the problems.
4. Evaluate the authentication and hash algorithms.
5. Apply wireless security and internet security protocols.

#### **Reference Books**

1. Cryptography and Network Security: Principles and Practice, 7<sup>th</sup> Edition, Pearson Education by William Stallings
2. Cryptography and Network Security, Behrouz A.Foruzan, 3rd edition, Tata McGraw Hill, 2007
3. Cyber Defense Mechanisms: Security, Privacy, and Challenges (Artificial Intelligence (AI): Elementary to Advanced Practices) by Gautam Kumar (Editor), Dinesh Kumar Saini, Nguyen Ha Huy Cuong, 1<sup>st</sup> edition, CRC Press, 2020.

**08**

**Apply**

# B.N.M. Institute of Technology

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## Department of Artificial Intelligence and Machine Learning

### SEMESTER – VI

#### Data Warehousing & Data Mining (Professional Elective I)

Credit : 3

Course Code	22AML165X	CIA Marks	50
Teaching Hours/Week (L: T: P: J)	3:0:0:0	SEA Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

#### Course Learning Objectives:

This course will enable students to

1. Define multi-dimensional data models.
2. Explain rules related to association, classification and clustering analysis.
3. Compare and contrast between different classification and clustering algorithms

	Number of Hours	Bloom's Level
<b>Module-1 Data Warehouse: Basic Concepts and Modeling</b>		
<b>Basic Concepts:</b> Introduction, A multitier Architecture, Data warehouse models: Enterprise warehouse, Data mart and virtual warehouse, Extraction, Transformation and loading, Metadata Repository.	8	Apply
<b>Data Cube:</b> 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, Starnet Query Model for Querying multidimensional databases.		
<b>Module-2 Data Warehouse: Design, Usage &amp; Implementation</b>		
<b>Design, Usage:</b> A Business Analysis Framework for data warehouse design, Data Warehouse design process, data warehouse usage for Information processing, Online analytics processing to Multidimensional Data Mining.	8	Apply
<b>Implementation:</b> Efficient Data cube Computation: An Overview, Indexing OLAP Data: Bitmap Index and Join Index, Efficient Processing of OLAP Queries, OLAP server architectures: ROLAP versus MOLAP versus HOLAP.		
<b>Module-3 Data Mining: Introduction &amp; Association Analysis</b>		
<b>Introduction:</b> What is data mining, Challenges, Data Mining Tasks, Data: Types of Data, Data Quality, Data Preprocessing, Measures of Similarity and Dissimilarity.	8	Apply
<b>Association Analysis:</b> Problem definition, Frequent Itemset Generation, Rule Generation, Compact Representation of Frequent Itemsets, Alternative methods for generating frequent itemsets, FP-Growth algorithm		
<b>Module-4 Clustering</b>		

<b>Prototype- Based Clustering:</b> Fuzzy Clustering, Slustering usng mixture models, Self-Organizing Maps (SOM) <b>Density-based clustering:</b> Grid-based, subspace, DENCLUE	<b>8</b>	<b>Apply</b>
<b>Module-5 Clustering-II</b>		
<b>Graph- Based Clustering:</b> Sparsification, Minimum Spanning tree clustering, OPOSSUM: Optimal partitioning of Sparse similarities using METIS,Chameleon: Hierarchical clustering with dynamic modeling, shared nearest neighbor similarity, The Jarvis-Patrick clustering algorithm, SNN Density, SNN-Density Based clustering, <b>Scalable Clustering algorithms:</b> General Issues and approaches, BIRCH, CURE.	<b>8</b>	<b>Apply</b>
<b>Course outcomes:</b> <ol style="list-style-type: none"> <li>Identify data mining problems and implement the data warehouse</li> <li>Write association rules for a given data pattern.</li> <li>Choose between classification and clustering solution.</li> </ol>		
<b>Reference Books:</b> <ol style="list-style-type: none"> <li>Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Pearson, First impression,2014.</li> <li>Jiawei Han, Micheline Kamber, Jian Pei: Data Mining -Concepts and Techniques, 3rd Edition, Morgan Kaufmann Publisher, 2012.</li> <li>Sam Anahory, Dennis Murray: Data Warehousing in the Real World, Pearson,Tenth Impression,2012.</li> <li>Michael.J.Berry,Gordon.S.Linoff: Mastering Data Mining , Wiley Edition, second edition,2012.</li> </ol>		

# B.N.M. Institute of Technology

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## Department of Artificial Intelligence and Machine Learning

### Semester VI

#### Mobile Application Development (Professional Elective)

Credit: 3

Course code	22AML165X	CIA Marks	50
Teaching Hours/Week(L:T: P: J)	3:0:0:0	SEA Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

**Course Learning Objectives:** This course will enable students to:

- Identify the requirements and components of android application.
- Experiment with various components of Android application.
- Design interactive user interface.
- Develop Android Applications.

	Number of Hours	Bloom's Level
<b>Module – I: Introduction to Android</b> The Android Platform, Android SDK, Eclipse Installation, Android Installation, building you First Android application, Understanding Anatomy of Android Application, Android Manifest file.	8	Apply
<ul style="list-style-type: none"> <li>Installation of Android and its supporting softwares.</li> <li>Building first android application.</li> <li>Create an application to design a Visiting Card. The Visiting card should have a company logo at the top right corner. The company name should be displayed in Capital letters, aligned to the centre. Information like the name of the employee, job title, phone number, address, email, fax and the website address are to be displayed. Insert a horizontal line between the job title and the phone number.</li> </ul>	8	Apply
<b>Module – II: Android Application Design Essentials</b> Anatomy of an Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions.	8	Apply
<ul style="list-style-type: none"> <li>Develop an Android application using controls like Button, TextView, EditText for designing a Calculator having basic functionality like Addition, Subtraction, Multiplication, and Division.</li> <li>Write a program using a Table Layout for our restaurant data entry form, add a set of radio buttons to represent the type of restaurant</li> <li>Create a SIGN Up activity with Username and Password. Validation of password should happen based on the following rules: <ul style="list-style-type: none"> <li>Password should contain uppercase and lowercase letters.</li> <li>Password should contain letters and numbers.</li> <li>Password should contain special characters.</li> <li>Minimum length of the password (the default value is 8).</li> </ul> </li> </ul> <p>On successful SIGN UP proceed to the next Login activity. Here the user should SIGN IN using the Username and Password created during signup activity. If the Username and Password are matched then</p>	8	Apply

<p>navigate to the next activity which displays a message saying “Successful Login” or else display a toast message saying “Login Failed”. The user is given only two attempts and after that display a toast message saying “Failed Login Attempts” and disable the SIGN IN button. Use Bundle to transfer information from one activity to another</p> <ul style="list-style-type: none"> <li>• Write a program to create an activity with two buttons START and STOP. On Pressing of the START button, the activity must start the counter by displaying the numbers from One and the counter must keep on counting until the STOP button is pressed. Display the counter value in a TextView control.</li> </ul>		
<b>Module – III: Android User Interface Design Essentials</b> User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation.		
<ul style="list-style-type: none"> <li>• Develop an application to set an image as wallpaper. On click of a button, the wallpaper image should start to change randomly every 30 seconds.</li> <li>• Create two files of XML and JSON type with values for City_Name, Latitude, Longitude, Temperature, and Humidity. Develop an application to create an activity with two buttons to parse the XML and JSON files which when clicked should display the data in their respective layouts side by side.</li> <li>• Write a program to send user from one application to another. (For example redirection to map)</li> </ul>	8	<b>Apply</b>
<b>Module – IV: Testing Android applications</b> Testing Android applications, Publishing Android application, Using Android preferences, Managing Application resources in a hierarchy, working with different types of resources.		
<ul style="list-style-type: none"> <li>• Develop a simple application with one Edit Text so that the user can write some text in it. Create a button called “Convert Text to Speech” that converts the user input text into voice.</li> <li>• Write a program to play audio files.</li> <li>• Write a program to play video files.</li> </ul>	8	<b>Apply</b>
<b>Module – V: Using Common Android APIs</b> Using Android Data and Storage APIs, managing data using Sqlite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World. Department of Computer Science and Engineering		
<ul style="list-style-type: none"> <li>• Create an activity like a phone dialer with CALL and SAVE buttons. On pressing the CALL button, it must call the phone number and on pressing the SAVE button it must save the number to the phone contacts.</li> <li>• Write a program to send SMS.</li> <li>• Write a program to capture image using built in camera.</li> </ul>	8	<b>Apply</b>
<b>Course Outcomes:</b> The student will be able to: <ul style="list-style-type: none"> <li>• Identify the requirements for designing an android application and perform installations.</li> <li>• Experiment with various components in android.</li> <li>• Design efficient user interface using different layouts.</li> </ul>		

- Develop application with persistent data storage using SQLite

1. J. F. DiMarzio, Beginning Android Programming with Android Studio, 4thEdition, 2017
2. John Horton, Android Programming for Beginners, 1stEdition, 2015
3. Dawn Griffiths & David Griffiths, Head First Android Development, O'Reilly, 1stEdition, 2015
4. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd
5. Android Application Development All in one for Dummies by Barry Burd, Edition: I

# B.N.M. Institute of Technology

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## Department of Artificial Intelligence and Machine Learning

### SEMESTER –VI

#### Professional Elective 2-Responsible AI(22AML16612)

Credit:3

Course Code	<b>22AML16612</b>	CIA Marks	50
Teaching Hours/Week(L:T:P:J)	3:0:0:0	SEA Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

#### Course Learning Objectives:

This course will enable students to

1. Responsible AI and Ethics
2. Ethics and Social implications of AI.
3. Principles of Responsible AI and machine learning
4. Global AI governance framework and standards of OECD
5. Legal and regulatory landscape for AI, covering laws related to non-discrimination , data protection and intellectual property

	Number of Hours	Bloom's Level

#### Module-1: Introduction to Responsible AI and its Principles, Fundamentals of AI

Responsible AI, Principles, AI Framework ,Bias in AI, RAI Policies and Governance, Creating and Evaluating AI models, Identify Ethical issues, Issue spotting and mitigation, monitoring and optimizing AI model  Types of AI Systems: Narrow vs. General AI, Machine Learning Basics and Training Methods, Deep Learning, Generative AI, and Transformer Models, Natural Language Processing and Multi-modal Models, Socio-technical AI Systems and Cross-disciplinary Collaboration, The History and Evolution of AI and Data Science	8	Apply
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#### Module-2 Understand AI impact on society, RAI principles trustworthy AI

Individual Harms: Civil Rights, Safety, and Economic Impact, Group Harms: Discrimination and Bias in AI Systems, Societal Harms: Democracy, Education, and Public Trust, Organizational Risks: Reputational, Cultural, and Economic Threats, Environmental and Ecosystem Impacts of AI, Redistribution of Jobs and Economic Opportunities Due to AI, AI's Impact on Workforce and Educational Access  Core Principles of Responsible AI, Human-centric AI Systems, Transparency, Explainability, and Accountability in AI, Safe, Secure, and Resilient AI Systems,	8	Apply
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Privacy-Enhanced AI Systems and Data Protection, OECD and EU Standards for Trustworthy AI, Comparison of Global Ethical Guidelines for AI		
<b>Module-3: AI laws and regulatory compliance, AI Legal Framework, GDPR Requirements</b>		
Section Introduction, AI-Specific Laws and Regulations, Non-Discrimination Laws and AI Applications, Product Safety Laws for AI Systems, Privacy and Data Protection in AI Systems, Intellectual Property and AI: Legal Considerations, Key Components of the EU Digital Services Act , the Intersection of AI and GDPR Requirements  Comparison of Global Ethical Guidelines for AI, Requirements for High-Risk AI Systems and Foundation Models, Notification and Enforcement Mechanisms under the EU AI Act, Canada's Artificial Intelligence and Data Act (Bill C-27), Key Components of U.S. AI-related State Laws, China's Draft Regulations on Generative AI, Harmonizing Global AI Laws and Risk Management Frameworks	8	Apply
<b>Module-4: AI Development Life Cycle and Testing</b>		
Section introduction, Determining AI governance structure and responsibilities, Data strategies, model selection, Ethical design in AI system and Architecture, Understanding the Governance Challenges in AI Planning, Cross-functional Team Collaboration in AI Planning  Feature engineering in AI model, Model Training and best practices, Testing and Validation process AI Models, Testing AI Models with Edge Cases and Adversarial Inputs, Privacy-preserving Machine Learning Techniques, Repeatability Assessments and Model Fact Sheets, conducting Algorithm Impact Assessments	8	Apply
<b>Module-5: Implementation of AI Governance, AI Project Management and Risk Management</b>		
Section Introduction, Creating AI Risk Management Frameworks, AI Governance Infrastructure: Key Roles and Responsibilities, Cross-functional Collaboration in AI Governance, AI Regulatory Requirements and Compliance Procedures, Establishing a Responsible AI Culture within Organizations, Assessing AI Maturity Levels in Business Functions, Managing Third-Party Risks in AI Systems  Scoping AI Projects: Identifying Key Objectives, Mapping AI Risks: Identifying Internal and External Threats, Developing Risk Mitigation Strategies for AI Projects, Constructing a Harms Matrix for AI Risk Assessment, Conducting Algorithm Impact Assessments, Engaging Stakeholders in AI Risk Management, Data Provenance, Lineage, and Accuracy in AI Systems	8	Apply

**Course Outcomes:**

The students will be able to

1. Understand Responsible AI ,its Principles and AI Life cycle
2. Apply fundamentals of AI and its impact into society
3. Apply AI laws, regulatory compliance, AI Legal Framework,
4. Apply AI Governance and Risk Management
5. Apply OECD standards in the AI product life cycle

Reference Link:

<https://lms.simplilearn.com/courses/6752/Introduction-to-Responsible-AI/syllabus>

<https://www.simplilearn.com/free-google-cloud-responsible-ai-course-skillup?tag=ethical%20AI>

<https://www.udemy.com/course/ai-governance-professional-aigp-certification-ai-mastery/?couponCode=JUST4U02223>

**Marks Distribution for Assessment**

CIA (50)	Components	Description	Marks
	Written test	<ul style="list-style-type: none"> <li>• Total Number of Test:03</li> <li>• Each Theory test will be conducted for 30 marks</li> <li>• Average of 3 tests= 30 Marks</li> </ul>	<b>30</b>
	Practical	<ul style="list-style-type: none"> <li>• Case Study Demonstration(mini project)</li> <li>• 3 Course Certificates</li> </ul>	<b>10</b>
			<b>Total CIA</b> <b>50</b>
SEA (50)	Written exam	<ul style="list-style-type: none"> <li>• Theory exam will be conducted for 100 marks and scaled down to 50 marks.</li> <li>• The question paper will have 10 full questions each of 20 marks. Students have to answer 5 full questions.</li> </ul>	<b>50</b>
		<b>Total Marks for the Course</b>	<b>100</b>

# B.N.M. Institute of Technology

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## Department of Artificial Intelligence and Machine Learning

### SEMESTER –VI

#### Cyber Security and Privacy

**Credit:3**

Course Code	22AML16642	CIA Marks	50
Teaching Hours/Week(L:T:P:J)	3:0:0:0	SEA Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

#### Course Learning Objectives:

This course will enable students to

- Understand fundamentals of Cyber security.
- Explain security Architecture and security techniques
- Illustrate risk management issues and solutions.
- Explain data privacy and protection.

	<b>Number of Hours</b>	<b>Bloom's Level</b>
<b>Module-1: Introduction to Cyber Security</b>		
Introduction: Fundamentals of Security, Threat actors, physical Security, Social Engineering, Malware.	8	<b>Understand</b>
<b>Module-2: Risk Management</b>		
Cryptographic solutions, Risk management, Third party vendor risk management, Governance and Compliance. Asset and change management, Cyber Resilience and Redundancy	8	<b>Apply</b>
<b>Module-3: Architecture</b>		
Security Architecture, Security Infrastructure, identity and access management (IAM) Solution, Vulnerabilities and attacks, Malicious Activity.	8	<b>Apply</b>
<b>Module-4: Security Techniques</b>		
Hardening, Security Techniques, Vulnerability Management, Alerting and Monitoring, Incident Response, Investigating an Incident, Automation and orchestration, Security Awareness.	8	<b>Apply</b>
<b>Module-5: Data Privacy and Protection</b>		
Data privacy - Data Protection, Complete GDPR, GDPR Certification, privacy, Hands on Programs.	8	<b>Apply</b>

**Course Outcomes:**

The students will be able to

1. Understand the Fundamental Cyber Security Concept.
2. Apply security risk management strategies.
3. Identify different types of attack, vulnerability issues and Malicious Activity.
4. Apply different security techniques to address security issues.
5. Make use of GDPR for data Privacy and Protection.

**Reference Books:**

1. Udemy course:  
<https://www.udemy.com/share/101Wj83@I57HMBLebSbmoRf1WCIXshoCztsg0Vo2PMWANE92oMcvsCK9YVpf-YTnK604c1JQ/>
2. Cryptography and Network Security: Principles and Practice, 7<sup>th</sup> Edition, Pearson Education by William Stallings
3. Cryptography and Network Security, Behrouz A. Foruzan, 3rd edition, Tata McGraw Hill, 2007
4. Cyber Defense Mechanisms: Security, Privacy, and Challenges (Artificial Intelligence (AI): Elementary to Advanced Practices) by Gautam Kumar (Editor), Dinesh Kumar Saini, Nguyen Ha Huy Cuong, 1<sup>st</sup> edition, CRC Press, 2020

**Marks Distribution for Assessment**

<b>CIA (50)</b>	<b>Components</b>	<b>Description</b>	<b>Marks</b>
	Written test	<ul style="list-style-type: none"> <li>• Total Number of Test:03</li> <li>• Each Theory test will be conducted for 30 marks</li> <li>• Average of 3 tests= 30 Marks</li> </ul>	<b>30</b>
	Practical	<ul style="list-style-type: none"> <li>• Activity to demonstrate the Cyber Security issue</li> <li>• Presentation +Course Certificate</li> </ul>	<b>10</b>
			<b>10</b>
<b>Total CIA</b>			<b>50</b>
<b>SEA (50)</b>	Written exam	<ul style="list-style-type: none"> <li>• Theory exam will be conducted for 100 marks and scaled down to 50 marks.</li> <li>• The question paper will have 10 full questions each of 20 marks. Students have to answer 5 full questions.</li> </ul>	<b>50</b>
		<b>Total Marks for the Course</b>	<b>100</b>

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## Department of Artificial Intelligence and Machine Learning

### SEMESTER – VI

#### Data Science Credit : 3

Course Code	22AML16652	CIA Marks	50
Teaching Hours/Week (L: T: P: J)	3:0:0:0	SEA Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

#### Course Learning Objectives:

This course will enable students to

- Introduce the concepts of python programming, SQL and HTML.
- Identify different cloud platforms and their characteristics for data specific core computations.
- Identify the concepts of data warehousing and big data.
- Determine the concepts of Power Business Intelligence.
- Design queries for analysis of data.

	Number of Hours	Bloom's Level

#### Module-1

**SQL:** Database and RDBMS, NoSQL, RDBMS Advanced Queries, Functions, Aggregate and Analytical, Data Integrity, Subqueries & Views, SQL Advanced Concepts

**Python:** Introduction to python, python variables and syntax, conditions, python strings, tuples, functions in python, Matplotlib and seaborn for data visualization, Data visualization: plots, histograms, heatmap, Data preprocessing: missing values, outliers, encoding, Scaling and normalization, multivariate analysis, packages and python connectivity

**XML, Javascript and Webservices:** What is XML, XML basic tags and XML examples, What is Javascript and why Javascript Requires and Javascript example, Introduction to Webservices, What is Client and server technologies, HTTP Protocols and various methods of HTPP?

8

Apply

#### Module-2

**Data specific core: AWS Data Services:** Identity Access Management-IAM, Elastic Cloud Compute- EC2, AWS RDS, AWS Glue, AWS Redshift, AWS EMR, AWS - Dynamo DB, AWS QuickSight, AWS SageMaker

8

Apply

**GCP Data Services:** Compute Engine, Cloud Storage, Cloud SQL, Spanner, Datastore, Bigtable, BigQuery, Data Proc, DataFlow, Cloud Composer, Dataprep, Data Fusion, Cloud AutoML, Looker

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<p><b>Azure Data Services:</b> introduction to Azure storage, benefits of Azure storage, <b>Blob storage</b>, <b>Azure files</b>, <b>Azure container storage</b>, types of storage accounts, <b>encryption</b>, <b>Azure HDInsight</b>, What is HDInsight and the Hadoop technology stack?, Cluster types in HDInsight, Programming languages in HDInsight, Azure Cosmos DB - Database for the AI Era, Simplified application development</p>		
<b>Module-3</b>		
<p><b>Data Specific - DWH, DI/BI Concepts:</b> Introduction to NoSQL, Key Features of NoSQL, advantages and disadvantages of NoSQL, Types of NoSQL database, Databricks architecture overview, High-level architecture, Serverless compute plane, Classic compute plane</p> <p><b>Big Data Hadoop and Spark:</b> History and timeline of big data, RDDs vs DataFrames and Datasets, When to use them and why, Benefits of Dataset APIs, Understanding Hadoop Architecture, Components, and How It Works, Functional Programming.</p>	8	Apply
<b>Module-4</b>		
<p><b>Power BI:</b> What is PowerBI, the parts of Power BI, How Power BI matches the role in a team or project, The flow of work in Power BI, How Microsoft Fabric works with Power BI, Paginated reports in the Power BI service, On-premises reporting with Power BI Report Server, powerBI visuals, Preattentive Attributes in Visualization</p>	8	Apply
<b>Module-5</b>		
<p><b>Snowflake:</b> Getting started with snowflake, key concepts and architecture, supporting cloud platforms, supported cloud regions, snowflake editions, snowflake releases, overview of key features, overview of data life cycle, continuous data protection, snowflake ecosystem, snowflake partner connect, general configuration, snowflake architecture, snowflake virtual warehouse overview, snowflake features, Analysis of real time applications through snowflake.</p>	8	Apply
<p><b>Course outcomes:</b>  The students will be able to:</p> <ul style="list-style-type: none"> <li>• Apply the core concepts of SQL, Python and XML to perform analytics on data. (Apply)</li> <li>• Develop a comparison study of various cloud platforms and study their services and database. (Apply)</li> <li>• Apply the concept of Data warehousing, business intelligence and big data to analyze datasets. (Apply)</li> <li>• Design and develop power business intelligence and visualization for data analytics through snowflake platform. (Apply)</li> <li>• Analyze datasets with appropriate programming language, SQL and snowflake queries. (Analyze)</li> </ul>		

## References:

SI No	Modules	Recommended Links for reference
<u>1</u>	Data Specific - SQL Deep-dive	<a href="https://www.slideshare.net/search?searchfrom=header&amp;q=SQL">https://www.slideshare.net/search?searchfrom=header&amp;q=SQL</a>
<u>2</u>		<a href="https://docs.snowflake.com/en/sql-reference-commands">https://docs.snowflake.com/en/sql-reference-commands</a>
<u>3</u>		<a href="https://comparecloud.in/">https://comparecloud.in/</a>
<u>4</u>	Data Specific - DWH, DI/BI Concepts	<a href="https://www.geeksforgeeks.org/introduction-to-nosql/">https://www.geeksforgeeks.org/introduction-to-nosql/</a>
<u>5</u>		<a href="https://docs.databricks.com/en/getting-started/overview.html">https://docs.databricks.com/en/getting-started/overview.html</a>
<u>6</u>		<a href="https://docs.snowflake.com/en/sql-reference-commands">https://docs.snowflake.com/en/sql-reference-commands</a>
<u>7</u>	Data Specific - Big Data Hadoop + Spark	<a href="https://www.techtarget.com/whatis/feature/A-history-and-timeline-of-big-data">https://www.techtarget.com/whatis/feature/A-history-and-timeline-of-big-data</a>
<u>8</u>		<a href="https://www.databricks.com/blog/2016/07/14/a-tale-of-three-apache-spark-apis-rdds-dataframes-and-datasets.html">https://www.databricks.com/blog/2016/07/14/a-tale-of-three-apache-spark-apis-rdds-dataframes-and-datasets.html</a>
<u>9</u>		<a href="https://medium.com/@chenglong.w1/demystifying-yarn-understanding-its-architecture-components-and-how-it-works-738dd95ad453">https://medium.com/@chenglong.w1/demystifying-yarn-understanding-its-architecture-components-and-how-it-works-738dd95ad453</a>
<u>10</u>		<a href="https://github.com/readme/guides/functional-programming-basics">https://github.com/readme/guides/functional-programming-basics</a>
<u>11</u>	AWS Data Services	<a href="https://aws.amazon.com/quickstart/">https://aws.amazon.com/quickstart/</a>
<u>12</u>		<a href="https://aws.amazon.com/about-aws/global-infrastructure/?p=ngi&amp;loc=0">https://aws.amazon.com/about-aws/global-infrastructure/?p=ngi&amp;loc=0</a>
<u>13</u>	Azure Data Services	<a href="https://learn.microsoft.com/en-us/azure/storage/common/storage-introduction">https://learn.microsoft.com/en-us/azure/storage/common/storage-introduction</a>
<u>14</u>		<a href="https://learn.microsoft.com/en-us/training/paths/azure-sql-fundamentals/">https://learn.microsoft.com/en-us/training/paths/azure-sql-fundamentals/</a>
<u>15</u>		<a href="https://learn.microsoft.com/en-us/azure/data-factory/quickstart-get-started">https://learn.microsoft.com/en-us/azure/data-factory/quickstart-get-started</a>
<u>16</u>		<a href="https://learn.microsoft.com/en-us/azure/hdinsight/hdinsight-overview">https://learn.microsoft.com/en-us/azure/hdinsight/hdinsight-overview</a>
<u>17</u>		<a href="https://learn.microsoft.com/en-us/azure/synapse-analytics/overview-what-is">https://learn.microsoft.com/en-us/azure/synapse-analytics/overview-what-is</a>
<u>18</u>		<a href="https://learn.microsoft.com/en-us/fabric/get-started/microsoft-fabric-overview">https://learn.microsoft.com/en-us/fabric/get-started/microsoft-fabric-overview</a>
<u>19</u>		<a href="https://learn.microsoft.com/en-us/azure/cosmos-db/introduction">https://learn.microsoft.com/en-us/azure/cosmos-db/introduction</a>
<u>20</u>		<a href="https://learn.microsoft.com/en-IN/azure/machine-learning/tutorial-azure-ml-in-a-day?view=azureml-api-2">https://learn.microsoft.com/en-IN/azure/machine-learning/tutorial-azure-ml-in-a-day?view=azureml-api-2</a>
<u>21</u>	GCP Data Services	<a href="https://www.youtube.com/@googlecloudtech">https://www.youtube.com/@googlecloudtech</a>
<u>22</u>		<a href="https://thecloudgirl.dev/sketchnote.html">https://thecloudgirl.dev/sketchnote.html</a>
<u>23</u>		<a href="https://cloud.google.com/docs">https://cloud.google.com/docs</a>
<u>24</u>		<a href="https://cloud.google.com/architecture">https://cloud.google.com/architecture</a>
<u>25</u>	Power BI	<a href="https://www.youtube.com/watch?v=yKTSLfVGbk">https://www.youtube.com/watch?v=yKTSLfVGbk</a>
<u>26</u>		<a href="https://learn.microsoft.com/en-us/power-bi/fundamentals/power-bi-overview">https://learn.microsoft.com/en-us/power-bi/fundamentals/power-bi-overview</a>
<u>27</u>		<a href="https://powerbi.microsoft.com/en-us/blog/">https://powerbi.microsoft.com/en-us/blog/</a>
<u>28</u>		<a href="https://powerbi.microsoft.com/en-my/search/community/">https://powerbi.microsoft.com/en-my/search/community/</a>
<u>29</u>		<a href="https://www.youtube.com/watch?v=77jlzgvCIYy">https://www.youtube.com/watch?v=77jlzgvCIYy</a>
<u>30</u>		<a href="https://appsource.microsoft.com/en-us/marketplace/apps?product=power-bi-visuals">https://appsource.microsoft.com/en-us/marketplace/apps?product=power-bi-visuals</a>
<u>31</u>		<a href="https://www.perceptualedge.com/about.php">https://www.perceptualedge.com/about.php</a>
<u>32</u>		<a href="https://daydreamingnumbers.com/blog/preattentive-attributes-example/">https://daydreamingnumbers.com/blog/preattentive-attributes-example/</a>
<u>33</u>		<a href="https://www.storytellingwithdata.com/">https://www.storytellingwithdata.com/</a>

<u>34</u>	Snowflake	<a href="https://docs.snowflake.com/en/sql-reference-commands">https://docs.snowflake.com/en/sql-reference-commands</a>
<u>35</u>		<a href="https://learn.snowflake.com/en/">https://learn.snowflake.com/en/</a>
<u>36</u>		<a href="https://quickstarts.snowflake.com/">https://quickstarts.snowflake.com/</a>
<u>37</u>		<a href="https://www.snowflake.com/resource/7-snowflake-reference-architectures-application-builders/#main-content">https://www.snowflake.com/resource/7-snowflake-reference-architectures-application-builders/#main-content</a>
<u>38</u>		<a href="https://www.snowflake.com/en/data-cloud/pricing-options/">https://www.snowflake.com/en/data-cloud/pricing-options/</a>

### Marks Distribution for Assessment

CIA (50)	Components	Description	Marks
	Written test	<ul style="list-style-type: none"> <li>• Total Number of Test:03</li> <li>• Each Theory test will be conducted for 30 marks</li> <li>• Average of 3 tests= 30 Marks</li> </ul>	<b>30</b>
	Assignment	Perform data analytics with a dataset and represent them with data visualization.	<b>10</b>
	Presentation	Presenting the data visualization and representing the concepts of data analytics.	<b>10</b>
		<b>Total CIA</b>	<b>50</b>
SEA (50)	Written exam	<ul style="list-style-type: none"> <li>• Theory exam will be conducted for 100 marks and scaled down to 50 marks.</li> <li>• The question paper will have 10 full questions each of 20 marks. Students have to answer 5 full questions.</li> </ul>	<b>50</b>
		<b>Total Marks for the Course</b>	<b>100</b>

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## Department of Artificial Intelligence and Machine Learning

### SEMESTER – VI

#### Big Data Analytics and Data Visualization (Open Elective)

Credit : 3

Course Code	22AML1671	CIA Marks	50
Teaching Hours/Week (L: T: P: J)	3:0:0:0	SEA Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

#### Course Learning Objectives:

This course will enable students to

- Describe Big Data and its importance with its applications
- Get familiar with Hadoop distributions, configuring Hadoop and performing File management tasks
- Develop map-reduce analytics using Hadoop and related tools
- Interpret the data in the context of the business.
- Identify an appropriate method to analyze the data.

	Number of Hours	Bloom's Level
<b>Module-1 Introduction</b>		
Classification of Digital data: Structured Data, Semi Structured Data, Unstructured Data; Definition of Big Data, Characteristics of Data, Big Data Types, Big Data Classification, Big Data Handling Techniques; Scalability And Parallel Processing; Designing Data Architecture; Data Sources, Quality, Pre-Processing and Storing; Data Storage and Analysis; Big Data Analytics Applications and Case Studies.	8	Apply
<b>Module-2 Introduction to Hadoop</b>		
Introduction; Why Hadoop? RDBMS Vs Hadoop, Distributed computing challenges, Hadoop Features, Advantages of Hadoop, Versions of Hadoop; Processing data with Hadoop ; Hadoop and its Ecosystem; Hadoop Distributed File System; MapReduce Framework and Programming Model; Hadoop Yarn; Hadoop Ecosystem Tools;	8	Apply
<b>Module-3 Introduction to Map Reduce Programming</b>		
Introduction; MapReduce Map Tasks, Reduce Tasks and MapReduce Execution- Map-Tasks, Key-Value Pair, Grouping by Key, Partitioning; Combiners, Reduce Tasks, Details of MapReduce Processing Steps, Coping with Node Failures. Composing MapReduce for Calculations and Algorithms – Composing MapReduce for Calculations, Matrix-Vector Multiplication by MapReduce, Relational-Algebra Operations, Matrix Multiplication; Searching and Sorting algorithms implementations using MapReduce.	8	Apply
<b>Module-4 Introduction to visual analytics</b>		

Introduction to visual analytics, Foundations of data visualization, Visual perception, Information analysis and visual variables, Data and task abstraction, Scientific Visualization Scientific data models, Basic visualization techniques. Human and computer in the Loop, External Representation, Use Interactivity, Vis Idiom Design, Most Designs Ineffective, Validation Difficulty in Validation, Resource Limitations.	<b>8</b>	<b>Analyze</b>
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### **Module-5 Data Visualization Techniques**

Data Visualization: Bar Charts, Histograms, Pie Charts, Scatter Plots, Line Plots, Regression. Case Studies	<b>8</b>	<b>Analyze</b>
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#### **Course outcomes:**

The students will be able to

1. Understand fundamentals of Big Data analytics
2. Investigate Hadoop framework and Hadoop Distributed File system.
3. Demonstrate the MapReduce programming model to process the big data
4. Explain the importance of visual analysis
5. Visualize big data to perform decision making in real world problems

#### **Reference Books:**

1. Raj Kamal and Preeti Saxena, “Big Data Analytics Introduction to Hadoop, Spark, and Machine-Learning”, McGraw Hill Education, 2018 ISBN: 9789353164966, 9353164966
2. S C Albright and W L Winston, Business analytics: data analysis and decision making, 5/e Cenage Learning
3. Seema Acharya, SubhasiniChellappan, “Big Data and Analytics”, Wiley Publications, 2015.
4. Hadoop: The Definitive Guide, Tom White, Third Edition, O'Reilley, 2012.
5. Visualization Analysis and Design by Tamara Munzner, A K Peters Visualization Series, CRC Press.

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## Department of Artificial Intelligence and Machine Learning

### SEMESTER – VI

#### Natural Language Processing (Open Elective)

Credit: 3

Course Code	22AML1672	CIA Marks	50
Teaching Hours/Week(L:T: P: J)	3:0:0:0	SEA Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

#### Course Learning Objectives:

This course will enable students to

- Understand, Natural Language Processing Concepts and its Applications.
- Analysis of regular expression, parsing.
- Semantic Analysis of meaning representation.
- Design of information retrieval models.

	Number of Hours	Bloom's Level
<b>Module-1 Introduction</b> What is Natural Language Processing?, Stages in natural language Processing, Origins and challenges of NLP Language and Grammar-Processing Indian Languages.	8	Apply
<b>Module-2 Word level Analysis</b> Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction. Part-of-Speech Tagging- Rule based tagger, Stochastic tagger	8	Apply
<b>Module-3 N-Grams</b> Simple N-grams, Smoothing- Laplace smoothing, Good Turing Discounting, Backoff, Entropy.	8	Apply
<b>Module-4 Lexical Semantic</b> Meaning Representation, Lexical Semantics, Word Sense Disambiguation – Selectional Restriction-based word sense disambiguation, context-based word sense disambiguation Approaches.	8	Apply
<b>Module-5 Information Retrieval</b> Design features of information retrieval systems- Indexing, eliminating stop words, Stemming, Classical information retrieval Models-Boolean model, Probabilistic model.	8	Apply

#### Course outcomes:

The students will able to

1. Apply the Natural Language processing concepts to the different applications of Corpus.
2. Solve the given regular expressions and Ngrams.
3. Design of meaning representation and word sense disambiguation.
4. Design of NLP models-Information retrieval, text summarization, topic modeling and etc.

**Reference Books:**

1. Siddiqui T., Tiwary U. S. Natural language processing and Information retrieval, OUP, 2008.
2. Daniel Jurafsky and James H Martin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics, and SpeechRecognition", 2nd Edition, Prentice Hall, 2008.
3. R. Kibble Introduction to natural language processing CO3354 2013.
4. James A.. Natural language Understanding 2e, Pearson Education, 1994
5. Bharati A., Sangal R., Chaitanya V. Natural language processing: a Paninian perspective, PHI, 2000.

# B.N.M. Institute of Technology

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## Department of Artificial Intelligence and Machine Learning

SEMESTER – VI

### COMPUTER VISION (Open Elective)

Credit: 3

<b>Course Code</b>	22AML1673	<b>CIA Marks</b>	50
Teaching Hours/Week (L: T: P: J)	3:0:0:0	<b>SEA Marks</b>	50
<b>Total Number of Contact Hours</b>	40	<b>Exam Hours</b>	03

#### Course Learning Objectives:

This course will enable students to:

1. Understand the fundamentals of Computer Vision
2. Understand the Color images and cameras functions
3. Understand the Object recognition and optimization Techniques
4. Understand the 3D vision Geometry and single perspective camera.

<b>Module-1: Introduction</b>	<b>Contact Hours</b>	<b>Bloom's Level</b>
<b>Introduction to Computer Vision:</b> Image representation and Image analysis task, Image representations, Image Digitization, Digital Image Properties: Metric and topological properties of digital images, Histograms, Entropy, Visual perception of the image, Image quality and Noise in images.	8	Apply
<b>Module-2: Color Image Processing</b>		
<b>Color Images:</b> Physics of color, color perceived by humans, color spaces, Palette images, color constancy. <b>Cameras:</b> An Overview- Photo sensitive sensors, A monochromatic camera, A color camera.	8	Apply
<b>Module-3: Object Recognition</b>		
<b>Object Recognition:</b> Statistical pattern recognition: classification principles, Support Vector machines, Cluster Analysis. <b>Recognition as Graph Matching:</b> Isomorphism of graphs and subgraphs, Similarity of graphs. <b>Optimization Techniques:</b> Genetic Algorithm, Simulated annealing.	8	Apply
<b>Module-4: 3D Vision Geometry</b>		
<b>3D Vision Geometry:</b> 3D Vision tasks: Marr's theory, Basics projective geometry: Points and Hyperplanes in projective space, Homography, <b>A single perspective camera:</b> Camera model. Projection and back projection in homogeneous coordinates. Scene reconstruction from multiple views	8	Apply
<b>Module-5: Motion Analysis</b>		
<b>Motion Analysis:</b> Differential motion analysis methods, Optical flow: Optical flow computation, Optical flow in motion analysis, Detection of specific motion pattern, Video tracking: background modeling, Kernel based object tracking.	8	Apply

**Course Outcomes:** At the end of the course students should be able to:

1. Apply the concepts of Computer Vision based on image representation and digitization process
2. Apply the mathematical methods on Color images and cameras functions
3. Apply the Object recognition and optimization Techniques using statistical pattern recognition
4. Apply 3D vision Geometry and single perspective camera concepts for motion analysis

**Reference Books:**

1. Sonka, Hlavac, Boyle," Digital Image Processing and Computer Vision", India Edition.
2. Digital Image Processing- S.Jayaraman, S.Esakkirajan, T.Veerakumar, TataMcGraw Hill 2014.
3. Fundamentals of Digital Image Processing-A. K. Jain, Pearson 2004.

# B.N.M. Institute of Technology

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## Department of Artificial Intelligence and Machine Learning

### SEMESTER VI

#### Virtual Reality and Augmented Reality(Open Elective)

**Credit: 3**

Course Code	22AML1674	CIA Marks	50
Teaching Hours/Week (L:T:P:J)	3:0:0:0	SEA Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

#### Course Learning Objectives:

- Learn the fundamental Computer Vision, and Human-Computer interaction Techniques related to VR.
- Apply the basics of C# and develop the Virtual Reality /Augmented Reality Applications.
- Review the Geometric Modelling Techniques Review the Virtual Environment
- Discuss and Examine VR Technologies
- Simulate and Apply Augmented Reality to varieties of Applications.

	Number of Hours	Bloom's Level
<b>Module – 1: Introduction to Virtual Reality</b>		
The three I's of Virtual Reality (VR), commercial VR technology and the five classic components of a VR system. Input Devices: (Trackers, Navigation, and Gesture Interfaces): Three-dimensional position trackers, navigation and manipulation, interfaces, and gesture interfaces.	8	Apply CO1
<b>Module – 2: Introducing C# with Unity Tool</b>		
Basics of C# and implementation in Unity, Creating a Simple C# Console Application, Identifiers and Keywords. System Data Types, Variables and Constants: Value Types, Reference Types, Understanding Type Conversions, .NET Array Types. <b>Classes, Objects and Object-Oriented Programming, C# with Unity tool.</b>	8	Apply CO2
<b>Module – 3: Devices</b>		
Output Devices: Graphics displays: The Human Visual System, Personal Graphics Displays, Large-Volume Displays, sound displays: The Human Auditory System, Speaker-Based Three-Dimensional Sound & haptic feedback: The Human Haptic System, Tactile Feedback Interfaces, Force Feedback Interfaces	8	Apply CO3
<b>Module – 4: Computing Architectures for VR 116</b>		
The Rendering Pipeline: The Graphics Rendering Pipeline, PC Graphics Architecture: PC Graphics Accelerators, Workstation-Based Architectures: The Sun Blade 1000 Architecture, The SGI Infinite Reality Architecture, Distributed VR Architectures: Multipipeline Synchronization. Modelling:	8	Apply CO4

Geometric modelling: Physical Modelling: Behaviour Modelling.		
<b>Module – 5:</b> Introduction to Augmented Reality		
Introduction to Augmented Reality-Computer vision for AR-Interaction-Modelling.	8	<b>Apply CO5</b>
<b>Course outcomes:</b>		
<b>The students should be able to:</b>		
<ol style="list-style-type: none"> <li>1. Describe the Virtual Reality as a complete device.</li> <li>2. Demonstrate the use of C# using Unity and develop Virtual Reality and Augmented Reality Devices.</li> <li>3. Apply the different displays, sound, and Interfaces where VR System are built.</li> <li>4. Design the graphics, Architecture, Models, and texturing where VR Systems are built.</li> <li>5. Implement the Augmented Reality, Visual Perception, Tracking Technology while implementing Augmented Reality</li> </ol>		
<b>Reference Books:</b>		
<ol style="list-style-type: none"> <li>1. Virtual Reality Technology, Second Edition, Gregory C. Burdea &amp; Philippe Coiffet, John Wiley &amp; Sons.</li> <li>2. Dieter Schmalstieg, Tobias Hollerer, “Augmented Reality: Principles &amp; Practice”, Addison Wesley, 2016</li> <li>3. NET 4.0 Programming (6-in-1), Black Book, Kogent Learning Solutions Inc., Wiley-Dream Tech Press. (Chapters: 10,11,12).</li> <li>4. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016</li> <li>5. Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics”). Morgan Kaufmann Publishers, San Francisco, CA, 2002</li> <li>6. Developing Virtual Reality Applications: Foundations of Effective Design, Alan B Craig, William R Sherman and Jeffrey D Will, Morgan Kaufmann, 2009.</li> </ol>		

# BNM Institute of Technology

## Syllabus for Employability Skills-2

### SEMESTER – VI

<b>Subject Name</b>	Employability Skills-2 (Technical)	<b>Weekly Assignments(6 tests)</b>	Max 10 Min 4
<b>Subject Code</b>	22XXX168	<b>Evaluation on Resume Building &amp; Etiquettes</b>	Max 10 Min 4
<b>Number of Contact Hours/Week</b>	2	<b>Evaluation on Group Discussion &amp; Personal Interviews</b>	Max 15 Min 6
		<b>Final Company Specific Assessment</b>	Max 15 Min 6
<b>Total Number of Contact Hours</b>	24	<b>Credits</b>	1
<b>Industry Readiness hands on Courses (12 hrs)</b>	<p>Tableau and Power BI, Cloud Computing &amp; AWS - fundamental AWS concepts related to compute, database, storage, networking, monitoring, and security with AWS hands-on course experiences</p> <p>Industrial Automation 4.0</p> <p>Competitive Coding</p>		
<b>Personality &amp; Grooming Training (2hrs)</b>	<p>Dressing &amp; Group Discussion Etiquettes, Interview Skills, Resume Building (should include introduction to Github, Hackerrank, LeetCode, Codechef), Email &amp; Telephone Etiquettes, Social Media Etiquettes, &amp; LinkedIn Profiling.</p>		
<b>Interview Preparation Training (2hrs)</b>	<p><b><u>Pre-Preparation Formalities</u></b></p> <ul style="list-style-type: none"> <li>• Training session on Pre-Preparation formalities of Campus Selection should be conducted Job Profiles analysis must be done.</li> <li>• Understanding the salary breakups &amp; other perks, researching about the Company and the work culture through their websites &amp; other digital platforms like Glassdoor &amp; LinkedIn.</li> <li>• Rewriting resumes keeping the job profiles in view.</li> </ul> <p>Group Discussion &amp; Personal Interview</p>		

	<ul style="list-style-type: none"> <li>• Pre-Placement Talk, Mock GD &amp; Personal Interview training sessions for each individual student should be conducted by the Industry Experts and they should brief students on the area of improvements, presentation &amp; behavioural skills required during the campus selection process.</li> </ul>
<b>MOCK RECRUITMENT PROCESS (2hrs)</b>	Aptitude test, Coding test, Group Discussions, Personal Interviews by industry personnel,
	Feedback to be shared to each student,
	Shadowing done by students during interviews to learn better.



29/02