



**SCHOOL of ENGINEERING
& MANAGEMENT**
KASABA BAWADA, KOLHAPUR
Approved by AJCTE, New Delhi

Constituent Unit of
**D. Y. PATIL EDUCATION SOCIETY
(DEEMED TO BE UNIVERSITY), KOLHAPUR**
Notification No. F.9-26/2004- U.3 dt. 01-09- 2005 of the GOI
Accredited by NAAC with 'A++' Grade

"Imparting knowledge with excellence"

Department of Computer Applications

Academic Cycle 2024-2026

SEMESTER – I



Course Plan

Course Title: Database Management Systems	
Course Code : 242MCA1L101	Semester: I
Teaching Scheme:L-T-P:3-0-0	Credits:3
Evaluation Scheme: ISE+MSE Marks:20+20	ESE Marks : 60

Course Description:

The objective of the course is to understand the concept of Database Management System. It also aims to aware the students about important concepts in DBMS and data modelling. It also insist on normalization upto three levels . It also includes file structure and data administration. It also considers concurrency control and recovery techniques.

Course Objectives:

- To teach the fundamentals of the database systems at a master level. A variety of topics Will be covered that are important for modern databases in order to prepare the students for real life applications of databases.
- To impart knowledge of the concepts related to database and operations on databases. It also gives the idea how database is managed in various environments with emphasis on security measures as implemented in database management systems.

Course Outcomes (COs):

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

CO1	Understand the concept of database and techniques for its management. Understand data security standards and methods.
CO2	Design different data models at conceptual and logical level and translate ER Diagrams to Relational Data Model.
CO3	Identify and study the file organization schemes for DBMS.
CO4	Analyze and describe features for Concurrency and Recovery.
CO5	Evaluate relational algebra statements to the SQL statements
CO6	Create and design the queries using Relational Algebra

Prerequisite:	Basic Knowledge of Database
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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs			BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
101.1	3	2	-	2	-	3	-	-	-	-	-	2	-	2	2	2
101.2	3	-	3	-	-	-	-	-	-	-	-	-	3	3	-	3
101.3	2	-	3	-	-	-	-	-	-	-	-	-	2	-	-	1
101.4	3	-	2	-	-	-	-	-	-	-	-	-	-	2	-	4
101.5	3	3	-	-	-	-	-	-	-	-	-	-	3	3	-	5
101.6	3	-	3	-	-	-	-	-	-	-	-	-	3	2	-	3

Content	Hours
Unit1:Introduction to DBMS Difference between Data& Information, Data Processing& Data Management, Database oriented approach data Management, Need for DBMS, Characteristic of Database, Database Architecture: Levels of Abstraction, Database schema and instances, three tier architecture of DBMS, Data Independence. Database users, Types of Database System. Database Languages	8
Unit 2:Data Modeling in Database 2.1 Data Models : Logical Data Modeling, Hierarchical Data Model, Network Data Model, Relational Data Model. 2.2 Conceptual Data Modeling : Entitites, Attributes, Types of attributes, Entity Relationship, Relationship set, degree of relationship set, Mapping Cardinalities, Keys, ER Diagram Notations 2.3 Roles Participation: Total and Partial, Strong and Weak Entity Set. Subclass,Superclass,Generalization,Specialization,AttributeInheritance. 2.4 Relational Data Model : Codd's Rules for RDBMS, Translating ER Diagram to Relational Database.	8



Unit 3: Normalization and Relational Algebra: 3.1 Normalization Vs De-Normalization, Decomposition, Lossy and Lossless Decomposition, Functional Dependencies, Normal forms 1NF, 2NF, 3NF, BCNF, Example on Normalization. 3.2 Keys: Composite, Candidate, Primary, Secondary, Foreign, Relational Algebra: Select, Project, Divide, rename. 3.3 Set Operations: Union, Intersect, Difference, And Product, Joins: Outer Joins, Inner Joins with example	8
Unit 4: File Structures and Data Administration 4.1 File Organization, Overview of Physical Storage Media, Magnetic Disk, RAID, Tertiary Storage, Storage Access, Data Dictionary Storage, Organization of File (Sequential, Clustering), Indexing and Hashing, 4.2 Basic Concepts, indices, B+ Tree index file, B- tree index file, Static hashing, Dynamic Hashing	8
Unit 5: Concurrency Control 5.1 Single-user and Multiuser systems, Multi programming and Multiprocessing, Concept of transaction, transaction state, ACID properties, Schedules, Serializability of schedules., 5.2 Concurrency Control, Need for Concurrency control, lock based protocols, time stamp based protocols, 5.3 Deadlock and its handling, Wait-Die and Wound-Wait, Deadlock prevention without using timestamps, Deadlock detection and timeouts, Starvation.	7
Unit 6 : Recovery Techniques 6.1 Database Recovery, Types of Failures, Storage Structure: Volatile, Non Volatile and stable storage, Data access. 6.2 Recovery and atomicity, Recovery Techniques: Log Based Recovery, Check points, Shadow Paging.	6



Reference Books:

1. Ramez Elmasri, Shamkant B. Navathe , "Fundamentals of Database Systems" Global Edition By
2. A Silberschatz, H Korth, S Sudarshan, "Database System and Concepts" published by McGraw-Hill.

Online References :

Online Resources No.	Website address
1	https://www.udemy.com/course/fundamentals-of-information-technology/
2	https://www.youtube.com/watch?v=DLb8IFee-DI
3	https://www.youtube.com/watch?v=mOYpH24GR6Y

Evaluation Scheme:

Assessment	Total Marks	Intended course learning outcomes to be assessed (Please tick as appropriate)					
		CO1	CO2	CO3	CO4	CO5	CO6
ISE	20	✓	✓	✓	✓	✓	✓
MSE	20	✓	✓	✓			
ESE	60	✓	✓	✓	✓	✓	✓
Total	100						

Formative Assessment Tools/Methods	Total Marks	CO1	CO2	CO3	CO4	CO5	CO6
Assessment 1 – Concept Map / Poster Presentation (DBMS architecture, Levels of abstraction, Users, Data Independence, etc.)	20	✓	✓				
Assessment 2 – ER Diagram Design and Normalization Assignment (Design ER model for a business case, convert to relations, and normalize up to BCNF)			✓			✓	✓
Assessment 3 – Hands-on SQL / Relational Algebra Lab Task (Perform SELECT, JOIN, UNION, DIVIDE operations and equivalent RA expressions)						✓	✓
Assessment 4 – File Organization / Indexing Case Study or Mini Project (Analyze and present file structure, indexing or hashing scheme for an application)				✓			



Course Plan

Course Title : Data Structures and Algorithms	
Course Code : 242MCA1L102	Semester :I
Teaching Scheme : L-T-P : 3-0-0	Credits : 3
Evaluation Scheme : ISE+MSE Marks: 20+20	ESE Marks: 60

Course Description:

The course aims to aware the students about basics of data structure. It also insists on working with functions and built in data structure. Course also introduce the fundamentals of data structures and will provide understanding of how to systematically organize data in a computer system. Also, includes topics which focus on searching and sorting techniques, linked list, tress and graphs.

Course Objectives:

- To study basics of data structures.
- To study searching & sorting techniques.
- To demonstrate implementation of stack, queue, linked list and trees data structures.

Course Outcomes (COs):

CO1	Understand basic concepts of data structure
CO2	Analyze searching and sorting techniques and study its complexity
CO3	Understand and analyze concept of stack & queue
CO4	Analyze linked list representation of stack & queue
CO5	Understand and analyze working mechanism of tree traversing algorithms and binary search trees.
CO6	Analyze working mechanism of graphs & graph traversals

Prerequisite:	Prior knowledge of programming.
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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):



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COs	POs												PSOs			BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
1	3	2	2	1	-	-	-	-	-	-	-	-	2	-	-	2
2	3	3	2	1	1	-	-	-	-	-	-	-	3	-	-	4
3	3	3	2	1	-	-	-	-	-	-	-	-	3	-	-	2
4	3	3	3	2	-	-	-	-	-	-	-	-	3	1	-	4
5	3	3	2	2	-	-	-	-	-	-	-	-	3	1	-	2
6	3	3	3	2	-	-	-	-	-	-	-	-	3	1	-	4



Content	Hours
Unit 1 : Introduction Data Structure- Definition, Types of data structures, Data Structure Operations, Algorithms: Complexity, Time and Space complexity	5
Unit 2: Searching & Sorting Techniques 2.1 Linear search, Binary search, Sentinel search, Fibonacci search, 2.2. Hashing – Definition, hash functions, Collision, 2.3 Bubble sort, Selection sort, Insertion sort, Merge sort, Quick sort, Radix sort, Complexity and analysis	8
Unit 3: Stacks and Queues 3.1 Stack: Definition, operations, Array representation of stack, applications. 3.2 Queue: Definition, operations, Array representation of queue, applications, Circular queue, Priority queue, dequeue.	8
Unit 4: Linked Lists 4.1 Linked Lists Definition, representation, operations, implementation and applications of singly, doubly and circular linked lists. 4.2 Linked representation of stack and Queue, Dynamic memory management, Memory efficient doubly linked list	8
Unit 5: Trees 5.1 Terminology, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals - Inorder, postorder, preorder; 5.2 Threaded binary trees, Binary Search Trees – Definition, Insertion, Deletion, Traversal, Searching, Application of Trees-Evaluation of Expression, Programming Examples.	8
Unit 6 : Graphs Basic Terminology of Graphs, Implementation of Graphs as an Arrays & Linked List, Operation on Graphs, Graphs Traversals, Representation of Graphs, Breadth First Search and Depth First Search.	8

Reference Books

1. Data Structure and Algorithmic Thinking with Python Paperback – 2015 by Narasimha Karumanchi
2. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, —Fundamentals of Data Structures in C, Second



Edition, University Press, 2008.

3. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, —Data Structures and Algorithms, Pearson Education, 1983.

Online References :

Online Resources No.	Website address
1	https://nptel.ac.in/courses/106102064
2	nptel.ac.in/courses/106/106/106106127/
3	www.courseera.com

Evaluation Scheme:

Assessment	Total Marks	Intended course learning outcomes to be assessed (Please tick as appropriate)					
		CO1	CO2	CO3	CO4	CO5	CO6
ISE	20	✓	✓	✓	✓	✓	✓
MSE	20	✓	✓	✓			
ESE	60	✓	✓	✓	✓	✓	✓
Total	100						

Formative Assessment Tools/Methods	Total Marks	CO1	CO2	CO3	CO4	CO5	CO6
Assessment 1 – Concept Map / Poster Presentation (On Data Structures types, operations, and algorithm complexities)	20	✓					
Assessment 2 – Searching & Sorting Hands-on Practice / Algorithm Trace Assignment (Write and trace algorithms for searching and sorting with time complexity analysis)	25		✓				
Assessment 3 – Stack and Queue Implementation in C / Pseudocode Writing Task (Array implementation and real-life applications like expression evaluation or job scheduling)	20			✓	✓		
Assessment 4 – Linked List Mini Project / Viva (Implement singly, doubly, and circular linked lists; demonstrate stack and queue using linked lists)	20				✓		
Assessment 5 – Tree and Graph Traversal Lab Task / Simulation (Binary Tree traversals, BST insertion & deletion, BFS/DFS traversal on graph)	25					✓	✓



Course Plan

Course Title: Software Engineering	
Course Code: 242MCA1L103	Semester: I
Teaching Scheme: L-T-P:3-0-0	Credits:3
Evaluation Scheme: ISE+MSE Marks:20+20	ESE Marks: 60

Course Description:

This course provides an in-depth understanding of software engineering principles and practices essential for developing high-quality software systems. Students will learn the fundamental concepts of software engineering, including the software development life cycle, requirement engineering, system design, software testing, and maintenance. The course also covers advanced topics such as software project management, risk management, and emerging trends in software engineering.

Course Objectives:

- To understand the essential principles and methodologies of software engineering.
- To differentiate and apply various software development life cycle models.
- To develop the skills to gather and document software requirements effectively.
- To design software systems using appropriate design principles and strategies.
- To implement software testing techniques and maintenance processes.
- To explore advanced software engineering practices and emerging industry trends.

Course Outcomes(COs):

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

CO1	Understand and explain the fundamental concepts of software engineering and its importance in software development.
CO2	Describe and differentiate between various software development life cycle models.
CO3	Apply requirement engineering principles to gather and document software requirements.
CO4	Design software solutions using appropriate architectural and detailed design principles.
CO5	Implement effective testing strategies and maintenance processes for software quality assurance.
CO6	Analyze and apply advanced software engineering practices, including project management.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):



COs	POs												PSOs			BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
1	3	2	2	1	-	-	-	-	-	-	-	-	2	-	-	2
2	3	2	2	2	-	-	-	-	-	-	-	-	2	-	-	4
3	3	3	2	1	1	-	-	-	-	-	-	-	2	-	-	3
4	3	2	3	2	1	-	-	-	-	-	-	-	2	1	-	6
5	3	2	2	2	1	-	-	-	-	-	-	-	2	1	-	3
6	3	3	3	2	2	-	-	-	-	-	-	-	2	-	-	4

Content	Hours
Unit 1: Introduction to Software Engineering Definition of Software and Software Engineering, Importance of Software Engineering, Software Characteristics, Principles of Software Engineering, Software Development vs. Software Programming, Members Involved in Software Development	7
Unit 2: Software Development Life Cycle (SDLC) Models Phases of SDLC, Waterfall Model, Prototyping Model, Spiral Model, Rapid Application Development (RAD) Model, Agile Model	8
Unit 3: Requirement Engineering Definition and Importance of Requirement Engineering, Types of Requirements, Requirement Elicitation Techniques, Verification and Validation Process, Principles of Requirement Specification, Software Requirement Specification (SRS) Document	8
Unit 4: System Design Introduction to System Design, Design Concepts and Principles, Architectural Design, Detailed Design, Design Strategies (Top-Down and Bottom-Up), Designing for Quality Attributes	8
Unit 5: Software Testing and Maintenance Introduction to Software Testing, Types of Testing (Unit, Integration, System, Acceptance), Testing Strategies and Techniques, Test Case Design, Software Maintenance Types and Importance, Maintenance Process and Issues	7
Unit 6: Advanced Topics in Software Engineering Software Project Management, Risk Management, Configuration Management, Software Quality Assurance, Software Metrics and Measurements, Emerging Trends in Software Engineering (e.g., DevOps, Continuous Integration/Continuous Deployment (CI/CD))	7



Reference Books:

1. "Software Engineering: A Practitioner's Approach" by Roger S. Pressman, McGraw-Hill Education, 2019 (9th Edition)
2. "Software Engineering" by Ian Sommerville, Pearson, 2015 (10th Edition)
3. "Fundamentals of Software Engineering" by Rajib Mall, PHI Learning Pvt. Ltd., 2014 (4th Edition)
4. "Software Engineering Principles and Practice" by Waman S Jawadekar, McGraw-Hill Education, 2014 (3rd Edition)
5. "Object-Oriented Software Engineering: Practical Software Development using UML and Java" by Timothy C. Lethbridge and Robert Laganière, McGraw-Hill Education, 2004 (2nd Edition)

Online References:

Online Resources No.	Website address
1	https://www.coursera.org/learn/software-processes
2	https://www.javatpoint.com/software-engineering
3	https://www.udemy.com/courses/development/software-engineering/
4	: https://www.geeksforgeeks.org/software-engineering/
5	https://www.tutorialspoint.com/software_engineering/index.htm



Evaluation Scheme:							
Assessment	Total Marks	Intended course learning outcomes to be assessed (Please tick as appropriate)					
		CO1	CO2	CO3	CO4	CO5	CO6
ISE	20	✓	✓	✓	✓	✓	✓
MSE	20	✓	✓	✓			
ESE	60	✓	✓	✓	✓	✓	✓
Total	100						

Formative Assessment Tools / Methods	Total Marks	CO1	CO2	CO3	CO4	CO5	CO6
Assessment 1 – Poster Presentation	20	✓	✓		✓		
Assessment 2 – Concept Map / Diagram Drawing + Problem Solving Task		✓	✓	✓	✓		
Assessment 3 – Open Book Assignment				✓		✓	✓
Assessment 4 – Group Presentation on Advanced Topics / AI Integration in Software Engineering			✓		✓	✓	✓
Assessment 5 – Hands-on Lab Task / Video Demonstration				✓	✓	✓	



Course Plan

Course Title: Computational Statistics	
Course Code: 242MCA1L104	Semester :I
TeachingScheme:L-T-P:3-0-0	Credits:3
Evaluation Scheme: ISE+MSE Marks:20+20	ESE Marks : 60

Course Description:

The course aims to aware the students about frequency distribution and tabulation in statistics. It also insist about different types of central tendency like mean, median and mode. It tries to aware the students about dispersion and its types and the concept of variance. Further it attempts to aware about the techniques of correlation and regression analysis.

Course Objectives:

- To build a strong foundation for students.
- To become proficient in all Statistics concepts and their Application necessary to become a Data science Professional.
- To keep the students and faculty a breast with the emerging technologies in the field of computer applications.
- To bring professionalism amongst the students and promote holistic development

Course Outcomes (COs):

CO1	Remember the definitions of concepts
CO2	Understand the fundamentals of statistics and their Application
CO3	Identify and study the data for analytics purpose
CO4	Analyze different techniques of statistics in real world.
CO5	Analyze regression & time series analysis in real world
CO6	Implement statistical techniques in practical applications.

Prerequisite:	Basic knowledge of Statistics
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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs			BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
104.1	3	2	-	-	-	-	-	-	-	-	-	-	2	-	-	1
104.2	3	2	-	-	-	-	-	-	-	-	-	-	2	-	-	2
104.3	3	3	-	-	-	-	-	-	-	-	-	-	2	-	-	1
104.4	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-	3
104.5	3	3	-	-	-	-	-	-	-	-	-	-	3	-	-	3
104.6	3	3	2	-	-	-	-	-	-	-	-	-	3	-	-	4



Content	Hours
Unit 1: Introduction to Statistics(4Lectures): Meaning of Statistics as a Science, Importance of Statistics Scope of Statistics, Types of data: Primary data, Secondary data , Cross-sectional data, time series data, directional data, classification data and its classification, ungrouped frequency distribution,, grouped frequency distribution, cumulative frequency distribution, and relative frequency distribution.	6
Unit 2: Measures of Central Tendency(15Lectures): Concept of central tendency of statistical data, Statistical averages, characteristics of a good statistical average. Arithmetic Mean(A.M.):Definition, effect of change of origin and scale, combined Mean of a number of groups, merits and demerits, Mode and Median: Definition, formulae (for ungrouped and grouped data), merits and demerits, Quartiles, Deciles and Percentiles (for ungrouped and grouped data)	8
Unit 3: Measures of Dispersion :Concept of dispersion, characteristics of good measure of dispersion, Range, Quartile deviation, Mean deviation: Definition ,merits and demerits, Variance and standard deviation	8
Unit 4: Correlation Bivariate data, Scatter diagram and interpretation., Concept of correlation between two variables, positive correlation, negative correlation, no correlation. variance between two variables, Karl Pearson's coefficient of correlation(r), Spearman's rank correlation coefficient, compute Karl Pearson's correlation coefficient between ranks	8
Unit 5: Regression Meaning of regression, difference between correlation and regression, Concept of error in regression, error modeled as a continuous random variable. Simple linear regression model Estimation of a, b by the method of least squares, Interpretation of parameters.	8
Unit 6 : Time Series Analysis Meaning and utility , Components of time series , Additive and multiplicative models , Methods of estimating trend : moving average method, least squares method and exponential smoothing method(with graph and interpretation)	7

Reference Books :

1. Fundamental of Statistics by S.C .Gupta
2. Freedman, David, Robert Pisani, & Roger Pervis (2007).*Statistics*. NewYork: W.W. Norton.



3. James, Gareth, Daniela Witten, Trevor Hastie, & Robert Tibshirani (2013). *An Introduction to Statistical Learning: With Applications in R*. New York: Springer.

Online Resources :

Online Resources No.	Website address
1	nptel.ac.in/courses/110/107/110107114/
2	https://nptel.ac.in/courses/111105090

Evaluation Scheme:							
Assessment	Total Marks	Intended course learning outcomes to be assessed (Please tick as appropriate)					
		CO1	CO2	CO3	CO4	CO5	CO6
ISE	20	✓	✓	✓	✓	✓	✓
MSE	20	✓	✓	✓			
ESE	60	✓	✓	✓	✓	✓	✓
Total	100						

Formative Assessment Tools / Methods	Total Marks	CO1	CO2	CO3	CO4	CO5	CO6
Assessment 1 – Concept Map / Diagram Drawing	20	✓	✓	✓			
Assessment 2 – Problem Solving / Numerical Assignment			✓	✓	✓	✓	✓
Assessment 3 – Group Presentation on Statistical Applications			✓	✓	✓	✓	✓
Assessment 4 – Open Book Assignment / Case Study Analysis		✓	✓	✓	✓	✓	✓
Assessment 5 – Hands-on Lab / Data Analysis Project			✓	✓	✓	✓	✓



Course Plan

Course Title: Management Concepts and Applications	
Course Code: 242MCA1L105	Semester: I
Teaching Scheme:L-T-P:3-0-0	Credits:3
Evaluation Scheme: ISE+MSE Marks:20+20	ESE Marks : 60

Course Description:

Management is essential in our daily life. This course introduces management concepts and principles. It also makes aware about the concepts of planning, directing, staffing and organizing also guiding towards decision making process in the organization. It also provides insight to understand types of organization and nature of centralization and decentralization. This course will help students to be aware about the different types of leadership skills, techniques and requirements of effective controlling techniques in the organization.

Course Objectives:

- To make students understand fundamental concepts and principles of management, including the basic roles, skills, and functions of management.
- To make students aware historical development, theoretical aspects and practical application of managerial process.
- To introduce students to modern concepts and trends in Management

Course Outcomes (COs):

105.1	Describe the concepts of management
105.2	Understand and use planning concepts
105.3	Understand importance of organization structure and process
105.4	Effectively gaining knowledge of recruitment process
105.5	Understand importance of directing and apply leadership styles and theories
105.6	Apply controlling principles in real life problems

Prerequisite:	Basic knowledge of Management
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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs			BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
105.1	-	-	1	-	-	-	-	-	2	-	-	-	-	-	2	4



105.2	-	-	1	-	-	-	-	-	2	-	-	-	-	-	2	2
105.3	-	-	2	-	-	-	-	-	2	-	-	-	-	-	2	2
105.4	-	-	2	-	-	-	-	-	2	-	-	-	-	-	2	-
105.5	-	-	2	-	-	-	-	-	2	-	-	-	-	-	3	2
105.6	-	-	2	-	-	-	-	-	2	-	-	-	-	-	2	3

Content	Hours
Unit 1: Management Concepts (6 Lectures) Definition and Meaning, Nature and purpose, Evolution of Management thoughts, Contributions of F.W Taylor, Contributions of Henry Fayol, Human relations approach System approach to management, Skills and Functions of a manager	6
Unit2: Planning (8 Lectures) Definition and Importance of Planning ,Types of Planning, Steps in Planning ,Limitations of Planning , Management by Objectives (MBO):Concept, Objective setting Process, Benefits and Weaknesses, concept of software project planning	8
Unit 3: Organization (8 Lectures) Definition, Nature of organizing, Importance, Process of organizing, Organization chart, Types of organizational Structure, Difference between Centralization and Decentralization structure of IT organization, Case study	8
Unit 4: Staffing (8 Lectures) Nature & Significance of staffing, A brief knowledge of Recruitment, Selection, Training & Development, Performance Appraisal in IT organization. Case study	8
Unit5: Directing (7 Lectures) Nature, Concept of Leadership, Leadership Styles, Theories of Leadership, Charismatic Leadership Theory, Role of Software Team Leader, Case-study	7
Unit 6: Controlling (8 Lectures) Concept and Importance of Control, Control Process, types of Control Mechanism, Responsibility and authority, Management by Exceptions, case study. Globalization – Opportunities and risks in Global Business, Culture in Global Organizations, Case study	8

Reference Books :

1.Richard L. Daft, "New Era of Management",



2. S. A. Sherlekar, "Modern Business Administration and Management", Himalaya Publication
3. Stephen P. Robins, "Management", Prentice Hall
4. Koontz And Weinrich, ". Essentials Of Management & Principles and Practice of Management",

Online References :

Online Resources No.	Website address
1	https://hbr.org/
2	http://www.managementstudyguide.com/
3	www.courseera.com

Evaluation Scheme:							
Assessment	Total Marks	Intended course learning outcomes to be assessed (Please tick as appropriate)					
		CO1	CO2	CO3	CO4	CO5	CO6
ISE	20	✓	✓	✓	✓	✓	✓
MSE	20	✓	✓	✓			
ESE	60	✓	✓	✓	✓	✓	✓
Total	100						

Formative Assessment Tools / Methods	Total Marks	CO1	CO2	CO3	CO4	CO5	CO6
Assessment 1 – Concept Map / Diagram Drawing	20	✓	✓	✓			
Assessment 2 – Problem Solving / Numerical Assignment			✓	✓	✓	✓	✓
Assessment 3 – Group Presentation on Statistical Applications			✓	✓	✓	✓	✓
Assessment 4 – Open Book Assignment / Case Study Analysis		✓	✓	✓	✓	✓	✓
Assessment 5 – Hands-on Lab / Data Analysis Project			✓	✓	✓	✓	✓



Course Plan

Course Title: Lab on Applied Database Management Systems	
Course Code: 242MCA1P106	Semester: I
Teaching Scheme:L-T-P:0-0-2	Credits:2
Evaluation Scheme: IPE Marks: 20	EPE :30

Course Description:

The objective of the course is to understand the concept of Database Management System. It also aims to aware the students about different types of SQL commands like DDL, DML and DCL. It also insist about operators, functions and joins in SQL. It also aims to understand the concepts of PL/SQL , cursor management and trigger.

Course Objectives:

- To practice the application of the concepts related to database its techniques and Operations.
- To introduce SQL(Structured Query Language)with its practical implications.
- To create strong foundation for application of database design.

Course Outcomes (COs):

CO1	Remembering the different formats of SQL
CO2	Apply and Implementation of RDBMS concepts through Oracle
CO3	Analyze the performance of the query with different datasets.
CO4	Evaluate results obtained from the different queries PL/SQL blocks, functions

Prerequisite:	Basic Knowledge of Database
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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs			BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
1	2	1	1	-	-	-	1	-	-	-	-	-	2	-	-	1
2	2	1	1	-	-	-	1	-	-	-	-	-	2	-	-	2
3	2	2	2	1	1	-	1	-	-	-	-	-	3	-	-	3
4	2	2	2	1	1	-	1	-	-	-	-	-	3	2	-	4



Content	Hours
Unit 1: Introduction to Oracle and SQL : History, Features, Versions of Oracle, Database Structure: Logical Structure and Physical Structure, Oracle Architecture: System Global Area Processes: Server Processes, Background Processes, Tools of Oracle: SQL*Plus, PL/SQL, Forms, Reports, Pre Compilers: SQL Loader, Import, Export. Introduction to SQL Keywords, Delimiters, Literals, Data Types, Components of SQL: DDL Commands—Defining a database in SQL, Creating table, changing table definition, Removing table, Creating Tables with constraints on row level and column level, primary key, foreign key, check. Altering Constraints. DML Commands—Inserting, updating, deleting data, DQL Commands: Select Statement with all options. Renaming table, Describe Command, Distinct Clause, Sorting Data in a Table, Creating table from a table, Inserting data from other table, Table alias, and Column alias. DCL Commands—Granting and Revoking Permissions	7
Unit 2: Operators and Functions Operators: Arithmetic, Logical, Relational, Range Searching, Pattern Matching, IN & NOT IN Predicate, all, % any, exists, not exists clauses, Set Operations: Union, Union All, Minus, Intersect, Grouping data. Functions : Aggregate Functions, Numeric Functions, String Functions, Date Functions, Conversion Functions, Miscellaneous Sub-queries Joins: Relating data through join concept. Simple join, equi-join, non- equi join, Self join, Outer-join	6
Unit 3 : Introduction To PL/SQL (5 Lectures) Introduction, Advantages, PL/SQL Block, PL/SQL Execution Environment, PL/SQL Character set, Literals, Data types, PL/SQL Block: Attributes %type, %rowtype, Variables, Constants, Displaying User Message on screen, Conditional Control in PL/SQL, Iterative Control Structure: While Loop, For Loop, Goto Statement, Commit, Rollback, Savepoint	7



Unit 4 :Cursor Management and Triggers(5Lectures)

8

Cursor: Explicit & Implicit Cursor, Declaring Cursor Variables, Constrained& Unconstrained Cursor Variables, Opening Cursor, Fetching Cursor in to Variables Closing Cursor, Cursor For Loops ,Parametric Cursors.

Triggers: Definition, Syntax ,Parts of triggers: statement, body, restricted,
Types of triggers: Enabling & disabling triggers. Closing Cursor, Cursor For Loops, Parametric Cursors.

Reference Books:

1. Ramez Elmasri, Shamkant B. Navathe , "Fundamentals of Database Systems" Global Edition By
2. A Silberschatz,H Korth,S Sudarshan, "Database System and Concepts" published by McGraw-Hill.

Online References :

Online Resources No.	Website address
1	https://www.udemy.com/course/fundamentals-of-information-technology/
2	https://www.youtube.com/watch?v=DLb8IFee-DI
3	https://www.youtube.com/watch?v=mOYpH24GR6Y



Evaluation Scheme:					
Assessment	Total Marks	Intended course learning outcomes to be assessed (Please tick as appropriate)			
		CO1	CO2	CO3	CO4
IPE	20	✓	✓	✓	✓
EPE	30	✓	✓	✓	✓
Total	20				

Formative Assessment Tools / Methods	Total Marks	CO1	CO2	CO3	CO4
Assessment 1 – Hands-on SQL/PLSQL Lab Tasks	20	✓	✓	✓	✓
Assessment 2 – Open Book Assignment / SQL Query Problems		✓	✓	✓	
Assessment 3 – Group Presentation on Oracle Architecture & SQL Concepts		✓	✓		
Assessment 4 – Case Study / Scenario-Based SQL Problems		✓	✓	✓	✓
Assessment 5 – Mini Project / Video Demonstration on PL/SQL Blocks, Cursors, Triggers			✓	✓	✓



Course Plan

Course Title: Java Programming	
Course Code: 242MCA1P107	Semester: I
Teaching Scheme:L-T-P: 2—0-4	Credits:4
Evaluation Scheme: IPE : 20	EPE Marks : 30

Course Description:

The course introduces about the object oriented programming concepts. It also insist to understand the concept of modifiers, function overloading, arrays and strings . It further aims to aware about the concept of inheritances, polymorphism and concurrent programming. It also considers to making use of Object Streams for Serialization and deserialization.

Course Objectives:

- To introduce Object Oriented Programming using Java,
- To use Java for implementing OO Concepts
- To make students familiarize to use JDK and Java API for concurrent programming, input/output, Java data structures and GUI (AWT) programming using java.

Course Outcomes (COs):

CO1	Understand the basic programming constructs of Java and OOP concepts to develop Java programs.
CO2	Analyze Class and Object concepts & understand use of wrapper classes.
CO3	Analyze use of packages & string buffer class.
CO4	Understand & create java Applications with use of classes & interfaces .
CO5	Understand Interface & method overriding
CO6	Analyze a given problem statement to identify classes and relationships among the and making use of Java API efficiently.

Prerequisite:	Basic Knowledge of Programming
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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs			BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
1	2	2	1	1	-	-	1	-	-	1	-	-	3	2	-	2
2	2	2	2	1	1	-	1	-	-	1	1	-	3	2	-	4
3	2	2	2	1	1	-	1	-	-	1	1	-	3	2	-	4
4	2	2	2	2	1	-	1	-	-	2	1	-	3	2	-	2
5	2	2	2	2	1	-	1	-	-	2	1	-	3	2	-	2
6	2	2	2	2	1	-	1	-	-	2	1	-	3	2	-	4



Content	Hours
Unit 1: Introduction to Java – 1.1 Java Basics: Features of Java, History of Java, Installations of JDK and eclipse as IDE Writing and executing first Java program. Understanding role Java compiler, JVM understanding how Java is platform independent and secure. 1.2 Java data types, variables, operators, expressions, type conversion and casting in Java. 1.3 Control structures in java: if, if-else and switch statements, 1.4 Iterative/looping statements in Java: while, do-while and for. 1.5 Writing functions: Need of functions/ methods, Writing and using static method; concepts of passing values and returning	7
Unit 2: Class and Object Concepts: 2.1 Introduction to Object Oriented concepts, defining a class, creating objects from class, adding attributes and methods to the class, using constructors, Java naming conventions for class, properties and methods/functions. 2.2 Passing values to the functions – pass by value, pass by reference, Function overloading. 2.3 Modifiers – public, private, protected, default, static, final Understanding use of Wrapper classes and Garbage collection in Java	8
Unit 3: Arrays and Strings 3.1 One dimensional arrays, Multidimensional arrays, exploring String class and methods, String Buffer class. 3.2 Packages-creating and accessing a package, importing, packages, creating user defined packages, Concept of package. 3.3 Introduction to Exception Handling , Try-Catch-Finally, Throws, throw, User Defined Exception examples	8
Unit 4: Inheritance and Polymorphism 4.1 Concept and importance of inheritance, is-a relationship, types of inheritance, 4.2 Polymorphism–function overriding, dynamic method dispatch. Overriding methods with throws clause. Using abstract and final keywords with class declaration.	8
Unit 5: Interface & Method Overriding 5.1 Concept of interface , Comparison of Interface and class Access modifiers and data accessibility in derived classes, method access modifier and method overriding.	7



Unit 6 : JavaInput /Outputs 6.1 Concept of streams ,types of streams–by teststreams, character streams, The Console: System.out, System.in, and System.err 6.2Understanding File class, Input Stream class, Output Stream class, File Input Streams, File Output Stream, 6.3Using character oriented Reader and Writer class, File Reader, File Writer. 6.4 Introduction to Buffered streams–Data Input and Data Output Streams using Buffered Reader, Buffered Writer. 6.5Making use of Object Streams for Serialization and deserialization	8
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List of Java Programs

Sr.No.	Title
1	Install the JDK (Download the JDK and install it.) • Set path of the jdk/bin directory • Create the java program • Compile and run the java program Write a simple “Hello World” java program, compilation, debugging, executing using java compiler and interpreter.
2	Write a program to pass Starting and Ending limit and print all prime numbers and Fibonacci numbers between this range
3	Write a java program to check whether number is palindrome or not.
4	Write a java program to print value of x^n .
5	Write a java program to check Armstrong number
6	Write a program in Java to find minimum of three numbers using conditional operator.
7	Write a Java application to count and display frequency of letters and digits from the String given by user as command-line argument
8	Create a class “Student” that would contain enrollment No, name, and gender and marks as instance variables and count as static variable which stores the count of the objects; constructors and display(). Implement constructors to initialize instance variables. Also demonstrate constructor chaining. Create objects of class “Student” and displays all values of objects.
9	Write a program in Java to demonstrate use of this keyword. Check whether this can access the Static variables of the class or not



10	Create a class "Rectangle" that would contain length and width as an instance variable and count as a static variable. Define constructors [constructor overloading (default, parameterized and copy)] to initialize variables of objects. Define methods to find area and to display variables' value of objects which are created.
11	Write a java program static block which will be executed before main () method in a class
12	Write programs in Java to use Wrapper class of each primitive data types.
13	Write a class "circle" with radius as data member and count the number of instances created using default constructor only.
14	Create a class "Vehicle" with instance variable vehicle_type. Inherit the class in a class called "Car" with instance model_type, company name etc. display the information of the vehicle by defining the display() in both super and sub class [Method Overriding]
15	Create a class "Account" containing accountNo, and balance as an instance variable. Derive the Account class into two classes named "Savings" and "Current". The "Savings" class should contain instance variable named interestRate, and the "Current" class should contain instance variable called overdraftLimit. Define appropriate methods for all the classes to enable functionalities to check balance, deposit, and withdraw amount in Savings and Current account
16	Write a program in Java in which a subclass constructor invokes the constructor of the super class and instantiate the values.
17	Write a program in Java to demonstrate the use of 'final' keyword in the field declaration.
18	Write a java program to illustrates how to access a hidden variable. Class A declares a static variable x. The class B extends A and declares an instance variable x. display () method in B displays both of these variables
19	Describe abstract class called Shape which has three subclasses say Triangle, Rectangle, and Circle. Define one method area () in the abstract class and override this area () in these three subclasses to calculate for specific object i.e. area () of Triangle subclass should calculate area of triangle etc. Same for Rectangle and Circle
20	Write a java program to implement an interface called Exam with a method Pass (int mark) that returns a boolean. Write another interface called Classify with a method Division (int average) which returns a String. Write a class called Result which implements both Exam and Classify. The Pass method should return true if the mark



	is greater than or equal to 50 else false. The Division method must return "First" when the parameter average is 60 or more, "Second" when average is 50 or more but below 60, "No division" when average is less than 50.
21	Assume that there are two packages, student and exam. A student package contains Student class and the exam package contains Result class. Write a program that generates mark sheet for students.
22	Write a java program to use important methods of String class
23	Write a program in Java to demonstrate use of final class, final variable and final method
24	Write a program in Java to demonstrate throw, throws, finally, multiple try block and multiple catch exception
25	Write a small application in Java to develop Banking Application in which user deposits the amount Rs 1000.00 and then start withdrawing of Rs 400.00, Rs 300.00 and it throws exception "Not Sufficient Fund" when user withdraws Rs. 500 thereafter

Reference Books:

1. Herbert Schildt Java: The Complete Reference, McGraw- Hill Osborne Media;SeventhEdition,2007.
2. Cay S. Horstmann and Gary Cornell,CoreJava-Volume-I,SunCoreSeries,EighthEdition,2008
3. Bruce Eckel, Thinking In Java –Printice Hall, Fourth Edition

Online References :

Online Resources No.	Website address
1	http://www.learnjavaonline.org/
2	http://java.sun.com/docs/books/tutorial/index.html



Evaluation Scheme:					
Assessment	Total Marks	Intended course learning outcomes to be assessed (Please tick as appropriate)			
		CO1	CO2	CO3	CO4
IPE	20	✓	✓	✓	✓
EPE	30	✓	✓	✓	✓
Total	50				

Formative Assessment Tools / Methods	Total Marks	CO1	CO2	CO3	CO4	CO5	CO6
Assessment 1 – Hands-on Programming Lab Tasks	20	✓	✓	✓	✓	✓	✓
Assessment 2 – Open Book Assignment / Coding Problems		✓	✓	✓	✓	✓	✓
Assessment 3 – Group Presentation on OOP Concepts / Java Packages		✓	✓	✓	✓		
Assessment 4 – Mini Project / Video Demonstration on Inheritance, Polymorphism, and I/O Streams		✓	✓	✓	✓	✓	✓
Assessment 5 – Concept Map / Flow Diagram / Case Study Analysis		✓	✓	✓	✓	✓	✓



Course Plan

Course Title : Lab on Data Structure	
Course Code : 242MCA1P108	Semester :I
Teaching Scheme : L-T-P : 0-0-2	Credits : 1
Evaluation Scheme : IPE Marks: 50	ESE Marks:

Course Description:

The course aims to aware the students about basics of data structure. It also insists on working with functions and built in data structure. Course also introduce the fundamentals of data structures and will provide understanding of how to systematically organize data in a computer system. Also, includes topics which focus on searching and sorting techniques, linked list, tress and graphs.

Course Objectives:

- To study basics of data structures.
- To study searching & sorting techniques.
- To demonstrate implementation of stack, queue, linked list and trees data structures.

Course Outcomes (COs):

CO1	Understand working mechanism of searching & hash functions
CO2	Understand working mechanism of sorting techniques and study its complexity
CO3	Understand and analyze concept of stack & queue
CO4	Understand and analyze working mechanism of tree traversing algorithms and binary search trees.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs			BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
1	2	2	1	1	-	-	1	-	-	1	-	-	3	2	-	2
2	2	2	2	1	1	-	1	-	-	1	1	-	3	2	-	2
3	2	2	2	1	1	-	1	-	-	1	1	-	3	2	-	2
4	2	2	2	2	1	-	1	-	-	2	1	-	3	2	-	4



Content	Hours
Unit 1: Introduction to data structure 1. Write C programs for the following operations on Array. (i) Creation (ii) insertion (iii) deletion (iv) traversal 2. Write C programs for implementing the following searching techniques. 1) Linear search 2) Binary search 3. Write C programs for implementing the following sorting techniques to arrange a list of integers in ascending order. 1) Bubble sort 2) Insertion sort 3) Selection sort	8
Unit 2: Stack 1. Write a C program to implement stack using array. 2. Write a C program to implement stack using linked list. 3. Write a C program that convert infix expression into postfix form. 4. Write a C program to convert decimal to binary using stack	8
Unit 3: Queue 1. Write a C program to demonstrate queue using array. 2. Write a C program to demonstrate queue using linked list.	8
Unit 4: Linked List & Tree 1. Write a C program for the following operations on Singly Linked List. 1) Creation 2) insertion 3) deletion 4) traversal 5) Searching 2. Write a C program to count number of items present in a singly linked list. 3. Write a program to demonstrate Trees & Tree Traversals 4. Write a program to demonstrate implementation of Binary Search trees	6

Reference Books

4. Data Structure and Algorithmic Thinking with Python Paperback – 2015 by Narasimha Karumanchi
5. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, —Fundamentals of Data Structures in C, Second Edition, University Press, 2008.
6. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, —Data Structures and Algorithms, Pearson Education, 1983.

Online References :



Online Resources No.	Website address
1	https://nptel.ac.in/courses/106102064
2	nptel.ac.in/courses/106/106/106106127/
3	www.courseera.com

Evaluation Scheme:					
Assessment	Total Marks	Intended course learning outcomes to be assessed (Please tick as appropriate)			
		CO1	CO2	CO3	CO4
IPE	25	✓	✓	✓	✓
IPE	25	✓	✓	✓	✓
Total	50				

Formative Assessment Tools / Methods	Total Marks	CO1	CO2	CO3	CO4
Assessment 1 – Hands-on Lab Tasks (Array Operations & Searching)	50	✓	✓		
Assessment 2 – Hands-on Lab Tasks (Sorting Techniques)			✓		
Assessment 3 – Stack & Queue Implementation Lab Tasks				✓	
Assessment 4 – Linked List & Tree Implementation Lab Tasks				✓	✓
Assessment 5 – Mini Project / Problem Solving Using Data Structures		✓	✓	✓	✓



Course Plan

Course Title: open Course - Universal Human Values	
Course Code: 242MCA1L109	Semester: I
Teaching Scheme: L-T-P: 2-0-0	Credits:2
Evaluation Scheme: ISE1+ISE2 Marks:25+25	ESE Marks : -

Course Description:

The course aims to introduce the student to value and its need . It introduces making the students to understand the terms through various examples and bringing in a holistic perception of existence . It also considers to understand the students the importance of harmony with human being. It also mains to make the students to understand the terms through various examples and bringing in a holistic perception of existence .

Course Objectives:

- To help the student to see the need for developing a holistic perspective of life.
- To sensitize the student about the scope of life – individual, family, society and nature/existence.
- Strengthening self-reflection.
- To develop more confidence and commitment to understand, learn and act accordingly

Course Outcomes (COs):

CO1	Provide an overview of Prerequisites to Human Values
CO2	Understand the role of a human being in ensuring harmony in self and society
CO3	Analyze ethical dilemma while discharging duties in professional life.
CO4	Evaluate ethical and unethical decisions and take a right stand

Prerequisite:	Importance of ethics
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Program Specific Outcomes (PSOs):

COs	POs												PSOs			BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
1	-	-	-	-	-	2	-	-	-	-	-	-	-	-	2	3
2	-	-	-	-	-	3	1	-	-	-	-	-	-	1	2	2
3	-	1	1	-	1	3	1	2	-	-	-	-	-	1	2	4
4	-	1	1	-	1	3	1	2	-	-	-	-	-	-	2	5



Content	Hours
Unit 1: Introduction to Value Education Value Education, Definition, Concept and Need for Value Education, Self exploration as a means of Value Education.	4
Unit2: Harmony in Human Being Human Being is more than just the Body, Harmony of the Self („I“) with the Body, happiness and physical facility , Understanding Myself as Co-existence of the Self and the Body, Understanding Needs of the Self and the needs of the Body, Understanding the activities in the Self and the activities in the Body.	7
Unit 3: Harmony in the Family and Society and Harmony in the Nature Family as a basic unit of Human Interaction and Values in Relationships. , The Basics of Respect and today's Crisis: Affection, e, Guidance, Reverence, Glory, Gratitude, Prosperity and Love. Comprehensive Human Goal: The Five Dimensions of Human Endeavour Harmony in Nature: The Four Orders in Nature, The Holistic Perception of Harmony in Existence.	8
Unit 4: Professional Ethics Value based Life and Profession. , Professional Ethics and Right Understanding, Competence in Professional Ethics, Issues in Professional Ethics – The Current Scenario.	7

Reference Books :

1. Human Society in Ethics & Politics - Bertrand Russell (2015), Taylor and Francis
2. Ethical Philosophy of India - I.C. Sharma (1965)-Johnson publication

Online References :

Online Resources No.	Website address
1	fdp-si.aicte-india.org/verifiedProgramDetailsList.php
2	https://citizenchoice.in/course/Universal-Human-



3	Values/Unit%201/Happiness-and-Prosperity
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Evaluation Scheme:							
Assessment	Total Marks	Intended course learning outcomes to be assessed (Please tick as appropriate)					
		CO1	CO2	CO3	CO4	CO5	CO6
ISE	25	√	√	√	√	√	√
MSE	25	√	√	√			
Total	50						

Formative Assessment Tools / Methods	Total Marks	CO1	CO2	CO3	CO4
Assessment 1 – Reflective Essay / Personal Diary	50	✓	✓		
Assessment 2 – Group Discussion / Debate on Ethical Scenarios			✓	✓	✓
Assessment 3 – Case Study Analysis on Professional Ethics				✓	✓
Assessment 4 – Concept Map / Flow Diagram on Human Values & Harmony		✓	✓		
Assessment 5 – Presentation on Ethical Dilemmas in Society & Profession			✓	✓	✓



**SCHOOL of ENGINEERING
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KASABA BAWADA, KOLHAPUR
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Constituent Unit of
D. Y. PATIL EDUCATION SOCIETY
(DEEMED TO BE UNIVERSITY), KOLHAPUR
Notification No. F.9-26/2004- U.3 dt. 01-09- 2005 of the GOI
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SEMESTER-II



Course Plan

Course Title : Object Oriented Modelling	
Course Code : 242MCA1L201	Semester : II
Teaching Scheme : L-T-P : 3-0-0	Credits : 3
Evaluation Scheme : ISE+MSE Marks: 20+20	ESE Marks : 60

Course Description:

The course aims to aware the students about the Object Oriented Methodologies and fractional view. It also insist on static structural view and class modelling and design approaches. It aims to aware about state diagram and interaction diagram . It also aims about approaches for developing dynamic system.

Course Objectives:

- To aware the students about object Oriented Methodologies.
- To study about static structural view & class modelling approaches.
- To study different types of state diagram & interaction diagram.
- To study approaches for developing dynamic system.

Course Outcomes (COs):

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

201.1	Remember overview of OO Methodologies
201.2	Understand fractional view & Activity diagram
201.3	Analyze static structural view.
201.4	Analyze Class Modeling and Design Approaches
201.5	Apply state diagram & Interaction diagram
201.6	Analyze approaches for developing dynamic systems



Prerequisite:	Programming skills, Database Concepts.
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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs			BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
201.1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
201.2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
201.3	1	3	-	-	-	-	-	-	-	-	-	-	1	-	-	4
201.4	2	3	-	-	-	-	-	-	-	-	-	-	1	-	-	4
201.5	1	2	2	-	-	-	-	-	-	-	-	-	-	-	-	2
201.6	1	2	2	-	-	-	-	-	-	-	-	-	-	-	-	4

Content	Hours
Unit 1: Overview of Prominent OO Methodologies: Rumbaugh OMT, Booch methodology, Jacobson's OOSE methodologies, Unified Proces, Introduction to UML, Important views & diagram	8



Unit 2: Factional view(models): a)Use case diagram : Requirement Capture with Use case, Building blocks of Use Case diagram - actors, use case guidelines for use case models, Relationships between use cases - extend, include, generalize. b)Activity diagram : Elements of Activity Diagram - Action state, Activity state, Object. node, Control and Object flow, Transition (Fork, Merge, Join) , Guidelines for Creating Activity Diagrams, Activity Diagram - Action Decomposition (Rake) , Partition - Swim Lane.	8
Unit 3: Static Structural View (Models): a)Classes, values and attributes, operations and methods, responsibilities for classes, abstract classes, access specification(visibility of attributes and operations). b. Relationships among classes: Associations, Dependencies., Inheritance - Generalizations, Aggregation. c. Adornments on Association: association names, association classes, qualified association, n-ary associations, ternary and reflexive association. d. Dependency relationships among classes, notations e. Notes in class diagram, Extension mechanisms, Metadata, Refinements, Derived , data, constraint, stereotypes, Package & interface notation. f. Object diagram notations and modeling, relations among objects (links).	8
Unit 4: Class Modeling and Design Approaches: a. Three approaches for identifying classes - using Noun phrases, Abstraction, Use Case Diagram. b. Comparison of approaches. c. Using combination of approaches. d. Flexibility guidelines for class diagram: Cohesion, Coupling, Forms of coupling (identity, representational, subclass, inheritance), class Generalization, class specialization versus aggregation.	7
Unit 5 : Behavioral (Dynamic structural view): I.State diagram : a. State Diagram Notations, events (signal events, change events, Time events).	7



b. State Diagram states (composite states, parallel states, History states), transition and condition, state diagram behavior(activity effect, do-activity, entry and exit activity), completion transition, sending signals. II. Interaction diagrams: a. Sequence diagram - Sequence diagram notations and examples, iterations, conditional messaging, branching, object creation and destruction, time constraints, origin of links, Activations in sequence diagram. b. Collaboration diagram - Collaboration diagram notations and examples, iterations, conditional messaging, branching, object creation and destruction, time constraints, origin of links, activations in sequence diagram.	
Unit 6 : Approaches for developing dynamic systems: a)Top - down approach for dynamic systems. b. Bottom - up approach for dynamic systems. c. Flexibility Guidelines for Behavioral Design - guidelines for allocating and designing behaviors that lead to more flexible design.	7

Reference books:

1. Designing Flexible Object Oriented systems with UML - Charles Ritcher
2. Object Oriented Analysis & Design, Sat/.inger. Jackson, Burd Thomson
3. Object oriented Modeling and Design with UML - James Rumbaugh. Micheal Blaha (second edition)
4. The Unified Modeling Language User Guide - Grady Booch, James Rumbaugh, Ivar Jacobson.
5. Object Oriented Modeling and Design - James Rumbaugh
6. Teach Yourself UML in 24 Hours - Joseph Schmuilers



7. Object-Oriented Analysis and Design: using UML Mike O'Docherty Wiley Publication

Online References :

Online Resources No.	Website address
1	https://www.udemy.com/course/fundamentals-of-information-technology/
2	https://www.youtube.com/watch?v=DLb8IFee-DI
3	https://www.youtube.com/watch?v=mOYpH24GR6Y
4	https://onlinecourses.nptel.ac.in/noc24_cs40/preview



Evaluation Scheme:							
Assessment	Total Marks	Intended course learning outcomes to be assessed (Please tick as appropriate)					
		CO1	CO2	CO3	CO4	CO5	CO6
ISE	20	√	√	√	√	√	√
MSE	20	√	√	√			
ESE	60	√	√	√	√	√	√
Total	100						

Formative Assessment Tools / Methods	Total Marks	CO1	CO2	CO3	CO4	CO5	CO6
Assessment 1 – Group Presentation on OO Methodologies	20	✓					
Assessment 2 – Concept Map / Diagram Drawing on Use Case & Activity Diagrams			✓	✓			
Assessment 3 – Class Diagram & Static Structural Modeling Lab Tasks				✓	✓		
Assessment 4 – State Diagram & Interaction Diagram Exercises						✓	✓
Assessment 5 – Mini Project / Case Study on Dynamic System Development Approaches		✓	✓	✓	✓	✓	✓



**SCHOOL of ENGINEERING
& MANAGEMENT**

KASABA BAWADA, KOLHAPUR
Approved by AJCTE, New Delhi

Constituent Unit of
D. Y. PATIL EDUCATION SOCIETY
(DEEMED TO BE UNIVERSITY), KOLHAPUR
Notification No. F.9-26/2004- U.3 dt. 01-09- 2005 of the GOI
Accredited by NAAC with 'A++' Grade

"Imparting knowledge with excellence"

Course Plan

Course Title: Computer Networks	
Course Code : 242MCA1L203	Semester: II
Teaching Scheme: L-T-P:3-0--0	Credits:3



Evaluation Scheme: ISE+MSE Marks:20+20

ESE Marks : 60

Course Description:

The key objective is to acquire a foundational understanding of computer network and communication technologies. Networking concepts will be illustrated using TCP/IP networks. It also aims to enable the learner with network technologies and applications of network. The aim is to make aware the students with advanced network technologies like mobile adhoc networks and wireless sensor networks.

Course Objectives:

- To teach the fundamentals of the database systems at a master level. A variety of topics will be covered that are important for modern databases in order to prepare the students for real life applications of databases.
- To impart knowledge of the concepts related to database and operations on databases. It also gives the idea how data base is managed in various environments with emphasis on security measures as implemented in database management systems.

Course Outcomes (COs):

203.1	Remembering the basic concepts of Computer Hardware and Network terminology for development of basic networks in the organization.
203.2	Understand the concepts of Network topology, network operating systems and how the networks are developed as per the need of the organization
203.3	Applying the knowledge of computer network for the Information Sharing, device sharing and use of various new network technologies.
203.4	Analyze the existing knowledge of computer network , so that students will get exposure to advanced network technologies like MANET, WSN and 4G.
203.5	Create the own procedure by the students to protect the computer network and use the sharing proper resources
203.6	To analyze & understand Mobile Ad-hoc Networks



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Prerequisite :	Basic knowledge of Computer Network
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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

[illegible]



Content	Hours
Unit 1 : Introduction to Computer Networks (6Lectures) Basic concepts of computer hardware and network terminology, What is Computer Network? Network Goals and Motivations, Application of Networks, Network Topologies, Classification of Networks, Network software in brief: Network Protocols, Protocol Hierarchies, Design issues for the Layers, Connection Oriented and Connectionless Services, Service Primitives, Relation of services to Protocols, Network Models: The OSI Reference Model, The TCP/IP Reference Model, Comparison of OSI and TCP/IP Reference Model, A critique of OSI Model, A critique of TCP/IP Model, Examples of some networks: Internet, X.25, ISDN, Frame relay, ATM, Ethernet, Wireless LANs-(wi-fi)	8
Unit 2 :Data Transmission and Physical Layer:(7Lectures) Signals :Analog and digital signals, Data Rate, Transmission impairment, Signal Measurement : Throughput, propagation , speed and time, wavelength, frequency, bandwidth, spectrum Transmission Media & Characteristics : Guided and Unguided media, Synchronous and Asynchronous Transmission, Multiplexing : FDM, WDM, TDM Switching : Circuit, Message and Packet switching	8
Unit 3:Network Layer: Network Layer Design Issues; Routing Algorithms : Static/Dynamic, Direct/Indirect, Shortest Path Routing, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, Multicast routing Congestion control Algorithm : General principles of congestion control, congestion prevention policies, load Shedding, jitter control IP Addressing : IP Protocol, IP Address classes (A,B,C,D,E), Broadcast address, Multicast address	8



Unit 4:Transport and Application Support Protocols Transport service, Service Primitives, Internet, and Transport Protocols: TCP/UDP, Remote Procedure Calls, RTP Session Layer: Token Concept	7
Unit 5:Advance Networks: Concept of 4G Networks, Introduction of 802.16,802.20,Bluetooth, Infrared, MANET, Sensor Networks. Technical Issues of Advanced, Networks	7
Unit 6 : Mobile Ad- hoc Networks : Introductory concept ts, Destination- Sequenced Distance Vector protocol, AdHoc On-Demand Distance Vector protocol, Wireless Sensor Networks: Sensor networks overview:	7

Reference Books:

1. Network Essential Notes GSWMCSE Study Notes
2. Internetworking Technology Handbook CISCO System
3. Introduction to Networking and Data Communications Eugene Blanchard
4. Computer Networks and Internets with Internet Applications Douglas E.Comer.

Online References :

Online Resources No.	Website address
1	https://www.tutorialspoint.com/computer_fundamentals/computer_networking.htm
2	https://www.javatpoint.com/computer-network-tutorial
3	https://www.youtube.com/watch?v=4D55Cmj2t-A
4	https://www.youtube.com/watch?v=ET2W8DyA7zI



Evaluation Scheme:							
Assessment	Total Marks	Intended course learning outcomes to be assessed (Please tick as appropriate)					
		CO1	CO2	CO3	CO4	CO5	CO6
ISE	20	✓	✓	✓	✓	✓	✓
MSE	20	✓	✓	✓			
ESE	60	✓	✓	✓	✓	✓	✓
Total	100						

Formative Assessment Tools / Methods	Total Marks	CO1	CO2	CO3	CO4	CO5	CO6
Assessment 1 – Open Book Assignment / Conceptual Questions	20	✓	✓				
Assessment 2 – Group Presentation on Network Topologies & Protocols			✓	✓			
Assessment 3 – Hands-on Lab / Mini Project on Network Setup & Configuration		✓	✓	✓		✓	
Assessment 4 – Case Study / Scenario Analysis on Advanced Networks (MANET, WSN, 4G)				✓	✓	✓	
Assessment 5 – Simulation / Problem Solving on Mobile Ad-hoc Networks				✓	✓	✓	✓



Course Plan

Course Title : Data Warehousing and Data Mining	
Course Code : 242MCA1L204	Semester : II
Teaching Scheme : L-T-P : 3 -0-0	Credits : 3
Evaluation Scheme : ISE+MSE Marks: 20+20	ESE Marks : 60

Course Description:

It aims to aware the students about important concepts of data warehousing , its architecture and data mart. It also considers data summarization, data cleaning and data transformation. It insist on data mining system and its functionalities. It aims about mining association rule and importance of classification.

Course Objectives:

- To expose the students to study various design and implementation issues and techniques in data warehousing.
- To aware the students about functionalities of data mining system.

Course Outcomes (COs):

CO1	Understand the components, architecture and other important tools of data warehousing and data mining.
CO2	Understand different data preprocessing techniques
CO3	Discover interesting patterns from large amount of data to analyze and extract patterns to solve problems
CO4	Evaluate and select appropriate data mining algorithms
CO5	Apply the Classification, association and other data mining algorithms to the data.
CO6	Apply cluster analysis and web mining to the data

Prerequisite:	Basic understanding of Relational database and algorithm
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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs			BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
1	2	2	-	-	-	-	-	--	-	-	-	-	1	-	-	2
2	1	2	-	-	-	-	-	-	-	-	-	-	1	-	-	2
3	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-	4
4	1	2	2	-	-	-	-	-	-	-	-	-	1	-	-	5
5	1	2	2	-	-	-	-	-	-	-	-	-	-	-	-	3
6	2	2	-	-	-	-	-	-	-	-	--	-	1	-	-	3



Content	Hours
Unit 1: Data warehousing Overview and Concepts: Need for data warehousing, Characteristics of Data Warehouse, Data Warehouse Users, Building blocks of Data warehouse, Data Warehouse Architecture- Two Tier architecture, Three Tier Architecture, Extract Transform Load Cycle: ETL overview, Extraction, Loading, Transformation techniques. Reporting and Query tools and Applications, OLTP and OLAP systems, OLAP – Need, Design of OLAP database, OLAP operations : slice, dice, rollup, drill_down,etc	8
Unit 2: Data Mart Data Marts, Reasons for creating Data Marts, Building Data Marts: Top down Approach & Bottom up Approach	6
Unit 3 : Data Preprocessing Need, Objectives and Techniques of data preprocessing. Descriptive Data Summarization: Measuring the Central Tendency, Measuring the Dispersion of Data, Data Cleaning: Handling of Missing values and Noisy Data, Data cleaning as a process Data Integration and Transformation: Data Integration: Schema integration, Data Transformation: Smoothing, Aggregation, Generalization, Attribute construction, Normalization	8
Unit 4: Introduction to Data Mining Introduction to data mining, architecture of a typical data mining system, Types of data, Data Mining Functionalities, Classification of Data Mining systems, Data Mining Task Primitives, Integration of a Data Mining System with Data Warehouse System, Major issues in Data Mining. Association and Correlations – Mining various kinds of Association rules – Market Basket Analysis, Apriori Algorithm, Correlation Analysis	8
Unit 5: Classification and Prediction Introduction to Classification and Prediction: Basics of Supervised & Unsupervised Learning, Classification by Decision Tree Induction, Tree Pruning, Rule Based Classification, Decision Tree, Bayesian classification based on Bayes Theorem, Naïve Bayesian classification, Prediction using Regression analysis.	8
Unit 6: Clustering and Web mining Cluster Analysis – Different clustering methods – Partitioning methods, K-means clustering, Hierarchical clustering, Outlier Analysis. Web mining, web content mining, web structure mining, web usage mining	7



Reference Books :

1. Jiawei Han, Micheline Kamber, Data Mining: Concepts and Techniques, Harcourt India Pvt., 2011.
2. Alex Berson, Stephen J. Smith, Data Warehousing, Data Mining and OLAP, McGrawHill, 2004
3. D. Hand, H. Mannila, and P. Smyth, Principles of Data Mining, MIT Press, 2011

Online Resources :

Online Resources No.	Website address
1	https://onlinecourses.nptel.ac.in/noc24_cs22/preview
2	http://guidetodatamining.com/ , "A programmers Guide to Data Mining"

Evaluation Scheme:							
Assessment	Total Marks	Intended course learning outcomes to be assessed (Please tick as appropriate)					
		CO1	CO2	CO3	CO4	CO5	CO6
ISE	20	✓	✓	✓	✓	✓	✓
MSE	20	✓	✓	✓			
ESE	60	✓	✓	✓	✓	✓	✓
Total	100						

Formative Assessment Tools / Methods	Total Marks	CO1	CO2	CO3	CO4	CO5	CO6
Assessment 1 – Open Book Assignment / Conceptual Questions on Data Warehousing & OLAP	20	✓					
Assessment 2 – Hands-on Lab / Mini Project on Data Preprocessing			✓	✓			
Assessment 3 – Case Study / Problem Solving on Association & Classification		✓	✓	✓	✓	✓	
Assessment 4 – Group Presentation on Classification, Prediction & Clustering Techniques		✓	✓	✓	✓	✓	✓
Assessment 5 – Web Mining Project / Simulation Exercises				✓	✓	✓	✓



Course Plan

Course Title: Operating System	
Course Code: 242MCA1L 205	Semester:II
Teaching Scheme: L-T-P:3-0-0	Credits:3
Evaluation Scheme : ISE+MSE Marks:20+20	ESE Marks : 60

Course Description:

This course introduces the concept of operating system & types of operating system. It also introduces process management and scheduling algorithm. It covers memory management, virtual memory and page replacement algorithms. It also includes interprocess communication and deadlocks.

Course Objectives:

- To acquire knowledge regarding structure and working of the major operating system components.
- To learn and apply different process and memory scheduling algorithms and synchronization techniques to achieve better performance of computer system.
- To understand structure and organization of file system.

Course Outcomes (COs):

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

CO1	Understand the concept of Operating system
CO2	Analyze the working mechanism of Process management
CO3	Analyze the working mechanism of Memory management
CO4	Understand Inter-process communication & synchronization
CO5	Understand the mechanism of storage and file management
CO6	Understand the concept of I/O systems

Prerequisite:	Basic Knowledge of Computer
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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs			BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
1	1															2
2	1	2											1			4
3	1	2	2										1			4
4	1	2	2													2
5	2	2	2													2
6	2	2	2													2

Content	Hours
Unit 1: Introduction to Operating System Overview of Operating system Definition and purpose, History and evaluation, Types of OS- Batch System, Time-sharing Multitasking, Multiprogramming, Multiprocessing, Real time, Distributed operating system, Embedded operating system. Operating System Architecture- System components, OS services and functions, Operating system structure- simple, monolithic, Microkernel, Layered, Modular. User operating-system interface: command line interface, GUI, system calls, Interrupt Concept, Concept of Virtual Machine, System Calls, System Programs	7



Unit 2: Process Management Process, Thread- Definition Concept, Difference between Process and Thread, Process Control Block (PCB), , process states and its transitions, context switch, Inter-process Communication, Communication in Client-Server .OS services for Process management, CPU scheduling and types of schedulers, Scheduling algorithm-FCFS, SJF, RR, Priority based, SRJF, multilevel queue, multiprocessor scheduling, Real time scheduling	8
Unit 3: Memory Management Introduction, Memory hierarchy, Base and limit registers, swapping, Memory Management Techniques -Contiguous & Non Contiguous allocation, Fixed partitioning, Dynamic partitioning, Fragmentation, paging- Demand paging, Page fault, page tables and page replacement algorithms (FIFO, LRU, Optimal), multilevel paging and inverted page tables. Segmentation – Basic concepts, Segmentation hardware, Segmentation with paging.	7
Unit 4: Inter-process Communication and Synchronization Need, critical section problem, Synchronization mechanisms - Mutual Exclusion, Semaphore, Busy-wait Implementation, characteristics of semaphore, queuing implementation of semaphore, classic synchronization problems - producer consumer, Readers-Writers, Deadlock - concept, Necessary Conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance, Bankers Algorithm, Deadlock Detection, Deadlock Detection Algorithm for Single and Multiple Instance of Resources, Deadlock Recovery	8
Unit 5: Storage management File System: Files-basic concept, file attributes, file operations and types, file structure, access methods, FILE system, Implementation, Directory structure and organization- single level directory system, two level directory system, hierarchical directory system, directory operations, protection, security, allocation method, Recovery. Disk Management: Disk Structure, Disk Scheduling algorithms (FCFS, SSTF, SCAN, C-SCAN, LOOK),	7



Unit 6: I/O systems

8

I/O hardware- I/O devices and controllers, Direct Memory Access (DMA), I/O system layers, Device drivers, Interrupt handling

Network operating system – Networking basics, Network operating system functions, Network protocols (TCP/IP, UDP)

Reference Books:

1. Andrew S. Tanenbaum, —Modern Operating Systems, Prentice Hall of India, 2 nd Ed. 2006
2. Achyut Godbole, —Operating System, Tata McGraw Hill, 3rd Ed. 2013
3. Abraham Silberschatz, Peter Galvin Operating Systems: Concepts - Willey- Sixth edition.
4. D.M. Dhamdhare, System Programming and Operating Systems -TMH –Second Edition.
5. William Stallings, Operating Systems: Internals and Design Principles, Seventh Edition, Pearson Publications
6. Madnick and Donovan , Operating Systems -Tata McGraw-Hill Education

Online References:

Online Resources No.	Website address
1	https://www.geeksforgeeks.org/introduction-of-operating-system-set-1/
2	https://www.javatpoint.com/os-tutorial
3	https://www.cse.iitb.ac.in/~mythili/os/

Evaluation Scheme:

Assessment	Total Marks	Intended course learning outcomes to be assessed (Please tick as appropriate)					
		CO1	CO2	CO3	CO4	CO5	CO6
ISE	20	√	√	√	√	√	√
MSE	20	√	√	√			
ESE	60	√	√	√	√	√	√



Total	100						
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Formative Assessment Tools / Methods	Total Marks	CO1	CO2	CO3	CO4	CO5	CO6
Assessment 1 – Open Book Assignment / Conceptual Questions on OS Fundamentals	20	✓					
Assessment 2 – Lab / Simulation on Process Scheduling & CPU Management	20		✓	✓			
Assessment 3 – Lab / Simulation on Memory Management & Paging Techniques	20			✓	✓		
Assessment 4 – Case Study / Problem Solving on Synchronization & Deadlock	20			✓	✓	✓	

Course Plan

Course Title: Problem solving using Python	
Course Code: 241BCA1L102	Semester:II
Teaching Scheme:L-T-P:3-0-0	Credits:3
Evaluation Scheme:ISE1+ ISE 2 Marks:20+20	EPE Marks : 60

Course Description:

To Understand the principles of Python and acquire skills in programming in python .
It also provides to develop the emerging applications of relevant field using Python .
It also helps to interpret the fundamental Python syntax and semantics and be fluent in the use of Python control flow statements.

Course Objectives:

- Describe the core syntax and semantics of Python programming language.
- Illustrate the process of structuring the data using lists, dictionaries, tuples and sets.
- Discover the need for working with the strings and functions.



- Understand the usage of files, exceptions, modules & packages

Course Outcomes (COs):

COs	POs												PSOs			BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
2	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	2
3	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	3
4	2	2	2	-	-	-	-	-	-	-	-	-	1	--	-	4
5	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-	5
6	1	2	1	-	-	-	-	-	-	-	-	-	1	-	-	-

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

CO1	Understand the principles of Python
CO2	Understand to read, write, execute by hand simple Python programs
CO3	Represent compound data using Python lists, tuples, dictionaries
CO4	Decompose a Python program into functions
CO5	Evaluate string & array using Python
CO6	Read and write data from/to files in Python Programs

Requisite :	Basic Knowledge of Programming
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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):



Content	Hours
Unit1: Introduction to Python The process of computational problem solving, Introduction to Python and installation, data types: Int, float, Boolean, string, and list; variables and Identifiers - Operators - Expressions and Data types., expressions, statements, precedence of operators, comments	7
Unit 2: Control Structures Control Structures: Boolean Expressions , Selection Control - If Statement, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: while, for, break, continue, definite vs. Indefinite Loops, Boolean Flags and Indefinite Loops.	8
Unit 3: LISTS, TUPLES, DICTIONARIES Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters, list comprehension Tuples: tuple assignment, tuple as return value, tuple comprehension Dictionaries: operations and methods, comprehension	8
Unit 4: Functions Defining Functions, return values, parameters, , function composition, - Calling Non-Value-Returning Functions- Parameter Passing - Keyword Arguments in Python - Default Arguments in Python - local and global scope , recursion	8
Unit 5: Strings Strings: string slices, immutability, string functions and methods, string module; Python arrays, Access the Elements of an Array, array methods.	8
Unit 6: FILES, EXCEPTIONS, MODULES, PACKAGES Files and exception: text files, reading and writing files, command line arguments, errors and exceptions, handling exceptions, modules (datetime, time, OS , calendar, math module), Explore packages.	6

Reference Books:

1. Mark Lutz, "Learning Python Powerful Object Oriented Programming", O'reilly Media 2018, 5th Edition.
2. Timothy A. Budd, "Exploring Python", Tata MCGraw Hill Education Private Limited



2011, 1st Edition.

3. Allen Downey, Jeffrey Elkner, Chris Meyers, "How to think like a computer scientist: learning with Python", 2012.

4. Sheetal Taneja & Naveen kumar, "Python Programming a Modular approach – A Modular approach with Graphics, Database, Mobile and Web applications", Pearson, 2017.

5. Ch Satyanarayana M Radhika Mani, B N Jagadesh, "Python programming", Universities Press 2018.

6. **Murugan Swaminathan**, "Python for beginners", paperback , 2020, first edition

7. Yashwant Kanetkar, "Let us Python", BPB, 2022, sixth Edition

Online References :

Online Resources No.	Website address
1	http://interactivepython.org/courselib/static/pythonds
2	http://www.ibiblio.org/g2swap/byteofpython/read/
3	http://www.diveintopython3.net/ – http://greenteapress.com/wp/think-python-2e/
4	http://docs.python.org/3/tutorial/index.html

Evaluation Scheme:							
Assessment	Total Marks	Intended course learning outcomes to be assessed (Please tick as appropriate)					
		CO1	CO2	CO3	CO4	CO5	CO6
ISE	20	√	√	√	√	√	√
ISE	20	√	√	√	√	√	√
Total	40						



Formative Assessment Tools / Methods	Total Marks	CO1	CO2	CO3	CO4	CO5	CO6
Assessment 1 – Open Book Assignment / Conceptual Questions on Python Basics	40	✓	✓				
Assessment 2 – Hands-on Lab / Mini Programs on Control Structures		✓	✓	✓			
Assessment 3 – Lab Exercises on Lists, Tuples, Dictionaries			✓	✓	✓		
Assessment 4 – Functions & Recursion Exercises				✓	✓		
Assessment 5 – String, Array, File Handling & Exception Handling Lab					✓	✓	✓

Course Plan

Course Title: Dot Net Technology	
Course Code: 242MCA1P206	Semester: II



Teaching Scheme: L-T-P: 2-0-4	Credits:4
Evaluation Scheme: ISE1+ISE2 Marks:40	EPE Marks : 60

Course Description:

The objective of course is to understand working knowledge of C# programming constructs and the .NET Framework. To understand use of OOP concepts using C#. Builds a strong understanding of Develop and debug well-formed Web Forms with ASP. NET Controls.

Course Objectives:

- To learn .Net environment and its Technologies.
- To learn OOP concepts using C#.
- To learn development skilled in Windows based programming and web based programming.
- To learn creation of application using MVC.

Course Outcomes (COs):

On Successful completion of course student will be able to :

CO1	Understand the basic working methodology of .NET architecture.
CO2	Demonstrate approaches for performance and effective coding
CO3	Apply the features of Dot Net Framework along with the features of C#
CO4	Develop various kinds of Window-based applications and web-based applications.
CO5	Create dynamic Website/ Web based Applications using ASP.NET and Database
CO6	Students will be able to develop application using MVC and understand Entity Framework.

Prerequisite	Basic Knowledge of Object Oriented Programming and Web Technology
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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):



COs	POs												PSOs			BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	2
2	2	2	-	-	-	-	-	-	-	-	-	-	1	-	-	4
3	1	2	2	-	-	-	-	-	-	-	-	-	1	-	-	3
4	1	2	2	-	-	-	-	-	-	-	-	-	-	-	-	4
5	1	2	2	-	-	-	-	-	-	-	-	-	1	-	-	6
6	2	2	2	-	-	-	-	-	-	-	-	-	1	1	-	4

Content	Lectures
UNIT I: Introduction to .Net .NET Framework Architecture, An Overview, Components of .NET: CLR , CLS, Microsoft Intermediate Language ("MSIL" or "IL"), The Common Type System (CTS), Namespaces, .NET Framework Base Classes, DLL and Exe. An Overview of C#, Data Types, Value and Reference Types, Boxing and Unboxing, C# - Flow Control: Branching, Switching and Looping Structure.	6
Unit-II Object Oriented Concepts C# Program compilation and execution, Command Line Arguments, Classes and Objects, Inheritance, Polymorphism, Abstract Classes, Sealed Classes, Partial Classes, COLLECTION, Exception Handling	8
Unit-III Windows Form Application Using C# IDE – (Integrated Development Environment), Form Controls: Label, Button, Textbox, Checkbox, RadioButton, Timer, calendar, ListBox, Image etc. its properties and events	7
Unit-IV ADO.Net Introduction to ADO.Net: ADO.NET Architecture- Connection, command, data reader, data adapter, data set, understanding connected layer of ADO.NET and disconnected layer of ADO.NET.	8



Unit-V Introduction to Asp.Net Architecture of ASP.NET web application. Understanding ASP.NET page structure. Page level events, Asp.Net page life cycle. Asp.Net Controls: Server Controls, Cross page postback property of button, Response.Redirect, Server.transfer, Response.Write. Data controls: Gridview, Listview, FormView, DetailsView, Repeater, Validation Controls, Navigation controls- Menu, TreeView, SiteMapPath, Master Page. Asp.Net State Management: Client Side State Management, Server Side State management, Caching in ASP.NET: Page caching, data caching, fragment caching.	8
Unit-VI Introduction to MVC Introduction to MVC, Benefits of using ASP.NET MVC, Role of Model, View, and Controller, ASP.NET MVC Works, Naming conventions, creating views, defining controllers, defining a data model, creating strongly-typed views, creating strongly-typed views, Razor View Engine: Razor Basics, Razor design goals, Implementation of Razor view, Razor syntax, Accessing Model Data in Razor views. Entity Framework.	8

Lab on Dot Net Technology

Content
Unit 1: Introduction to .Net 1.1 Installation of .Net IDE. 1.2 Write a console application in C# to demonstrate concept of flow control statements. 1.3 Write a console application in C# to demonstrate concept of looping statements.
Unit 2: Object Oriented Concepts 2.1 Write a console application that demonstrates concept of class and object using C# 2.2 Write a console application that demonstrates concept of inheritance, polymorphism using C# 2.3 Write a console application that demonstrates concept of partial class, sealed class and



abstract class using C#

2.4 Write a console application that demonstrates concept of exception handling in C#.

Unit 3: Windows form application using C#

3.1 Develop a windows application to demonstrate use of different common controls.

3.2 Create a window application for employee. Following information should be accepted Empid, name, birth date, joining date, basic, hra%, da% & following information should be calculated & displayed in appropriate control. Age, retirement date, total HRA, total DA & total salary.

Unit 4: ADO.Net

4.1 Develop windows application that perform CRUD operation.

4.2 Develop windows application that display records from database using Database Reader object.

Unit 5: Introduction to Asp.Net

5.1 Develop a web application to demonstrate use of different server controls with all validations.

5.2 Develop a web application to demonstrate use of navigation control.

5.3 Develop master page for college website.

Unit 6: Introduction to MVC

6.1 Demonstrate MVC architecture.

6.2 Demonstrate Razor View Engine.

Reference Books:

1. C# 4.0 The Complete Reference Schildt Mc Graw Hill
2. Inside C# - By Tom Archer, Andrew Whitechapel (Microsoft Pub)
3. Programming in C#- E Balagurusamy
4. Beginning ASP.NET 4.5 in C# and VB, Wrox, 2012, ISBN-10: 1118311809



5. ASP.NET MVC 4 and the Web API: Building a REST Service from Start to Finish by Jamie

Kurtz

Online Resources:

Online Resources No.	Website address
1	//dotnet.microsoft.com/en-us/learn
2	https://www.udemy.com/topic/net/
3	https://www.besanttechnologies.com/dot-net-online-training
4	https://www.coursera.org/specializations/asp-dot-net-experience

Evaluation Scheme:							
Assessment	Total Marks	Intended course learning outcomes to be assessed (Please tick as appropriate)					
		CO1	CO2	CO3	CO4	CO5	CO6
ISE	20	✓	✓	✓	✓	✓	✓
ISE	20	✓	✓	✓	✓	✓	✓
Total	40						

Formative Assessment Tools / Methods	Total Marks	CO1	CO2	CO3	CO4	CO5	CO6
Assessment 1 – Open Book Assignment / Conceptual Questions on .NET Basics	40	✓	✓				
Assessment 2 – Hands-on Lab / Console Applications on Flow Control, Looping & OOP Concepts		✓	✓	✓	✓		
Assessment 3 – Lab / Mini Project on Windows Form Applications				✓	✓		
Assessment 4 – Lab / Project on ADO.NET CRUD Operations & Database Interaction				✓	✓	✓	
Assessment 5 – Web Application using ASP.NET & MVC (Server Controls, Navigation, Razor Engine)					✓	✓	✓



Course Plan:

Course Title: Lab on Linux	
Course Code: 242MCA1P209	Semester: II
Teaching Scheme: L-T-P: 0-0--2	Credits:1
Evaluation Scheme: ISE1+ISE2 Marks:25+25	ESE Marks:-

Course Description:

This course is designed to provide students with hands-on experience in using the Linux operating system. Students will learn to navigate the Linux environment, use terminal commands, manage files and directories, and write shell scripts. The course also introduces basics about networking like networking devices, cables.

Course Objectives:

- To familiarize students with the Linux operating system and its environment.
- To teach students the usage of essential Linux commands for general-purpose utilities, file, and directory management.



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Unit no.	Contents	Hours
UNIT-1: - Introduction to Linux & File Management Directory Management in Linux	● Installing virtual box. ● Installing ubuntu. Q.1. Install Ubuntu. Q.2. Open terminal and check version with lsb_release command. Writing different file management commands – ls, cd, pwd, mkdir ,rmdir, mv, cp, touch. Q.1. Create a directory and into the directory create a file with touch command. Q.2. Displays information about files. Q.3. Display current working directory. Q.4. Copy files from one directory to another, rename, replace and delete the directory	8
UNIT-2: - General-Purpose Commands	● cal, date, calendar, who, cat, uname, echo, clear, head, tail, Q.1. Demonstrate the use of cal, date, calendar. Q.2. Create a user with a uname command. Q.3. Demonstrate use of echo, clear. Q.4. Demonstrate the use of cat, head and tail.	8
UNIT-3: - Vi editor & Shell script	● Command mode and Insert mode. Q.1. Create a new file in command mode. Q.2. Open multiple files. Q.3. Change from default mode to insert mode and write something to your file. Q.4. Demonstrate the use of other navigational commands. ● Create and write the shell script and then execute it. Q.1. Write a shell script using if statements to check if the file exists or not. Q.2. Write a shell script to see if the number is even or odd. Q.3. Write a shell script to display grades of students according to marks of 3 subjects.	8
UNIT-4: - Introduction to Network	Q.1. Introduction to LAN, MAN, WAN Q.2. Different network devices.	6

References: -

1. Andrew Tannabaum," Modern Operating Systems", Pearson Publication, Fourth Edition.
2. Abraham Silberschatz, "Operating System Concept", Paperback, Ninth Edition.



Online References :

Online Resources No.	Website address
1	https://archive.nptel.ac.in/courses/106/105/106105214/
2	https://onlinecourses.nptel.ac.in/noc20_cs04/preview
3	https://nptel.ac.in/courses/106105214
4	https://archive.nptel.ac.in/courses/106/102/106102132/
5	https://www.coursera.org/courses?query=computer%20network
6	https://www.udemy.com/course/the-complete-computer-networks-course-from-zero-to-expert/

Evaluation Scheme:							
Assessment	Total Marks	Intended course learning outcomes to be assessed (Please tick as appropriate)					
		CO1	CO2	CO3	CO4	CO5	CO6
ISE	25	√	√	√	√	√	√
ISE	25	√	√	√	√	√	√
Total	50						

Formative Assessment Tools / Methods	Total Marks	CO1	CO2	CO3	CO4
Assessment 1 – Lab Exercises on File & Directory Management	40	✓			
Assessment 2 – Lab Exercises on General-Purpose Commands			✓		
Assessment 3 – Lab Exercises on vi Editor & Shell Scripts				✓	
Assessment 4 – Conceptual Questions / Mini Quiz on Network Basics					✓



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SEMESTER-III



Course Plan:

Course Title: Cloud Computing	
Course Code: 26MCA2L101	Semester: III
Teaching Scheme:L-T-P:3-0-0	Credits:3
Evaluation Scheme: ISE+MSE Marks:20+20	ESE Marks : 60

Course Description:

This course provides a comprehensive understanding of cloud computing concepts, models, technologies, and practices that form the foundation of modern scalable and on-demand computing services. It introduces students to cloud service models and deployment models offering insights into how cloud infrastructure supports business agility, innovation, and efficiency. The course covers the role of virtualization, cloud-based service-oriented architectures (SOA), and the design and deployment of cloud-native applications. It emphasizes cloud service performance, scalability, security, and the economic implications of adopting cloud platforms like AWS, Microsoft Azure, and Google Cloud. Students also learn about reliability, monitoring, and management of cloud services, and are encouraged to evaluate cloud adoption decisions based on technical and financial criteria.



Course Outcomes (COs):

Course Outcomes:	After the completion of the course the student will be able to -
CO1	Understand the foundational concepts, deployment models, and service models of cloud computing, and evaluate its benefits and challenges.
CO2	Explain the role of virtualization in enabling cloud infrastructure, and assess its impact on availability, agility, security, and performance
CO3	Understand the principles of Service-Oriented Architecture (SOA) and analyze its integration with cloud technologies to deliver scalable business solutions
CO4	Analyze the architecture and deployment processes of cloud based applications, including web services inside and outside cloud platforms
CO5	Evaluate management strategies for cloud services including performance, scalability, reliability, and securing using modern cloud tools
CO6	Assess the economics of cloud platforms and make informed decisions about platform selection based on business, technical, and financial needs.

Prerequisite:

Basic knowledge of Computer Networks, Operating systems and web technologies

CO-PO Mapping:

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



CO4	3	3	3	3	2	1	2	1	2	2	2	2	3	2
CO5	3	3	3	3	2	2	3	1	2	2	3	2	3	2
CO6	3	2	2	3	2	3	3	2	2	2	3	3	3	3

Course Contents:

Unit 1	Cloud Computing Fundamentals	7 Hours
Definition, Characteristics and Advantages of cloud, Deployment models: private, public, Hybrid Service models – IaaS, PaaS, SaaS, Benefits and Challenges of Cloud Computing, Public vs Private clouds		
Unit 2	Virtualization and Cloud Enablement	8 Hours
Introduction to Virtualization, Types of Virtualization, Role of Virtualization in Cloud Computing, visualizing and managing Virtualization, Business Agility: Benefits & Challenges in Cloud Architecture Availability, Performance, Security, and Disaster Recovery, Introduction to Next Generation Cloud Applications		
Unit 3	Infrastructure, Storage and Networking	7 Hours
Introduction to Service-Oriented Architecture (SOA), Loose Coupling and Reusability Concepts, Implementation of SOA Services in the Cloud, SOA and Cloud Synergy: Serving the Business		
Unit 4	Cloud Application Development and Deployment	7 Hours
Web Technologies for Cloud, Cloud Application , Architecture Overview, Deploying Web Services Inside and Outside, Cloud, Cloud-Native vs. Traditional Application Models, Advantages and Disadvantages of Cloud-based Deployment		
Unit 5	Cloud Service Management	8Hours



Reliability and Availability of Cloud Services, Security Mechanisms for Cloud Services, Scalability and Performance Optimization, Monitoring and Managing Cloud Services, Tools and Technologies for Cloud Management

Unit 6	Cloud Economics and Industry Platforms	8 Hours
Cloud Computing Infrastructures: Amazon AWS, Microsoft Azure, Google Cloud, Cost Models and Pricing Strategies, Cloud Economics: ROI, Cost-Benefit Analysis, Choosing a Cloud Platform Based on Business Needs, Open-source Cloud Solutions: Ubuntu, Red Hat, Vendor Lock-in and Multi-cloud Strategies		

Text Books

1. Cloud Application Architecture by George Reese, Oreilly publishers
2. Thomas Erl, Cloud Computing Concepts, Technology & Architecture, Pearson, 1st Edition
3. Cloud computing and SOA convergence in your enterprise by David S, Linthicum, Addison- Wesley
4. Cloud computing: Principles and Paradigms by Rajkumar Buyya, James Broberg and Andrzej, M. Goscinski, Wiley, 2011.

Online Resources No.	Website address
1	https://nptel.ac.in/courses/106105167
2	https://learn.microsoft.com/en-us/training/paths/azure-fundamentals/
3	https://cloud.google.com/training/cloud-infrastructure

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4	https://cognitiveclass.ai/courses/cloud-computing
5	https://www.coursera.org/learn/could-computing

Evaluation Scheme:							
Assessment	Total Marks	Intended course learning outcomes to be assessed (Please tick as appropriate)					
		CO1	CO2	CO3	CO4	CO5	CO6
ISE	20	√	√	√	√	√	√
MSE	20	√	√	√	√	√	√
ESE	60	√	√	√	√	√	√
Total	100						

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Course Plan

Course Title: Research Methodology	
Course Code: 24MCA2L102	Semester: III



Teaching Scheme: L-T-P:3-0-0	Credits:3
Evaluation Scheme: ISE+MSE Marks:20+20	ESE Marks : 60

Course Description:

This course introduces the concept of Research Methodology and importance and application of research.

It also aims to aware students about different types of research and research design, methods of sampling and data collection. After completing the course, students should be able to check plagiarism and how to analyze the data and can prepare research report.

Course Objectives:

- To endow with various types of research and research design.
- To explore different sampling design and data collection methods.
- To design research report.

Course Outcomes(COs):

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

CO1	To understand the concept of Research Methodology
CO2	To study and analyze research process
CO3	To study & implement different sampling methods in research
CO3	To understand processing and analysis of data
CO4	To analyze reporting of research work
CO5	To study and analyze role of computer in research.



Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs			BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1	3	-	-	-	2	-	-	-	-	-	-	-	2	-	-	2
CO2	-	3	-	-	3	-	-	-	-	-	-	-	-	2	-	4
CO3	2	3	-	-	3	-	-	-	-	-	-	-	-	2	-	4
CO4	3	3	-	-	3	-	-	-	-	-	-	-	-	2	-	2
CO5	-	-	-	-	3	-	-	2	-	-	-	-	-	2	-	4
CO6	3	-	-	3	3	-	-	-	-	-	-	-	-	2	-	4

Content

Ho



Unit 1: Introduction to Research Methodology

Introduction to Research : Concept of research, characteristics of good research, Importance
Of Review of Literature, Organizing the review of Literature, Research Process

Unit 2: Types of Research

2.1 Types of research, pure (basic, fundamental) and applied research, qualitative and quantitative.
2.2 Research Design : Meaning, contents & components of research design, Characteristics,
Features of good Research design, Types of research design

Unit 3 : Sampling & Data Collection

3.1 Types and sources of data – Primary and secondary,
3.2 Methods of collecting primary data – interview, observation, questionnaires, survey methods etc,
3.3 Methods of collecting Secondary data – Library and Documentary Sources etc. , precautions while
using secondary data
3.4 Sampling: Concepts of Statistical Population, Sample, Sampling Frame, Sampling Error, Sample
Size, Non Response. Characteristics of a good sample. Probability Sample- Simple Random Sample,
Systematic Sample, Stratified Random Sample & Multi-stage sampling. Determining size of the
sample, Practical considerations in sampling and sample size.

Unit 4 : Processing and Analysis of Data

4.1 Data Preparation - Univariate analysis (frequency tables, bar charts, pie charts, percentages),
Bivariate analysis- classification and tabulation of data,
4.2 Processing and Analysis of Data :Meaning, importance and steps involved in processing of data.



4.3 Hypothesis : Meaning, importance of hypothesis, types of hypothesis : Null & Alternative hypothesis, types of error, tests of significance, critical region, one sided & two sided tests, Process of Testing of Hypothesis , Chi Square test.

Unit 5: Reporting of Research Work

5.1 Types of Reports,

5.2 Report Writing: Importance of written and oral reports presentation, types of reports, format of a good research report, Precautions in writing a research report.. Plagiarism and its types. References and Bibliography. Dissemination of research results.

Unit 6: Role of ICT in research

6.1 Methods to search required information effectively,

6.2 Reference Management Software like Zotero / Mendeley,

6.3 Software for paper formatting like LaTeX/ MS Office, Software for detection of Plagiarism

Reference Books:

1. Donald Cooper and PS Schindler (2009) Business Research Methods, 9th edition, Tata McGraw Hill.
2. Kothari C. R Research Methodology
3. Uma Sekaran (2010) Research Methods for Business, 4th edition, Wiley.
4. Ranjit Kumar (2009) Research Methodology, 2nd edition, Pearson Education
5. Naresh Malhotra and S Dash (2009) Marketing Research, 5th edition, Pearson Prentice Hall.
6. Michael V. P Research Methodology.
7. Fred N. Kerlinger : Foundations of Behavioral Research.



Online References :

Online Resources No.	Website address
1	nptel.ac.in/courses/127/106/127106227/
2	https://onlinecourses.nptel.ac.in/noc22_ge08
3	https://onlinecourses.swayam2.ac.in/ntr24_ed08
4	https://onlinecourses.swayam2.ac.in/cec20_hs17

Evaluation Scheme:							
Assessment	Total Marks	Intended course learning outcomes to be assessed (Please tick as appropriate)					
		CO1	CO2	CO3	CO4	CO5	CO6
IPE	40	√	√	√	√	√	√
EPE	60	√	√	√	√	√	√
Total	100						

Suggestive Formative Assessment Tools/Methods for IPE (Minimum 3 and Max. 5 tools)							
Formative Assessment Tools/Methods	Total Marks	Course Learning Outcomes to be assessed (Please tick as appropriate)					
		CO1	CO2	CO3	CO4	CO5	CO6
Assessment 1 – Assignments / Mini Tasks	40	√	√				
Assessment 2 – Practical / Lab Performance		√	√	√			



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Assessment 3 – Project / Mini Project		√	√	√	√	√	
Assessment 4 – Viva / Oral Examination		√	√	√	√	√	
Assessment 5 – Portfolio Submission		√	√	√	√	√	√

Course Plan

Course Title: Artificial Intelligence	
Course Code: 24MCA2L103	Semester:III
Teaching Scheme:L-T-P:3-0-0	Credits:3



Evaluation Scheme : ISE+MSE Marks:20+20

ESE Marks : 60

Course Description:-

This course provides a comprehensive introduction to Artificial Intelligence (AI), including intelligent agents, search strategies, knowledge representation, and reasoning. It also covers modern AI approaches such as neural networks, deep learning, fuzzy logic, genetic algorithms, and natural language processing. Students will learn to apply these techniques to solve real-world problems using intelligent systems.

Course Objectives:

- To introduce core concepts, history, and applications of Artificial Intelligence.
- To cover search methods, knowledge representation, and reasoning techniques.
- To explain neural networks, deep learning, and fuzzy logic systems.
- To explore genetic algorithms and natural language processing applications.

Course Outcomes (COs):

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

CO1	Understand the fundamentals of AI, intelligent agents, and core techniques.
CO2	Apply search strategies and game-playing algorithms for problem-solving.
CO3	Implement knowledge representation methods and inference mechanisms.
CO4	Understand the structure of neural networks and the fundamentals of deep learning techniques.



CO5	Develop fuzzy logic systems and differentiate reasoning approaches in AI.
CO6	Understand the working of genetic algorithms and the basics of NLP techniques and their applications.

Prerequisite:	Basic knowledge of computer programming, logic, and data structures.
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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

Cos	POs												PSOs			BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1	1	2	-	1		3	3	1	-	1	-	1	-	1	1	2
CO2	3	2	2	2	2		2	3	-	2	2	1	1	2	2	5
CO3	2	3	2	3	3	3	3	3	1	3	3	2	1	2	2	4
CO4	1	3	2	3	3		3	1	1	2	1	1	1	2	2	2
CO5	2	3	3	3	3	3	3	3	1	3	3	3	1	2	2	4
CO6	2	3	-	3	3	3	3	3	1	3	3	2	1	2	2	4

Content	Hours
Unit 1: Introduction to Artificial Intelligence Introduction and Definition of Artificial Intelligence, History of AI, Application of AI, Problems in Artificial Intelligence, AI Techniques. Agents and Environments: Types of agents (simple reflex, goal-based, utility-based, learning agents); Types of environments (deterministic, stochastic, static, dynamic), AI Techniques: Symbolic vs. Sub-symbolic approaches	5



Unit 2: Search Techniques in AI State Space Search & Heuristic Search Techniques: Defining The Problems as A State Space Search, Difference between Uninformed search and Informed search. Uninformed search: Breadth-first search, Depth-first search, Uniform-cost Search, Bidirectional search algorithm and Depth-limited search. Informed search: - A* Search, best first search. Game Playing: - Minimax algorithm, Alpha – Beta pruning. Classic examples: Tic-Tac-Toe, Water-Jug, 8-Puzzle.	10
Unit 3: Knowledge Representation in AI Knowledge Representation: Introduction to Knowledge, Approaches To Knowledge Representation. Techniques of knowledge representation: Logical representation (Propositional Logic and Predicate logic), Semantic networks, frame representation, Production rules. Normal forms: Disjunctive normal form and Conjunctive normal form. Inference engine: Forward and Backward chaining. Ontologies & Description Logics (OWL/RDF) and knowledge Graphs & Semantic Web (RDF, SPARQL).	8
UNIT-4: - Neural Networks Basic concept of Neural Networks, Typical structure of Neural Networks. Types of Neural Networks: Feedforward Network, Recurrent Network, Convolution Neural Networks. Deep Learning: - Deep Learning in Neural Networks and its application. Activation Functions: Sigmoid, Tanh, ReLU, Leaky ReLU, Softmax Regularization & Generalization: - Overfitting vs. Underfitting: Bias-variance trade-off Techniques: – L1/L2 weight regularization – Dropout	7



- Batch Normalization - Early stopping	
UNIT-5: - Fuzzy Set and Reasoning Fuzzy set, Membership function. Fuzzy operations: Union, Intersection, Complement. Fuzzy Logic: What is fuzzy logic, characteristics of fuzzy logic, architecture of the Fuzzy Logic system. Fuzzy Inference Systems: Mamdani and Sugeno, Defuzzification Techniques and Fuzzy Rule Base Design and Examples. Reasoning: Meaning, Types: Deductive reasoning, Inductive reasoning, Abductive reasoning, Common Sense Reasoning, Monotonic Reasoning and Non-Monotonic Reasoning.	8
UNIT-6: GA and NLP Genetic Algorithm and NLP: Working of Genetic Algorithm, Genetic operator: Selection Operator – Roulette wheel selection, Tournament selection, Rank-based selection, Crossover Operator -One point crossover, Two-point crossover. Mutation Operator. Natural Language Processing: Introduction, working, technology and application of NLP.	7

Reference Books:

1. Artificial Intelligence, 3rd Edition, Elaine Rich, Kevin Knight, S.B. Nair - Tata McGraw Hill.
2. Artificial Intelligence: A Modern Approach Textbook by Peter Norvig and Stuart J. Russell
3. Artificial Intelligence by Patrick Henry Winston - Addison-Wesley, Third Edition.
1. Artificial Intelligence and Intelligent Systems by N.P.Padhy - Oxford University Press.



2. Neural Networks and Learning Machines, 3rd Edition – *Simon Haykin* – Pearson
3. Fuzzy Logic with Engineering Applications – *Timothy J. Ross* – Wiley

Online References :

Online Resources No.	Website address
1	https://nptel.ac.in/courses/106102220
2	https://nptel.ac.in/courses/106105077
3	http://www.digimat.in/nptel/courses/video/106106126/L01.html
4	https://www.geeksforgeeks.org

Evaluation Scheme:							
Assessment	Total Marks	Intended course learning outcomes to be assessed (Please tick as appropriate)					
		CO1	CO2	CO3	CO4	CO5	CO6
ISE	20	√	√	√	√	√	√
MSE	30	√	√	√	√	√	√
ESE	50	√	√	√	√	√	√
Total	100						

Suggestive Formative Assessment Tools/Methods for ISE (Minimum 3 and Max. 5 tools)							
Formative Assessment Tools/Methods	Total Marks	Course Learning Outcomes to be assessed (Please tick as appropriate)					
		CO1	CO2	CO3	CO4	CO5	CO6
Assessment 1 – Class Test (MCQ or Short Answer)	20	√	√		√		



Assessment 2 – Concept Map / Diagram Drawing + Search Problem Solving		√	√	√	√		
Assessment 3 – Open Book Assignment		√				√	√
Assessment 4 – Group Presentation on AI Applications		√			√	√	√
Assessment 5 – Hands-on Lab Task (or Video Submission)			√	√	√		

Course Plan

Course Title: Elective-I -Basics of Data Science	
Course Code: 24MCA2L104	Semester: III
Teaching Scheme L-T-P:3-0-0	Credits: 3
Evaluation Scheme: ISE+MSE Marks:20+20	ESE Marks : 60

Course Description:

This course introduces students to the interdisciplinary domain of Data Science, which integrates computing, statistical modeling, and domain knowledge to extract meaningful insights from structured and unstructured data. Students will learn practical data handling, preprocessing, visualization, statistical analysis, and the



implementation of machine learning models using Python and its data science libraries. Ethical and responsible use of data science in real-world contexts is emphasized throughout.

Course Objectives:

- Understand the role of data in solving real-world problems through analytical thinking.
- Apply data preprocessing techniques using Python libraries.
- Perform exploratory and statistical data analysis.
- Build and evaluate basic machine learning models for prediction and classification.
- Visualize insights through plots and statistical charts.
- Reflect on ethical concerns and responsible use of data.

Course Outcomes (COs):

After successful completion of this course, the students will be able to:

CO1	Describe data science process, roles, and essential tools.
CO2	Clean and transform datasets using Python libraries like Pandas and NumPy.
CO3	Perform statistical analysis and explore data patterns visually and numerically.
CO4	Implement machine learning models using Scikit-learn.
CO5	Evaluate model accuracy and performance using appropriate metrics.
CO6	Discuss ethical, legal and social implications of data usage in real-world applications.

Prerequisites:	Basic Python programming, Statistics, and Linear Algebra
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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):



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COs	Pos												PSOs			BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
C01	3	2					2						3	2		2
C02	3	3	3	3									3	3		3
C03	3	3	2	2									3	2		4
C04	3	3	3	3									3	3		3
C05	3	3	3	3	2								3	3		5
C06	3					3	2				2	2	3	3	2	2



Content	Hours
Unit 1: Introduction to Data Science What is Data Science? Evolution and importance in modern decision-making Components of the data science life cycle: business understanding, data collection, cleaning, analysis, modeling, communication Roles in a data science project: Data Analyst, Data Engineer, Data Scientist, Business Analyst Types of Data: structured, unstructured, semi-structured Overview of data science tools: Python, Jupyter notebook, Google Colab, GitHub, Anaconda Overview of data sources: APIs, web scraping, public datasets (Kaggle, UCI, Data.gov)	7
Unit 2: Preparing Data for Analysis and Modeling Loading data from different sources: CSV, Excel, JSON Introduction to Pandas Dataframes, Handling missing values: imputation detection strategies, Detecting and handling duplicates, Encoding categorical data: label encoding, one-hot encoding Feature scaling: normalization vs standardization Data type conversion and type consistency Feature engineering basics: feature extraction, feature transformation (log, binning)	8
Unit 3 Exploratory Data Analysis Understanding dataset structure: shape, types, missing values, unique values Data summarization: describe (), .info (), .value_counts () Outlier detection using IQR and Z-score Feature-wise data distribution using histograms and box plots Visual EDA with Seaborn (countplot, distplot, pairplot), Feature correlation heatmaps, Detecting skewness, duplicates and imbalance in data	8
Unit 4 Machine Learning Fundamentals	7



Machine learning overview: supervised vs unsupervised learning, Model development process: data splitting, training, testing, Regression: Linear Regression, multiple regression, Classification: K-Nearest Neighbors (KNN), Unsupervised learning: K-Means Clustering, Model implementation using Scikit-learn, using pipelines for preprocessing and modeling, introduction to bias-variance tradeoff	
Unit 5 Model Evaluation and Optimization Classification matrix: Accuracy, Precision, recall, F1-score, confusion matrix, ROC curve and AUC, Regression metrics: MAE, MSE, RMSE, R^2 score Cross- validation, K-fold, Overfitting vs Underfitting, Introduction to basic hyperparameter tuning (GridSearchCV), Model comparison using metrics	7
Unit 6 Ethics, Responsibility and Case Studies Ethical challenges in data science: privacy, data leaks, consent, Fairness and bias in algorithms, Transparency, accountability, and explainability, Role of laws: GDPR, IT Act (India), Responsible AI, Case studies: healthcare diagnosis, credit scoring, recommendation systems, fraud detection	7

Reference Books:

1. Joel Grus, *Data Science from Scratch*, 2nd Edition, O'Reilly Media
2. Wes McKinney, *Python for Data Analysis*, 2nd Edition, O'Reilly Media
3. Jake VanderPlas, *Python Data Science Handbook*, O'Reilly Media
4. Anuradha Bhasin, *Data Science and Machine Learning using Python*, Wiley India

Online References:

Online Resources No.	Website address
1	https://www.kaggle.com/learn
2	https://scikit-learn.org/
3	https://pandas.pydata.org/
4	https://seaborn.pydata.org/



Evaluation Scheme:							
Assessment	Total Marks	Intended course learning outcomes to be assessed (Please tick as appropriate)					
		CO1	CO2	CO3	CO4	CO5	CO6
ISE	20	√	√	√	√	√	√
MSE	20	√	√	√	√	√	√
ESE	60	√	√	√	√	√	√
Total	100						

Suggestive Formative Assessment Tools/Methods for ISE (Minimum 3 and Max. 5 tools)							
Formative Assessment Tools/Methods	Total Marks	Course Learning Outcomes to be assessed (Please tick as appropriate)					
		CO1	CO2	CO3	CO4	CO5	CO6
Assessment 1 – Class Test/ Unit Test	40	√	√	√	√	√	√
Assessment 2 – Development of unsupervised machine learning problem		√	√	√	√	√	√
Assessment 3 – Development of unsupervised machine learning problem		√	√	√	√	√	√
Assessment 4 – Viva Voce / Oral		√	√	√	√	√	√
Assessment 5 – Portfolio Submission		√	√	√	√	√	√

Course Plan

Course Title: Elective-I –Basics of Machine Learning	
Course Code: 24MCA2L104	Semester: III
Teaching Scheme L-T-P:3-0-0	Credits: 3



Evaluation Scheme: ISE+MSE Marks:20+20

ESE Marks : 60

Course Description:

This course introduces students to the basics of machine learning and its applications. It covers techniques like regression, classification, clustering, and model evaluation. Students will explore how machines learn from data and use Python-based tools to implement simple models.

Course Objectives:

- To introduce students to machine learning fundamentals, types of learning, and the overall flow of Machine learning.
- To help students understand regression algorithms for prediction tasks and evaluate their performance.
- To understand the principles of classification and how to evaluate classification model performance.
- To introduce unsupervised learning techniques such as clustering and dimensionality reduction.
- To explain techniques for evaluating and improving machine learning model performance through validation and tuning.
- To expose real-world applications of machine learning and introduce them to commonly used tools and platforms.

Course Outcomes (COs):

After successful completion of this course, the students will be able to:

CO1	Explain the types of machine learning and outline the steps involved in building a machine learning model.
CO2	Apply linear and polynomial regression models to real-world datasets and assess accuracy using error metrics.
CO3	Build classification models using logistic regression, decision trees, or k-NN and interpret results using confusion matrices.
CO4	Apply K-Means and Hierarchical Clustering to group data and use PCA for reducing feature dimensions.
CO5	Perform cross-validation and adjust hyperparameters to optimize model accuracy and avoid overfitting.



CO6	Implement end-to-end machine learning solutions using Scikit-learn or similar tools on real datasets.
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Prerequisites:	Basic programming knowledge, statistics, and logic
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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	Pos												PSOs			BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1	3	2	1	1			2						3			2
CO2	3	3	2	2									3			3
CO3	3	3	3	2									3			3
CO4	3	3	3	3									3	2		4
CO5	3	3	3	3	2		2						3	3		5
CO6	3	3	3	3	2		3	1		1			3	3	2	6



Content	Hours
Unit 1: Introduction to Machine Learning Definition and goals of Machine Learning, Types: Supervised, Unsupervised, Reinforcement Learning, Real-world applications in healthcare, finance, and education, Overview of machine learning workflow: data collection to prediction, Introduction to datasets and basic ML tools	8
Unit 2: Data Preparation and Visualization Data cleaning and handling missing values, Data normalization and standardization, Feature selection and encoding techniques, Splitting data into training and testing sets, Data visualization techniques for analysis	8
Unit 3: Regression Techniques Linear regression: simple and multiple, Polynomial regression: curve fitting, Regularization: basic idea of Ridge and Lasso, measuring model accuracy using Mean Squared Error and R^2 , Applications in forecasting and trend prediction	8
Unit 4: Classification Techniques Logistic Regression and Decision Trees, k-Nearest Neighbors (k-NN), Evaluation metrics: Confusion Matrix, Precision, Recall, F1-Score, Binary and multi-class classification problems, Practical examples: spam detection, student performance prediction	8
Unit 5: Unsupervised Learning Introduction to clustering: K-Means, Hierarchical clustering: dendrograms and grouping, Dimensionality reduction: concept of PCA, Use cases in customer segmentation, behavior analysis, Visualizing clusters and interpreting groups	6
Unit 6: Model Tuning and Use Cases	7



Overfitting and underfitting: causes and remedies, Cross-validation techniques, Basics of hyperparameter tuning, Case studies of real-life ML applications, Introduction to deploying simple machine learning models

Reference Books:

1. Tom M. Mitchell, *Machine Learning*, 1st Edition, McGraw-Hill, 1997.
2. Ethem Alpaydin, *Introduction to Machine Learning*, 4th Edition, MIT Press, 2020.
3. Aurélien Géron, *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*, 3rd Edition, O'Reilly Media, 2022.
4. Christopher M. Bishop, *Pattern Recognition and Machine Learning*, Springer, 2006.
5. Trevor Hastie, Robert Tibshirani, Jerome Friedman, *The Elements of Statistical Learning*, 2nd Edition, Springer, 2009.
6. Shai Shalev-Shwartz & Shai Ben-David, *Understanding Machine Learning: From Theory to Algorithms*, Cambridge University Press, 2014.

Online References:

Online Resources No.	Website address
1	https://developers.google.com/machine-learning/crash-course
2	https://scikit-learn.org/stable/user_guide.html
3	https://www.kaggle.com/learn/intro-to-machine-learning



4	https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-036-introduction-to-machine-learning-fall-2020/
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Evaluation Scheme:							
Assessment	Total Marks	Intended course learning outcomes to be assessed (Please tick as appropriate)					
		CO1	CO2	CO3	CO4	CO5	CO6
ISE	20	√	√	√	√	√	√
MSE	20	√	√	√	√	√	√
ESE	60	√	√	√	√	√	√
Total	100						

Suggestive Formative Assessment Tools/Methods for ISE (Minimum 3 and Max. 5 tools)							
Formative Assessment Tools/Methods	Total Marks	Course Learning Outcomes to be assessed (Please tick as appropriate)					
		CO1	CO2	CO3	CO4	CO5	CO6
Assessment 1 – Class Test/ Unit Test	40	√	√	√	√	√	√
Assessment 2 – Development of unsupervised machine learning problem		√	√	√	√	√	√
Assessment 3 – Development of unsupervised machine learning problem		√	√	√	√	√	√
Assessment 4 – Viva Voce / Oral		√	√	√	√	√	√
Assessment 5 – Portfolio Submission		√	√	√	√	√	√



Course Plan

Course Title: Mobile Application Development	
Course Code: 24MCA2P105	Semester: III
Teaching Scheme: L-T-P: 2-0-4	Credits: 4
Evaluation Scheme: IPE Marks:40	EPE Marks: 60

Course Description:

This course is designed to introduce students to the fundamentals of mobile application development with a focus on the Android platform. Students will explore the architecture and components of the Android operating system, learning how to set up the development environment and create functional Android applications. Through a combination of theoretical concepts and practical hands-on experience, students will gain proficiency in designing user interfaces, managing data storage, handling user interactions, and integrating services and broadcast receivers within Android applications.

Course Objectives:

1. To understand the fundamentals and evolution of mobile application development.
2. To learn the architecture and core components of the Android operating system.
3. To develop user interfaces and handle user interactions in Android applications.
4. To explore Android services, broadcast receivers, and their practical applications.
5. To design and use menus and dialog boxes for improved user experience.
6. To implement data storage and management solutions in Android applications.

Course Outcomes(COs):

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



CO1	Understand the history, versions, and architecture of the Android operating system.
CO2	Develop applications using Android's core components like activities, intents, services, and broadcast receivers.
CO3	Design user-friendly interfaces using various Android UI components and layouts.
CO4	Utilize menus, dialog boxes, and notifications to enhance the user experience.
CO5	Develop applications using services, and broadcast receivers.
CO6	Implement data storage solutions using SQLite databases and Shared Preferences.

Prerequisites:

Basic programming skills in Java, Understanding of object-oriented programming principles, Familiarity with basic concepts of databases and data storage.

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs			BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1	2	1	-	1	-	-	2	-	-	-	-	1	1	2	2	2
CO2	2	2	2	2	-	-	2	-	-	2	-	-	2	2	2	6
CO3	-	1	2	2	-	-	2	2	-	2	-	1	1	2	2	6
CO4	-	1	1	2	-	-	2	2	-	2	-	1	1	2	2	3
CO5	1	2	2	2	-	-	2	-	-	2	-	-	2	2	2	6
CO6	1	2	2	2	-	-	2	-	-	2	-	-	2	2	2	3

Content	Hours
Unit 1: Introduction to Mobile Application Development Overview of Mobile Applications, Introduction to Android: History, Versions, Android Architecture and Components, Android Project Structure, setting up Android Development Environment: Introduction to Android Studio, Android	8



SDK Overview, and Emulator, Building First Android Application, Understanding the Android Manifest File.	
Unit 2: Building Blocks of Android Application Components: Activities, Activity lifecycle, Intents, Services, Content Providers, Broadcast Receivers, Fragments and Fragment Lifecycle, Passing data between activities.	7
Unit 3: Designing Android UI Understanding Android UI Components: TextView, EditText, Button, ImageView, etc., Layouts and Its Types, Layout Attribute, working with Views, Event Handling and Listeners.	8
Unit 4: Handling Menus and Dialog Boxes Menus: Designing menu in XML, Options Menu, Context Menu, Popup Menu, Dialogs: AlertDialog, ProgressDialog, Custom Dialogs,	7
Unit 5: Android Services and Broadcast Receivers Broadcast Receivers. What are Broadcast Receivers. Implementing broadcast receiver. System broadcasts and how to use them. Intent Filters.	7
Unit 6: Data Storage and Persistence Data Storage- Shared Preference, Internal And External Storage Storing Data Using SQLite Databases, Introducing SQLite, SQLiteOpenHelper and creating a database, SQLite Database: CRUD Operations, Content Provider	8

Reference Books:

1. *Android Programming: The Big Nerd Ranch Guide* by Bill Phillips, Chris Stewart, and Kristin Marsicano, Big Nerd Ranch, 2019.



2. *Head First Android Development: A Brain-Friendly Guide* by Dawn Griffiths and David Griffiths, O'Reilly Media, 2017.
3. *Professional Android* by Reto Meier and Ian Lake, Wrox, 2022.
4. *Fundamentals of Android App Development*: by Sujit Kumar Mishra, BPB Publications, 2020.
5. *Mobile App Development - Android Programs Using Eclipse Indigo*: by S.Sydhani Begum, 2019.
6. *Android App Development for Dummies*: by Michael Burton, 2015.

Online Resources:

Online Resources		Website address						
No.								
Evaluation Scheme:		https://developer.android.com/						
Assessment 2	Total Marks	Intended course learning outcomes to be assessed						
		https://youtu.be/EOfCEh1P838 (Please tick as appropriate) TDazUK						
		CO1	CO2	CO3	CO4	CO5	CO6	
IPE	3	40	https://www.youtube.com/playlist?list=PL2F07DBCDCC01493A	✓	✓	✓	✓	✓
ESPE	60	3A	✓	✓	✓	✓	✓	✓
Total	100							
4		https://www.geeksforgeeks.org/android/android-tutorial/						
5		https://abhiandroid.com/#gsc.tab=0						
6		https://www.tutorialspoint.com/android/index.htm						

Suggestive Formative Assessment Tools/Methods for IPE (Minimum 3 and Max. 5 tools)							
Formative Assessment Tools/Methods	Total Marks	Course Learning Outcomes to be assessed (Please tick as appropriate)					
		CO1	CO2	CO3	CO4	CO5	CO6
Assessment 1 – Lab Assignments	40	✓	✓	✓	✓	✓	✓
Assessment 2 – Mini Project		✓	✓	✓	✓	✓	✓
Assessment 3 – Quizzes		✓	✓	✓	✓	✓	✓



Assessment 4 – Oral Viva		√	√	√	√	√	√
Assessment 5 – Midterm Practical Test		√	√	√			

Course Plan

Course Title: Advanced Java	
Course Code: 24MCA2P106	Semester: III
Teaching Scheme: L-T-P : 2-0-4	Credits:4
Evaluation Scheme: IPE Marks: 40	EPE Marks : 60

Course Description:

This course provides in-depth knowledge of advanced Java technologies essential for building robust, scalable, and dynamic applications. It builds upon core Java concepts and introduces students to enterprise-level programming components such as **Swing GUI, Event Handling, JDBC (Java Database Connectivity), Servlets, JSP (Java Server Pages), Spring Boot, and Remote Method Invocation (RMI)**. Students will learn how to develop desktop applications, dynamic web applications, RESTful services, and distributed applications using advanced Java features.

Course Objectives:

- **Develop GUI-based applications** using Swing and effectively implement event handling mechanisms in Java.
- **Design and build dynamic web applications** using Servlets, JSP, and JDBC for database connectivity and CRUD operations.
- **Create modern RESTful web services and distributed applications** using Spring Boot and Java RMI.

Course Outcomes (COs):

On Successful completion of course student will be able to:

CO1	Understand the fundamental concepts of Swing, JDBC, Servlets, JSP, Spring Boot, and RMI in Java development.
CO2	Design and implement interactive GUI applications using Java Swing and apply



	appropriate event-handling mechanisms.
CO3	Connect Java applications to relational databases using JDBC and perform CRUD operations effectively.
CO4	Develop dynamic web applications using Java Servlets and JSP , including form processing and session management.
CO5	Evaluate the suitability and performance of Spring Boot frameworks in building RESTful services and full-stack web applications.
CO6	Design and create distributed Java applications using RMI and develop CRUD-based web systems using Spring Boot and Thymeleaf.

Prerequisite	Basic Knowledge of Core Java
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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs			BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1	3	-	3	2	-	-	-	-	-	-	-	-	-	-	-	6
CO2	3	3	2	-	-	-	-	-	-	-	-	-	-	-	-	3
CO3	3	2	3	3	-	-	-	-	-	-	-	-	-	-	-	6
CO4	3	3	3	3	-	-	-	-	-	-	-	-	1	-	-	6
CO5	3	3	3	3	-	-	-	-	-	-	-	-	1	-	-	6
CO6	3	3	3	3	-	-	-	-	-	-	-	-	1	-	-	6

Content	Lectures
UNIT I: Swing & Event Handling Swing: Need for swing components, Difference between AWT and swing, Components hierarchy, Swing components: JFrame, JLabel, JTextField and JPasswordField, JTextArea, JButton, JCheckBox, JRadioButton, JCombo Box , JList, JMenu ,JtabbedPane , JScrollBar , JColorchooser, JFile Chooser, JTable, Dialogs (Message, confirmation, input) etc. Layouts: Flow Layout, Grid Layout, Border Layout, Card Layout.	8



Event Handling: Event-Delegation-Model, Events, Event classes: Mouse Event Class, Action Event Class, Key Event Class, Window Event Class, Text Event Class, MouseMotionEvent class. Event listener interfaces: Mouse Listener, Action Listener, Window Listener, Key Listener, MouseMotion Listener, Focus Listener. Lab Exercise: 1. Create a login form using JFrame, JLabel, JTextField, JPasswordField, and JButton. On clicking the button, verify hardcoded username and password and display appropriate message. 2. Design a registration form using JTextArea, JCheckBox, JRadioButton, JComboBox, and JList. Display the entered data on a new panel or dialog. 3. Design a GUI that uses FlowLayout, GridLayout, BorderLayout, CardLayout. 4. Write a program that uses event listeners (MouseListener, KeyListener, ActionListener) to capture and print event details. 5. Create a UI with multiple tabs using JTabbedPane, where each tab contains different form elements.	
Unit II: JDBC What is JDBC? Steps for connectivity between Java program and database, Type of drivers, Making the Connection, Statement, PreparedStatement, ResultSet, Simple program-database operations like creating tables, CRUD(Create, Read, Update, Delete) operations using SQL. Lab Exercise: 1. Write a Java program to connect to a MySQL database using JDBC and print a connection success message. 2. Create a menu-driven CLI application to perform CRUD operations on a student table.	8
Unit III: Servlet Introduction of servlet, Uses of servlet, Life cycle of servlet, Execution process of Servlet Application, Servlet API: packages- javax.servlet and javax.servlet.http, Session Tracking Mechanisms, Servlet and JDBC. Lab Exercise:	7



1. Create an HTML form and use a servlet to process user input and display it on the response page. 2. Write a servlet that uses: Session Tracking using cookies and HttpSession to store and retrieve user data. 3. Build a small application using Servlet + JDBC to insert and display records.	
Unit IV: JSP Introduction to JSP, Components of JSP Directives, Tags, Scripting Elements, Execution process of JSP Application, building a simple application using JSP, JSP with Database, JSP v/s Servlet Lab Exercise: 1. Create a registration form (HTML) and process the data using JSP to display entered values. 2. Create a simple JSP-based CRUD application.	8
Unit-V: Modern Web Applications using Spring Boot Introduction to Spring Framework and Spring Boot, Spring Boot Architecture and Project Setup, Creating RESTful Web Services with Spring Boot, Spring Boot MVC and Template Integration, Building a Simple CRUD Application, Spring Boot DevTools and Application Deployment. Lab Exercise: 1. Create a basic Spring Boot application that displays "Welcome to Spring Boot" on a browser. 2. Create a RESTful API with endpoints: 3. Use Spring Boot MVC to create a web form for student details and display submitted data on another page using Thymeleaf.	7
Unit VI: Remote Method Invocation (RMI) Remote Method Invocation (RMI) –Introduction, architecture, Working of RMI application, RMI registry, defining remote objects, creating stubs and skeleton, RMI activation, registering remote objects. Lab Exercise: 1. Create a simple RMI application that returns "Hello from RMI Server" when called	7



from the client.	
2. Implement a Calculator application using RMI that can perform add, subtract, multiply, and divide.	
3. Write an RMI program where multiple clients can access the same remote object.	

Reference Books:

1. Java 2 Complete Reference - (Tata McGraw Hill)
2. Herbert Schildt, Java2: The Complete Reference, Tata McGraw-Hill
3. Java server pages
4. Java 2EE – Ivan Bayross (PHI)
5. Java 2 Black Book –(DreamTech)

Online References:

Online Resources No.	Website address
1	https://archive.nptel.ac.in/courses/106/105/106105191
2	https://onlinecourses.nptel.ac.in/noc22_cs47
3	https://www.udemy.com/course/java-programming-complete-beginner-to-advanced/?couponCode=IND21PM

Evaluation Scheme:

Assessment	Total Marks	Intended course learning outcomes to be assessed (Please tick as appropriate)					
		CO1	CO2	CO3	CO4	CO5	CO6
IPE	40	√	√	√	√	√	√
EPE	60	√	√	√	√	√	√
Total	100						



Suggestive Formative Assessment Tools/Methods for IPE (Minimum 3 and Max. 5 tools)							
Formative Assessment Tools/Methods	Total Marks	Course Learning Outcomes to be assessed (Please tick as appropriate)					
		CO1	CO2	CO3	CO4	CO5	CO6
Assessment 1 – Assignments / Mini Tasks	40	√	√				
Assessment 2 – Practical / Lab Performance		√	√	√			
Assessment 3 – Project / Mini Project		√	√	√	√	√	
Assessment 4 – Viva / Oral Examination		√	√	√	√	√	
Assessment 5 – Portfolio Submission		√	√	√	√	√	√

Course Plan

Course Title: Foreign Language	
Course Code : 24MCA2L108	Semester: III
Teaching Scheme:L-T-P: 2-0-0	Credits:2
Evaluation Scheme : ISE1+ISE2 Marks :25+25	ESE Marks: -50

Course Description:

This course introduces beginners to the German language. Students will learn the basics of communication in German including grammar, vocabulary, and pronunciation for everyday contexts. The course emphasizes practical usage through listening, speaking, reading, and writing exercises.

Course Objectives:

- Develop an understanding of German vocabulary and phrases.



- Build basic conversational and listening skills.
- Understand and use common grammatical structures.
- Familiarize with German-speaking culture and customs.

Course Outcomes (COs):

CO1	Recognize and apply everyday German vocabulary.
CO2	Introduce oneself and interact in basic conversations.
CO3	Understand simple grammar rules (articles, verbs, sentence structure).
CO4	Read and write basic German phrases and sentences.

Prerequisite: Importance of Environment

Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs										PSOs			
	1	2	3	4	5	6	7	8	9	10	1	2	3	4
CO1	2						1	-	1	-	-	-	-	
CO2	2						2	-	1	-	-	-	-	
CO3	2						2	-	1	-	-	-	-	
CO4	2						2	-	1	-	-	-	-	
CO5	2						2	-	1	-	-	-	-	

Content	Hours
Unit 1: Greetings, introductions, German alphabet, and numbers. Days of the week, months, telling time, basic questions, Family and personal information, professions, possessives.	7
Unit 2: Daily activities, hobbies, regular verb conjugation, Food and drink, shopping phrases, polite expressions, Describing people and objects, basic adjectives.	7



Unit 3: Directions, locations, places in the city, Transportation vocabulary, asking for and giving directions, Health and body parts, expressing ailments	8
Unit 4: Making plans, future expressions with "werden", Mini dialogues and practical conversation practice. Revision, vocabulary quiz, and oral conversation test.	8

Reference Books:

- Netzwerk A1 – Deutsch als Fremdsprache
- Schulz-Griesbach – Deutsch als Fremdsprache, Grundstufe

Online References:

Online Resources No.	Website address
1	Goethe-Institut Practice Site
2	NPTEL German-I Course
3	Duolingo – Learn German Free
4	Deutsche Welle – Learn German A1

Evaluation Scheme:							
Assessment	Total Marks	Intended course learning outcomes to be assessed (Please tick as appropriate)					
		CO1	CO2	CO3	CO4	CO5	
ISE1	20	√	√				
ISE2	30	√	√	√	√	√	
Total	50						



Suggestive Formative Assessment Tools/Methods for ISE

(Minimum 3 and Max. 5 tools)

Formative Assessment Tools/Methods	Total Marks	Course Learning Outcomes to be assessed (Please tick as appropriate)					
		CO1	CO2	CO3	CO4	CO5	
Assessment 1 – Multiple Choice Based	50	√	√				
Assessment 2 – Review vocabulary, grammar recap				√			
Assessment 3 – interactive speaking test.		√					
Assessment 4 – Field or Desk Project / application based / Term paper or Report writing		√				√	
Assessment 5 – Any applicable assessment method to Computer Application in relevance of course outcome(s).			√		√	√	



**SCHOOL of ENGINEERING
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KASABA BAWADA, KOLHAPUR
Approved by AJCTE, New Delhi

Constituent Unit of
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SEMESTER - IV



Course Plan

Course Title: Software Testing & Quality Assurance	
Course Code : 242MCA2L110	Semester: IV
Teaching Scheme:L-T-P:3-0-0	Credits:3
Evaluation Scheme: ISE+MSE Marks:20+20	ESE Marks : 60

Course Description:

This course introduces concepts & importance of testing . It also provides deeper insights into software testing life cycle & testing process. . This course will help students to learn about different testing strategies . It also help students to aware risk management techniques.

Course Objectives:

- Understanding Software Testing Principles
- Learning Testing Methodologies
- Developing Test Strategies and Plans

Course Outcomes (COs):

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



CO1	To understand characteristics & importance of testing
CO2	To understand software testing life cycle & software testing process.
CO3	To analyze different software strategies
CO4	To aware different software techniques.
CO5	To analyze and understand testing of client –server architecture
CO6	To analyze different types of risk management

Requisite :	Basic Knowledge of Software Engineering
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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs			BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1	2	1	2	2	1	-	-	1	1	-	1	-	2	-	1	2
CO2	2	1	3	2	1	-	1	-	-	-	-	-	2	-	-	2
CO3	2	3	3	2	1	-	-	-	-	-	-	-	3	-	-	4
CO4	2	3	3	2	1	-	-	-	-	-	-	-	3	1	-	4
CO5	2	3	3	2	1	-	-	-	-	-	-	-	3	-	-	5
CO6	2	3	3	2	1	-	-	1	1	-	1	-	-	1	1	5



Content	Hours
Unit 1: Introduction to Testing: 1.1 Introduction : Why, When and How Testing, Importance of Testing. Testing goals and characteristics, 1.2 Testing during planning stage, Testing during design stage, Testing during coding stage.	6
Unit 2: Software Testing Lifecycle & Software Testing Process: 2.1 Overview of STLC, Principles of Verification and Validation, Techniques of verification (review, inspections, walkthroughs), 2.2 V testing model : Software development V & V, Software acquisition V & V, Software supply V & V 2.3 Software Testing Process: Testing process: a) Plan b) Develop c) Execute d) Manage Conventional Software Architectures.	7
Unit 3: Software Testing Strategies: 3.1 Test strategies for conventional software : a) Unit Testing b) Integration Testing : i) Top-Down Integration ii) Bottom-Up Integration iii) Regression Testing iv) Smoke Testing v) Integration test documents c) Validation Testing a. Test Criteria b. Configuration Review c. Alpha and Beta Testing d) System Testing i) Recovery Testing ii) Security Testing iii) Stress Testing iv) Performance Testing 3.2 Difference between Testing and Debugging,	8



3.3 The Art of Debugging a) Debugging Process b) Debugging strategies c) Correcting the Error.	
Unit 4: Software Testing Techniques: 4.1 Overview of Black-Box and White-Box Testing, 4.2 Methods of White-box Testing: a) Basis Path Testing i) Flow Graph Notation ii) Independent Program Paths iii) Deriving Test Cases iv) Graph Matrices b) Control Structure Testing i) Conditional Testing ii) Data Flow Testing iii) Loop Testing - Simple Loops - Nested Loops - Concatenated Loop 4.3 Methods of Black-Box Testing: a) Graph Based Testing b) Equivalence Partitioning c) Boundary Value Analysis d) Orthogonal Array Testing	8
Unit 5: Testing of client server architecture & Real time system 5.1 Testing of client/server Architectures, Testing Documentation and Help Facilities, 5.2 Testing for Real-Time Systems: a) Task Testing b) Behavioral Testing c) Intertask Testing d) System Testing 5.3 Testing Patterns: Pair Testing, Separate Test Interface, Scenario Testing	8



Unit 6: Risk Management: Introduction and Characteristics of Risks, Role of Testing in Risk Management, Types of Risks: Project Risks a) Technical Risks b) Business Risks c) Predictable Risks d) Unpredictable Risks	8

Reference Books:

1. Software Engineering by Roger S. Pressman
2. Software Testing Principles And Practices by Srinivasan Desikan and Gopalaswamy
3. Anirban Basu , "Software Quality Assurance, Testing & Matrices", PHI,
4. Sunil Khilari, "Software Testing And Quality Assurance", Everest Pub House,
5. Renu Rajani and Pradeep Oak, "Software Testing "



Online References :

Online Resources No.	Website address
1	https://nptel.ac.in/courses/106105150
2	https://www.classcentral.com/course/swayam-software-testing-14295
3	https://www.nptelvideos.com/software_engineering/software_engineering_video_lectures.php

Evaluation Scheme:

Assessment	Total Marks	Intended course learning outcomes to be assessed (Please tick as appropriate)					
		CO1	CO2	CO3	CO4	CO5	CO6
ISE	20	√	√	√	√	√	√
MSE	20	√	√	√			
ESE	60	√	√	√	√	√	√
Total	100						

Assessment Tools / Methods	Total Marks	CO1	CO2	CO3	CO4	CO5	CO6
Assessment 1 – Introduction to Testing (importance, goals, testing during SDLC stages)	10	✓					
Assessment 2 – Software Testing Lifecycle & Testing Process (STLC, V-Model, Verification & Validation)	10		✓				
Assessment 3 – Software Testing Strategies (Unit, Integration, Validation, System Testing, Debugging)	10			✓			
Assessment 4 – Software Testing Techniques (Black-Box & White-Box Testing Methods)	10				✓		
Assessment 5 – Testing of Client-Server Architecture & Real-Time Systems (Testing Patterns, Documentation)	10					✓	
Assessment 6 – Risk Management (Types of Risks, Role of Testing in Risk Management)	10						✓

Course Plan

Course Title: Full Stack Development



Course Code: 242MCA2P111	Semester: IV
Teaching Scheme: L-T-P:2-0-4	Credits:3
Evaluation Scheme: IPE1+IPE Marks:20+20	EPE Marks: 60

Course Description:

This course provides a comprehensive introduction to full stack web development, covering both front-end and back-end technologies. Students will learn to design, build, and deploy dynamic web applications. The course emphasizes practical skills and project-based learning.

Course Objectives:

- To understand the fundamental concepts of front-end and back-end development.
- To gain proficiency in designing and developing responsive web applications.
- To learn the integration of front-end and back-end technologies.
- To acquire skills in using databases for dynamic web applications.
- To develop and deploy full stack applications in a real-world environment.

Course Outcomes(COs):

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

CO1	Demonstrate an understanding of front-end development technologies.
CO2	Develop responsive web pages using HTML, CSS, and JavaScript.
CO3	Implement server-side programming and APIs using Node.js or similar technologies.
CO4	Utilize databases effectively in web applications.
CO5	Integrate front-end and back-end components to create full stack applications.
CO6	Deploy and manage web applications on cloud platforms.

Prerequisites:	Basic knowledge of programming languages such as JavaScript, Understanding of web technologies like HTML and CSS, Familiarity with databases.
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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs			BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1	3	-	-	2	-	-	1	1	-	-	-	-	2	-	-	3
CO2	3	-	3	2	-	-	1	-	-	-	-	-	2	-	-	3
CO3	3	3	3	2	-	-	-	-	-	-	-	-	3	1	-	3
CO4	3	2	3	2	-	-	-	-	-	-	-	-	3	1	-	4
CO5	3	3	3	3	1	-	-	-	-	-	-	-	3	2	-	4
CO6	3	-	3	3	-	-	2	1	-	-	2	-	3	1	1	5



Content	Hours
Unit 1: Introduction to Full Stack Development Overview of Full Stack Development, Understanding Front-end, Back-end, and Databases, Tools and Technologies used in Full Stack Development, Setting up Development Environment, Version Control with Git and GitHub	6
Unit 2: Front-End Development HTML5: Structure of Web Pages, CSS3: Styling Web Pages, JavaScript: Client-Side Scripting, Responsive Design with Bootstrap, Introduction to Front-End Frameworks (React, Angular, or Vue.js)	8
Unit 3: Back-End Development Introduction to Server-Side Programming, Node.js and Express.js Framework, Building RESTful APIs, Middleware and Routing, Authentication and Authorization	8
Unit 4: Databases and Data Storage Introduction to Databases, SQL vs NoSQL Databases, Working with MongoDB, Integrating Databases with Node.js, Data Modeling and Schema Design	7
Unit 5: Integration of Front-End and Back-End Introduction to Software Testing, Types of Testing (Unit, Integration, System, Acceptance), Testing Strategies and Techniques, Test Case Design, Software Maintenance Types and Importance, Maintenance Process and Issues	8
Unit 6: Deployment and Project Work Introduction to Cloud Services (AWS, Heroku, etc.), Deployment of Web Applications, Continuous Integration and Continuous Deployment (CI/CD), Project Work: Developing a Full Stack Application, Presentation and Evaluation of Projects	8

Reference Books:

1. Full-Stack Web Development with Vue.js and Node by Aneeta Sharma - 2020



2. Pro MERN Stack: Full Stack Web App Development with Mongo, Express, React, and Node by Vasana Subramanian - 2019
3. Learning React: Modern Patterns for Developing React Apps by Alex Banks and Eve Porcello - 2020
4. Node.js Design Patterns by Mario Casciaro and Luciano Mammino - 2019
5. MongoDB: The Definitive Guide by Shannon Bradshaw, Eoin Brazil, and Kristina Chodorow - 2019

Online References:

Online Resources No.	Website address
1	https://www.w3schools.com/
2	https://github.com/bmorelli25/Become-A-Full-Stack-Web-Developer
3	https://www.coursera.org/courses?query=full%20stack%20web%20development

Evaluation Scheme:					
Assessment	Total Marks	Intended course learning outcomes to be assessed (Please tick as appropriate)			
		CO1	CO2	CO3	CO4
IPE	40	√	√	√	√
EPE	60	√	√	√	√
Total	100				

Assessment Tools / Methods	Total Marks	CO1	CO2	CO3	CO4	CO5	CO6
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Assessment 1 – Introduction to Full Stack Development (Overview, Front-end, Back-end, Tools, Git & GitHub)	40	✓					
Assessment 2 – Front-End Development (HTML, CSS, JavaScript, Bootstrap, Front-End Frameworks)			✓				
Assessment 3 – Back-End Development (Node.js, Express.js, RESTful APIs, Middleware, Authentication)				✓			
Assessment 4 – Databases and Data Storage (SQL vs NoSQL, MongoDB, Data Modeling, Integration)					✓		
Assessment 5 – Integration of Front-End and Back-End (Testing, Maintenance, Test Case Design, Process)						✓	
Assessment 6 – Deployment and Project Work (Cloud Deployment, CI/CD, Full Stack Project Evaluation)							✓



Course Plan

Course Title: Machine Learning -II	
Course Code: 242MCA2L112	Semester:IV
Teaching Scheme:L-T-P:3-0-0	Credits: 3
Evaluation Scheme: ISE+MSE Marks:20+20	ESE Marks : 60

Course Description:

This course introduces basic concepts and working mechanism of machine learning. It provides deeper insights into multilayer network and recommendation system. This course will help the students to understand the concepts of evolutionary learning , reinforcement learning & dimensionality reduction.

Course Objectives:

- Get familiar with machine learning concepts.
- Study of different types of multilayer network & ensemble learning.
- To study evolutionary learning & reinforcement learning.

Course Outcomes (COs):

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

CO1	Understand basic concepts of Artificial neural network
CO2	Understand working mechanism of Multilayer network
CO3	Understand working mechanism of Ensemble learning and recommendation system
CO4	Analyze working mechanism of evolutionary learning and reinforcement learning
CO5	Analyze working nature of Dimensionality Reduction
CO6	Analyze application of machine learning

Requisite :	Basic Knowledge of Machine Learning
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Course Articulation Matrix: Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

COs	POs												PSOs			BTL
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
CO1	3	2	2	2	-	-	-	-	-	-	-	-	2	-	-	2
CO2	3	3	3	3	-	-	-	-	-	-	-	-	3	-	-	2
CO3	3	-	3	3	-	-	-	-	-	-	-	-	3	-	-	2
CO4	3	-	3	3	-	-	-	-	-	-	-	-	3	-	-	4
CO5	3	-	3	3	-	-	-	-	-	-	-	-	3	-	-	4
CO6	3	-	3	3	-	-	-	-	-	-	-	-	3	-	-	4



Content	Hours
Unit 1 Artificial Neural Network Artificial Neural Network : The brain and the Neuron- Hebb's rule, McCulloch and Pits Neurons, Perceptron – Representational Power of Perceptrons ,The Perceptron Training Rule, Gradient Decent and Delta Rule, Mutlilayer Perceptron algorithm	6
Unit 2 : Multilayer Network Feed forward Network- Multilayer networks and Back Propagation algorithm : The Differentiable Threshold Unit, The Back propagation Algorithm	7
Unit 3 : Ensemble learning and Recommendation system Boosting-AdaBoost, stumping, Bagging: subbagging, Introduction to Recommendation systems	7
Unit 4 : Introduction to Evolutionary Learning and Reinforcement Learning Genetic Algorithm- Representing Hypothesis, Genetic Operators Fitness Function and Selection, Genetic Programming – Representing Programs , Illustrative Examples, Introduction of Reinforcement Learning	8
Unit 5 : Dimensionality Reduction Linear Discriminant Analysis Principal Component Analysis , Introduction of optimization	7
Unit 6 : Applications of Machine Learning	10



Introduction to application of Machine Learning, Image Processing and Pattern Recognition, Application in Bio- informatics, Application in Digital Forensics, Application in retails and finance.

References :

1. Machine Learning – An Algorithmic Perspective by Stephen Marsland.
2. Machine Learning by Tom M. Mitchell, International Edition 1997, McGraw Hill Education

Online Resources:

Online Resources No.	Website address
1	https://livebook.manning.com/book/machine-learning-in-action/about-this-book/
2	https://www.coursera.org/learn/machine-learning https://nptel.ac.in/courses/10610613

Evaluation Scheme:					
Assessment	Total Marks	Intended course learning outcomes to be assessed (Please tick as appropriate)			
		CO1	CO2	CO3	CO4
IPE	40	√	√	√	√
EPE	60	√	√	√	√
Total	100				

Assessment Tools / Methods	Total Marks	CO1	CO2	CO3	CO4	CO5	CO6
Assessment 1 – Artificial Neural Network (Brain and Neuron, Hebb's Rule, Perceptron, Delta Rule, MLP)	40	✓					



Algorithm)						
Assessment 2 – Multilayer Network (Feed Forward Network, Backpropagation Algorithm, Differentiable Threshold Unit)		✓				
Assessment 3 – Ensemble Learning and Recommendation System (Boosting, Bagging, Stumping, Recommendation Systems)			✓			
Assessment 4 – Evolutionary and Reinforcement Learning (Genetic Algorithm, Operators, Fitness Function, Genetic Programming, RL Introduction)				✓		
Assessment 5 – Dimensionality Reduction (LDA, PCA, Optimization Techniques)					✓	
Assessment 6 – Applications of Machine Learning (Applications in Image Processing, Bioinformatics, Forensics, Retail, Finance)						✓