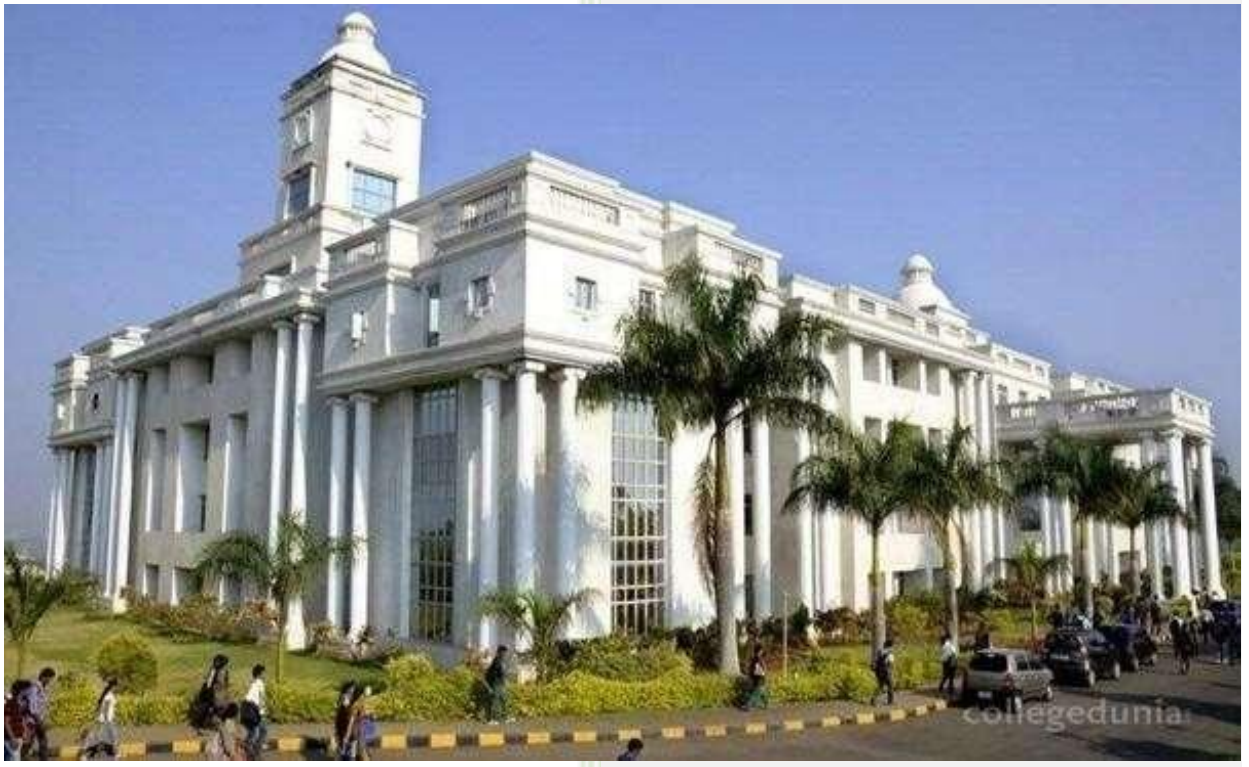
III-VIII Semester
Scheme & Syllabus
(2023-24)
Department of Artificial Intelligence & Machine Learning

SYLLABUS



GLOBAL ACADEMY OF TECHNOLOGY
Autonomous institution affiliated to VTU, Belagavi.
Accredited by NAAC with 'A' grade,
Ideal Homes Township,
Raja Rajeshwari Nagar, Bengaluru-560098

DISCRETE MATHEMATICS AND GRAPH THEORY

Course Code	MAT23301A	CIE Marks	50
Hours/Week(L:T:P)	2:2:0	SEE Marks	50
No. of Credits	3	Examination Hours	03

Course Objectives: To enable students to apply the knowledge of Mathematics in fields of computer science and allied branches by making them to learn:

CLO1	Counting Principles
CLO2	Mathematical Logic and Set Theory
CLO3	Well ordering principle and Properties of Integers
CLO4	Probability and Random Variables

Content	No. of Hours/ RBT levels
Module 1 The Rules of Sum and Product, The Pigeon-hole Principle, Permutations, Combinations, The Binomial Theorem, Combinations with Repetition.	**08 Hours L2, L3**
Module 2 Sets and Subsets, Set operations and Laws of Set Theory. Counting and Venn Diagrams. Probability, Conditional probability and Bayes Theorem	**08 Hours L2, L3**
Module 3 Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implications: Rules of Inference. Quantifiers, Definitions and the Proofs of Theorems.	**08 Hours L2, L3**
Module 4 The Well-Ordering Principle: Mathematical induction, Recursive Definitions, The division algorithm, Euclidian algorithm, Fundamental theorem of arithmetic.	**08 Hours L2, L3**
Module 5 Random Variable, Binomial, Poisson, Exponential and Normal distributions. Joint distributions, Expectation and Covariance.	**08 Hours L2, L3**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO31.1	Use computational techniques essential for the study of mathematical logic, set operations, counting principles and properties of integers.
CO41.2	Solve problems associated with random variables using probability distributions.

Textbooks:

1. Raiph P. Grirnaldi: Discrete and Combinatorial mathematics, 5th Edition, pearson Education.2020.

2. T Veerarajan' Probability, Statistics and Randomm Processes for Engineers, Tata McGrarv Hill,3rd Edition, 2008.

Reference books:

1. Kenneth H. Rosen: Discrete Mathematics and its Applications, 6th Edition, McGraw Hill, 2007
2. Richard H Williams, Probability, Statistics and Random Processes for Engineers, Cengage learning, 1st Edition, 2003

Scheme of Examination:

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

Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs:** seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern for regular courses is shown in Table 2.

Table 2: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	Assignments	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

CO/PO Mapping																
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO301A.1	3	2	1									3				
CO301A.2	3	2	1									3				
Average	3	2	1									3				

Low-1: Medium-2: High-3

DATA STRUCTURES
(Common to CSE /ISE/AD/AM/CI)

Course Code	**CSE23302**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3 Hours**
No. of Credits	**3**		

Course Learning Objectives:
The course will enable students to:

CLO1	To provide the knowledge of basic data structures and their implementations
CLO2	To develop skills to apply appropriate data structures in problem solving
CLO3	To efficiently implement the different data structures and solutions for specific problems
CLO4	Create and use appropriate data structures in C programs for solving real life problems

CONTENTS	**# of Hours**
MODULE 1 **Introduction:** Introduction to Data Structures, Review of Arrays, Types of Data Structures, Linear & non-linear Data Structures. **Stacks: Stack** definitions & concepts, Representing stacks in C, Operations on stacks, Applications of Stacks: Infix to Postfix, Infix to Prefix, Postfix expression evaluation, **Recursion:** Sample Programs.	**08**
MODULE 2 **Queues**: Representation of queue, operations, circular queues. Application of Queues, Priority Queues. **Dynamic Memory allocation:** malloc(), calloc(),free(), realloc(). **Linked Lists:** Definition and terminology, Singly Linked List (SLL), Various operations on SLL: insertion, deletion and display, Programming Examples Such as Polynomials and others., Header Node.	**08**
MODULE 3 **Circular Singly Linked List (CSLL):** Definition, Various operations, Application. **Doubly Linked List (DLL)** Definition, Various operations Applications: Sparse matrix and others. **Trees:** Definition, Terminology, Binary Trees (BT), Binary Search Trees (BST): Insertion, Deletion and Traversals : Preorder, Post order and In order.	**08**
MODULE 4 **Expression Trees (ET)**: Definition and Construction of Expression Tree. **Threaded Binary Tree:** Types and application. **Heap:** Definition, Construction, Applications of Heap: Priority Queue.	**08**
MODULE 5 **Balanced tree:** AVL trees, B tree, B+ tree, Splay. **Graphs:** Introduction, Matrix and List Representation. **Hashing:** Open Hashing, Closed Hashing, Collision and Collision Resolution Strategies.	**08**

Course Outcomes:

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

CO1	Apply the knowledge of computing to various data structures and its operations
CO2	Analyze a problem and identify suitable data structure to provide solution
CO3	Design solution using modern tools and suitable data structure
CO4	Implement programs with suitable data structure based on the requirements of the application

Text Books:

1. Data Structures using C and C++, Yedidyah Langsam Moshe J. Augenstein and Aaron M. Tenenbaum, 2nd Edition, 2009, PHI/Pearson.
2. Data Structures and Algorithm Analysis in C++, Mark Allen Weiss, 4th Revised Edition, 2013, Addison-Wesley, ISBN-13: 9780132847377

Reference Books:

1. Data Structures Using C, Reema Thareja, 1st Edition, 2011, Oxford Higher Education
2. Fundamentals of Data Structures, Ellis Horowitz, Sartaj Sahni, Illustrated Edition, Computer Science Press.

E-Books / Web References:

1. https://ds1-iiith.vlabs.ac.in/List%20of%20experiments.html
2. https://ds2-iiith.vlabs.ac.in/List%20of%20experiments.html

MOOCs:

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

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	2	-	-	-	-	-	-	2	2	-
CO2	3	3	3	-	2	-	-	-	-	-	-	2	2	-
CO3	3	3	3	-	2	-	-	-	-	-	-	2	2	-
CO4	3	3	3	-	2	-	-	-	-	-	-	2	2	-
Average	**3**	**3**	**3**	**-**	**2**	-	-	-	-	-	-	**2**	**2**	-

Low-1: Medium-2: High-3

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

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

	Component	Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignment	10	
SEE	Semester End Examination	100	50
	Grand Total		100

Scheme of Examination (SEE):

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

PYTHON PROGRAMMING

Semester:	**III**	**CIE Marks**	**50**
Course Code	**AML23303**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**3:0:2**	**Duration of SEE (hours):**	**03**
Type of Course	**IPC**	**Credits**	**04**

Prerequisites (if any):

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	**Understand** fundamental concepts of Python Programming including data types, variables and the flow control
2	**Understand and Apply** the concepts of functions, lists and dictionaries
3	**Understand and demonstrate** manipulation of strings and pattern matching
4	**Understand and Apply** Numpy library
5	**Understand and Apply** Pandas library

Module 1	No. of Hours	RBT Level
Python Basics : Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program **Flow Control:** Boolean Values, Comparison Operators, Boolean Operators, Mixing Boolean and Comparison Operators, Elements of Flow Control, Flow Control Statements, Importing Modules, Ending a Program Early with the sys.exit() Function	**10**	**L2**
Module 2		
Functions: def Statements with Parameters, Return Values and return Statements, The None Value, Keyword Arguments and the print() Function, The Call Stack, Local and Global Scope, the global Statement, Exception Handling **Lists:** the List Data Type, Working with Lists, Augmented Assignment Operators, methods, Sequence Data Types, References **Dictionaries and Structuring Data :** The Dictionary Data Type	**10**	**L3**
Module 3		
Manipulating Strings : Working with Strings, Useful String Methods, Numberic Values of Characters with the ord() and chr() Functions **Pattern Matching with Regular Expressions :** Finding patterns without regular expressions, Finding Patterns of text with regular expressions, More pattern matching with regular expressions, The findall() method, Character Classes, Making your own Character Classes, The caret and dollar sign characters, The wildcard character, Review of Regex Symbols, Case-insensitive matching, Substituting Strings with the sub() method	**10**	**L3**
Module 4		
NumPy Basics: Arrays and vectorized Computation: The NumPy ndarrray: A Multidimensional Array Object, Creating ndarrays, Data Typesfor ndarrays, Arithmetic with NumPy Arrays, Basic lndexing and Slicing , Boolean lndexing, Fancy lndexing, Transposing Arrays and Swapping Axes, Universal Functions: Fast Element-Wise Array Functions, Array-Oriented Programming with Arrays , Expressing Conditional Logic as Array Operations, Mathematical and Statistical Methods, Methods for Boolean Arrays, Sorting, Unique and Other Set Logic, File Input and Output with Arrays, Linear Algebra, Pseudorandom Number	**10**	**L3**
Module 5		

Getting Started with Pandas: Introduction to Pandas Data Structures, Series, DataFrame, Index Objects, Essential Functionality, Reindexing, Dropping Entries from an Axis , Indexing, Selection, and Filtering, Integer Indexes, Arithmetic and Data Alignment, Function Application and Mapping, Sorting and Ranking, Axis lndexes with Duplicate Labels, Summarizing and Computing Descriptive Statistics, Correlation and Covariance, Unique Values, Value Counts, and Membership	**10**	**L3**

Course Outcomes:

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

CO1	**Understand and Demonstrate** the creation of datatypes and flow control concepts
CO2	**Understand and Demonstrate** functions, strings, lists by implementing suitable programs
CO3	**Develop** methods illustrating string manipulation and pattern matching
CO4	**Apply** Python NumPy package for a given use case
CO5	**Apply** Python Pandas package for a given use case

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3		3			2	2	2		2	1	2
CO2	3	3	3		3			2	2	2		2	1	2
CO3	3	3	3		3			2	2	2		2	1	2
CO4	3	3	3		3			2	2	2		2	1	2
CO5	3	3	3		3			2	2	2		2	1	2
Avg	3	3	3		3			2	2	2		2	1	2

High-3: Medium-2: Low-1

Text Books:

1. Al Sweigart, “Automate the Boring Stuff with Python”, 2nd Edition, No Starch Press, 2015 (automate-the-boring-stuff-with-python-2nd-edition.pdf (archive.org))
2. Wes McKinney, "Python for Data Analysis" 2nd Edition O'Reilly, 2017.

Reference Books:

1. Allen B Downey, “Think Python: How to Think Like a Computer Scientist”, 2nd Edition, Green Tea Press, 2015
2. Reema Thareja, “Python Programming using problem solving approach”, Oxford University press, 2017
3. Phuong Vo.T.H, Martin Czygan, Ashish Kumar, Kirthi Raman, "Python: Data Analytics and Visualization", Packt Publishing Limited,2017, ISBN :9781788290098

E-Books / Web References:

1. Python 3 Tutorial https://www.tutorialspoint.com/python3/python_tutorial.pdf
2. Python 3 for Absolute Beginners http://index-of.es/Python/Python%203%20for%20Absolute%20Beginners.pdf

MOOCs:

1. Programming for Everybody (Getting Started with Python) : Programming for Everybody (Getting Started with Python) Course by University of Michigan | Coursera
2. Data Analysis with Python - Data Analysis with Python Course by IBM | Coursera

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

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

	Component	**Marks**	**Total Marks**
CIE	CIE Test-1	30	50
	CIE Test-2	30	
	CIE Test-3	30	
	Laboratory	20	
SEE	Semester End Examination	100	50
	Grand Total		100

Scheme of Examination (SEE):

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

COMPUTER ORGANIZATION AND OPERATING SYSTEMS

Semester:	**III**	**CIE Marks**	**50**
Course Code	**AML23304**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**Duration of SEE (hours):**	**03**
Type of Course	**PC**	**Credits**	**03**

Prerequisites (if any): Basic functional units of a computer system, and Number system.

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	Understand the organization and architecture of computer systems, their structure and operation.
2	Illustrate the concept of machine instructions and programs.
3	Demonstrate different ways of communicating with I/O devices.
4	Explain arithmetic and logical operations with different data types.
5	To understand the types, features and design considerations of operating systems
6	To design a model scheduling algorithm to compute various scheduling criteria.

Module 1	No. of Hours	RBT Level
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, MemoryOperations, Instructions and Instruction Sequencing, and Addressing Modes.	08	L2
Module 2		
Input / Output Organization: Accessing I/O Devices, Interrupts – Interrupt Hardware, Direct Memory Access, Buses, Interface Circuits. **Memory System:** Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size, and Cost, Cache Memories – Mapping Functions, Virtual Memories	08	L2
Module 3		
Arithmetic: Numbers, Arithmetic Operations and Characters, Addition and Subtraction of Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers. **Basic Processing Unit:** Fundamental Concepts, Execution of a Complete Instruction, Hardwired control, Microprogrammed control.	08	L3
Module 4		
Overview-Introduction: What operating systems do; Operating System Structure, Operating System operations. System Structures: Operating System Services; System calls; Types of System calls. Process Management-Process Concept: Process concept; Process scheduling; Process Scheduling: Basic concepts; scheduling criteria; Scheduling algorithms: FCFS, Pre-emptive and Non-preemtive SJF, Priority Scheduling and Round Robin Scheduling	08	L2
Module 5		
Process Coordination- Synchronization: The Critical section problem, Semaphores; Classical problems of synchronization: Bounded-Buffer Problem, Reader's-Writer's Problem. Deadlocks: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.	08	L3

Course Outcomes:

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

CO1	Explain the basics of organizational and architectural issues of a digital computer and classify and compute the performance of machines and machine Instructions.
CO2	Describe various data transfer techniques in digital computers and the I/O interfaces.
CO3	Analyze the performance of various classes of Memories, build large memories using small memories for better performance, and analyze arithmetic for ALU implementation
CO4	Understand the importance of operating systems in utilizing the hardware and software resources.
CO5	Comprehend and analyze various resource management techniques.

	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO1	3	2	1					3		1		2	2	
CO2	2	2	1					3		1		2	2	
CO3	3	2	1					3		1		2	2	
CO4	2	3	2					2		1		2	2	
CO5	2	3	2					2		1		2	2	

High-3: Medium-2: Low-1

Text Books:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Computer Organization, 5th Edition,Tata McGrawHill .
2. M. Morris Mano, Computer System Architecture, PHI, 3rd Edition
3. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Principles, 8th edition, Wiley India, 2009.

Reference Books:

1. William Stallings: Computer Organization & Architecture, 9th Edition, Pearson, 2015.
2. D.M Dhamdhere: Operating systems - A concept based Approach,2nd Edition, Tata McGraw- Hill, 2002.
3. P.C.P. Bhatt: Introduction to Operating Systems: Concepts and Practice, 2nd Edition, PHI, 2008.Harvey M Deital: Operating systems, 3rd Edition, Pearson Education, 1990.
4. Harvey M Deital: Operating systems, 3rd Edition, Pearson Education, 19

E-Books / Web References:

1. https://passlab.github.io/CSCE513/resources/
2. https://gateoverflow.in/blog/9728/some-good-resources-for-computer-organisation- architecture.
3. https://www.tutorialspoint.com/computer_logical_organization/computer_logical_organization _useful_re sources.htm

4. https://nptel.ac.in/courses/106103068/pdf/coa.pdf
5. https://sites.google.com/site/uopops/ebooks
6. https://www.e-booksdirectory.com/details.php?ebook=9907

MOOCs:

1. https://www.udemy.com/course/computer-organization-and-architecture-j/?
2. https://nptel.ac.in/courses/106/103/106103068/
3. https://nptel.ac.in/courses/106105214
4. https://www.my-mooc.com/en/mooc/introduction-to-operating-systems--ud923/

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged touse the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ conceptvideos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

Note: CIE pattern for courses like Drawing and Laboratories can be decided by the respective board of Studies and can be given here.

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

	Component	**Marks**	**Total Marks**
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	AAT	10	
SEE	Semester End Examination	100	50
	Grand Total		100

Scheme of Examination (SEE):

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

MACHINE LEARNING FOUNDATIONS

Semester:	**III**	**CIE Marks**	**50**
Course Code	**AML23305**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**Duration of SEE (hours):**	**03**
Type of Course	**ETC**	**Credits**	**03**

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
CLO1	To provide students with a foundational understanding of machine learning concepts and linear algebra techniques essential for data analysis and model development
CLO2	Acquaint students with symmetric matrices, singular value decomposition (SVD), and principal component analysis (PCA) in image processing, facilitated by practical software implementation using Python libraries
CLO3	Equip students with a comprehensive understanding of unconstrained optimization techniques and convex optimization principles, focusing on gradient descent methods and their applications, including support vector machines (SVM).
CLO4	Provide students with a deep understanding of constrained optimization, Lagrange multipliers, logistic regression, regularization techniques, and model evaluation metrics, with practical applications in machine learning
CLO5	Equip students with a comprehensive understanding of the exponential family of distributions, parameter estimation methods, and the Expectation Maximization algorithm, including its applications to Gaussian Mixture Models and Hidden Markov Models.

Module 1	**No. of Hours**	**RBT Level**
Introduction to machine learning, Linear Algebra - Least Squares Regression: Introduction to Least Squares Regression, Vectors and vector spaces, Matrices and matrix operations, Inner product and orthogonality, Formulating the Least Squares Problem, Solving the Least Squares Problem. Linear Algebra - Eigenvalues and eigenvectors. **Software Implementation:** Using Python libraries (NumPy, SciPy, scikit-learn)	**10**	**L2**
Module 2		
Linear Algebra - Symmetric matrices: Introduction to Symmetric Matrices, Properties of Symmetric Matrices, Computation with Symmetric Matrices, Linear Algebra - Singular value decomposition: Introduction to Singular Value Decomposition, Properties and Interpretation of SVD, Applications of SVD, Principal Component Analysis in Image Processing: Introduction to Principal Component Analysis, Steps in PCA, PCA for Image Processing **Software Implementation:** Using Python libraries (NumPy, SciPy) for computations with symmetric matrices, SVD	**10**	**L3**
Module 3		
Unconstrained Optimization: Introduction to Unconstrained Optimization, First-Order Optimization Methods- Gradient Descent, Variants of Gradient Descent, Convex sets, functions and optimization problems: Introduction to Convexity, Convex Sets, Applications of Convex Optimization (SVM). **Software Implementation:** Using Python libraries (SciPy, TensorFlow, PyTorch) for optimization	**10**	**L3**
Module 4		

Constrained Optimization and Lagrange Multipliers: Introduction to Constrained Optimization, Lagrange Multipliers , Logistic regression as an optimization problem: Introduction to Logistic Regression, Formulating Logistic Regression as an Optimization Problem- Regularization techniques: L1 (Lasso) and L2 (Ridge) , Examples of probabilistic models in machine learning problems: Model Assessment and Evaluation- Metrics for evaluating logistic regression models: accuracy, precision, recall, F1 score, ROC curves and AUC, Cross-validation and model selection **Software Implementation:** Using Python libraries (scikit-learn, TensorFlow Probability) for probabilistic models	**10**	**L4**
Module 5		
Exponential Family of distributions: Introduction to Exponential Family, Examples of Exponential Family Distributions- Bernoulli distribution, Binomial distribution, Poisson distribution, Exponential distribution, Gaussian distribution, Parameter estimation. Expectation Maximization: Introduction to Parameter Estimation (Maximum Likelihood Estimation (MLE)), Introduction to Expectation Maximization, Derivation and Convergence of EM Algorithm, Gaussian Mixture Models (GMMs), Hidden Markov Models (HMMs) **Software Implementation:** Using Python libraries (SciPy, stats models) for working with exponential family distributions	**10**	**L4**

Course Outcomes:

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

CO1	Acquire fundamental abilities in machine learning and linear algebra to analyze data and develop models, employing Python libraries (NumPy, SciPy, scikit-learn)
CO2	Gain proficiency in understanding and applying concepts of symmetric matrices, singular value decomposition, and principal component analysis, with a focus on their properties, computational techniques, and applications in image processing.
CO3	Develop expertise in unconstrained optimization methods, including gradient descent and its variants, as well as understanding and applying convex sets, functions, and optimization problems in practical applications such as SVM
CO4	Achieve proficiency in constrained optimization techniques, logistic regression formulation, regularization methods, and evaluating probabilistic machine learning models using various metrics and cross-validation
CO5	Develop proficiency in the exponential family of distributions, parameter estimation, and the Expectation Maximization algorithm, including its application to Gaussian Mixture Models and Hidden Markov Models.

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**
CO1	2	2	2		3					3		2		3
CO2	2	2	2		3					3		2		3
CO3	3	2	3		3				3	3		2		2
CO4	3	2	3	1	3				3	3		2		3
CO5	3	3	3	1	3				3	3		2		2
Average	3	2	3	1	3				3	3		2		3

High-3: Medium-2: Low-1

Text Books:

1. Marc Peter Deisenroth A. Aldo Faisal Cheng Soon Ong, “Mathematics for Machine Learning”,

Reference Books:

1. Pattern Recognition and Machine Learning by Christopher Bishop

E-Books / Web References:

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

MOOCs:

1. edX - Mathematics for Data Science
2. https://www.coursera.org/learn/machine-learning
3. https://www.coursera.org/specializations/mathematics-for-data-science
4. https://www.youtube.com/user/joshstarmer

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.
Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.
Typical evaluation pattern for regular courses is shown in Table 1:

	Component	**Marks**	**Total Marks**
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	AAT	10	
SEE	Semester End Examination	100	50
	Grand Total		100

Scheme of Examination (SEE):

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

Social Connect & Responsibility		Semester	3rd
Course Code	**SCK23306**	CIE Marks	**100**
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	------
Total Hours of Pedagogy	40 hour Practical Session +15 hour Planning	Total Marks	**100**
Examination nature (No SEE – Only CIE)	For CIE Assessment - Activities Report Evaluation by College NSS Officer / HOD / Sports Dept / Any Dept.		
Credits	01 - Credit		

Course objectives: The course will enable the students to:

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

General Instructions - Pedagogy :

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied social and cultural skills.
2. State the need for activities and its present relevance in the society and Provide real-life examples.
3. Support and guide the students for self-planned activities.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
5. Encourage the students for group work to improve their creative and analytical skills.

Contents :

The course is mainly activity-based that will offer a set of activities for the student that enables them to connect with fellow human beings, nature, society, and the world at large.

The course will engage students for interactive sessions, open mic, reading group, storytelling sessions, and semester-long activities conducted by faculty mentors.

In the following a set of activities planned for the course have been listed:

Social Connect & Responsibility - Contents

Part I:

Plantation and adoption of a tree:

Plantation of a tree that will be adopted for four years by a group of BE / B.Tech students. (ONE STUDENT ONE TREE)They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, its appearance in folklore and literature - – Objectives, Visit, case study, report, outcomes.

Part II :

Heritage walk and crafts corner:

Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms - – Objectives,Visit, case study, report, outcomes.

Part III :

Organic farming and waste management:

Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus

Objectives, Visit, case study, report, outcomes.

Part IV:

Water conservation:

Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photoblog presenting the current practices – Objectives, Visit, case study, report, outcomes.

Part V :

Food walk:

City's culinary practices, food lore, and indigenous materials of the region used in cooking – Objectives, Visit, case study, report, outcomes.

Course outcomes (Course Skill Set):

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

CO1: Communicate and connect to the surrounding.

CO2: Create a responsible connection with the society.

CO3: Involve in the community in general in which they work.

CO4: Notice the needs and problems of the community and involve them in problem –solving.

CO5: Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.

CO6: Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

Activities:

Jamming session, open mic, and poetry: Platform to connect to others. Share the stories withothers. Share the experience of Social Connect. Exhibit the talent like playing instruments, singing, one-act play, art-painting, and fine art.

PEDAGOGY:

The pedagogy will include interactive lectures, inspiring guest talks, field visits, social immersion, and a course project. Applying and synthesizing information from these sources to define the social problem to address and take up the solution as the course project, with your group. Social immersionwith NGOs/social sections will be a key part of the course. Will all leadto the course project that will address the needs of the social sector?

COURSE TOPICS:

The course will introduce social context and various players in the social space, and present approaches to discovering and understanding social needs. Social immersion and inspiring conversional will culminate in developing an actual, idea for problem-based intervention, based on an in-depth understanding of a key social problem.

Duration :

A total of 40 - 50 hrs engagement per semester is required for the 3rd semester of the B.E. /B.Tech. program. The students will be divided into groups. Each group will be handled by faculty mentor. Faculty mentor will design the activities (particularly Jamming sessions open mic ,and poetry) Faculty mentors has to design the evaluation system as per VTU guidelines ofscheme & syllabus.

Guideline for Assessment Process:

Continuous Internal Evaluation (CIE):

After completion of the course, the student shall prepare, with daily diary as reference, a comprehensive report in consultation with the mentor/s to indicate what he has observed and learned in the social connect period. The report should be signed by the mentor. The report shall be evaluated on the basis of the following criteria and/or other relevant criteria pertaining to the activity completed. Marks allotted for the diary are out of 50. Planning and scheduling the socialconnect Information/Data collected during the social connect Analysis of the information/data and report writing Considering all above points allotting the marks as mentioned below

Excellent : 80 to 100
Good : 60 to 79
Satisfactory : 40 to59
Unsatisfactory and fail : <39

Special Note :

NO SEE – Semester End Exam – Completely Practical and activities based evaluation

Pedagogy – Guidelines :

It may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.

Sl No	Topic	Group size	Location	Activity execution	Reporting	Evaluation Of the Topic
1.	**Plantation and adoption of a tree:**	May be individual or team	Farmers land/ parks / Villages / roadside/ community area / College campus etc…..	Site selection /proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty
2.	**Heritage walk and crafts corner:**	May be individual or team	Temples / monumental places / Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Site selection /proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty
3.	**Organic farming and waste management:**	May be individual or team	Farmers land / parks / Villages visits / roadside/ community area / College campus etc…..	Group selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty
4.	**Water conservation:** & conservation techniques	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers / campus etc…..	site selection / proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty

5.	**Food walk: Practices in society**	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Group selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty

Plan of Action (Execution of Activities)

Sl.NO	Practice Session Description
1	**Lecture session in field to start activities**
2	**Students Presentation on Ideas**
3	**Commencement of activity and its progress**
4	**Execution of Activity**
5	**Execution of Activity**
6	**Execution of Activity**
7	**Execution of Activity**
8	**Case study based Assessment, Individual performance**
9	**Sector/ Team wise study and its consolidation**
10	~~**Video-based seminar for 10 minutes by each student At the end of semester with Report.**~~

- Each student should do activities according to the scheme and syllabus.
- At the end of semester student performance has to be evaluated by the faculty for the assigned activity progress and its completion.
- At last consolidated report of all activities from 1st to 5th, compiled report should be submitted as per the instructions and scheme.

Assessment Details for CIE (both CIE and SEE)

Weightage	**CIE – 100%**
Field Visit, Plan, Discussion	10 Marks
Commencement of activities and its progress	20 Marks
Case study based Assessment Individual performance with report	20 Marks
Sector wise study & its consolidation 5*5 = 25	25 Marks
Video based seminar for 10 minutes by each student At the end of semester with Report. **Activities 1 to 5, 5*5 = 25**	25 Marks
Total marks for the course in each semester	**100 Marks**

- Implementation strategies of the project (NSS work).
- The last report should be signed by NSS Officer, the HOD and principal.
- At last report should be evaluated by the NSS officer of the institute.
- Finally the consolidated marks sheet should be sent to the university and also to be made available at LIC visit.

For each activity, 20 marks CIE will be evaluated for IA marks at the end of semester, Report and assessment copy should be made available in the department.

Students should present the progress of the activities as per the schedule in the prescribed practical session in the field. There should be positive progress in the vertical order for the benefit of society in general through activities.

WEB APPLICATIONS FRAMEWORKS

Semester:	**III**	**CIE Marks**	**50**
Course Code	**AML23307**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**2:0:0**	**Duration of SEE (hours):**	**03**
Type of Course	**AEC**	**Credits**	**02**

Prerequisites (if any):

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	Introduce students to the basics of HTML, CSS and JavaScript
2	Familiarize students with the Document Object Model
3	Enable them to create dynamic web pages that react to user input.
4	Introduce students to the CSS & React framework

Module 1	No. of Hours	RBT Level
Fundamentals and Introduction to XHTML: Internet, WWW, Web Browsers, Web Servers, URLs, Basic Markup and Syntax, Images,Hypertext links, Lists, Tables, Forms.	10	**L2**
Module 2		
Cascading Style Sheets (CSS): Introduction, Basics of CSS, Style and Stylesheets, Selectors, Properties (font, list, color), Box Model.	10	**L2**
Module 3		
HTML5 and JavaScript: HTML5 (New Tags, New Inputs, Elements). JavaScript: JavaScript Basics, Screen Output and Keyboard Input, Control Statements, Functions, Arrays, JavaScript Objects.	10	**L3**
Module 4		
DOM and DOM Events: Accessing and modifying DOM, Events andEvent Handlers, Related events, DOM 2 Event model. **Dynamic documents with JavaScript**.	10	**L3**
Module 5		
React Library: Fundamentals of React (till React DOM), Styling in React:CSS in React, Deploying a React Application.	10	**L3**

Course Outcomes:

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

CO1	Apply web technologies in the construction of a website.
CO2	Design and develop website effectively using availableresources for the given specification.
CO3	Articulate the implemented solutions effectively with profound documentation.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2		3					1	1	1	3	
CO2	2	2	3		3	1		1		1	1	2	3	
CO3	1	1	1					1	3	3		1	1	
AVG	1.7	1.7	2		3	1		1	3	1.7	1	1.3	2.3	

High-3: Medium-2: Low-1

Text Book:

1. "Programming the World Wide Web", Robert W Sebesta, Pearson, 7th Edition, 2013.
2. "The_Road_to_React" ,Robin Wieruch, Lean Publishing ,2020

Reference Books:

1. "JavaScript Absolute Beginner's Guide", Kirupa Chinnathambi, Que Publishing, 1st Edition,2017.
2. Learning React, Functional Web Development with React and Redux", Alex Banks and Eve Porcello, O'Reilly Media, May 2017

E-Books / Web References:

1. https://sd.blackball.lv/library/the_road_to_react_(2020).pdf
2. https://sajtr.ga/Neumesceno/mega/FRI-UNI-Zapiski/3.%20LETNIK%202014-2015/3.%20letnik/Razvoj%20programske%20opreme/SP/Literatura/programming%20the_%20world%20wide%20web%20-%20sebesta_%20robert%20w_2.pdf

MOOCs:

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

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have beenencouraged to use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed

organizations/ any other.

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

	Component	**Marks**	**Total Marks**
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	QUIZ/Assignment	10	
SEE	Semester End Examination	100	50
	Grand Total		100

Note: CIE pattern for courses like Drawing and Laboratories can be decided by the respectiveBoard of Studies and can be given here.

Scheme of Examination (SEE):

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

National Service Scheme (NSS)		Semester	3rd to 6th
Course Code	**NSK23308**	CIE Marks	**25*4 = 100**
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	------
Total Hours of Pedagogy	40 hour Practical Session +15 hour Planning	Total Marks	**25*4 = 100**
Examination nature (SEE)	Activities Report Evaluation by College NSS Officer at the end of every semester (3rd to 6th semester)		
Credits	NCMC – Non Credit Mandatory Course (Completion of the course shall be mandatory for the award of degree)		

Course objectives: National Service Scheme (NSS) will enable the students to:

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

General Instructions - Pedagogy :

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied social and cultural skills.
2. State the need for NSS activities and its present relevance in the society and Provide real-life examples.
3. Support and guide the students for self-planned activities.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
5. Encourage the students for group work to improve their creative and analytical skills.

National Service Scheme (NSS) – Contents

==========

1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.
2. Waste management– Public, Private and Govt organization, 5 R's.
3. Setting of the information imparting club for women leading to contribution in social and economic issues.
4. Water conservation techniques – Role of different stakeholders– Implementation.
5. Preparing an actionable business proposal for enhancing the village income and approach for implementation.
6. Helping local schools to achieve good results and enhance their enrolment in Higher/

technical/ vocational education.

7. Developing Sustainable Water management system for rural areas and implementation approaches.
8. Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swatch Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.
9. Spreading public awareness under rural outreach programs.(minimum5 programs).
10. Social connect and responsibilities.
11. Plantation and adoption of plants. Know your plants.
12. Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).
13. Govt. school Rejuvenation and helping them to achieve good infrastructure.

NOTE:

- Student/s in individual or in a group Should select any one activity in the beginning of each semester till end of that respective semester for successful completion as per the instructions of NSS officer with the consent of HOD of the department.
- At the end of every semester, activity report should be submitted for evaluation.

Distribution of Activities - Semester wise from 3rd to 6th semester

Sem	Topics / Activities to be Covered
3rd Sem for 25 Marks	1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing. 2. Waste management– Public, Private and Govt organization, 5 R's. 3. Setting of the information imparting club for women leading to contribution in social and economic issues.
4th Sem for 25 Marks	4. Water conservation techniques – Role of different stakeholders– Implementation. 5. Preparing an actionable business proposal for enhancing the village income and approach for implementation. 6. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.
5th Sem for 25 Marks	7. Developing Sustainable Water management system for rural areas and implementation approaches. 8. Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc. 9. Spreading public awareness under rural outreach programs.(minimum5 programs). 10. Social connect and responsibilities.
6th Sem for 25 Marks	11. Plantation and adoption of plants. Know your plants. 12. Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs). 13. Govt. school Rejuvenation and helping them to achieve good infrastructure.

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

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

6.	Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.	May be individual or team	Local government / private/ aided schools/Government Schemes officers/ etc…..	School selection/proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
7.	Developing Sustainable Water management system for rural areas and implementation approaches.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Governme nt Schemes officers/ campus etc…..	site selection/proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
8.	Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Governme nt Schemes officers/ campus etc…..	Group selection/proper consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
9.	Spreading public awareness under rural outreach programs.(minimum5 programs). ///// Social connect and responsibilities.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Governme nt Schemes officers/ campus etc…..	Group selection/proper consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
10.	Plantation and adoption of plants. Know your plants.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Governme nt Schemes officers/ campus etc…..	Place selection/proper consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

11.	Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).	May be individu al or team	Villages/ City Areas / Grama panchayat/ public associations/Governme nt Schemes officers/ campus etc…..	Place selection/proper consultation/Continu ous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
12.	Govt. school Rejuvenation and helping them to achieve good infrastructure.	May be individu al or team	Villages/ City Areas / Grama panchayat/ public associations/Governme nt Schemes officers/ campus etc…..	Place selection/proper consultation/Continu ous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

Plan of Action (Execution of Activities For Each Semester)

Sl.NO	Practice Session Description
1	**Lecture session by NSS Officer**
2	**Students Presentation on Topics**
3	**Presentation - 1 , Selection of topic, PHASE - 1**
4	**Commencement of activity and its progress - PHASE - 2**
5	**Execution of Activity**
6	**Execution of Activity**
7	**Execution of Activity**
8	**Execution of Activity**
9	**Execution of Activity**
10	**Case study based Assessment, Individual performance**
11	**Sector wise study and its consolidation**
12	**Video based seminar for 10 minutes by each student At the end of semester with Report.**

- In every semester from 3rd semester to 6th semester, Each student should do activities according to the scheme and syllabus.
- At the end of every semester student performance has to be evaluated by the NSS officer for the assigned activity progress and its completion.
- At last in 6th semester consolidated report of all activities from 3rd to 6th semester, compiled report should be submitted as per the instructions.

Course outcomes (Course Skill Set):

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

CO1: Understand the importance of his / her responsibilities towards society.

CO2: Analyse the environmental and societal problems/issues and will be able to design solutions for the same.

CO3: Evaluate the existing system and to propose practical solutions for the same for sustainable development.

CO4: Implement government or self-driven projects effectively in the field.

CO5: Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

Assessment Details for CIE (both CIE and SEE)

Weightage	**CIE – 100%**	• Implementation strategies of the project (NSS work). • The last report should be signed by NSS Officer, the HOD and principal. • At last report should be evaluated by the NSS officer of the institute. • Finally the consolidated marks sheet should be sent to the university and also to be made available at LIC visit.
Presentation - 1 Selection of topic, PHASE - 1	10 Marks	
Commencement of activity and its progress - PHASE - 2	10 Marks	
Case study based Assessment Individual performance	10 Marks	
Sector wise study and its consolidation	10 Marks	
Video based seminar for 10 minutes by each student At the end of semester with Report.	10 Marks	
Total marks for the course in each semester	**50 Marks**	

Marks scored for 50 by the students should be Scale down to 25 marks In each semester for CIE entry in the VTU portal.

25 marks CIE entry will be entered in University IA marks portal at the end of each semester 3rd to 6th sem, Report and assessment copy should be made available in the department semester wise.

Students should present the progress of the activities as per the schedule in the prescribed practical session in the field. There should be positive progress in the vertical order for the benefit of society in general.

Suggested Learning Resources:

Books :

1. **NSS Course Manual,** Published by NSS Cell, VTU Belagavi.
2. Government of Karnataka, NSS cell, activities reports and its manual.
3. Government of India, nss cell, Activities reports and its manual.

Semester: III						
PHYSICAL EDUCATION (SPORTS & ATHLETICS) – I						
Course Code	**:**	NSK23308		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	0:0:2		**SEE**	:	000
Total Hours	**:**	24 P				

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

1. Understand the fundamental concepts and skills of Physical Education, Health,Nutrition and Fitness
2. Familiarization of health-related Exercises, Sports for overall growth anddevelopment
3. Create a foundation for the professionals in Physical Education and Sports
4. Participate in the competition at regional/state / national / international levels.
5. Create consciousness among the students on Health, Fitness and Wellness indeveloping and maintaining a healthy lifestyle.
6. Understand and practice of Traditional Games

Module I : Orientation **4 Hours**

A. Lifestyle
B. Health & Wellness
C. Pre-Fitness test.

Module II: General Fitness & Components of Fitness **4 Hours**

A. Warming up (Free Hand exercises)
B. Strength – Push-up / Pull-ups
C. Speed – 30 Mtr Dash

Module III : Specific games (Any one to be selected by the student) **16 Hours**

1. Kabaddi – Hand touch, Toe Touch, Thigh Hold, Ankle hold and Bonus.
2. Kho-Kho – Giving Kho, Single Chain, Pole dive, Pole turning, 3-6 Up.

Scheme and Assessment for auditing the course and Grades:

Sl. No.	Activity	Marks
1.	Participation of student in all the modules	20
2.	Quizzes – 2, each of 15 marks	30
3.	Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	50
	Total	**100**

Yoga		Semester	III – VI sem
Course Code	**YOK23308**	CIE Marks	100/sem
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	000
Total Hours of Pedagogy per semester	24 - 28 hours (Theory + practical)	Total Marks	100/sem
Examination nature (SEE)	**Objective type Theory / Practical / Viva-Voce**		

Course objectives:

1) To enable the student to have good health.
2) To practice mental hygiene.
3) To possess emotional stability.
4) To integrate moral values.
5) To attain higher level of consciousness.

The Health Benefits of Yoga

The benefits of various yoga techniques have been supposed to improve

- body flexibility,
- performance,
- stress reduction,
- attainment of inner peace, and
- self-realization.

The system has been advocated as a complementary treatment to aid the healing of several ailments such as

- coronary heart disease,
- depression,
- anxiety disorders,
- asthma, and
- extensive rehabilitation for disorders including musculoskeletal problems and traumatic brain injury.

The system has also been suggested as behavioral therapy for smoking cessation and substance abuse (including alcohol abuse).

If you practice yoga, you may receive these physical, mental, and spiritual benefits:

- Physical
    1. Improved body flexibility and balance
    2. Improved cardiovascular endurance (stronger heart)
    3. Improved digestion
    4. Improved abdominal strength
    5. Enhanced overall muscular strength
    6. Relaxation of muscular strains
    7. Weight control
    8. Increased energy levels
    9. Enhanced immune system
- Mental
    1. Relief of stress resulting from the control of emotions
    2. Prevention and relief from stress-related disorders
    3. Intellectual enhancement, leading to improved decision-making skills
- Spiritual
    1. Life with meaning, purpose, and direction
    2. Inner peace and tranquility
    3. Contentment

Yoga Syllabus

Semester III

Yoga, its origin, history and development. Yoga, its meaning, definitions.
Different schools of yoga, Aim and Objectives of yoga, importance of prayer
Yogic practices for common man to promote positive health
Rules to be followed during yogic practices by practitioner
Yoga its misconceptions,
Difference between yogic and non yogic practices
Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar12 count, 2 rounds

Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits of each asana
Different types of Asanas

a. Sitting 1. Padmasana
   2. Vajrasana
b. Standing 1. Vrikshana
   2. Trikonasana
c. Prone line 1. Bhujangasana
   2. Shalabhasana
d. Supine line 1. Utthitadvipadasana
   2. Ardhahalasana

Course outcomes (Course Skill Set):
At the end of the course, the student will be able to:

- Understand the meaning, aim and objectives of Yoga.
- Perform Suryanamaskar and able to Teach its benefits.
- Understand and teach different Asanas by name, its importance, methods and benefits.
- Instruct Kapalabhati and its need and importance.
- Teach different types of Pranayama by its name, precautions, procedure and uses
- Coach different types of Kriyas, method to follow and usefulness.

Assessment Details (both CIE and SEE)

- Students will be assessed with internal test by a. Multiple choice questions b. Descriptivetype questions (Two internal assessment tests with 25 marks/test)
- Final test shall be conducted for whole syllabus for 50 marks.
- Continuous Internal Evaluation shall be for 100 marks (including IA test)

Suggested Learning Resources:
Books:

1. **Yogapravesha in Kannada by Ajitkumar**
2. **Light on Yoga by BKS Iyengar**
3. **Teaching Methods for Yogic practices by Dr. M L Gharote & Dr. S K Ganguly**
4. **Yoga Instructor Course hand book published by SVYASA University, Bengaluru**
5. **Yoga for Children –step by step – by Yamini Muthanna**

Web links and Video Lectures (e-Resources): Refer links

6. **https://youtu.be/KB-TYlgd1wE**
7. **https://youtu.be/aa-TG0Wg1Ls**

DATA STRUCTURES LABORATORY
(Common to CSE/ISE/AI/AM/CI)

Course Code	**CSEL23309**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**0:0:2**	**SEE Marks**	**50**
No. of Credits	**1**	**Examination Hours**	**3 Hours**

Course Learning Objectives:
The course will enable students to:

CLO1	Understand elementary data structures with an emphasis on problem-solving.
CLO2	Develop skills to design and analyze simple linear and non-linear data structures.
CLO3	Strengthen the ability of the students to identify and apply the suitable data structure for the given real-world problem.
CLO4	Enables them to gain knowledge in practical applications of data structures.

Sl. No.	**EXPERIMENTS**
1	Develop a menu driven Program for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX) a. Push an Element on to Stack b. Pop an Element from Stack c. Demonstrate Overflow and Underflow situations on Stack d. Display the status of Stack e. Exit Support the program with appropriate functions for each of the above operations
2	Develop a Program for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, % (Remainder), ^ (Power) and alphanumeric operands
3	Develop and Implement a Program for evaluation of Stack Suffix expression with single digit operands and operators: +, -, *, /, %, ^.
4	Develop recursive program to i) To Find GCD of 2 numbers ii) To Solve the Tower of Hanoi Problem.
5	Develop a menu driven Program for the following operations on QUEUE of Characters (Array Implementation of QUEUE with maximum size MAX) a. Enqueue an Element on to Queue b. Dequeue an Element from Queue c. Demonstrate Overflow and Underflow situations on Queue d. Display the status of Queue e. Exit Support the program with appropriate functions for each of the above operations
6	Implement a program to multiply two polynomials using singly linked list.

7	Design a doubly linked list to represent sparse matrix. Each node in the list can have the row and column index of the matrix element and the value of the element. Print the complete matrix as the output.
8	Write a program to create Binary Tree and to traverse the tree using In-order, Preorder and Post order.
9	Write a program to implement priority queue using Heap.
10	Write a program to implement Hashing using Linear probing. Implement insertion, deletion, search and display.

Course Outcomes:

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

CO1	Implement stack and queue operations using array
CO2	Demonstrate Recursive functions
CO3	Demonstrate working of linked lists
CO4	Implement Binary tree traversals, Priority queue and hashing

Text Books:

1. Ellis Horowitz, Sartaz Sahni, Fundamentals of Data Structures in C, Anderson, Freed, Second Edition, University press, 2008, Reprinted 2016
2. Seymour Lipschutz, Schaum's Outlines, Data Structures with C, McGraw Hill, Special Indian Edition, Thirteenth Reprint 2015.

Reference Books:

1. Aaron Tanenbaum, Yedidyah Langsam and Moshe Augenstein, Data Structures using C, Pearson, Thirteenth Impression, 2014. ISBN:978-81-317-0229-1
2. Richard F. Gilberg and Behrouz A. Forouzan, Data Structures A Pseudo code approach with C, Thomson, 2005. ISBN:978-81-315-0314-0

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

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	2	-	-	2	-	2	-	2	2	-
CO2	3	3	3	-	2	-	-	2	-	2	-	2	2	-
CO3	3	3	3	-	2	-	-	2	-	2	-	2	2	-
CO4	3	3	3	-	2	-	-	2	-	2	-	2	2	-
Average	**3**	**3**	**3**	**-**	**2**	**-**	**-**	**2**	**-**	**2**	**-**	**2**	**2**	**-**

Low-1: Medium-2: High-3

SEMESTER – IV
PROBABILITY AND LINEAR ALGEBRA

Course Code	**MAT23401A**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**SEE Marks**	**50**
No. of Credits	**3**	**Examination Hours**	**03**

Course Objectives: To enable students to apply the knowledge of Mathematics in fields of computer science and allied branches by making them to learn:

CLO1	Probability and Random Variables
CLO2	System of linear equations
CLO3	Vector spaces, linear transformations
CLO4	Eigenvalues, Eigenvectors, diagonalization and Singular value decomposition

Content	**No. of Hours/ RBT levels**
Module 1 Random Variable, Binomial, Poisson, Exponential and Normal distributions. Joint distributions (both discrete and continuous), Expectation and Covariance. Central limit theorem and law of large numbers.	**08 Hours L2, L3**
Module 2 System of linear equations, row reduction and echelon form, vector equations, The matrix equation AX = b. Linear independence and introduction to linear transformations. Matrix of linear transformation, invertible matrix, inverse of a matrix by Gauss Jordan method.	**08 Hours L2, L3**
Module 3 Vector space, subspaces, linearly independent sets, Bases. Coordinate systems, the dimensions of a vector space, Rank, Change of basis. Eigen vectors and Eigen values, diagonalization, Eigen vectors and linear transformations.	**08 Hours L2, L3**
Module 4 Inner products; inner product spaces; orthogonal sets and projections; Gram-Schmidt process; QR-factorization.	**08 Hours L2, L3**
Module 5 Least square solutions and fittings, diagonalization of symmetric matrices, quadratic forms, constrained optimization; Singular value decomposition.	**08 Hours L2, L3**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1	Solve problems associated with random variables using probability distributions
CO2	Solve systems of linear equations.
CO3	Work within vector spaces.
CO4	Use computational techniques for the study of Eigenvalues, Eigenvectors, and diagonalization

Textbooks:

1. T Veerarajan, Probability, Statistics and Random Processes for Engineers, Tata McGraw Hill, 3rd Edition, 2008
2. David C Lay, Linear Algebra and its applications, Pearson, 4th Edition, 2012.

Reference books:

1. Richard H Williams, Probability, Statistics and Random Processes for Engineers, Cengage Learning, 1st Edition, 2003
2. Gilbert Strang, Linear Algebra and its Applications, Cengage Learning, 4th Edition, 2006
3. K. Hoffman and R. Kunze, Linear Algebra, Prentice Hall, 2nd Edition, 2004.

Scheme of Examination:

Semester End Examination (SEE):

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

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs:** seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern for regular courses is shown in Table 2.

Table 2: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	Assignments	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

CO/PO Mapping																
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO41.1	3	2	1									3				
CO41.2	3	2	1									3				
Average	3	2	1									3				

Low-1: Medium-2: High-3

DESIGN AND ANALYSIS OF ALGORITHMS
(Common to CSE/ISE/AD/AM/CI)

Course Code	**CSE23402**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**SEE Marks**	**50**
Total Hours	**40**	**Examination Hours**	**3 Hours**
No. of Credits	**3**		

Course Objectives:
The course will enable students to:

CLO1	To learn mathematical background for analysis of algorithm
CLO2	Analyze the asymptotic performance of algorithms.
CLO3	To understand the concept of designing an algorithm.
CLO4	Synthesize efficient algorithms in common engineering design situations.

CONTENTS	**# of Hours**
MODULE 1 **Introduction:** Notion of algorithm, Fundamentals of Algorithmic Problem Solving, Fundamentals of the Analysis of Algorithmic Efficiency: Analysis frame work, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-recursive and Recursive Algorithms. **Brute Force**: Selection Sort and Bubble Sort.	**08**
MODULE 2 **Divide and Conquer:** Merge sort, Quicksort, Multiplication of long integers, Strassen's Matrix multiplication, Max-Min Problem **Decrease and Conquer:** Insertion Sort, Depth First Search, Breadth First Search, Topological Sorting, Applications of DFS and BFS.	**08**
MODULE 3 **Transform and Conquer:** Presorting, Heapsort, Problem reduction. **Space and Time Tradeoffs:** Sorting by Counting, Naive String Matching, Input Enhancement in String Matching: Horspool's and Boyer-Moore algorithm.	**08**
MODULE 4 **Dynamic Programming:** Computing a Binomial Coefficient, Warshall's and Floyd's Algorithms, The Knapsack Problem and Memory Functions. **Greedy Technique:** Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees and codes.	**08**
MODULE 5 **Backtracking:** N-Queen's Problem, Sum of Subset Problem. **Branch-and-Bound:** Travelling Sales Person problem,0/1 Knapsack problem **NP and NP-Complete Problems**: Basic concepts, nondeterministic algorithms, P, NP, NP-Complete, and NP-Hard classes	**08**

Course Outcomes:

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

CO1	Understand and explore the asymptotic runtime complexity of algorithms by using mathematical relations.
CO2	Analyze a problem and identify the computing requirements appropriate for a solution
CO3	Apply mathematical foundations, algorithmic principles, and computer science theory to the modeling, and evaluation of computer-based solutions.
CO4	Investigate and apply optimal design, development principles, skills and tools in the construction of software solutions of varying complexity.

Text Books:

1. Introduction to the Design and Analysis of Algorithms, Anany Levitin, University, 3rd Edition, 2012, Pearson, ISBN 13: 978-0-13-231681-1.
2. Introduction to Algorithms, Cormen T.H., Leiserson C.E., Rivest R.L., Stein C., 3rd Edition, 2010, PHI, ISBN:9780262033848.

Reference Books:

1. Computer Algorithms, Horowitz E., Sahani S., Rajasekharan S., 2nd Edition, 2006, Galgotia Publications, ISBN:9780716783169.

E-Books / Web References:

1. http://www.facweb.iitkgp.ac.in/~sourav/daa.html
2. https://freevideolectures.com/course/2281/design-and-analysis-of-algorithms

MOOCs:

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

Mapping of CO-PO:

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	3	-	3	-	-	-	-	-	-	2	3	-
CO2	3	3	3	-	3	-	-	-	-	-	-	2	3	-
CO3	3	3	3	-	3	-	-	-	-	-	-	2	3	-
CO4	3	3	3	-	3	-	-	-	-	-	-	2	3	-
Average	**3**	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**-**

Low-1: Medium-2: High-3

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

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

	Component	**Marks**	**Total Marks**
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignment	10	
SEE	Semester End Examination	100	50
	Grand Total		100

Scheme of Examination (SEE):

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

DATABASE MANAGEMENT SYSTEM

Semester:	**IV**	**CIE Marks**	**50**
Course Code	**AML23403**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**3:0:2**	**Duration of SEE (hours):**	**03**
Type of Course	**IPC**	**Credits**	**04**

Prerequisites (if any):

Course Learning Objectives:

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

Module 1	No. of Hours	RBT Level
Basics of Database Introduction and applications of DBMS, Purpose of database, View of Data, Database Languages, Database architecture, Database users and DBA **Relational Model** Structure of Relational Databases, Database Schema, Keys, Relational Operations and Relational Algebra	10	L2
Module 2		
Entity Relationship Model Basic Concepts and definitions, Constraints, Entity Relationship Diagram, Weak Entity Sets, Extended E-R Features, Conversion of ER diagram into relations **SQL** Introduction to SQL, Data Definition of SQL, Basic structure of SQL queries, Basic SQL operations (rename, string operations, order by, where clause), Set operations, Null values, Aggregate functions, Nested Subqueries, Modification of Database, JOIN expressions, Views, Integrity constraints, Data types and Schemas, Authorization	10	L2
Module 3		
Relational Database Design First Normal Form, Decomposition, Desirable Properties of Decomposition, Functional Dependencies, Second and Third Normal Form and Boyce-Codd Normal Form **Advanced SQL** Introduction, Cursors, Stored Procedures, Stored Functions, Triggers, Partitioning **Indexing and Hashing** Basic concepts, Ordered Indices, Hash Based Indexing, Tree based Indexing	10	L3
Module 4		
Transaction Management and concurrency Transaction concepts, properties of transactions, serializability, testing for	10	L3

serializability, Transaction Isolation and Atomicity, Transaction isolation levels, Implementation of isolation levels, Lock based protocols, Deadlock handling, Timestamp based protocols, two- phase locking protocol		
Module 5		
NoSQL Databases Introduction, properties of NoSQL Databases, types of NoSQL databases	10	L3

Course Outcomes:

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

CO1	Understand database concepts and query language
CO2	Understand the E R model and relational model
CO3	Design and build a database system and demonstrate competence with the fundamental tasks involved with modelling, designing, and implementing a DBMS.
CO4	Apply PL/SQL programming using various basic and advanced concepts of RDBMS.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1		1	2					3			1	2	
CO2	2	1	1	2	1						2	1	2	
CO3	2	1	2	2		1			2			1	2	
CO4	2	1	1	3	1						1	1	2	

High-3: Medium-2: Low-1

Text Books:

1. Database System Concepts By Silberschatz, Korth, Sudarshan
2. MySQL(TM): The Complete Reference By Vikram Vaswani

Reference Books:

1. An Introduction to Database Systems : Eighth Edition By C. J. Date
2. Database Management Systems by G K Gupta

E-Books / Web References:

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

MOOCs:

1. https://onlinecourses.nptel.ac.in/noc19_cs46/preview

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic

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

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

	Component	**Marks**	**Total Marks**
CIE	CIE Test-1	30	50
	CIE Test-2	30	
	CIE Test-3	30	
	Laboratory	20	
SEE	Semester End Examination	100	50
	Grand Total		100

Scheme of Examination (SEE):

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

MACHINE LEARNING TECHNIQUES

Semester:	**IV**	**CIE Marks**	**50**
Course Code	**AML23404**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**Duration of SEE (hours):**	**03**
Type of Course	**PC**	**Credits**	**03**

Prerequisites (if any): Machine Learning Foundations

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
CLO1	Provide an in-depth understanding of machine learning, focusing on unsupervised learning algorithms and representation learning techniques, with practical implementation and applications.
CLO2	Equip students with the knowledge and skills to implement and analyze unsupervised learning techniques, using Python, with practical applications in data segmentation.
CLO3	Provide comprehensive knowledge of supervised learning techniques, with practical implementation and hyper parameter tuning using Python, focusing on applications like image classification.
CLO4	To provide a comprehensive understanding and practical implementation of discriminative models
CLO5	Equip students with comprehensive knowledge and practical skills in artificial neural networks for multiclass classification

Module 1	No. of Hours	RBT Level
Introduction; Overview of Machine Learning, Unsupervised Learning: Common unsupervised learning algorithms: clustering, association, and dimensionality reduction, Representation learning – PCA: PCA Algorithm, Implementing PCA. Unsupervised Learning - Representation learning - Kernel PCA. **Implementation of PCA using Python (NumPy, SciPy, scikit-learn), Visualization of PCA results, Case study: PCA applied to image compression / face recognition**	**8**	**L2**
Module 2		
Unsupervised Learning - Clustering - K-means/Kernel K-means. Unsupervised Learning - Estimation - Recap of MLE + Bayesian estimation, Gaussian Mixture Model - EM algorithm. **Implementation using Python (NumPy, scikit-learn), Visualization of clustering results, Case study: K-means applied to customer segmentation**	**8**	**L3**
Module 3		
Supervised Learning - Regression - Least Squares; Bayesian view. Supervised Learning - Regression - Ridge/LASSO. Supervised Learning - Classification - K-NN, Decision tree. Supervised Learning - Classification - Generative Models - Naive Bayes. **Implementation using Python (scikit-learn), Tuning hyperparameters: C and gamma, Case study: SVMs in image classification**	**8**	**L3**
Module 4		
Discriminative Models – Perceptron: Introduction to Discriminative Models, Perceptron Algorithm, ; Logistic Regression. Support Vector Machines. **Implementation using Python (NumPy), Visualization of decision boundaries, Case study: Perceptron for binary classification**	**8**	**L4**
Module 5		
Neural networks models in scikit-learn: History and development of neural networks, Biological inspiration and artificial neurons, Basic concepts: Neurons, layers, activation functions,Types	**8**	**L4**

of neural networks: Single-layer, multi-layer, convolutional, recurrent , Overview of neural network modules in scikit-learn, Multi-layer Perceptron (MLP) Classifier and Repressors -MLP Classifier, MLP Regressor, Training Neural Networks, Evaluating Neural Network Models		

Course Outcomes:

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

CO1	Applying machine learning techniques, particularly unsupervised learning algorithms and PCA, for practical tasks such as clustering, dimensionality reduction, and image processing using Python tools
CO2	Develop the ability to apply and implement unsupervised learning techniques using Python, with practical experience in visualizing results and real-world applications like customer segmentation.
CO3	Develop proficiency in implementing and optimizing supervised learning algorithms, classification, and SVMs using Python, with a focus on hyper parameter tuning and application to image classification scenarios.
CO4	Implementing and visualizing discriminative models using Python (NumPy), with practical experience in visualizing decision boundaries and applying the Perceptron algorithm to binary classification problems.
CO5	Implementation and application of artificial neural networks for multiclass classification, using Python (NumPy, scikit-learn, TensorFlow, Keras)

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**
CO1	2	2	2		3					3		2		3
CO2	2	2	2		3					3		2		3
CO3	3	2	3		3				3	3		2		2
CO4	3	2	3	1	3				3	3		2		3
CO5	3	3	3	1	3				3	3		2		2
Average	3	2	3	1	3				3	3		2		3

High-3: Medium-2: Low-1

Text Books:

1. "Deep Learning" by Ian Goodfellow, Yoshua Bengio, and Aaron Courville
2. "Neural Networks and Deep Learning" by Michael Nielsen

Reference Books:

1. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron

E-Books / Web References:

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

MOOCs:

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

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.
Typical evaluation pattern for regular courses is shown in Table 1:

	Component	**Marks**	**Total Marks**
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	AAT	10	
SEE	Semester End Examination	100	50
	Grand Total		100

Scheme of Examination (SEE):

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

OBJECT ORIENTED PROGRAMMING USING JAVA

Semester:	**IV**	**CIE Marks**	**50**
Course Code	**AML23405A**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**Duration of SEE (hours):**	**03**
Type of Course	**ETC**	**Credits**	**03**

Prerequisites (if any):

Course Learning Objectives:

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

Module 1	No. of Hours	RBT Level
Object-Oriented Thinking- A way of viewing world – Agents and Communities, messages and methods, Responsibilities, Classes and Instances, Class Hierarchies- Inheritance, Method binding, Overriding and Exceptions, Summary of Object-Oriented concepts. Java buzzwords, An Overview of Java, Data types, Variables and Arrays, operators, expressions, control statements, Introducing classes, Methods and Classes, String handling. Inheritance– Inheritance concept, Inheritance basics, Member access, Constructors, Creating Multilevel hierarchy, super uses, using final with inheritance, Polymorphism-ad hoc polymorphism, pure polymorphism, method overriding, abstract classes, Object class, forms of inheritance specialization, specification, construction, extension, limitation, combination, benefits of inheritance, costs of inheritance.	8	**L2**
Module 2		
Packages- Defining a Package, CLASSPATH, Access protection, importing packages. Interfaces-defining an interface, implementing interfaces, Nested interfaces, applying interfaces, variables in interfaces and extending interfaces. Stream based I/O(java.io) – The Stream classes-Byte streams and Character streams, Reading console Input and Writing Console Output, File class, Reading and writing Files, Random access file operations, The Console class, Serialization, Enumerations, auto boxing, generics.	8	**L2**
Module 3		

Exception handling - Fundamentals of exception handling, Exception types, Termination or resumptive models, Uncaught exceptions, using try and catch, multiple catch clauses, nested try statements, throw, throws and finally, built- in exceptions, creating own exception sub classes. Multithreading- Differences between thread-based multitasking and process-based multitasking, Java thread model, creating threads, thread priorities, synchronizing threads, inter thread communication.	8	**L3**
Module 4		
The Collections Framework (java.util)- Collections overview, Collection Interfaces, The Collection classes- Array List, Linked List, Hash Set, Tree Set, Priority Queue, Array Deque. Accessing a Collection via an Iterator, Using an Iterator, The For-Each alternative, Map Interfaces and Classes, Comparators, Collection algorithms, Arrays, The Legacy Classes and Interfaces- Dictionary, Hashtable ,Properties, Stack, Vector More Utility classes, String Tokenizer, Bit Set, Date, Calendar, Random, Formatter, Scanner	8	**L3**
Module 5		
GUI Programming with Swing – Introduction, limitations of AWT, MVC architecture, components, containers. Understanding Layout Managers, Flow Layout, Border Layout, Grid Layout, Card Layout, Grid Bag Layout. Event Handling- The Delegation event model- Events, Event sources, Event Listeners, Event classes, Handling mouse and keyboard events, Adapter classes, Inner classes, Anonymous Inner classes. A Simple Swing Application, Applets – Applets and HTML, Security Issues, Applets and Applications, passing parameters to applets. Creating a Swing Applet, Painting in Swing, A Paint example, Exploring Swing Controls- JLabel and Image Icon, JText Field, The Swing Buttons- JButton, JToggle Button, JCheck Box, JRadio Button, JTabbed Pane, JScroll Pane, JList, JCombo Box, Swing Menus, Dialogs.	8	**L3**

Course Outcomes:

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

CO1	Demonstrate the object-oriented concept of Java Programming
CO2	Create computer programs to solve real world problems in Java and basic concepts of Java.
CO3	Develop reusable programs using the concepts of inheritance, polymorphism, interfaces and packages.
CO4	Apply the concepts of Multithreading and Exception handling to develop efficient and error free codes.
CO5	Implementing Java Collectors, Swings programs based on real time cases.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2		2			1	2	2		2	2	
CO2	2	2	2		2			1	2	2		2	2	
CO3	2	2	2		2			1	2	2		2	2	
CO4	2	2	2		2			1	2	2		2	2	
CO5	2	2	2		2			1	2	2		2	2	
AVG	2	2	2		2			1	2	2		2	2	

High-3: Medium-2: Low-1

Text Book:

1. Java The complete reference, 9th edition, Herbert Schildt, McGraw Hill Education (India) Pvt. Ltd.
2. Understanding Object-Oriented Programming with Java, updated edition, T. Budd, Pearson Education.

Reference Books:

1. E Balagurusamy, Programming with Java A primer, Tata McGraw Hill companies.
2. Anita Seth and B L Juneja, JAVA One step Ahead, Oxford University Press, 2017
3. Mahesh Bhave and Sunil Patekar, "Programming with Java", First Edition, Pearson Education,2008, ISBN:9788131720806.
4. Rajkumar Buyya,S Thamarasi selvi, xingchen chu, Object oriented Programming with java, Tata McGraw Hill education private limited.

Books / Web References:

1. https://www.javatpoint.com/java-tutorial
2. https://devfreebooks.github.io/java/
3. https://www.codejava.net/books/4-best-free-java-e-books-for-beginners

MOOCs:

1. https://in.coursera.org/specializations/java-programming
2. https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013788171933728768154_shared/overview

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have beenencouraged to use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

	Components	Marks	Total
CIE	CIE TEST 1	40	50
	CIE TEST 2	40	
	CIE TEST 3	40	
	AAT/Assignment	10	
SEE	SEE	Semester End Exam	50
		Grand Total	100

Scheme of Examination (SEE):

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

DISCRETE MATHEMATICAL STRUCTURES

Semester:	**IV**	**CIE Marks**	**50**
Course Code	**AML23405B**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**Duration of SEE (hours):**	**03**
Type of Course	**ETC**	**Credits**	**03**

Course objectives:

1. To help students to understand discrete and continuous mathematical structures.
2. To impart basics of relations and functions.
3. To facilitate students in applying principles of Recurrence Relations to find the generatingfunctions and solve the Recurrence relations.
4. To have the knowledge of groups and their properties to understand the importance ofalgebraic properties relative to various number systems.

Teaching-Learning Process

Pedagogy (General Instructions):

These are sample Strategies, teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may beadopted so that the delivered lessons shall develop students' theoretical and applied Mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will assign homework, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students to group learning to improve their creative and analytical skills.
6. Show short related video lectures in the following ways:
   - As an introduction to new topics (pre-lecture activity).
   - As a revision of topics (post-lecture activity).
   - As additional examples (post-lecture activity).
   - As an additional material of challenging topics (pre-and post-lecture activity).
   - As a model solution for some exercises (post-lecture activity).

Module-1: Fundamentals of Logic

Basic Connectives and Truth Tables, Logic Equivalence – The Laws of Logic, Logical Implication – Rules of Inference. The Use of Quantifiers, Quantifiers, Definitions and the Proofs of Theorems. **(8 hours)**

(RBT Levels: L1, L2 and L3)

Module-2: Properties of the Integers

Mathematical Induction, The Well Ordering Principle – Mathematical Induction, Recursive Definitions.

Fundamental Principles of Counting: The Rules of Sum and Product, Permutations, Combinations – The Binomial Theorem, Combinations with Repetition. **(8 Hours)**

(RBT Levels: L1, L2 and L3)

Module-3: Relations and Functions

Cartesian Products and Relations, Functions – Plain and One-to-One, Onto Functions. The Pigeon-hole Principle, Function Composition and Inverse Functions.

Properties of Relations, Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders – Hasse Diagrams, Equivalence Relations and Partitions. **(8 hours)**

(RBT Levels: L1, L2 and L3)

Module-4: The Principle of Inclusion and Exclusion

The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials.

Recurrence Relations: First Order Linear Recurrence Relation, The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients.(8 Hours)

(RBT Levels: L1, L2 and L3)

Module-5: Introduction to Groups Theory

Definitions and Examples of Particular Groups Klein 4-group, Additive group of Integers modulo n, Multiplicative group of Integers modulo-p and permutation groups, Properties of groups, Subgroups, cyclic groups, Cosets, Lagrange's Theorem. (8 Hours)

(RBT Levels: L1, L2 and L3)

Course outcome (Course Skill Set)

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

1. Apply concepts of logical reasoning and mathematical proof techniques in proving theorems and statements.
2. Demonstrate the application of discrete structures in different fields of computer science.
3. Apply the basic concepts of relations, functions and partially ordered sets for computer representations.
4. Solve problems involving recurrence relations and generating functions.
5. Illustrate the fundamental principles of Algebraic structures with the problems related to computer science & engineering.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE, the minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
- Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)

The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

The Internal Assessment Test question paper is designed to attain the different levels ofBloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common questionpapers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books (Name of the author/Title of the Book/Name of the publisher/Edition and Year)Text Books:

1. **Ralph P. Grimaldi, B V Ramana: "Discrete Mathematical Structures an Applied Introduction",** 5th Edition, Pearson Education, 2004.
2. **Ralph P. Grimaldi: "Discrete and Combinatorial Mathematics"**, 5th Edition, Pearson Education. 2004.

Reference Books:

1. **Basavaraj S Anami and Venakanna S Madalli: "Discrete Mathematics – A Concept-based approach"**, Universities Press, 2016
2. **Kenneth H. Rosen: "Discrete Mathematics and its Applications"**, 6th Edition, McGraw Hill, 2007.
3. **Jayant Ganguly: "A Treatise on Discrete Mathematical Structures",** Sanguine-Pearson, 2010.
4. **D.S. Malik and M.K. Sen: "Discrete Mathematical Structures Theory and Applications,** Latest Edition, Thomson, 2004.
5. **Thomas Koshy: "Discrete Mathematics with Applications"**, Elsevier, 2005, Reprint 2008.

Web links and Video Lectures (e-Resources):

- http://nptel.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/
- VTU e-Shikshana Program
- VTU EDUSAT Program.
- **http://www.themathpage.com/**
- **http://www.abstractmath.org/**
- **http://www.ocw.mit.edu/courses/mathematics/**

Activity-Based Learning (Suggested Activities in Class)/Practical-Based Learning

- Quizzes
- Assignments
- Seminar

OPTIMIZATION TECHNIQUE

Semester:	**IV**	**CIE Marks**	**50**
Course Code	**AML23405C**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**Duration of SEE (hours):**	**03**
Type of Course	**ETC**	**Credits**	**03**

Course objectives: The objectives of the course are to fecilitate the learners to:

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

Teaching-Learning Process

Pedagogy (General Instructions):

These are sample Strategies, teachers can use to accelerate the attainment of the variouscourse outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied Mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will assign homework, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students to group learning to improve their creative and analyticalskills.
6. Show short related video lectures in the following ways:
   - As an introduction to new topics (pre-lecture activity).
   - As a revision of topics (post-lecture activity).
   - As additional examples (post-lecture activity).
   - As an additional material of challenging topics (pre-and post-lecture activity).
   - As a model solution of some exercises (post-lecture activity).

Module-1: VECTOR CALCULUS

Functions of several variables, Differentiation and partial differentials, gradients of vector-valued functions, gradients of matrices, useful identities for computing gradients, linearization and multivariate Taylor series.

(8 hours)

(RBT Levels: L1, L2 and L3)

Module-2: APPLICATIONS OF VECTOR CALCULUS

Backpropagation and automatic differentiation, gradients in a deep network, The Gradient of Quadratic Cost, Descending the Gradient of Cost, The Gradient of MeanSquared Error. **(8 hours)**

(RBT Levels: L1, L2 and L3)

Module-3: Convex Optimization-1

Local and global optima, convex sets and functions separating hyperplanes, application of Hessian matrix in optimization, Optimization using gradient descent, Sequential search 3- point search and Fibonacci search.**(8 hours)**

(RBT Levels: L1, L2 and L3)

Module-4: Convex Optimization-2

Unconstrained optimization -Method of steepest ascent/descent, NR method, Gradient descent, Mini batch gradient descent, Stochastic gradient descent. **(8 hours)**

(RBT Levels: L1, L2 and L3)

Module-5: Advanced Optimization

Momentum-based gradient descent methods: Adagrad, RMSprop and Adam.
Non-Convex Optimization: Convergence to Critical Points, Saddle-Point methods. **(8 hours)**

(RBT Levels: L1, L2 and L3)

Course outcome (Course Skill Set)

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

1. Apply the concepts of vector calculus to solve the given problem.
2. Apply the concepts of partial differentiation in machine learning and deep neural networks.
3. Analyze the convex optimization algorithms and their importance in computer science & engineering.
4. Apply the optimization algorithms to solve the problem.

Analyze the advanced optimization algorithms for machine learning .

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam(SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE, the minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous

Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- There are 25 marks for the CIE's Assignment component and 25 for the InternalAssessment Test component.
- Each test shall be conducted for 25 marks. The first test will be administered after 40- 50% of the coverage of the syllabus, and the second test will be administered after 85- 90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each

assignment shall be conducted for 25 marks. (If two assignments are conductedthen the sum of the two assignments shall be scaled down to 25 marks)

- The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels ofBloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under amodule (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

Marks scored shall be proportionally reduced to 50 marks.

Suggested Learning Resources:

Books (Name of the author/Title of the Book/Name of the publisher/Edition andYear)

Text Books:

1. Mathematics for Machine learning, Marc Peter Deisennroth, A. Aldo Faisal, Cheng Soon Ong, 2020, Cambridge University Press.
2. S. Bubeck, Convex Optimization: Algorithms and Complexity, Foundations and Trends in Optimization, 2015.
3. S. Boyd, N. Parikh, and E. Chu," Distributed optimization and statistical learning viathe alternating direction method of multipliers", Foundations and Trends in Machine Learning, Now Publishers Inc.

Reference Books:

1. Linear Algebra and Optimization for Machine Learning, Charu C. Aggarwal, Springer, 2020.
2. A. Beck, First-Order Methods in Optimization, MOS-SIAM Series on Optimization, 2017.

F. Bach, "Learning with Submodular Functions: A Convex Optimization Perspective", Foundations and Trends in Machine Learning, Now Publishers Inc.

Web links and Video Lectures (e-Resources):

- https://ocw.mit.edu/courses/mathematics/18-06sc-linear-algebra-fall-2011/index.htm
- https://www.math.ucdavis.edu/~linear/linear.pdf
- https://www.coursera.org/learn/linear-algebra-machine-learning
- https://nptel.ac.in/syllabus/111106051/
- https://github.com/epfml/OptML_course

https://www.youtube.com/playlist?list=PL4O4bXkI-fAeYrsBqTUYn2xMjJAqlFQzX

Activity-Based Learning (Suggested Activities in Class)/Practical-Based Learning

- Quizzes
- Assignments
- Seminar

ALGORITHMIC GAME THEORY

Semester:	**IV**	**CIE Marks**	**50**
Course Code	**AML23405D**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**Duration of SEE (hours):**	**03**
Type of Course	**ETC**	**Credits**	**03**

Course objectives:

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

Teaching-Learning Process

Pedagogy (General Instructions):

These are sample Strategies, teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied Mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will assign homework, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students to group learning to improve their creative and analytical skills.
6. Show short related video lectures in the following ways:
   - As an introduction to new topics (pre-lecture activity).
   - As a revision of topics (post-lecture activity).
   - As additional examples (post-lecture activity).
   - As an additional material of challenging topics (pre-and post-lecture activity).
   - As a model solution for some exercises (post-lecture activity).

Module-1

Introduction to Strategic Games: What is game theory? The theory of rational choice, Strategic games; Examples: The prisoner's dilemma, Bach or Stravinsky, Matching pennies; Nash equilibrium; Examples of Nash equilibrium; Best response functions; Dominated actions. **(8 hours)**

(RBT Levels: L1, L2 and L3)

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Module-2

Introduction; Strategic games in which players may randomize; Mixed strategy Nash equilibrium; Dominated actions; Pure equilibrium when randomization is allowed.
Illustration: Expert Diagnosis; Equilibrium in a single population. **(8 hours)**
(RBT Levels: L1, L2 and L3)

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Module-3

Extensive games with perfect information; Strategies and outcomes; Nash equilibrium; Sub- game perfect equilibrium; Finding sub-game perfect equilibria of finite horizon games: Backward induction; Illustrations: The ultimatum game, Stackelberg's model of duopoly. **(8 hours)**
(RBT Levels: L1, L2 and L3)

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Module-4

Bayesian Games**,** Motivational examples; General definitions; Two examples concerning information; Illustrations: Cournot's duopoly game with imperfect information, Providing a public good; Auctions: Auctions with an arbitrary distribution of valuations. **(8 hours)**
(RBT Levels: L1, L2 and L3)

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Module-5

Competative Games: Strictly competitive games and maximization.
Repeated games: The main idea; Preferences; Repeated games; Finitely and infinitely repeated Prisoner's dilemma; Strategies in an infinitely repeated Prisoner's dilemma; Nash equilibrium of an infinitely repeated Prisoner's dilemma, Nash equilibrium payoffs of an infinitely repeated Prisoner's dilemma.**(8 hours)**
(RBT Levels: L1, L2 and L3)

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Course outcome (Course Skill Set)
At the end of the course, the student will be able to:

1. Interpret the basics of strategic gaming and extensive games.
2. Analyze gaming strategies on real-time incidence.
3. Develop the models of gaming on real-time incidence.
4. Apply game theory in the real world problems.

Assessment Details (both CIE and SEE)
The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE, the minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the total of the CIE (Continuous Internal Evaluation)and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
- Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks

- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)
- The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels ofBloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books (Name of the author/Title of the Book/Name of the publisher/Edition and Year)

Text Books:

1. **Martin Osborne: "An Introduction to Game Theory",** Oxford University Press, First Indian Edition, 2009, 7th impression, ISBN – 0195128958.

Reference Books:

1. **Roger B. Myerson: "Analysis of Conflict Game Theory",** Re-print Edition, Harvard University Press, 2008, ISBN – 978-0674341166.
2. **Frederick S. Hillier and Gerald J. Lieberman: "Introduction to Operations Research, Concepts and Cases",** 9th Edition; Tata McGraw Hill, 2010, ISBN – 0073376299.
3. **Joel Watson: "An Introduction to Game Theory"** Strategy, 2nd Edition, W.W. Norton &Company, 2007, ISBN – 9780393929348.

Web links and Video Lectures (e-Resources):

- http://nptel.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/
- VTU e-Shikshana Program
- VTU EDUSAT Program.

Activity-Based Learning (Suggested Activities in Class)/Practical-Based Learning

- Quizzes
- Assignments
- Seminar

Universal Human Values

Course Code	**UHK23406**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**1:0:0**	**SEE Marks**	**50**
No. of Credits	**1**	**Examination Hours**	**01**

Course Objectives:

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

Content
Module 1 (03 hours)
Introduction to Value Education: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations
Module 2 (03 hours)
Harmony in the Human Being : Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health
Module 3 (03 hours)
Harmony in the Family and Society : Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order
Module 4 (03 hours)
Harmony in the Nature/Existence: Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence
Module 5 (03 hours)
Implications of the Holistic Understanding – a Look at Professional Ethics: Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

Reference Books:

1. The Textbook A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana,G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978- 93-87034-47-1
2. The Teacher‟s Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur,R Asthana, G

COURSE OUTCOMES:

Upon completion of this course, student would:

CO 1	Become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
CO 2	Have better critical ability
CO 3	Become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
CO 4	Apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction

Scheme of Examination:

Semester End Examination (SEE):

SEE paper shall be set for 50 questions, each of the 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is 01 hour.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. Typical Evaluation pattern for regular courses is shown in Table 2.

Table 2: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	Assignments	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

CO/PO	PO6
CO 1	3
CO 2	3
CO 3	3
CO 4	3
Average	3

Low-1: Medium-2: High-3

AI TOOLS, FRAMEWORKS & ITS APPLICATIONS I

Semester:	**IV**	**CIE Marks**	**50**
Course Code	**AML23407A**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**1:0:2**	**Duration of SEE (hours):**	**03**
Type of Course	**AEC**	**Credits**	**02**

Prerequisites (if any): **None**

Course Learning Objectives:

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

Sl.NO	Laboratory Experiments
	PART A
1	Simulate to measure the light intensity using Thinkercad
2	Simulate an ultrasonic distance sensor to detect the distance from the object.
3	Simulate a DC motor with specified input that runs continuously and vary with the DC motor speed.
4	Simulate door sensor for smart homes using IoT sensor
5	Installation of NLTK Library and working with Basic commands
6	Write a python code for Tokenizing and count word Frequency
7	Write a python code NLTK word stemming and Lemmatizing words using WordNet
	PART B
1	**AI in Agriculture** **Smart Irrigation System** Build a smart irrigation system using Arduino or Raspberry Pi that incorporates soil moisture sensors and weather data. They will develop an AI algorithm to optimize irrigation based on real-time conditions.
2	**AI in Smart Cities** **Smart Street Lighting with IoT** Design a smart street lighting system using Arduino or Raspberry Pi and IoT sensors to detect light levels and motion. They will develop an AI algorithm to optimize street lighting based on real-time conditions.
3	**AI in Education** **Recommendation System for Online Courses**

	Create a basic recommendation system using collaborative filtering with TensorFlow. Use it to recommend online courses to students based on their previous choices.
4	**AI in Healthcare** **Predicting Disease Outcomes from Patient Data** Build a predictive model using TensorFlow to estimate the progression of a specific disease (e.g., diabetes) based on patient data such as age, BMI, and blood sugar levels.

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

CO1	Understand the usage of AI and IoT's impact on Agricultural Innovation with AI and IoT.
CO2	Understand AI and IoT's role in Smart Solutions for Sustainable Urban Living.
CO3	Apply text preprocessing, neural networks for sentiment analysis, and interpreting sentiment scores.
CO4	Evaluate AI's importance in diagnosing medical conditions.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2		3				1	1		1		2
CO2	2	2	2		3				1	1		1		2
CO3	3	3	2		3				1	2		1		2
CO4	3	3	2		3				1	2		1		2

Conduct of Practical Examination:

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

Mini Project

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

Scheme of Examination (CIE):

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

SCALA

Semester:	**IV**	**CIE Marks**	**50**
Course Code	**AML23407B**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**1:0:2**	**Duration of SEE (hours):**	**03**
Type of Course	**AEC**	**Credits**	**02**

Course objectives:

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

Sl.NO	Experiments
1	a. Write a Scala program to compute the sum of the two given integer values. If the two values are the same, then return triples their sum. b. Write a Scala program to check two given integers, and return true if one of them is 22 or if their sum is 32.
2	a. Write a Scala program to remove the character in a given position of a given string. The given position will be in the range 0...string length -1 inclusive. b. Write a Scala program to create a new string taking the first 5 characters of a given string and return the string with the 5 characters added at both the front and back.
3	a. Write a Scala program to print the multiplication table of a given number using a for loop. b. Write a Scala program to find the largest element in an array using pattern matching
4	a. Write a Scala function to calculate the product of digits in a given number b. Write a Scala function to check if a given number is a perfect square
5	a. Write a Scala program that creates a subclass Student that extends the Person class. Add a property called grade and implement methods to get and set it. b. Write a Scala program that creates a class Triangle with properties side1, side2, and side3. Implement a method isEquilateral to check if the triangle is equilateral.
6	a. Write a Scala program that creates an enum class Color with values for different colors. Use the enum class to represent an object's color. b. Write a Scala program that creates a class ContactInfo with properties name, email, and address. Create a class Customer that includes a ContactInfo object.
7	a. Write a Scala program to create a set and find the difference and intersection between two sets. b. Write a Scala program to create a set and find the second largest element in the set.
8	a. Write a Scala program to create a list in different ways. Note: Use Lisp style, Java style, Range list, Uniform list, Tabulate list b. Write a Scala program to flatten a given List of Lists, nested list structure.
9	a. Write a Scala program to add each element n times to a given list of integers. b. Write a Scala program to split a given list into two lists.
10	a. Write a Scala program to swap the elements of a tuple Further print no swapping required if elements are same. b. Write a Scala program to find non-unique elements in a tuple

Course outcomes (Course Skill Set):

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

- Get familiar with the Scala syntax and object-oriented principles
- Learn advanced concepts - loops, expressions, inheritance, pattern matching
- Learn to write clean and functional Scala codes and test it
- Learn functional programming using Scala

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation (CIE):

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

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

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students atthe beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-upwill be evaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed inthe syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge willcarry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Suggested Learning Resources:

- Programming Scala, Third Edition, O'Reilly Media.
- Paul Chiusano, Rúnar Bjarnason, Functional Programming in Scala 1st Edition, Manning Publications
- https://docs.scala-lang.org/tutorials/scala-for-java-programmers.html
- https://www.javatpoint.com/scala-tutorial

MONGODB

Semester:	**IV**	**CIE Marks**	**50**
Course Code	**AML23407C**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**1:0:2**	**Duration of SEE (hours):**	**03**
Type of Course	**AEC**	**Credits**	**02**

Course objectives:

- Understand basic MongoDB functions, operators and types of operations in MongoDB.
- Demonstrate the use of Indexing, Advanced Indexing in MongoDB.
- Apply the aggregation and Map Reduction in MongoDB.
- Demonstrate text searching on collections in MongoDB.

Sl.NO	Experiments
1	a. Illustration of Where Clause, AND,OR operations in MongoDB. b. Execute the Commands of MongoDB and operations in MongoDB : Insert, Query, Update, Delete and Projection. (Note: use any collection) [Refer: Book 1 chapter 4].
2	a. Develop a MongoDB query to select certain fields and ignore some fields of the documents fromany collection. b. Develop a MongoDB query to display the first 5 documents from the results obtained in a.[use of limit and find] [Refe: Book1 Chapter 4, book 2: chapter 5]
3	a. Execute query selectors (comparison selectors, logical selectors) and list out the results on any collection b. Execute query selectors (Geospatial selectors, Bitwise selectors) and list out the results on any collection [Refer: Book 3 Chapter 13]
4	Create and demonstrate how projection operators ($, $elematch and $slice) would be used in theMondoDB. [Refer: Book 3 Chapter 14]
5	Execute Aggregation operations ($avg, $min,$max, $push, $addToSet etc.). students encourage to execute several queries to demonstrate various aggregation operators) [Refer: Book 3 Chapter 15]
6	Execute Aggregation Pipeline and its operations (pipeline must contain $match, $group, $sort, $project, $skip etc. students encourage to execute several queries to demonstrate various aggregation operators)[refer book 2: chapter 6]
7	a. Find all listings with listing_url, name, address, host_picture_url in the listings And Reviewscollection that have a host with a picture url b. Using E-commerce collection write a query to display reviews summary. [refer Book2: chapter 6]
8	a. Demonstrate creation of different types of indexes on collection (unique, sparse, compound and multikey indexes) b. Demonstrate optimization of queries using indexes. Refer: Book 2: Chapter 8 and Book 3: Chapter 12]
9	a. Develop a query to demonstrate Text search using catalog data collection for a given word b. Develop queries to illustrate excluding documents with certain words and phrasesRefer: Book 2: Chapter 9]

10	Develop an aggregation pipeline to illustrate Text search on Catalog data collection. Refer: Book 2 :Chapter 9]

Course outcomes (Course Skill Set):

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

1. Make use of MangoDB commands and queries.
2. Illustrate the role of aggregate pipelines to extract data.
3. Demonstrate optimization of queries by creating indexes.
4. Develop aggregate pipelines for text search in collections.

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation (CIE):

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

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

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students atthe beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-upwill be evaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed inthe syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge willcarry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners areappointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.

- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.

The minimum duration of SEE is 02 hours

Suggested Learning Resources:

- **BOOK 1: "**MongoDB: The Definitive Guide", Kristina chodorow, 2nd ed O'REILLY, 2013.
- **BOOK 2: "***MongoDB in Action*" by KYLE BANKER et. al. 2nd ed, Manning publication, 2016
- **BOOK 3:** "MongoDB Complete Guide" by Manu Sharma 1st ed, bpb publication, 2023.
- **installation of MongoDB Video:** https://www.youtube.com/watch?v=dEm2AS5amyA
- **video on Aggregation:** https://www.youtube.com/watch?v=vx1C8EyTa7Y
- **MongoDB in action book Code download URL: h**ttps://www.manning.com/downloads/529
- **MongoDB Exercise URL:** https://www.w3resource.com/mongodb-exercises/

MERN

Semester:	**IV**	**CIE Marks**	**50**
Course Code	**AML23407D**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**1:0:2**	**Duration of SEE (hours):**	**03**
Type of Course	**AEC**	**Credits**	**02**

Course objectives:

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

Sl.NO	Experiments
1	Using MongoDB, create a collection called transactions in database usermanaged (drop if it already exists) and bulk load the data from a json file, transactions.json Upsert the record from the new file called transactions_upsert.json in Mongodb.
2	Query MongoDB with Conditions: [Create appropriate collection with necessary documents to answer the query] a. Find any record where Name is Somu b. Find any record where total payment amount (Payment.Total) is 600. c. Find any record where price (Transaction.price) is between 300 to 500. d. Calculate the total transaction amount by adding up Payment.Total in all records.
3	a. Write a program to check request header for cookies. b. write node.js program to print the a car object properties, delete the second property and get length of the object.
4	a. Read the data of a student containing usn, name, sem, year_of_admission from node js and store it in the mongodb b. For a partial name given in node js, search all the names from mongodb student documents created in Question(a)
5	Implement all CRUD operations on a File System using Node JS
6	Develop the application that sends fruit name and price data from client side to Node.js server using Ajax
7	Develop an authentication mechanism with email_id and password using HTML and Express JS (POST method)
8	Develop two routes: find_prime_100 and find_cube_100 which prints prime numbers less than 100 and cubes less than 100 using Express JS routing mechanism
9	Develop a React code to build a simple search filter functionality to display a filtered list based on the search query entered by the user.
10	Develop a React code to collect data from rest API.

Course outcomes (Course Skill Set):

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

- Apply the fundamentals of MongoDB, such as data modelling, CRUD operations, and basic queries to solve given problem.
- Use constructs of Express.js, including routing, software and constructing RESTful APIs to solve real world problems.
- Develop scalable and efficient RESTful APIs using NodeJS.
- Develop applications using React, including components, state, props, and JSX syntax.

Assessment Details (both CIE and SEE)

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

Continuous Internal Evaluation (CIE):

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

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

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students atthe beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-upwill be evaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed inthe syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge willcarry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners

jointly.

- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in - 60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.

The minimum duration of SEE is 02 hours

Suggested Learning Resources:

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

National Service Scheme (NSS)		Semester	3rd to 6th
Course Code	**NSK23408**	CIE Marks	**25*4 = 100**
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	------
Total Hours of Pedagogy	40 hour Practical Session +15 hour Planning	Total Marks	**25*4 = 100**
Examination nature (SEE)	Activities Report Evaluation by College NSS Officer at the end of every semester (3rd to 6th semester)		
Credits	NCMC – Non Credit Mandatory Course (Completion of the course shall be mandatory for the award of degree)		

Course objectives: National Service Scheme (NSS) will enable the students to:

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

General Instructions - Pedagogy :

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied social and cultural skills.
2. State the need for NSS activities and its present relevance in the society and Provide real-life examples.
3. Support and guide the students for self-planned activities.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
5. Encourage the students for group work to improve their creative and analytical skills.

National Service Scheme (NSS) – Contents

==========

1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.
2. Waste management– Public, Private and Govt organization, 5 R's.
3. Setting of the information imparting club for women leading to contribution in social and economic issues.
4. Water conservation techniques – Role of different stakeholders– Implementation.
5. Preparing an actionable business proposal for enhancing the village income and approach for implementation.
6. Helping local schools to achieve good results and enhance their enrolment in Higher/

technical/ vocational education.

7. Developing Sustainable Water management system for rural areas and implementation approaches.
8. Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swatch Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.
9. Spreading public awareness under rural outreach programs.(minimum5 programs).
10. Social connect and responsibilities.
11. Plantation and adoption of plants. Know your plants.
12. Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).
13. Govt. school Rejuvenation and helping them to achieve good infrastructure.

NOTE:

- Student/s in individual or in a group Should select any one activity in the beginning of each semester till end of that respective semester for successful completion as per the instructions of NSS officer with the consent of HOD of the department.
- At the end of every semester, activity report should be submitted for evaluation.

Distribution of Activities - Semester wise from 3rd to 6th semester

Sem	Topics / Activities to be Covered
3rd Sem for 25 Marks	1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing. 2. Waste management– Public, Private and Govt organization, 5 R's. 3. Setting of the information imparting club for women leading to contribution in social and economic issues.
4th Sem for 25 Marks	4. Water conservation techniques – Role of different stakeholders– Implementation. 5. Preparing an actionable business proposal for enhancing the village income and approach for implementation. 6. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.
5th Sem for 25 Marks	7. Developing Sustainable Water management system for rural areas and implementation approaches. 8. Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc. 9. Spreading public awareness under rural outreach programs.(minimum5 programs). 10. Social connect and responsibilities.
6th Sem for 25 Marks	11. Plantation and adoption of plants. Know your plants. 12. Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs). 13. Govt. school Rejuvenation and helping them to achieve good infrastructure.

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

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

6.	Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.	May be individual or team	Local government / private/ aided schools/Government Schemes officers/ etc…..	School selection/proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
7.	Developing Sustainable Water management system for rural areas and implementation approaches.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Governme nt Schemes officers/ campus etc…..	site selection/proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
8.	Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Governme nt Schemes officers/ campus etc…..	Group selection/proper consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
9.	Spreading public awareness under rural outreach programs.(minimum5 programs). ///// Social connect and responsibilities.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Governme nt Schemes officers/ campus etc…..	Group selection/proper consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
10.	Plantation and adoption of plants. Know your plants.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Governme nt Schemes officers/ campus etc…..	Place selection/proper consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

11.	Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).	May be individu al or team	Villages/ City Areas / Grama panchayat/ public associations/Governme nt Schemes officers/ campus etc…..	Place selection/proper consultation/Continu ous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
12.	Govt. school Rejuvenation and helping them to achieve good infrastructure.	May be individu al or team	Villages/ City Areas / Grama panchayat/ public associations/Governme nt Schemes officers/ campus etc…..	Place selection/proper consultation/Continu ous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

Plan of Action (Execution of Activities For Each Semester)

Sl.NO	Practice Session Description
1	**Lecture session by NSS Officer**
2	**Students Presentation on Topics**
3	**Presentation - 1 , Selection of topic, PHASE - 1**
4	**Commencement of activity and its progress - PHASE - 2**
5	**Execution of Activity**
6	**Execution of Activity**
7	**Execution of Activity**
8	**Execution of Activity**
9	**Execution of Activity**
10	**Case study based Assessment, Individual performance**
11	**Sector wise study and its consolidation**
12	**Video based seminar for 10 minutes by each student At the end of semester with Report.**

- In every semester from 3rd semester to 6th semester, Each student should do activities according to the scheme and syllabus.
- At the end of every semester student performance has to be evaluated by the NSS officer for the assigned activity progress and its completion.
- At last in 6th semester consolidated report of all activities from 3rd to 6th semester, compiled report should be submitted as per the instructions.

Course outcomes (Course Skill Set):

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

CO1: Understand the importance of his / her responsibilities towards society.

CO2: Analyse the environmental and societal problems/issues and will be able to design solutions for the same.

CO3: Evaluate the existing system and to propose practical solutions for the same for sustainable development.

CO4: Implement government or self-driven projects effectively in the field.

CO5: Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

Assessment Details for CIE (both CIE and SEE)

Weightage	**CIE – 100%**	• Implementation strategies of the project (NSS work). • The last report should be signed by NSS Officer, the HOD and principal. • At last report should be evaluated by the NSS officer of the institute. • Finally the consolidated marks sheet should be sent to the university and also to be made available at LIC visit.
Presentation - 1 Selection of topic, PHASE - 1	10 Marks	
Commencement of activity and its progress - PHASE - 2	10 Marks	
Case study based Assessment Individual performance	10 Marks	
Sector wise study and its consolidation	10 Marks	
Video based seminar for 10 minutes by each student At the end of semester with Report.	10 Marks	
Total marks for the course in each semester	**50 Marks**	

Marks scored for 50 by the students should be Scale down to 25 marks In each semester for CIE entry in the VTU portal.

25 marks CIE entry will be entered in University IA marks portal at the end of each semester 3rd to 6th sem, Report and assessment copy should be made available in the department semester wise.

Students should present the progress of the activities as per the schedule in the prescribed practical session in the field. There should be positive progress in the vertical order for the benefit of society in general.

Suggested Learning Resources:

Books :

1. **NSS Course Manual,** Published by NSS Cell, VTU Belagavi.
2. Government of Karnataka, NSS cell, activities reports and its manual.
3. Government of India, nss cell, Activities reports and its manual.

Semester: IV

PHYSICAL EDUCATION (SPORTS & ATHLETICS) – II						
Course Code	**:**	PEK23408		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	0:0:2		**SEE**	**:**	000
Total Hours	**:**	24 P				

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

1. Understand the ethics and moral values in sports and athletics
2. Perform in the selected sports or athletics of student's choice.
3. Understand the roles and responsibilities of organisation and administration of sports and games.

Module I : Ethics and Moral Values **4 Hours**

A. Ethics in Sports
B. Moral Values in Sports and Games

Module II : Specific Games (Any one to be selected by the student) **16 Hours**

A. Volleyball – Attack, Block, Service, Upper Hand Pass and Lower hand Pass.
B. Athletics (Track Events) – Any event as per availability of Ground.

Module III: Role of Organisation and administration **4 Hours**

Scheme and Assessment for auditing the course and Grades:

Sl. No.	Activity	Marks
1.	Participation of student in all the modules	20
2.	Quizzes – 2, each of 15 marks	30
3.	Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	50
	Total	**100**

Yoga		Semester	III – VI sem
Course Code	**YOK23408**	CIE Marks	100/sem
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	000
Total Hours of Pedagogy per semester	24 - 28 hours (Theory + practical)	Total Marks	100/sem
Examination nature (SEE)	**Objective type Theory / Practical / Viva-Voce**		

Course objectives:

1) To enable the student to have good health.
2) To practice mental hygiene.
3) To possess emotional stability.
4) To integrate moral values.
5) To attain higher level of consciousness.

The Health Benefits of Yoga

The benefits of various yoga techniques have been supposed to improve

- body flexibility,
- performance,
- stress reduction,
- attainment of inner peace, and
- self-realization.

The system has been advocated as a complementary treatment to aid the healing of several ailments such as

- coronary heart disease,
- depression,
- anxiety disorders,
- asthma, and
- extensive rehabilitation for disorders including musculoskeletal problems and traumatic brain injury.

The system has also been suggested as behavioral therapy for smoking cessation and substance abuse (including alcohol abuse).

If you practice yoga, you may receive these physical, mental, and spiritual benefits:

- Physical
    1. Improved body flexibility and balance
    2. Improved cardiovascular endurance (stronger heart)
    3. Improved digestion
    4. Improved abdominal strength
    5. Enhanced overall muscular strength
    6. Relaxation of muscular strains
    7. Weight control
    8. Increased energy levels
    9. Enhanced immune system
- Mental
    1. Relief of stress resulting from the control of emotions
    2. Prevention and relief from stress-related disorders
    3. Intellectual enhancement, leading to improved decision-making skills
- Spiritual
    1. Life with meaning, purpose, and direction
    2. Inner peace and tranquility
    3. Contentment

Yoga Syllabus

Semester IV

Patanjali's Ashtanga Yoga, its need and importance.
Yama :Ahimsa, satya, asteya, brahmacarya, aparigraha
Niyama :shoucha, santosh, tapa, svaadhyaya, Eshvarapranidhan

Suryanamaskar12 count- 4 rounds of practice

Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits of each asana
Different types of Asanas

a. Sitting 1. Sukhasana
   2. Paschimottanasana
b. Standing 1. Ardhakati Chakrasana
   2. Parshva Chakrasana
c. Prone line 1. Dhanurasana
d. Supine line 1. Halasana
   2. Karna Peedasana

Meaning, importance and benefits of Kapalabhati.
40 strokes/min 3 rounds
Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama
Pranayama – 1. Suryanuloma –Viloma 2. Chandranuloma-Viloma 3. Suryabhedana
4. Chandra Bhedana 5. Nadishodhana

Course outcomes (Course Skill Set):
At the end of the course, the student will be able to:

- Understand the meaning, aim and objectives of Yoga.
- Perform Suryanamaskar and able to Teach its benefits.
- Understand and teach different Asanas by name, its importance, methods and benefits.
- Instruct Kapalabhati and its need and importance.
- Teach different types of Pranayama by its name, precautions, procedure and uses
- Coach different types of Kriyas, method to follow and usefulness.

Assessment Details (both CIE and SEE)

- Students will be assessed with internal test by a. Multiple choice questions b. Descriptive type questions (Two internal assessment tests with 25 marks/test)
- Final test shall be conducted for whole syllabus for 50 marks.
- Continuous Internal Evaluation shall be for 100 marks (including IA test)

Suggested Learning Resources:
Books:

1. **Yogapravesha in Kannada by Ajitkumar**
2. **Light on Yoga by BKS Iyengar**
3. **Teaching Methods for Yogic practices by Dr. M L Gharote & Dr. S K Ganguly**
4. **Yoga Instructor Course hand book published by SVYASA University, Bengaluru**
5. **Yoga for Children –step by step – by Yamini Muthanna**

Web links and Video Lectures (e-Resources): Refer links

6. **https://youtu.be/KB-TYlgd1wE**
7. **https://youtu.be/aa-TG0Wg1Ls**

ALGORITHMS LABORATORY

(Common to CSE/ISE/AD/AM/CI)

Course Code:	**CSEL23409**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**0:0:2**	**SEE Marks**	**50**
No. of Credits	**1**	**Examination Hours**	**3**

Sl. No.	Experiments/Programs
1	a. Implement naïve String matching algorithm using Brute Force Approach b. Implement and analyze iterative and recursive binary search algorithm using divide and conquer method .
2	Sort a given set of n integer elements using Merge Sort method and compute its time complexity. Demonstrate this algorithm using Divide-and-Conquer method.
3	Sort a given set of n integer elements using Quick Sort method and compute its time complexity. Demonstrate this algorithm using Divide-and-Conquer method.
4	a. Incorporate the array data structure and demonstrate whether a given unweighted graph is connected or not using DFS method. b. Implement the graph traversal technique using BFS method to print all the nodes reachable from a given starting node in an unweighted graph.
5	Demonstrate how to obtain the Topological ordering of vertices in a given digraph.
6	Implement Horspool's String matching algorithm.
7	Compute the Transitive Closure for a given directed graph using Warshall's algorithm.
8	For a given weighted graph, construct an All-Pairs Shortest Path using Floyds algorithm .
9	Implement 0/1 Knapsack problem using Dynamic Programming Memory Functions technique.
10	Find Minimum Cost Spanning Tree for a given weighted graph using Prims and Kruskal's algorithm.
11	From a given vertex in a weighted connected graph, determine the Single Source Shortest Paths using Dijkstra's algorithm
12	Demonstrate the working of back tracking approach for solving N-Queen's problem.

Course Outcomes:

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

CO1	Interpret the brute-force, divide-and-conquer paradigms
CO2	Recognize the design techniques for graph traversal and String Matching problems using representative algorithms
CO3	Demonstrate the greedy technique, dynamic programming paradigm as to when an algorithmic design situation calls for it
CO4	Illustrate the Backtracking algorithm design paradigms

Text Books:

1. Introduction to the Design and Analysis of Algorithms, Anany Levitin, University, 3rd Edition, 2012, Pearson, ISBN 13: 978-0-13-231681-1.
2. Introduction to Algorithms, Cormen T.H., Leiserson C.E., Rivest R.L., Stein C., 3rd Edition, 2010, PHI, ISBN:9780262033848.

Reference Books:

1. Computer Algorithms, Horowitz E., Sahani S., Rajasekharan S., 2nd Edition, 2006, Galgotia Publications, ISBN:9780716783169.

Mapping of CO-PO:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	3	-	-	-	-	-	-	2	3	-
CO2	3	3	3	-	3	-	-	-	-	-	-	2	3	-
CO3	3	3	3	-	3	-	-	-	-	-	-	2	3	-
CO4	3	3	3	-	3	-	-	-	-	-	-	2	3	-
Average	**3**	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**-**

Low-1: Medium-2: High-3

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

ENGINEERING ECONOMICS & MANAGEMENT

Semester:	**V**	**CIE Marks**	**50**
Course Code	**AML23501**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**Duration of SEE (hours):**	**03**
Type of Course	**HSMS**	**Credits**	**03**

Prerequisites (if any): No

Course Learning Objectives: Upon successful completion of this course, student will be able to

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

Module 1	No. of Hours	RBT Level
Fundamentals of Economics: Wealth, Welfare and Scarce Definitions of Economics; Micro and Macro Economics; Demand- Law of Demand, Elasticity of Demand, Types of Elasticity and Factors determining price elasticity of Demand: Utility- Law of Diminishing Marginal Utility, its limitations and exceptions.	08	L2
Module 2		
Forms of Business Organizations: Features, merits and demerits of Sole Proprietorship, Partnership and Joint Stock Company- Public Enterprises and their types.	08	L2
Module 3		
Introduction - Meaning, nature and characteristics of management, scope and Functional areas of management, goals of management, levels of management, brief overview of evolution of management theories,. Planning- Nature, importance, types of plans, steps in planning, Organizing- nature and purpose, types of Organization, Staffing- meaning, process of recruitment and selection	08	L2
Module 4		
Directing and controlling- meaning and nature of directing, leadership styles, motivation Theories, Communication- Meaning and importance, Coordinationmeaning and importance, Controlling- meaning, steps in controlling, methods of establishing control	08	L2
Module 5		
Entrepreneur – meaning of entrepreneur, characteristics of entrepreneurs, classification and types of entrepreneurs, various stages in entrepreneurial process, role of entrepreneurs in economic development, entrepreneurship in India and barriers to entrepreneurship. Identification of business opportunities, market feasibility study, technical feasibility study, financial feasibility study and social feasibility study.	08	L3

Course Outcomes:

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

CO1	Understand needs, functions, roles, scope and evolution of Management
CO2	Understand importance, purpose of Planning and hierarchy of planning and also analyze its types
CO3	Discuss Decision making, Organizing, Staffing, Directing and Controlling
CO4	Understand various interest rate methods and implement the suitable one

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO1	3	2	2			2						1	1	1
CO2	3	3	2		2							1	3	2
CO3	3	3	2		1							1	3	2
CO4	3	3	3	3	3	1						1	3	3
Average	3	2.75	2.25	3	2	1						1	2.5	2

High-3: Medium-2: Low-1

Textbooks:

1. Principles of Management by Tripathy and Reddy
2. Engineering Economics, R.Paneerselvam, PHI publication.

Reference Books:

1. Management Fundamentals - Concepts, Application, Skill Development - Robers Lusier – Thomson
2. Basics of Engineering Economy, Leland Blank & Anthony Tarquin, McGraw Hill Publication (India) Private Limited.
3. Fundamentals of Management: Essential Concepts and Applications, Pearson Education, Robbins S.P. and Decenzo David A.

E-Books / Web References:

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

MOOCs:

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

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

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

	Components	Marks	Total
CIE	CIE TEST 1	40	50
	CIE TEST 2	40	
	CIE TEST 3	40	
	Assignment	10	
SEE	SEE	Semester End Exam	50
		Grand Total	100

Scheme of Examination (SEE):

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

MACHINE LEARNING PRACTICES

Semester:	**V**	**CIE Marks**	**50**
Course Code	**AML23502**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**3:0:2**	**Duration of SEE (hours):**	**03**
Type of Course	**IPC**	**Credits**	**04**

Prerequisites (if any): Machine Learning Foundations and Machine Learning Techniques

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
CLO1	Develop a comprehensive understanding of machine learning by planning and executing an end-to-end project using scikit-learn
CLO2	Develop a foundational understanding of graph theory concepts and algorithms, and master regression techniques using scikit-learn
CLO3	Understand and implement polynomial regression and regularized models to handle non-linearity and prevent over fitting, using scikit-learn for polynomial feature generation
CLO4	Master logistic regression, binary and multiclass classification using scikit-learn
CLO5	Equip students with comprehensive knowledge and practical skills in artificial neural networks for multiclass classification

Module 1	No. of Hours	RBT Level
End-to-end machine learning project on scikit-learn: Introduction to scikit-learn and Project Planning, Project Planning and Workflow, Data Exploration and Preprocessing, Feature Engineering and Selection, Model Selection and Training, Model Evaluation and Interpretation, End-to-End Project Implementation.	**10**	**L3**
Module 2		
Graph Theory: Introduction to Graph Theory, Shortest Path Algorithms, Minimum Spanning Tree, Graph Connectivity-Connected Components, Planar Graphs. Regression on scikit-learn - Linear regression Gradient descent - batch and stochastic: Overview of regression analysis, Ordinary Least Squares (OLS) method	**10**	**L3**
Module 3		
Polynomial regression: Introduction to polynomial regression, The need for polynomial regression (handling non-linearity), Polynomial feature generation, Fitting polynomial regression models using scikit-learn, Evaluating polynomial regression models, Regularized models: Introduction to over fitting and under fitting, Need for regularization, Types of regularization: L1 regularization (Lasso), L2 regularization (Ridge), Elastic Net (combination of L1 and L2), Implementing regularized models using scikit-learn-Using Ridge, Lasso, and Elastic Net classes, Hyper parameter tuning (alpha parameter), Cross-validation techniques for model selection.	**10**	**L3**
Module 4		
Logistic regression. Classifications on scikit-learn - Binary classifier, Classification on scikit-learn - Multiclass classifier, Decision Trees, Ensemble Learning: Introduction to ensemble learning, Types of ensemble methods: Bagging, Boosting, and Bagging: Bootstrap Aggregating, Boosting: Adaboost, Gradient Boosting, and Random Forests: Building random forests: ensemble of decision trees. **Case study:** Bagging for improved stability and accuracy, Boosting for difficult classification tasks	**10**	**L3**
Module 5		
Artificial Neural networks: Multiclass classification. Architecture of a single-layer perceptron, Multilayer perceptron (MLP) and feed forward neural networks, Softmax Regression, Designing		

Neural Network Architectures, Training Neural Networks, Back propagation and Optimization. **Implementing Softmax Regression: Implementation using Python (NumPy, scikit-learn), Case study:** Softmax regression for image classification Implementing a Simple ANN for Multiclass Classification: Step-by-step implementation using Python (TensorFlow, Keras), Visualization of training process and results, Case study: Handwritten digit recognition (MNIST dataset)	**10**	**L4**

Course Outcomes:

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

CO1	Execute an end-to-end machine learning project using scikit-learn, encompassing all stages from data exploration and preprocessing to model training, evaluation, and final implementation.
CO2	Apply graph theory algorithms and concepts, and perform regression analysis using scikit-learn
CO3	Implementing polynomial regression and regularized models using scikit-learn, effectively addressing non-linearity and overfitting
CO4	Develop proficiency in logistic regression, binary and multiclass classification using scikit-learn
CO5	Implementation and application of artificial neural networks for multiclass classification, using Python (NumPy, scikit-learn, TensorFlow, Keras), with hands-on experience in image classification.

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**
CO1	2	2	2		3					3		2		3
CO2	2	2	2		3					3		2		3
CO3	3	2	3		3				3	3		2		2
CO4	3	2	3		3				3	3		2		3
CO5	3	3	3		3				3	3		2		2
Average	3	2	3		3				3	3		2		3

High-3: Medium-2: Low-1

Text Books:

1. "Introduction to Machine Learning with Python" by Andreas C. Müller and Sarah Guido
2. "Introduction to Graph Theory" by Douglas B. West

Reference Books:

1. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron
2. "Neural Networks and Deep Learning: A Textbook" by Charu C. Aggarwal

E-Books / Web References:

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

MOOCs:

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

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

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

	Component	**Marks**	**Total Marks**
CIE	CIE Test-1	30	50
	CIE Test-2	30	
	CIE Test-3	30	
	Laboratory	20	
SEE	Semester End Examination	100	50
	Grand Total		100

Scheme of Examination (SEE):

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

PRACTICAL COMPONENT-IPC LAB

1. End-to-End Project Implementation **Case Study: Predictive Modeling**
   - Step-by-step implementation of an end-to-end machine learning project
   - Dataset selection and preprocessing
   - Model training, evaluation, and deployment
2. Implementation of linear regression using scikit-learn

   Evaluating model performance (R-squared, Mean Absolute Error, Mean Squared Error, Root Mean Squared Error)
3. Practical Implementation Using Python and scikit-learn
   - Implementing linear regression using scikit-learn
   - Implementing gradient descent algorithms from scratch
   - Visualizing data and regression results using Matplotlib and Seaborn
   - Best practices for building and evaluating regression models
   - Hands-on exercises and coding assignments
4. Applying regression techniques to real-world datasets
5. Binary classification on medical diagnosis dataset
6. Multiclass classification for handwritten digit recognition
7. End-to-end machine learning project including data preprocessing, model building, evaluation, and visualization

BIG DATA ANALYTICS

Semester:	**V**	**CIE Marks**	**50**
Course Code	**AML23503**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**4:0:0**	**Duration of SEE (hours):**	**03**
Type of Course	**PC**	**Credits**	**04**

Prerequisites (if any): Unix Commands, Unix Operating System, Python, Java

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	Understand the importance of big data technologies used for storage, analysis, and manipulation ofdata.
2	Analyze and explore the Hadoop framework and Hadoop Distributed File system
3	Understand various tools like Hive and Pig for Big Data Analytics.
4	Provide insights into Hadoop framework and management functionalities.
5	Provide exposure to Hadoop ecosystem tools and techniques for big data processing.

Module 1	No. of Hours	RBT Level
Introduction to Big Data Analytics: Big Data, Scalability and Parallel Processing, Designing Data Architecture, Data Sources, Quality, Pre-Processing and Storing, Data Storage and Analysis. **SLT**: Applications of Big Data in the real world.	**10**	**L2**
Module 2		
Introduction to Hadoop: Introduction, Hadoop and its Ecosystem, Hadoop Distributed File System, MapReduce Framework and Programming Model, Hadoop Yarn, Hadoop Ecosystem Tools. **Hadoop Distributed File System Basics:** HDFS Design Features, Components SLT: HDFS User Commands.	**10**	**L3**
Module 3		
NoSQL Big Data Management, MongoDB and Cassandra: Introduction, NoSQL Data Store, NoSQL Data Architecture Patterns, NoSQL to Manage Big Data, Shared-Nothing Architecture for Big Data Tasks, MongoDB, Databases. SLT: Cassandra Databases.	**10**	**L3**
Module 4		
MapReduce, Hive and Pig: Introduction, MapReduce Map Tasks, Reduce Tasks and MapReduce Execution, Composing MapReduce for Calculations and Algorithms, Hive, HiveQL. **SLT**: Pig	**10**	**L3**
Module 5		
Spark: Installing Spark, An Example: Spark Applications, Jobs, Stages, and Tasks, A Scala Standalone Application, A Java Example, A Python Example, Resilient Distributed Datasets: Creation, Transformations and Actions, Persistence, Serialization, Shared Variables: BroadcastVariables, Accumulators, Anatomy of a Spark Job: Run: Job Submission, DAG Construction. **SLT**: Task Scheduling, Task Execution. **Textbook 2**: Ch: 1	**10**	**L3**

Course Outcomes:

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

CO1	**Understand** the fundamentals of Big Data analytics
CO2	**Apply** the concept of HDFS, Map reduce for storing and processing of big data
CO3	**Demonstrate** the use of any modern Hadoop tool in team or individually to perform the data analytics
CO4	**Evaluate** the performance and efficiency of the installed tools and platform
CO5	**Develop** advanced Big Data programs that solve specific data processing challenges.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	1		1	1			2		2			2	
CO2	3	1		0	3			2		2			2	
CO3	3	1		3	3			2		2			2	
CO4	3	1		3	3			2		2			2	
CO5	3	1		1	3			2		2			2	
Average	2.8	1		2.3	2.6			2		2			2	

High-3: Medium-2: Low-1

Textbooks:

1. Raj Kamal, Preeti Saxena, “Big Data Analytics, Mc graw Hill, 2019
2. Tom White, Hadoop: The Definitive Guide, 4th edition, O’Reilly.

Reference Books:

1. Big Data: Black Book, DT Editorial Services, Wiley India Pvt Ltd, 2016 Edition
2. Arshdeep Bahga, Vijay Madisetti, "Big Data Analytics: A Hands-On Approach", 1st Edition, VPT Publications, 2018. ISBN-13: 978-0996025577
3. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.
4. Tom White, Hadoop: The Definitive Guide, O’Reilly Media, Third Edition, 2012.
5. Dan C. Marinescu, Cloud Computing Theory and Practice, Morgan Kaufmann, Elsevier 2013.
6. Mining of massive Dataset , by Jure Leskovec , Anand Rajaraman , Jeffrey David Ullman ,Stanford University, 3rd Edition.

E-Books / Web References:

1. Big Data Now http://cdn.oreillystatic.com/ oreilly/radarreport/ 0636920028307/ Big_Data_Now_2012_ Edition.pdf
2. Bigdata Analytics with Hadoop: https://www.packtpub.com/free-ebook/big-data-analytics-with-hadoop-3/9781788628846

MOOCs:

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

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and

flexibility) of individual faculty and enables them to create innovative pedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partialreproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box forproblem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

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

	Component	**Marks**	**Total Marks**
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignment	10	
SEE	Semester End Examination	100	50
	Grand Total		100

Scheme of Examination (SEE):

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

Big Data Analytics LAB

Semester:	**V**	**CIE Marks**	**50**
Course Code	**AMLL23504**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**0:0:2**	**Duration of SEE (hours):**	**03**
Type of Course	**PCL**	**Credits**	**01**

Prerequisites (if any): Unix Commands, Unix Operating System, Python.

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	Familiarization and working with different big data frameworks and platform.
2	Execution of map-reduce program using java and python
3	Implementation of a Machine learning algorithm in Spark.

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

Course Outcomes: Upon successful completion of this course, student will be able to

Sl. No	Course Objectives (CO)
1	Implement Hadoop-Map reduce concepts using python

2	Implement spark concepts using python
3	Apply Machine Learning algorithms to solve real-world problems.
4	Implement Data visualization concepts using plotly

Conduct of Practical Examination:

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

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation

Textbooks:

1. Raj Kamal, Preeti Saxena, "Big Data Analytics, Mc graw Hill, 2019
2. Tom White, Hadoop: The Definitive Guide, 4th edition, O'Reilly.

Reference Books:

1. Big Data: Black Book, DT Editorial Services, Wiley India Pvt Ltd, 2016 Edition
2. Arshdeep Bahga, Vijay Madisetti, "Big Data Analytics: A Hands-On Approach", 1st Edition, VPT Publications, 2018. ISBN-13: 978-0996025577
3. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.
4. Tom White, Hadoop: The Definitive Guide, O'Reilly Media, Third Edition, 2012.
5. Dan C. Marinescu, Cloud Computing Theory and Practice, Morgan Kaufmann, Elsevier 2013.
6. Mining of massive Dataset , by Jure Leskovec , Anand Rajaraman , Jeffrey David Ullman ,Stanford University, 3rd Edition.

E-Books / Web References:

1. Big Data Now http://cdn.oreillystatic.com/ oreilly/radarreport/ 0636920028307/ Big_Data_Now_2012_ Edition.pdf
2. Bigdata Analytics with Hadoop: https://www.packtpub.com/free-ebook/big-data-analytics-with-hadoop-3/9781788628846

MOOCs:

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

Mapping of CO-PO:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	3					1		1		2
CO2	3	3	1	1	3					1		1		2
CO3	3	3	1	1	3					1		1		2
CO4	3	3	1	1	3					1		1		2
AVG	3	3	1	1	3					1		1		2

DEVOPS ESSENTIALS

Semester:	**V**	**CIE Marks**	**50**
Course Code	**AML23505A**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**Duration of SEE (hours):**	**03**
Type of Course	**PEC**	**Credits**	**03**

Prerequisites (if any):

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	Understand the key concepts and principles of DevOps
2	Develop proficiency in Cloud Computing and Virtualization
3	Learn GIT workflows for effective version control in software projects
4	Apply agile principles to a range of decision possibilities
5	Acquire skills to work with Docker, understanding its technology

Module 1	No. of Hours	RBT Level
Introduction to DevOps: What Is Devops, History of Devops, Devops definition, DevOps Main Objectives, DevOps and Software Development Life Cycle-Waterfall Model, Agile Model, DevOps Technical Challenges, DevOps Tools	**8**	**L2**
Module 2		
DevOps On Cloud: Essentials on Cloud Computing. Cloud and Virtualization architecture, Cloud deployment architecture, Cloud Providers-An Overview, Why we need DevOps on Cloud? Introduction to Amazon Web Services	**8**	**L3**
Module 3		
GIT: A Version controlling tool: Introduction, Essentials of GIT in industry. How to setup GET, Working with various commands in GIT, Recording Changes to the Repository, Viewing the Commit History, Undoing Things, Working with Remotes, Branching and Merging in Git, Git workflows	**8**	**L3**
Module 4		
Jenkins: Essentials of Continuous Integration, Know about Jenkins and its architecture in detail, Jenkins tool Management in detail, Know about User management in Jenkins. Authentication, Authorization, Adding a slave node to Jenkins, Building Delivery Pipeline, Notification settings in Jenkins, Plugin management in Jenkins	**8**	**L3**
Module 5		
Docker: Introduction-Real-world Shipping Transportation Challenges, Introducing Docker and its technology, Understanding of Docker images and containers, Working with container-How to Share and copy a container, Container Life Cycle, How to use Base Image and customize o Creation of Docker File, How to Publish Image on Docker Hub, Introduction to Docker Networking, Docker Swarm-An introduction	**8**	**L3**

Course Outcomes:

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

CO1	Interpret the principles of DevOps
CO2	Understand the usage of Cloud on DevOps
CO3	Use GIT tool for workflows
CO4	Use Jenkins tool for Continuous Integration and Continuous Deliver
CO5	Implement DevOps principles using Docker

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2	1	3							2	2	
CO2	3	3	2	1	3							2	2	
CO3	3	1	2	1	3							2	2	
CO4	3	1	3	3	3							2	2	
CO5	3	2	3	3	3							2	2	
Avg	3	2	3	2	3							2	2	

High-3: Medium-2: Low-1

Textbooks:

1. Mikael Krief, “Learning DevOps: The complete guide to accelerate collaboration with Jenkins, Kubernetes, Terraform and Azure DevOps”, Packt Publishing Limited, 2019.

Reference Books:

1. DevOps: Continuous Delivery, Integration, and Deployment with DevOps: Dive-Sricharan Vadapalli, Packt, 2018.
2. DevOps: Puppet, Docker, and Kubemetes -Thomas Uphill, John Arundel, Neependra Khare, Hideto Saito, Hui-Chuan Chloe Lee, Ke-Jou Carol Hsu, Packt, 2017

Infosys Springboard:

1. The Language of *DevOps*: *DevOps* Tools & Processes
2. *DevOps* with Azure
3. Mastering *DevOps*

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

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

	Component	Marks	Total Marks
CIE	CIE Test-1	30	50
	CIE Test-2	30	
	CIE Test-3	30	
	Assignment	20	
SEE	Semester End Examination	100	50
	Grand Total		100

Scheme of Examination (SEE):

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

MICROCONTROLLER AND EMBEDDED SYSTEMS

Semester:	**V**	**CIE Marks**	**50**
Course Code	**AML23505B**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**Duration of SEE (hours):**	**03**
Type of Course	**PEC**	**Credits**	**03**

Prerequisites: Basic understanding of digital and analog circuits, C programming skills.

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	Understand the fundamentals of ARM-based systems, including programming modules with registers and the CPSR.
2	Use the various instructions to program the ARM controller.
3	Program various embedded components using the embedded C program
4	Identify various components, their purpose, and their application to the embedded system's applicability.
5	Understand the embedded system's real-time operating system and its application in IoT.

Module 1	No. of Hours	RBT Level
Microprocessors versus Microcontrollers, ARM Embedded Systems: The RISC design philosophy, The ARM Design Philosophy, Embedded System Hardware, Embedded System Software. **ARM Processor Fundamentals:** Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts, and the Vector Table, Core Extensions	8	**L2**
Module 2		
Introduction to the ARM Instruction Set: Data Processing Instructions, Branch Instructions, Software Interrupt Instructions, Program Status Register Instructions, Coprocessor Instructions, Loading Constants. **C Compilers and Optimization:** Basic C Data Types, C Looping Structures, Register Allocation, Function Calls, Pointer Aliasing	8	**L2**
Module 3		
C Compilers and Optimization: Structure Arrangement, Bit-fields, Unaligned Data and Endianness, Division, Floating Point, Inline Functions and Inline Assembly, Portability Issues. **ARM programming using Assembly language:** Writing Assembly code, Profiling and cycle counting, instruction scheduling, Register Allocation, Conditional Execution, Looping Constructs	8	**L3**
Module 4		
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 including all types of processor/controller, Memory, Sensors, Actuators, LED, 7 segment LED display, stepper motor, Keyboard, Push button switch, Communication Interface (onboard and external types), Embedded firmware, Other system components.	8	**L3**
Module 5		

RTOS and IDE for Embedded System Design: Operating System basics, Types of operating systems, Task, process and threads (Only POSIX Threads with an example program), Thread preemption, Multiprocessing and Multitasking, Task Communication (without any program), Task synchronization issues – Racing and Deadlock, Concept of Binary and counting semaphores (Mutex example without any program), How to choose an RTOS, Integration and testing of Embedded hardware and firmware, Embedded system Development Environment – Block diagram (excluding Keil), Disassembler/decompiler, simulator, emulator and debugging techniques, target hardware debugging, boundary scan.	8	**L3**

Course Outcomes:

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

CO1	Explain C-Compilers and optimization
CO2	Describe the ARM microcontroller's architectural features and program module.
CO3	Apply the knowledge gained from programming on ARM to different applications.
CO4	Program the basic hardware components and their application selection method.
CO5	Demonstrate the need for a real-time operating system for embedded system applications

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	1										1	3	1
CO2	3	1										1	3	1
CO3	3	3	3	3	3							1	3	1
CO4	3	3	3	3	3							1	3	1
CO5	3	3	3	3	3							1	3	1

High-3: Medium-2: Low-1

Text Book:

1. Andrew N Sloss, Dominic Symes and Chris Wright, ARM system developers guide, Elsevier, Morgan Kaufman publishers, 2008.
2. Shibu K V, Introduction to Embedded Systems, Tata McGraw Hill Education, Private Limited, 2nd Edition.

Reference Books:

1. Raghunandan. G.H, Microcontroller (ARM) and Embedded System, Cengage learning Publication,2019
2. The Insider's Guide to the ARM7 Based Microcontrollers, Hitex Ltd.,1st edition, 2005.
3. Steve Furber, ARM System-on-Chip Architecture, Second Edition, Pearson, 2015.
4. Raj Kamal, Embedded System, Tata McGraw-Hill Publishers, 2nd Edition, 2008

E-Books / Web References:

1. https://archive.nptel.ac.in/courses/106/105/106105193/
2. NPTEL Lecture https://nptel.ac.in/courses/microcontroller

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have beenencouraged to use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.Typical evaluation pattern for regular courses is shown in Table 1:

	Components	**Marks**	**Total**
CIE	CIE TEST 1	40	50
	CIE TEST 2	40	
	CIE TEST 3	40	
	Assignment	10	
SEE	SEE	Semester End Exam	50
		Grand Total	100

Scheme of Examination (SEE):

• The SEE question paper will be set for 100 marks and the marks scored will be proportionatelyreduced to 50.

• The question paper will have ten full questions carrying 20 marks each.

• There will be two full questions (with a maximum of four sub questions) from each module.

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

INTRODUCTION TO INTELLIGENCE NETWORKS

Semester:	**V**	**CIE Marks**	**50**
Course Code	**AML23505C**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**Duration of SEE (hours):**	**03**
Type of Course	**PEC**	**Credits**	**03**

Prerequisites (if any):

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	Understand about the fundamentals of Internet of Things and its building blocks along with their characteristics.
2	Understand the recent application domains of IoT in everyday life.
3	Discuss the concepts, characteristics, delivery models and benefits of cloud computing
4	Explore the key technical, organizational and compliance challenges of cloud computing

Module 1	No. of Hours	RBT Level
Basics of Networking: Introduction, Network Types, Layered network models Emergence of IoT: Introduction, Evolution of IoT, Enabling IoT and the Complex Interdependence of Technologies, IoT Networking Components Textbook 1: Chapter 1- 1.1 to 1.3 Chapter 4 – 4.1 to 4.4	8	**L2**
Module 2		
IoT Sensing and Actuation: Introduction, Sensors, Sensor Characteristics, Sensorial Deviations, Sensing Types, Sensing Considerations, Actuators, Actuator Types, Actuator Characteristics. Textbook 1: Chapter 5 – 5.1 to 5.9	8	**L2**
Module 3		
IoT Processing Topologies and Types: Data Format, Importance of Processing in IoT, Processing Topologies, IoT Device Design and Selection Considerations, Processing Offloading. Textbook 1: Chapter 6 – 6.1 to 6.5	8	**L3**
Module 4		
Introduction, Cloud Infrastructure: Cloud computing, Cloud computing delivery models and services, Ethical issues, Cloud vulnerabilities, Cloud computing at Amazon, Cloud computing the Google perspective, Microsoft Windows Azure and online services, Open-source software platforms for private clouds, Cloud storage diversity and vendor lock-in, Energy use and ecological impact, Service level agreements, User experience and software licensing. Exercises and problems.	8	**L3**

Module 5		
Cloud Computing: Application Paradigms.: Challenges of cloud computing, Architectural styles of cloud computing, Workflows: Coordination of multiple activities, Coordination based on a state machine model: The Zookeeper, The Map Reduce programming model, A case study: The Gre The Web application, Cloud for science and engineering, High-performance computing on a cloud, Cloud computing for Biology research, Social computing, digital content and cloud computing.	8	**L3**

Course Outcomes:

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

CO1	Describe the evolution of IoT, IoT networking components, and addressing strategies in IoT.
CO2	Classify various sensing devices and actuator types.
CO3	Demonstrate the processing in IoT.
CO4	Compare the strengths and limitations of cloud computing
CO5	Identify the architecture, infrastructure and delivery models of cloud computing

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	1										1	3	1
CO2	3	1										1	3	1
CO3	3	3	3	3	3							1	3	1
CO4	3	3	3	3	3							1	3	1
CO5	3	3	3	3	3							1	3	1

High-3: Medium-2: Low-1

Text Book:

1. Sudip Misra, Anandarup Mukherjee, Arijit Roy, “Introduction to IoT”, Cambridge University Press 2021.
2. Cloud Computing:Theory and Practice, Dan C Marinescu Elsevier (MK), 2013
3. Computing Principles and Paradigms, RajkumarBuyya , James Broberg, Andrzej Goscinsk,i Willey, 2014.

Reference Books:

1. S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0.
2. Vijay Madisetti and Arshdeep Bahga, “Internet of Things (A Hands-on-Approach)”,1st Edition, VPT, 2014.
3. CRC Press.Cloud Computing Implementation, Management and Security John W Rittinghouse, James F Ransome, CRC Press, 2013.**E-Books / Web References:**

MOOCs:

1. https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-cs31/
2. https://www.digimat.in/nptel/courses/video/106105167/L01.html

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have beenencouraged to use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

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

	Component	**Marks**	**Total Marks**
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	QUIZ/Assignment	10	
SEE	Semester End Examination	100	50
	Grand Total		100

Note: CIE pattern for courses like Drawing and Laboratories can be decided by the respectiveBoard of Studies and can be given here.

Scheme of Examination (SEE):

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

COMPUTER NETWORKS AND SECURITY

Semester:	**V**	**CIE Marks**	**50**
Course Code	**AML23505D**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**Duration of SEE (hours):**	**03**
Type of Course	**PEC**	**Credits**	**03**

Prerequisites (if any): Computer networks

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	Demonstration of application layer protocols
2	Discuss transport layer services and understand UDP and TCP protocols
3	Explain routers, IP and Routing Algorithms in network layer
4	Disseminate the Wireless and Mobile Networks covering IEEE 802.11 Standard
5	Illustrate concepts of Multimedia Networking, Security and Network Management

Module 1	No. of Hours	RBT Level
Application Layer: Principles of Network Applications: Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the Internet, Application-Layer Protocols. The Web and HTTP: Overview of HTTP, Non-persistent and Persistent Connections, HTTP Message Format, User-Server Interaction: Cookies, Web Caching, The Conditional GET, File Transfer: FTP Commands & Replies, Electronic Mail in the Internet: SMTP, Comparison with HTTP, Mail Message Format, Mail Access Protocols, DNS; The Internet's Directory Service: Services Provided by DNS, Overview of How DNS Works, DNS Records and Messages, Peer-to-Peer Applications: P2P File Distribution, Distributed Hash Tables, Socket Programming: creating Network Applications: Socket Programming with UDP, Socket Programming with TCP. T1: Chap 2 RBT: L1, L2, L3	08	L3
Module 2		
Transport Layer: Introduction and Transport-Layer Services: Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and Demultiplexing: Connectionless Transport: UDP,UDP Segment Structure, UDP Checksum, Principles of Reliable Data Transfer: Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go-Back-N, Selective repeat, Connection-Oriented Transport TCP: The TCP Connection, TCP Segment Structure, RoundTrip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control: The Causes and the Costs of Congestion, Approaches to Congestion Control, Network-assisted congestion-control example, ATM ABR Congestion control, TCP Congestion Control: Fairness. T1: Chap 3 RBT: L1, L2, L3	08	L3
Module 3		
The Network layer: What's Inside a Router?: Input Processing, Switching, Output Processing, Where Does Queuing Occur? Routing control plane, IPv6,A Brief foray into IP Security, Routing Algorithms: The Link-State (LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm, Hierarchical Routing, Routing in the Internet, Intra-AS Routing in the Internet: RIP, Intra-AS Routing in the Internet: OSPF, Inter/AS Routing: BGP, Broadcast Routing Algorithms and Multicast. T1: Chap 4: 4.3-4.7 RBT: L1, L2, L3	08	L3
Module 4		

Network Security: Overview of Network Security:Elements of Network Security , Classification of Network Attacks ,Security Methods ,Symmetric-Key Cryptography :Data Encryption Standard (DES),Advanced Encryption Standard (AES) , Public-Key Cryptography :RSA Algorithm ,Diffie-Hellman Key-Exchange Protocol , Authentication :Hash Function , Secure Hash Algorithm (SHA) , Digital Signatures , Firewalls and Packet Filtering ,Packet Filtering , Proxy Server . Textbook2: Chapter 10 RBT: L1, L2, L3	08	L3
Module 5		
Multimedia Networking: Properties of video, properties of Audio, Types of multimedia Network Applications, Streaming stored video: UDP Streaming, HTTP Streaming, Adaptive streaming and DASH, content distribution Networks Voice-over-IP : Limitations of the Best-Effort IP Service ,Removing Jitter at the Receiver for Audio ,Recovering from Packet Loss Protocols for Real-Time Conversational Applications , RTP , SIP Textbook11: Chap 7 RBT: L1, L2, L3	08	L3

Course Outcomes:

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

CO1	Apply principles of application layer protocols
CO2	Recognize transport layer services and infer UDP and TCP protocols
CO3	Classify routers, IP and Routing Algorithms in network layer
CO4	Understand the Wireless and Mobile Networks covering IEEE 802.11 Standard
CO5	Illustrate Multimedia Networking and Network Management

	PO -1	**PO -2**	**PO -3**	**PO -4**	**PO -5**	**PO -6**	**PO -7**	**PO -8**	**PO -9**	**PO -10**	**PO -11**	**PO -12**	**PSO -1**	**PSO -2**
CO1	3	2	1										1	1
CO2	3	2	1		1								1	1
CO3	3	2	0										1	1
CO4	3	3	1		1	2		2					1	1
CO5	3	3	1		1	2		2					1	1
Average	3	2	1		1	1		1					1	1

High-3: Medium-2: Low-1

Textbooks:

1. James F Kurose and Keith W Ross, Computer Networking, A Top-Down Approach, Sixth edition, Pearson,2017 .
2. Nader F Mir, Computer and Communication Networks, 2nd Edition, Pearson, 2014.

Reference Books:

1. Behrouz A Forouzan, Data and Communications and Networking, Fifth Edition, McGraw Hill, Indian Edition
2. Larry L Peterson and Brusce S Davie, Computer Networks, fifth edition, ELSEVIER
3. Andrew S Tanenbaum, Computer Networks, fifth edition, Pearson
4. Mayank Dave, Computer Networks, Second edition, Cengage Learning

E-Books / Web References:

1. Weblinks and Video Lectures (e-Resources):
2. http://www.digimat.in/nptel/courses/video/106105183/L11.html
3. http://www.digimat.in/nptel/courses/video/106105081/L25.html
4. https://nptel.ac.in/courses/106105081

MOOCs:

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

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ conceptvideos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

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

	Components	Marks	Total
CIE	CIE TEST 1	40	50
	CIE TEST 2	40	
	CIE TEST 3	40	
	Assignment	10	
SEE	SEE	Semester End Exam	50
		Grand Total	100

Note: CIE pattern for courses like Drawing and Laboratories can be decided by the respectiveBoard of Studies and can be given here.

Scheme of Examination (SEE):

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

MINI PROJECT

Course Code	AMLP23506	CIE Marks	100
Hours/Week (L: T: P)	0:0:4	SEE Marks	-
No. of Credits	2	Examination Hours	3 hour

Course Outcome

CO1-Problem Formulation and Analysis: To identify a problem relevant to the field of AI & ML, analyze its existing solutions, and assess the feasibility of their proposed approach.

CO2-Project Design and Implementation: To design an AI/ML solution, plan the project workflow, and effectively utilize teamwork to implement their proposed approach.

CO3-Evaluation and Communication: To evaluate their AI/ML solution, incorporating feedback and suggestions for improvement, and effectively communicate their results through presentations and reports.

CO4-Technical Expertise: Students will be able to demonstrate a strong understanding of the AI/ML concepts and techniques relevant to their chosen project.

CO5-Professional Skills: To demonstrate professional conduct, effective teamwork, and adherence to deadlines throughout the mini-project development process.

RUBRICS FOR MINI PROJECT EVALUATION

Rubrics Review

Review #	Agenda	Assessment	Review Assessment Weightage	Over all Weightage
Review 1	Project Synopsis/ Proposal Evaluation	Rubric R1	(6)	**(50)**
Review 2	Mid-Term Project Evaluation	Rubric R2	(10)	
Review 3	End Semester Project Evaluation	Rubric R3	(14)	
Review 4	Project Report Evaluation	Rubric R4	(10)	
Review 5	Evaluation by Guide	Rubric R5	(10)	
Evaluation			(50)	(50)
Total			(100)	**(100)**

CO-PO Mapping

The following table shows how the Course Outcomes (COs) map to the Program Outcomes (POs) for an AI & ML program:

Mini Project	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	1	3				3	3		2	1	2
CO2	3	3	2	2	3				3	3		2	1	2
CO3					2				3	3		2	1	2
CO4	3	3	2	2	3				3	2		2	1	2
CO5	2	2	2	1	3				3	2		2	1	2
Average	**2**	**2.2**	**1.6**	**1.2**	**2.8**				**3**	**2.6**		**2**	**1**	**2**

Research Methodology and IPR

Semester:	**V**	**CIE Marks**	**50**
Course Code	**RMIK23507**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**2:2:0**	**Examination Hours**	**03**
Type of Course	**AEC**	**Credits**	**03**

Course Objectives:

CLO1	To make the student understand the foundations of Research and problem solution
CLO2	Knowledge in Research design, Qualitative and Quantitative Research
CLO3	Knowledge to formulate and derive static and dynamic aero elastic equations of motion.
CL04	To understand the different types of IPR

Content	No. of Hours/ RBT levels
Module 1 **RESEARCH METHODOLOGY:** Introduction, Meaning of Research, Objectives of Research, Types of Research, Research Approaches, Significance of Research, Research and Scientific Method, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India. **DEFINING THE RESEARCH PROBLEM:** Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration	**08 Hours/ L3**
Module 2 **REVIEWING THE LITERATURE:** Place of the literature review in research, bringing clarity and focus to research problem, improving research methodology, broadening knowledge base in research area, enabling contextual findings, Review of the literature, searching the existing literature, reviewing the selected literature, developing a theoretical framework, developing a conceptual framework, writing about the literature reviewed. **RESEARCH DESIGN**: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs	**08 Hours/ L3**
Module 3 **DESIGN OF SAMPLE SURVEYS:** Design of Sampling: Introduction, Sample Design, Sampling and Non-Sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs. **MEASUREMENT AND SCALING:** Qualitative and Quantitative Data, **DATA COLLECTION:** Introduction, Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method.	**08 Hours/ L3**

Module 4 **TESTING OF HYPOTHESES:** Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis. **INTERPRETATION AND REPORT WRITING:** Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.	**08 Hours/ L3**
Module 5 **INTELLECTUAL PROPERTY**: Principles of IPR, Kinds of IPR, Patent- Concepts, Novelty, Utility Inventiveness/Non-obviousness, Procedure for granting and obtaining patents; Copyright- conditions for grant of copyright, Copyright in Literary, Dramatic and Musical ,Works, Sound Recording, Cinematograph Films, Copyright in Computer Programme, Author Special Rights, Right of Broadcasting and performers, Trademark Law and Practices - Procedure of registration of trademark; Emerging Issues and Challenges; Few Future Aspects of Intellectual Property Rights;	**08 Hours/ L3**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO1	Understand the research problem by literature review to solve problems
CO2	Develop skills in qualitative and quantitative data analysis and presentation.
CO3	Develop advanced critical thinking skills.
CO4	Understand to write the report writing and awareness about IPR

Textbooks:

1. Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition
2. Business Research Methods – Alan Bryman & Emma Bell, Oxford University Press.
3. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p.
4. Lionel Bently., Brad Sherman-Intellectual Property Law, 3rd Edition

Reference books:

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
2. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications. 2 volumes.
3. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
4. Wadehra, B.L. 2000. Law relating to patents, trademarks, copyright designs and geographical indications. Universal Law Publishing.

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

Continuous Internal Evaluation (CIE):
Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is addedto test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. **Some possible AATs:** seminar/assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern for regular courses is shown in Table 2.

Table 2: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	Assignments	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

CO/PO	PO6	PO8
CO 1	3	3
CO 2	3	3
CO 3	3	3
CO 4	3	3
CO 5	3	3
Average	3	3

Low-1: Medium-2: High-3

ENVIRONMENTAL STUDIES

Semester:	**V**	**CIE Marks**	**50**
Course Code	**CIVK23508**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**2:0:0**	**Duration of SEE (hours):**	**01**
Type of Course	**MC**	**Credits**	**2**

Prerequisites:

Course Objectives: Students will be taught:

CLO1	To understand ecosystem functions and 17 SDG's for sustainable development
CLO2	To understand advanced energy systems and natural resource management.
CLO3	To understand about pollution and waste management solutions and laws
CLO4	To understand global environmental issues, related policies and solutions through case studies
CLO5	To understand key environmental legislation related to water, air, waste and environmental protection.

Content	No. of Hours/ RBT levels
Module 1 – Ecosystem and Sustainability Ecosystems (Structure and Function): Forest, Desert, Wetlands, River, Oceanic and Lake. Sustainability: 17 SDGs-History, targets, implementation, Capacity Development	**6 Hours L2**
Module 2 - Natural Resource Management Advances in Energy Systems (Merits, Demerits, Global Status and Applications): Hydrogen, Solar, OTEC, Tidal and Wind. Natural Resource Management (Concept and case-studies): Disaster Management, Sustainable Mining - case studies and Carbon Trading	**6 Hours L2**
Module 3 – Environmental Pollution & Waste Management Environmental Pollution (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies): Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution. Waste Management: Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge	**6 Hours L2**
Module 4 - Global Environmental Issues Global Environmental Concerns (Concept, policies and case-studies): Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology	**6 Hours L2**
Module 5 – Environmental Legislation Environmental Legislation: Water Act 1974, Air Act 1981, Environmental Protection Act 1984, Solid Waste Management Rules-2016, E- Waste management Rule - 2022, Biomedical Waste management- 2016	**6 Hours L2**

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CIVK23508.1	**Analyze** ecosystem dynamics to formulate strategies for addressing sustainability challenges and implementing the SDGs.
CIVK23508.2	**Evaluate** energy technologies to design effective resource management strategies.
CIVK23508.3	**Evaluate** the impacts of pollution to develop effective waste management strategies.
CIVK23508.4	**Evaluate** global environmental issues to design solutions for sustainable management.
CIVK23508.5	**Interpret** environmental laws and regulations for sustainable management practices.

Textbooks:

1. Environmental studies, Benny Joseph, Tata Mcgraw-Hill 2nd edition 2012
2. Environmental studies, S M Prakash, pristine publishing house, Mangalore 3rd edition-2018

References:

1. Benny Joseph, Environmental studies, Tata Mcgraw-Hill 2nd edition 2009
2. M.Ayi Reddy Textbook of environmental science and Technology, BS publications 2007
3. Dr. B.S Chauhan, Environmental studies, university of science press 1st edition

Web Reference:

https://www.hzu.edu.in/bed/E%20V%20S.pdf
https://onlinecourses.nptel.ac.in/noc23_hs155/preview
https://onlinecourses.swayam2.ac.in/cec19_bt03/preview

Scheme of Examination:

Semester End Examination (SEE):

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

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of three test marks will be added to test component. CIE is executed by way of two quizzes/Alternate Assessment Tools(AAT's), some possible AAT's: Seminar/ assignments/ mini-projects/ concept videos/ partial reproduction of research work/ group activity/ any other.

Typical Evaluation pattern is shown in Table 1.

Table 1: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	40	**50**
	CIE Test-2	40	
	CIE Test-3	40	
	Average of CIE	**40**	
	Quiz 1/AAT	**05**	
	Quiz 2/AAT	**05**	
SEE	**Semester End Examination**	**100**	**50**
Grand Total			**100**

CO/PO Mapping															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CIVK23508.1	2					1	1	1							3
CIVK23508.2	2	2	2			1	3	1							3
CIVK23508.3		2	2	2		1	3	1							2
CIVK23508.4		2	2	2		1	3	1							2
CIVK23508.5	1	2	2	2		1	2	1							2
Average	**1.67**	**2**	**2**	**2**		**1**	**2.4**	**1**							**2.4**

National Service Scheme (NSS)		Semester	3rd to 6th
Course Code	**NSK23509**	CIE Marks	**25*4 = 100**
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	------
Total Hours of Pedagogy	40 hour Practical Session +15 hour Planning	Total Marks	**25*4 = 100**
Examination nature (SEE)	Activities Report Evaluation by College NSS Officer at the end of every semester (3rd to 6th semester)		
Credits	NCMC – Non Credit Mandatory Course (Completion of the course shall be mandatory for the award of degree)		

Course objectives: National Service Scheme (NSS) will enable the students to:

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

General Instructions - Pedagogy :

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied social and cultural skills.
2. State the need for NSS activities and its present relevance in the society and Provide real-life examples.
3. Support and guide the students for self-planned activities.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
5. Encourage the students for group work to improve their creative and analytical skills.

National Service Scheme (NSS) – Contents

==========

1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.
2. Waste management– Public, Private and Govt organization, 5 R's.
3. Setting of the information imparting club for women leading to contribution in social and economic issues.
4. Water conservation techniques – Role of different stakeholders– Implementation.
5. Preparing an actionable business proposal for enhancing the village income and approach for implementation.
6. Helping local schools to achieve good results and enhance their enrolment in Higher/

technical/ vocational education.

7. Developing Sustainable Water management system for rural areas and implementation approaches.
8. Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swatch Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.
9. Spreading public awareness under rural outreach programs.(minimum5 programs).
10. Social connect and responsibilities.
11. Plantation and adoption of plants. Know your plants.
12. Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).
13. Govt. school Rejuvenation and helping them to achieve good infrastructure.

NOTE:

- Student/s in individual or in a group Should select any one activity in the beginning of each semester till end of that respective semester for successful completion as per the instructions of NSS officer with the consent of HOD of the department.
- At the end of every semester, activity report should be submitted for evaluation.

Distribution of Activities - Semester wise from 3rd to 6th semester

Sem	Topics / Activities to be Covered
3rd Sem for 25 Marks	1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing. 2. Waste management– Public, Private and Govt organization, 5 R's. 3. Setting of the information imparting club for women leading to contribution in social and economic issues.
4th Sem for 25 Marks	4. Water conservation techniques – Role of different stakeholders– Implementation. 5. Preparing an actionable business proposal for enhancing the village income and approach for implementation. 6. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.
5th Sem for 25 Marks	7. Developing Sustainable Water management system for rural areas and implementation approaches. 8. Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc. 9. Spreading public awareness under rural outreach programs.(minimum5 programs). 10. Social connect and responsibilities.
6th Sem for 25 Marks	11. Plantation and adoption of plants. Know your plants. 12. Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs). 13. Govt. school Rejuvenation and helping them to achieve good infrastructure.

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

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

6.	Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.	May be individual or team	Local government / private/ aided schools/Government Schemes officers/ etc…..	School selection/proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
7.	Developing Sustainable Water management system for rural areas and implementation approaches.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Governme nt Schemes officers/ campus etc…..	site selection/proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
8.	Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Governme nt Schemes officers/ campus etc…..	Group selection/proper consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
9.	Spreading public awareness under rural outreach programs.(minimum5 programs). ///// Social connect and responsibilities.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Governme nt Schemes officers/ campus etc…..	Group selection/proper consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
10.	Plantation and adoption of plants. Know your plants.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Governme nt Schemes officers/ campus etc…..	Place selection/proper consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

11.	Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).	May be individu al or team	Villages/ City Areas / Grama panchayat/ public associations/Governme nt Schemes officers/ campus etc…..	Place selection/proper consultation/Continu ous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
12.	Govt. school Rejuvenation and helping them to achieve good infrastructure.	May be individu al or team	Villages/ City Areas / Grama panchayat/ public associations/Governme nt Schemes officers/ campus etc…..	Place selection/proper consultation/Continu ous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

Plan of Action (Execution of Activities For Each Semester)

Sl.NO	Practice Session Description
1	**Lecture session by NSS Officer**
2	**Students Presentation on Topics**
3	**Presentation - 1 , Selection of topic, PHASE - 1**
4	**Commencement of activity and its progress - PHASE - 2**
5	**Execution of Activity**
6	**Execution of Activity**
7	**Execution of Activity**
8	**Execution of Activity**
9	**Execution of Activity**
10	**Case study based Assessment, Individual performance**
11	**Sector wise study and its consolidation**
12	**Video based seminar for 10 minutes by each student At the end of semester with Report.**

- In every semester from 3rd semester to 6th semester, Each student should do activities according to the scheme and syllabus.
- At the end of every semester student performance has to be evaluated by the NSS officer for the assigned activity progress and its completion.
- At last in 6th semester consolidated report of all activities from 3rd to 6th semester, compiled report should be submitted as per the instructions.

Course outcomes (Course Skill Set):

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

CO1: Understand the importance of his / her responsibilities towards society.

CO2: Analyse the environmental and societal problems/issues and will be able to design solutions for the same.

CO3: Evaluate the existing system and to propose practical solutions for the same for sustainable development.

CO4: Implement government or self-driven projects effectively in the field.

CO5: Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

Assessment Details for CIE (both CIE and SEE)

Weightage	**CIE – 100%**	• Implementation strategies of the project (NSS work). • The last report should be signed by NSS Officer, the HOD and principal. • At last report should be evaluated by the NSS officer of the institute. • Finally the consolidated marks sheet should be sent to the university and also to be made available at LIC visit.
Presentation - 1 Selection of topic, PHASE - 1	10 Marks	
Commencement of activity and its progress - PHASE - 2	10 Marks	
Case study based Assessment Individual performance	10 Marks	
Sector wise study and its consolidation	10 Marks	
Video based seminar for 10 minutes by each student At the end of semester with Report.	10 Marks	
Total marks for the course in each semester	**50 Marks**	
Marks scored for 50 by the students should be Scale down to 25 marks In each semester for CIE entry in the VTU portal.		
25 marks CIE entry will be entered in University IA marks portal at the end of each semester 3rd to 6th sem, Report and assessment copy should be made available in the department semester wise.		
Students should present the progress of the activities as per the schedule in the prescribed practical session in the field. There should be positive progress in the vertical order for the benefit of society in general.		

Suggested Learning Resources:

Books :

1. **NSS Course Manual,** Published by NSS Cell, VTU Belagavi.
2. Government of Karnataka, NSS cell, activities reports and its manual.
3. Government of India, nss cell, Activities reports and its manual.

Semester: V						
PHYSICAL EDUCATION (SPORTS & ATHLETICS) – I						
Course Code	**:**	PEK23509		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	0:0:2		**SEE**	**:**	000
Total Hours	**:**	24 P				

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

1. Understand the fundamental concepts and skills of Physical Education, Health,Food, Nutrition and general fitness
2. Familiarization of health-related Exercises, Sports for overall growth anddevelopment
3. Create a foundation for the professionals in Physical Education and Sports
4. Participate in the competition at regional/state / national / international levels.
5. Understand and practice of specific games and athletic throwing events.

Module I : Orientation **4 Hours**

A. Fitness
B. Food & Nutrition

Module II: General Fitness & Components of Fitness **4 Hours**

A. Agility – Shuttle Run
B. Flexibility – Sit and Reach
C. Cardiovascular Endurance – Harvard step Test

Module III : Specific games (Any one to be selected by the student) **16 Hours**

1. Badminton (Fore hand low/high service, back hand service, smash, drop)
2. Basketball (Dribbling, passing, shooting etc.)
3. Athletics (Field events – Throws)

Scheme and Assessment for auditing the course and Grades:

Sl. No.	Activity	Marks
1.	Participation of student in all the modules	20
2.	Quizzes – 2, each of 15 marks	30
3.	Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	50
	Total	**100**

Yoga		Semester	III – VI sem
Course Code	YOK23509	**CIE Marks**	100/sem
Teaching Hours/Week (L:T:P)	0:0:2	**SEE Marks**	000
Total Hours of Pedagogy per semester	24 - 28 hours (Theory + practical)	**Total Marks**	100/sem
Examination nature (SEE)	**Objective type Theory / Practical / Viva-Voce**		

Course objectives:

1) To enable the student to have good health.
2) To practice mental hygiene.
3) To possess emotional stability.
4) To integrate moral values.
5) To attain higher level of consciousness.

The Health Benefits of Yoga

The benefits of various yoga techniques have been supposed to improve

- body flexibility,
- performance,
- stress reduction,
- attainment of inner peace, and
- self-realization.

The system has been advocated as a complementary treatment to aid the healing of severalailments such as

- coronary heart disease,
- depression,
- anxiety disorders,
- asthma, and
- extensive rehabilitation for disorders including musculoskeletal problems and traumatic brain injury.

The system has also been suggested as behavioral therapy for smoking cessation and substanceabuse (including alcohol abuse).

If you practice yoga, you may receive these physical, mental, and spiritual benefits:

- Physical
    1. Improved body flexibility and balance
    2. Improved cardiovascular endurance (stronger heart)
    3. Improved digestion
    4. Improved abdominal strength
    5. Enhanced overall muscular strength
    6. Relaxation of muscular strains
    7. Weight control
    8. Increased energy levels
    9. Enhanced immune system
- Mental
    1. Relief of stress resulting from the control of emotions
    2. Prevention and relief from stress-related disorders
    3. Intellectual enhancement, leading to improved decision-making skills
- Spiritual
    1. Life with meaning, purpose, and direction

2. Inner peace and tranquility
3. Contentment

Yoga Syllabus

Semester V

Patanjali'sAshtanga Yoga its need and importance.

Ashtanga Yoga

1. Asana
2. Pranayama
3. Pratyahara

Asana its meaning by name, technique, precautionary measures and benefits of each asana

Different types of Asanas

a. Sitting 1. Ardha Ushtrasana
   2. Vakrasana
   3. Yogamudra in Padmasana
b. Standing 1. UrdhvaHastothanasana
   2. Hastapadasana
   3. ParivrittaTrikonasana
   4. Utkatasana
c. Prone line 1. Padangushtha Dhanurasana
   2. Poorna Bhujangasana / Rajakapotasana
d. Supine line 1. Sarvangasana
   2. Chakraasana
   3. Navasana/Noukasana
   4. Pavanamuktasana Revision of

practice 60 strokes/min 3 rounds

Meaning by name, technique, precautionary measures and benefits of each Pranayama

1. Ujjayi 2. Sheetali 3. Sheektari

Course outcomes (Course Skill Set):

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

- Understand the meaning, aim and objectives of Yoga.
- Perform Suryanamaskar and able to Teach its benefits.
- Understand and teach different Asanas by name, its importance, methods and benefits.
- Instruct Kapalabhati and its need and importance.
- Teach different types of Pranayama by its name, precautions, procedure and uses
- Coach different types of Kriyas, method to follow and usefulness.

Assessment Details (both CIE and SEE)

- Students will be assessed with internal test by a. Multiple choice questions b. Descriptivetype questions (Two internal assessment tests with 25 marks/test)
- Final test shall be conducted for whole syllabus for 50 marks.
- Continuous Internal Evaluation shall be for 100 marks (including IA test)

Suggested Learning Resources:

Books:

1. **Yogapravesha in Kannada by Ajitkumar**
2. **Light on Yoga by BKS Iyengar**
3. **Teaching Methods for Yogic practices by Dr. M L Gharote & Dr. S K Ganguly**
4. **Yoga Instructor Course hand book published by SVYASA University, Bengaluru**
5. **Yoga for Children –step by step – by Yamini Muthanna**

Web links and Video Lectures (e-Resources): Refer links

6. **https://youtu.be/KB-TYlgd1wE**
7. **https://youtu.be/aa-TG0Wg1Ls**

NATURAL LANGUAGE PROCESSING

Semester:	**VI**	**CIE Marks**	**50**
Course Code	**AML23601**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**3:0:2**	**Duration of SEE (hours):**	**03**
Type of Course	**IPC**	**Credits**	**04**

Prerequisites (if any):

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	**Explain** the core concepts of Natural Language Processing and Deep Learning.
2	**Implement** Python packages like NumPy, Pandas, and SciPy for data processing.
3	**Develop** proficiency in NLP techniques such as text preprocessing and word embedding.
4	**Analyze** the architecture and functioning of word embedding models like Word2vec and LSTM networks.
5	**Design and create** a chatbot using advanced NLP and Deep Learning methodologies.

Module 1	No. of Hours	RBT Level
Introduction to Natural Language Processing and Deep Learning: Python Packages- NumPy, Pandas, SciPy, Introduction to Natural Language Processing, Common Terms Associated with Language Processing, Natural Language Processing Libraries- NLTK, TextBlob, SpaCy, Gensim, Getting Started with NLP- Text Search Using Regular Expressions, Text to List, Preprocessing the Text, Accessing Text from the Web, Removal of Stopwords, Counter Vectorization, TF-IDF Score, Text Classifier.	**10**	**L2**
Module 2		
Word Vector Representations: Introduction to Word Embedding, Neural Language Model, Word2vec, Skip-Gram Model, Model Components: Architecture, Model Components: Hidden Layer, Model Components: Output Layer, CBOW Model, Subsampling Frequent Words, Negative Sampling. **Word2vec Code, Skip-Gram Code, CBOW Code.**	**10**	**L2**
Module 3		
Unfolding Recurrent Neural Networks: Recurrent Neural Networks, What Is Recurrence?, Differences Between Feedforward and Recurrent Neural Networks, Recurrent Neural Network Basics, Natural Language Processing and Recurrent Neural Networks, RNNs Mechanism, Training RNNs, Meta Meaning of Hidden State of RNN, Tuning RNNs.	**10**	**L2**
Module 4		
Long Short-Term Memory Networks: Components of LSTM, How LSTM Helps to Reduce the Vanishing Gradient Problem- Understanding GRUs, Limitations of LSTMs. Sequence-to-Sequence Models- What Is It?, Bidirectional Encoder, Stacked Bidirectional Encoder, Decoder. Advanced Sequence-to-Sequence Models- Attention Scoring, Teacher Forcing. **Sequence-to-Sequence Use Case.**	**10**	**L2**
Module 5		
Developing a Chatbot: Introduction to Chatbot, Origin of Chatbots, But How Does a Chatbot Work, Anyway? Conversational Bot, Chatbot: Automatic Text Generation.	**10**	**L2**

Course Outcomes:

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

CO1	Understand the fundamentals of Natural Language Processing (NLP) and Deep Learning
CO2	Apply Python packages such as NumPy, Pandas, and SciPy for data manipulation and analysis in NLP
CO3	Implement NLP techniques including text preprocessing, word vector representations, and sequence-to-sequence models
CO4	Analyze the architecture and components of word embedding models like Word2vec and LSTM networks
CO5	Develop a chatbot using advanced NLP and Deep Learning techniques

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3		3			2	2	2		2	1	2
CO2	3	3	3		3			2	2	2		2	1	2
CO3	3	3	3		3			2	2	2		2	1	2
CO4	3	3	3		3			2	2	2		2	1	2
CO5	3	3	3		3			2	2	2		2	1	2
Avg	3	3	3		3			2	2	2		2	1	2

High-3: Medium-2: Low-1

Texts:

1. Deep Learning for Natural Language Processing Creating Neural Networks with Python-Palash Goyal, Sumit Pandey, Karan Jain. ISBN-13 (pbk): 978-1-4842-3684-0.
2. https://github.com/ashishpatel26/500-AI-Machine-learning-Deep-learning-Computer-vision-NLP-Projects-with-code

References:

1. D. O'Shaughnessy, Speech Communications: Human and Machine, 2nd Ed, IEEE Press, 2000.
2. A. Gersho and R. M. Gray, Vector Quantization and Signal Compression, Kluwer Academic, 1991.
3. L. Rabiner and R. W. Schafer, Digital Processing of Speech Signals, Prentice Hall, 1978.
4. K. Sayood, Introduction to Data Compression, 2nd Ed, Morgan Kaufmann, 2000.
5. James Allen, “Natural Language Understanding”, 2nd edition, Benjamin/Cummings publishing company, 1995.
6. Gerald J. Kowalski and Mark.T. Maybury, “Information Storage and Retrieval systems”, Kluwer academic Publishers, 2000
7. Anne Kao and Stephen R. Poteet (Eds), “Natural Language Processing and Text Mining”, Springer-Verlag London Limited 2007.

E-Books / Web References:

1. https://www.ldc.upenn.edu/
2. https://ocw.mit.edu/courses/6-864-advanced-natural-language-processing-fall-2005/pages/lecture-notes/
3. https://www.nltk.org/
4. https://opennlp.apache.org/

Coursera:

1. Natural Language Processing Specialization by University of Michigan: This specialization covers topics in NLP, including sequence models, deep learning, and more.
2. Speech and Audio Processing by Duke University: This course covers the fundamentals of speech and audio signal processing.

Udemy:

1. Natural Language Processing with Python by Udemy: This course focuses on practical NLP applications using Python.
2. Deep Learning for NLP and Speech Recognition by Udemy: This course covers deep learning techniques for NLP and speech recognition.

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

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

	Component	**Marks**	**Total Marks**
CIE	CIE Test-1	30	50
	CIE Test-2	30	
	CIE Test-3	30	
	Laboratory	20	
SEE	Semester End Examination	100	50
	Grand Total		100

Scheme of Examination (SEE):

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

DEEP LEARNING PRINCIPLES & PRACTICES

Semester:	**VI**	**CIE Marks**	**50**
Course Code	**AML23602**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**Duration of SEE (hours):**	**03**
Type of Course	**PC**	**Credits**	**03**

Prerequisites (if any): Machine Learning Essentials, Python Programming, Linear Algebra.

Course Learning Objectives:

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

Module 1	No. of Hours	RBT Level
Fundamentals of Neural Networks: Introduction, Understanding the Biological Neuron. Exploring the Artificial Neurons, Early Implementation of ANN, Types of Activation Function. Architectures of Neural Networks, Learning process in ANN.	10	L2
Module 2		
Training Deep Neural Networks: Introduction, Mathematics Behind Backpropagation, Deep Llayer Neural Network, Understanding the notion of forward and backward propagation, Initializing weights in Neural Network, Batch, Mini-batch and stochastic Gradient Descent.	10	L2
Module 3		
Convolutional Neural Networks: How computers sees the world, Challenges faced by Traditional ANN to work with Image Data, Building blocks of CNN, Building a CNN, Popular Carchitectures.	10	L3
Module 4		
Sequence-based Models: Introduction to Sequence Data, Recurrent Neural Networks, Long Short-term Memory, Gated Recurrent Units, Bi-directional Models.	10	L3
Module 5		
Encoder-Decoder Architecture, Attention Mechanism, Transformer Architecture, Genera Adversarial Networks.	10	L3

Course Outcomes:

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

CO No.	DEEP LEARNING PRINCIPLES & PRACTICES-21AML53	RBT Level / Cognitive Level
CO1	Understand and Analyse the fundamentals that drive deep learning networks	L2
CO2	Build, train and apply fully connected neural networks	L3
CO3	Analyse convolutional networks and their role in image processing.	L3
CO4	Implementation of deep learning techniques to solve real-world problems.	L5

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	3	3	-	2	-	-	-	-	1	-	2	-	2
CO2	2	3	2	-	2	-	-	-	-	1	-	2	-	2
CO3	2	2	2	-	3	-	-	-	-	1	-	2	-	2
CO4	2	2	3	-	3	-	-	-	-	1	1	2	-	2

Text Books:

1. “Deep Learning”, Amit kumar das, Saptarsi goswami, Pabitra mitra, Amlan, 1st edition, Pearson.

Reference Books:

1. Deep Learning”, Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press, 2017.
2. "Deep Learning: A Practitioner's Approach" Josh Patterson, Adam Gibson, O'Reilly Media, 2017
3. “Applied Deep Learning. A Case-based Approach to Understanding Deep Neural Networks” UmbertoMichelucci Apress, 2018.
4. "Machine Learning: A Probabilistic Perspective", Kevin P. Murphy The MIT Press, 2012.
5. "Introduction to Machine Learning”, EthemAlpaydinMIT Press, Prentice Hall of India, Third Edition 2014.
6. "Deep Learning with TensorFlow: Explore neural networks with Python", Giancarlo Zaccone, Md.Rezaul Karim, Ahmed Menshawy Packt Publisher, 2017.
7. "Deep Learning with Keras", Antonio Gulli, Sujit Pal Packt Publishers, 2017.
8. "Deep Learning with Python", Francois Chollet Manning Publications, 2017.

E-Books / Web References:

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

MOOCs:

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

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partialreproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box forproblem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

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

	Component	**Marks**	**Total Marks**
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignment	10	
SEE	Semester End Examination	100	50
	Grand Total		100

Scheme of Examination (SEE):

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

PARALLEL AND DISTRIBUTED COMPUTING

Semester:	**VI**	**CIE Marks**	**50**
Course Code	**AML23603A**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**Duration of SEE (hours):**	**03**
Type of Course	**PEC**	**Credits**	**03**

Prerequisites (if any):

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	To introduce the fundamentals of parallel and distributed computing architecturesand paradigms
2	To understand the technologies, system architecture, and communication architecture that propelled the growth of parallel and distributed computing systems
3	To develop and execute basic parallel and distributed application using basic programming models and tools.

Module 1	No. of Hours	RBT Level
Introduction to Parallel Computing: The Idea of Parallelism, Power and potential of parallelism, Examining sequential and parallel programs, Scope and issues of parallel and distributed computing, Goals of parallelism, Parallelism and concurrency using multiple instructions streams. **Parallel Architecture:** Pipeline architecture, Array processor, Multi processor architecture, Systolic architecture, Dataflow architecture, Architectural classification schemes, Memory access classification, **Memory Issues :** Shared vs. distributed, Symmetric multiprocessing (SMP), SIMD, Vector processing, GPU co-processing, Flynn's Taxonomy, Instruction Level support for parallel programming, Multiprocessor caches and Cache Coherence, Non-Uniform Memory Access (NUMA).	08	L2
Module 2		
Parallel Algorithm and Design: Preliminaries – Decomposition Techniques – Characteristics of Tasks and Interactions – Mapping Techniques for Load balancing – Parallel Algorithm Models.	08	L2
Module 3		
Introduction to Distributed Systems: Introduction – Characterization of Distributed Systems – Distributed Shared Memory – Message Passing – Programming Using the Message Passing Paradigm – Group Communication	08	L2

– Case Study (RPC and Java RMI).		
Module 4		
Coordination: Time and Global States – Synchronizing Physical Clocks – Logical Time and Logical Clock – Coordination and Agreement – Distributed Mutual Exclusion – Election Algorithms – Consensus and Related Problems	08	L3
Module 5		
Distributed Transactions: Transaction and Concurrency Control – Nested Transactions – Locks – Optimistic Concurrency Control – Timestamp Ordering - Distributed Transactions – Flat and Nested – Atomic – Two PhaseCommit Protocol – Concurrency Control. **Distributed System Architecture and its Variants:** Distributed File System: Architecture – Processes – Communication Distributed Web-basedSystem: Architecture – Processes – Communication. Overview of Distributed Computing Platforms.	08	L3

Course Outcomes:

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

CO1	Design and implement distributed computing systems and Asses models for distributedsystems.
CO2	Design and implement distributed algorithms.
CO3	Experiment with mechanisms such as client/server and P2P algorithms, remote procedure calls (RPC/RMI), and consistency
CO4	Analyze the requirements for programming parallel systems and critically evaluate the strengths and weaknesses of parallel programming models.
CO5	Analyze the efficiency of a parallel processing system and evaluate the types of applicationfor which parallel programming is useful.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		2	2	2				1		3		2
CO2	3	3		3	3	2				1		3		2
CO3	3	3		3	3	2				1		3		2
CO4	3	3		3	3	2				1		3		2
CO5	3	3		2	2	2				1		3		2
Average	3	3		2.6	2.6	2				1		3		2

High-3: Medium-2: Low-1

Text Books:

1. George Coulouris, Jean Dollimore, Tim Kindberg, and Gordon Blair, ―Distributed Systems: Concepts and Design, 5th Edition, Pearson / Addison –Wesley, 2012
2. Ananth Grama, Anshul Gupta, George Karypis and Vipin Kumar, ―Introduction to Parallel

Computing‖, Pearson, 2nd Edition, 2008
3. I.A Dhotre, Parallel and Distributed Computing, 2nd Edition, Technical Publication, 2022

Reference Books:

1. Andrew S. Tanenbaum and Maarten Van Steen, ―Distributed Systems: Principles and Paradigms‖, Pearson, 2nd Edition, 2006
2. Pradeep K. Sinha, ―Distributed Operating System: Concepts and Design‖, PHILearning Pvt.Ltd., 2007

E-Books / Web References:

1. https://www.geeksforgeeks.org/difference-between-parallel-computing-and-distributed computing/
2. https://www.gacbe.ac.in/pdf/ematerial/18MCS35E-U1.pdf

MOOCs:

1. https://www.mygreatlearning.com/iit-madras-acse?&utm_source=Search
2. https://in.coursera.org/courses?query=parallel%20computing

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

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

	Component	**Marks**	**Total Marks**
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignment	10	
SEE	Semester End Examination	100	50
	Grand Total		100

Scheme of Examination (SEE):

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

INTELLIGENT EMBEDDED SYSTEMS

Semester:	**VI**	**CIE Marks**	**50**
Course Code	**AML23603B**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**Duration of SEE (hours):**	**03**
Type of Course	**PEC**	**Credits**	**03**

Prerequisites (if any): C and C++ programming languages, RTOS.

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	To understand principles and algorithms for prototyping embedded systems with high level of deduction and adaptation.
2	To provide students with holistic view and detailed knowledge of hardware – software co-design of intelligent, real-time embedded systems

Module 1	No. of Hours	RBT Level
Fundamentals of Embedded System: Core of the embedded system, Memory, Sensors (resistive, optical, position, thermal) and Actuators (solenoid valves, relay/switch, opto-couplers), Communication Interface, Embedded firmware (RTOS, Drivers, Application programs), Power-supply (Battery technology, Solar), PCB and Passive components, Safety and reliability, environmental issues. Ethical practice. Characteristics and quality attributes (Design Metric) of embedded system. Real time system‘s requirements, real time issues, interrupt latency	8	**L2**
Module 2		
Embedded Hardware Design: Introduction to ARM-v7-M (Cortex-M3), ARM- v7-R(CortexR4) and comparison between them. Embedded System Interfacing:Study of basic communication protocols like SPI, SCI (RS232, RS485), I2C, CAN, Field-bus (Profibus), USB (v2.0), Bluetooth, Zig-Bee, Wireless sensor network	8	**L2**
Module 3		
Learning in Embedded Systems: Introduction, From Metrology to Digital Data, Uncertainty; Information and Learning Mechanisms, Randomized Algorithms, Robustness Analysis , Embedded C-programming concepts (from embedded system point of view): Optimizing for Speed/Memory needs, Interrupt service routines, macros, functions, modifiers, data types, device drivers, Multithreading programming. Basic embedded C programs/applications for ARM-v7, using ARM-GCC-tool-chain,Emulation of ARM-v7 (e.g. using QEMU), and Linux porting on ARM-v7 (emulation) board	8	**L3**
Module 4		
Introduction to Embedded Systems in Health Care Domain: Embedded System in Bio-medical applications: Criticality, Reactivity, Autonomy; Trends in medicalsystems: Ambient Intelligence, Assistive technologies for procedures, In-Body devices, Treating	8	**L3**

Machines, Monitoring/Imaging Systems, VR enhanced Realitysystems		
Module 5		
Embedded Systems and Medical Applications: Managing Chronic conditions, Wellness Management, Clinical Support, Specific Embedded Architectures with grid service architectures, Privacy and Security Issues, Hybrid Electronic and biological systems: Informatics and biologically active – augmentation with genetic data	8	**L3**

Course Outcomes:

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

CO1	Understanding of the fundamental design paradigms, architectures, possibilities andchallenges for embedded systems from both hardware and software perspective.
CO2	Understanding the methodological knowledge of the development of intelligent embedded systems.
CO3	Use of recent methods and tools to carry out intelligent embedded system design in the areas ofhealth care
CO4	Understand principles and algorithms for prototyping embedded systems with high level of deduction and adaptation.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1									1	3	3
CO2	3	3	1									1	3	3
CO3	3	2	3		3				1	1	2	2	3	3
CO4	3	3	3	3	3				1	1	2	2	3	3
Average	3	2.75	2	3	3				1	1	2	2	3	3

High-3: Medium-2: Low-1

Text Book:

1. Introduction to Embedded Systems, Shibu K. V. TMH Publications, 2009.
2. Embedded System Design –A unified hardware and software introduction, Frank Vahid, Tony D. Givargis, John Wiley Publications, 2000.
3. U-Healthcare Monitoring Systems: Volume 1: Design and Applications, Nilanjan Dey, ISBN-13: 978-0128153703, Academic Press Publication, 2018.

Reference Books:

1. Embedded microcontroller and processor design, Charles Greg Osborn,Pearson Publcation, 2010.
2. Embedded Microcomputer Systems –Real Time Interfacing –Jonathan W. Valvano; Cengage Learning; Third edition, CENGAGE Learning Publication, 2012.

E-Books / Web References:

1. https://archive.nptel.ac.in/noc/courses/noc18/SEM1/noc18-cs05/
2. https://onlinecourses.nptel.ac.in/noc20_cs14/preview

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

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

	Component	**Marks**	**Total Marks**
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	QUIZ/Assignment	10	
SEE	Semester End Examination	100	50
	Grand Total		100

Scheme of Examination (SEE):

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

ARTIFICIAL INTELLIGENCE IN BLOCK CHAIN

Semester:	**VI**	**CIE Marks**	**50**
Course Code	**AML23603C**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**Duration of SEE (hours):**	**03**
Type of Course	**PEC**	**Credits**	**03**

Prerequisites (if any):

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	To introduce the concept and the basics of blockchain technologies
2	To provide knowledge on various applications of blockchain technologies
3	To discuss and describe the history, technology, and applications of Blockchain

Module 1	No. of Hours	RBT Level
Introduction to Blockchain: Blockchain Introduction, history of blockchain, other technologies spawned from blockchain, mechanism behind blockchain, limitations and challenges of blockchain.	08	L2
Module 2		
Applications of Blockchain: Demystifying the blockchain, uses ofblockchain, new components of blockchain, challenges in the use of blockchain technology, more applications of blockchain technology.	08	L2
Module 3		
Blockchain Consensus: Distributed Consensus: Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Di_culty Level, Sybil Attack, Energy utilization and alternate	08	L2
Module 4		
Blockchain and cryptocurrency: Cryptocurrency: History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Name coin	08	L3
Module 5		
AI in Blockchain: The Blockchain as a Path to Artificial Intelligence, data collection, cleaning, and processing in AI modelling, Smart Contract Advocates on Behalf of Digital Intelligence, Hyperledger **Blockchain implementation:** Naive Blockchain construction, Memory Hard algorithm - Hashcash implementation **Etherium:** Direct Acyclic Graph, Play with Go-etherium, Smart Contract Construction,Toy application using Blockchain, Mining puzzles	08	L3

Course Outcomes:

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

CO1	Describe the concept of blockchain and cryptocurrency, Consensus, AI in Blockchain.
CO2	Summarize challenges and uses of blockchain ledgers, Bitcoin protocols and different Blockchain Consensus and AI modeling.
CO3	Analyze Blockchain Consensus and different Vulnerability, Attacks, Sidechain, Namecoin etc.,
CO4	Design Crypto token and smart path by using AI modeling.
CO5	Implement the blockchain algorithms and etherium Concepts.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	0	2	2	0	0	0	0	1	0	0	-	2
CO2	3	3	0	3	3	0	0	0	0	1	0	0	-	2
CO3	3	3	0	3	3	0	0	0	0	1	0	0	-	2
CO4	3	3	0	3	3	0	0	0	0	1	0	0	-	2
CO5	3	3	0	2	2	0	0	0	0	1	0	0	-	2
Average	3	3	-	3	3	-	-	-	-	1	-	-	-	2

High-3: Medium-2: Low-1

Text Books:

1. Blockchain for Beginners: The Complete Step by Step Guide to Understanding Blockchain Technology, Mark Watney, 2017
2. Blockchain: Step-By- Step Guide to Understanding and Implementing Blockchain Technology, Paul Laurence, 2018

Reference Books:

1. Ganesh Prasad Kumble, ―Hands-On Artificial Intelligence for Blockchain: Converging Blockchain and AI to build smart applications for new economies‖ 2020
2. Kiran Garimella, Peter Fingar, Vint Cerf, ―AI + Blockchain‖ 2018
3. Stein Smith, Sean, Blockchain, Artificial Intelligence and Financial Services Implications and Applications for Finance and Accounting Professionals, Springer,2020

E-Books / Web References:

1. https://www.pdfdrive.com/iot-ai-and-blockchain-for-net-e176367528.html
2. https://dl.ebooksworld.ir/motoman/Apress.IoT.AI.and.Blockchain.for.NET.www.EBooksWorld.ir.pdf

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/

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

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

	Component	**Marks**	**Total Marks**
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	QUIZ/Assignment	10	
SEE	Semester End Examination	100	50
	Grand Total		100

Scheme of Examination (SEE):

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

TIME SERIES ANALYSIS

Semester:	**VI**	**CIE Marks**	**50**
Course Code	**AML23603D**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**Duration of SEE (hours):**	**03**
Type of Course	**PEC**	**Credits**	**03**

Prerequisites (if any):

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	To understand the fundamentals of time series data and its components.
2	To gain proficiency in breaking down time series into its core components and applying smoothing techniques to clean the data.
3	To apply transformations to achieve stationarity and use AR, MA, ARMA, and ARIMA models for basic time series forecasting.
4	To implement advanced forecasting models and evaluate the performance of their forecasts using various metrics.
5	To apply machine learning and deep learning techniques to time series data for forecasting and anomaly detection.

Module 1	No. of Hours	RBT Level
Introduction to Time Series and Basic Concepts: Definition and Scope of Time Series ; Types of Time Series Data: Univariate, Multivariate, Stationary, Non-stationary Components of Time Series: Trend, Seasonality, Cyclicality, and Irregular Components Time Series Plotting: Visualizing Time Series Data Applications of Time Series in AI and Machine Learning Introduction to Open-Source Tools: Python libraries like pandas, matplotlib, seaborn.	08	L2
Module 2		
Time Series Decomposition and Smoothing Techniques : **Decomposition of Time Series**: Additive and Multiplicative Models, Trend and Seasonality Estimation, Smoothing Techniques: Moving Average, Exponential Smoothing (Simple, Double, and Triple), Detecting Anomalies in Time Series, Case Study: Decomposing real-world time series data.	08	L2
Module 3		
Stationarity and Time Series Models : Understanding Stationarity: Stationary vs. Non-Stationary Processes, Transformation to tationarity: Differencing, Logarithmic Transformation Autoregressive (AR) Models, Moving Average (MA) Models, ARMA and ARIMA Models: Basics of ARIMA Modeling, Use of Python for ARIMA Modeling (statsmodels library).	08	L2
Module 4		
Advanced Time Series Forecasting: Seasonal ARIMA (SARIMA), Exponential Smoothing State Space Model (ETS), Vector Autoregressive (VAR) Model, Forecasting Future Time Series Values, Evaluating Forecast Accuracy: Mean Absolute Error (MAE), Root Mean Squared Error (RMSE), etc. Hands-on Forecasting: Applying SARIMA, ETS, and VAR models to real-world data.	08	L3
Module 5		

Machine Learning Approaches for Time Series: Time Series in Machine Learning: Introduction to feature engineering for time series Using ML Algorithms for Time Series: Random Forest, Gradient Boosting, and Support Vector Regression (SVR). Recurrent Neural Networks (RNNs) and Long Short-Term Memory (LSTM) Networks. Autoencoder Models for Time Series Anomaly Detection. Case Study: Implementing LSTM for time series prediction using TensorFlow or Keras.	08	L3

Course Outcomes:

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

CO1	**Describe** the fundamental concepts of time series data, including its components and types, and its real-world applications.
CO2	**Analyze** time series data by decomposing it into trend, seasonality, and irregular components, and applying smoothing techniques for data cleaning.
CO3	**Understand** the importance of stationarity in time series modeling and implement AR, MA, ARMA, and ARIMA models for forecasting.
CO4	**Discuss** advanced forecasting techniques such as SARIMA, ETS, and VAR, and evaluate the accuracy of forecasts using performance metrics.
CO5	**Design** and **implement** machine learning and deep learning models like Random Forest, LSTM, and Autoencoders for time series forecasting and anomaly detection.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2							2		2		2
CO2	3	2	2							2		2		2
CO3	2	2	2						1	2		2		2
CO4	3	3	2	1	2	1			1	2		2		3
CO5	3	3	2	1	2	1			1	2		2		3
Average	3	2.4	2	0.4	0.8	0.4			0.6	2		2		2.4

High-3: Medium-2: Low-1

Text Books:

1. **"Introduction to Time Series and Forecasting"** by Peter J. Brockwell and Richard A. Davis (Available online)
2. **"Time Series Analysis with Applications in R"** by Jonathan D. Cryer and Kung-Sik Chan (Available in open access formats)

Reference Books:

1. **"Forecasting: Principles and Practice"** by Rob J Hyndman and George Athanasopoulos (Open-source version available online at https://otexts.com/fpp3/)
2. **Python Data Science Handbook** by Jake VanderPlas (Open-source version available online)

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

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

	Component	**Marks**	**Total Marks**
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	QUIZ/Assignment	10	
SEE	Semester End Examination	100	50
	Grand Total		100

Scheme of Examination (SEE):

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

NEXT-GEN DATABASE TECHNOLOGY USING MONGODB

Semester:	**VI**	**CIE Marks**	**50**
Course Code	**AML23604A**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**Duration of SEE (hours):**	**03**
Type of Course	**OEC**	**Credits**	**03**

Prerequisites (if any): SQL, Hadoop, Python fundamentals, Web development

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	To gain a foundational understanding of NoSQL databases, particularly their architecture and advantages compared to relational databases (SQL) for specific data models.
2	To advance the fundamentals of MongoDB including data structures, document organization, schema design principles, and data manipulation techniques (CRUD) using the Mongo Shell.
3	To Explore advanced functionalities of MongoDB such as secondary indexes, replication, and aggregation frameworks to optimize performance and data manipulation capabilities.
4	To Develop practical skills in building simple web applications with Node.js that leverage MongoDB for data persistence and retrieval.

Module 1	No. of Hours	RBT Level
MySQL: Databases, MySQL: Installing MySQL, Creating a database The mysqladmin command. Tables: Data types, Creating a database, Creating tables, Dropping tables, Allowing NULL values, Specifying a primary key, Updating tables. Basic Syntax: INSERT, SELECT, UPDATE, DELETE. SELECT: SELECT all columns, Formatting, SELECT specific columns only, LIMIT, COUNT, MIN, MAX, AVG, and SUM. WHERE: WHERE Clause example, Operators, AND keyword, OR keyword, LIKE operator, IN operator, IS operator **Textbook 1**	**8**	**L3**
Module 2		
NoSQL Big Data Management, MongoDB and Cassandra: Introduction, NoSQL Data Store, NoSQL Data Architecture Patterns, NoSQL to Manage Big Data, Shared-Nothing Architecture for Big Data Tasks **Textbook 2**	**8**	**L2**
Module 3		
MongoDB—A Database for the Modern Web: What is MongoDB?, JSON, JSON Structure, MongoDB Structure, Document Store Example, MongoDB as a Document Database, Transaction Management in MongoDB, Scaling Up vs. Scaling Out, Features of MongoDB, Secondary Indexes, Replication, Memory Management, Auto Sharding, Aggregation and MapReduce, Collection and Database, Schema Design and Modeling, Reference Data Model, Embedded Data Model, Data Types, Installing MongoDB on Linux, Windows, Starting MongoDB On Windows, **Use Cases:** Explore MongoDB database **Textbook 3**	**8**	**L4**
Module 4		
CRUD Operations in MongoDB: Data Modification in MongoDB, Batch Insert in MongoDB, Ordered Bulk Insert, Performing Ordered Bulk Insert, Unordered Bulk Insert, Inserts: Internals and Implications, Retrieving the documents, $in, $or , and "AND" Conditions, Regular Expression, $Where Query, Advance query option, Update Operation, Replacing Existing Document with New Document, Removing Documents, **Case Study:** MongoDB using CRUD operations	**8**	**L4**

Textbook 3		
Module 5		
Web Application with Node.js and MongoDB: Installing Node.js, Testing that Node.js is installed properly ,Installing MongoDB, Confirming successful MongoDB installation, Writing your first app, Adding the application code, Node and MongoDB Basics-A JavaScript primer: Syntax basics, Understanding the scope of variables, Data types, Operators and flows Understanding, objects Understanding arrays, Understanding functions Anonymous, functions and callbacks JSON, The basics of Node.js, Installing modules using npm, The basics of MongoDB: The Mongo shell: Inserting data, Querying, Updating data, Deleting data. **Textbook 4**	**8**	**L5**

Course Outcomes:

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

CO1	**Compare and contrast** the features and architecture of NoSQL databases like MongoDB with traditional relational databases like MySQL.
CO2	**Design and implement** a document schema for a MongoDB database considering factors like reference and embedded data models.
CO3	**Perform** CRUD operations (Create, Read, Update, Delete) on documents within a MongoDB database using the Mongo Shell.
CO4	**Construct** queries using operators, filters, and regular expressions to retrieve specific data from a MongoDB collection.
CO5	**Develop** a simple web application using Node.js that interacts with a MongoDB database for data persistence.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3		2				2	2	2		2	
CO2	2	3	3		2				2	2	2		2	
CO3	2	3	3		2				2	2	2		2	
CO4	2	3	3		2				2	2	2		2	
CO5	2	3	3		2				2	2	2		2	
Average	**2**	**3**	**3**		**2**				**2**	**2**	**2**		**2**	

High-3: Medium-2: Low-1

Text Books:

1. Bobby ILiev, “Introduction to SQL” An Open EBOOK.
2. Raj Kamal, Preeti Saxena, “Big Data Analytics, Mc graw Hill, 2019.
3. https://learn.mongodb.com/courses/start-here-introduction-to-mongodb
4. Web Development with MongoDB and Node, Third Edition, Bruno Joseph D'mello Mithun Satheesh Jason Krol.

Reference Books:

1. The Definitive Guide to MongoDB A complete guide to dealing with Big Data using MongoDB — Third Edition — David Hows Peter Membrey Eelco Plugge Tim Hawkins.
2. MongoDB Cookbook Second Edition, Cyrus Dasadia Amol Nayak. Packt Publishinhg E-Books / Web References:
3. https://learn.mongodb.com/courses/start-here-introduction-to-mongodb

4. https://www.w3schools.com/mongodb/

MOOCs:

1. https://www.coursera.org/courses?query=mongodb.
2. https://learn.mongodb.com/

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

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

	Component	**Marks**	**Total Marks**
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignment	10	
SEE	Semester End Examination	100	50
	Grand Total		100

Note: CIE pattern for courses like Drawing and Laboratories can be decided by the respective Board of Studies and can be given here.

Scheme of Examination (SEE):

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

PROJECT PHASE-1

Semester:	**6**	**CIE Marks**	**50**
Course Code	**AMLP23605**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**0:0:6**	**Duration of SEE (hours):**	**03**
Type of Course	**PROJ**	**Credits**	**03**

The course 'Project Work' is mainly intended to evoke the innovation and invention skills in a student. The course will provide an opportunity to synthesize and apply the knowledge and analytical skills learned, to be developed as a prototype or simulation. The project extends to 2 semesters and will be evaluated in the 7th and 8th semester separately, based on the achieved objectives. One third of the project credits shall be completed in 7^{th} semester and two third in 8^{th} semester. It is recommended that the projects may be finalized in the thrust areas of the respective engineering stream or as interdisciplinary projects. Importance should be given to address societal problems and developing indigenous technologies.

Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary project can be assigned to an individual student or to a group having not more than 4 students. In extraordinary cases, like the funded projects requiring students from different disciplines, the project student strength can be 5 or 6.

Course Objectives

- To apply engineering knowledge in practical problem solving.
- To foster innovation in design of products, processes or systems.
- To develop creative thinking in finding viable solutions to engineering problems

Course Outcomes [COs]: After successful completion of the course, the students will be able to:

CO1	Identify technology/research gaps and propose innovative/creative solutions (Cognitive knowledge level: Analyze).
CO2	Organize and communicate technical and scientific findings effectively in written and oral forms (Cognitive knowledge level: Apply).
CO3	Plan and execute tasks utilizing available resources within timelines, following ethical and professional norms (Cognitive knowledge level: Apply).
CO4	Model and solve real world problems by applying knowledge across domains (Cognitive knowledge level: Apply)
CO5	Develop products, processes or technologies for sustainable and socially relevant applications (Cognitive knowledge level: Apply).

PROJECT PHASE I

Phase 1 Target

- Literature study/survey of published literature on the assigned topic
- Formulation of objectives
- Formulation of hypothesis/ design/ methodology
- Formulation of work plan and task allocation.
- Block level design documentation
- Seeking project funds from various agencies
- Preliminary Analysis/Modeling/Simulation/Experiment/Design/Feasibility study
- Preparation of Phase 1 report.

RUBRICS FOR PROJECT PHASE - I EVALUATION

Rubrics Review

Review #	Agenda	Assessment	Review Assessment Weightage	Over all Weightage
Review 1	Interim evaluation by the Evaluation Committee	Rubric R1	(20)	**(100)**
Review 2	Final Evaluation by the Evaluation Committee	Rubric R2	(30)	
Review 3	Project Phase - I Report	Rubric R3	(20)	
Review 4	Project progress evaluation by guide		(30)	
Evaluation			(100)	(100)
Total			(100)	**(100)**

(The evaluation committee comprises HoD or a senior faculty member, Project coordinator and project supervisor).

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3		2	1	3	3		2	2	2
CO2	2	2	3		3		2	1	3	3		2		
CO3	2	2	3		2		2	1	3	3		2		
CO4	3	3	3	2	3		2	1	3	3		2	2	2
CO5	3	3	3	2	3		2	1	3	3		2	2	2

DEEP LEARNING LAB

Semester:	**VI**	**CIE Marks**	**50**
Course Code	**AMLL23606**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**0:0:2**	**Duration of SEE (hours):**	**03**
Type of Course	**PCL**	**Credits**	**03**

Prerequisites (if any): Machine Learning Essentials, Python Programming, Linear Algebra.

Course Learning Objectives:

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

Mode of Evaluation: LAB			
Prog No.	Integrated component of Professional Course (IPC-Practical)- **List of Indicative Program Description**	**CO**	**RBT Level**
	Part - A		
1.	Implementation of Artificial neural network for classification.	CO1	L3
2.	Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.	CO2	L3
3.	Develop a baseline neural network model for the regression problem. (for Boston house price dataset)	CO1	L3
4.	Apply deep feedforward networks to practical problems by designing network architectures and hidden units, with a focus on learning the XOR problem as an example.	CO2	L3
5.	Convolutional Neural Networks Best Practices To Develop a deep learning model to achieve near state-of-the-art performance on the MNIST handwritten digit recognition task in Python using the Keras deep learning library	CO3	L4

Prog No.	**Additional Programs**	**CO**	**RBT Level**
	Part – B		
6.	Perform Sentiment Analysis in network graph using RNN	CO3	L5
7.	Image Captioning using Deep Learning	CO4	L5

8.	Generating cifar-10 fake images using Deep Convolutional Generative Adversarial Networks (DCGAN)	CO4	L5

Course Outcomes:

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

CO No.	DEEP LEARNING PRINCIPLES & PRACTICES-21AML53	RBT Level / Cognitive Level
CO1	Understand and Analyse the fundamentals that drive deep learning networks	L2
CO2	Build, train and apply fully connected neural networks	L3
CO3	Analyse convolutional networks and their role in image processing.	L3
CO4	Implementation of deep learning techniques to solve real-world problems.	L5

Text Books:

2. "Deep Learning", Amit kumar das, Saptarsi goswami, Pabitra mitra, Amlan, 1st edition, Pearson.

Reference Books:

9. Deep Learning", Ian Goodfellow, Yoshua Bengio and Aaron Courville, MIT Press, 2017.
10. "Deep Learning: A Practitioner's Approach" Josh Patterson, Adam Gibson, O'Reilly Media, 2017
11. "Applied Deep Learning. A Case-based Approach to Understanding Deep Neural Networks" UmbertoMichelucci Apress, 2018.

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	3	3	-	2	-	-	-	-	1	-	2	-	2
CO2	2	3	2	-	2	-	-	-	-	1	-	2	-	2
CO3	2	2	2	-	3	-	-	-	-	1	-	2	-	2
CO4	2	2	3	-	3	-	-	-	-	1	1	2	-	2

AI TOOLS, FRAMEWORK & ITS APPLICATIONS II

Semester:	**6**	**CIE Marks**	**50**
Course Code	**AML23607A**	**SEE Marks**	**50**
Hours/Week (L:T:P)	**1:0:2**	**Duration of SEE (hours):**	**03**
Type of Course	**AEC**	**Credits**	**02**

Prerequisites: Basics of Probability

Course Learning Objectives: The course will enable students to:

CLO1	Use and analyze the concept of text mining
CLO2	Explore and Apply NLP libraries like NLTK
CLO3	Apply SKLearn library for disease prediction
CLO4	Use and Apply data exploration and feature engineering

Sl.NO	**Laboratory Experiments**
	PART A
1	Installation of NLTK Library and working with Basic commands
2	Write a python code for Tokenizing and count word frequency.
3	Write a python code NLTK word stemming and Lemmatizing words using WordNet.
4	Write a python code for healthcare data exploration
5	Perform feature engineering for healthcare dataset.
6	Built a training/validation/test sample model for healthcare dataset.
	PART B
	Mini Project **1. Clinical decision making on healthcare domain using SkLearn** **2. Design and build a model for AI Education using NLP libraries.**

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

CO607A.1	**Extraction** of meaning insights using Natural Language processing
CO607A.2	**Measure** the information content using Natural Language processing
CO607A.3	**Recommendations** using Natural Language processing

Conduct of Practical Examination:

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

Mini Project

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

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enablesthem to create innovative pedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/concept videos/ partial reproduction of research work/ oral presentation

GENERATIVE AI

Semester:	**6**	**CIE Marks**	**50**
Course Code	**AML23607B**	**SEE Marks**	**50**
Hours/Week (L:T:P)	**1:0:2**	**Duration of SEE (hours):**	**03**
Type of Course	**AEC**	**Credits**	**02**

Prerequisites: Basics of Probability

Course Learning Objectives: The course will enable students to:

CLO1	To learn Python and TensorFlow skills for Generative AI.
CLO2	To study techniques for cleaning and preparing data for Generative AI tasks.
CLO3	To implement generative AI models
CLO4	To develop innovative applications using generative AI tools and techniques.

Sl.NO	Laboratory Experiments
	PART A
1	Write Python scripts to implement basic operations and TensorFlow 2 tensors.
2	Preprocess and clean datasets for Generative AI applications using Python libraries such as Pandas and NumPy. Handle missing data, normalize features, and encode categorical variables.
3	Use Matplotlib or Seaborn to visualize data distributions and patterns in Generative AI datasets. Plot histograms, scatter plots, and heatmaps to analyze data characteristics.
4	Implement a Generative Adversarial Network (GAN) architecture using TensorFlow 2. Train the GAN model on a dataset such as MNIST or CIFAR-10 for image generation tasks.
5	Train a GAN model on a custom dataset for image generation. Experiment with hyperparameters, loss functions, and optimization techniques to optimize GAN training.
6	Explore advanced techniques such as Wasserstein GANs, Progressive GANs, or StyleGANs for image generation. Implement and compare these techniques for generating high-quality images.
7	Develop applications for image and video generation using trained Generative AI models. Use the models to generate art, create deep fakes, or synthesize video content.
8	**Text Generation: I**mplement a Long Short-Term Memory (LSTM) network using TensorFlow 2 for text generation tasks. Train the LSTM model on a dataset of text sequences and generate new text samples.
9	**Text generation**: Implement a Transformer-based language model (e.g., GPT) using TensorFlow 2 for text generation. Fine-tune the model on a text corpus and generate coherent and contextually relevant text.
10	**Music Generation:**

	Preprocess music data and represent it in a suitable format for music generation tasks. Explore MIDI or audio representations for training Generative AI models.
	PART B
	Mini Project **1. Music Generation: Implement a Long Short-Term Memory (LSTM) network using TensorFlow 2 for music generation. Train the LSTM model on a dataset of music sequences and generate new musical compositions.** **2. Generate Novel Music Compositions: Transformer-based Music Generation: Implement a Transformer-based architecture (e.g., MusicBERT, MusicGPT) using TensorFlow 2 for music generation. Fine-tune the model on a music dataset and generate novel music compositions.**

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

CO607B.1	Implement Python and TensorFlow basics, including data handling and preprocessing techniques.
CO607B.2	Implement Generative AI models such as GANs, VAEs, LSTM networks, and Transformer models for image, text, and music generation tasks.
CO607B.3	Evaluate model performance and experiment with hyperparameters and optimization techniques to enhance Generative AI outcomes.
CO607B.4	Develop innovative applications in image, text, and music generation, showcasing practical skills.

Conduct of Practical Examination:
All laboratory experiments are to be included for practical examination.

1. Breakup of marks and the instructions printed on the cover page of the answer script tobe strictly adhered by the examiners.
2. Students can pick one experiment from the questions lot prepared by the examiners.
3. Change of experiment is allowed only once and 15% Marks allotted to the procedurepart to be made zero.

Mini Project

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

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enablesthem to create innovative pedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/concept videos/ partial reproduction of research work/ oral presentation

EXPLAINABLE AI

Semester:	**6**	**CIE Marks**	**50**
Course Code	**AML23607C**	**SEE Marks**	**50**
Hours/Week (L:T:P)	**1:0:2**	**Duration of SEE (hours):**	**03**
Type of Course	**AEC**	**Credits**	**02**

Prerequisites: Basics of Probability

Course Learning Objectives: The course will enable students to:

CLO1	Understand the need for explainability in AI systems.
CLO2	Explore various methods and tools for explaining the decisions made by AI/ML models.
CLO3	Implement and analyze explainability techniques for different AI models.
CLO4	Develop skills to evaluate and interpret AI models from a fairness, accountability, and transparency perspective.

Sl.NO	Laboratory Experiments
	PART A
1	**Introduction to Explainable AI** To understand the concept of explainability in AI, its importance, and use cases. **Tasks**: 1. Overview of XAI. 2. Study examples of opaque models (e.g., deep neural networks) and interpretable models (e.g., decision trees). 3. Setup of basic tools (Python, `sklearn`, and `XAI` libraries).
2	**Visualizing Model Predictions with Feature Importance (Using Decision Trees)** To analyze feature importance in Decision Trees. **Tasks**: 1. Train a Decision Tree on a dataset (e.g., Titanic dataset). 2. Visualize the tree structure and feature importance using `sklearn` and `matplotlib`. 3. Interpret how feature importance affects predictions.
3	**Explainability of Black Box Models using LIME (Local Interpretable Model-Agnostic Explanations)** Apply LIME to explain predictions of black-box models.

	Tasks: 1. Train a black-box model (e.g., Random Forest or Neural Network) on a dataset. 2. Use the `LIME` package to explain individual predictions. 3. Visualize and analyze the explanations.
4	**Global Interpretability with SHAP (SHapley Additive exPlanations)** Use SHAP to provide global interpretability for machine learning models. **Tasks**: 1. Train a Random Forest or XGBoost model. 2. Use the `SHAP` package to compute SHAP values for the dataset. 3. Analyze the SHAP summary plot and dependence plots for feature importance.
5	**Visualizing CNN Filters and Activations (Explainability in Convolutional Neural Networks)** Understand how Convolutional Neural Networks (CNNs) interpret images. **Tasks**: 1. Train a CNN model (e.g., on CIFAR-10 or MNIST dataset). 2. Visualize the filters and activations of convolutional layers using `tensorflow`/`keras`. 3. Interpret how the network processes visual data through different layers.
6	**Saliency Maps and Grad-CAM for CNN Model Explanations** Apply Saliency Maps and Grad-CAM to visualize the important regions in an image for CNN predictions. **Tasks**: 1. Implement Saliency Maps to highlight important pixels. 2. Apply Grad-CAM to localize the regions in the image responsible for a classification decision. 3. Analyze and compare the results.
7	**Counterfactual Explanations in AI Systems** Explore counterfactual explanations and how they explain model predictions. **Tasks**: 1. Train a classifier (e.g., logistic regression) on a dataset. 2. Generate counterfactual explanations for incorrect or critical predictions using `alibi` library.

	3. Discuss how these explanations provide insights into what minimal changes would alter the outcome.
8	**Fairness and Bias Detection in AI Models** Detect and mitigate bias in AI models. **Tasks**: 1. Train a model on a biased dataset (e.g., a dataset with gender or racial bias). 2. Use fairness metrics (such as disparate impact or equal opportunity) to evaluate the model. 3. Apply bias mitigation techniques (e.g., reweighing or adversarial debiasing).
9	**Model Transparency through Rule-Based Models** Interpret black-box models using surrogate rule-based models. **Tasks**: 1. Train a complex model (e.g., Random Forest). 2. Create a simpler surrogate rule-based model (e.g., decision rules or decision trees) to mimic the black-box model. 3. Use the rule-based model to explain the behavior of the original model.
10	**Case Study – Explainability in Healthcare AI** Apply XAI techniques to a real-world healthcare dataset. **Tasks**: 1. Use a healthcare-related dataset (e.g., predicting heart disease). 2. Train a complex model (e.g., neural network or ensemble model). 3. Apply LIME, SHAP, and counterfactual explanations to explain the predictions made for high-risk patients. 4. Discuss the ethical implications of explainability in AI systems used for healthcare.

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

CO607C.1	Gain hands-on experience in explaining AI models using various tools and techniques.
CO607C.2	Understand the trade-offs between model accuracy and interpretability.
CO607C.3	Be equipped with the skills to analyze and interpret the decisions made by black-box AI models.
CO607C.4	Understand the ethical considerations in building explainable and fair AI systems.

Conduct of Practical Examination:

All laboratory experiments are to be included for practical examination.

1. Breakup of marks and the instructions printed on the cover page of the answer script tobe strictly adhered by the examiners.
2. Students can pick one experiment from the questions lot prepared by the examiners.
3. Change of experiment is allowed only once and 15% Marks allotted to the procedurepart to be made zero.

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enablesthem to create innovative pedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/concept videos/ partial reproduction of research work/ oral presentation.

National Service Scheme (NSS)		Semester	3rd to 6th
Course Code	**NSK23608**	CIE Marks	**25*4 = 100**
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	------
Total Hours of Pedagogy	40 hour Practical Session +15 hour Planning	Total Marks	**25*4 = 100**
Examination nature (SEE)	Activities Report Evaluation by College NSS Officer at the end of every semester (3rd to 6th semester)		
Credits	NCMC – Non Credit Mandatory Course (Completion of the course shall be mandatory for the award of degree)		

Course objectives: National Service Scheme (NSS) will enable the students to:

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

General Instructions - Pedagogy :

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied social and cultural skills.
2. State the need for NSS activities and its present relevance in the society and Provide real-life examples.
3. Support and guide the students for self-planned activities.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
5. Encourage the students for group work to improve their creative and analytical skills.

National Service Scheme (NSS) – Contents

==========

1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.
2. Waste management– Public, Private and Govt organization, 5 R's.
3. Setting of the information imparting club for women leading to contribution in social and economic issues.
4. Water conservation techniques – Role of different stakeholders– Implementation.
5. Preparing an actionable business proposal for enhancing the village income and approach for implementation.
6. Helping local schools to achieve good results and enhance their enrolment in Higher/

technical/ vocational education.

7. Developing Sustainable Water management system for rural areas and implementation approaches.
8. Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swatch Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.
9. Spreading public awareness under rural outreach programs.(minimum5 programs).
10. Social connect and responsibilities.
11. Plantation and adoption of plants. Know your plants.
12. Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).
13. Govt. school Rejuvenation and helping them to achieve good infrastructure.

NOTE:

- Student/s in individual or in a group Should select any one activity in the beginning of each semester till end of that respective semester for successful completion as per the instructions of NSS officer with the consent of HOD of the department.
- At the end of every semester, activity report should be submitted for evaluation.

Distribution of Activities - Semester wise from 3rd to 6th semester

Sem	Topics / Activities to be Covered
3rd Sem for 25 Marks	1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing. 2. Waste management– Public, Private and Govt organization, 5 R's. 3. Setting of the information imparting club for women leading to contribution in social and economic issues.
4th Sem for 25 Marks	4. Water conservation techniques – Role of different stakeholders– Implementation. 5. Preparing an actionable business proposal for enhancing the village income and approach for implementation. 6. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.
5th Sem for 25 Marks	7. Developing Sustainable Water management system for rural areas and implementation approaches. 8. Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc. 9. Spreading public awareness under rural outreach programs.(minimum5 programs). 10. Social connect and responsibilities.
6th Sem for 25 Marks	11. Plantation and adoption of plants. Know your plants. 12. Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs). 13. Govt. school Rejuvenation and helping them to achieve good infrastructure.

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

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

6.	Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.	May be individual or team	Local government / private/ aided schools/Government Schemes officers/ etc…..	School selection/proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
7.	Developing Sustainable Water management system for rural areas and implementation approaches.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	site selection/proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
8.	Contribution to any national level initiative of Government of India. For eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Group selection/proper consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
9.	Spreading public awareness under rural outreach programs.(minimum5 programs). ///// Social connect and responsibilities.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Group selection/proper consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
10.	Plantation and adoption of plants. Know your plants.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Place selection/proper consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

11.	Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Place selection/proper consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer
12.	Govt. school Rejuvenation and helping them to achieve good infrastructure.	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Place selection/proper consultation/Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by NSS officer

Plan of Action (Execution of Activities For Each Semester)

Sl.NO	Practice Session Description
1	**Lecture session by NSS Officer**
2	**Students Presentation on Topics**
3	**Presentation - 1 , Selection of topic, PHASE - 1**
4	**Commencement of activity and its progress - PHASE - 2**
5	**Execution of Activity**
6	**Execution of Activity**
7	**Execution of Activity**
8	**Execution of Activity**
9	**Execution of Activity**
10	**Case study based Assessment, Individual performance**
11	**Sector wise study and its consolidation**
12	**Video based seminar for 10 minutes by each student At the end of semester with Report.**

- In every semester from 3rd semester to 6th semester, Each student should do activities according to the scheme and syllabus.
- At the end of every semester student performance has to be evaluated by the NSS officer for the assigned activity progress and its completion.
- At last in 6th semester consolidated report of all activities from 3rd to 6th semester, compiled report should be submitted as per the instructions.

Course outcomes (Course Skill Set):

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

CO1: Understand the importance of his / her responsibilities towards society.

CO2: Analyse the environmental and societal problems/issues and will be able to design solutions for the same.

CO3: Evaluate the existing system and to propose practical solutions for the same for sustainable development.

CO4: Implement government or self-driven projects effectively in the field.

CO5: Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

Assessment Details for CIE (both CIE and SEE)

Weightage	**CIE – 100%**	• Implementation strategies of the project (NSS work). • The last report should be signed by NSS Officer, the HOD and principal. • At last report should be evaluated by the NSS officer of the institute. • Finally the consolidated marks sheet should be sent to the university and also to be made available at LIC visit.
Presentation - 1 Selection of topic, PHASE - 1	10 Marks	
Commencement of activity and its progress - PHASE - 2	10 Marks	
Case study based Assessment Individual performance	10 Marks	
Sector wise study and its consolidation	10 Marks	
Video based seminar for 10 minutes by each student At the end of semester with Report.	10 Marks	
Total marks for the course in each semester	**50 Marks**	

Marks scored for 50 by the students should be Scale down to 25 marks In each semester for CIE entry in the VTU portal.

25 marks CIE entry will be entered in University IA marks portal at the end of each semester 3rd to 6th sem, Report and assessment copy should be made available in the department semester wise.

Students should present the progress of the activities as per the schedule in the prescribed practical session in the field. There should be positive progress in the vertical order for the benefit of society in general.

Suggested Learning Resources:

Books :

1. **NSS Course Manual,** Published by NSS Cell, VTU Belagavi.
2. Government of Karnataka, NSS cell, activities reports and its manual.
3. Government of India, nss cell, Activities reports and its manual.

PHYSICAL EDUCATION (SPORTS & ATHLETICS) – I						
Course Code	**:**	PEK23608		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	0:0:2		**SEE**	**:**	000
Total Hours	**:**	24 P				

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

1. Understand the fundamental concepts and skills of Physical Education, Health,Food, Nutrition and general fitness
2. Familiarization of health-related Exercises, Sports for overall growth anddevelopment
3. Create a foundation for the professionals in Physical Education and Sports
4. Participate in the competition at regional/state / national / international levels.
5. Understand and practice of specific games and athletic throwing events.

Module I : Orientation **4 Hours**

A. Fitness
B. Food & Nutrition

Module II: General Fitness & Components of Fitness **4 Hours**

A. Agility – Shuttle Run
B. Flexibility – Sit and Reach
C. Cardiovascular Endurance – Harvard step Test

Module III : Specific games (Any one to be selected by the student) **16 Hours**

1. Badminton (Fore hand low/high service, back hand service, smash, drop)
2. Basketball (Dribbling, passing, shooting etc.)
3. Athletics (Field events – Throws)

Scheme and Assessment for auditing the course and Grades:

Sl. No.	Activity	Marks
1.	Participation of student in all the modules	20
2.	Quizzes – 2, each of 15 marks	30
3.	Final presentation / exhibition / Participation in competitions/ practical on specific tasks assigned to the students	50
	Total	**100**

Yoga		Semester	III – VI sem
Course Code	**YOK23608**	CIE Marks	100/sem
Teaching Hours/Week (L:T:P)	0:0:2	SEE Marks	000
Total Hours of Pedagogy per semester	24 - 28 hours (Theory + practical)	Total Marks	100/sem
Examination nature (SEE)	**Objective type Theory / Practical / Viva-Voce**		

Course objectives:

1) To enable the student to have good health.
2) To practice mental hygiene.
3) To possess emotional stability.
4) To integrate moral values.
5) To attain higher level of consciousness.

The Health Benefits of Yoga

The benefits of various yoga techniques have been supposed to improve

- body flexibility,
- performance,
- stress reduction,
- attainment of inner peace, and
- self-realization.

The system has been advocated as a complementary treatment to aid the healing of several ailments such as

- coronary heart disease,
- depression,
- anxiety disorders,
- asthma, and
- extensive rehabilitation for disorders including musculoskeletal problems and traumatic brain injury.

The system has also been suggested as behavioral therapy for smoking cessation and substance abuse (including alcohol abuse).

If you practice yoga, you may receive these physical, mental, and spiritual benefits:

- Physical
    1. Improved body flexibility and balance
    2. Improved cardiovascular endurance (stronger heart)
    3. Improved digestion
    4. Improved abdominal strength
    5. Enhanced overall muscular strength
    6. Relaxation of muscular strains
    7. Weight control
    8. Increased energy levels
    9. Enhanced immune system
- Mental
    1. Relief of stress resulting from the control of emotions
    2. Prevention and relief from stress-related disorders
    3. Intellectual enhancement, leading to improved decision-making skills
- Spiritual
    1. Life with meaning, purpose, and direction
    2. Inner peace and tranquility
    3. Contentment

Yoga Syllabus

Semester V

Patanjali'sAshtanga Yoga its need and importance.

Ashtanga Yoga

1. Asana
2. Pranayama
3. Pratyahara

Asana its meaning by name, technique, precautionary measures and benefits of each asana

Different types of Asanas

a. Sitting 1. Ardha Ushtrasana
   2. Vakrasana
   3. Yogamudra in Padmasana

b. Standing 1. UrdhvaHastothanasana
   2. Hastapadasana
   3. ParivrittaTrikonasana
   4. Utkatasana

c. Prone line 1. Padangushtha Dhanurasana
   2. Poorna Bhujangasana / Rajakapotasana

d. Supine line 1. Sarvangasana
   2. Chakraasana
   3. Navasana/Noukasana
   4. Pavanamuktasana

Revision of practice 60 strokes/min 3 rounds

Meaning by name, technique, precautionary measures and benefits of each Pranayama

1. Ujjayi 2. Sheetali 3. Sheektari

Course outcomes (Course Skill Set):

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

- Understand the meaning, aim and objectives of Yoga.
- Perform Suryanamaskar and able to Teach its benefits.
- Understand and teach different Asanas by name, its importance, methods and benefits.
- Instruct Kapalabhati and its need and importance.
- Teach different types of Pranayama by its name, precautions, procedure and uses
- Coach different types of Kriyas, method to follow and usefulness.

Assessment Details (both CIE and SEE)

- Students will be assessed with internal test by a. Multiple choice questions b. Descriptivetype questions (Two internal assessment tests with 25 marks/test)
- Final test shall be conducted for whole syllabus for 50 marks.
- Continuous Internal Evaluation shall be for 100 marks (including IA test)

Suggested Learning Resources:

Books:

1. **Yogapravesha in Kannada by Ajitkumar**
2. **Light on Yoga by BKS Iyengar**
3. **Teaching Methods for Yogic practices by Dr. M L Gharote & Dr. S K Ganguly**
4. **Yoga Instructor Course hand book published by SVYASA University, Bengaluru**
5. **Yoga for Children –step by step – by Yamini Muthanna**

Web links and Video Lectures (e-Resources): Refer links

6. **https://youtu.be/KB-TYlgd1wE**
7. **https://youtu.be/aa-TG0Wg1Ls**

INDIAN KNOWLEDGE SYSTEM

Course Code	**BIKK23609**	**CIE Marks**	**50**
Hours/Week (L: T: P)	**1:0:0**	**SEE Marks**	**50**
No. of Credits	**0**	**Examination Hours**	**01**

Course Objectives:

CLO1	To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system
CLO2	To make the students understand the traditional knowledge and analyse it and apply it to their day-to-day life.

Content
Module 1 (05 hours)
Introduction to Indian Knowledge Systems (IKS): Overview, Vedic Corpus, Philosophy, Character scope and importance, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge vs. western knowledge.
Module 2 (05 hours)
Traditional Knowledge in Humanities and Sciences: Linguistics, Number and measurements-Mathematics, Chemistry, Physics, Art, Astronomy, Astrology, Crafts and Trade in India and Engineering and Technology
Module 3 (05 hours)
Traditional Knowledge in Professional domain: Town planning and architecture Construction, Health, wellness and Psychology-Medicine, Agriculture, Governance and public administration, United Nations Sustainable development goals.

Reference Books:

1. Introduction to Indian Knowledge System- concepts and applications, B Mahadevan, Vinayak Rajat Bhat, Nagendra Pavana R N, 2022, PHI Learning Private Ltd, ISBN-978-93- 91818-21-0
2. Traditional Knowledge System in India, Amit Jha, 2009, Atlantic Publishers and Distributors (P) Ltd., ISBN- 13: 978-8126912230,
3. Knowledge Traditions and Practices of India, Kapil Kapoor, Avadesh Kumar Singh, Vol. 1, 2005, DK Print World (P) Ltd., ISBN 81-246-0334,

COURSE OUTCOMES:

Upon completion of this course, student will be able to:

CO 1	Provide an overview of the concept of the Indian Knowledge System and its importance.
CO 2	Appreciate the need and importance of protecting traditional knowledge.
CO 3	Recognize the relevance of Traditional knowledge in different domains.
CO 4	Establish the significance of Indian Knowledge systems in the contemporary world

Scheme of Examination:

Semester End Examination (SEE):

SEE paper shall be set for 50 questions, each of the 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is 01 hour.

Continuous Internal Evaluation (CIE):

Three Tests are to be conducted for 40 marks each. Average of Marks scored in all three tests is added to test component. CIE is executed by way of quizzes / Alternate Assessment Tools (AATs), and three tests. Typical Evaluation pattern for regular courses is shown in Table 2.

Table 2: Distribution of weightage for CIE & SEE of Regular courses

Component		Marks	Total Marks
CIE	CIE Test-1	**40**	**50**
	CIE Test-2	**40**	
	CIE Test-3	**40**	
	Assignments	**10**	
SEE	Semester End Examination	**50**	**50**
Grand Total			**100**

CO/PO	**PO6**
CO 1	3
CO 2	3
CO 3	3
CO 4	3
Average	3

Low-1: Medium-2: High-3

IMAGE ANALYTICS WITH COMPUTER VISION

Semester:	**VII**	**CIE Marks**	**50**
Course Code	**AML23701**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**3:0:2**	**Duration of SEE (hours):**	**03**
Type of Course	**IPC**	**Credits**	**04**

Prerequisites (if any): Image Processing & Deep Learning

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
CLO1	To impart the fundamentals of image formation, the major ideas, methods, and techniques of computer vision and pattern recognition
CLO2	To evaluate the techniques followed in image enhancements.
CLO3	To develop an appreciation for various techniques of Computer Vision for Object detection and Face Recognition systems
CLO4	To provide the student with programming experience from implementing computervision and object recognition applications.

Module 1	No. of Hours	RBT Level
Digital Image Fundamentals: What is Digital Image Processing? Origins of Digital Image Processing, Examples of fields that use DIP, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships between Pixels, Linear and Nonlinear Operations. [Text1: Chapter 1 and Chapter 2: Sections 2.1 to 2.5, 2.6.2]	**10**	**L2**
Module 2		
Spatial Domain: Some Basic Intensity Transformation Functions, Histogram Processing, Fundamentals of Spatial Filtering,-Smoothing Spatial Filters, Sharpening Spatial Filters Frequency Domain: Preliminary Concepts, The Discrete Fourier Transform (DFT) of Two Variables, Properties of the 2-D DFT, Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters, and Selective Filtering.	**10**	**L3**
Module 3		
Image Representation and Description: Representation schemes, Boundary descriptors, Region descriptors Binary Machine Vision: Thresholding, Segmentation, Connected component labeling, Hierarchal segmentation, Spatial clustering, Split& merge, Rule-based Segmentation, Motion-based segmentation. Area Extraction: Concepts, Data-structures, Edge, Line-Linking, Hough transform, Line fitting, Curve fitting (Least-square fitting).	**10**	**L3**
Module 4		
Introduction to Computer Vision: Basic concepts: pixel representation of an image, Image in frequency domain, different color models, and their transformation, Filtering and Convolution, Image preprocessing using PIL/Pillow, OpenCV, and	**10**	**L4**

Keras: reading multiple images from a directory, plotting, enhancement, filtering, re-scaling, morphological operations and image data augmentation.		
Module 5		
Object Detection Basic concepts: bounding box representation, sliding window methods, anchorboxes, grid cells, and non-maximum suppression (NMS). State-of-the-artarchitectures: R-CNN and YOLO. Evaluation metrics: Intersection over Union (IoU) and Mean Average Precision (mAP), Practical use case. Face Detection: Face identification & verification using VGGFace2, Face Net, Eigen faces.	**10**	**L4**

Course Outcomes:

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

CO1	Comprehend the basic concepts, terminology, theories, models, and methods in the field of computer vision.
CO2	Analyze images in the frequency domain using the Discrete Fourier Transform (DFT) and understand the properties of the 2-D DFT.
CO3	Critically evaluate the performance and limitations of different image representation, segmentation, and feature extraction techniques.
CO4	Apply state-of-the-art architectures such as R-CNN and YOLO for object detection.
CO5	Demonstrate the face recognition concepts in face identification, face classification.

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	2	2	2		3					3		2		3
CO2	2	2	2		3					3		2		3
CO3	3	2	3		3				3	3		2		2
CO4	3	2	3		3				3	3		2		3
CO5	3	3	3		3				3	3		2		2
Average	3	2	3		3				3	3		2		3

High-3: Medium-2: Low-1

Text Books:

1. Rafael C. Gonzalez and Richard E. Woods, “Digital Image Processing”, Third Edition, Pearson Education, 2009.
2. Deep learning for Computer Vision by Jason Brownlee.

Reference Books:

1. Milan Sonka, Vaclav Hlavac and Roger Boyle, “Image Processing, Analysis and Machine Vision”, Third Edition, Cengage Learning, 2007.

2. Computer Vision: Algorithms and Applications (Texts in Computer Science) Hardcover – 19 October 2010 by Richard Szeliski (Author)

E-Books / Web References:

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

MOOCs:

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

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.
Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.
Typical evaluation pattern for regular courses is shown in Table 1:

	Component	**Marks**	**Total Marks**
CIE	CIE Test-1	30	50
	CIE Test-2	30	
	CIE Test-3	30	
	Laboratory	20	
SEE	Semester End Examination	100	50
	Grand Total		100

Scheme of Examination (SEE):

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

ADVANCE NATURAL LANGUAGE PROCESSING

Semester:	**VII**	**CIE Marks**	**50**
Course Code	**AML23702**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**3:0:2**	**Duration of SEE (hours):**	**03**
Type of Course	**IPC**	**Credits**	**04**

Prerequisites (if any):

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	**Understand** the techniques to transform unstructured text to structured data
2	**Understand** the development of Question Answering System and Chatbot
3	**Develop** Ontology and knowledge graph for a given use case.
4	**Understand** the concept of topic modeling and its applications
5	**Understand and apply** the concept of WordNet disambiguation.

Module 1	No. of Hours	RBT Level
Information Extraction : POS Tagging, Named Entities and Named Entity Tagging, Named Entity Recognition, Relation Extraction, Extracting Events and Time : Temporal Ordering of Events	**10**	**L3**
Module 2		
Question Answering and Chabot's : Information Retrieval, IR-based Factoid Question answering, Knowledge-based Question Answering, Classic QA Models, Using multiple information sources: IBM's Watson, Evaluation of Factoid Answers, Properties of Human Conversation, GUS: Simple Frame-based Dialogue Systems, Dialogue System Design.	**10**	**L3**
Module 3		
Semantic web ontology and Knowledge Graph: Introduction to semantic web, Semantic web ontology, Semantic web languages, Ontology Engineering, Ontology Learning, Knowledge graph –construction of graph	**10**	**L3**
Module 4		
Topic Modeling : Mathematical foundations for LDA : Multinomial and Dirichlet distributions, Intuition behind LDA, LDA Generative model, Latent Dirichlet Allocation Algorithm and Implementation, Gibbs Sampling	**10**	**L3**
Module 5		
Word Senses and WordNet: Word Senses, Relation between Senses, WordNet: A Database of Lexical relations, Word Sense disambiguation, Alternate WSD algorithms and Tasks, Word Sense Induction	**10**	**L3**

Course Outcomes:

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

CO1	Apply the POS, NER and other information extraction techniques
CO2	Apply the concepts and develop a Question answering system
CO3	Understand the real time need of knowledge graph and its applications
CO4	Understand the topic modeling and apply it in a given scenario
CO5	Understand the concept of Word Senses and WordNet

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO1	3	3	3		3			2	2	2		2	1	2
CO2	3	3	3		3			2	2	2		2	1	2
CO3	3	3	3		3			2	2	2		2	1	2
CO4	3	3	3		3			2	2	2		2	1	2
CO5	3	3	3		3			2	2	2		2	1	2
Avg	3	3	3		3			2	2	2		2	1	2

High-3: Medium-2: Low-1

Text Books :

1. Speech and Language processing: An introduction to Natural Language Processing,
2. Computational Linguistics and speech Recognition by Daniel Jurafsky and James H.
3. Martin (Speech and Language Processing (stanford.edu))

Reference Book(s) & other resources

1. Manning and Schütze, Foundations of Statistical Natural Language Processing, MIT Press. Cambridge, MA
2. Knowledge Graphs Methodology, Tools and Selected Use Cases by Dieter Fensel , Umutcan Şimşek, Kevin Angele, Elwin Huaman , Elias Kärle , Oleksandra Panasiuk , Ioan Toma, Jürgen Umbrich, and Alexander Wahler, Springer 2019

E-Books / Web References:

1. https://ocw.mit.edu/courses/6-864-advanced-natural-language-processing-fall-2005/pages/lecture-notes/
2. Natural Language Toolkit. Bird and Loper, and other developers. Available for
3. free at: – http://www.nltk.org
4. https://opennlp.apache.org/

Coursera:

1. NLP – Twitter Sentiment Analysis: A Guided Project that gives hands-on experience

Udemy:

1. Knowledge graph solutions with Neo4j
2. Deep Learning: Natural Language Processing with Transformers

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.
Typical evaluation pattern for regular courses is shown in Table 1:

	Component	Marks	Total Marks
CIE	CIE Test-1	30	50
	CIE Test-2	30	
	CIE Test-3	30	
	Laboratory	20	
SEE	Semester End Examination	100	50
	Grand Total		100

Scheme of Examination (SEE):

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

QUANTUM COMPUTING

Semester:	**VII**	**CIE Marks**	**50**
Course Code	**AML23703**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**3:2:0**	**Duration of SEE (hours):**	**03**
Type of Course	**PC**	**Credits**	**04**

Prerequisites (if any): Basics of Maths, Calculus, Linear Algebra

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	To Analyze the behavior of basic quantum algorithms
2	To Implement simple quantum algorithms and information channels in the quantum circuit model
3	To Prove basic facts about quantum information channels
4.	Simulate a simple quantum error-correcting code

Module 1	No. of Hours	RBT Level
Introduction: Overview, Computers and the Strong Church–Turing Thesis, The Circuit Model of Computation, A Linear Algebra Formulation of the Circuit Model, Reversible Computation, A Preview of Quantum Physics, Quantum Physics and Computation	10	L2
Module 2		
Qubits And The Framework Of Quantum Mechanics: The State of a Quantum System, Time-Evolution of a Closed System, Composite Systems, Measurement, Mixed States and General Quantum Operations	10	L2
Module 3		
A Quantum Model Of Computation: The Quantum Circuit Model, Quantum Gates, 1-Qubit Gates, Controlled-U Gates, Universal Sets of Quantum Gates, Efficiency of Approximating Unitary Transformations, Implementing Measurements with Quantum Circuits.	10	L3
Module 4		
Superdense Coding And Quantum Teleportation: Superdense Coding, Quantum Teleportation, An Application of Quantum Teleportation **Introductory Quantum Algorithms**: Probabilistic Versus Quantum Algorithms, Phase Kick-Back, The Deutsch Algorithm, The Deutsch–Jozsa Algorithm, Simon's Algorithm.	10	L3
Module 5		
Algorithms With Superpolynomial Speed-Up: Quantum Phase Estimation and the Quantum Fourier Transform, Error Analysis for Estimating Arbitrary Phases, Periodic States, LCM, the Extended Euclidean Algorithm, Eigenvalue Estimation, TEAM LinG, Finding-Orders, The Order-Finding Problem, Some Mathematical Preliminaries, The Eigenvalue Estimation Approach to Order Finding, Shor's Approach to Order Finding	10	L3

Course Outcomes:

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

CO1	Describe the behavior of basic quantum algorithms concepts.
CO2	Gather and Analyze different quantum operations.
CO3	Analyze Superdense Coding And Quantum Teleportation, Quantum Gates etc.,
CO4	Design a suitable Quantum Gates and Implementing Measurements with Quantum Circuits.
CO5	Apply Quantum Circuit Model, Algorithms With Super Polynomial Speed-Up, Reversible Computation.

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O**	**PS O**
CO1	3	2	1	1	1	1					1		1	2
CO2	2	3	1	1	1	2					1		1	2
CO3	2	2	3	2	1	1					1		1	2
CO4	2	1	2	1	1	1					2		1	2
CO5	2	2	2	1	2	1					3		1	2
Average														

High-3: Medium-2: Low-1

Text Book:

1. Phillip Kaye, Raymond Laflamme, Michele Mosca: An Introduction to Quantum Computing, Oxford University Press, 2007.

Reference Books:

1. M. A. Nielsen and I. L. Chuang. Quantum Computation and Quantum Informatio, Cambridge University Press, 2000.
2. Peres, Asher. Quantum Theory: Concepts and Methods. New York, NY: Springer, 1993. ISBN: 9780792325499.

E-Books / Web References:

1) Preskill, J. Notes on Quantum Computation.

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the Alternative Assessment Tool (AAT). The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

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

	Component	Marks	Total Marks
CIE	CIE Test-1	30	50
	CIE Test-2	30	
	CIE Test-3	30	
	QUIZ/Assignment	20	
SEE	Semester End Examination	100	50
		Grand Total	100

Scheme of Examination (SEE):

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

DATA MINING & DATA WAREHOUSING

Semester:	**VII**	**CIE Marks**	**50**
Course Code	**AML23704A**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**Duration of SEE (hours):**	**03**
Type of Course	**PEC**	**Credits**	**03**

Prerequisites (if any): NIL

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	Introduction to general issues of Data Warehouse and Data Mining.
2	Understanding of the different architectures and mining techniques
3	The role and functions of Data Warehouse and Data Mining
4	Explain the stages and process different data mining techniques
5	Learn mining and warehouse techniques through the use of different tools

Module 1	No. of Hours	RBT Level
Data Warehousing & modeling: Basic Concepts: Data Warehousing: A multitier Architecture, Data warehouse models: Enterprise warehouse, Data mart and virtualwarehouse, Extraction, Transformation and loading, Data Cube: A multidimensional data model, Stars, Snowflakes and Fact constellations: Schemasfor multidimensional Data models, Dimensions: The role of concept Hierarchies, Measures: Their Categorization and computation, Typical OLAP Operations. **T2C.4.1,4.2**	08	L2
Module 2		
Data warehouse implementation & Data mining: Efficient Data Cube computation: An overview, Indexing OLAP Data: Bitmap index and join index, Efficient processing of OLAP Queries, OLAP server Architecture ROLAP versus MOLAP Versus HOLAP.: Introduction: What is data mining, Challenges, Data Mining Tasks, Data: Types of Data, Data Quality, Data Preprocessing, Measures ofSimilarity and Dissimilarity **T2C.4.4** **T1C:1.1,1.2,1.4, 2.1 to 2.4**	08	L2
Module 3		
Association Analysis: Association Analysis: Problem Definition, Frequent Item set Generation, Rule generation. Alternative Methods for Generating Frequent Itemsets, FP-Growth Algorithm, Evaluation of Association Patterns. **T1C6:** 6.1 to 6.3, 6.5 to 6.7	08	L2
Module 4		
Classification: Decision Trees Induction, Method for Comparing Classifiers, RuleBased Classifiers, Nearest Neighbor Classifiers, Bayesian Classifiers **T1C4:**4.3,4.6 **T1C5:** 5.1,5.2,5.3	08	L3

Module 5		
Clustering Analysis: Overview, K-Means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation, Density-Based Clustering, Graph BasedClustering, Scalable Clustering Algorithms **T1C8:** 8.1 to 8.5**, T1C9:**9.3 to 9.5	08	L3

Course Outcomes:

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

CO704A.1	Explain the components of a data warehouse system and differentiate between data warehouse models.
CO704A.2	Design and implement extraction, transformation, and loading processes for a given dataset.
CO704A.3	Construct and analyze data cubes and schemas for multidimensional data analysis.
CO704A.4	Develop and optimize algorithms for efficient data cube computation.
CO704A.5	Evaluate association patterns using various association analysis techniques.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO704A.1	3	3	2	2	2			1	1	1		2	2	
CO704A.2	3	3	2	2	2			1	1	1		2	2	
CO704A.3	3	3	2	2	2			1	1	1		2	2	
CO704A.4	3	3	2	2	2			1	1	1		2	2	
CO704A.5	3	3	2	2	2			1	1	1		2	2	
Average	3	3	2	2	2			1	1	1		2	2	

High-3: Medium-2: Low-1

Text Books:

1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Pearson, First impression,2014.
2. Jiawei Han, Micheline Kamber, Jian Pei: Data Mining -Concepts and Techniques, 3rd Edition,Morgan Kaufmann Publisher, 2012

References:

1. Sam Anahory, Dennis Murray: Data Warehousing in the Real World, Pearson, TenthImpression,2012.
2. Michael. J. Berry, Gordon. S. Linoff: Mastering Data Mining, Wiley Edition, second edtion,2012.

E-Books / Web References:

1. https://nptel.ac.in/courses/106/106/106106093/
2. https://nptel.ac.in/courses/110/107/110107092/
3. https://nptel.ac.in/courses/106/105/106105174/
4. VTU e-Shikshana Program 5. VTU EDUSATProgram

MOOCs:

1. https://www.udemy.com/course/data-warehouse-fundamentals-for-beginners/
2. https://www.udemy.com/course/data-warehouse-the-ultimate-guide/
3. https://www.udemy.com/course/data-mining-fundamentals-for-beginners/
4. https://onlinecourses.nptel.ac.in/noc21_cs06/preview

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have beenencouraged to use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

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

	Component	**Marks**	**Total Marks**
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignment	10	
SEE	Semester End Examination	100	50
	Grand Total		100

Scheme of Examination (SEE):

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

INTRODUCTION TO ROBOTICS

Semester:	**VII**	**CIE Marks**	**50**
Course Code	**AML23704B**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**Duration of SEE (hours):**	**03**
Type of Course	**PEC**	**Credits**	**03**

Prerequisites (if any): Sound knowledge of basic mathematics concepts to implement in software.
Statistics, linear algebra, matrix, calculus, probability, programming languages and data modelling.

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	Fundamental concept of Robotics, Robotic sensors.
2	Concept of AI programming languages.
3	Applications of AI in the field of Robotics.

Module 1	No. of Hours	RBT Level
Fundamentals of Robotics: Basic Concepts: Definition and historical development of robotics – different types and classification of robots – various generations of robots – Definition of Industrial Robot, degrees of freedom – Asimov's laws of robotics – dynamic stabilization of robots.	08	L2
Module 2		
Robot Kinematics: Robot Kinematics: Position Analysis, Dynamic Analysis and Forces, Robot configurations, Robot Components, Robot Degrees ofFreedom, Work volume and work envelope, Robot Joints and symbols, Robot Coordinates, Robot Reference Frames, Resolution, accuracy and precision ofRobot, Work cell control.	08	L3
Module 3		
Robotic Sensors: Transducers and sensors, Sensors in robotics, Principles and applications of the following types of sensors- Proximity Sensors, Photo Electric Sensors, Position sensors – Piezo Electric Sensor, LVDT, Resolvers, Encoders, Touch Sensors, Safety Sensor: Light Curtain, Laser Area Scanner, Safety Switches,Machine vision too much content in the same module	08	L3
Module 4		
Robot Programming languages & systems: Introduction to Robot Programming,requirements of a robot programming language, Robot software functions -coordinate systems, position control, other control functions, subroutines, problems peculiar to robot programming languages, Program planning for Robot flowcharting for robot programs with few examples.	08	L3
Module 5		
Introduction to Robotic Process Automation: RPA Platforms: Components of RPA- RPA Platforms-About Ui Path- About UiPath - The future of automation - Record and Play - Downloading and installing UiPath Studio -Learning Ui Path Studio- - Task recorder - Step-by step examples using the recorder.	08	L3

Course Outcomes:

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

CO1	Describe Robotics, automation, robotics motion, sensors and control, machinevision, robotic programming and roles of robots in industry.
CO2	Understand the working methodology of robotics and automation, motion and control, machine vision and programming, application of robots in industry.
CO3	Understand the basic concept of RPA and describe various components & platforms of RPA.
CO4	Apply working principles of programming for various applications.
CO5	Write the program for robot for various applications.

	PO -1	**PO -2**	**PO -3**	**PO -4**	**PO -5**	**PO -6**	**PO -7**	**PO -8**	**PO -9**	**PO -10**	**PO -11**	**PO -12**	**PSO -1**	**PSO -2**
CO1	3	1	1	1	0							1	1	3
CO2	3	1	1	1	1							1	3	3
CO3	3	1	2	2	3							1	3	3
CO4	3	3	3	3	3				1	1	2	2	3	3
CO5	3	3	3	3	3				1	1	2	2	3	3
Average	3	1.8	1.6	1.6	2.5				1	1	2	1.4	2.6	3

High-3: Medium-2: Low-1

Text Books:

1. John J. Craig, “Introduction to Robotics”, Addison Wesley publication
2. Dilip Kumar Pratihar, “Fundamentals of Robotics”, Narosa Publishing House, (2019)3.
3. Tom Taulli, “The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems”,2020, ISBN-13 (electronic): 978-1-4842-5729-6, Publisher: A press
4. Alok Mani Tripathi, Learning Robotic Process Automation, Publisher: Packt Publishing Release Date: March 2018 ISBN: 9781788470940

Reference Books

1. Srikanth Merianda, “Robotic Process Automation Tools, Process Automation and their benefits: Understanding RPA and Intelligent Automation”
2. Mikell P Groover, Mitchell Weiss, Roger N. Nagel and Nicholas G. Odrey, “Industrial RoboticsTechnology, Programming and Applications”, Mc. Graw Hill Book Company, 1986
3. https://www.uipath.com/rpa/robotic-process-automation
4. Introduction to Robotics Mc Kerrow P.J Addison Wesley, USA 1991

E-Books / Web References:

1. https://onlinecourses.nptel.ac.in/noc20_de11/preview
2. https://Introduction-Robotics-eBook-Global-Craig-ebook/dp/B09839HBK4

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have beenencouraged to use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.
Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

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

	Component	**Marks**	**Total Marks**
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignment	10	
SEE	Semester End Examination	100	50
	Grand Total		100

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

HUMAN COMPUTER INTERACTION

Semester:	**VII**	**CIE Marks**	**50**
Course Code	**AML23704C**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**Duration of SEE (hours):**	**03**
Type of Course	**PEC**	**Credits**	**03**

Prerequisites (if any):

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	To determine the necessity of user interaction by understanding usability engineering and user modeling.
2	To learn the methodologies for designing interactive systems.
3	To investigate the core and complex user experience design issues.
4	To examine the evaluation methodologies of design.
5	To Understand design issues for web and mobile platforms.

Module 1	No. of Hours	RBT Level
HCI AND USABILITY: Context of Interaction – Ergonomics - Designing Interactive systems – Understanding Userscognition and cognitive frameworks, User Centered approaches, Usability, Universal Usability, Understanding and conceptualizing interaction, Guidelines, Principles and Theories	**08**	**L2**
Module 2		
INTERACTION STYLES: HCI patterns, design frameworks, design methods, prototyping. Understanding interaction styles, Direct Navigation and Immersive environments, Fluid navigation, Expressive Human and Command Languages, Communication and Collaboration.	**08**	**L2**
Module 3		
USER EXPERIENCE DESIGN: Frameworks for User Centric Computing, Computational models of users, Advancing the user experience, Timely user Experience, Information search, Data Visualization.	**08**	**L2**
Module 4		
COGNITIVE SYSTEMS AND EVALUATION OF HCI: Communication and collaboration models Task analysis, dialog notations and design, Evaluation Techniques-assessing user experience- usability testing – Heuristic evaluation and walkthroughs, analytics predictive models.	**08**	**L3**
Module 5		
INTERACTION TECHNIQUES FOR WEB AND MOBILE: Overview, K-Means, Designing websites, social media, Collaborative environments, Agents and Avatars, Ubiquitous computing, Mobile Computing, Wearable Computing, Multimodal interface design Ethics in Design.	**08**	**L2**

Course Outcomes:

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

CO1	Understand the models and theories for user interaction.
CO2	Use complex interaction styles and techniques for contextual design.
CO3	Suggest suitable designs for web and mobile applications.
CO4	Design for usability based on a variety of classic Universal user-centric models.
CO5	Evaluate interaction designs and implementations.

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**
CO1	3					2		2		1		3		
CO2		3				2	2			1		3		
CO3				3	3	2		2		1		3		
CO4			3			2	2			1		3		
CO5			3			2		2		1		3		
Average	3	3	3	3	3	2	2	2		1		3		

High-3: Medium-2: Low-1

Texts:

1. Gerard Jounghyun Kim, Human Computer Interaction – Fundamentals and Practice, – CRC press, 2015.
2. Regina Bernhaupt , Game User Experience Evaluation-2015 Edition, Kindle Edition
3 Martin Helander, Handbook of Human-Computer Interaction-1988 Elsevier

References:

1 Julie A. Jacko, The Human–Computer Interaction Handbook: Fundamentals, Evolving Technologies, and Emerging Applications, 3rd Edition, CRC Press (Taylor & Francis Group) 2012.

2 Ben Shneiderman, Catherine Plaisant, Maxine Cohen,Steven Jacobs, Designing the User Interface: Strategies for Effective Human Computer Interaction, 5th Edition, Pearson, 2009.

3 Alan Dix, Janet E. Finlay, Gregory D. Abowd, Russell Beale, Human - Computer Interactio3rd Edition, Pearson, 2003.

4 The Encyclopedia of Human-Computer Interaction, 2nd Ed. interaction Design Foundation

5 Myounghoon Jeon ,Emotions and Affect in Human actors and Human–Computer Interaction, 2017Academic Press

6 Kevin mullet, Darvel sano,Designing Visual Interfaces: Communication Oriented Techniques,Englewood Cliffs, NJ : SunSoft Press

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

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

	Component	Marks	Total Marks
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignment	10	
SEE	Semester End Examination	100	50
	Grand Total		100

Scheme of Examination (SEE):

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

DATA SECURITY AND PRIVACY

Semester:	**VII**	**CIE Marks**	**50**
Course Code	**AML23704D**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**Duration of SEE (hours):**	**03**
Type of Course	**PEC**	**Credits**	**03**

Prerequisites (if any):

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	Explain standard algorithms used to provide confidentiality, integrity and authenticity for data.
2	Distinguish key distribution and management schemes.
3	Deploy encryption techniques to secure data in transit across data networks.
4	Implement security applications in the field of Information technology.
5	Illustrate data privacy.

Module 1	No. of Hours	RBT Level
Classical Encryption Techniques Symmetric Cipher Model, Cryptography, Cryptanalysis and Brute-Force Attack, Substitution Techniques, Caesar Cipher, Mono- alphabetic Cipher, Playfair Cipher, Hill Cipher, Poly alphabetic Cipher, One Time Pad. **Block Ciphers and thedata encryption standard:** Traditional block Cipher structure, stream Ciphers and block Ciphers, Motivation for the feistel Cipher structure, the feistel Cipher, The data encryption standard, DES encryption, DES decryption, A DES example, results, the avalanche effect, the strength of DES, the use of 56-Bit Keys, the nature of the DES algorithm, timing attacks, Block cipher design principles, number of rounds, design of function F, key schedule algorithm.	08	L2
Module 2		
Public-Key Cryptography and RSA: Principles of public-key cryptosystems. Public-key cryptosystems. Applications for public-key cryptosystems, requirements for public-key cryptosystems. Public-key cryptanalysis. The RSA algorithm, description of the algorithm, computational aspects, the security of RSA. **Other Public-Key Cryptosystems:** Diffiehellman key exchange, The algorithm, key exchange protocols, man in the middle attack, Elgamal Cryptographic systems, Elliptic curve arithmetic, abelian groups, elliptic curves over real numbers, elliptic curves over Zp, elliptic curves overGF(2m), Elliptic curve cryptography, Analog of Diffie-hellman key exchange, Elliptic curve encryption/ decryption, security of Elliptic curve cryptography, Pseudorandom number generation based on a asymmetric cipher	08	L3
Module 3		

Key Management and Distribution: Symmetric key distribution using Symmetric encryption, A key distribution scenario, Hierarchical key control, session key lifetime, a transparent key control scheme, Decentralized key control, controlling key usage, Symmetric key distribution using asymmetric encryption, simple secret key distribution, secret key distribution with confidentiality and authentication, A hybrid scheme, distribution of public keys, public announcement of public keys, publicly available directory, public key authority, public keys certificates, X-509 certificates. Certificates, X-509 version 3, Public Key infrastructure	08	L3
Module 4		
An Introduction to privacy preserving data mining: Privacy-Preserving Data Mining Algorithms, The Randomization Method, Group Based Anonymization.	08	L3
Module 5		
Distributed Privacy-Preserving Data Mining, Privacy-Preservation of Application Results, Limitations of Privacy: The Curse of Dimensionality, Applications of Privacy- Preserving Data Mining.	08	L3

Course Outcomes:

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

CO1	Analyze the vulnerabilities in any computing system and hence be able to design a security solutions.
CO2	Identify the security issues in the network and resolve it.
CO3	Evaluate security mechanisms using rigorous approaches, including theoretical.
CO4	Describe importance of data privacy, limitations and applications

	PO -1	**PO -2**	**PO -3**	**PO -4**	**PO -5**	**PO -6**	**PO -7**	**PO -8**	**PO -9**	**PO -10**	**PO -11**	**PO -12**	**PSO -1**	**PSO -2**
CO1	3					2		2		1		3	2	
CO2		3				2	2			1		3	2	
CO3				3	3	2		2		1		3	2	
CO4			3			2	2			1		3	2	
Average	3	3	3	3	3	2	2	2		1		3	2	

High-3: Medium-2: Low-1

Text Books:

1. Cryptography and Network Security, William Stallings., Pearson 7th edition.
2. Privacy Preserving Data Mining: Models and Algorithms, Charu C. Aggarwal, Philip S Yu, Kluwer Academic Publishers, 2008, ISBN 978-0-387-70991-8, DOI 10.1007/978-0-387-70992-5.

Reference Books:

1. Cryptography and Network Security, AtulKahate, McGraw Hill Education, 4th Edition
2. Cryptography and Information Security, V K Pachghare, 2nd edition, PHI

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have beenencouraged to use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.
Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

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

	Component	**Marks**	**Total Marks**
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignment	10	
SEE	Semester End Examination	100	50
	Grand Total		100

Scheme of Examination (SEE):

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

BUSINESS INTELLIGENCE

Semester:	**VII**	**CIE Marks**	**50**
Course Code	**AML23705A**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**Duration of SEE (hours):**	**03**
Type of Course	**OEC**	**Credits**	**03**

Prerequisites (if any): Data Base systems

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	Be exposed with the basic rudiments of business intelligence system
2	Understand the Business Planning activities and database design.
3	Understand of the business growth management methods used.

Module 1	No. of Hours	RBT Level
Development Steps, BI Definitions, BI Decision Support Initiatives, Development Approaches, Parallel Development Tracks, BI Project Team Structure, Business Justification, Business Divers, Business Analysis Issues, Cost – Benefit Analysis, Risk Assessment, Business Case Assessment Activities, Roles Involved in These Activities, Risks of Not Performing Step, Hardware, Middleware, DBMS Platform, Non Technical Infrastructure Evaluation	08	L2
Module 2		
Managing the BI Project, Defining and Planning the BI Project, Project Planning Activities, Roles and Risks Involved in These Activities, General Business Requirement, Project Specific Requirements, Interviewing Process.	08	L2
Module 3		
Differences in Database Design Philosophies, Logical Database Design, Physical Database Design, Activities, Roles and Risks Involved in These Activities, Incremental Rollout, Security Management, Database Backup and Recovery	08	L2
Module 4		
Growth Management, Application Release Concept, Post Implementation Reviews, Release Evaluation Activities, The Information Asset and Data Valuation, Actionable Knowledge – ROI, BI Applications, The Intelligence Dashboard.	08	L3
Module 5		
Business View of Information technology Applications: Business Enterprise excellence, Key purpose of using IT, Type of digital data, basics of enterprise reporting, BI road ahead.	08	L3

Course Outcomes:

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

CO1	Understand the business intelligence and approaches
CO2	Show the business planning activities
CO3	Apply business intelligence to data base design
CO4	Implement business growth management methods
CO5	Develop real time IT business applications

	PO -1	**PO -2**	**PO -3**	**PO -4**	**PO -5**	**PO -6**	**PO -7**	**PO -8**	**PO -9**	**PO -10**	**PO -11**	**PO -12**	**PSO--1**	**PSO -2**
CO1	3	2	-	-	-	1	-	1	-	-	-	2	-	2
CO2	3	2	-	-	-	1	-	1	-	-	-	2	-	2
CO3	3	2	-	-	-	1	-	1	-	-	-	2	-	2
CO4	3	2	-	-	3	1	-	1	-	-	-	2	-	2
CO5	3	2	-	-	-	1	-	1	-	-	-	2	-	2
Average	3	2	-	-	0.6	1	-	1	-	-	-	2	-	2

High-3: Medium-2: Low-1

Text Books:

1. Larissa T Moss and Shaku Atre, Business Intelligence Road map: The Complete Project Lifecycle for Decision Support Applications, Addison Wesley Information Technology Series, 2003
2. R N Prasad, Seema Acharya, Fundamentals of Business Analytics, Wiley India, 2011

Reference Books:

1. "David Loshin, Business Intelligence: The Savvy Manager's Guide, Morgan Kaufmann
2. Brian Larson, Delivering Business Intelligence with Microsoft SQL Server 2005, McGraw Hill, 2006
3. Lynn Langit, Foundations of SQL Server 2008 Business Intelligence, A press ,2011

E-Books / Web References:

1. https://github.com/topics/business-intelligence
2. https://www.techtarget.com/searchbusinessanalytics/resources/Business-intelligence- technology
3. https://www.pdfdrive.com/business-intelligence-and-analytics-e56416503.html

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have been encouraged to use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative pedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.
Typical evaluation pattern for regular courses is shown in Table 1:

	Component	**Marks**	**Total Marks**
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	Assignment	10	
SEE	Semester End Examination	100	50
	Grand Total		100

Scheme of Examination (SEE):

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

SOFT COMPUTING

Semester:	**VII**	**CIE Marks**	**50**
Course Code	**AML23705B**	**SEE Marks**	**50**
Hours/Week (L: T: P)	**3:0:0**	**Duration of SEE (hours):**	**03**
Type of Course	**OEC**	**Credits**	**03**

Prerequisites (if any): A strong mathematical background. Proficiency with algorithms. Programming skills and Critical thinking and problem-solving skills

Course Learning Objectives:

Sl. No	Course Learning Objectives (CLO)
1	Soft computing
2	Fuzzy logic and its applications.
3	Artificial neural networks and its applications.
4.	Solving optimization problems using GAs.
5	Applications of Hybrid Soft computing approaches to solve problems in varieties of application domains.

Module 1	No. of Hours	RBT Level
Introduction to soft computing: Concept of computing systems. "Soft" computing versus "Hard" computing. Characteristics of Soft computing Some applications of Soft computing techniques. ANN, FS, GA, SI, ES, Comparing among intelligent systems	8	**L2**
Module 2		
Fuzzy logic: Introduction to Fuzzy logic.Fuzzy sets and membership functions. Operations on Fuzzy sets. Fuzzy relations, rules, propositions, implications and inferences. Defuzzification techniques. Fuzzy logic controller design. Some applications of Fuzzy logic.	8	**L3**
Module 3		
Artificial Neural Networks: Biological neurons and its working. Simulation of biological neurons to problem solving. Different ANNs architectures. Training techniques for ANNs. Applications of ANNs to solve some real-life problems	8	**L3**
Module 4		
Genetic Algorithms: Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques. Basic GA framework and different GA architectures. GA operators: Encoding, Crossover, Selection, Mutation, etc. Solving single-objective optimization problems using Gas.	8	**L3**
Module 5		

Course Outcomes:

CO1	Illustrate soft computing techniques and their applications.
CO2	Demonstrate the fuzzy systems.
CO3	Analyze various neural network architectures.
CO4	Evaluate the genetic algorithm concepts and their applications.
CO5	Develop a suitable Soft Computing technology to solve the problem; construct a Solution and implement a Soft Computing solution.

	PO -1	**PO -2**	**PO -3**	**PO -4**	**PO -5**	**PO -6**	**PO -7**	**PO -8**	**PO -9**	**PO -10**	**PO -11**	**PO -12**	**PSO -1**	**PSO -2**
CO1	3	1	1	0	1	0	0	0	0	0	0	0	3	3
CO2	3	2	3	0	3	0	0	0	0	0	0	0	3	3
CO3	3	3	3	1	3	0	0	0	0	0	0	0	3	3
CO4	3	2	2	1	3	0	0	0	0	0	0	0	3	3
CO5	3	3	3	1	3	0	0	0	0	2	0	0	3	3
Average	3	2	2	1	3	0	0	0	0	0.3	0	0	3	3

High-3: Medium-2: Low-1

Text Book:

1. Soft computing: N. P Padhy and S P Simon , Oxford University Press 2015
2. Sivanandam.S. N, Deepa.S.N, “Principles of soft computing”,2nd Edition, Wiley India Pvt Limited, 2011.
3. Juh Shing Roger Jang, Cheun Tsai Sun, Eiji Mizutani, “Neuro fuzzy and soft computing”, Prentice Hall, 1997.

Reference Books:

1. Aliev,R.A, Aliev,R.R, “Soft Computing and its Application”, World Scientific Publishing Co. Pvt. Ltd., 2001.
2. Mehrotra.K, Mohan.C.K, Ranka.S, “Elements of Artificial Neural Networks”, The MIT Press, 1997.
3. Juh Shing Roger Jang,Cheun Tsai Sun,Eiji Mizutani, “Neuro fuzzy and soft computing”, Prentice Hall, 1997.
4. Ronald R.Yager, Lofti Zadeh, “An Introduction to fuzzy logic applications in intelligent Systems”, Kluwer Academic, 1992.
5. Cordón.O, Herrera.F, Hoffman.F, Magdalena.L “Genetic Fuzzy systems”, World Scientific Publishing Co. Pvt. Ltd., 2001.

E-Books / Web References:

1. **https://www.youtube.com/watch?v=K9gjuXjJeEM**
2. **https://archive.nptel.ac.in/courses/106/105/106105173/**

Scheme of Examination (CIE):

In order to encourage innovative methods while delivering a course, the faculty members have beenencouraged to use the **Alternative Assessment Tool (AAT).** The AAT enhances the autonomy (freedom and flexibility) of individual faculty and enables them to create innovative

pedagogical practices.

Possible AATs are - seminar/ assignments/term paper/ open ended experiments/ mini-projects/ concept videos/ partial reproduction of research work/ oral presentation of research work/ group activity/ developing a generic tool-box for problem solving/ report based on participation in create-a-thon/ make-a-thon/ code-a-thon/ hack-a-thon conducted by reputed organizations/ any other.

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

	Component	**Marks**	**Total Marks**
CIE	CIE Test-1	40	50
	CIE Test-2	40	
	CIE Test-3	40	
	QUIZ/Assignment	10	
SEE	Semester End Examination	100	50
	Grand Total		100

Note: CIE pattern for courses like Drawing and Laboratories can be decided by the respective Board of Studies and can be given here.

Scheme of Examination (SEE):

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

MAJOR PROJECT PHASE-II

Semester	**7**	**CIE Marks**	**100**
Course Code	**AMLP23706**	**SEE Marks**	**100**
Hours/Week (L: T: P)	**0:0:12**	**Examination Hours**	**--**
Course Type	**-**	**No. of Credits**	**6**

The course 'Project Work' is mainly intended to evoke the innovation and invention skills in a student. The course will provide an opportunity to synthesize and apply the knowledge and analytical skills learned, to be developed as a prototype or simulation. The project extends to 2 semesters and will be evaluated in the 7th and 8th semester separately, based on the achieved objectives. One third of the project credits shall be completed in 7th semester and two third in 8th semester. It is recommended that the projects may be finalized in the thrust areas of the respective engineering stream or as interdisciplinary projects. Importance should be given to address societal problems and developing indigenous technologies.

Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary project can be assigned to an individual student or to a group having not more than 4 students. In extraordinary cases, like the funded projects requiring students from different disciplines, the project student strength can be 5 or 6.

Course Objectives

- To apply engineering knowledge in practical problem solving.
- To foster innovation in design of products, processes or systems.
- To develop creative thinking in finding viable solutions to engineering problems

Course Outcomes [COs]: After successful completion of the course, the students will be able to:

CO84.1	Identify technology/research gaps and propose innovative/creative solutions (Cognitive knowledge level: Analyze).
CO84.2	Organize and communicate technical and scientific findings effectively in written and oral forms (Cognitive knowledge level: Apply).
CO84.3	Plan and execute tasks utilizing available resources within timelines, following ethical and professional norms (Cognitive knowledge level: Apply).
CO84.4	Model and solve real world problems by applying knowledge across domains (Cognitive knowledge level: Apply)
CO84.5	Develop products, processes or technologies for sustainable and socially relevant applications (Cognitive knowledge level: Apply).

PROJECT PHASE II

Phase 2 Target

- In depth study of the topic assigned in the light of the report prepared under Phase - I;
- Review and finalization of the approach to the problem relating to the assigned topic.
- Preparing a detailed action plan for conducting the investigation, including teamwork.
- Detailed Analysis/ Modeling / Simulation/ Design/ Problem Solving/Experiment as needed.
- Final development of product/ process, testing, results, conclusions and future directions.
- Preparing a paper for Conference Presentation/ Publication in Journals, if possible.

- Presenting projects in Project Expos conducted by the University at the cluster level and/ or state level as well as others conducted in India and abroad.
- Filing Intellectual Property Rights (IPR) if applicable.
- Preparing a report in the standard format for being evaluated by the Department Assessment Board.
- Final project presentation and viva voce by the assessment board including the external expert.

RUBRICS FOR PROJECT PHASE - II EVALUATION

Rubrics Review

Review #	Agenda	Assessment	Review Assessment Weightage	Over all Weightage
Review 1	Two interim evaluations by the Evaluation Committee	Rubric R1	(30)	**(100)**
Review 2	Final evaluation by the Final Evaluation committee	Rubric R2	(25)	
Review 3	Quality of the report evaluated by the evaluation committee	Rubric R3	(15)	
Review 4	Project progress evaluation by guide		(30)	
Evaluation			(100)	(100)
Total			(100)	**(100)**

(The evaluation committee comprises HoD or a senior faculty member, Project coordinator and project supervisor. The final evaluation committee comprises of Project coordinator, expert from Industry/research/academic Institute and a senior faculty from a sister department).

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3		2	1	3	3	1	2	2	2
CO2	2	2	3	2	3		2	1	3	3	1	2		
CO3	2	2	3	2	3		2	1	3	3	1	2		
CO4	3	3	3	2	3	1	2	1	3	3	1	2	2	2
CO5	3	3	3	2	3		2	1	3	3	1	2	2	2