DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
CHHATRAPATI SAMBHAJINAGAR.

CIRCULAR NO.SU/Engg./AI&ML/CBC&GS/35/2024

It is hereby inform to all concerned that, the syllabus prepared by the Board of Studies and recommended by the Dean, Faculty of Science & Technology, the Hon'ble Vice-Chancellor has accepted the **New Syllabus of B.E. Artificial Intelligence & Machine Learning IIIrd & IVth semester under the scheme of Choice Based Credit & Grading System** in his emergency powers under section 12(7) of the Maharashtra Public Universities Act, 2016 on behalf of the Academic Council as appended herewith.

This is effective from the Academic Year 2024-25 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Aurangabad-431 004.
REF.NO.SU/2024/ 66304-39
Date:- 29.08.2024.

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Deputy Registrar,
Academic Section

Copy forwarded with compliments to :-

1] **The Principal of all concerned Colleges,**
Dr. Babasaheb Ambedkar Marathwada University,

2] **The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.**

Copy to :-

1] **The Director, Board of Examinations & Evaluation,** Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
2] The Section Officer,[Engg.Unit] Examination Branch, Dr.Babasaheb Ambedkar Marathwada Univcrsity, Chhatrapati Sambhajinagar.
3] The Programmer [Computer Unit-1] Examinations, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
4] The Programmer [Computer Unit 2] Examinations, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
5] The In-charge,[E-Suvidha Kendra], Rajarshi Shahu Maharaj Pariksha Bhavan, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
6] The Public Relation Officer, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.
7] The Record Keeper, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

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SCHEME AND DETAILED SYLLABUS

of

SE (Artificial Intelligence and Machine Learning)

Under Choice Based Credit & Grading System(w.e.f. academic year 2024-25 & onwards/-)

FOUR YEAR DEGREE COURSE IN SCIENCE& TECHNOLOGY

HOD
MCA Department
Govt. College of Engg. Aurangabad
and
Chairman, BOS in
Computer Sci. & Engg.

Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,

CHHATRAPATI SAMBHAJINAGAR

Dean, Faculty of S&T

Faculty of Science and Technology

Curriculum Structure of SE (Artificial Intelligence and Machine Learning Engineering)

Effective from 2024-25 & onwards/-

PART-I

Sub Code	Semester-I	Contact Hrs/Week				Examination Scheme						Duration of The Theory Examination
	Subject	L	T	P	Total	CT	TH	TW	PR	Total	credits	
BSH201	Engineering Mathematics -III	4	--	--	4	20	80	--	--	100	4	3 Hrs
AIM202	Data Structures & Algorithm	4	--	--	4	20	80	--	--	100	4	3 Hrs
AIM203	Operating system	4	--	--	4	20	80	--	--	100	4	3 Hrs
AIM204	Database management System	4	--	--	4	20	80	--	--	100	4	3 Hrs
AIM205	Python Programming	4	--	--	4	20	80	--	--	100	4	3 Hrs
AIM221	Lab 1 Data Structures & Algorithm	--	--	2	2	--	--	--	50	50	1	
AIM222	Lab 2: Operating system	--	--	2	2	--	--	50	--	50	1	
AIM223	Lab 3: Database management System r	--	--	2	2	--	--	50	--	50	1	
AIM224	Lab 4: Python Programming	--	--	2	2	--	--	--	50	50	1	
AIM225	Lab 5: Introduction to Web Programming	--	--	4	4	--	--	--	50	50	2	
	Total	**20**	**--**	**12**	**32**	**100**	**400**	**100**	**150**	**750**	**26**	

PART - II

Sub Code	Semester-II	Contact Hrs/Week				Examination Scheme						
	Subject	L	T	P	Total	CT	TH	TW	PR	Total	Credits	Duration of The Theory Examination
BSH251	Engineering Mathematics-IV	4	--	--	4	20	80	--	--	100	4	3 Hrs
AIM252	Discrete Mathematics	4	--	--	4	20	80	--	--	100	4	3 Hrs
AIM253	Object Oriented Programming	4	--	--	4	20	80	--	--	100	4	3 Hrs
AIM254	Basic of Data Science	4	--	--	4	20	80	--	--	100	4	3 Hrs
AIM255	Machine learning	4	--	--	4	20	80	--	--	100	4	3 Hrs
AIM271	Lab 6: Object Oriented Programming	--	--	2	2	--	--	--	50	50	1	
AIM272	Lab 7: Basic of Data Science	--	--	2	2	--	--	--	50	50	1	
AIM273	Lab 8: Machine learning	--	--	2	2	--	--	50	--	50	1	
AIM274	Lab 9: Introduction to OSL LAB	--	--	2	2	--	--	--	50	50	1	
BSH275	Lab 10: Communication Skills-I	--	--	4	4	--	--	50	--	50	2	
	Total	**20**	**--**	**12**	**32**	**100**	**400**	**100**	**150**	**750**	**26**	
	Total of Semester I & II	**40**		**24**	**64**	**200**	**800**	**200**	**300**	**1500**	**52**	

L: Lecture hours per week **T:** Tutorial hours per week **P:** Practical hours per week

CT: Class Test, **TH:** University Theory Examination, **TW:** Term Work, **PR:** Practical/Oral Examination

Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, CHHATRAPATI SAMBHAJINAGAR FACULTY OF SCIENCE AND TECHNOLOGY
Second Year Engineering
(AI&ML)Semester – III

Course Code: BSH 201 — **Engineering Mathematics-III**
Teaching scheme — **Examination scheme**
Theory: 4 hrs / week — Class Test: 20 Marks
Credit: 4 — Theory Examination:80 Marks
Theory Examination (Duration): 03 Hours

Objectives:

- To develop Logical understanding of the subject.
- To develop mathematical skill so that students are able to apply mathematical methods &Principle's in solving problems from engineering fields.
- To produce graduates with mathematical knowledge & computational skill.

CONTENTS

SECTION-A

Unit1: Linear Differential Equations **[8 hrs.]**

Linear Differential Equations with constant coefficients General method, short cut methods to find particular integral, Homogenous Linear differential equations(Cauchy's & Legendre's form),method of variation of parameters.

Unit2: Application of Linear Differential Equations **[6hrs.]**

Application of L i n e a r Differential Equations to Electrical circuits & to Mechanical system (Analogous study of two systems), to Civil Engineering, Free oscillations/vibrations, forced oscillation /vibrations, Damped Free oscillations / vibrations, Damped Forced oscillations / vibrations.

Unit3: Fourier Transform **[6hrs.]**

Fourier Transform, Fourier sine and cosine transform Fourier integral, Fourier sine and cosine integral.

SECTION-B

Unit4: Statistics & Probability **[8hrs.]**

Measures of central Tendency and Measures dispersion (for grouped data only), Karl Pearson's coefficient of skew ness, Probability distributionfor random variables, Binomial and Normal Distributions, Regression and Correlation.

Unit 5: Vector Differentiation **[6hrs.]**

Differentiationof vectors, Gradient of scalar point function, Directional derivative, Divergence of vector point function, Curl of a vector point function. Irrigational and solenoid vector field.

Unit6: Vector Calculus (Integral calculus) **[6hrs.]**

The line integral, Surface integral, volume integral, Gauss Divergence theorem, Stoke's theorem, Green's theorem (All theorem without proof).

Text Books:

1. P.N.WartikarandJ.N.Wartikar,"AText Book of Engineering Mathematics"(Volume-I,II,III) Pune Vidyarthi Griha Prakashan,Pune.
2. B.S.Grewal,"Higher Engineering Mathematics,"Khanna Publications, New Delhi.
3. H. K.Das,"Advanced Engineering Mathematics," S.Chand&Company.

Reference Books:

1. B.V.Ramana,"Higher Engineering Mathematics,"(Tata McGraw- Hill).
2. Erwin K reyszig,"Advanced Engineering Mathematics,"Wiley EasternLtd.
3. Ravish R Singh,Mukul Bhat,"Engineering Mathematics," A Tutorial Approach,McGrawHill
4. S.C Gupta and V.K Kapoor,"Fundamentals of Mathematical Statistics, S. Chand and Sons

Pattern of Question Paper:

The nits in this syllabus shall be divided in two equal sections. Question paper shall be set having two sections A and B. Section A questions shall be set on first three units (1,2,3)and Section B questions on remaining three units (4,5,6). Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Minimum ten questions.
2. Five questions in each section.
3. Question no1 and 6 be made compulsory and should have at least EIGHT bits of two marks out of which FIVE to be solved.
4. Two questions from remaining questions from each section beasked to solve having weight age of 15 marks.

Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, CHHATRAPATI SAMBHAJINAGAR

Second Year Engineering
(AI&ML)Semester – III

Course Code: AIM202
Teaching Scheme
Theory: 4 Hours/Week
Credit: 4

Title: Data Structures & Algorithm
Examination Scheme
Class Test: 20 Marks
Theory Examination (Marks): 80 Marks
Theory Examination (Duration): 03 Hours

Prerequisite:
1. Computer Fundamental-1
2. Computer Fundamental-2

Objectives:
1. To impart basic concepts of Data Structures
2. To understand and implement various linear and non-linear data structures
3. To study applications of data structures
4. To understand and implement various searching and sorting techniques

CONTENTS

SECTION-A

Unit 1 Introduction to Data Structures & Algorithms [06 Hrs]

Data types, Data structure and Abstract date type, Dynamic memory allocation in C, Introduction to Algorithms, Asymptotic notations and common functions

Unit 2: Stack and Queue [7 Hours]

Stack Basic: Concept of Stack, Stack as an ADT, Stack Operations, Stack Applications Conversion from infix to postfix/prefix expression, Evaluation of postfix/ prefix expressions, Recursion Queue Basic: Concept of Queue, Queue as an ADT, Primitive Operations in Queue, Linear Queue, Circular Queue, Queue Applications

Unit 3: Linked List [7 Hours]

Basic Concept, List and ADT, Array Implementation of Lists, Linked List, Types of Linked List: Singly Linked List, Doubly Linked List, Circular Linked List. Basic operations in Linked List: Node Creation, Node Insertion and Deletion from Beginning, End and Specified Position, Stack and Queue as Linked List

SECTION-B

Unit 4: Trees & Graphs [7 Hours]

Concept and Definitions, Basic Operations in Binary Tree, Tree Height, Level and Depth, Binary Search Tree, Insertion, Deletion, Traversals techniques, Search in BST, Applications of Trees, Graph: Definition and Representation of Graphs, Graph Traversal techniques.

Unit 5: Searching and Sorting [7 Hours]

Sorting: Introduction and Types of sorting: Internal and External sort, Comparison Sorting Algorithms: Bubble, Selection and Insertion Sort, Shell Sort, Efficiency of Sorting Algorithms Searching and Hashing: Introduction to Searching, Search Algorithms: Sequential Search, Binary Search Efficiency of Search Algorithms Hashing: Hash Function and Hash Tables, Collision Resolution Techniques.

Unit 6: Algorithmic Techniques [6 Hours]

Divide-n- Conquer: General Strategy, Merge and Quick Sort, Greedy Approach: General Strategy, Minimum Cost Spanning Trees: Kruskal and Prims Algorithm

Text Books:

1. Horowitz, Sahni, Anderson-Freed, "Fundamentals of Data Structures in C," 2nd Edition, Universities Press, 2007
2. Yedidyah, Augenstein, Tannenbaum, "Data Structures Using C and C++," 2nd Edition, Pearson Education, 2003.

Reference Books:

1. Richard F. Gilberg and Behrouz A. Forouzan, "Data Structures A Pseudocode Approach with C," Cengage Learning, 2005
2. G. A. V. Pai, "Data Structures and Algorithms", Mc Graw Hill Education

PATTERN OF QUESTION PAPER:

Six units in the syllabus shall be divided in two equal parts i.e. 3 units in each part. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Minimum ten questions
2. Five questions in each section
3. Question no. 1 from section A and Question no. 6 from section B, 10 marks each, will be compulsory.
4. From the remaining questions in section A and B students are supposed to solve any two questions, 15 marks each.

Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, CHHATRAPATI SAMBHAJINAGAR FACULTY OF SCIENCE AND TECHNOLOGY

Second Year Engineering

(AI&ML)Semester – III

Course Code: AIM203
Teaching Scheme
Theory: 04 Hours/Week

Title: Operating systems
Examination Scheme
Class Test: 20 Marks
Theory Examination (Marks): 80 Marks
Theory Examination (Duration): 03 Hours

Prerequisite:

1: Understanding of data structures and digital electronics,
2: Knowledge of basic computer, hardware components, microprocessor and peripheral components.
3: Programming skills in C, C++.

Objectives:

1. Students should learn fundamentals which will help them to understand design of modern operating system.
2. To study different components of OS.
3. Students should have overview of different types and structures of OS.
4. Should learn important system resources and their management policies.

CONTENTS

SECTION A

Unit 1: Introduction (6 hrs)

- Operating System as an extended machine , OS as a resource manager.
- History of operating system: Generations- batch system, multiprogramming, time sharing, multitasking, distributed, handheld computer system, embedded OS, real time OS and smart OS. Computer hardware review. OS concepts.
- Operating system structure: monolithic, layered systems, microkernel, client server models, virtual machines, exokernels, mainframe OS. System calls.
- Comparison of Linux, Windows, DOS

Unit 2: Process management (8 hrs)

- Processes: Process Model, Process creation/termination, Hierarchies, process states (two state, five state), Implementation of process.
- THREAD: process and thread, thread functionality, user level and kernel level threads.
- Inter process Communication: race condition, critical regions, mutual exclusion with busy waiting, sleep and wakeup, Producer consumer problem, semaphore, message passing, Monitors
- Classical IPC Problem: Dining philosopher problems, Readers and writers problems.

- Process Scheduling, scheduling criteria, scheduling algorithms.

Unit 3: File systems (6 hrs)

- Files: File Naming, File Types, Access, File operations,
- Directories: Types, Operations.
- File System Implementation: Layout, Implementation Files and directories.
- File system management: Disk space management, File system consistency.
- Comparison of Linux and windows file systems

SECTION B

Unit 4: Memory management (8 hrs)

- Memory management strategies: Basic Hardware, Address binding, Logical vs Physical Address space, Swapping, contiguous memory allocation.
- Memory partitioning: fixed, dynamic partitioning, buddy system reallocation, fragmentation.
- Managing free memory: memory management with bitmap, linked list.
- Virtual memory: demand paging, page replacement algorithms- options, FIFO, LRU, allocations of frames, thrashing and working set models.
- Paging: Basic method, hardware support, structure of page table.
- Segmentation: Basic method, hardware

Unit 5: Device management (6 hrs)

- Principles of I/O hardware: I/O device controllers
- Principles of I/O software.
- I/O software layers
- Disk: disk hardware-magnetic disk, RAID, CDs, DVDs, Disk formatting, disk scheduling algorithms, clocks

Unit 6: Deadlock Management (6 hrs)

Deadlock:

- Introduction to deadlocks: Resources- Types and resource acquisition. Conditions for resource deadlock, Deadlock Modelling.
- Deadlock detection and recovery with one resource and multiple resources.
- Deadlock avoidance:- Resource trajectories, safe & unsafe states, bankers algorithm for single and multiple resources
- Deadlock Prevention.

Text Books:

1. Andrew S. Tanenbaum, "Modern Operating Systems", Third Edition, Prentice Hall Publication.
2. Peter Galvin, Greg Gagne, Abraham Silberschatz, "Operating Systems Concepts", 8th Edition,

Reference Book:

1. William Stallings, "Operating Systems: Internal and design Principles", 7th Edition, Pearson Education.

Links :

1. http://stst.elia.pub.ro/news/SO/Modern%20Operating%20System%20-%20Tanenbaum.pdf
2. Comparison of LINUX and Windows file systems:- https://www.guru99.com/linux-differences.html
3. Memory management requirements & Memory partitioning: http://dinus.ac.id/repository/docs/ajar/Operating_System.pdf
4. Case study:- Windows 7:- http://codex.cs.yale.edu/avi/os-book/OSE1/slide-dir/PDF-dir/ch16.pdf

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Second Year Engineering

(AI&ML)Semester – III

Course Code: AIM204
Teaching Scheme
Theory: 04 Hours/Week

Title: Database Management System
Examination Scheme
Class Test: 20 Marks
Theory Examination (Marks): 80 Marks
Theory Examination (Duration): 03 Hours

Prerequisites:

1. Programming Concepts
2. Discrete Mathematics
3. Object Oriented Programming

Objectives:

1. To understand the different issues in the design and implementation of a database system
2. To design and build simple database systems
3. To retrieve information efficiently and effectively from database

CONTENTS

SECTION-A

Unit 1: Introduction (06 hrs)

- DBMS and Database System Applications
- Purpose of Database Systems
- View of Data
    - Data Abstraction
    - Instances and Schemas
    - Data Models
- Database Languages
    - DDL, DML
- Database Architecture
- Database Users and Administrators
- History of Database Systems.

Unit 2: Introduction to Database Design (08 hrs)

- Database Design and ER diagrams
    - Beyond ER Design
- Entities, Attributes And Entity sets
- Relationships and Relationship sets
- Additional features of ER Model

- Key Constraints
- Participation Constraints
- Weak Entities
- Class Hierarchies
- Aggregation

- Conceptual Design with the ER Model
  - Entity versus Attribute
  - Entity versus Relationship
  - Binary versus Ternary Relationships
  - Aggregation versus Ternary Relationships
- Case Study : The Internet Shop

Unit 3: Relational Model (06 hrs)

- Relational Model Concepts
  - Domains, Attributes, Tuples and Relations
  - Characteristics of Relations
- Relational Model Constraints
  - Domain Constraints
  - Key Constraints and Constraints on Null Values
  - Relational Databases and Relational Database Schemas
  - Entity Integrity, Referential Integrity and Foreign Keys
- Relational Database Design Using ER-to-Relational Mapping

SECTION-B

Unit 4: Relational Algebra and SQL (06 hrs)

- Relational Algebra
  - Selection and Projection
  - Set operations
  - Renaming
  - Joins
  - Examples of Algebra Queries
- SQL
  - SQL Data Definition
  - Specifying Constraints in SQL
  - Form of Basic SQL Query
  - Joins
  - Nested Queries
  - Aggregate Operators
  - NULL values
  - Views
  - Active Databases

Unit 5: Functional Dependencies and Normalization (06 hrs)

- Functional Dependencies
    - Definition of Functional Dependency
    - Inference Rules for Functional Dependencies
    - Equivalence of Sets of Functional Dependencies
    - Minimal Sets of Functional Dependencies
- Normal Forms based on Primary Keys
- General Definitions of Second and Third Normal Forms
- Boyce-Codd Normal Form
- Properties for Relational Decompositions
- Multi-valued Dependencies and 4NF
- Join Dependencies and 5NF

Unit 6: Transaction Management (08 hrs)

- Transaction Support
    - Properties of Transactions
- Concurrency Control
    - The Need for Concurrency Control
    - Serializability and Recoverability
    - Locking Methods
    - Deadlock
    - Timestamping Methods
- Database Recovery
    - The Need for Recovery
    - Transactions and Recovery
    - Recovery Facilities
    - Recovery Techniques

Text Books:

1. Ramez Elmasri and Shamkant B. Navathe, "Fundamentals of Database Systems", 5th Edition, Pearson Education
2. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", 6th Edition, McGraw Hills
3. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", 3rd Edition, TATA McGraw Hill, 2003

Reference Books:

1. Thomas Connolly, Carolyn Begg "Database Systems, A Practical approach to Design implementation and Management", Third Edition, , Pearson Education

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Section B questions on second part. Question paper should cover the entire syllabus.

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Second Year Engineering

(AI&ML)Semester – III

Course Code: AIM205

SystemTeaching

Theory: 04 Hours/Week

Title: Python Programming

SchemExamination Scheme

Class Test: 20 Marks

Theory Examination (Marks): 80

MarksTheory Examination (Duration): 03 Hours

Prerequisite:

Knowledge of 'C' Programming language

Course Objectives:

1 To effectively use basics of Python Programming.

2 To understand how to use and implement object-oriented features in python.

3 To understand how to deal with strings, files and database using python.

SECTION A

Unit1: Introduction:, [6]

Introduction to Python identifiers, variables, indentation in Python, input- output functions, operators, data types, numbers, stings, list, tuple set, dictionary, data conversion, Case Study: Counting words, Dictionaries, Case study: Occurrence of words

Unit2: Conditional and control statements: [6]

Using if, else and if else , Simple for loops in python, For loop using ranges, string, list and dictionaries, Use of while loops in python, Loop manipulation using pass, continue, break and else, Programming using Python conditional and loops block.

Unit3: Functions: [8]

function definition, function calling, function arguments, keyword, default, var length, anonymous function, recursive functions,

Built in modules, creating modules, import statement, packages in python, importing modules from packages

SECTION B

Unit4: Object oriented concepts: [6]

Class and objects, Constructor and destructors, Inheritance, Overlapping and overloading operators, organizing python codes using functions, organizing python projects into modules, Importing own module as well as external modules, Understanding Packages, Powerful Lamda function in python.

Unit5: Understanding string: [6]

In build methods, List manipulation using in build methods, Dictionary manipulation Avoiding code break using exception handling, Safe guarding file operation using exception handling, Handling and helping developer with error code, Programming using Exception handling.

Unit6: File and Database Handling: [8]

Understanding read functions, read(), readline() and readlines(), Understanding write functions, write() and writelines(), Manipulating file pointer using seek Programming using file operations, SQL Database connection using python, Creating and searching tables, Reading and storing information in Database.

Text Books

1 The Complete Reference Python, Mc Graw Hill
2. Y. Daniel Liang, Introduction to Programming using Python, Pearson
3.Rao, k. Nageswara, Shaikh Akbar python Programing.

Reference Books

1 Python Crash Course, Eric Matthes (No Starch Press, 2016)
2 Learn Python 3 the Hard Way, Zed A. Shaw (Addison-Wesley, 2016)
3 Think Python First Edition, by Allen B. Downey, Green Tea Press

E Books/ Online learning material

1 https://nptel.ac.in/courses/106/106/106106182/
2 https://swayam.gov.in/nd1_noc19_cs41/preview
3 https://docs.python.org/3/tutorial/
4 http://www.codecademy.com/tracks/python
5 http://corepython.com/
6 http://www.python-course.eu/python3_course.php

PATTERN OF QUESTION PAPER:

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For 80 marks Paper:

1. Minimum ten questions
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From the remaining questions in section A and B students are supposed to solve any two questions,15 marks eac

Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, CHHATRAPATI SAMBHAJINAGAR

Second Year Engineering

(AI&ML) Semester – III

Course Code: AIM221	**Title: LAB-I Data Structures & Algorithm**
Teaching Scheme	**Examination Scheme**
Practical: 2 Hours/Week	Practical /Oral Examination: 50 Marks
Credit: 1	Practical /Oral Examination (Duration): 03 Hours

Suggestive List of Practical's:

Design, develop and implement the following:

1 Write a program with dynamic memory allocation and de-allocation.

2 Write a program to implement stack operations.

3 Write a program using stack to convert infix expression to postfix/prefix expression and to evaluate postfix/prefix expression.

4 Write a program to implement queue operations for linear, circular, and priority queue.

5 Write recursive program to implement factorial, Fibonacci sequence, GCD, and Tower of Hanoi algorithms.

6 Write a program to implement list using array and linked list.

7 Write a program for linked list implementation of stack and queue.

8 Write a program to implement sorting, searching and hashing algorithms.

9 Write a program to implement Binary Search Trees.

10 Write a program to implement searching, spanning tree

Practical Examination:

Practical Examination should be conducted by internal examiner for three hours under the supervision of external examiner. External examiner should evaluate student by checking practical performance and conducting viva.

Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, CHHATRAPATI SAMBHAJINAGAR FACULTY OF SCIENCE AND TECHNOLOGY

Second Year Engineering

(AI&ML)Semester – III

Course Code: AIM222 **Title: LAB – I Operating SystemTeaching Scheme**

Practical: 02 Hours/week

Examination Scheme

Practical /Oral Examination (Marks): 50 Marks

Practical /Oral Examination (Duration): 03 Hours

Suggestive List of Practical Assignments:

1.Implement basic shell commands.

2 Shell programming: Simple logic programs. i) Write a menu driven script using the select statement to print calories for food items such as pizza, burger, Salad, Pasta etc. ii) Write a shell script that, given a filename as the argument, will count vowels, blank spaces, characters, number of lines and symbols.

3 Develop a program to provide synchronization among the 5 philosophers in Dining Philosophers problem using semaphore.

4 Develop a program to provide synchronization among the producer and consumer processes in producer – consumer problem using a monitor.

5 Consider the following scenario: A process has been allocated 3 page frames. Assume that none of the pages of the process are available in the memory initially. The process makes the following sequence of page references (reference string): 1, 2, 1, 3, 7, 4, 5, 6, 3, 1, 2, 4, 6, 3, 1. Find out a page replacement policy which gives the least number of page faults.

6 Simulate the Virtual Memory concept.

7 Implement the first fit and best fit algorithm in memory management.

8 Simulate the Contiguous file allocation method.

9 Implement a bit map for the following scenario. For a memory of size 32 blocks ,the allocated blocks are 2,3,4,5,8,9,10,11,12 and display the bitmap pattern.

Practical Examination:

Practical Examination should be conducted by internal examiner for three hours under the supervision of external examiner. External examiner should evaluate student by checking practical performance and conducting viva.

Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, CHHATRAPATI SAMBHAJINAGAR FACULTY OF SCIENCE AND TECHNOLOGY

Second Year Engineering

(AI&ML)Semester – III

Course Code: AIM223
Teaching Scheme
Practical: 02 Hours/week

Title: LAB – I Database Management System
Examination Scheme
Practical /Oral Examination (Marks): 50 Marks
Practical /Oral Examination (Duration): 03 Hours

Suggestive List of Practical Assignments:

Design, develop and implement any ten assignments from the following in SQL using Oracle/DB2 environment.

Assignment No.: 1

Implementation of DDL and DML Commands of SQL with suitable example

Assignment No.: 2

Implementation of different types of SQL functions with suitable example

- Number Function
- Character Function
- Aggregate Function
- Conversion Function
- Date Function

Assignment No.: 3

Implementation of different types of SQL operators with suitable example

- Arithmetic operators
- Logical operators
- Comparison Operators
- Special operators
- Set operators

Assignment No.:4

Study and Implementation of different types of Constraints

Assignment No.:5

Implementation of different types of joins

- Equijoin
- Non Equijoin
- Outer join

- Self join

Assignment No.:6

Study and implementation of:

- Group by & Having Clause
- Order by
- Indexing

Assignment No.:7

Study and implementation of:

- Sub queries
- Views
- Sequences

Assignment No.:8

Study and implementation of:

- TCL commands : Rollback, Commit, Save point
- DCL commands : Grant, Revoke, Creating & Managing users

Assignment No.:9

Study and Implementation of PL/SQL Block

Assignment No.: 10

Study and Implementation of PL/SQL Exceptions

Assignment No.:11

Study and Implementation of Triggers

Assignment No.:12

Study and Implementation of Cursors

Note: It is compulsory for the Students to perform one additional application based on assignment which should cover maximum possible queries.

Practical Examination:

Practical Examination should be conducted by internal examiner for three hours under the supervision of external examiner. External examiner should evaluate student by checking practical performance and conducting viva.

Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, CHHATRAPATI SAMBHAJINAGAR

Second Year Engineering (AI&ML)

Semester – III

Course Code: AIM224
Teaching Scheme:
Practical: 2Hours/Week
Credit: 1

Title: Lab 4: Python Programming
Examination Scheme:
Practical/Oral/Examination: 50 Marks
Practical/Oral/Exam (Duration): 03 Hours

Suggestive List of Programs

1. Introduction to Python and its Installation
2. Create a simple program of taking user input and print it using different data types variables.
3. Working with different conditional and looping statements, create functions in python.
4. Working with various string operations.
5. Implementing OOPS concept with Python (Class, Object, Inheritance, Polymorphism, Abstraction, Encapsulation
6. Create own module/import external module in program.
7. Implementing Exception Handling, Lambda Function in Python.
8. Using File Handling in Python.
9. Working with Database using Python

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, CHHATRAPATI SAMBHAJINAGAR
Second Year Engineering (AI&ML)
Semester – III

Course Code: AIM225
Teaching Scheme
Practical: 04 Hrs/week
Credit: 2

Title: LAB-V Introduction to Web Programming
Examination Scheme
Practical /Oral Examination: 50 Marks
Practical /Oral Examination (Duration): 03 Hours

Prerequisites:

1. You will need a text editor, such as Notepad and an Internet browser, such as Internet Explorer or Netscape.

Objectives - The student will be able to:

1. Define the basics in web design
2. Visualize and apply the basic concept of HTML.
3. Recognize the elements of HTML.
4. Define basics concept of JavaScript
5. Develop the web sites

Unit 1: Introduction to Web Design: **[4 hours]**

Web page & web site, Web Publishing, Introduction to HTML: Structure tags: <html>, <head>, <title>, <body> Block level tags: Headings, Paragraph, Comments, Breaks, Center, Division, Preformatted, Text alignment and font size. Text level tags: Bold, Italic, Underlined, Strike-through, superscript, subscript. Horizontal Rules Colours in web page: Background colour, Text colour, Link colour. Lists: Ordered Lists, Unordered Lists, Definition List, Nesting lists. HTML Links, Linking HTML Documents, Anchor tag, URLs

Unit 2: Tables and Forms **[4 hours]**

Tables: Creating Tables, Editing of rows and columns, rowspan, colspan, formatting tables using attributes border, Border colour, background, align, width, cell spacing and cell height.

Forms: Creating Forms, Forms controls: text controls, Password fields, Radio Buttons, Check boxes, Reset and Submit buttons.

Style sheets: Adding style sheet to document, Linking to a Style sheet, Embedding style sheet, Using inline Style sheet

Unit 3: JavaScript **[4 hours]**

JavaScript: Introduction, Variables, Operators, Arithmetic, Assignment, Data Types, Functions, Objects, Scope, Events, Strings, String Methods, Numbers, Number Methods, Math, Random, Dates, Date Formats, Date Methods, Arrays, Array Methods, Array Sort, Booleans, Comparisons, Conditions, Switch, Loop For, Loop While, Break, Type Conversion, Bitwise,

Regular Expressions, Errors, Debuggin

Unit 4: JQuery and Bootstrap **[3 hours]**

JQuery: Syntax, Events, Slide, Animate;

Bootstrap: Framework Introduction, Forms, Buttons

Unit 5: AngularJS **[3 hours]**

AngularJS: Expressions, Modules, Data Binding, Controllers, SQL, DOM, Events, Forms and validation

Unit 6: XML **[2 hours]**

XML: embedding XML into HTML, DTD. Introduction to Content Management System: Wordpress, Joomla, Drupal overview, publish a website with any one CMS.

Text Books:

1. Castro, "HTML 4 for World Wide Web, 3rd ed. Pearson education, 1998.
2. Barrett, "Essential JavaScript for web professionals", Pearson Education, 2000

Reference Books:

1. Yong, "XML step by step", PHI
2. "WordPress 3 Complete - Create your own complete website or blog from scratch with WordPress" by April Hodge Silver, PACKT.
3. "Web Development with jQuery" by Richard York , WROX publication
4. "AngularJS"by Brad Green and Shyam Seshadri

Suggestive list of Practical's

- Design a home page which will display your information i.e Bio data.
- Create Hyperlinks in home page for educational details, Hobbies, Achievement, My Ideals etc
- Use table tag to format web page. Also display educational details in tabular format.
- Implement a CSS programs for layers, inline, internal and external style sheets
- Design signup form to validate username, password, phone numbers etc using Java script/AngularJS
- Design a sign up form information in database. Perform change password/AngularJS
- Develop and demonstrate a DHTML file that includes Javascript for the following problems
  Input: A number n obtained using prompt
  Output: The factorial of a number n
- Develop and demonstrate a DHTML file the includes JavaScript for using various menu items and submenu items
- Design a web page for your Department.
- Design and Develop a shopping cart using HTML and JavaScript
- Create a table to display time table of your class. ii) Use table tags to display library details iii) Use frames such that page is divided into 2 frames 40% on top to show contents of pages, 60% in bottom to show body of page. iv) use image tags also
- Write a JavaScript program to find the area of a triangle where lengths of the three sides is given
- Write a JavaScript program to determine whether a given year is a leap year in the Gregorian calendar.
- Write a JavaScript program to convert temperatures to and from celsius, fahrenheit.
- Write a javascript for handling events with jQuery.

- Use the animate() method to set the following CSS properties for :opacity: 0.4, height: 400px, width: 400px.
- Use the animate() method to set the font-size of to 100 pixels.The duration of the effect should be "slow".
- Implement a program, which takes User Id as an input and returns the user details by taking the user information from the XML document
- Create an XML document, which contains 10 users information.
- Publish a website with Wordpress
- Publish a website with Joomla,

Practical Examination:

Practical Examination should be conducted by internal examiner for three hours under the supervision of external examiner. External examiner should evaluate student by checking practical performance and conducting viva.

Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, CHHATRAPATI SAMBHAJINAGAR
Second Year Engineering
(AI&ML)Semester – IV

Course Code: BSH 251
Teaching scheme
Theory: 4 Hours/Week
Credit: 4

Title: Engineering Mathematics-IV
Examination scheme
Class Test: 20 Marks
Theory Examination (Marks): 80 Marks
Theory Examination (Duration): 03 Hours

Objectives:

- To develop Logical understanding of the subject
- To develop mathematical skill so that students are able to apply mathematical methods & Principal's in solving problems from Engineering fields
- To produce graduates with mathematical knowledge & computational skill.

CONTENTS

SECTION-A

Unit1: Laplace Transform **[6 hrs]**
Definition, Transforms of elementary functions, Properties & theorems of Laplace transforms (without proof), transforms of periodic function, Heavy side unit step function, displace dun it step function, Dirac delta function, error function, Bessel' function of zero order.

Unit2:InverseLaplace Transform and its Applications **[6hrs]**
Inverse Laplace transforms by using (i) properties, ii) partial fractions, iii) Convolution theorem, Applications to solve linear differential equations with constant coefficients (Initial value problems), Simultaneous Linear differential equations.

Unit3: Z Transform: **[8hrs]**
Definition, Z transform of elementary functions , properties of Z transform, Inverse Z transform byusing partial fraction and residues theorem, Solution of difference equation by Z transform.

SECTION-B

Unit4: Numerical Methods and Curve Fitting [8 hrs]
Solution of trans dental equations by Newton Raphson method, Gauss Seidel method to solve simultaneous linear equations, LaGrange's interpolation formula for unequal intervals, numerical differentiation: Newton's forward and Newton's Backward difference formulae, Solution of ordinary differential equation by Eular modified Method and Runge-Kutta IVth order method, Curve fitting: Principle of least squares, Fitting of linear curve, parabola, exponential curve.

Unit-5: Function of Complex Variable (Differential calculus): **[6hrs]**
Introduction, Analytic function Cauchy Riemann equations in Cartesian and Polarform, Harmonicfunction, Laurent's series (without proof) ,Conformal mapping: Translation, Magnification,Rotation and in version bilinear transformation.

Unit6: Function of Complex Variable (Integral calculus): **[6hrs]**
Line integral, contourintegral: Cauchy's integral theorem, Cauchy's integral formula Residues, Cauchy's residue theorem (All theorems without proof),

Text Books:

1. P.N.WartikarandJ.N.Wartikar,"A Text Book of Engineering Mathematics(Volume-I,II,III) "Pune Vidyarthi Griha Prakashan,Pune.
2. B.S.Grewal,"Higher Engineering Mathematics,"Khanna Publications,NewDelhi.
3. H. K.Das,"Advanced Engineering Mathematics," S.Chand &Company.

Reference Books:

1. B.V.Ramana,"Higher Engineering Mathematics,"(Tata McGraw-Hill).
2. Erwin Kreyszig,"Advanced Engineering Mathematics,"Wiley Eastern Ltd.
3. Ravish R Singh, Mukul Bhat, "Engineering Mathematics A Tutorial Approach,"by,McGrawHill

Pattern of Question Paper: The unit sin the syllabus shall be divided in two equal sections. Question paper shall be set having two sections A and B. Section A questions shall be set on first three units(1,2,3) and Section B questions on remaining three units (4,5,6).Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Minimum ten questions
2. Five question sin each section
3. Question no1 and 6 be made compulsory and should have at least EIGHT bit soft marks outof which FIVE to be solved.
4. Two questions from remaining questions from each section be asked to solve having weight age of 15marks.

Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, CHHATRAPATI SAMBHAJINAGAR
Second Year Engineering
(AI&ML)Semester – IV

Course Code: AIM252	**Title: Discrete Mathematics**
Teaching Scheme	**Examination Scheme**
Theory: 04 Hours/Week	Class Test: 20 Marks
Credit: 4	Theory Examination (Marks): 80
	MarksTheory Examination (Duration): 03 Hours

Prerequisites:
1. Basic knowledge of set theory
2. Fundamentals of probability
3. Preliminary concepts of encoding, decoding

Objectives:

1. To construct simple mathematical proofs and possess the ability to verify them
2. To understand logical arguments and logical constructs
3. Have a better understanding of sets, functions, and relations.
4. Possess the mathematical knowledge and maturity that are required for upper level computer.

CONTENTS

SECTION-A

Unit 1: Set Theory [5 Hours]
Sets and Subsets, Set Operations and the Laws of Set Theory, Counting and Venn Diagrams, Probability, Conditional probability, Permutation and Combination

Unit 2: Fundamentals of Logic: [11 Hours]
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.

Unit 3: Properties of the Integers: [4 Hours]
The Well Ordering Principle – Mathematical Induction, Recursive Definitions

SECTION-B

Unit 4: Relations and Functions:[10 Hours]
Cartesian Products and Relations, Properties of Relations, Computer Recognition – Zero-One Matrices and Directed Graphs, Partial Orders – Hasse Diagrams, Lattice, Equivalence Relations

and Partitions, Functions – Plain and One-to-One, Onto Functions – Stirling Numbers of the Second Kind, Special Functions, The Pigeon-hole Principle, Function Composition and Inverse Functions

Unit 5: Groups and Rings: [5 Hours]
Definitions, Examples, and Elementary Properties, Homomorphisms and Cyclic Groups, Cosets and Lagrange's Theorem, Rings and Modular Arithmetic: The Ring Structure – Definition and Examples, Ring Properties and Substructures

Unit 6:Coding Theory: [5 Hours]
Elements of Coding Theory, The Hamming Metric, The Parity Check, and Generator Matrices, Group Codes: Decoding with Coset Leaders, Hamming Matrices

Text Book:

1. Ralph P. Grimaldi, "Discrete and Combinatorial Mathematics", 5th Edition, Pearson Education, 2004.

Reference Books:

1. Kenneth H. Rosen, "Discrete Mathematics and its Applications", 7th Edition, McGraw Hill, 2010.
2. Jayant Ganguly, "A Treatise on Discrete Mathematical Structures", Sanguine-Pearson, 2010.
3. D.S. Malik and M.K. Sen, Discrete Mathematical Structures: Theory and Applications, Cengage Learning, 2004.

PATTERN OF QUESTION PAPER:
Six units in the syllabus shall be divided in two equal parts i.e. 3 units in each part. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 80 marks Paper:
1. Minimum ten questions
2. Five questions in each section
3. Question no. 1 from section A and Question no. 6 from section B, 10 marks each, will be compulsory. From the remaining questions in section A and B students are supposed to solve any two questions, 15 marks each.

Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, CHHATRAPATI SAMBHAJINAGAR
Second Year Engineering
(AI&ML)Semester – IV

Course Code: AIM253	**Title: Object Oriented Programming**
Teaching Scheme	**Examination Scheme**
Theory: 04 Hours/Week	Class Test: 20 Marks
Credit: 4	Theory Examination (Marks): 80 MarksTheory Examination (Duration): 03 Hours

Prerequisite:

1. Fundamental knowledge about computers.
2. Computing knowledge
3. Basics of programming paradigms/constructs.

Objectives:

1. To study and understand the object oriented programming concepts and methodology
2. Be able to build C++ classes using appropriate encapsulation and design principles.
3. Be able to solve computational problems using C++ features such as composition of objects, operator overloads, dynamic memory allocation, inheritance and polymorphism, file I/O, exception handling, etc.

CONTENTS

SECTION-A

Unit 1:Getting Started[06 Hours]
Need of Object-Oriented Programming (OOP), Object Oriented Programming Paradigm, Basic Concepts of Object-Oriented Programming, Benefits of OOP, C++ as object oriented programming language ,Different data types, operators, expressions, and statements, arrays and strings, pointers & user-defined types. Function Components, argument passing, inline functions, function overloading, recursive functions

Unit 2:Classes and Objects[06 Hours]
Specifying a Class, Defining Member Functions, A C++ Program with Class, Making an Outside Function Inline, Nesting of Member Functions, Private Member Functions, Arrays within a class, Memory Allocation for Objects, Static Data Members, Static member functions, Arrays of Objects, Objects as Function Arguments, Friendly functions, Returning Objects.

Unit 3: Constructors and Destructors **[08 Hours]**
Introduction, Constructors, Parameterized Constructors, Multiple Constructors in a Class, Constructors with Default Arguments, Dynamic Initialization of Objects, Copy Constructor, Dynamic Constructors and Destructors.
Operator Overloading and Type Conversions: concept of overloading, Rules for Overloading Operators, Overloading Unary Operators, Overloading Binary Operators, Data Conversion, Type casting (implicit and explicit), Pitfalls of Operator Overloading and Conversion, Keywords explicit and mutable.

SECTION-B

Unit 4:Inheritance [08 Hours]

Base Class and derived Class, Public and Private Inheritance, protected members, Constructors Destructors and Inheritance -When Constructor and Destructor functions Are executed, Passing Parameters to Base-Class Constructors. Overriding Member Functions, Class Hierarchies, Levels of Inheritance, Multiple Inheritance, Ambiguity in Multiple Inheritance, Aggregation, Classes within Classes. Virtual Base Classes.

Virtual functions and Polymorphism:

Introduction to Pointers, Pointer to objects, this pointer, Pointer to derived classes, Virtual functions, Calling a Virtual Function Through a Base Class Reference ,The Virtual Attribute Is Inherited ,Virtual Functions Are Hierarchical ,Pure Virtual Functions ,Abstract Classes ,Early vs. Late Binding .

Unit 5:Managing Console I/O Operations [06 Hours]

Introduction, C++ Streams, C++ Stream Classes, Unformatted I/O Operations, Formatted Console I/O Operations, Managing Output with Manipulators

Working with Files:

Introduction, Classes for file stream operations, Opening and Closing of a File, File Modes, File pointers and their Manipulations, Sequential Input and Output Operations, Error Handling during file operations, Command line arguments

Unit6:Templates [06 Hours]

Introduction, Class templates, Class Templates with multiple parameters, Function templates, Overloading of Template Functions, Member Function Templates.

Exception handling:

Introduction, Basics of Exception Handling, Exception Handling Mechanism, Throwing Mechanism, Catching Mechanism, Rethrowing an exception, Specifying exceptions

Text Books:

1. "Object Oriented Programming with C++" by E Balagurusamy (6th Edition, McGraw Hill Pvt Ltd.) ISBN-13:978-1-25-902993-6.
2. "Object-Oriented Programming in C++", Robert L afore ,fourth edition, Sams Publishing,ISBN:0672323087 (ISBN 13: 9780672323089)
3. "The Complete Reference C++"by Herbert Schildt (5th Edition, McGraw Hill Pvt Ltd.) ISBN-13: 978-0071634809

Reference Books:

1. *"C++ Programming Language"* by Bjarne Stroustrup (4th Edition, Addison Wesley) ISBN-13: 978-0321563842
2. *"Mastering C++"* by K.R.Venugopal, Rajkumar, T.Ravishankar (2nd Edition, McGraw Hill Pvt Ltd.) ISBN-13:978-93-83286-77-5.

PATTERN OF QUESTION PAPER:

Six units in the syllabus shall be divided in two equal parts i.e. 3 units in each part. Question paper shall be set having two sections A and B. Section A questions shall be set on first part and Section B questions on second part. Question paper should cover the entire syllabus.

For 80 marks Paper:

1. Minimum ten questions
2. Five questions in each section
3. Question no. 1 from section A and Question no. 6 from section B, 10 marks each, will be compulsory.
4. From the remaining questions in section A and B students are supposed to solve any two questions, 15 marks each.

Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, CHHATRAPATI SAMBHAJINAGAR

Second Year Engineering (AI&ML)

Semester – IV

Course Code: AIM254 | **Title: Basic of Data Science**

Teaching Scheme | **Examination Scheme**

Theory: 4 Hours/Week | **Class Test: 20 Marks**

Credit: 4Theory | **Examination (Marks): 80 Marks**

Theory Examination: (Duration): 03 Hours

Prerequisite:

- Discrete Mathematics,
- Algebra, Probability and Statistics.

Objectives:

- To understand the need of Data Science
- To understand computational statistics in Data Science
- To study and understand the different technologies used for Data processing
- To give a hands-on experience with real-world data analysis
- To learn the probability and probabilistic models of data science

SECTION-A

Unit I: Introduction to Data Science **(7 Hours)**

Basics and need of Data Science, Applications of Data Science, Relationship between Data Science and Information Science, Business intelligence versus Data Science, Data: Data Types, Data Collection. Need of Data wrangling, Methods: Data Cleaning, Data Integration, Data Reduction, Data Transformation, and Data Discretization.

Unit II: Statistical Inference **(6 Hours)**

Need of statistics in Data Science, Measures of Central Tendency: Mean, Median, Mode, Mid-range. Measures of Dispersion: Range, Variance, Mean Deviation, Standard Deviation. Bayes theorem, Basics and need of hypothesis and hypothesis testing, Pearson Correlation, Sample Hypothesis testing, Chi-Square Tests, t-test

Unit III: Data Analytics Life Cycle **(7 Hours)**

Introduction, Data Analytic Lifecycle: Introduction, Phase 1: Discovery, Phase 2: Data Preparation, Phase 3: Model Planning, Phase 4: Model Building, Phase 5: Communication results, Phase 6: Operationalize.

Fundamentals of Predictive Data Analytics with Python: Introduction, Essential Python Libraries, Basic examples. Data Preprocessing: Removing Duplicates, Transformation of Data using function or mapping, replacing values, Handling Missing Data.

SECTION-B

Unit No IV: Data transformation and standardization **[07 Hours]**

Box-Cox and power transforms, Freeman-Tukey (square root and arcsine) transforms, Log and Exponential transforms, Logit transforms, Normal transform.

Unit V: Analysis of Variance and Covariance **[07 Hours]**

Variance test: Chi square test of single variable, F-test of two variables, test of homogeneity; Wilcoxon rank-sum/Mann-Whitney U test; Sign test.

Contingency Tables: Chi-square contingency table test, G contingency table test, Fisher's exact test, Measures of association, McNemar's test.

Unit VI: Data Reduction & Data visualization: **[6 Hours]**

Data Reduction: Overview of Data Reduction Strategies, Wavelet Transforms, Principal Components Analysis, Attribute Subs Selection, Regression and Log-Linear Models: Parametric Data Reduction, Histograms, Clustering, Sampling, Data Cube Aggregation. Data Visualization: Pixel-Oriented R18 B.Tech. CSE (Data Science) III & IV Year JNTU Hyderabad Visualization Techniques, Geometric Projection Visualization Techniques, Icon-Based Visualization Techniques, Hierarchical Visualization Techniques, Visualizing Complex Data and Relations

Text Books:

1) Ethem Alpaydın, Introduction to Machine Learning, PHI, Third Edition, ISBN No. 978-81-203- 5078-6 2.Christopher M. Bishop, Pattern Recognition and Machine Learning, Mcgraw-Hill, ISBN No. 0- 07- 115467-1.
2) Dr. Michael J de Smith, Statistical Analysis Handbook, A Comprehensive guide to statistical concepts methods and tools The Winchelsea Press, Drumlin Security Ltd, Edinburgh 2018 edition. https://www.statsref.com/HTML/index.html
3) Doing Data Science, Straight Talk from The Frontline. Cathy O'Neil and Rachel Schutt, O'Reilly, 2014
4) David Dietrich, Barry Hiller, "Data Science and Big Data Analytics", EMC education services, Wiley publication, 2012, ISBN0-07-120413-X.
5) Jiawei Han, Micheline Kamber, and Jian Pie, "Data Mining: Concepts and Techniques" Elsevier Publishers Third Edition, ISBN: 9780123814791, 9780123814807
6) Tom Mitchell, Machine Learning, Mcgraw-Hill, First Edition, ISBN No. 0-07-115467-1.
7) 5 .Giuseppe Bonaccorso, "Machine Learning Algorithms", Packt Publishing Limited, ISBN10: 1785889621, ISBN-13: 978-1785889622

Reference Books:

1) 1.R.O. Duda, P.E. Hart, D.G. Stork, Pattern Classification, 2/e, Wiley, 2001
2) 2. Shai shalev-Shwartz and Shai Ben-David, Understanding Machine Learning (From Theory to Algorithms), Cambridge University Press, First Edition, ISBN No. 978-1-107-51282-5.
3) 3. A. Rostamizadeh, A. Talwalkar, M. Mohri, Foundations of Machine Learning, MIT Press.
4) 4. A. Webb, Statistical Pattern Recognition, 3/e, Wiley, 2011.
5) 5. https://python-course.eu/machine-learning

PATTERNOFQUESTIONPAPER:

Six units in the syllabus shall be divided in two equalpartsi.e.3unitsineachpart.Questionpapershallbe set having two sections and B. Section A questions shall be set on first part and Section B questionsonsecond part.Question papershou

covertheentiresyllabus.

For80marksPaper:

4. Minimumten questions
5. Fivequestionsineachsection
6. Questionno.1fromsectionAandQuestion no.6fromsection B,10 markseach,willbe compulsory. FromtheremainingquestionsinsectionAandBstudentsaresupposedtosolveanytwoquestions,15marks each.

Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, CHHATRAPATI SAMBHAJINAGAR

Second Year Engineering (AI&ML)
Semester – IV

Course Code: AIM255
Teaching Scheme
Theory: 4 Hours/Week
Credit: 4

Title: Machine Learning
Examination Scheme
Class Test: 20 Marks
Theory Examination (Marks): 80 Marks
Theory Examination (Duration): 03 Hours

Prerequisite:

Data Analysis, Python Programming Language

Objectives:

After completion of the course, students will learn:-

1) To understand fundamental concepts of machine learning and its various algorithms
2) To understand various strategies of generating models from data and evaluating them
3) To apply ML algorithms on given data and interpret the results obtained
4) To design appropriate ML solution to solve real world problems in AI domain

CONTENTS

SECTION-A

Unit No 1: Introduction to Machine Learning **[7 Hours]**

Introduction to Machine Learning: Definition of Machine Learning, Definition of learning. Classification of Machine Learning: Supervised learning, unsupervised learning, Reinforcement learning, Semi-supervised learning. Categorizing based on required Output: Classification, Regression, and Clustering. Difference in ML and Traditional Programming, Definition of Data, Information and Knowledge. Split data in Machine Learning: Training Data, Validation Data and Testing Data.

Unit No 2: Machine Learning - Performance Metrics **[6 Hours]**

Performance Metrics for Classification Problems- Confusion Matrix, Classification Accuracy, Classification Report- Precision, Recall or Sensitivity, Support, F1 Score, AUC (Area Under ROC curve). Performance Metrics for Regression Problems- Mean Absolute Error (MAE), Mean Square Error (MSE), R Squared (R2)

Unit No 3: Linear and Logistic Regression **[7 Hours]**

Introduction to linear regression: Introduction to Linear Regression, Optimal Coefficients, Cost function, Coefficient of Determination, Analysis of Linear Regression using dummy Data, Linear Regression Intuition. Multivariable regression and gradient descent: Generic Gradient Descent, Learning Rate, Complexity Analysis of Normal Equation Linear Regression, How to find More Complex Boundaries,

Variations of Gradient Descent. Logistic regression: Handling Classification Problems, Logistic Regression, Cost Function, Finding Optimal Values, Solving Derivatives, Multiclass Logistic Regression,

SECTION-B

Unit No 04: Unsupervised Learning [7 Hours]

Introduction, Association Rules-Market Basket Analysis, The Apriori Algorithm, Unsupervised as Supervised Learning, Generalized Association Rules, Cluster AnalysisProximity Matrices, Clustering Algorithms-K-mean, Gaussian Mixtures as Soft K-means Clustering, Example: Human Tumor Microarray Data, Vector Quantization, K-medoids, Hierarchical Clustering, Self-Organizing Maps, PCA-Spectral Clustering

Unit No 5: Decision Trees and Random Forests [6 Hours]

Decision trees: Decision Trees, Decision Trees for Interview call, Building Decision Trees, Getting to Best Decision Tree, Deciding Feature to Split on, Continuous Valued Features Code using Sklearn decision tree, information gain, Gain Ratio, Gini Index, Decision Trees & Over fitting, Pruning.

Random forests: Introduction to Random Forests, Data Bagging and Feature Selection, Extra Trees, Regression using decision Trees and Random Forest, Random Forest in Sklearn.

Unit No 6: Naive Bayes, KNN and SVM [7 Hours]

Naive Bayes: Bayes Theorem, Independence Assumption in Naive Bayes, Probability estimation for Discrete Values Features, How to handle zero probabilities, Implementation of Naive Bayes, Finding the probability for continuous valued features, Text Classification using Naive Bayes.

K-Nearest Neighbours: Introduction to KNN, Feature scaling before KNN, KNN in Sklearn, Cross Validation, Finding Optimal K, Implement KNN, Curse of Dimensionality, Handling Categorical Data, Pros & Cons of KNN.

Support Vector Machine: Intuition behind SVM, SVM Cost Function, Decision Boundary & the C parameter, using SVM from Sklearn, Finding Non Linear Decision Boundary, Choosing Landmark Points, and Similarity Functions.

TextBooks:

1. Ethem Alpaydın, Introduction to Machine Learning, PHI, Third Edition, ISBN No. 978-81-203- 5078-6
2. Christopher M. Bishop, Pattern Recognition and Machine Learning, Mcgraw-Hill, ISBN No. 0- 07-115467-1
3. Tom Mitchell, Machine Learning, Mcgraw-Hill, First Edition, ISBN No. 0-07-115467-1.

ReferenceBooks:

1.R.O. Duda, P.E. Hart, D.G. Stork, Pattern Classification, 2/e, Wiley, 2001
2. Shai shalev-Shwartz and Shai Ben-David, Understanding Machine Learning (From Theory to Algorithms), Cambridge University Press, First Edition, ISBN No. 978-1-107-51282-5.
3. A. Rostamizadeh, A. Talwalkar, M. Mohri, Foundations of Machine Learning, MIT Press.

PATTERNOFQUESTIONPAPER:

Six units in the syllabus shall be divided in two equal parts i.e. 3 units in each part. Questionpaper shall be set having two sections A and B. Section A questions shall be set on first part andSectionBquestionsonsecond part.Questionpapershouldcovertheentire syllabus.

For80 marks Paper:

1. Minimumtenquestions
2. Fivequestionsineach section
3. Question no. 1 from section A and Question no. 6 from section B, 10 marks each, will becompulsory.
4. From the remaining questions in section A and B students are supposed to solve any twoquestions,

15markseach.

Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, CHHATRAPATI SAMBHAJINAGAR

Second Year Engineering (AI&ML)
Semester – IV

Course Code: AIM271	**Title: LAB-6 Object Oriented Programming**
Teaching Scheme	**Examination Scheme**
Practical: 02 Hours/Week	Practical /Oral Examination: 50 Marks
Credit: 1	Practical /Oral Examination (Duration): 03 Hours

Suggestive List of Practical's:
Design, develop and implement the following:

1. Develop programs to implement the concepts of classes and object, accessing members: e.g.
   a. Design an EMPLOYEE class to contain
      Data members: Employee_Number,Employee_Name,Basic_Salary,All_Allowances, IT, Net_Salary.
      Member functions: to read the data of an employee, to calculate Net_Salary and to print the values of all the data members.
   b. Design a STUDENT class
   c. Design Bank Account class.

2. Design a program to Demonstrate concept of
   a. **Arrays within a class, Arrays of Objects** (e.g Develop program to calculate best of two class Test marks of six subjects of a student)
   b. **Objects as Function Arguments, Returning Objects.** (e.g.Complex number arithmetic)

3. Design a C++ program for static members
   a. Design a class having static member function which has capability to display number of objects created.
   b. Design matrix and vector classes with static allocation and a friend function to do matrix-vector multiplication.

4. Design a program to Demonstrate concept of constructor. Create a class called 'TIME' that has:
   a. three integer data members for hours, minutes and seconds
   b. constructor to initialize the object to zero
   c. constructor to initialize the object to some constant value
   d. member function to add two TIME objects
   e. member function to display time in HH:MM:SS format
   Write a main function to create two TIME objects, add them and display the result in HH:MM:SS format.

5. Design a program to demonstrate operator overloading for unary as well as binary operation.
   a. Design, develop and execute a program in C++ to create a class called DATE with methods to accept two valid dates in the form dd/mm/yy and to implement the

following operations by overloading the operators + and -. After every operation, the results are to be displayed by overloading the operator <<.

i. no_of_days = d1 – d2; where d1 and d2 are DATE objects, d1 >=d2 and no_of_days is an integer.

ii. d2 = d1 + no_of_days; where d1 is a DATE object and no_of_days is an integer.

b. Design a class Complex which represents the Complex Number data type. Implement the following operations:

i. Constructor (including a default constructor which creates the complex number 0+0i).

ii. Overloaded **operator+** to add two complex numbers.

iii. Overloaded **operator*** to multiply two complex numbers.

iv. Overloaded << and >> to print and read Complex Numbers.

6. Design a program to demonstrate Single, multiple, multilevel, hybrid, hierarchical inheritance and Virtual base classes.

7. Design a program to implement Array of pointers, pointer to functions, pointer to objects.

8. Design a program to implement concept of Virtual functions:
   a. Create a class called LIST with two pure virtual function store() and retrieve().To store a value call store and to retrieve call retrieve function. Derive two classes stack and queue from it and override store and retrieve.
   b. Create a base class called 'SHAPE' having
      i. two data members of type double
      ii. member function get-data( ) to initialize base class data members
      iii. pure virtual member function display-area( ) to compute and display the area of the geometrical object. Derive two specific classes 'TRIANGLE' and 'RECTANGLE' from the base class. Using these three classes design a program that will accept dimension of a triangle / rectangle interactively and display the area.

9. File Handling
   a. Develop a program to demonstrate Opening and Closing of file using constructors and open () function.
   b. Write a program to read the class object of student info such as name, age,gender,height and weight from the keyboard and to store them on a specified file using read() and write() functions. Again the same file is opened for reading and displaying the contents ofthe file on the screen.

10. Develop a program to implement class and function template for stack and queue.

11. Design a program to demonstrate the concepts of catching and throwing of an exception.

Practical Examination:

Practical Examination should be conducted by internal examiner for three hours under the supervision of external examiner. External examiner should evaluate student by checking practical performance and conducting viva.

Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, CHHATRAPATI SAMBHAJINAGAR
Second Year Engineering (AI&ML)
Semester – IV

Course Code: AIM272	**Title: Lab 7: Basic of Data Science**
Teaching Scheme	**Examination Scheme:**
Practical: 2Hours/Week	**Practical/Oral/Examination: 50 Marks**
Credit: 1	**Practical/Oral/Exam (Duration): 03 Hours**

Suggestive List of Practical's:

Software Tools: Programming languages, namely Python is highly recommended for students to use when completing their assignments and/or practicals for this course.

LIST OF EXPERIMENTS Tools:
Python, Numpy, Scipy, Matplotlib, Pandas, statmodels, seaborn, plotly, bokeh Working with Numpy arrays

1. Working with Pandas data frames
2. Basic plots using Matplotlib
3. Frequency distributions, Averages, Variability
4. Normal curves, Correlation and scatter plots, Correlation coefficient
5. Regression
6. Z-test
7. T-test
8. ANOVA
9. Building and validating linear models
10. Building and validating logistic models
11. Time series analysis

Practical Examination:

Practical Examination should be conducted by internal examiner for three hours under the supervision of external examiner. External examiner should evaluate student by checking practical performance and conducting viva.

Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, CHHATRAPATI SAMBHAJINAGAR
Second Year Engineering (AI&ML)
Semester – II

Course Code: AIM273
Teaching Scheme
Practical: 2 Hours/Week
Credit: 1

Title: LAB-8: Machine learning
Examination Scheme
Term Work: 50 Marks

Suggestive List of Practical's:

Design, develop and implement following:
List of practicals:

1. Python Libraries for Data Science-
a. Pandas Library
b. Numpy Library
c. Scikit Learn Library
d. Matplotlib
2. Evaluation Metrics-
a. Accuracy
b. Precision
c. Recall
d. F1-Score
3. Train and Test Sets by Splitting Learn and Test Data.
4. Linear Regression
5. Multivariable Regression
6. Decision Tree Algorithm implementation.
7. Random Forest Algorithm implementation.
8. Naive Bayes Classification Algorithm implementation.
9. K-Nearest Neighbor Algorithm implementation.
10. SVM Algorithm implementation

Term Work:
Term work shall consists of record of the experiments carried out during the course, which should include appropriate explanation for the corresponding experiment indicating what is learnt from the experiment. The term work shall consist of at least 10 experiments.

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, CHHATRAPATI SAMBHAJINAGAR
Second Year Engineering
(AI&ML)Semester-IV

Course Code: AIM274	**Title: LAB-IX Open Source Laboratory**
Teaching Scheme	**Examination Scheme**
Practical: 02 Hours/Week	Practical /Oral Examination (Duration): 03Hours
Credit: 1	Practical Examination (Marks): 50 Marks

Prerequisite:

- Basic Knowledge of HTML, CSS, JS.
- Knowledge of programming constructs

Objectives:

This course is aimed to:

- Understand open source movement worldwide
- Enable competency in industry-problem identification and resolution
- Develop application using lampp/xampp

Unit 1: Apache and PHP

Introduction to Open source, 3-Tier architecture, Apache webserver, XAMPP/LAMPP, Basic syntax, Variables, Data Types, Operators and expressions, Constants. Flow Control: Switch flow, Loops, Code Block, Sending data to the browser. Working with Arrays: Arrays, Creating array, Array related Functions. Working with Function: Function, Calling Function, Defining Function, Returning the Values from user defined function, Variable Scope, Argument. Working with Strings, Date and Time Functions: Formatting String with PHP.

Unit 2: Forms and Session Handling

Working with Forms: Creating form, Handling form, Validating form data, Accessing form data, use of Hidden fields to save State, Redirecting user, file Upload and Sending Mail on Form Submission, Working with Cookies and User Session: Introduction of Cookie, Setting a Cookie with PHP, Introduction of Session and Improving Session Security, Starting a Session, Working with Session Variables, Passing Session Id in the query String, Destroying Session and Unsetting Variables. Error Handling and Debugging: General error types and debugging, displaying PHP errors, Adjusting Error Reporting, Creating Custom error handler, PHP debugging techniques

Unit 3: MySQLi.

Understanding the Database Design Process: The importance of good database design, Basic SQL Command: Table Creation, Insert row, Select Command Using Where Clause, Update and Delete Command, String Function, Date and Time Functions, Using MySQL with PHP: Connecting to MySQLi and selecting the database, executing simple queries, retrieving query results, counting return Records, updating, Record Addition, Viewing Record, and Deletion Record with PHP. MYSQL Error Handling: SQL and MySQL debugging techniques.

Unit 4: PHP Data Object (PDO) functions.

Why PDO? , Connections and Connection management, Running Queries,Running SELECT INSERT, UPDATE, or DELETE statements, Getting data out of statement- foreach().Getting data out of statement-fetch().Error Handling.

Unit 5: AJAX

Introduction to Ajax, Pre-Ajax JavaScript Communication Techniques,Defining Ajax, The Ajax Toolkit, XMLHttpRequest Object, Data Formats, Developing an Ajax library, Networking considerations, user interface design for Ajax. Develop a dynamic website with PHP, MYSQLi, Ajax (login, registration, feedback, file uploading).

Reference Books:

1. Red Hat Linux Bible, Christopher Negus, Wiley Publishing ISBN: 0-7645-4333-4
2. PHP, MySQL and Apache, Julie C Meloni, Pearson Education ISBN: 81-297-0443-9
3. AJAX: The Complete Reference, Thomas Powell McGraw-Hill Education, ISBN-10: 007149216X

Internet Resources:

1. PHP Manual, http://php.net/
2. AJAX, http://w3schools.com/ajax/,http://tutorialspoint.com/ajax/
3. MySQLi, http://w3schools.com/mysql/, http://tutorialspoint.com/ajax/
4. Linux Course for Intermediate Level Users, http://www.linux.org/lessons/interm/index.html

Suggestive List of Practical's:

1. Demonstration of Open source software's installation i.e. xampp, lamp, etc.
2. Design HTML form and retrieve the values in PHP script.
3. PHP variables, arrays (array multiplication, addition ...etc).
4. PHP Functions: array, string, date-time, and calendar.
5. MySQLi connectivity, INSERT, SELECT, DELETE with PHP
6. PHP script using PDO for MySQLi connectivity, data storing and retrieval.
7. PHP Mysqli connectivity using OOP method.
8. PHP script for File uploading.
9. PHP script for-Session Management (login form).
10. AJAX Script using XMLHttpRequest, Data Formats, PHP.
11. PHP script to update and retrieve data stored in database from user using Ajax.
12. Chat Application using PHP, MYSQLi, and AJAX.
13. Miniproject: Design of website using PHP – MYSQLi, AJAX.

Practical Examination:
Practical Examination should be conducted by internal examiner for three hours under the supervision of external examiner. External examiner should evaluate student by checking practical performance and conducting viva.

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, CHHATRAPATI SAMBHAJINAGAR
Second Year Engineering
Semester-IV

Course Code: BSH 275
Teaching scheme
Practical: 04 hrs /week
Credit: 2

Title: Communication Skills-I
Examination scheme
Term work /Oral Exam: 50 Marks

The teacher shall explain in detail, the gist and techniques involved in the following work units to the students. The teacher shall subsequently formulate the exercises to adjudge the skill sets acquired by the students.

Unit 1 Time Management **[04 Hrs]**
Value of time, Diagnosing Time Management, Weekly Planner to do list and Prioritizing work.

Unit 2: Grammar and Usage **[08 Hrs]**
Overview of basic Mid-level English Grammar, Parts of speech, Preparations and Conditions, Tense and Concept of time, Sentence Construction (Concord), Vocabulary: Words, Idioms, Phrases, Antonyms and Synonyms

Unit 3: Speaking Skills **[08 Hrs]**
Training in Sound Recognition, the speech process, message, audience, speech style, feedback, conversation and oral skills, fluency and self-expression body language phonetics and spoken English, speaking techniques, word stress, correct stress patterns, voice quality, correct tone, types of tones, Presentation skills-planning, preparation, organization, Stress and Intonationpattern in spoken communication, Sound Recording Exercise (Language Lab Exercise), Communication Errors in English.

Unit 4: Listening and Reading Skill **[08 Hrs]**
Active and Passive Listening, the reading process, purpose, different kinds of texts, reference material, scientific and technical texts, active and passive reading, strategies-vocabulary skills, eye reading and visual perception, Skimming and scanning reading, drawing inferences and conclusions, comprehension of technical material- scientific and technical texts, instructions and technical manuals, graphic information. Note making- tool for study skills.

Unit 5: Writing Skills **[06 Hrs]**

Identification of different writing styles (Four Writing Style), Types of reports, information and analytical reports, oral and written reports, formal and non-formal reports, printed forms, letter and memo format, manuscript format, proposals, technical articles, journal articles and conference papers, Drafting: Memo, Circulars, Notices, agendas etc. E-mails, Business Memos / Letters, Employment Communication- resume design, resume style.

Unit 6 Developing Skills and Presentations **[06 Hrs]**

Developing key traits 1: creativity, critical thinking and problem solving. Effective Presentations-Gathering Information and Building Presentation. Presentation bystudents in team.

Text Books:

1. 'Effective Technical Communication' by M Ashraf Rizvi, Tata McGraw Hill Publishing Company Ltd.
2. 'Basic Managerial Skills for all' E. H. McGrath, Eastern Economy Edition, Prentice hall India.
3. 'Developing Communication Skills' Krishna Mohan, Meera Banerji, McMillan India Ltd.
4. Skills' Krishna Mohan, Meera Banerji, McMillan India Ltd.

Term Work:

Term work marks should be given on the basis of online test conducted internally at college level.