B.N.M. Institute of Technology

An Autonomous Institution under VTU, Approved by AICTE

Department of Mathematics

Syllabus

Semester: III			
Course: Fourier Transform, Numerical Methods and Linear Algebra			
Course Code: 21MAT131B (Common to CSE, ISE, AIML)			
L:T:P:J	**2:2:0:0**	**CIA**	**: 50**
Credits:	**03**	**SEA**	**: 50**
Hours:	**40**	**SEA Duration**	**: 03 Hours**

Course Learning Objectives: The students will be able to

1 Have an insight into Fourier series, Fourier transforms.
2 Develop knowledge of solving ODE's arising in engineering applications, using numerical methods.
3 Develop knowledge Fundamentals of logic and Relations, Vector Spaces & Linear Transformation arising in engineering.

Module-1: Fourier Series & Fourier Transforms	No. of hours	Blooms cognitive Levels
Fourier series: Periodic functions, Introduction to Fourier Series, Dirichlet's condition. Problems on Fourier series over $(-l, l)$. **Fourier Transforms:** Introduction to infinite Fourier transform, Fourier sine and cosine transform and properties, problems on infinite Fourier transform, Discrete & Fast Fourier Transform **Self-study:** Applications of Fourier Transform in Engineering.	**L : 04** **T : 04**	**Apply**
Module-2: Numerical Solutions of Ordinary Differential Equations		
Numerical solution of ordinary differential equations of first order- Taylor series method, Euler's method, Modified Euler's method, Runge-Kutta method of fourth order, Milne's predictor and corrector methods (without proof) Numerical solution of second order ordinary differential equation using Runge-Kutta method of fourth order. **Self-study**: Solution of first order ordinary differential equation using Adam-Bashforth predictor and corrector methods.	**L : 04** **T : 04**	**Apply**
Module-3: Fundamentals of logic and Relations		
Fundamentals of logic: Basic connectives and truth tables, logic equivalence - the laws of logic, logical implication- rules of inference and Quantifiers. **Relations:** First order linear recurrence relation, second order linear homogenous recurrence relation with constant coefficients. **Self-study:** Applications of Quantifiers.	**L : 04** **T : 04**	**Apply**
Module-4: Vector Spaces & Linear Transformation		
Vector Spaces: Introduction to vector spaces- illustrative examples, subspaces, linear dependence, basis and dimension, coordinate vectors. **Linear transformations:** Linear transformations, algebra of transformations, representation of transformations by matrices, Rank-nullity theorem (without proof). **Self-study:** Linear transformation- Projection.	**L : 04** **T : 04**	**Apply**
Module-5: Inner Product Spaces		
Inner Product Spaces: Introduction to Inner product spaces, Orthogonal and ortho normal bases, Gram-Schmidt process, QR-factorization, Eigen values and Eigen vectors (recapitulation), diagonalization of a matrix (symmetric matrices), singular value decomposition. **Self-study:** Singular value decomposition applied to digital image processing.	**L : 04** **T : 04**	**Apply**

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: Solve first and second order ordinary differential equations arising in engineering problems using single step and multistep numerical methods.

CO 3: Communicate the basic concepts of logic and their relevance for computer science engineering.

CO 4: Apply the knowledge of vector spaces and 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,10th Edition(Reprint), 2016.
2. B. S. Grewal: "Higher Engineering Mathematics", Khanna Publishers, 44th 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" 11th Edition, Tata McGraw-Hill, 2010.
7. Srimanta Pal & Subobh 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", 3rd Edition, Pearson Education Ltd., 2017.
9. Ralph P. Grimaldi, " Discrete and Combinatorial Mathematics, 5th Edition, Pearson Education 2004.

Web links and Video Lectures:

1. https://nptel.ac.in/courses/111106111
2. https://www.digimat.in/nptel/courses/video/111105038/L01.html
3. https://archive.nptel.ac.in/courses/111/107/111107058/
4. https://archive.nptel.ac.in/courses/111/106/111106051/
5. https://www.youtube.com/watch?v=zvRdbPMEMUI
6. https://www.youtube.com/watch?v=cHNmT1-qurk
7. https://www.youtube.com/watch?v=ATqV_I8DCh0

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Department of Artificial Intelligence and Machine Learning

SEMESTER – III

COMPUTER ORGANIZATION

Credit : 3

Course Code	21AML132	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**
Module 1 : CENTRAL PROCESSING UNIT		
Basic Structure of Computers: Basic Operational Concepts, Bus Structures, Performance – Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement **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	**8**	**Understand (CO1, CO2)**
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 **Use Case:** Data Representation and operations performed in Arithmetic Logical Unit (ALU) in computer hardware.	**8**	**Understand (CO1, CO2)**
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**	**Apply (CO1, CO2, CO3)**

Use Case: Helps in designing cost, space, time optimized applications **Prerequisite for:** Operating System- Memory Management		
Module 4 : INPUT - OUTPUT ORGANIZATION		
Accessing I/O Devices, Interrupts – Interrupt Hardware, Direct Memory Access, Buses, Interface Circuits **Use Case:** To build device drivers	**8**	**Apply (CO1, CO2, CO3)**
Module 5 : BASIC PROCESSING UNIT		
Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control **Pipelining:** Basic concepts of pipelining **Use Case:** Optimization of Processor speed	**8**	**Apply (CO1, CO2,CO3)**
Course outcomes: The students will be able to • Understand the basic organization of a computer system.(Understand) • Understand functioning of processor, Input/output, and memory. (Understand) • Estimate the processor time and CPU usage. (Apply) • Design and analyze Memory devices (Analyze- for Assignment)		
Reference Books: 1. Carl Hamacher, ZvonkoVranesic, SafwatZaky, Computer Organization, 5th Edition, Tata McGraw Hill, 2002. 2. William Stallings: Computer Organization & Architecture, 9th Edition, Pearson, 2015. 3. M.Morris Mano, "Computer system Architecture", 3rd Edition, Prentice-Hall Publishers, 2007.		

Marks Distribution for Assessment

CIA (50)	Components	Description	Marks
	Written test	• Total Number of Test:03 • Each Theory test will be conducted for 30 marks • Average of 3 tests= 30 Marks	**30**
	Assignment	Design Memory devices using Virtual Lab Simulator.	**10**
	Quiz	Average of two rounds of quiz of 10 marks each after 1st and 2nd assessment.	**10**
		Total CIA	**50**
SEA (50)	Written Exam	• Theory exam will be conducted for 100 marks and scaled down to 50 marks. • The question paper will have 9 full questions each of 20 marks. Students have to answer 5 full questions.	**50**
		Total Marks for the Course	**100**

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SEMESTER –III

Operating System
Credit : 3

Course Code	21AML133	CIE Marks	50
Teaching Hours/Week (L: T: P: J)	3:0:0:0	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

Course Learning Objectives:

This course will enable students to

- Introduce concepts and terminology used in OS.
- Explain threading and multithreading systems.
- Illustrate process synchronization and concept of Deadlock
- Introduce Memory and Virtual memory management, File system and storage techniques

Module-1- Introduction to Operating Systems	**Number of Hours**	**Bloom's Level**
Introduction to Operating Systems: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Distributed system; Special-purpose systems; Computing environments. Operating System Services; User - Operating System interface; System calls; Types of system calls; System programs. **Virtual Machines**; Operating System generation; System boot. Process management; Memory management; Storage management; Protection and Security.	**8**	**Understand (CO1)**
Module-2 Process Management and Multi-threaded Programming		
Process Management: Process Concept; Process scheduling; Operations on processes; Inter process communication. Process Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms; **Multi-threaded Programming**: Overview; Multithreading models; Thread scheduling, Threading issues. Multiple-processor scheduling: Approaches to multiple processor scheduling, Processor Affinity, and Load Balancing.	**8**	**Apply (CO2)**
Module-3 Process Synchronization and Deadlocks		
Process Synchronization: The critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; **Deadlocks**: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.	**8**	**Apply (CO2)**
Module-4 Memory Management and Virtual Memory Management		
Memory Management: Background, Swapping, Contiguous Memory	**8**	**Apply**

Allocation, Paging, Segmentation **Virtual Memory Management**: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing.		**(CO2)**
Module-5 Secondary Storage Structures and File Systems		
Secondary Storage Structures: Mass storage structures; Disk structure; Disk scheduling; Swap space management. **File systems**: File concept; Access methods; Directory and Disk structure: Directory Overview, Single Level, Two Level and Tree Structured Directory; File system implementation, Directory Implementation, Allocation Methods, Protection.	**8**	**Apply (CO3)**

Course outcomes:

The students will able to

- Understand the basic concepts of OS (Understand)
- Apply the concepts of paging to support multi-programming using process synchronization (Apply)
- Understand the file system structures and implementations on secondary storage devices (Apply)
- Analyze deadlock detection algorithm and paging concepts with an example problems (Analyze)

Reference Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles 9th edition, Wiley-India, 2013
2. William Stallings Operating Systems: Internals and Design Principles, 6th Edition, Pearson.
3. Ann McHoes Ida M Fylnn, Understanding Operating System, Cengage Learning, 6th Edition.
4. D.M Dhamdhere, Operating Systems: A Concept Based Approach 3rd Ed, McGraw- Hill, 2013.
5. P.C.P. Bhatt, An Introduction to Operating Systems: Concepts and Practice 4th Edition, PHI(EEE), 2014.

Marks Distribution for Assessment

CIA (50)	Components	Description	Marks
	Written test	• Total Number of Test:03 • Each Theory test will be conducted for 30 marks • Average of 3 tests= 30 Marks	**30**
	Assignment	Solve Problems on Deadlock Detection/Paging	**10**
	Quiz	Average of two rounds of quiz of 10 marks each after 1st and 2nd assessment.	**10**
		Total CIA	**50**
SEA (50)	Written Exam	• Theory exam will be conducted for 100 marks and scaled down to 50 marks. • The question paper will have 9 full questions each of 20 marks. Students have to answer 5 full questions.	**50**
		Total Marks for the Course	**100**

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SEMESTER – III

Data Structures Using C
Credit: 4

Course Code	21AML134	CIA Marks	50
Teaching Hours/Week(L:T: P: J)	2:2:2:0	SEA Marks	50
Total Number of Lecture Hours	50	Exam Hours	03

Course Learning Objectives:

This course will enable students to

- Understand, Practice and Assimilate fundamentals of data structures and their applications essential for programming / problem solving
- Describe, Analyze, Design and Evaluate the Linear Data Structures: Stack, Queues, Lists
- Describe, Analyze, Design and Evaluate the Non-Linear Data Structures: Trees, Graphs
- Describe, Analyze, Design and Evaluate the sorting & searching algorithms
- Assess appropriate data structure during program development/Problem Solving

	Number of Hours	**Bloom's Level**
Module-1 INTRODUCTION, LINEAR DATA STRUCTURES		
Introduction: Data Structures, Classification, Data Structure operations. **Stacks:** Stack ADT, definition and operations, Implementations of stacks using array, Applications of stacks: arithmetic expression conversion and evaluation. **Queues:** Primitive operations; Implementation of queues using Arrays, circular queue and double ended queue (Deque).	**6**	**Apply (CO1,CO2)**
• Design, Develop and Implement a menu driven Program in C for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX) a) Push an Element on to Stack b) Pop an Element from Stack c) Demonstrate how Stack can be used to check Palindrome d) Demonstrate Overflow and Underflow situations on Stack e) Display the status of Stack f) Exit Support the program with appropriate functions for each of the above operations • 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. • Design, Develop and Implement a Program in C to Evaluation of	**4**	**Apply (CO1, CO2, CO3)**

Suffix expression with single digit operands and operators: +, -, *, /, %, ^ using Stack. • 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) a) Insert an Element on to Circular QUEUE b) Delete an Element from Circular QUEUE c) Demonstrate Overflow and Underflow situations on Circular QUEUE d) Display the status of Circular QUEUE e) Exit Support the program with appropriate functions for each of the above operations.		
Module-2 LINKED LISTS		
Introduction, singly linked list, representation of a linked list in memory, operations on a single linked list; Application of linked lists: Polynomial representation, Types of linked lists: Circular linked lists and doubly linked lists.	**6**	**Apply (CO1,CO2)**
• 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. Create a SLL of N Students Data by using front insertion. Display the status of SLL and count the number of nodes in it Perform Insertion / Deletion at End of SLL Perform Insertion / Deletion at Front of SLL(Demonstration of stack) Exit. • 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 Create a DLL of N Employees Data by using end insertion. Display the status of DLL and count the number of nodes in it Perform Insertion and Deletion at End of DLL Perform Insertion and Deletion at Front of DLL Demonstrate how this DLL can be used as Double Ended Queue. Exit • Design, Develop and Implement a Program in C for the following operations on Singly Circular Linked List (SCLL) with header nodes Represent and Evaluate a Polynomial $P(x,y,z) = 6x^2y^2z-4yz^5+3x^3yz+2xy^5z-2xyz^3$ Find the sum of two polynomials POLY1(x,y,z) and POLY2(x,y,z) and store the result in POLYSUM(x,y,z) Support the program with appropriate functions for each of the above operations.	**4**	**Apply (CO1, CO2, CO3)**

Module-3 TREE		
Trees: Basic concept, binary tree, binary tree representation, array and linked representations, binary tree traversal, threaded binary trees, heaps, forests.	**6**	**Apply (CO1,CO2)**
• 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. • Write a C program to construct MAX-Heap and write a function to search an element.	**4**	**Apply (CO1, CO2, CO3)**
Module-4 BINARY SEARCH TREE		
Binary Search Tree, properties and operations; AVL trees; M-Way search trees, B trees; B^+ Tree,	**6**	**Apply (CO1,CO2)**
• 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 Exit • Write a C program by considering following scenario : Start with an empty AVL tree. Perform the following sequence of insertion : December, January, April, March, July, August, October, February, November, May and June. Use a strategy of *AVLinsertion* to perform each insert and state the rotation type (if any) for each insert. • Write a C program for insertion and deletion in B-tree and B^+ tree.	**4**	**Apply (CO1, CO2, CO3)**
Module-5 HASHING and GRAPHS		
Hashing : Static and Dynamic Hashing Graphs : Graph Abstract Data Type, Breadth Fist Search, Depth First Search	**6**	**Apply (CO1,CO2)**
• Design, Develop and Implement a Program in C for the following operations on Graph(G) of Cities Create a Graph of N cities using Adjacency Matrix. Print all the nodes reachable from a given starting node in a digraph using DFS/BFS • Write a C Program to detect Cycle in a Directed Graph • Write a C Program to find if there is a path between two vertices in a directed graph • Given a File of N employee records with a set K of Keys(4-digit) which uniquely determine the records in file F. Assume that file F is maintained in memory by a Hash Table(HT) of m memory locations with L as the set of memory addresses (2-digit) of	**4**	**Apply (CO1, CO2, CO3)**

locations in HT. Let the keys in K and addresses in L are Integers. Design and develop a Program in C that uses Hash function H: K ->L as H(K)=K mod m (remainder method), and implement hashing technique to map a given key K to the address space L. Resolve the collision (if any) using linear probing.		

Course outcomes:

The students will able to

- Understand the concepts of linear and non-linear Data Structures (Understand)
- Apply searching and sorting techniques on various data structure (Apply)
- Make use of various Data structures for problem solving (Apply)

Reference Books:

1. T. Cormen, C. Leiserson, R. Rivest, C. Stein, Introduction to Algorithms, 2nd edition, Prentice-Hall India, 2001.
2. S. Sahni, Data Structures, Algorithms and Applications in C++, 2nd edition, Universities Press, 2005.
3. S. Lipschutz, "Data Structures", Tata McGraw Hill Education, 1st Edition, 2008.
4. D. Samanta, "Classic Data Structures", PHI Learning, 2nd Edition, 2004.

M**arks Distribution for Assessment**

CIA (50)	**Components**	**Description**	**Marks**
	Written test	• Total Number of Test:03 • Each Theory test will be conducted for 30 marks • Average of 3 tests= 30 Marks	**30**
	Practical	• Total number of Test : 02 [Part-A(Modue-1 and 2) and Part-B(Module 3,4 and 5)] Each Lab test will be conducted for 50 marks and scaled down to 10 Average of 2 tests= 10 Marks • Laboratory conduction is to be evaluated every week. conducted & Viva = 5 Marks Lab Record = 5 Marks	**10** **10**
		Total CIA	**50**
SEA (50)	Practical Exam	• Students are allowed to pick one experiment from Part-A and one experiment from PART-B. • Mark Distribution : Total 100 marks Part – A : 40 Marks (Functions:6, Execution:28, Viva: 6) Part – B : 60 Marks (Functions:9, Execution:42, Viva: 9) • Scaled down to 50 marks	**50**
		Total Marks for the Course	**100**

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Department of Artificial Intelligence and Machine Learning

SEMESTER – III

MICROCONTROLLER AND EMBEDDED SYSTEMS
Credit : 4

Course Code	21AML135	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

- 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**
Module-1		
ARM-32 bit 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.	**6**	**Understand (CO1)**
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. 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.	**4**	**Apply (CO1, CO2)**
Module-2		
ARM Cortex M3 Instruction Sets and Programming: Assembly basics, Instruction list and description, Special instructions, Useful instructions, Assembly and C language Programming	**6**	**Apply (CO2)**
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.	**4**	**Apply (CO2)**

1. Write a program to find the square of a number (1 to 10) using look-up table. 2. Write a program to find the largest/smallest number in an array of 32 numbers. 3. Write a program to arrange a series of 32 bit numbers in ascending/descending order. 4. Write a program to count the number of ones and zeros in two consecutive memory locations.		
Module-3		
Embedded System Components: 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 (12C, SPI, IrDA, Bluetooth, Wi-Fi, Zigbee only), Embedded firmware.	**6**	**Understand (CO3)**
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. 1. Display "Hello World" message using Internal UART. 2. Interface and Control the speed of a DC Motor. 3. Interface a Stepper motor and rotate it in clockwise and anti-clockwise direction. 4. Interface a DAC and generate Triangular and Square waveforms.	**4**	**Apply (CO3, CO4)**
Module-4		
Characteristics and Quality Attributes of Embedded Systems, Operational quality attributes, non-operational quality attributes, Embedded Systems-Application and Domain specific, Hardware Software Co-Design and Program Modelling, embedded firmware design and development.	**6**	**Apply (CO4)**
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. 1. Demonstrate the use of an external interrupt to toggle an LED On/Off 2. Display the Hex digits 0 to F on a 7-segment LED interface, with an appropriate delay in between. 3. Measure Ambient temperature using a sensor and SPI ADC IC.	**4**	**Apply (CO4)**
Module-5		
Programming with Arduino: 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.	**6**	**Apply (CO5)**
Conduct the following experiments by writing program using Arduino Uno board and the required software tool. 1. Interface a DHT11 sensor with Arduino Uno.	**4**	**Apply (CO5)**

2. Interface GPS module with Arduino Uno. 3. Interface GSM module with Arduino Uno. 4. Interface LCD module with Arduino Uno.		

Course outcomes:

The students will be able to

- Describe the architectural features and instructions of 32-bit microcontroller ARM CortexM3. (Understand)
- Apply the knowledge gained for Programming ARM Cortex M3 for different applications.(Apply)
- Understand the basic hardware components and their selection method based on the characteristics and attributes of an embedded system. (Understand)
- Apply the concept of embedded system firmware design. (Apply)
- Interact with Arduino using Arduino sketch to program the devices. (Apply)

Reference Books:

1. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M3", 211d Edition, Newnes, (Elsevier), 2010.
2. Shibu K V, "Introduction to Embedded Systems", Tata McGraw Hill Education Private Limited, 2nd Edition.
3. Exploring Arduino: Tools and Techniques for Engineering, Wizardry 1st Edition WILEY, ISBN-10: 1118549368, ISBN-13: 978-1118549360.

Marks Distribution for Assessment

CIA (50)	Components	Description	Marks
	Written test	• Total Number of Test:03 • Each Theory test will be conducted for 30 marks • Average of 3 tests= 30 Marks	**30**
	Practical	• Total number of Test : 02 [Part-A(Modue-1 and 2) and Part-B(Module 3,4 and 5)] Each Lab test will be conducted for 50 marks and reduce to 10 Average of 2 tests= 10 Marks • Laboratory conduction is to be evaluated every week. conducted & Viva = 5 Marks Lab Record = 5 Marks	**10** **10**
		Total CIA	**50**
SEA (50)	Practical Exam	• Students are allowed to pick one experiment from Part-A and one experiment from PART-B. Mark Distribution : Total 100 marks Part – A : 40 Marks (Procedure:6, Execution:28, Viva: 6) Part – B : 60 Marks(Procedure:9, Execution:42, Viva: 9) Scale down to 50 marks	**50**
		Total Marks for the Course	**100**

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SEMESTER – III

Object Oriented Programming Using JAVA
Credit: 2

Course Code	21AML136	CIA Marks	50
Teaching Hours/Week(L:T: P: J)	0:0:2:2	SEA Marks	50
Total Number of Lecture Hours	40	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**
Laboratory 1		
An Overview of Java, Data Types, Variables, and Arrays, Operators, Control Statements, Classes and Methods,	**2**	**Understand (CO1)**
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 student USN, 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**	**Apply (CO1, CO2)**
Laboratory 2		
Method overloading, Inheritance, polymorphism, encapsulation	**2**	**Understand (CO1)**
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	**2**	**Apply (CO1, CO2)**

class Vehicle using private strings and getter/setter methods to achieve encapsulation.		
Laboratory 3		
Multithreaded Programming	**2**	**Understand (CO1)**
1. 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. 2. 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. 3. Write an application that executes two threads. One thread displays "An" every 1000 milliseconds and other displays "B" every 3000 milliseconds. Create the threads by extending the Thread class.	**2**	**Apply (CO1, CO2)**
Laboratory 4		
Enumerations, Strings	**2**	**Understand (CO1)**
1. Write a java program to create an enum of restaurants that can be used to pick user choice restaurant. 2. 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. 3. Write a java program to find the duplicate words and their number of occurrences in a string. 4. Write a Java program to replace each substring of a given string that matches the given regular expression with the given replacement.	**2**	**Apply (CO1, CO2)**
Laboratory 5		
Collections	**2**	**Understand (CO1)**
1. Write a Java program to create a new array list, add some colors (string) and print out the collection. 2. Write a Java program to iterate through all elements in a linked list starting at the specified position. 3. Write a Java program to append the specified element to the end of a hash set. 4. Write a Java program to create a new tree set, add some colors (string) and print out the tree set. 5. Write a Java program to create a new priority queue, add some colors (string) and print out the elements of the priority queue.	**2**	**Apply (CO1, CO2)**

Laboratory 6		
Collections	**2**	**Understand (CO1)**
1. Write a Java program to associate the specified value with the specified key in a Tree Map. 2. 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. 3. Write a Java program to store content in Hash table and use enumeration to display contents of Hash Table. 4. Write a Java program to create a vector of n elements and perform the following operations: Adding elements, Removing elements and Display elements. 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.	**2**	**Apply (CO1, CO2)**
Laboratory 7		
Event Handling	**2**	**Understand (CO1)**
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 Num 2 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. 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. 3. 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. 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**	**Apply (CO1, CO2)**
Laboratory 8		
Event Handling and Exception Handling	**2**	**Understand (CO1)**
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	**2**	**Apply (CO1, CO2)**

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. 5. Write a java program to represent a list of items together and popup menu to display some message. One or more than one item can be selected from the list. 6. 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. 7. 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.		
Laboratory 9		
Java Script	**2**	**Understand (CO1)**
1. Write a program to Swap Two Variables. 2. Write a program to Generate a Random Number. 3. Write a program to Check the Number of Occurrences of a Character in the String. 4. Write a program to Count the Number of Vowels in a String. 5. Write a java script program to pass a 'javascript function' as parameter.	**2**	**Apply (CO1, CO2)**
Laboratory 10		
File handling	**2**	**Understand (CO1)**
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. 3. Write a java program that reads a file and displays the file on the screen with line number before each line. 4. 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. 5. Write a java program in which data is read from one file and should be written in another file line by line.	**2**	**Apply (CO1, CO2)**
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. Electricity bill generation		**Create (CO1, CO2, CO3)**

Currency converter / Distance converter / Time converter Pay slip generation Online book store Airline reservation system Designing of simple calculator	

Course Outcomes:

The students will be able to

1. Understand the fundamentals of object-oriented programming in Java. (Understand)
2. Apply the object-orient concept to develop robust programs. (Apply)
3. 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, 7th 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.

M**arks Distribution for Assessment**

CIA (50)	**Components**	**Description**	**Marks**
	Practical	• Lab Record - 5 Marks • Performance Day wise – 10 marks (conduction - 7 marks and viva – 3 marks) • Total number of Test : 02 [PART-A (Laboratory -1 to 5) and PART-B (Laboratory -6 to 10)] Each Lab test will be conducted for 40 (Functions:6, Execution:28, Viva: 6) marks and scaled down to 20 Average of 2 tests= 20 Marks	**35**
	Project	Demonstration – 10 marks Viva voce – 5 marks	**15**
		Total CIA	**50**
SEA (50)	Practical Exam	• External lab examination: Students are allowed to pick one experiment from Part-A and one experiment from PART-B. • Mark Distribution : Total 100 marks Part – A : 40 Marks (Functions:6, Execution:28, Viva: 6) Part – B : 60 Marks (Functions:9, Execution:42, Viva: 9) • Scaled down to 50 marks	**50**
		Total Marks for the Course	**100**

B.N.M. Institute of Technology

An Autonomous Institution under VTU

Semester: III/IV		
COURSE: CONSTITUTION OF INDIA, INDIAN POLITY AND PROFESSIONAL ETHICS		
Course Code: 22SFH117/127	**L:T:P:J: 0:2:0:0**	**CIE Marks:** 50
Credits:	**1**	**SEE Marks: 50**
Hours:	**15 hrs**	**SEE Duration:**

Course Learning Objectives: 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.

MODULE 1: Introduction to Indian Constitution	**RBT**	**Hrs**
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**	**3**
MODULE 2: System of Government, Central Government, State Government	**RBT**	**Hrs**
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**	**3**
MODULE 3: Judiciary, Amendments and Emergency Provisions	**RBT**	**Hrs**
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**	**3**
MODULE 4: Elections, Constitutional and Non Constitutional Bodies	**RBT**	**Hrs**
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**	**3**

MODULE 5: Professional Ethics	RBT	Hrs
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" byCengage 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 https://successesacademy

Question paper pattern for SEE and CIE.

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

LEADERSHIP SKILLS

Course Code:	**Credit: 1**
L:T:P:J:0:0:2:0	**CIA Marks: 100**

Course Objectives

1. To prepare students to exercise different types of communication by engaging them across various real life and hypothetical scenarios.
2. To make students practically understand the essential aspects of communication that will aid them in becoming a leader.

Module No.	Contents of the Module	Session	COs
1	**Module-1 Fundamentals of communication skills for leaders** Practicing various types of communication Verbal and non-verbal communication, electronic means of communication, 3Vs of communication – Verbal, Vocal and Visual communication Visual – Eye contact, gestures, postures, gait, facial expressions, appearance and dressing Vocal – Voice modulation, emotions, audibility, pitch, pace. Verbal – Language and vocabulary	**8**	**CO1**
2	**Module -2 Practicing effective communication** Effective Email Writing, Netiquettes Aspects of communication – Presenting, simplifying complex information, questioning and listening, giving and receiving feedback, dialogues.	**7**	**CO2**

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

CO1	Apply different types of communication in various real life and hypothetical scenarios
CO2	Practically understand the essential aspects of communication to be a leader
CO3	Apply the skills learnt to practice effective public speaking skills

Mapping of Course Outcomes with Programme Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1					2				2
CO2				2	2				2
CO3				2	2				2

MOOC Course

Storytelling and influencing: Communicate with impact -
https://www.coursera.org/learn/communicate-with-impact

Practical component:

- The students are to be involved in various activities and games such as Just a Minute or Pick and speak to demonstrate each topic.

B.N.M. Institute of Technology

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Department of Mathematics

Syllabus

Semester: IV		
Course: Statistics, Probability and Graph theory **Course Code: 21MAT141B (Common to CSE, ISE, AIML)**		
L:T:P:J	**2:2:0:0**	**CIA: 50**
Credits:	**03**	**SEA: 50**
Hours:	**40**	**SEA Duration: 03 Hours**

Course Learning Objectives: The students will be able to

1	Provide an insight into applications of Graph Theory, Curve fitting & Statistical methods.
2	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	No. of hours	Blooms cognitive Levels
Curve Fitting: Curve fitting by the method of least squares-fitting the curves of the form: $y = ax+b$, $y = ax^b$ and $y = ax^2 + bx + c$. Introduction to Moments, Skewness, kurtosis and problems. Karl Pearson's coefficient of correlation and lines of regression. **Self-study:** Rank correlation.	**L: 04** **T: 04**	**Apply**
Module-2: Probability Distributions & 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. **Self study:** Applications of probability distribution in Engineering.	**L: 04** **T: 04**	**Apply**
Module-3:Markov Chain & 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. **Self study:** Applications of Markov Chain in Engineering.	**L: 04** **T: 04**	**Apply**
Module-4: Queuing theory		
Introduction, Symbolic representation of a queuing model, single server, Poisson queuing model with infinite capacity (M/M/1: ∞/FCFS), when $\lambda_n = \lambda$ and $\mu_n = \mu(\lambda < \mu)$, Performance measures of the model, Single server Poisson queuing model with finite capacity (M/M/S:N/FCFS), Performance measures of the model, derivation of L_s , L_q, w_s, w_q of M/M/1 queuing model with finite and infinite capacity, Multiple server Poisson queuing model with infinite capacity(M/M/S: ∞/ FCFS), when $\lambda_n = \lambda$ for all $n, (\lambda > S\mu)$, Multiple server Poisson queuing model with finite capacity (M/M/S:N/FCFS), Introduction to M/G/1 queuing model – problems. **Self study:** Applications of Queuing theory in Engineering.	**L: 04** **T: 04**	**Apply**
Module-5: Graph Theory		
Basic concepts, types of graphs, graphs and graph, 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. **Self study:** Applications of graph theory in network system	**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:

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

Web links and Video Lectures:

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

B.N.M. Institute of Technology

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Department of Artificial Intelligence and Machine Learning

SEMESTER – IV

MACHINE LEARNING
Credit: 3

Course Code	**21AML142**	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

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

	Number of Hours	**Bloom's Level**
Module-1		
Linear Models for Regression: Linear Basis Function Models, The Bias Variance Decomposition, The Evidence Approximation **Linear Models for Classification :** Discriminant Functions, Probabilistic Generative Models, Probabilistic Discriminative Models	**8**	**Apply (CO1, CO3)**
Module-2		
Evaluating Hypotheses: Estimating Hypothesis Accuracy, Basis of Sampling Theory, A General Approach for Deriving Confidence Intervals, Difference in Error of Two Hypotheses	**8**	**Analyze (CO1, CO2)**
Module-3		
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, Issues in Decision Tree Learning	**8**	**Apply (CO1, CO3)**
Module-4		
Bayesian Learning: Introduction, Bayes theorem, Bayes theorem and Concept Learning, Naïve Bays Classifier, Bayesian Belief Network	**8**	**Apply (CO1, CO3)**
Module-5		
Instance Based Learning: Introduction, k-Nearest Neighbor Learning, Locally Weighted Regression, Radial Basis Functions, Case Based Reasoning	**8**	**Apply (CO1,**

Genetic Algorithms: Genetic Algorithms, An Illustrative Example		**CO3)**
Course outcomes: The students will able to: • Understand the concepts of Machine Learning and Concept Learning. (Understand) • Analyze the data to understand the distribution of the data. (Analyze) • Apply the classification techniques to classify the data. (Apply)		
Reference Books: 1. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, Second Indian Reprint 2015. 2. Tom M. Mitchell, "Machine Learning", McGraw Hill Education (India) Edition, 2013.		

M**arks Distribution for Assessment**

CIA (50)	**Components**	**Description**	**Marks**
	Written test	• Total Number of Test:03 • Each Theory test will be conducted for 30 marks • Average of 3 tests= 30 Marks	**30**
	Assignment	Complete online course on Machine Learning on Skillup by Simplilearn and Machine Learning with Python on https://cognitiveclass.ai/ before Test -3 and submit certificate.	**10**
	Assignment	Write a Survey paper on Application of Machine Learning (Healthcare / Automobile / Farming etc.). Minimum Reference papers = 20 Reference papers should be from IEEE/Springer/Elsevier/ACM Number of pages : 6 Plagiarism report should be less than 20% from Turnitin software	**10**
		Total CIA	**50**
SEA (50)	Written Exam	• Theory exam will be conducted for 100 marks and scale down to 50 marks. • The question paper will have 9 full questions each of 20 marks. Students have to answer 5 full questions.	**50**
		Total Marks for the Course	**100**

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Department of Artificial Intelligence and Machine Learning

SEMESTER – IV

DATABASE MANAGEMENT SYSTEM
Credit: 4

Course Code	21AML143	CIA Marks	50
Teaching Hours/Week (L: T: P: J)	2:2:1:1	SEA Marks	50
Total Number of Lecture Hours	50	Exam Hours	3

Course Learning Objectives:

This course will enable students to

- Provide a strong foundation in database concepts, technology, and practice.
- Practice SQL and NOSQL programming through a variety of database problems.
- Demonstrate the use of concurrency and transactions in database.
- Design and build database applications for real world problems.

	Number of Hours	**Bloom's Level**
Module-1		
Databases and Databases Users: Characteristics of database Approach, Advantages of using the DBMS Approach **Database System Concepts and Architecture:** Data Models-Schemas and Instances, Three-Schema Architecture and Data Independence, Database Languages and Interfaces, The Database System Environment **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, ER design for COMPANY Database, Relational database design using ER to Relational Mapping	**6**	**Understand (CO1)**
Draw ER Diagram for the following Databases using GitMind software. COMPANY Database UNIVERSITY Database AIRLINE Database BANK Database LIBRARY Database MOVIE Database ORDER Database COLLEGE Database	**4**	**Understand (CO1)**
Module-2		
Basic SQL: 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	**6**	**Apply (CO1, CO2)**

More SQL: Complex Queries, Triggers, Views and Schema Modification: More Complex SQL Retrieval Queries, Specifying Constraints as Assertions and actions as Triggers, Views (Virtual Tables) in SQL, Schema Change Statements in SQL		
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) PUBLISHER(Name, Address, Phone) BOOK_COPIES(Book_id, Branch_id, No-of_Copies) BOOK_LENDING(Book_id, Branch_id, Card_No, Date_Out, Due_Date) LIBRARY_BRANCH(Branch_id, Branch_Name, Address) Write SQL queries to 1. Retrieve details of all books in the library – id, title, name of publisher, authors, number of copies in each branch, etc. 2. Get the particulars of borrowers who have borrowed more than 3 books, but from Jan 2017 to Jun 2017. 3. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation. 4. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query. 5. Create a view of all books and its number of copies that are currently available in the Library.	**4**	**Apply (CO1, CO2, CO3)**
Module-3		
Basics of Functional Dependencies and Normalization for Relational Database: Functional Dependencies, Normal forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Forms, Multi-valued Dependency and Fourth Normal Form, Join Dependencies and fifth Normal Form	**6**	**Apply (CO1, CO3)**
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. SALESMAN(Salesman_id, Name, City, Commission) CUSTOMER(Customer_id, Cust_Name, City, Grade, Salesman_id) ORDERS(Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id) Write SQL queries to 1. Count the customers with grades above Bangalore's average. 2. Find the name and numbers of all salesman who had more than one customer. 3. List all the salesman and indicate those who have and don't have customers in their cities (Use UNION operation.) 4. Create a view that finds the salesman who has the customer with the highest order of a day.	**4**	**Apply (CO1, CO2, CO3)**

5. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.		
Module-4		
Introduction to Transaction Processing – Concepts and Theory: Introduction to Transaction Processing, Transaction and System Concepts, Desirable Properties on Transactions **Concurrency Control Techniques:** Two-Phase Locking Techniques for Concurrency Control, Multi-version Concurrency Control Techniques, Other Concurrency Control Issues **Database Recovery Techniques:** Recovery Concepts, Shadow Paging, Recovery in Multi- database Systems	**6**	**Understand (CO1)**
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. EMPLOYEE(SSN, Name, Address, Sex, Salary, SuperSSN, DNo) DEPARTMENT(DNo, DName, MgrSSN, MgrStartDate) DLOCATION(DNo,DLoc) PROJECT(PNo, PName, PLocation, DNo) WORKS_ON(SSN, PNo, Hours) Write SQL queries to 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. 2. Show the resulting salaries if every employee working on the 'IoT' project is given a 10 percent raise. 3. Find the sum of the salaries of all employees of the 'Accounts' department, as well as the maximum salary, the minimum salary, and the average salary in this department 4. Retrieve the name of each employee who works on all the projects controlled by department number 5 (use NOT EXISTS operator). 5. For each department that has more than five employees, retrieve the department number and the number of its employees who are making more than Rs. 6,00,000.	**4**	**Apply (CO1, CO2, CO3)**
Module-5		
Why NoSQL? : The Emergence of NoSQL Data Models : Relationships, Graph Database, Schemaless Database, Materialized View, Modelling for Data Access. Types of Databases : What Is a Key-Value Store, What Is a Document Database?, What Is a Column-Family Data Store?, What Is a Graph Database?	**6**	**Apply (CO1)**
Consider real-time product purchase transaction application to construct graph database using Neo4j. Create a single and multiple nodes with label and properties Create Relationship and path	**4**	**Evaluate (CO4)**

Set Properties. List the on demand product.		
Mini-Project		
• Develop real world database application for selected problem statement. • For any selected problem make sure that the application should include health care, salary management, office automation, etc. area. • Application should have five or more tables, trigger, stored procedure, interactive web pages and search engine. • Use Java, C#, PHP, Python, or any other similar front-end tool. • All applications must be demonstrated on desktop/laptop as a stand-alone or web based application (Mobile apps on Android/IOS are not permitted.)		**Create (CO1, CO2, CO3. CO5)**
Course outcomes: The students will able to: • Understand the concept of structured and un-structured database, functional dependencies and transaction processing. (Understand) • Apply Structured Query Language (SQL) for database manipulation. (Apply) • Apply Functional Dependency to normalize relation. (Apply) • Solve the real time problem by using NOSQL Model. (Evaluate) • Develop application to interact with databases. (Create – For Mini Project)		
Reference Books: 1. Ramez Elmasari, Shamkant B Navathe, "Fundamentals of Database Systems", Pearson, Seventh Edition 2017. 2. Pramod J Sadalage, Martin Fowler, "NOSQL Distilled", Pearson, 2013.		

M**arks Distribution for Assessment**

CIA (50)	**Components**	**Description**	**Marks**
	Written test	• Total Number of Test:03 • Each Theory test will be conducted for 30 marks • Average of 3 tests= 30 Marks	**30**
	Practical	• Total number of Test : 01 Lab test will be conducted for 50 marks and scale down to 10 marks. • Laboratory conduction is to be evaluated every week. conducted & Viva = 5 Marks Lab Record = 5 Marks	**10** **10**
		Total CIA	**50**
SEA (50)	Practical Exam	• Students are allowed to pick any one problem statement (May be other than the problem statements listed in the syllabus) Mark Distribution : Total 40 marks (Procedure:10, Execution:25, Viva: 5) Scale Down to 20 marks • Mini Project Evaluation (Procedure:6, Execution:20, Viva: 4)	**20** **30**
		Total Marks for the Course	**100**

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Department of Artificial Intelligence and Machine Learning

SEMESTER – IV

DESIGN AND ANALYSIS OF ALGORITHMS
Credit : 4

Course Code	21AML144	CIA Marks	50
Teaching Hours/Week (L: T: P: J)	2:2:2:0	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: What is an Algorithm?**,** Algorithm Specification**,** Analysis Framework**,** **Performance Analysis**: Space complexity, Time complexity. **Asymptotic Notations:** Big-Oh notation (*O*), Omega notation (*Ω*), Theta notation (), and Little-oh notation (*o*), Mathematical analysis of Non-Recursive and recursive Algorithms with Examples**.** **Important Problem Types:** Sorting, Searching, String processing, Graph Problems, Combinatorial Problems.	**6**	**Analyze (CO1, CO2, CO3, CO4)**
1. Write a JAVA program to find the value of largest element in list of n numbers and perform mathematical analysis of the algorithm. 2. Write a JAVA program to check whether all the elements in a given array is distinct and perform mathematical analysis of the algorithm 3. Write a JAVA program to do matrix multiplication and perform mathematical analysis of the algorithm. 4. Write a JAVA program to compute factorial function F(n) = n! for an arbitrary non negative integer n and perform mathematical analysis of the algorithm.	**4**	**Analyze (CO1, CO2, CO3, CO4)**
Module-2		
Divide and Conquer: General method, Binary search, Recurrence equation for divide and conquer, Merge sort, Quick sort, Strassen's matrix multiplication, **Decrease and Conquer Approach:** Topological Sort.	**6**	**Analyze (CO1, CO2, CO3, CO4)**
1. Sort a given set of n integer elements using Quick Sort method	**4**	**Analyze**

and compute its time complexity. Run the program for varied values of n > 5000 and record the time taken to sort. Demonstrate using Java how the divide- and-conquer method works along with its time complexity analysis: worst case, average case and best case. 2. Implement QuickSort using Singly Linked List using Java. 3. Sort a given set of *n* integer elements using Merge Sort method and Compute its time complexity. Run the program for varied values of *n* > 5000, and record the time taken to sort. Demonstrate using Java how the divide and conquer method works along with its time complexity analysis: worst case, average case and best case. 4. Write a Java program with following: Merge sort involves recursively splitting the array into 2 parts, sorting and finally merging them. A variant of merge sort is called 3-way merge sort where instead of splitting the array into 2 parts we split it into 3 parts. Merge sort recursively breaks down the arrays to subarrays of size half. Similarly, 3-way Merge sort breaks down the arrays to subarrays of size one third. Input : 45, -2, -45, 78, 30, -42, 10,19,73,93 Output : -45, -42, -2, 10, 19, 30, 45, 73, 78, 93 Input : 23, -19 Output : -19, 23		**(CO1, CO2, CO3, CO4)**
Module-3		
Greedy Method: General method, Knapsack Problem, **Minimum cost spanning trees:** Prim's Algorithm, Kruskal's Algorithm. **Single source shortest paths:** Dijkstra's Algorithm. **Optimal Tree problem:** Huffman Trees and Codes.	**6**	**Analyze (CO1, CO2, CO3, CO4)**
1. Implement in Java, the 0/1 Knapsack problem using Greedy method. 2. Find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm. Implement the program in Java language. 3. Find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm. Implement the program in Java language. 4. From a given vertex in a weighted connected graph, find shortest paths to other vertices using Dijkstra's algorithm. Write the program in Java.	**4**	**Analyze (CO1, CO2, CO3, CO4)**
Module-4		
Dynamic Programming: 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	**6**	**Analyze (CO1, CO2, CO3, CO4)**
1. Write Java programs to implement All-Pairs Shortest Paths problem	**4**	**Analyze**

using Floyd's algorithm with dynamic programming. 2. Write a program to implement Travelling Sales Person problem using Dynamic programming. 3. Write a program to find shortest path from source to destination using Bellman-ford algorithm. The graph may contain negative weight edges.		**(CO1, CO2, CO3, CO4)**
Module-5		
Backtracking: General method, Sum of subsets problem, Graph coloring, Hamiltonian cycles. **Programme and Bound:** Assignment Problem, Travelling Sales Person problem, 0/1 Knapsack problem, **NP-Complete and NP-Hard problems:** Basic concepts, non-deterministic algorithms, P, NP, NP-Complete, and NP-Hard classes.	**6**	**Analyze (CO1, CO2, CO3, CO4)**
1. Design and implement in Java to find a subset of a given set S = {Sl, S2,.....,Sn} of *n* positive integers whose SUM is equal to a given positive integer *d*. For example, if S ={1, 2, 5, 6, 8} and *d*= 9, there are two solutions {1,2,6}and {1,8}. Display a suitable message, if the given problem instance doesn't have a solution. 2. Design and implement the presence of Hamiltonian Cycle in an undirected Graph G of n vertices. 3. Write a program to detect cycle in a Directed Graph using BFS 4. Given a directed graph, check whether the graph contains a cycle or not. Your function should return true if the given graph contains at least one cycle, else return false. For example, the following graph contains two cycles 0->1->2->3->0 and 2->4->2, so your function must return true.	**4**	**Analyze (CO1, CO2, CO3, CO4)**
Course outcomes: The students will able to • Describe computational solution to engineering problems. (Understand) • Estimate the computational complexity of different algorithms. (Apply) • Develop an algorithm using appropriate design strategies for problem solving. (Apply) • Analyze computational complexity of an algorithm to increase efficiency. (Analyze)		
Reference Books: 1. Anany Levitin, Introduction to the Design and Analysis of Algorithms, Pearson, 2nd Edition, 2009] 2. Thomas H. Cormen, Charles E. Leiserson, Ronal 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.		

M**arks Distribution for Assessment**

CIA (50)	**Components**	**Description**	**Marks**
	Written test	• Total Number of Test:03 • Each Theory test will be conducted for 30 marks • Average of 3 tests= 30 Marks	**30**
	Practical	• Total number of Test : 02 [Part-A(Module – 2 and 3) and Part-B(Module 4 and 5)] Each Lab test will be conducted for 50 marks and scale down to 10 Average of 2 tests= 10 Marks • Laboratory conduction is to be evaluated every week. conducted & Viva = 5 Marks Lab Record = 5 Marks	**10** **10**
		Total CIA	**50**
SEA (50)	Practical Exam	• Students are allowed to pick one experiment from Part-A and one experiment from PART-B. • Mark Distribution : Total 100 marks Part – A : 40 Marks (Functions:6, Execution:28, Viva: 6) Part – B : 60 Marks (Functions:9, Execution:42, Viva: 9) • Scale down to 50 marks	**50**
		Total Marks for the Course	**100**

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SEMESTER – IV

Python Programming and Applications

Credit: 2

Course Code	21AML145	CIA Marks	50
Teaching Hours/Week (L: T: P: J)	0:0:2:2	SEA Marks	50
Total Number of Lecture Hours	40	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**
Laboratory – 1		
Python introduction, data types, operators, flow control and exception handling in Python	**2**	**Apply**
• 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**	
Laboratory – 2		
Functions, passing parameters and return values	**2**	**Apply**
• 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 Fn = Fn-1 + Fn-2. Write a Python program	**2**	

which accepts a value for N (where N >0) as input and pass this value to the function. Display suitable error message if the condition for input value is not followed. • Develop a python program to convert binary to decimal, octal to hexadecimal using functions.		
Laboratory – 3		
String Related Operations	**2**	**Apply**
• Write a python program to create, concatenate and print a string • Write a Python program to print substring from a given string. • Write a Python program that accepts a sentence and find the number of words, digits, uppercase letters and lowercase letters. • Write a Python program to find the string similarity between two given strings	**2**	
Laboratory – 4		
Lists, List Processing, Tuples, and Dictionaries.	**2**	
a. Write a python program to print duplicates from a list of integers and remove them from the list. 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(). 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 iems 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() e. Write a python program that takes two lists and returns True if they are equal otherwise false	**2**	**Apply**
Laboratory – 5		
Pattern Matching with Regular Expression	**2**	
• 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. • Develop a python program that could search the text in a file for phone numbers (+919900889977) and email addresses (sample@gmail.com) • Write a python program to match parenthesis in the given equation. • Write a Python program to match string using regular expression.	**2**	**Apply**
Laboratory – 6		
File Handling	**2**	
• Write a python program to open and write “hello world” into a file? • 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? • Write a python program to open a file and check what are the access permissions acquired by that file using os module? • 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.	**2**	**Apply**

• Write a program that inputs a text file. The program should print all of the unique words in the file in alphabetical order		
Laboratory – 7		
Classes, methods, objects, inheritance, polymorphism, overriding	**2**	
• By using the concept of inheritance write a python program to find the area of triangle, circle and rectangle. • 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. • 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.	**2**	**Apply**
Laboratory – 8		
Working with excel spreadsheets and web scraping	**2**	
• Demonstrate python program to read the data from the spreadsheet and write the data in to the spreadsheet • Write a Program to append data into spreadsheet. • Write a python program to download the all XKCD comics	**2**	**Apply**
Laboratory – 9		
Working with PDF, word and JSON files, Sending Email and Text Messages	**2**	
• Write a python program to combine select pages from many PDFs • Write a python program to fetch current weather data from the JSON file. • Write a Python program to send e-mail, • Write a Python program to send message updates.	**2**	**Apply**
Laboratory – 10		
Image Processing	**2**	
• Write a python program to perform open(), show(), rotate() and convert to grayscale image by processing any image. • Write a python program to print thumbnails, resize() the image by processing any image. • Write a python program to convert an image to ASCII image in Python. • Write a python program to plot solar image and flipping any image. • Write a python program to load an image in grayscale mode. By grayscale mode, convert this image to a black & white image composing by shades of gray and count white dots on a black background.	**2**	**Apply**
Mini Project		
• Develop real world application using Python for selected problem statement. • The problem statement can be selected from the following title but not limited to the same. Temperature converter tool		

Stock investment tracker Election simulator High-scores tracker Dice Rolling Simulator	

Course outcomes:

The students will be able to

- Demonstrate proficiency in handling of loops and creation of functions.
- Identify the methods to create and manipulate lists, tuples and dictionaries.
- Discover the commonly used operations involving regular expressions and file system.
- Interpret the concepts of Object-Oriented Programming as used in Python.
- 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",1stEdition, 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

M**arks Distribution for Assessment**

CIA (50)	**Components**	**Description**	**Marks**
	Practical	• Lab Record - 5 Marks • Performance Day wise – 10 marks (conduction - 7 marks and viva – 3 marks) • Total number of Test : 02 [PART-A (Laboratory -1 to 5) and PART-B (Laboratory -6 to 10)] Each Lab test will be conducted for 40 (Functions:6, Execution:28, Viva: 6) marks and scale down to 20 Average of 2 tests= 20 Marks	**35**
	Project	Demonstration – 10 marks Viva voce – 5 marks	**15**
		Total CIA	**50**
SEA (50)	Practical Exam	• External lab examination in that students are allowed to pick one experiment from Part-A and one experiment from PART-B. • Mark Distribution : Total 100 marks Part – A : 40 Marks (Functions:6, Execution:28, Viva: 6) Part – B : 60 Marks (Functions:9, Execution:42, Viva: 9) • Scale down to 50 marks	**50**
		Total Marks for the Course	**100**

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Department of Artificial Intelligence and Machine Learning

SEMESTER – IV

Machine Learning Laboratory
Credit: 2

Course Code	21AML146	CIA Marks	50
Teaching Hours/Week (L: T: P: J)	0:0:2:0	SEA Marks	50
Total Number of Lecture Hours	20	Exam Hours	03

Course Learning Objectives:

This course will enable students to

- learn and understand the Importance of Machine learning Algorithms
- Able to solve and analyze the problems on Decision tree, Bayesian and Instant learning techniques.
- Impart the knowledge of clustering and classification Algorithms for predictions and evaluating Hypothesis.

Programs	Number of Hours	Bloom's Level
1. Write a python program to predict home prices using Linear Regression.	**2**	**Analyze (CO1,CO2, CO3)**
2. Write a python program to predict the weather using parameters with Linear Regression	**2**	**Analyze (CO1,CO2, CO3)**
3. Using python, calculate the confidence intervals for samples having n less than 30	**2**	**Analyze (CO1,CO2, CO3)**
4. Implement an automated customer information system to direct the customer to correct department based on preference using Decision Trees.	**2**	**Analyze (CO1,CO2, CO3)**
5. Write a python program to decide whether the budget of a company is exceeding or not with decision trees, with a sample dataset	**2**	**Analyze (CO1,CO2, CO3)**
6. Based on customer credit information, using decision trees, implement python code to decide whether the person will be able to pay the insurance monthly or not	**2**	**Analyze (CO1,CO2, CO3)**
7. Using KNN algorithm for linear regression, get the fertiliser response for an agricultural experiment where the crop yield is tested against fertilizers. The response from crops is the variable.	**2**	**Analyze (CO1,CO2, CO3)**
8. Write a Python program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions.	**2**	**Analyze (CO1,CO2, CO3)**

9. 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 learners 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?	**2**	**Analyze (CO1,CO2, CO3)**
10. Using Genetic algorithm optimisation develop python code to implement vehicle routing problem in traffic with maximum 10 cars.	**2**	**Analyze (CO1,CO2, CO3)**

Course outcomes:

The students will be able to

- Understand the importance of different classification and clustering algorithms. (Understand)
- Demonstrate the working of various algorithms with respect to training and test data sets. (Apply)
- Analyze the problems on Decision tree, Bayesian and Instant learning techniques. (Analyze)

Reference Books:

1. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, Second Indian Reprint 2015.
2. Tom M. Mitchell, "Machine Learning", McGraw Hill Education (India) Edition, 2013.

M**arks Distribution for Assessment**

CIA (50)	**Components**	**Description**	**Marks**
	Practical	• Lab Record - 10 Marks • Performance Day wise – 20 marks (Write – up - 6, Execution - 10 marks and viva – 4 marks) • Total number of Test : 02 [PART-A (Laboratory -1 to 5) and PART-B (Laboratory -6 to 10)] Each Lab test will be conducted for 40 (Functions:6, Execution:28, Viva: 6) marks and scale down to 20 Average of 2 tests= 20 Marks	**50**
		Total CIA	**50**
SEA (50)	Practical Exam	• External lab examination: students are allowed to pick one experiment. • Mark Distribution : Total 100 marks Write up : 15, Execution: 70, Viva: 15 • Scale down to 50 marks	**50**
		Total Marks for the Course	**100**

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Semester: III/IV		
COURSE: ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ (ಕನ್ನಡೇತರ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ)		
Course Code:	**L:T:P:J: 1:0:0:0**	**CIE Marks:** 50
Credits:	**1**	**SEE Marks: 5 0**
Hours:	**15 hrs**	**SEE Duration:**

Course Learning Objectives: The students will be able to

1	ಪದವಿ ವಿದ್ಯಾರ್ಥಿಗಳಾಗಿರುವುದರಿಂದ ಸಿಂಸ್ಕೃತಿಕ ಕನ್ನಡದ ಜೊತೆಗೆ ಕ್ರಿಯಾತ್ಮಕ ಕನ್ನಡವನ್ನನ , ಕನ್ನಡ ಸಹಿತ್ಾ , ಸಂಸ್ಕೃತಿ ಮತ್ತು ನಾಡು ನ್ನುಡಿಯ ಪರಚಯ ಮಾಡಿಕೊಡುವುದು.
2	ಆಧುನಿಕ ಪೂವಿ ನ್ನುಗನ್ನ ಡ ಸಹಿತ್ಾ ದ ಪಿ ಮುಖ ಸಹಿತ್ಾ ಪಿ ಕಾರಗಳಾದ ವಚನ್ ಸಹಿತ್ಾ ಮತ್ತು ಕ್ರೀತ್ಿನ್ ಸಹಿತ್ಾ ಇವೆರಡರ ಮಹತ್ವ ವನ್ನನ ಪರಚಯ ಮಾಡಿಕೊಡುವುದು.
3	ಆಧುನಿಕ ಕಾವಾ ಭಾಗದಲ್ಲಿ ಅನೇಕ ಪಿ ಮುಖ ಕವಿಗಳು ಇದ್ದರಾದರೂ ಇಲ್ಲಿ ಸಿಂಕೇತಿವಾಗಿ ಈ ನಾಲ್ಕಕ ಕವಿಗಳ ಸ್ಕಾಲ್ಲೀನ್ ಪಿ ಜ್ಞೆ ಯಿಂದ ಕೂಡಿದ ಕವನ್ಗಳನ್ನನ ಪರಚಯ ಮಾಡಿಕೊಡುವುದು.
4	ಕನ್ನಡದ ತಿಂತಿಿ ಕ ವಿಜ್ಞೆ ನ್ ಕ್ಷೀತ್ಿದ ಅಸ್ತುಭಾರ ಹಾಕ್ರದ ಸ್ರ ವಿಂ ವಿಶ್ವೇಶ್ವರಯಾ ನ್ವರ ಬಗೆೆ ಜನಾಮ್ನಸ್ವಲ್ಲರುವ ನೆನ್ಪಿನ್ ಪಿ ಸಂಗಗಳನ್ನನ ಇಟ್ಟು ಕೊಿಂಡು ಕನಾಿಟಕಕ್ಕ ಅವರು ಮಾಡಿದ ಸೇವೆಯನ್ನನ ಪರಚಯ ಮಾಡಿಕೊಡುವುದು.
5	ಕನ್ನಡ ಭಾಷಾಭಾಷ್,ಸಮಾನ್ಾ ಕನ್ನಡ ಹಾಗೂ ಆಡಳಿತ್ ಕನ್ನಡದ ಪದಗಳ ಪರಚಯ ಮಾಡಿಕೊಡುವುದು

Module 1 – ಕನ್ನಡ ನಾಡು ನ್ನುಡಿ ಮತ್ತು ಸಂಸ್ಕೃತಿಗೆ ಸಂಬಂಧಿಸ್ತದ ಲೇಖನ್ಗಳು	**RBT**	**Hrs**
ಕನಾಿಟಕ ಸಂಸ್ಕೃತಿ - ಹಂಪನಾಗರಾಜಯಾ ಕನಾಿಟಕದ ಏಕ್ರೀಕರಣ, ಒಿಂದು ಅಪೂವಿ ಚರತೆಿ - ಪ್ರಿ ಜಿ ವೆಿಂಕಟಸುಬಬ ಯಾ ಆಡಳಿತ್ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ – ಡಾ॥ಎಲ್ ತಿಮ್ಮೀಶ್ ಮತ್ತು ಪ್ರಿವಿ ಕೇಶ್ವಮೂತಿಿ	**1,2,3**	**3**

Module 2 – ಕಾವಾ ಭಾಗ (ಆಧುನಿಕ ಪೂವಿ)	**RBT**	**Hrs**
ವಚನ್ಗಳು: ಜೇಡರ ದ್ಯಸ್ತಮಯಾ , ಅಲ್ಲಮಪಿ ಭು, ಬಸ್ವಣಣ , ಅಕ್ಕಮಹಾದೇವಿ, ಆಯದಕ್ಕ ಲಕ್ಷ ಮ್ಮು, ಆಯದಕ್ಕ ಮಾರಯಾ ಕ್ರೀತ್ಿನೆಗಳು : ಪುರಂದರದ್ಯಸ್, ಕನ್ಕದ್ಯಸ್	**1,2,3**	3

Module 3 – ಕಾವಾ ಭಾಗ (ಆಧುನಿಕ)	**RBT**	**Hrs**
ಮಂಕುತಿಮಮ ನ್ ಕಗೆ : ಡಿ.ವಿ.ಜಿ. ಕುರುಡು ಕಾಿಂಚಣಾ : ದ.ರಾ. ಬಿಂದ್ರಿ ಹೊಸ್ ಬಾಳಿನ್ ಗೀತೆ : ಕುವೆಿಂಪು ಚೀಮನ್ ಮಕ್ಕಳ ಹಾಡು : ಸ್ತುದಲ್ಲಿಂಗಯಾ	**1,2,3**	**3**

Module 4 – ತಿಂತಿಿ ಕ ವಾಕ್ಯಪರಚಯ	**RBT**	**Hrs**
ಕಥೆ ಮತ್ತು ಪಿ ವಾಸ್ ಕಥನ್ - ಸ್ರ ವಿಂ ವಿಶ್ವೇಶ್ವರಯಾ - ವಾಕ್ಯಮತ್ತು ಐತಿಹಾ - ಎ ಎನ್ ಮೂತಿಿರಾವ್	**1,2,3**	**3**

Module 5 – ತ್ವಜ್ಞೆ ನ್ ಮತ್ತು ತಂತ್ರಿ ಜ್ಞೆ ನ್	**RBT**	**Hrs**
ಭಗವದ್ಗೀತೆಯ ಸರ, ಭಗವದ್ಗೀತೆಯಲ್ಲಲ ಬರುವ ಗುರು ಶಿಷ್ಾ ಸಂಬಂಧ. ತಿಂತಿಿ ಕ ಪದಕೊೀಶ್ - ತಿಂತಿಿ ಕ ಹಾಗೂ ಪಾರಭಾಷಿಕ ಕನ್ನಡ ಪದಗಳು	**1,2,3**	**3**

Reference Books

1. **"ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ"** ವಿಶ್ವೇಶ್ವರಯಾ ತಿಂತಿಿ ಕ ವಿಶ್ವವಿದ್ಯಾಲ್ಯದ ಕನ್ನಡ ಮಾತೃಭಾಷೆಯ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ನಿಗದಪಡಿಸ್ತದ ಪಠ್ಾ ಪುಸ್ತಕ
   ಪಿ ಧಾನ್ ಸಂಪಾದಕರು - ಕುಲ್ಪತಿಗಳು ವಿಶ್ವೇಶ್ವರಯಾ ತಿಂತಿಿ ಕ ವಿಶ್ವವಿದ್ಯಾಲ್ಯ ಬೆಳಗಾವಿ ಸಂಪಾದಕರು – ಡಾ॥ ಹಿ. ಚಿ. ಬೀರಲ್ಲಿಂಗಯಾ , ಕುಲ್ಪತಿಗಳು ಕನ್ನಡ ವಿಶ್ವವಿದ್ಯಾಲ್ಯ ಹಂಪಿ ಡಾ॥ ಎಲ್ ತಿಮ್ಮೀಶ್ , ಪಾಿಧಾಾ ಪಕರು ಸ್ತಿರ ಇಂಜಿನಿಯರಿಂಗ್ ಕಾಲೇಜ್, ಹಾಸ್ನ

B.N.M. Institute of Technology

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Semester: III/IV		
COURSE: Balake Kannada (For non Karnataka students)		
Course Code:	**L:T:P:J: 1:0:0:0**	**CIE Marks:** 50
Credits:	**1**	**SEE Marks: 50**
Hours:	**15 hrs**	**SEE Duration:**

Course Learning Objectives: The students will be able to	
1	The course will enable the non Karnataka students to understand speak read and write Kannada language and communicate or Converse in Kannada language in their daily life with Kannada speakers
2	

Module 1 – SPOKEN KANNADA	**RBT**	**Hrs**
i. Interaction in Hostel / College. ii. Conversation in a Bus. iii. Conversation between friends. iv. Conversation with Teachers. v. Telephonic Conversation. vi. Conversation with shopkeeper. vii. Conversation with Auto and Cab Driver.	**1,2,3**	**5**
Module 2 – READ AND WRITE	**RBT**	**Hrs**
Vowels, Initial forms & Secondary forms Yogavahas Classified consonants, Un-classified consonants.	**1,2,3**	**4**
Module 3 – HISTORY OF KARNATAKA	**RBT**	**Hrs**
Royal Dynasties of Karnataka	**1,2,3**	**2**
Module 4 – LITERATURE AND TOURIST PLACES OF KARNATAKA	**RBT**	**Hrs**
The Birds view of Kannada Literature Karnataka's Tourist Paradise	**1,2,3**	**2**
Module 5 – KANNADA LANGUAGE	**RBT**	**Hrs**
History of Kannada Language	**1,2,3**	**2**

Reference Books

1. **"ಬಳಕೆ ಕನ್ನಡ"** ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಂತ್ರಜ್ಞಾನ ಕೇಂದ್ರವಿದ್ಯಾಲಯದ ಕನ್ನಡ ಮಾತೃಭಾಷೆ ಆಲ್ಲದ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ನಿಗಧಪಡಿಸ್ತದ ಪಠ್ಯ ಪುಸ್ತಕ.
   ಪ್ರಧಾನ್ ಸಂಪಾದಕರು - ಕುಲ್ಪತಿಗಳು ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಂತ್ರಜ್ಞಾನ ಕೇಂದ್ರವಿದ್ಯಾಲಯ ಬೆಳಗಾವಿ ಸಂಪಾದಕರು – ಡಾ॥ ಎಲ್ ತಿಮ್ಮೇಶ್ , ಪ್ರಾಧ್ಯಾಪಕರು ಸ್ನಾತಕೋತ್ತರ ಇಂಜಿನಿಯರಿಂಗ್ ಕಾಲೇಜ್, ಹಾಸ್ಸನ

ADVANCED LEADERSHIP SKILLS

Course Code:	**Credit: 1**
L:T:P:J: 0:0:2:0	**CIA Marks: 100**

Course Objectives

1. To prepare students to exercise different types of communication by engaging them across various real life and hypothetical scenarios.
2. To make students practically understand the essential aspects of communication that will aid them in becoming a leader.

Module No.	Contents of the Module	Session	COs
1	**Module-1 Understanding and Managing Self** 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. Personality analysis using Big 5 personality test. Critical Thinking, Problem solving, Creativity and innovation Integrity, ethics, values.	7	CO1
2	**Module -2 Corporate etiquettes** Resume Writing, Basic etiquettes, Grooming etiquettes, Effective meeting skills Group discussion and Personal interview.	8	CO2

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

CO1	Understand their strengths and weakness
CO2	Develop analytical and creative ability to solve problems
CO3	Become industry ready through practice of corporate etiquettes

Mapping of Course Outcomes with Program Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
CO1		2			2			1	2
CO2					2				2
CO3		2			2				2

MOOC Course:

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.

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Department of Artificial Intelligence and Machine Learning

SEMESTER – V

Software Project Management and Finance (PCC)
Credit : 3

Course Code	21AML151	CIA Marks	50
Teaching Hours/Week (L: T: P: J)	2:2:0:0	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. **Design and Implementation**: Introduction to RUP, Design Principles **Software Testing:** Development testing, Test-driven development, Release testing, User testing.	**8**	**(CO2) Apply**
Module-3: Project management, Project Planning, Quality management		
Project management: Risk management, Managing People, Teamwork. **Project Planning:** Software pricing, Plan-driven development, Project scheduling: Estimation techniques, **Quality management:** Software quality, Reviews and inspections, Software measurement and metrics, Software standards	**8**	**(CO3) Apply**

Module-4: Agile Software Development		
Agile Software Development: 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**
Module-5: Managing Project Finances		
How to Manage Project Finances-Cost estimating: Work Breakdown Structure, Cost budgeting: Cost Aggregation, Reserve Analysis, Parametric estimating, Infrastructure and overheads, Cost control: Change Control, Resource Management **Performance Measurement and Analysis**- 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**

Course outcomes:

1. Understand the activities involved in software engineering and identify the role of various process models.
2. Design a software system, component, or process to meet desired needs within realistic constraints and describe various software testing methods
3. Illustrate the role of project planning and quality management in software development.
4. Describe agile project management and benefits of using agile approaches.
5. Understanding financial concepts and apply it to control Project Costs.

Reference Books:

1. Software Engineering Ian Sommerville Pearson Education 9th Edition, 2012
2. Software Engineering-A Practitioner approach Roger S. Pressman Tata McGraw Hil 7th Edition
3. An Integrated Approach to Software Engineering Pankaj Jalote Wiley India
4. A guide to the project Management body of knowledge- PMBOK guide , 7th edition

M**arks Distribution for Assessment**

CIA (50)	**Components**	**Description**	**Marks**
	Written test	• Total Number of Test:03 • Each Theory test will be conducted for 30 marks • Average of 3 tests= 30 Marks	**30**
	Assignment	Activity to demonstrate all the phases of the software development life cycle	**10**
	Quiz	Conduct quiz after 1st IA	**10**
		Total CIA	**50**
SEA (50)	Written exam	• Theory exam will be conducted for 100 marks and scaled down to 50 marks. • The question paper will have 10 full questions each of 20 marks. Students have to answer 5 full questions.	**50**
		Total Marks for the Course	**100**

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SEMESTER – V

Automata Theory and Computations (PCC)
Credit : 3

Course Code	21AML152	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 | n mod 2=0, m≥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**

Module-3: Context-Free Grammars & Pushdown Automata		
Context-Free Grammars(CFG): 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. **Pushdown Automata (PDA)**: 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. **Syntax analysis**: role of parser, top down parsing, bottom up parsing, operator precedence parsing, LR parsers, parser generators **Use Case:** Construct PDA for the context free grammar using using JFLAP • Derive a parse tree using python programming • Construct a PDA using python programming for a set of languages	**8**	**(CO2) Apply**
Module-4: Turing Machine		
Turing Machine: 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. **Decidability:** Definition of an algorithm, decidability, decidable languages, Undecidable languages, halting problem of TM, Post correspondence problem. **Use Case:** Construct Turing machine and check decidability and undecidability of languages using JFLAP • Construct a DTM which matches all strings beginning with '0's, and followed by the same number of '1's • Turing machine for the language L = {a^mb^na^mb^n | m,n≥0}	**8**	**(CO3) Apply**
Module-5: Complexity & Lexical Analysis		
Complexity: 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. **Lexical Analysis**: 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. **Use Case:** Apply Automata concepts to check syntax of programming language. • Implement lexical analyzer using python	**8**	**(CO4) Apply**
Course outcomes: The students will be able to: 1. Apply the core concepts of Automata Theory and Computation and convert different automata models, Regular Expressions to FSM. (Apply) 2. Develop Grammars and Automata for different language classes. (Apply) 3. Apply the concept of Turing machine, decidability and undecidability on the grammar (Apply) 4. Design and develop lexical analyzers and parsers. (Apply) 5. Analyze different type for models using simulators (Analyze)		

Reference Books:

1. Elaine Rich, Automata, Computability and Complexity, 1st 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, 2nd Edition, 2007.

Marks Distribution for Assessment

CIA (50)	**Components**	**Description**	**Marks**
	Written test	• Total Number of Test:03 • Each Theory test will be conducted for 30 marks • Average of 3 tests= 30 Marks	**30**
	Assignment	Check the correctness of the automata designed in JFLAP simulator and show the results	**10**
	Certification Course	Infosys Springboard certification course on Automata Theory and Computation	**10**
		Total CIA	**50**
SEA (50)	Written exam	• Theory exam will be conducted for 100 marks and scaled down to 50 marks. • The question paper will have 10 full questions each of 20 marks. Students have to answer 5 full questions.	**50**
		Total Marks for the Course	**100**

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Department of Artificial Intelligence and Machine Learning

Computer Networks and Security (PCI)

Credit: 4

SEMESTER– V

Course Code	21AML153	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**
Data communication: 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. **Physical Layer**: Data and Signals, Periodic analog signals, digital signals, Transmission impairment. **Practical Component using NS2:** 1. Implement three nodes point – to – point network with duplex links between them. 2. Implement the following topologies: Bus, Star, Ring	**6+4**	**(CO1) Apply**
Module 2 : Data Link Layer		
Data-Link Layer: 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. **Practical Component using NS2:** 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. 2. Implement an Ethernet LAN using n nodes and set multiple traffic nodes and plot congestion window for different source / destination.	**6+4**	**(CO2) Apply**
Module 3: Network Layer		

Network Layer: Introduction, Network Layer services: Packetizing, Routing and Forwarding, Packet Switching: Datagram Approach, Virtual Circuit Approach. IPV4 Addresses: Address Space, Classful Addressing, Classless Addressing, DHCP, Network Address Resolution, Distance Vector Routing, Link State Routing, Path vector routing. **Practical Component using NS2:** 1. Simulation of distance vector routing algorithm. 2. Simulation of link state routing algorithm	**6+4**	**(CO3) Apply**
Module 4: Transport and Application Layer		
Transport Layer: 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. **Application Layer:** Introduction: providing services, Application- layer paradigms, Standard Client -Server Protocols: World wide web, Hyper Text Transfer Protocol, FTP: Domain Name system. **Practical Component using NS2:** 1. Implement Transport Control Protocol in sensor network 2. Implement User Datagram protocol in sensor network 3. Simulation of stop and wait protocol and sliding window protocol **Cisco Packet Tracer:** 4. Configuration of TELNET protocols on router for remote access.	**6+4**	**(CO3) Apply**
Module 5: Network Security		
Security Introduction, Attacks, Services, Mechanism, network security, Cryptography, DES, AES, Public-Key Cryptography: RSA, Hash and MAC Algorithms: Secure Hash Algorithm (SHA), Digital Signatures. **Practical Component using JAVA:** 1. Write a Java program to implement the DES algorithm logic 2. Write a Java program to implement RSA Algorithm 3. Calculate the message digest of a text using the SHA-1 algorithm in JAVA. **Introduction to Wireshark and network traffic analysis** • Introduction to Wireshark • Installation of Wireshark and basic usage • Network traffic analysis of HTTP, FTP protocol	**6+4**	**(CO4) Apply**

Course Outcomes:

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

1. Apply the concepts of networking and data transmission to solve various real time problems.
2. Apply the various services and protocols of data link layer.
3. Apply and analyze the various networking architectures, protocols and services of network and transport layers for real time networking.
4. Identify the networks security, threats, and vulnerabilities and Apply the different cryptographic operations.

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

M**arks Distribution for Assessment**

CIA (50)	**Components**	**Description**	**Marks**
	Written test	• Total Number of Test:03 • Each Theory test will be conducted for 30 marks • Average of 3 tests= 30 Marks	**30**
	Practical	• Total number of Test: 02 • Each Lab test will be conducted for 50 marks and scaled down to 10 Average of 2 tests= 10 Marks • Laboratory conduction is to be evaluated every week. conduction & Viva = 10 Marks	**10** **10**
		Total CIA	**50**
SEA (50)	Written Test	• Theory exam will be conducted for 100 marks and scaled down to 50 marks. • The question paper will have 10 full questions each of 20 marks. Students have to answer 5 full questions.	**50**
		Total Marks for the Course	**100**

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SEMESTER – V

ARTIFICIAL INTELLIGENCE (PCI)

Credit : 4

Course Code	21AML154	CIA Marks	50
Teaching Hours/Week (L: T: P: J)	3:0:1:1	SEA Marks	50
Total Number of Lecture Hours	50	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. **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		
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.** Implement N-Queens algorithm.	**6+4**	**(CO2) Apply**
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. **Practical:** 1. Write a program to implement Missionaries and Cannibals. 2. Write a program to implement Monkey and Bananas Problem 3. Write a Program to Implement Tower of Hanoi	**6+4**	**(CO2) Apply**
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. **Practical:** 1. Implementation of the problem solving strategies: either using Forward Chaining or Backward Chaining. 2. Write predicates to convert centigrade temperatures to Fahrenheit and check if temperature is below freezing.	**6+4**	**(CO3) Apply**
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, XOON. **Practical:** 1. Implement MYCIN expert system	**6+4**	**(CO4) Apply**
MINI PROJECT		
1. Spare Tire Problem 2. Air Cargo Transport 3. Vaccum World 4. Bullet-Maze Problem 5. Horizon Effect Problem 6. Wumpus World 7. TSP 8. Scrabble 9. Soccer and Billiards 10. Baye's Rule 11. Chess 12. Go		

13. Backgammon
14. Bridge-Card
15. Map coloring
16. Job-shop scheduling
17. Sudoku problem.

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

M**arks Distribution for Assessment**

CIA (50)	**Components**	**Description**	**Marks**
	Written test	• Total Number of Test:03 • Each Theory test will be conducted for 30 marks • Average of 3 tests= 30 Marks. • Scaled down to 20	**20**
	Practical	• Lab Test = 10 • Laboratory conduction is to be evaluated every week. conducted & Viva = 10 Marks • Mini Project = 10	**30**
		Total CIA	**50**
SEA (50)	Written exam	• Theory exam will be conducted for 100 marks and scaled down to 50 marks. • The question paper will have 10 full questions each of 20 marks. Students have to answer 5 full questions.	**50**
		Total Marks for the Course	**100**

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SEMESTER - V

Virtual Reality and Augmented Reality(PBL)

Credit 2

Course Code	21AML155	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		
Unity Introduction • Introduction to C# programming. • Demonstrate Unity's Interface, Overlay Reference, Position on Overlay, Managing Layouts, Camera Overlay • Demonstrate Scene view navigation, Scene view camera, Game View. • Project Creation, Scene Creation, Plane creation, cube creation , Explanation of cube camera and position, Material Selection, Script creation, Both name of .cs and class file same, adding motion to the script ,Run. • Setting up google cardboard for unity.	**4+ 2(Project)**	**Apply**
Task – 2		
Unity Programming • Show the use of unity for Creating, loading and saving the scenes. • Show the use of Set up multiple scene, Edit multiple scenes. • Demonstrate to Create Multiple scenes, Edit Multiple scenes, Customize the new scene. • Demonstrate the Transforms, Components,2D primitives, creating components, Saving the work. • Demonstrate the Layers, Constraints, Editor Feature (2d mode 3d mode, Preferences, Build settings. • Show the use of Asset overflow, Asset database, Asset Bundles, Introduction to 2D, Sprites, Sprites Editor. • Unity Remote 5, Installation of android or IOS, Viewing through the mobile. • Setting up google cardboard for unity.	**4+ 2(Project)**	**Apply**

Task – 3		
Graphics • Demonstrate the use of Render Pipelines, Cameras, lighting, models. • Demonstrate the use of Meshes, Textures, shaders, materials • Demonstrate the concept Visual effects, sky, colour for suitable example. • Demonstrate the concept of World Building, Terrain, tree Editor for suitable example. • Demonstrate XR Plug-in Management, Installation of packages. • Demonstrate Creation of left hand, left hand Controller and right hand controller. • Setting up google cardboard for unity.	**4+ 2(Project)**	**Apply**
Task 4		
Scripting, Multiplayer and Networking, Audio Video and Animation • Demonstrate the Setting up scripting Environment. • Apply the concepts for Creating scripts, event Functions, namespaces, attributes, Unity Events. • Apply the Multiplayer, audio files, tracker Modules, Audio Group inspector. • Demonstrate for suitable example to create Animation, Rotation in animation, animation clips, Humanoid avatars, Animation.	**4+ 2(Project)**	**Apply**
Task - 5		
Augmented reality • Program to show augmented reality. • Program to show The Relationship Between Augmented Reality and Other Technologies-Media, Technologies. • Program to show Spectrum Between Real and Virtual Worlds, applications of augmented reality Augmented.	**4+ 2(Project)**	**Apply**
Mini project • Using VR exploring the human body level by level, including cell level. • Using VR describing how medicine and body cures the illness. • Touchless ATM Using Augmented Reality. • Augmented Reality Controlled Hologram. • Augmented Reality House devices. • Augmented Reality Agriculture Field. • Augmented Reality and Medical devices. • VR Game Development. • VR Application Development. • Development of AI controlled VR Device, that accurately work to keep the clarity very good and using technology keep the eye healthy. • Development of Cardboard VR device as activity.		

- Improvising the quality of the VR Device and determining the accuracy.
- Development of Satellite with the capability of VR Camera and more features.
- Ability to view the Solar system using the VR Device using compatible camera sent through the satellite.

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

Marks Distribution for Assessment

	Components	**Description**	**Marks**
CIA (50)	Practical	• Performance Day wise – 10 marks (conduction - 7 marks and viva – 3 marks) • Total number of Test: 02 [Test -1(Tasks -1 to 3) and Test-2 (Tasks 4 & 5)] Each Lab test will be conducted for 50 (procedure writing:8, Execution:35, Viva: 7) marks and scale down to 20. Average of 2 tests= 20 Marks	**20**
	Project	• Phase-1(feasibility) -30 marks • Phase -2 (design and development) - 30 marks • Phase-3 (Final Demonstration) - 30 marks Average of three phases=30 marks	**30**
		Total CIA	**50**
SEA (50)	Practical Exam	• Project is evaluated for 100 marks and scaled down to 50.	**50**
		Total Marks for the course	**100**

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	21AML1561	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
Module-1: Introduction		
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 Bays 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.

Marks Distribution for Assessment

CIA (50)	**Components**	**Description**	**Marks**
	Written test	• Total Number of Test:03 • Each Theory test will be conducted for 30 marks • Average of 3 tests= 30 Marks	**30**
	Assignment	Quiz	**10**
	Certification Course	Mooc course on Basics of Machine Learning	**10**
		Total CIA	**50**
SEA (50)	Written exam	• Theory exam will be conducted for 100 marks and scaled down to 50 marks. • The question paper will have 10 full questions each of 20 marks. Students have to answer 5 full questions.	**50**
		Total Marks for the Course	**100**

B.N.M. Institute of Technology

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Department of Artificial Intelligence and Machine Learning

SEMESTER – V

Introduction to Artificial Intelligence (Open Elective)
Credit : 3

Course Code	21AML1562	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. **Informed (Heuristic) Search strategies:** Best-first search, A* algorithm, AO* algorithm	**8**	**Apply**
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.		
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

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

M**arks Distribution for Assessment**

CIA (50)	**Components**	**Description**	**Marks**
	Written test	• Total Number of Test:03 • Each Theory test will be conducted for 30 marks • Average of 3 tests= 30 Marks	**30**
	Assignment	Quiz	**10**
	Certification Course	Mooc course on Basics of Artificial Intelligence	**10**
		Total CIA	**50**
SEA (50)	Written exam	• Theory exam will be conducted for 100 marks and scaled down to 50 marks. • The question paper will have 10 full questions each of 20 marks. Students have to answer 5 full questions.	**50**
		Total Marks for the Course	**100**

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	21AML1563	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**
Foundations of Data Science 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		
Making Sense of Unstructured Data What is unsupervised learning, and why is it challenging? Examples unsupervised learning:	**08**	**Apply**
Module 3: Classification		
Classification 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		
Clustering 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		
Deep Learning 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 Goodfelllow, Yoshua Benjio, Aaron Courville, The MIT Press

M**arks Distribution for Assessment**

CIA (50)	**Components**	**Description**	**Marks**
	Written test	• Total Number of Test: 03 • Each Theory test will be conducted for 30 marks • Average of 3 tests= 30 Marks	**30**
	Assignment	Activity on Data driven decision making	**20**
		Total CIA	**50**
SEA (50)	Written exam	• Theory exam will be conducted for 100 marks and scaled down to 50 marks. • The question paper will have 10 full questions each of 20 marks. Students have to answer 5 full questions.	**50**
		Total Marks for the Course	**100**

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

Course Code	21AML1564	**CIA Marks**	50
Teaching Hours/Week (L: T: P: J)	3:0:0:0	**SEA Marks**	50
Total Number of Contact Hours	40	**Exam Hours**	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.

Module-1: Strain, Pressure, Position, direction, distance, and motion	**Contact Hours.**	**Bloom's Level**
Strain and Pressure: Mechanical strain, Interferometry, Fibre optic methods, pressure gauges, low gas pressures, Ionization gauges, Transducer use. **Position, direction, distance, and motion:** Position, Direction, Distance measurement, Distance travelled, Accelerometer systems, Rotation.	**8**	**Apply**
Module-2: Light and associated radiation		
Light and associated radiation: 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**
Module-3: Temperature sensors and thermal transducers		
Temperature sensors and thermal transducers: 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**
Module-4: Industrial Robotics		
Industrial Robotics: 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**
Module-5: Robot programming		
Robot programming: 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

Marks Distribution for Assessment

CIA (50)	Components	Description	Marks
	Written test	• Total Number of Test:03 • Each Theory test will be conducted for 30 marks • Average of 3 tests= 30 Marks	**30**
	Assignment =10 Marks Activity = 10 Marks		**20**
		Total CIA	**50**
SEA (50)	Written Exam	• Theory exam will be conducted for 100 marks and scaled down to 50 marks. • The question paper will have 9 full questions each of 20 marks. Students have to answer 5 full questions.	**50**
		Total Marks for the Course	**100**

B N M Institute of Technology

An Autonomous Institution under VTU

For Internal Communication
Department of Training & Placement

Syllabus

Course Name: Employability Skills-1

Class: V Semester **Year of Study: 2023-24**

Course Code: 21AML157

Course Objectives: This course will enable students to

- ability to apply programing techniques/languages to solve complex problems.
- understand the course specific technical topics in view of the industry requirements.

Module	Topics to be covered	No of Hours
General Technical Training **(All Branches)**	**Programming Languages** C, Java, Python (Platforms to be used Hacker Rank, Leet Code and Github)	**10 Hours**
General Employability Skills	Complex problem Solving and Critical Thinking Skills	**2 Hours**
Course Specific Technical Training	**CSE, ISE & AIML** Algorithms, Data Structures, DBMS, Computer Organisation, Computer Networks, Operating Systems & AIML.	**12 Hours**
	Electronics & Communication Engineering Matlab, SCADA, System Verilog, VLSI, & Embedded Systems, Computer Organisation, Introduction to Data Structures & Operating Systems	

	Electrical & Electronics & Engineering Power Electronics, Power Systems, Introduction to Robotic Process Automation (RPA), Introduction to Data Structures & EV Vehicles.	
	Mechanical Engineering Thermodynamics, Aerodynamics, Automobile & Engines, Solidworks, Ansys, Industrial Automation, Mechatronics, & EV Vehicles	

Course Outcome: (CO)

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

1. Apply the appropriate coding techniques to solve problems.
2. Analyze the problem and solve it within the allocated time span.
3. Implement out of the box solutions for complex problems.

CO-PO/PSO Mapping:

CO No.	Statement	Bloom's Cognitive level	POs
1	apply the appropriate coding techniques to solve problems.	**Apply**	PO1, PO2 & PO12
2	analyze the problem and solve it within the allocated time span	**Analyze**	PO1 & PO2
3	implement out of the box solutions for complex problems.	**Analyze**	PO1 & PO2

Assessment processes:

	Components	Description	Marks
CIA (100)	Assignments	On completion of important topics assignments has to be given	20
	Written / Online Test	• **Total Tests: 03** ➢ With 75 minutes duration & 50 marks each ➢ Average score of 50 Marks from 3 tests will be considered for the final score	50
	Company Simulation Tests	• Mandatory to complete 5 (CSA) Company Simulative Coding Assessments before Test -3	30
	Total Marks for the Course		**100**

B.N.M. Institute of Technology

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Department of Artificial Intelligence and Machine Learning

SEMESTER – VI

Big Data Analytics (PCI)
Credit : 3

Course Code	21AML161	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

- Get familiar with Hadoop distributions, configuring Hadoop and performing File management tasks
- Describe Big Data and its importance with its applications
- 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.

	Number of Hours	**Bloom's Level**
Module-1: Introduction		
Introduction: Classification of Digital data: Structured Data, Semi Structured Data, Unstructured Data; Definition of Big Data, Characteristics of Data, Challenges of Big Data Introduction to Hadoop: RDBMS Vs Hadoop, Distributed computing challenges, Hadoop: Features, Advantages of Hadoop, Versions of Hadoop, Hadoop ecosystem, HDFS, Processing data with Hadoop, The Command Line Interface, Basic File System Operations, Hadoop File Systems Interfaces, File Management in Hadoop **Practical:** 1. Hadoop Installation – Stand Alone mode, Pseudo distributed mode and Fully Distributed mode 2. File Management tasks in Hadoop • Create a directory in HDFS at given path(s). • List the contents of a directory. • Upload and download a file in HDFS. • See contents of a file • Copy a file from source to destination • Copy a file from/To Local file system to HDFS • Move file from source to destination • Remove a file or directory in HDFS • Display last few lines of a file. • Display the aggregate length of a file	**6+4**	**(CO1) Apply**

Module-2: Map Reduce Programming		
Introduction to Map Reduce Programming: Introduction to Mapper, Reducer, Combiner, Partitioner, Searching, sorting, compression **Practical:** 1. Word Count Map Reduce program 2. Implementing Matrix Multiplication with Hadoop Map Reduce 3. Implement matrix multiplication with Hadoop Map Reduce. 4. Implement Searching with Hadoop Map Reduce. 5. Implement Sorting with Hadoop Map Reduce.	**6+4**	**(CO2) Apply**
Module-3: MongoDB , Pig Latin and Hive		
Introduction, Creating and Dropping database in MongoDB, MongoDB Query Language: Insert(), save(), update(), remove() and find() methods, Arrays, Aggregate Functions. **Pig Latin:** Introduction to PIG: Anatomy of PIG, PIG on Hadoop, PIG philosophy, overview of PIG, Data types in PIG, Running and execution modes of PIG, HDFS commands, Relational operators, Eval function, Complex Data types. **Hive:** Introduction, HIVE architecture, HIVE data types, HIVE file formats, HIVE query language, RCFile implementation, SerDe, User Defined Functions (UDF) **Practical:** 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 4. Installation of PIG. 5. Write Pig Latin scripts sort, group, join, project, and filter your data 6. Run the Pig Latin Scripts to find Word Count. 7. Run the Pig Latin Scripts to find a max temp for each and every year. 8. Implementing Database Operations on Hive. 9. Hive Commands : Data Definition Language (DDL) CREATE, DROP, TRUNCATE, ALTER, SHOW, DESCRIBE Statements. 10. Data Manipulation Language (DML) LOAD, INSERT Statements. 11. Aggregation, GroupBy and Having in Hive	**6+4**	**(CO3) Apply**
Module-4: Machine Learning Algorithms for Big Data Analytics		
Introduction; Estimating the relationships, Outliers, Variances, Probability Distributions, and Correlations; Regression analysis, Finding Similar Items, Similarity of Sets and Collaborative Filtering; Frequent Itemsets and Association Rule Mining. **Practical:** 1. Data visualization using python plotting library o Plot a pie chart of color transparency that can visualize the distribution of non-transparent and transparent colors. o Display a scatter graph on 50 random data points generated between (1,1) and (10,10) 2. Implement the SVM classifier which classifies the input dataset on the basis of transparency of the colors.	**6+4**	**(CO4) Apply**

Module-5: Text Mining		
Text, Web Content, Link, and Social Network Analytics: Introduction, Text mining, Web Mining, Web Content and Web Usage Analytics, Page Rank, Structure of Web and analyzing a Web Graph, Social Network as Graphs and Social Network Analytics: **Practical:** 1. Implement Page Rank Algorithm using Map-Reduce. 2. Frequent Itemset Mining (find patterns/regularities in customer's shopping behavior) Using MapReduce on Hadoop. 3. Write a program to get Rank of page in google search results using BeautifulSoup.	**6+4**	**(CO5) Apply**

Course outcomes:

The students will be able to

1. Investigate Hadoop framework and Hadoop Distributed File system
2. Demonstrate the MapReduce programming model to process the big data
3. Implement various big data technologies like Hadoop Pig and Hive.0
4. Use Machine Learning algorithms for real world big data.
5. Analyze web contents and Social Networks to provide analytics with relevant visualization tools.

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. Seema Acharya, SubhasiniChellappan, "Big Data and Analytics", Wiley Publications, 2015.
3. Hadoop: The Definitive Guide, Tom White, Third Edition, O'Reilley, 2012.
4. Big data analytics with R and Hadoop, Vignesh Prajapati, SPD 2013.

Marks Distribution for Assessment

CIA (50)	**Components**	**Description**	**Marks**
	Written test	• Total Number of Test:03 • Each Theory test will be conducted for 30 marks • Average of 3 tests= 30 Marks	**30**
	Practical	• Total number of Test : 02 [Part-A(Module – 2 and 3) and Part-B(Module 4 and 5)] Each Lab test will be conducted for 50 marks and scale down to 10 Average of 2 tests= 10 Marks • Laboratory conduction is to be evaluated every week. conducted & Viva = 5 Marks Lab Record = 5 Marks	**10** **10**
		Total CIA	**50**
SEA (50)	Written exam	• Theory exam will be conducted for 100 marks and scaled down to 50 marks. • The question paper will have 10 full questions each of 20 marks. Students have to answer 5 full questions.	**50**
		Total Marks for the Course	**100**

B.N.M. Institute of Technology

An Autonomous Institution under VTU, Approved by AICTE

Department of Artificial Intelligence and Machine Learning

SEMESTER – VI

Natural Language Processing (PCI)
Credit: 3

Course Code	21AML162	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**
Module-1: Introduction		
Introduction: Introduction to Natural Language Processing, Stages in natural language Processing, Origins and challenges of NLP Language and Grammar-Processing Indian Languages, Introduction to the corpus, elements in the balanced corpus. **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. **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**

Module-3: N-Grams		
N-Grams: Simple N-grams, Smoothing- Laplace smoothing, Good Turing Discounting, Backoff, Entropy, Morphology: Inflectional morphology, Derivational morphology. **Practical:** 1. N grams- Implement a Python program to implement N-Gram 2. Smoothing-Design a Python program to perform smoothing using various methods in Python. 3. Good turing- Develop a Python program to calculate good turing frequency.	**6+4**	**(CO2) Apply**
Module-4: Lexical Semantics		
Semantic: Meaning Representation, Lexical Semantics, Word Sense Disambiguation –Selectional Restriction-based word sense disambiguation, context-based word sense disambiguation Approaches. **Practical:** 1. Lexical Semantics- Design Python program to do text classification. 2. Meaning Representation- Implement a Python program to represent the meaning of the given text. 3. Disambiguity-Design the lesk algorithm in Python to handle word sense disambiguation.	**6+4**	**(CO3) Apply**
Module-5: Information Retrieval		
Information Retrieval-Design features of information retrieval systems- Indexing, eliminating stop words, Stemming, Classical information retrieval Models-Boolean model, Probabilistic model. Application: Information extraction, Automatic text summarization, topic modelling, Question –Answer System **Practical:** 1. Information Extraction- Design Python programs to extract structured information from unstructured information. 2. Filtering Stop Words- Implement a python program to filtering stop words. 3. Stemming- Design a Python program to reduce an inflected word down to its word stem. 4. Question Answering System- Design a questioning answer system using Python.	**6+4**	**(CO4) 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 N grams. 3. Design of meaning representation and word sense disambiguation models. 4. Design of NLP models-Information retrieval, text summarization and topic modeling		
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 2SpeechRecognition", 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.		

Marks Distribution for Assessment

CIA (50)	Components	Description	Marks
	Written test	• Total Number of Test:03 • Each Theory test will be conducted for 30 marks • Average of 3 tests= 30 Marks	**30**
	Practical	• Total number of Tests: 02 • Each Lab test will be conducted for 50 marks and reduced to 10 Average of 2 tests= 10 Marks • Laboratory conduction is to be evaluated every week. conducted & Viva = 5 Marks Lab Record = 10 Marks	**10** **10**
		Total CIA	**50**
SEA (50)	Written exam	• Theory exam will be conducted for 100 marks and scaled down to 50 marks. • The question paper will have 10 full questions each of 20 marks. Students have to answer 5 full questions.	**50**
		Total Marks for the Course	**100**

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Department of Artificial Intelligence and Machine Learning

SEMESTER – VI

Image Processing and Computer Vision (PCI)

Credit: 4

Course Code	21AML163	**CIA Marks**		50
Teaching Hours/Week (L: T: P: J)	3:0:1:1	**SEA Marks**		50
Total Number of Contact Hours	50	**Exam Hours**		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

Module-1: Digital Image Fundamentals	**Number of Hours**	**Bloom's Level**
Digital Image Fundamentals: 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. **Practical using MATLAB** 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.	**6+4**	**(CO1) Apply**
Module-2: Spatial Domain, Frequency Domain, Image Restoration and Reconstruction		
Spatial Domain: Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering -Smoothing Spatial Filters, Sharpening Spatial Filters. **Frequency Domain**: Preliminary Concepts, The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-D DFT. **Image Restoration and Reconstruction**: A model of the Image Degradation/Restoration Process, Noise Models, Restoration in the presence of Noise only- Special Filtering. **Practical using MATLAB** 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	**6+4**	**(CO2) Apply**

Module-3: Color Image Processing, Morphological Image Processing, and Image Segmentation		
Color Image Processing: Color Fundamentals, Color Models- RGB Color Model, CMY and CMYK Color model and HSI Color Model. **Morphological Image Processing:** Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transforms. **Image Segmentation**: Fundamentals, Edge detection, Region Segmentation using Clustering and Super pixels. **Practical using MATLAB** 1. Write a Program to analysis of images with different color models. 2. Write a Program to Image segmentation – Edge detection, line detection and point detection **3.** Write a Program to Region based segmentation - clustering technique.	**6+4**	**(CO3) Apply**
Module-4: Introduction to Computer Vision and 3D Vision Geometry		
Introduction to Computer Vision: Image representation and Image analysis task, Cameras: An Overview- Photo sensitive sensors, A monochromatic camera, A color camera. **3D Vision Geometry:** 3D Vision tasks: Marr's theory, Basics projective geometry: Points and Hyperplanes in projective space, Homography, A single perspective camera: Camera model. **Practical using MATLAB** 1. Write a Program on Image Compression algorithm **2.** Write a Program for human face detection using webcam. **3.** Write a Program for detect the object. 4. Write a program to analysis of images with different color models.	**6+4**	**(CO4) Apply**
Module-5: Image Data Compression and Motion Analysis		
Image Data Compression: Image data properties, Predictive compression Methods, Hierarchical and Progressive Compression Methods, Coding. JPEG and MPEG Image Compression. **Motion Analysis:** 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. **Practical using MATLAB** 1. Write a Program to demonstrate enhancing and segmenting low contrast 2D images 2. Write a Program to extract the human facial features Eye, Nose, Mouth of an image. 3. Write a Program to detect the motion of an object in an input video. 4. Write a Program to apply Histogram Processing to the video	**6+4**	**(CO5) Apply**

Course Outcomes: 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

Reference Books:

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, Third Ed., Prentice Hall, 2008.

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.

Marks Distribution for Assessment

CIA (50)	Components	Description	Marks
	Written test	• Total Number of Test:03 • Each Theory test will be conducted for 30 marks • Average of 3 tests= 30 Marks	**30**
	Practical	• Total number of Test : 02 [Part-A(Modue-1 and 2) and Part-B(Module 3,4 and 5)] Each Lab test will be conducted for 50 marks and reduce to 10 Average of 2 tests= 10 Marks • Laboratory conduction is to be evaluated every week. conducted & Viva = 5 Marks Lab Record = 5 Marks	**10** **10**
		Total CIA	**50**
SEA (50)	Written exam	• Theory exam will be conducted for 100 marks and scaled down to 50 marks. The question paper will have 10 full questions each of 20 marks. Students have to answer 5 full questions.	**50**
		Total Marks for the Course	**100**

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SEMESTER – VI

Cloud Computing & Applications (PBL)

Credit: 2

Course Code	21AML164	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

- Acquire knowledge and be exposed to tool kits for cloud Environment.
- Understand the representation and familiar with developing web services / Applications in cloud environment.
- Develop the ability to run Virtual machines of different Configuration
- Develop the ability to implement and use parallel programming using Hadoop.

	Number of Hours	Bloom's Level
Task – 1		
Control Systems Command To Clone, Commit, Push, Fetch, Pull, Checkout, Reset, And Delete	**2**	**Apply**
Task – 2		
Creating An Application In Salesforce.Com Using Apex Programming Language	**2**	**Apply**
Task – 3		
Install VIRTUALBOX/VMware Workstation	**2**	**Apply**
Task – 4		
Install a C Compiler In The Virtual Machine And Execute A Sample Program	**2**	**Apply**
Task – 5		
Install GOOGLE APP ENGINE	**2**	**Apply**
Task – 6		
Hosting A Static Website On GOOGLE APP ENGINE	**2**	**Apply**
Task – 7		
Simulate A Cloud Scenario Using Cloudsim And Run A Scheduling Algorithm That Is Not Present In Cloudsim	**2**	**Apply**
Task – 8		
Moving Files Between Virtual Machines	**2**	**Apply**
Task – 9		
Installation And Configuration Of Hadoop	**2**	**Apply**
Task – 10		
Find Procedure To Set Up The One Node Hadoop Cluster	**2**	**Apply**
Task – 11		
Hosting A Static Website On GOOGLE APP ENGINE	**2**	**Apply**
Task – 12		
Simulate A Cloud Scenario Using Cloudsim And Run A Scheduling Algorithm That Is Not Present In Cloudsim	**2**	**Apply**

Task – 13		
Moving Files Between Virtual Machines	**2**	**Apply**
Task – 14		
Installation And Configuration Of Hadoop	**2**	**Apply**
Task – 15		
Find Procedure To Set Up The One Node Hadoop Cluster	**2**	**Apply**
Mini Project		

Course outcomes:

The students will be able to

1. Configure various virtualization tools such as Virtual Box, VMware workstation.
2. Design and deploy a web application in a PaaS environment.
3. Learn how to simulate a cloud environment to implement new schedulers.
4. Install and use a generic cloud environment that can be used as a private cloud.
5. Manipulate large data sets in a parallel environment.

Reference Books:

1. Sandeep Bhowmik, "Cloud Computing",1st Edition, Cambridge University Press, 2017
2. Borko Furht "Handbook of Cloud Computing" Springer.
3. Dan C.Marinescu, "Cloud Computing Theory and Practice" Elsevier.
4. Rajkumar Buyya, James Broberg, "Cloud Computing Principles and Paradigms", Wiley.
5. Anthony T.Velte, Toby J.Velte, "Cloud Computing – A Practical Approach", The McGraw Hill, 2010

Marks Distribution for Assessment

CIA (50)	**Components**	**Description**	**Marks**
	Practical	• Lab Record - 5 Marks • Performance Day wise – 10 marks (conduction - 7 marks and viva – 3 marks) • Total number of Test: 02 [PART-A (Laboratory - 1 to 5) and PART-B (Laboratory -6 to 10)] Each Lab test will be conducted for 40 (Functions:6, Execution:28, Viva: 6) marks and scale down to 20 Average of 2 tests= 20 Marks	**35**
	Project	Demonstration – 10 marks Viva voce – 5 marks	**15**
		Total CIA	**50**
SEA (50)	Practical Exam	Project will be evaluated for 100 marks and scaled down to 50 marks.	**50**
		Total Marks for the Course	**100**

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SEMESTER – VI

Big Data Analytics and Data Visualization (Open Elective)
Credit : 3

Course Code	21AML1671	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**
Module-1 Introduction		
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**
Module-2 Introduction to Hadoop		
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**
Module-3 Introduction to Map Reduce Programming		
Introduction; MapReduce Map Tasks, Reduce Tasks and MapReduce Execution- Map-Tasks, Key-Value Pair, Grouping by Key, Partioning; 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**
Module-4 Introduction to visual analytics		

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.	**8**	**Analyze**
Module-5 Data Visualization Techniques		
Data Visualization: Bar Charts, Histograms, Pie Charts, Scatter Plots, Line Plots, Regression. Case Studies	**8**	**Analyze**

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.

Marks Distribution for Assessment

	Components	Description	Marks
CIA (50)	Written test	• Total Number of Test:03 • Each Theory test will be conducted for 30 marks • Average of 3 tests= 30 Marks	30
	Assignment	Two assignments	10
	Quiz	Average of two rounds of quiz of 10 marks each after 1st and 2nd assessment.	10
		Total CIA	**50**
SEA (50)	Written Exam	• Theory exam will be conducted for 100 marks and scaled down to 50 marks. • The question paper will have 10 full questions each of 20 marks. Students have to answer 5 full questions.	50
		Total Marks for the Course	**100**

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SEMESTER – VI

Natural Language Processing (Open Elective)
Credit: 3

Course Code	21AML1672	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
Module-1 Introduction		
What is Natural Language Processing?, Stages in natural language Processing, Origins and challenges of NLP Language and Grammar-Processing Indian Languages.	**8**	**Apply**
Module-2 Word level Analysis		
Regular Expressions-Finite-State Automata-Morphological Parsing-Spelling Error Detection and correction. Part-of-Speech Tagging- Rule based tagger, Stochastic tagger	**8**	**Apply**
Module-3 N-Grams		
Simple N-grams, Smoothing- Laplace smoothing, Good Turing Discounting, Backoff, Entropy.	**8**	**Apply**
Module-4 Lexical Semantic		
Meaning Representation, Lexical Semantics, Word Sense Disambiguation – Selectional Restriction-based word sense disambiguation, context-based word sense disambiguation Approaches.	**8**	**Apply**
Module-5 Information Retrieval		
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 2SpeechRecognition", 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.

M**arks Distribution for Assessment**

CIA (50)	**Components**	**Description**	**Marks**
	Written test	• Total Number of Test:03 • Each Theory test will be conducted for 30 marks • Average of 3 tests= 30 Marks	**30**
	Assignment	Develop NLP application models.	**10**
	Certification Course	Mooc course on Natural Language Processing	**10**
		Total CIA	**50**
SEA (50)	Written exam	• Theory exam will be conducted for 100 marks and scaled down to 50 marks. • The question paper will have 10 full questions each of 20 marks. Students have to answer 5 full questions.	**50**
		Total Marks for the Course	**100**

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SEMESTER – VI

COMPUTER VISION (Open Elective)
Credit: 3

Course Code	21AML1673	**CIA Marks**	50
Teaching Hours/Week (L: T: P: J)	3:0:0:0	**SEA Marks**	50
Total Number of Contact Hours	40	**Exam Hours**	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.

Module-1: Introduction	**Contact Hours**	**Bloom's Level**
Introduction to Computer Vision: 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**
Module-2: Color Image Processing		
Color Images: Physics of color, color perceived by humans, color spaces, Palette images, color constancy. **Cameras:** An Overview- Photo sensitive sensors, A monochromatic camera, A color camera.	**8**	**Apply**
Module-3: Object Recognition		
Object Recognition: Statistical pattern recognition: classification principles, Support Vector machines, Cluster Analysis. **Recognition as Graph Matching:** Isomorphism of graphs and subgraphs, Similarity of graphs. **Optimization Techniques:** Genetic Algorithm, Simulated annealing.	**8**	**Apply**
Module-4: 3D Vision Geometry		
3D Vision Geometry: 3D Vision tasks: Marr's theory, Basics projective geometry: Points and Hyperplanes in projective space, Homography, **A single perspective camera:** Camera model. Projection and cack projection in homogeneous coordinates. Scene reconstruction from multiple views	**8**	**Apply**
Module-5: Motion Analysis		
Motion Analysis: Differential motion analysis methods, Optical flow: Optical flow computation, Optical flow in motion analysis, Detection of specific motion pattern, Video tracking: background modeling, Kernal 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.

Marks Distribution for Assessment

CIA (50)	**Components**	**Description**	**Marks**
	Written test	• Total Number of Test:03 • Each Theory test will be conducted for 30 marks • Average of 3 tests= 30 Marks	**30**
	• Assignment =10 Marks • Activity = 10 Marks		**20**
		Total CIA	**50**
SEA (50)	Written Exam	• Theory exam will be conducted for 100 marks and scaled down to 50 marks. • The question paper will have 9 full questions each of 20 marks. Students have to answer 5 full questions.	**50**
		Total Marks for the Course	**100**

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SEMESTER VI

Virtual Reality and Augmented Reality(Open Elective)
Credit: 3

Course Code	21AML1674	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**
Module – 1: Introduction to Virtual Reality		
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**
Module – 2: Introducing C# with Unity Tool		
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. **Classes, Objects and Object-Oriented Programming,** C# with Unity tool.	8	**Apply CO2**
Module – 3: Devices		
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**
Module – 4: Computing Architectures for VR 116		
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: Geometric modelling: Physical Modelling:	8	**Apply CO4**

Behaviour Modelling.		
Module – 5: Introduction to Augmented Reality		
Introduction to Augmented Reality-Computer vision for AR-Interaction-Modelling.	8	**Apply CO5**

Course outcomes:

The students should be able to:

1. Describe the Virtual Reality as a complete device.
2. Demonstrate the use of C# using Unity and develop Virtual Reality and Augmented Reality Devices.
3. Apply the different displays, sound, and Interfaces where VR System are built.
4. Design the graphics, Architecture, Models, and texturing where VR Systems are built.
5. Implement the Augmented Reality, Visual Perception, Tracking Technology while implementing Augmented Reality

Reference Books:

1. Virtual Reality Technology, Second Edition, Gregory C. Burdea & Philippe Coiffet, John Wiley & Sons.
2. Dieter Schmalstieg, Tobias Hollerer, "Augmented Reality: Principles & Practice", Addison Wesley, 2016
3. NET 4.0 Programming (6-in-1), Black Book, Kogent Learning Solutions Inc., Wiley- Dream Tech Press. (Chapters: 10,11,12).
4. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016
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
6. Developing Virtual Reality Applications: Foundations of Effective Design, Alan B Craig, William R Sherman and Jeffrey D Will, Morgan Kaufmann, 2009.

Marks Distribution for Assessment

CIA (50)	**Components**	**Description**	**Marks**
	Written test	• Total Number of Test:03 • Each Theory test will be conducted for 30 marks • Average of 3 tests= 30 Marks	**30**
	• Assignment =10 Marks • Activity = 10 Marks		**20**
		Total CIA	**50**
SEA (50)	Written Exam	• Theory exam will be conducted for 100 marks and scaled down to 50 marks. • The question paper will have 9 full questions each of 20 marks. Students have to answer 5 full questions.	**50**
		Total Marks for the Course	**100**

B N M Institute of Technology

An Autonomous Institution under VTU

For Internal Communication
Department of Training & Placement

Syllabus

Course Name: Employability Skills-2

Class: VI Semester **Year of Study: 2023-24**

Course Code: 21AML168

Course Objectives: This course will enable students to

- ability to understand fundamentals of trending technologies currently used in the industry.
- understand the importance of professional etiquettes.
- to be prepared for group discussions and various modes of interviews.
- to solve company simulated aptitude and technical question papers related to campus recruitments.

Module	Topics to be covered	No of Hours
Introductory Courses	Data Science (Data Analytics & Visualization), Cyber Security, Industrial Automation 4.0, & IOT, AWS, & Cloud Computing	**10 Hours**
Personality & Grooming Training	Dressing & Group Discussion Etiquettes, Interview Skills, Resume Building(should include introduction to Github, Hackerrank, LeetCode, Codechef), Email & Telephone Etiquettes, Social Media Etiquettes, & LinkedIn Profiling.	**6 Hours**

Interview Preparation Training	**Pre-Preparation Formalities** • Training session on Pre-Preparation formalities of Campus Selection should be conducted Job Profiles analysis must be done. • Understanding the salary breakups & other perks, researching about the Company and the work culture through their websites & other digital platforms like Glassdoor & LinkedIn. • Rewriting resumes keeping the job profiles in view.	
	Group Discussion & Personal Interview • Pre-Placement Talk, Mock GD & 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 & behavioral skills required during the campus selection process.	
Assessment Tests	Company Specific Aptitude and Technical Tests	**6 Hours**

Course Outcome: (CO)

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

1. analyze the problem and solve it within the allocated time span.
2. apply the professional etiquettes during the recruitment drives.
3. implement the techniques and skills during the group discussions and various interview skills.

CO-PO/PSO Mapping:

CO No.	Statement	Bloom's Cognitive level	POs
1	analyze the problem and solve it within the allocated time span.	**Apply**	PO1, PO2 & PO12
2	apply the professional etiquettes during the recruitment drives.	**Analyze**	PO1, PO2 & PO12
3	implement the techniques and skills during the group discussions and various interview skills.	**Analyze**	PO1, PO2 & PO12

Assessment processes:

	Components	Description	Marks
CIA (100)	Continues Evaluation	Students to be evaluated on: 1. Mock G.D. 2. Interview- Offline and Online 3. Resume	50
	Written / Online Test	• **Total Tests: 03** ➢ Assessments with 75 minutes duration & 50 marks each ➢ Average score of 50 Marks from 3 tests will be considered for the final score	50
		Total Marks for the Course	100