

# Name of the Faculty: Science & Technology

(As per New Education Policy 2020)

Subject:-Computer Science and Engineering

# Name of the Course: T.Y.B.Tech.(Sem.–V & VI)

(Syllabus to be implemented from-2025-26)



Faculty of Science and Technology Third Year B.Tech. (Computer Science and Engineering) NEP 2020 Compliant Curriculum With effect from 2025-2026 SEMESTER - V

Course Code	Name of the Course	Engagement Hours		Engagement Credits Hours		FA	SA			
		L	Τ	Р		ESE	ISE	ICA	<i>OE</i> /	Total
									POE	
CSEPCC-07	Design and Analysis of Algorithms	3			3	70	30			100
CSEPCC-08	Operating System	3		2	4	70	30	25		125
CSEPCC-09	Database Engineering	3		2	4	70	30	25	25	150
CSEPEC-01	Programme Elective Course-I	3		2	4	70	30	25		125
AEC-02	Creativity and Design Thinking	1		2	2	50*		25		75
OE-03	Interdisciplinary Mini Project	1		2	2			25	25	50
MDM-03	MD Minor-III	2		2	3	70	30	25		125
	Total	16		12	22	400	150	150	50	750

Sem-V

#### \*ForAEC-02: MCQ-based examination to be conduct.

PCC-Programme Core Course

PEC-Programme Elective Course

AEC- Ability Enhancement Course

MDM-Multidisciplinary Minor: It should be selected from other UG Engineering Minor Programme.

Semester - VI										
Course Code	Name of the Course	Engagement Hours		Credits	FA	SA				
		L	T	Р		ESE	ISE	ICA	<i>OE</i> /	Total
									POE	
CSEPCC-10	Software Engineering	2			2	70	30			100
CSEPCC-11	Cloud Computing	2		2	3	70	30	25	25	150
CSEPCC-12	System software	3		2	4	70	30	25		125
CSEPEC-02	Programme Elective Course-II	3		2	4	70	30	25	25	150
CSEPEC-03	Programme Elective Course-III	3	1		4	70	30	25		125
CSESEC-02	Projects on Industrial Application			4	2			25	50	75
MDM-04	MD Minor-IV	2		2	3	70	30	25		125
	Total	15	1	12	22	420	180	150	100	850

Sem-VI PCC-Programme Core Course SEC- Skill Enhancement Course

PEC- Programme Elective Course

MDM-Multidisciplinary Minor: It should be selected from other UG Engineering Minor Programme.

# Programme Elective Course-I

Course Code	Name of the Course
CSEPEC-01A	Software Testing and Quality Assurance
CSEPEC-01B	Human Computer Interface
CSEPEC-01C	Mobile Computing
CSEPEC-01D	Object Oriented Modeling and Design

#### **Programme Elective Course-II**

Course Code	Name of the Course
CSEPEC-02A	Data Mining
CSEPEC-02B	Network Security
CSEPEC-02C	Advanced Operating System
CSEPEC-02D	Management Information System

#### **Programme Elective Course-III**

Course Code	Name of the Course
CSEPEC-03A	Internet of Things
CSEPEC-03B	Big Data Analytics
CSEPEC-03C	Artificial Neural Network

#### **CSEHON:** CSE Honors

#### Honors in Artificial Intelligence and Machine Learning

Semester	Course Code	Name of the Course	Engagement Hours			Engagement Hour		Hours	Credits	FA	Sz	4	Total
			L	Т	Р		ESE	ISE	ICA				
V	CSEHON-03A	Natural Language Processing	3		2	4	70	30	25	125			
VI	CSEHON-04A	Deep Learning	3		2	4	70	30	25	125			

#### Honors in Cyber Security

Semester	Course Code	Name of the Course	Engagement Hours		Credits	FA	S	A	Total	
			L	Т	Р		ESE	ISE	ICA	
V	CSEHON-03B	Cyber Forensic	3		2	4	70	30	25	125
VI	CSEHON-04B	Information Auditing and Monitoring	3		2	4	70	30	25	125

#### Honors in Data Science

Semester	Course Code	Name of the Course	Eng	Engagement Hours		Credits	FA	S	'A	Total
			L	T	Р		ESE	ISE	ICA	
V	CSEHON-03C	Machine Learning	3		2	4	70	30	25	125
VI	CSEHON-04C	Predictive Analytics	3		2	4	70	30	25	125

#### Multidisciplinary Minor in "Data Science"

Semester	Course Code	Course Title
V	CSEMDM-03A	Machine Learning
VI	CSEMDM-04A	Predictive Analytics

#### Multidisciplinary Minor in "Software Engineering"

Semester	Course Code	Course Title
V	CSEMDM-03B	Object Oriented Modeling and Design
VI	CSEMDM-04B	Management Information System



Faculty of Science and Technology

Third Year B.Tech (Computer Science and Engineering)

#### **SEMESTER - V**

CSEPCC-07: Design and Analysis of Algorithm

#### **Teaching Scheme**

Lectures - 3 Hrs./week, 3 Credits

**Examination Scheme** ESE - 70 Marks

ISE – 30 Marks

## Introduction:

This course introduces the algorithms, strategies of algorithms and analysis of algorithms which will help to compare and determine good algorithms.

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#### **Course Prerequisite:**

Students should have knowledge of basic programming. They should also have basic knowledge of data structure, discrete structures and graph theory.

#### **Course Objectives:**

- 1. To provide mathematical approaches for analysis of algorithms.
- 2. To understand and solve problems using various algorithmic approaches.
- 3. To analyze algorithms using various methods.

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#### **Course Outcomes:**

- At the end of the course, students will be able to
- 1. Analyze the running time and space complexity of algorithms.
- 2. Apply the complexity of divide and conquer strategy.
- 3. Apply the complexity of greedy strategy.
- 4. Analyze the complexity of dynamic programming strategy.
- 5. Use backtracking, branch and bound technique.
- 6. Distinguish complexity classes of problems.

SECTION-I

#### **UNIT-1 Introduction**

Algorithm specification: pseudo code conventions, recursive algorithm, performance analysis: space complexity, time complexity, calculating worst case, best case and average case complexities, complexities asymptotic notations, performance measurement

#### **UNIT 2 - Divide and Conquer**

The general method, binary search, finding the maximum and minimum, quick sort, selection sort, merge sort.

#### **UNIT 3 - The Greedy method**

The general method, knapsack problem, job sequencing with deadlines, minimum - cost spanning trees prim's and kruskal's algorithms, optimal storage on tapes, optimal merge patterns, single source shortest paths.

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#### **SECTION-II**

#### **UNIT 4 - Dynamic Programming**

The general method, multistage graphs, all pair shortest paths, optimal binary search trees, 0/1 knapsack, reliability design, the traveling sales person problem. flow shop scheduling

#### UNIT 5 - Backtracking

The general method, 8-queen problem, sum of subsets, knapsack problem, hamilton cycle, and graph coloring.

#### **UNIT 6 - NP-Hard and NP-Complete problems**

Tractable and intractable problems: computability. the halting problem, computability classes - p, np- class, np-complete and np-hard, standard np-complete problems, np-hard problem (only basics problems).

#### Internal Continuous Assessment (ICA) :

ICA shall consist of minimum ten practical assignment problems.

Suggested Experiment List is as follows:

- 1. Introduction :- Selection sort, Insertion sort.
- 2. Divide and Conquer Approach:- Finding Minimum and Maximum, Merge sort, Quick sort, Binary search.
- 3. Greedy Method Approach:- Single source shortest path- Dijkstra, Fractional Knapsack problem , Job sequencing with deadlines , Minimum cost spanning trees-Kruskal and Prim's algorithm.
- 4. **Dynamic Programming Approach:-** Single source shortest path- Bellman Ford, All pair shortest path- Floyd Warshall, Travelling salesperson problem.
- 5. Backtracking and Branch and bound :- N-queen problem, Sum of subsets, Graph coloring

The nature of the problems shall be with objectives to assess student's ability to

- a) Compare and choose an appropriate algorithm design paradigm on time and space complexity.
- b) Apply algorithm design paradigm to provide a solution to the problem using either C, C++, Python, Java or any other programming language the student is proficient in.
- c) Effectively assess performance of provided solutions w.r.t programming language's runtime implementation.

#### **Text Book:**

- 1. Fundamentals of Computer Algorithms, Horowitz, Sahni & Rajasekaran (Galgotia Publications)
- 2. Fundamental of Algorithm, Gilles Brassard, Paul Bratley (Pearson Publication)
- 3. Introduction to Algorithms, Thomas Cormen (Pearson Publication)

#### **Reference Books** :

1. Introduction to Design and Analysis of Algorithm, Goodman (McGrawhill)

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- 2. Design and analysis of algorithms, Aho, Hopfcraft and Ullman (Addison wesley)
- 3. Design & Analysis of Algorithms, Sharma, Khanna Publishing House, N.Delhi
- 4. Design & Analysis of Algorithms, S. Sridhar, Oxford

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## Punyashlok Ahilyadevi Holkar Solapur University, Solapur **Faculty of Science and Technology** Third Year B.Tech (Computer Science and Engineering) **SEMESTER-V**

**CSEPCC-08:** Operating System

Teaching Scheme	Examination Scheme
Lectures–3 Hours/week, 3 Credits	ESE –70 Marks
Practical – 2 Hours/week, 1 Credit	ISE – 30 Marks
	ICA-25 Marks

#### Introduction

This course introduces fundamentals and basic knowledge of an operating system. It also covers the details process management, deadlock, memory management and I/O subsystems.

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Course Prerequisite: Students should have knowledge of computer systems and basics of C programming language \_\_\_\_\_

#### \_\_\_\_\_ **Course Objectives:**

- 1. To describe features of operating system and understand process concept.
- 2. To analyze the principles of concurrency and synchronization.
- 3. To understand and solve problems based on process scheduling, deadlock and memory management.
- 4. To learn about storage and file systems.

#### **Course Outcomes:**

#### Students will be able to:

1. Comprehend the features of the operating system to formulate its role and responsibilities.

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- 2. Analyze the principles of process scheduling and process synchronization.
- 3. Simulate memory management technique for CPU performance.
- 4. Describe how the file system, mass storage, and I/O are handled in a modern computer system.

#### \_\_\_\_\_ **SECTION-I**

#### **UNIT 1 - Introduction**

Operating system definition, simple batch system, multiprogrammed batch system, time sharing system, personal computer system, parallel system, real time system, and system calls.

#### **UNIT 2 - Process**

Process concept, process scheduling, operations on processes, cooperating processes, threads, interprocess communication

#### **UNIT 3 - Process Scheduling**

Basic concept, scheduling criteria, scheduling algorithms, multiple processor scheduling

#### **UNIT 4 - Inter-process synchronization**

Background, the critical section problem, peterson's algorithm, synchronization hardware, semaphores, classical problems of synchronization, monitors.

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#### **SECTION II**

#### **UNIT 5 – Deadlocks**

System model, deadlock characterization, methods for handling deadlocks, deadlock prevention, deadlock avoidance, deadlock detection, recovery from deadlock, combined approach to deadlock.

#### **UNIT 6 - Memory Management**

Background, logical versus physical address space, swapping, contiguous allocation, paging, segmentation, segmentation with paging.

#### **UNIT 7 - Virtual Memory**

Background, demand paging, page replacement, page replacement algorithms, allocation of frames, thrashing (only concept).

#### **UNIT 8 - IO System**

Overview, I/O hardware, application I/O interface, mass storage structure – disk scheduling (FCFS scheduling, SSTF scheduling, scan scheduling, C-Scan scheduling, look scheduling)

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#### **International Continuous Assessment (ICA) :**

It should consist of laboratory assignments as follows:

- 1. Study of Unix commands.
- 2. Program using system calls: fork (), exec(), suspend(), resume().
- 3. Implementation of FCFS scheduling algorithm.
- 4. Implementation of SJF ( non preemptive).
- 5. Implementation of round robin (RR).
- 6. Implementation of priority scheduling algorithm (nonpreemptive).
- 7. Implementation of Mutual Exclusion 1<sup>st</sup> / 2<sup>nd</sup> / 3<sup>rd</sup> algorithm.
- 8. Implementation of Mutual Exclusion using semaphore (wait & signal).
- 9. Implement Bankers Algorithm for Deadlock Avoidance.
- 10. Implementation of RAG or WFG method for deadlock detection for single instance of resources.
- 11. Simulation of page replacement strategies (FIFO, LRU, Optimal).
- 12. Simulation of Memory Allocation Strategies (First Fit, Best Fit, Worst Fit).
- 13. Study of I/O subsystem.

#### **Text Books:**

- 1. Operating System concepts, Silberschatz, Galvin, 7th or 8th Edition (John Wiley).
- 2. Operating Systems: Internals and Design Principles by William Stallings, 5th Edition (PHI).
- 3. The design of Unix Operating Systems- Maurice J. Bach(PHI)

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#### **Reference Books:**

- 1. Operating system with case studies in UNIX, Netware and Windows NT by Achyut Godbole (TMGH).
- 2. Operating Systems, Deitel, Deitel, Choffnes, 3rd Edition, by Pearson Education.

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## Punyashlok Ahilyadevi Holkar Solapur University, Solapur **Faculty of Science and Technology** Third Year B.Tech (Computer Science and Engineering) **SEMESTER - V**

**CSEPCC-09 : Database Engineering** 

Teaching Scheme	
Lectures-3 Hours/week, 3 Credit	
Practical- 2 Hours/week, 1 Credit	

**Examination Scheme** ESE -70 Marks ISE – 30 Marks ICA – 25 Marks POE- 25 Marks

#### Introduction:

A database and data management systems is essential for both computer science and business curricula. This course covers the fundamentals of relational database systems, including data models, architectures, normalization, data integrity, security, and data manipulation. Students will gain both theoretical knowledge and practical skills in using databases and database management systems, particularly through Structured Query Language (SQL). Additionally, the course delves into database transaction and recovery concepts. By the end, students will be equipped to design and implement normalized database structures by creating simple databases.

Course Prerequisite: Prerequisites for a database and data management system course include introductory programming, basic data structures, and a solid understanding of computer science fundamentals, along with familiarity in mathematics, especially discrete mathematics.

#### **Course Objectives:**

The objectives of this course:

- 1. To understand the fundamental concepts and applications of database systems and relational databases.
- 2. To develop skills in data modelling using the Entity Relationship (ER) model and diagram conversion.
- 3. To acquire proficiency in relational algebra and calculus for effective data manipulation.
- 4. To gain expertise in SQL for database definition, querying, and advanced features.
- 5. To learn relational database design, normalization, and file organization techniques.
- 6. To comprehend transaction processing, including ACID properties and concurrency control techniques.

# **Course Outcomes:**

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

- 1. Demonstrate a clear understanding of database system concepts, applications, and architectures.
- 2. Apply data modeling techniques using the Entity Relationship (ER) model for effective database design. Execute relational algebra and calculus operations.
- 3. Develop proficiency in SQL for database creation, modification, and advanced querying tasks.
- 4. Design normalized relational databases and optimizes those using indexing and file organization techniques.
- 5. Implement transaction management, ensuring ACID properties and handling concurrency control and recovery.

#### **SECTION-I**

#### **UNIT 1: Introduction to Database Systems**

Overview of Database System Applications and Purpose, Understanding Views of Data and Database Languages, Relational Database Concepts and Design, Data Storage and Querying Techniques, Transaction Management and Database Architecture, Data Modeling using the Entity Relationship (ER) Model: ER Model Concepts and Notation for ER Diagrams, Defining Constraints, Keys, and Types of Keys: Super Key, Candidate Key, Primary Key, Understanding Weak Entity Sets and Codd's Rules, Extended ER Model Concepts: Generalization and Aggregation, Mapping Cardinality and Reduction of ER Diagrams to Tables.

#### **UNIT 2: Relational Data Model, Relational Algebra, and Calculus**

Structure of Relational Databases and Database Schema, Defining Keys and Relationships in the Relational Model, Relational Algebra: Fundamental Operations (Selection, Projection, Union, Difference, Cartesian Product, Join), Additional and Extended Relational Algebra Operations, Relational Calculus: Tuple Relational Calculus, Domain Relational Calculus

#### **UNIT 3: Introduction to SQL**

Overview of SQL and its Role in Database Management, SQL Data Definition Language (DDL) and Basic Query Structure, Key SQL Operators: Basic Operators, Set Operations, and Handling Null Values, Aggregate Functions and Nested Subqueries, Modifying the Database using SQL (INSERT, UPDATE, DELETE), Intermediate SQL: Joins, Views, Transactions, Integrity Constraints, SQL Data Types and Schema Definition, Authorization, Advanced SQL: Integrating SQL with Programming Languages (JDBC, ODBC, Embedded SQL), Functions, Procedures, and Triggers.

#### SECTION – II

#### **UNIT 4: Relational Database Design**

Normalization: Characteristics of Good Relational Designs, Functional Dependencies and Normal Forms: 1NF, 2NF, 3NF, BCNF, Multivalued Dependencies and Fourth Normal Form, Database Design Process.

#### **UNIT 5: Indexing & Hashing**

Basic Concepts, Ordered Indices, B+ Tree Index Files, B Tree Index Files, Multiple Key Access Hashing: Static Hashing, Dynamic Hashing, Comparison of Indexing and Hashing, Bitmap indices, Index definition in SQL.

#### **UNIT 6: Transaction Processing**

Overview of Transaction Concepts and Transaction Models, Ensuring Atomicity and Durability in Transactions, Transaction Isolation and the ACID Properties, Storage structure, Schedule, Serializability, Recoverability.

# UNIT 7: Concurrency Control Techniques & Recovery Systems(07)Concurrency Control Techniques: Lock-Based Protocols and Deadlock Handling, MultipleGranularity and Timestamp-Based Protocols, Recovery Systems: Failure Classification , Storage,Recovery and Atomicity, Recovery algorithms, Buffer management.

**Course Instructions:** Assignments 2 to 4 should be implemented in MySQL/Oracle/ Workbench. Assignments 6 to 11 should be implemented in C++/Java.

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#### Internal Continuous Assessment (ICA):

#### It should consist of 8-10 laboratory assignments as follows:

- 1. E-R Diagrams: Draw E-R diagram for any specific database application and create a data dictionary for the same.
- 2. a) Basic SQL DDL commands: write simple queries in SQL on above database application for schema creation and updation.

b) SQL DML commands: insert, update, select command with different clauses, queries using aggregates, grouping and ordering.

- 3. a) Nested sub queries, Joins and Set operations: write queries in SQL using concept of nested sub queries, join and different set operations.
- 4. a) Views, Integrity constraints and Authorization: queries for creating views, different integrity constraints and authorization commands. b) Advanced SQL: queries on embedded SQL, functions and procedures, triggers
- 5. Convert the created database into 1NF, 2NF, 3NF and BCNF.
- 6. Given a set of functional dependencies, find canonical cover and closure of functional dependency. 7. Write a Java program for database (created in expt-2) connectivity using JDBC.
- 7. Write a program to implement B+ tree index (n=3 or n=5) on the database previously created.
- 8. Write a program to implement dynamic hashing on the database previously created.
- 9. Write a program to simulate log based protocol using immediate or deferred database modification.
- 10. Write a program to simulate any one concurrency control protocol.

#### **Text Books:**

- 1. Database System Concepts by Abraham Silberschatz, Henry F. Korth, and S. Sudarshan
- 2. Fundamentals of Database Systems by Ramez Elmasri and Shamkant B. Navathe
- 3. Database Management Systems by Raghu Ramakrishnan and Johannes Gehrke

#### **Reference Books:**

- 1. Henry Korth, Abraham Silberschatz & S. Sudarshan, Database System Concepts, McGrawHill Publication, 6th Edition, 2011.
- 2. Principles of Database Systems by J. D. Ullman (Galgotia Publications)
- 3. SQL The Complete Reference, 3rd Edition by James R Groff, Paul N. Weinberg and Andy Oppel
- 4. Database system concepts by Peter Rob, Carlos Coronel (Cengage Learning) ninth edition.



#### Faculty of Science and Technology Third Year B.Tech (Computer Science and Engineering) SEMESTER-V

#### Programme Elective-I

**CSEPEC-01A : Software Testing and Quality Assurance** 

Leaching Scheme	
Lectures-3 Hours/week, 3 Credits	
Practical- 2 Hours/week, 1 Credit	

**Examination Scheme** ESE –70 Marks ISE – 30 Marks ICA-25 Marks

#### Introduction:

Software testing is a crucial phase of the software development life cycle (SDLC) that ensures the reliability, functionality, and performance of software applications. This course provides a foundational understanding of software testing principles, methodologies, and best practices. It covers various testing approaches, including black-box and white-box testing, verification and validation, and different levels of testing such as unit, integration, system, and acceptance testing.

#### **Prerequisite:**

**Basic Software Engineering Concepts** – Concepts like requirements analysis, design, coding, and maintenance

**Programming Fundamentals** – Knowledge of at least one programming language (e.g., Java, Python) to understand test automation and debugging.

#### **Course Objectives:**

- 1. To provide students with a comprehensive understanding of software testing principles, methodologies, and practices. To draw implications from basic primitives.
- 2. To introduce software quality assurance, industry-standard testing tools, and automation techniques.
- 3. To introduce the fundamental testing concepts, verification and validation techniques, levels of testing, and test planning.

#### Course Outcomes:

#### Students will be able to:

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- 1. Recall fundamental concepts, techniques, and methodologies of software testing.
- 2. Discuss testing levels and review system testing types to assess software performance.
- 3. Design effective test plans, test cases, and bug-tracking report using software quality assurance principles and standards.
- 4. Demonstrate automated testing tools to test software.

#### **SECTION-I**

#### **UNIT-1 Fundamentals of Software Testing**

Introduction, basics of software testing, approaches to testing, testing during development life cycle, essential of software testing, features of testing, misconceptions about testing, principles of software testing, test policy, strategy and test plan test, challenges in testing, test team approach, defect classification:-defect, error, mistake in software, defect life cycle, defect management process, testing process, test methodologies, skills required by tester.

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#### **UNIT-2 Methods of Testing**

Software verification and validation, black-box and white-box testing, static and dynamic testing, black-box testing techniques-equivalence partitioning, data testing, state testing, other black box test techniques. white-box testing techniques-data coverage, code coverage, other white box test techniques.

#### **UNIT-3** Levels of Testing

Levels of testing, proposal testing, requirement testing, design testing, code review, unit testing, module testing, integration testing, big-bang testing, sandwich testing, system testing- gui testing, compatibility testing, security testing, performance testing, volume testing, stress testing, load testing, installation testing, regression testing, smoke testing, sanity testing, ad hoc testing, usability testing, acceptance testing alpha testing, beta testing, gamma testing.

#### **SECTION II**

#### **UNIT-4 Test Planning & Documentation**

Test planning-the goal of test planning, test planning topics, writing and tracking test cases the goal of test case planning, test case planning overview, test case organization and tracking, reporting bugs-getting your bugs fixed, isolating and reproducing bugs, bug-tracking systems.

#### **UNIT-5 Quality Concepts & Software Quality Assurance**

Quality concepts-what is quality? software quality, quality assurance vs quality control, achieving software quality, SQA processes ,elements of software quality assurance, SQA tasks, goals and metrics, formal approaches to SQA, the ISO 9000 quality standards, CMM.

#### **UNIT-6 Automated Testing and Testing Tools**

Introduction of software test automation, API testing, benefits of automation and tools, open-source testing tools, case studies on testing tools-selenium & postman, realities of using test tools and automation.

#### **Text books:**

- 1. Software Testing Principles, Techniques and Tools By M G Limaye, Published by Tata McGraw-Hill Education Private Limited, Published 2009, ISBN (13): 978-0-07-013990-9, ISBN (10): 0-07-013990-3 (Chapter 1 & 3).
- 2. Software Testing, Second Edition By: Ron Patton, Published by SAMS, ISBN-13: 978-0672327988 ISBN-10: 0672327988 (Chapter 2, 4 & 6).
- 3. Software Engineering: A Practitioner's Approach by Roger S Pressman, 8th Edition, Publisher McGraw Hill (Chapter 5).

#### **Reference Books:**

- 1. Software Testing Principle and Practices By Ramesh Desikan, Gopalaswamy Ramesh, Pearson Education, ISBN 978-81-7758-121-8
- 2. Software Testing Principles and Practices By Naresh Chauhan, Publisher OXFORD UNIVERSITY PRESS-NEW DELHI, ISBN 0-19-806184-6
- 3. Beautiful Testing: Leading Professionals Reveal How They Improve Software By Adam Goucher, Tim Riley, Publisher O'reilly
- 4. Foundations of Software Testing By Rex Black, Dorothy Graham, Erik Van Veenendaal, Isabel Evans, Published by Cengage Learning India Pvt Ltd.
- 5. Lessons Learned in Software Testing by Cem Kaner, James Bach, Bret Pettichord, Publisher Wiley

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- 6. Testing Computer Software Cem Kaner, Jack Falk, Hung Q. Nguyen, Publisher Wiley
- 7. Selenium Testing Tools Cookbook By Unmesh Gundecha Published by Packt, ISBN: 978-1-84951-574-0
- 8. Dr. K.V.K.K. Prasad, "Software Testing Tools: Covering WinRunner, Silk Test, LoadRunner, JMeter and TestDirector With Case Studies", Dreamtech Publications ISBN: 10:81-7722-532-4



#### Punyashlok Ahilyadevi Holkar Solapur University, Solapur Faculty of Science and Technology Third Year B.Tech (Computer Science and Engineering) SEMESTER-V Programme Elective - I

## CSEPEC-01B : Human Computer Interaction

Teaching Scheme	Examination Scheme
Lectures: 3 Hours /Week, 3 Credits	ESE - 70 Marks
Practical- 2 Hours/week, 1 Credit	ISE – 30 Marks
	ICA- 25 Marks

#### Introduction:

Human-Computer Interaction (HCI) is an interdisciplinary field that focuses on the design, evaluation, and implementation of interactive computing systems for human use. It aims to improve the interaction between humans and computers by making systems more user-friendly, efficient, and accessible.

# Prerequisite:

To effectively grasp Human-Computer Interaction (HCI), it requires a combination of technical, design, and analytical skills.

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#### **Course Objectives:**

- 1. Know how to analyze and consider user's need in the interaction system
- 2. Understand various interaction design techniques and models
- 3. Understand the theory and framework of HCI
- 4. Understand and analyze the cognitive aspects of human machine interaction

#### **Course Outcomes:**

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

- 1. To develop good design for human machine interaction system
- 2. Analyze the user's need in interaction system
- 3. To design new interaction model to satisfy all types of customers
- 4. Evaluate the usability and effectiveness of various products
- 5. To know how to apply interaction techniques for systems

#### **SECTION-I**

#### UNIT: 1

Introduction- the human, the computer, the interaction, paradigms, usability of interactive systems, guidelines, principles, and theories.

#### **UNIT: 2**

Design Process - interaction design basics, hei in the software process, design rules, implementation support, evaluation techniques, universal design, user support.

#### UNIT: 3

Models and theories- cognitive models, socio-organizational issues and stakeholder requirements, communication and collaboration models, task analysis, dialogue notations and design, models of the system, modelling rich interaction.

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#### **UNIT: 4**

Interaction Styles- direct manipulation and virtual environments, menu selection, form filling and dialog boxes, command and natural languages, interaction devices.

#### **SECTION-II**

#### **UNIT: 5**

Design issues- quality of service, balancing function and fashion, user documentation and online help, information search, information visualization.

#### UNIT: 6

Ubiquitous computing - outside the box, group ware, ubiquitous computing and augmented realities, hypertext, multimedia, and the world wide web text.

#### **UNIT:7**

Information search and visualization - introduction, search in textual documents and database querying, multimedia document searches, advanced filtering and search interfaces, information visualization.

#### **UNIT: 8**

Hypertext, multimedia and the world wide web, introduction, understanding hypertext, web technology and issues, static web content, dynamic web content. \_\_\_\_\_

#### **Text Books:**

- 1. Human Computer Interaction, Alan Dix, Janet Finlay, Gregory Abowd and Russel Beale, Prentice Hall Publication
- 2. Designing the User Interface, Ben Shneiderman, 4th Edition, Pearson Education, 2008, ISBN 81-7808-262-4

#### **Reference Book:**

- 1. Human Computer Interaction, Dan R. Olsen, Cengage Learning, India Edition, ISBN No.978-81-315-1137-4
- 2. The Essential Guide to User Interface Design, Second Edition, An Introduction to GUI Design Principles and Techniques, Wilbert O. Galitz, Wiley India (P) Ltd., ISBN: 81-265-0280-0
- 3. The Essential of Interaction Design, Alan Copper, Robert Reimann, David Cronin, Wiley India (P) Ltd., ISBN: 978-81-265-1305-5

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#### Punyashlok Ahilyadevi Holkar Solapur University, Solapur Faculty of Science and Technology Third Year B.Tech (Computer Science and Engineering) SEMESTER-V Programme Elective - I CSEPEC-01C –Mobile Computing

Teaching Scheme	<b>Examination Scheme</b>
Lectures–3 Hours/week, 3 Credits	ESE –70 Marks
Practical- 2 Hours/week, 1 Credit	ISE – 30 Marks
	ICA- 25Marks

#### Introduction:

This course introduces wireless communication and data access anytime, overcoming constraints like bandwidth limitations and power consumption. It encompasses technologies like GSM, WAP, mobile networks, and emerging trends such as 5G, D2D communication, and mobile cloud computing.

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Course Prerequisite: Students shall have knowledge of Computer Networks and Security.

#### **Course Objectives:**

- 1. To understand fundamentals of mobile computing, and evolution from 1G to 5G, as well as to explore wireless communication technologies and routing techniques for ad-hoc networks.
- 2. To study the architecture of GSM, GSM networking, and location management techniques for efficient and secure mobile communication.
- 3. To understand mobile network including Mobile IP, and cellular IP, while also exploring Wireless Application Protocol (WAP), emerging trends in mobile computing and mobile cloud computing applications.

#### **Course Outcomes:**

#### Students will be able to:

- 1. Understand the fundamentals, constraints, applications, and evolution of mobile computing along with wireless technologies.
- 2. Analyze mobile wireless protocols, including WAP architecture, routing protocols for ad hoc networks, and multiple access techniques.
- 3. Explain the architecture, components, and services of GSM, GPRS, and UMTS core networks.
- 4. Examine GSM networking, signaling, mobile management, and location management techniques.
- 5. Evaluate mobile network and transport layer protocols, including Mobile IP, TCP variants, and cellular IP.
- 6. Explore Wireless Application Protocol (WAP), 5G architecture, mobile cloud computing, and emerging trends in mobile communication.

#### **SECTION-I**

#### **UNIT-1 Introduction to Mobile Computing**

Introduction to Mobile computing, Constraints in mobile computing, Application of mobile computing, Generations of mobile wireless 1G to 5G, Future of mobile computing, Radio frequency Technology, Public Switched Telephone network, (PSTN), Public Communication service (PCS), PCS Architecture, Blue tooth, Ad-hoc Networks.

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#### **UNIT-2 Mobile Wireless protocols**

Introduction of WAP, WAP applications, WAP Architecture, WAP Protocol Stack, Challenges in WAP, Introduction, Benefits, Difference, Routing protocols for ad hoc wireless networks: DSDV and AODV, Wireless Application protocols: MAC,SDMA, FDMA,TDMA,CDMA

#### **UNIT-3 Global System for Mobile Communications**

Global System for Mobile Communications (GSM) architecture, Mobile Station, Base Station System, Switching subsystem, Security, Data Services, HSCSD, GPRS - GPRS system and protocol architecture 2.3 UTRAN, UMTS core network

#### **SECTION II**

#### **UNIT-4 GSM Networking Signaling and Mobile Management**

GSM MAP Service framework, MAP protocol machine, GSM location management, Transaction Management, Mobile database, Introduction to location management HLR and LRVLR and HLR Failure restoration, VLR identification algorithm, O-I, O-II algorithm etc.

#### **UNIT-5 Mobile Network and Transport Layers**

Mobile IP, IP packet delivery, Tunnelling and encapsulation, IPv6, DHCP, Vehicular Ad Hoc networks (VANET), MANET, Traditional TCP, Snooping TCP, Mobile TCP, 3G wireless network, Wireless Application Protocol, WDP WTP, WML, WTA architecture, Cellular IP

#### **UNIT-6 Wireless Application Protocol (WAP) and current trends**

WAP model, WAP Gateway, WAP protocol, WAP UAProf and Caching, Wireless Bearer for WAP, WAP Developer Toolkits, Introduction to D2D communications; High level requirements for 5G architecture, Introduction to mobile cloud computing and its Applications

#### Text books:

- 1. Jochen Schiller, "Mobile Communications", Pearson Education, 2009.
- 2. Martin Sauter, "3G, 4G and Beyond: Bringing Networks, Devices and the Web Together", 2012, ISBN-13: 978-1118341483
- 3. Raj Kamal, "Mobile Computing", 2/e, Oxford University Press

#### **Reference Books:**

- 1. William Stallings, ""Wireless Communications & Networks", Second Edition, Pearson Education
- 2. Christopher Cox, "An Introduction to LTE: LTE, LTE-Advanced, SAE and 4G Mobile Communications", Wiley publications
- 3. Andrea Goldsmith, "Wireless Communications", Cambridge University Press, 2012.

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#### Faculty of Science and Technology Third Year B.Tech (Computer Science and Engineering) SEMESTER-V

## Programme Elective - I

#### CSEPEC-01D - Object Oriented Modeling and Design

Teaching Scheme	Examination Scheme
Lectures-3 Hours/week, 3 Credits	ESE –70 Marks
actical- 2 Hours/week, 1 Credit	ISE – 30 Marks
	ICA-25 Marks

#### Introduction:

This course presents Object Oriented approaches to software development based on modelling objects from the real world and then using the model to build a language independent design organized around those objects. These techniques promote better understanding of requirements, cleaner designs and more maintainable systems.

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Course Prerequisite: Student shall have undergone an introductory course on Object oriented Design and Programming.

#### **Course Objectives:**

- 1. To introduce students to the concepts and terms used in the object-oriented approaches.
- 2. To enable students to analyze real world problems and create an Object model to represent static view of the system.
- 3. To enable students to analyze real world problems and create a Dynamic model to represent behavioural view of the system.
- 4. To enable students to analyze real world problems and create a Functional model to represent process view of the system.
- 5. To enable students to use the above three models and create a system design and Object design.
- 6. To train students to use UML as a tool to create models in the form of diagrams.

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#### **Course Outcomes:**

#### Students will be able to:

- 1. Demonstrate the knowledge about concepts used in Object Oriented approaches.
- 2. Create the Object Model, Dynamic model, Functional model and use these models to create the system design and Object Design required for software development.
- 3. Draw respective UML Diagrams representing designs to be used for software development.

# SECTION-I

#### UNIT 1: Introduction to Object Oriented approach and Object Modelling.

Object oriented development and themes, modelling as a Design Technique. Objects, classes, links and associations, generalization and inheritance, grouping constructs, aggregation, abstract classes, generalization as extension and restriction, multiple inheritance, metadata, candidate keys and inheritance

#### **UNIT 2: Dynamic and Functional Modelling**

Events, states, operations, concurrency, nested state diagrams, advanced dynamic modelling concepts, relation of object and dynamic models, DFD, relation of functional to object and dynamic models.

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#### **UNIT 3: Implementation of OMT**

Use of programming language and database system, Object oriented style, feature of object-oriented languages, Applications of OMT like object diagram compiler, Computer animation

#### **SECTION II**

#### **UNIT 4: Structural Modelling using UML**

Classes, Relationships, Common mechanisms. Diagrams, Class Diagrams, Interfaces, Types and Roles, Packages, Instances and Object Diagram.

#### **UNIT 5: Behavioural Modelling using UML**

Interactions, Use cases, Use case diagram, Interaction Diagrams and Activity diagrams, Events and signals, State Machines, Processes and Threads, Time and space, State chart diagrams.

#### **UNIT 6: Architectural Modelling using UML**

Components, Deployment, Collaboration, Patterns and Frame works, Component diagrams and Deployment Diagrams.

#### Text books:

- 1. Object oriented Modelling and Design: Rambaugh, Premerlani, Eddy, Lorenson (PHI)
- 2. The Unified Modelling Language User Guide: Grady Booch, Jeams Rambaugh, Ivar Jacotson (Addison Wesley)

#### **Reference Books:**

- 1. Practical Object-Oriented Design with UML Mark Priestley.
- 2. UML-In a Nut Shell Sinon Alhair

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Faculty of Science and Technology

Third Year B.Tech (Computer Science and Engineering)

#### SEMESTER-V

#### AEC-02 : Creativity and Design Thinking

Teaching Scheme	<b>Examination Scheme</b>
Lectures-1 Hour/week, 1 Credit	ESE –50 Marks
Practical- 2 Hours/week, 1 Credit	(MCQs)
	ICA – 25 Marks

#### Introduction:

This course is intended for students from any discipline who require an understanding of design thinking for brand, product, and service development. Students will learn a series of design thinking concepts, methods and techniques that are used to bring about innovation in business and in the social sector

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Course Prerequisite: Students shall have communication and collaboration skills, openness to creativity and innovation.

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#### **Course Objectives:**

- 1. Understand the importance of creativity and design thinking in Engineering.
- 2. Apply design thinking principles to problem-solving in various problems.
- 3. Develop user-centric solutions using ideation and prototyping techniques.
- 4. Use various creativity-enhancing techniques for innovative technology solutions.
- 5. Implement usability testing, feedback loops, and data-driven design decisions.
- 6. Work on real-world projects to apply design thinking methodologies effectively.

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#### **Course Outcomes:**

#### Students will be able to:

- 1. Demonstrate an understanding of design thinking frameworks and methodologies.
- 2. Develop innovative and user-friendly applications using creative problem-solving.
- 3. Use prototyping and wire framing tools to build interfaces.
- 4. Conduct usability testing and refine designs based on user feedback.
- 5. Apply design thinking principles in computing fields.
- 6. Develop and present a capstone project that showcases creative and technical skills.

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#### **SECTION-I**

#### **UNIT-1 Introduction to Creativity and Design Thinking**

Definition and importance of creativity in computer science, overview of the design thinking process (empathize, define, ideate, prototype, test), human-centered design approach, case studies of innovative tech products.

#### **UNIT-2** Problem Identification and Ideation Techniques

Understanding complex engineering problems, brainstorming and idea generation techniques (SCAMPER, mind mapping, lateral thinking), TRIZ (theory of inventive problem solving), convergent vs. divergent thinking in engineering.

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## **UNIT-3 Prototyping and Concept Development**

Prototyping techniques: low-fidelity vs. high-fidelity prototypes, engineering design and product development, design for manufacturing (DFM) and sustainable engineering, role of ai and simulation in engineering prototyping.

#### **SECTION II**

#### **UNIT-4 Innovation in Engineering Applications**

Creativity in mechanical, electrical, and civil engineering, design thinking for smart cities and sustainable engineering, role of IoT, AI, and emerging technologies in engineering innovation, ethical and social considerations in engineering design

#### **UNIT-5** Testing, Iteration, and Implementation

Usability testing and performance evaluation, failure analysis and iterative design improvement, agile methodologies and lean engineering principles, data-driven decision making in engineering design

#### **UNIT-6 Capstone Project and Future Trends**

Real-world engineering challenges and case studies, team-based project using design thinking methodology, emerging trends in engineering innovation, presentation and peer review of final designs.

#### Text books:

- 1. Kelley, Tom & Kelley, David *Creative Confidence: Unleashing the Creative Potential Within Us All*, Crown Business, 2013.
- 2. Brown, Tim Change by Design: How Design Thinking Creates New Alternatives for Business and Society, Harper Business, 2009.
- 3. Plattner, Hasso, Meinel, Christoph, & Leifer, Larry Design Thinking: Understand Improve Apply, Springer, 2011.

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#### **Reference Books:**

- 1. Cross, Nigel Design Thinking: Understanding How Designers Think and Work, Berg Publishers, 2011.
- 2. Liedtka, Jeanne & Ogilvie, Tim Designing for Growth: A Design Thinking Toolkit for Managers, Columbia Business School Publishing, 2011.
- 3. **Buxton, Bill** Sketching User Experiences: Getting the Design Right and the Right Design, Morgan Kaufmann, 2007.
- 4. Norman, Donald A. The Design of Everyday Things, Basic Books, 2013.
- 5. **IDEO.org** Design Kit: The Human-Centered Design Toolkit (Available online at www.designkit.org).

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Faculty of Science and Technology

Third Year B.Tech (Computer Science and Engineering)

SEMESTER-V

**OE-03 : Interdisciplinary Mini Project** 

**Teaching Scheme** 

Lecture: 1Hr/Week, 1 Credit Practical: 2 Hrs/week, 1 Credit **Examination Scheme** ICA: 25 Marks POE: 25 marks

#### Introduction:

The **Interdisciplinary Mini Project** course introduces students to collaborative problem-solving across multiple disciplines. It encourages the integration of diverse knowledge areas, enabling students to apply theoretical concepts in real-world applications. Through this course, students gain hands-on experience in designing, developing, and implementing innovative solutions while fostering teamwork, creativity, and technical expertise.

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#### Prerequisite:

An interdisciplinary mini project involves integrating knowledge from multiple fields to solve a problem or create an innovative solution.

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#### **Course Objectives**

- 1. Identify problems and propose innovative, efficient solutions.
- 2. Develop project management skills, including planning, designing, and executing a small-scale project.
- 3. Improve proficiency in programming, hardware design, or other domain-specific skills.
- 4. Work effectively in a team, distributing tasks and responsibilities.
- 5. Encourage critical thinking and experimentation with new technologies.
- 6. Gain hands-on experience relevant to industry practices.
- 7. Consider ethical, environmental, and sustainability factors in project development.

#### **Course Outcomes:**

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

- 1. To encourage students to work on real-world problems through interdisciplinary collaboration.
- 2. To integrate computing skills with other domains such as IoT, AI, Healthcare, Finance, and Sustainability.
- 3. To develop problem-solving, research, teamwork, and project management skills.
- 4. To implement industry-relevant technologies using experiential learning.
- 5. To prepare students for innovation, entrepreneurship, and research.

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#### Note:

- 1. There should be a group of preferably 4/5 students.
- 2. At least two branches must be combined to form a group.
- 3. Students should be given projects in Hardware, Software, Embedded or any contemporary topic.
- 4. One guide should be allocated per group.



#### Punyashlok Ahilyadevi Holkar Solapur University, Solapur Faculty of Science and Technology Third Year B.Tech (Computer Science and Engineering) SEMESTER-V Multidisciplinary Minor in Data Science CSEMDM-03A: Machine Learning

Teaching Scheme	Examination Scheme
Lectures-2 Hours/week, 2 Credits	ESE –70 Marks
Practical – 2 Hours/week, 1 Credit	ISE – 30 Marks
	ICA- 25 Marks

#### **Introduction:**

This course introduces Machine Learning which deals with fundamentals of machine learning and its types. The course also introduces how to validate and evaluate the performance of machine learning model.

Course Prerequisite: Students should have prior knowledge of statistics, linear algebra, probability, and data pre-processing.

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#### **Course Objectives:**

- 1. To introduce various types of machine learning algorithms.
- 2. To enable designing of a model selecting appropriate machine learning algorithms for a given problem.
- 3. To study methods to validate previously designed machine learning models.
- 4. To introduce methods to evaluate and tune machine learning models.

#### **Course Outcomes:**

At the end of the course students will be able to

- 1. Demonstrate various types of machine learning algorithms and their applications.
- 2. Design classification and regression models by selecting appropriate machine learning algorithms for given problems.
- 3. Apply unsupervised learning techniques for data clustering and analysis.
- 4. Evaluate and optimize the performance of machine learning models using validation techniques, evaluation metrics, and hyperparameter tuning.

#### **SECTION-I**

#### **UNIT-1 Introduction to Machine Learning**

What is Machine Learning? How do machine learn, Well-posted learning problem, Types of Machine Learning: Supervised learning, unsupervised learning, Reinforcement learning, Comparison – supervised, unsupervised and reinforcement learning, Problems not to be solved using Machine Learning, Applications of Machine Learning.

#### **UNIT-2 Supervised Learning- Classification**

Classification: Introduction, Examples of Supervised Learning, Classification model, Classification learning steps, Common Classification ,conditional Probability, Bayes theorem, Algorithms-Naïve Bayes classifier- Applications of Bayes classifier, Handling continues numeric features in Bayes classifier, k-Nearest Neighbors (k-NN), Decision tree, Random Forest model, Support vector machine.

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#### **UNIT-3 Supervised Learning- Regression**

Regression: Introduction, Examples of regression, Common regression algorithms-Simple linear regression, Multiple linear regression, Assumptions in regression analysis, Main problems in regression analysis, Improving accuracy of the linear regression model, polynomial regression model, logistic regression model.

#### **SECTION II**

#### **UNIT-4 Unsupervised Learning**

Introduction, Unsupervised vs Supervised learning, Applications of Unsupervised learning, Clustering: Clustering as a Machine learning task, different types of clustering techniques, Partitioning methods, k-means algorithm, k-medoids, Hierarchical clustering, Association rule, Apriorism algorithm.

#### **UNIT-5 Validating Machine Learning Models**

Introduction: Bias, Variance, Underfitting, Overfitting, cost function, types of cost function, cross validation, Types of cross validation Training, Testing, Validation.

#### **UNIT-6 Modeling and Evaluation**

Introduction, selecting a Model, training a Model, Model, Representation and Interpretability, Evaluating Performance of a Model, Improving Performance of a Model. Applications of Machine Learning, future of Machine learning.

#### **Text books:**

- 1. Machine Learning Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, Pearson Publication.
- 2. Machine Learning for Dummies by John Paul Mueller, Luca Massaron (Published by For Dummies; First edition).

#### **Reference Books:**

- 1. Machine Learning by Tom M. Mitchell (Publisher: McGraw Hill Education; First edition + New Chapters from Second edition).
- 2. Introduction to Machine Learning (Second Edition) by Ethem Alpaydın (published by The MIT Press Cambridge, Massachusetts London, England
- 3. Machine Learning with Python for Everyone by Mark E. Fenner, Pearson Publication

#### **Internal Continuous Assessment (ICA):**

Minimum 8 assignments requiring students to develop machine learning applications for real world problem/use-case/scenario based on any of the following topics:

- 1. Linear and Multilinear Regression
- 2. Decision Tree regressor
- 3. K-Nearest Neighbour (KNN) classifier
- 4. Logistic Regression classifier
- 5. Support vector machine (SVM)
- 6. Decision Tree classifier
- 7. Naive-Bayes classifier
- 8. Ensemble Models
- 9. K-means clustering (Unsupervised Learning)

10. Improving Machine Learning models using cross-validation and Hyper parameters tunning

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#### Punyashlok Ahilyadevi Holkar Solapur University, Solapur Faculty of Science and Technology

### Third Year B.Tech (Computer Science and Engineering) **SEMESTER-V**

**Multidisciplinary Minor in Software Engineering** CSEMDM-03B - Object Oriented Modeling and Design

Teaching Scheme	Examination Scheme
Lectures-2 Hours/week, 2 Credits	ESE –70 Marks
Practical- 2Hours/week, 1 Credit	ISE – 30 Marks
	ICA – 25 Marks

#### Introduction:

This course presents Object Oriented approaches to software development based on modelling objects from the real world and then using the model to build a language independent design organized around those objects. These techniques promote better understanding of requirements, cleaner designs and more maintainable systems.

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Course Prerequisite: Student shall have undergone an introductory course on Object oriented Design and Programming. \_\_\_\_\_

#### **Course Objectives:**

- 1. To introduce students to the concepts and terms used in the object-oriented approaches.
- 2. To enable students to analyze real world problems and create an Object model to represent static view of the system.
- 3. To enable students to analyze real world problems and create a Dynamic model to represent behavioural view of the system.
- 4. To enable students to analyze real world problems and create a Functional model to represent process view of the system.
- 5. To enable students to use the above three models and create a system design and Object design.
- 6. To train students to use UML as a tool to create models in the form of diagrams.

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### **Course Outcomes:**

#### Students will be able to:

- 1. Demonstrate the knowledge about concepts used in Object Oriented approaches.
- 2. Create the Object Model, Dynamic model, Functional model and use these models to create the system design and Object Design required for software development.
- 3. Draw respective UML Diagrams representing designs to be used for software development.

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#### **SECTION-I**

#### **UNIT 1: Introduction to Object Oriented Modeling**

Object oriented development and themes, modelling as a Design Technique.Evidence for usefulness of Object Oriented development; Object oriented modeling history. Modeling as Design Technique: Modeling; abstraction; The three models. Class Modeling: Object and class concepts, metadata.

#### **UNIT 2: Dynamic and Functional Modelling**

Events, states, operations, concurrency, nested state diagrams, advanced dynamic modelling concepts, relation of object and dynamic models, DFD, relation of functional to object and dynamic models.

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#### **UNIT 3: Implementation of OMT**

OMT,Models in OMT,object and class,Object,links,Associations,Multipliticity,Types of Associations, Object oriented style, feature of object-oriented languages, Applications of OMT like object diagram compiler

#### **SECTION II**

#### UNIT 4: Structural Modelling using UML

Classes, Relationships, Common mechanisms. Diagrams, Class Diagrams, Interfaces, Types and Roles, Packages, Instances and Object Diagram.

#### **UNIT 5: Behavioural Modelling using UML**

Interactions, Purpose of Use cases, Application of Use case diagram, Interaction Diagrams and Activity diagrams, State Machines, Processes and Threads, Time and space.

#### **UNIT 6: Architectural Modelling using UML**

Components, Deployment, Collaboration, Patterns and Frame works, Component diagrams and Deployment Diagrams.

#### Internal Continuous Assessment (ICA):

ICA shall consist of minimum 8-10 practical assignment problems.

Identify objects and classes from a real-world scenario, Draw a Data Flow Diagram (DFD) for an ATM machine, Use OMT to create object models for a Student Enrollment System, Develop use case and behavioral diagrams, Understand software architecture with UML,Case Study.

#### **Text books:**

- 1. Object oriented Modelling and Design: Rambaugh, Premerlani, Eddy, Lorenson (PHI)
- 2. The Unified Modelling Language User Guide: Grady Booch, Jeams Rambaugh, Ivar Jacotson (Addison Wesley)

#### **Reference Books:**

1. Practical Object-Oriented Design with UML – Mark Priestley.

2. UML-In a Nut Shell – Sinon Alhair

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#### Faculty of Science and Technology Third Year B.Tech (Computer Science and Engineering) SEMESTER-V Honors in Artificial Intelligence and Machine Learning CSEHON-03A : Natural Language Processing

Teaching Scheme	Examination Scheme
Lectures – 3 Hours/week, 3 Credits	ESE - 70 Marks
Practical - 2 Hours/week, 1 Credits	ISE - 30 Marks
	ICA - 25 Marks

#### Introduction

**Natural Language Processing (NLP)** is a field of Artificial Intelligence (AI) that enables computers to understand, interpret, and generate human language. It combines computational linguistics with machine learning and deep learning techniques to process and analyze text and speech data.

#### Prerequisite

Natural Language Processing (NLP) need a combination of technical, mathematical, and linguistic skills.

#### **Course Objectives:**

- 1. Define NLP and its role in artificial intelligence and machine learning.
- 2. Develop NLP Applications Using Machine Learning.
- 3. Work with NLP Libraries and Frameworks.

#### **Course Outcomes:**

At the end of the course students will be able to

- 1. Demonstrate the fundamental mathematical models and algorithms in the field of NLP.
- 2. Apply these mathematical models and algorithms in applications of software design and implementation for NLP.
- 3. Use tools to analyze language resource annotation and apply to data for acquiring intended information.
- 4. Design and implement various NLP applications.

## SECTION-I

#### **UNIT: 1 Introduction**

Introduction to NLP, Artificial Intelligence, Machine Learning and NLP, Biology of Speech Processing; Place and Manner of Articulation, Word Boundary Detection, Arg-Max Computation, Lexical Knowledge Networks.

#### **UNIT: 2 Word-net Theory**

Semantic Roles, Word Sense Disambiguation (WSD): Word-Net, Word-net Application in Query Expansion, Wiktionary, semantic relatedness, Measures of Word-Net Similarity, Similarity Measures. Resnick's work on Word-Net Similarity, Indian Language Word-nets and Multilingual Dictionaries, Multi- linguality, Metaphors, Co-references.

#### **UNIT :3 Theories of Parsing**

Parsing Algorithms, Evidence for Deeper Structure, Top-Down Parsing Algorithms, Noun Structure, Non-noun Structure and Parsing Algorithms, Robust and Scalable Parsing on Noisy Text in Web documents, Probabilistic parsing, Hybrid of Rule Based and Probablistic Parsing sequence labeling,

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Training issues, Arguments and Adjuncts, inside-outside probabilities, Scope Ambiguity and Attachment Ambiguity resolution.

#### **SECTION-II**

#### **UNIT: 4 Speech**

Phonetics, HMM, Morphology, Morphology fundamentals; Morphological Diversity of Indian Languages; Morphology Paradigms; Finite State Machine Based Morphology; Automatic Morphology Learning ; Shallow Parsing; Named Entities; Maximum Entropy Models; Random Fields.

#### **UNIT: 5 Semantic Relations**

UNL, Towards Dependency Parsing, Universal Networking Language, Semantic Role Extraction, Baum Welch Algorithm, HMM and Speech Recognition. HMM training, Baum Welch Algorithm,

#### **UNIT: 6 NLP Applications**

Sentiment Analysis; Text Entailment; Robust and Scalable Machine Translation; Question Answering in Multilingual Setting; Cross Lingual Information Retrieval (CLIR).

#### Internal Continuous Assessment (ICA) :

Minimum 8 to 10 assignments on the above topics.

#### **Text Books:**

1. Allen, James, "Natural Language Understanding", Second Edition, Benjamin/Cumming, 1995.

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- 2. Charniack, Eugene, "Statistical Language Learning", MIT Press, 1993.
- 3. Jurafsky, Dan and Martin, James, Speech and Language Processing, Second Edition, Prentice Hall, 2008.
- 4. Manning, Christopher and Heinrich, Schutze, Foundations of Statistical Natural Language Processing, MIT Press, 1999.

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#### **Reference Books:**

- 1. Jurafsky, D., and Martin, J.H. (2008). "Speech and Language Processing" (2nd Edition). Upper Saddle River, NJ: PrenticeHall
- 2. Bird, S., Klein, E., Loper, E. (2009). "Natural Language Processing with Python". Sebastopol.

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#### **Faculty of Science and Technology** Third Year B.Tech (Computer Science and Engineering) **SEMESTER-V Honors in Cyber Security CSEHON-03B** : Cyber Forensic

Teaching Scheme	<b>Examination Scheme</b>
Lectures - 3 Hours/Week, 3 credits	ESE –70 Marks
Practical - 2 Hour/Week, 1 credit	ISE – 30 Marks
	ICA-25 Marks

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#### Introduction:

This course introduces Cyber Forensics involves investigating and analyzing digital evidence from devices like computers, phones, and networks to solve crimes. It helps uncover activities such as hacking, fraud, or identity theft. Experts use specialized tools to ensure the evidence is accurate and reliable. The findings are then used in legal proceedings to support or refute claims.

Course Prerequisite: Students shall have foundational knowledge of computer science, basic networking, and an interest in cyber security.

#### **Course Objectives:**

- 1. To explain the fundamental concepts of cybercrime and its classification based on different types.
- 2. To explore various tools and techniques used in cybercrimes, including their impact on security.
- 3. To understand the legal framework related to cybercrimes, including cyber laws and IT regulations.
- 4. To learn the principles of computer forensics, including digital evidence collection, forensic investigation life cycle, and chain of custody.
- 5. To apply forensic techniques to investigate cybercrimes involving networks and mobile devices.

#### **Course Outcomes (CO):**

On completion of the course, students will able to :

- 1. Explain the fundamentals of cybercrime and its various classifications.
- 2. Analyze various tools and techniques used in cybercrimes
- 3. Describe the legal aspects of cybercrime
- 4. Understand the principles of computer forensics, including digital evidence collection, forensic life cycle, and chain of custody.
- 5. Apply forensic methodologies for network and mobile device investigations

#### **SECTION-I**

#### **UNIT-1: Introduction to Cyber Security**

Introduction, Definition and Origins of the Word, Cybercrime and Information Security, Who are Cyber Criminals, Classification of Cybercrimes, How Criminal plan the Attack.

#### UNIT-2: Tools and Method used in cybercrime

Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and spywares, Virus and warms, Trojan Horses and Backdoors, DoS and DDoS Attacks, SQL Injection, Buffer Overflow.

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## **UNIT-3:** Cyber Crime : The Legal Perspectives

Cybercrime and Legal Landscape around the World, Why do we need cyber law: the Indian Context, The Indian IT Act, Digital Signature and Indian IT Act, Amendment to the Indian IT Act.

#### **SECTION II**

#### **UNIT-4: Understanding Computer Forensics**

Background of Cyber Forensics, Digital Forensics Science, Need for Computer Forensics, Cyber forensics and Digital Evidence, Digital Forensics Life Cycle, Chain of Custody Concept, Challenges in Computer Forensics

#### **UNIT- 5: Network Forensics**

Network Basics for Digital Investigators: Technical overview, Network Technologies, Connecting networks using Internet Protocols.

Applying Forensic Science to Networks: Preparation & Authorization, Identification, Documentation Collection Preservation, Filtering Data reduction, evidence recovery, investigation reconstruction, reporting results.

#### **UNIT- 6: Forensics of Hand-Held Devices**

Understanding Cell Phone Working Characteristics, Hand-Held Devices and Digital Forensics, Toolkits for Hand-Held Device Forensics, Techno-Legal Challenges with Evidence from Hand-Held Devices

#### **Internal Continuous Assessment (ICA):**

Minimum 8 to 10 Experiments/Assignments. Covering, but not limited to, the topic mentioned below:

- Installation of Linux(Kali, Ubuntu, parrot) operating system •
- IT act 2000 framework •
- Keylogger Implementation •
- SQL Injection attack •
- Implementation of Message Encryption and Decryption •
- Simulation of DoS attack •
- Network Traffic Analysis through Wireshark •
- Data Recovery •
- Steganography •
- Understanding Computer Forensics/ Mobile Forensics/ Network Forensics •
- Password cracking techniques •
- Phishing attack Detection (different malware types) •
- Cyber Crime: The Legal Perspectives •
- Forensics of Hand-Held Devices

#### **Text books:**

- 1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole, Sunita Belapure
- 2. Digital Evidence & Computer Crime Forensic science, Computers & The Internet', Eoghan Casey, 3rd edition
- 3. 'Computer Forensics Computer Crime scene investigation', 2nd edition, Johm R. Vacca

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#### **Reference Books:**

- 1. 'Computer Forensics Investigating Network Intrusions & Cybercrime', EC-Council press, Cengage Learning
- 2. Guide to Computer Forensics & Investigations, 4th edition, Bill Nelson, Amelia Phillips & Christopher Steuart, Cengage Learning
- 3. 'Guide to Integrating Forensic Techniques into Incident Response', NIST, Karen Kent, Suzanne Chevalier Tim Grance, Hung Dang



#### Faculty of Science and Technology Third Year B.Tech (Computer Science and Engineering) SEMESTER-V Honors in Data Science CSEHON-03C : Machine Learning

Teaching Scheme	Examination Scheme
Lectures-3 Hours/week, 3 Credits	ESE –70 Marks
Practical – 2 Hours/week, 1 Credit	ISE – 30 Marks
	ICA - 25 Marks

#### Introduction:

This course introduces Machine Learning which deals with fundamentals of machine learning and its types. The course also introduces how to validate and evaluate the performance of machine learning model.

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**Course Prerequisite:** Students should have prior knowledge of statistics, linear algebra, probability, and data pre-processing.

#### **Course Objectives:**

- 1. To introduce various types of machine learning algorithms.
- 2. To enable designing of a model selecting appropriate machine learning algorithms for a given problem.
- 3. To study methods to validate previously designed machine learning models.
- 4. To introduce methods to evaluate and tune machine learning models.

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#### **Course Outcomes:**

At the end of the course students will be able to

- 1. Demonstrate various types of machine learning algorithms and their applications.
- 2. Design classification and regression models by selecting appropriate machine learning algorithms for given problems.
- 3. Apply unsupervised learning techniques for data clustering and analysis.
- 4. Evaluate and optimize the performance of machine learning models using validation techniques, evaluation metrics, and hyperparameter tuning.

#### **SECTION-I**

#### **UNIT-1 Introduction to Machine Learning**

What is Machine Learning? How do machine learn, Well-posted learning problem, Types of Machine Learning: Supervised learning, unsupervised learning, Reinforcement learning, Comparison – supervised, unsupervised and reinforcement learning, Problems not to be solved using Machine Learning, Applications of Machine Learning.

#### **UNIT-2 Supervised Learning- Classification**

Classification: Introduction, Examples of Supervised Learning, Classification model, Classification learning steps, Common Classification ,conditional Probability Bayes theorem, Algorithms-Naïve Bayes classifier- Applications of Bayes classifier, Handling continues numeric features in Bayes classifier, k-Nearest Neighbors (k-NN), Decision tree, Random Forest model, Support vector machine.

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#### **UNIT-3 Supervised Learning- Regression**

Regression: Introduction, Examples of regression, Common regression algorithms-Simple linear regression, Multiple linear regression, Assumptions in regression analysis, Main problems in regression analysis, Improving accuracy of the linear regression model, polynomial regression model, logistic regression model.

#### **SECTION II**

#### **UNIT-4 Unsupervised Learning**

Introduction, Unsupervised vs Supervised learning, Applications of Unsupervised learning, Clustering: Clustering as a Machine learning task, different types of clustering techniques,

Partitioning methods, k-means algorithm, k-medoids, Hierarchical clustering, Association rule, Apriorism algorithm.

#### **UNIT-5 Validating Machine Learning Models**

Introduction: Bias, Variance, Underfitting, Overfitting, cost function, types of cost function, cross validation, Types of cross validation Training, Testing, Validation

#### **UNIT-6 Modeling and Evaluation**

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Introduction, selecting a Model, training a Model, Model, Representation and Interpretability, Evaluating Performance of a Model, Improving Performance of a Model. Applications of Machine Learning, future of Machine learning.

#### **Text books:**

- 1. Machine Learning Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, Pearson Publication.
- 2. Machine Learning for Dummies by John Paul Mueller, Luca Massaron (Published by For Dummies; First edition).

#### **Reference Books:**

- 1. Machine Learning by Tom M. Mitchell (Publisher: McGraw Hill Education; First edition + New Chapters from Second edition).
- 2. Introduction to Machine Learning (Second Edition) by Ethem Alpaydın (published by The MIT Press Cambridge, Massachusetts London, England
- 3. Machine Learning with Python for Everyone by Mark E. Fenner, Pearson Publication

#### **Internal Continuous Assessment (ICA):**

Minimum 8 assignments requiring students to develop machine learning applications for real world problem/use-case/scenario based on any of the following topics:

- 1. Linear and Multilinear Regression
- 2. Decision Tree regressor
- 3. K-Nearest Neighbour (KNN) classifier
- 4. Logistic Regression classifier
- 5. Support vector machine (SVM)
- 6. Decision Tree classifier
- 7. Naive-Bayes classifier
- 8. Ensemble Models
- 9. K-means clustering (Unsupervised Learning)

10. Improving Machine Learning models using cross-validation and Hyper parameters tunning

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#### Faculty of Science and Technology Third Year B.Tech (Computer Science and Engineering) SEMESTER-VI

**CSEPCC-10 : Software Engineering** 

# Teaching SchemeExaminatLecture: 2 Hrs/week, 2 CreditsESE:70 M

**Examination Scheme** ESE:70 Marks ISE:30 Marks

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**Introduction:** Current Software engineering methods and techniques have made us much better at building large and complex systems than we were. However, there are still too many projects that are late, over budget, and do not deliver the software that meets customer's needs. The main aim of introducing this course is to understand the methods, processes, techniques, and approaches which are required to develop high-quality software products within schedule and budget. On top of that this course ensures understanding of the complete Software Development Life Cycle (SDLC) for the development of software products as per the customer's needs. Further, it ensures the knowledge of various quality standards used in the software system and the Agile Project Management Process.

#### **Course Prerequisite:**

Student shall have undergone a course on Object Oriented Programming through C++.An understanding of Object Oriented Analysis and Design and Programming skills.

# Course Objectives:

- 1. To illustrate and compare the use of life cycle models for software development.
- 2. To identify different methods for analyzing software requirements.
- 3. To identify different methods for designing software requirements.
- 4. To apply different testing methods to the software system.
- 5. To describe various quality standards used in the software system.
- 6. To use the techniques and tools necessary for engineering practice.

#### **Course Outcomes:**

#### At the end of the course Student will be able to

- 1. Apply the appropriate lifecycle model for software development.
- 2. Prepare SRS accordingly for a given problem.
- 3. Prepare SDS accordingly for a given problem.
- 4. Apply appropriate software testing method.
- 5. Ensure the quality of a product by applying the quality management process.

6. Demonstrate an ability to use the techniques and tools necessary for engineering practice.

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#### **SECTION-I**

#### **UNIT 1 - Introduction to Software Engineering**

Introduction, The Problem Domain, Software Engineering Challenges and Approach, Software Process, Characteristics of Software Process, Software Development Process Models: Waterfall model, Prototype model, Iterative development model: Incremental Model, Spiral model, Rational unified Process model, Time Boxing model, Agile process model.

#### UNIT 2 - Software Requirement Analysis & Specification

Need of SRS, Characteristics of Good SRS, Requirement Process, Requirements specification, Functional Specification with Use Cases, Other Approaches for Analysis: Data Flow Diagram, Entity Relationship Diagram

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#### **UNIT 3- Software Architecture and Design**

Introduction to Software Design, Software Architecture: Role of Software Architecture, Architecture Views, Component & Connector View, Architecture Style for Component& Connector view, Documenting Architecture Design, Design Concepts: Design Principles, Conceptual Design and Technical Design, Coupling, Cohesion, Open Closed Principle, Function- Oriented Design, Object Oriented Design, High Level Design, Detailed Design, UML Diagrams, Verification, Metrics.

#### **SECTION-II**

#### **UNIT 4- Testing**

Testing Fundamentals, Testing Process, Black-Box Testing, White-Box Testing, Object-Oriented Software testing methods, Functional testing, Unit testing, System testing, User satisfaction testing.

#### **UNIT 5- Project Planning and Management**

Project management process, The Inspection and Audit Process, Software Configuration Management process, Effort estimation, Project Schedule and Staffing, Quality planning: Quality Concepts, Qualitative quality management planning. CMM, Project Management Process, Risk Management Planning, Project Monitoring Plan.

#### **UNIT 6- Agile Project Management**

Introduction to APM, Implementation, Iterative Project Management Life Cycle, Adaptive Project Management Life Cycle, Adaptive & Integrating the APM toolkit, The Science of Scrum, New Management Responsibilities.

#### **Text Books:**

- 1. An Integrated Approach to Software Engineering, Pankaj Jalote, 3<sup>rd</sup>Edition(Narosa Publishers)
- 2. Effective Project Management Traditional, Agile, Extreme, Robert K. Wysocki, Edition, WILEY INDIA
- 3. Software project management in practice, Pankaj Jalote Pearson India Ltd.

#### **Reference Books:**

- 1. Software Engineering, Ian Sommerville, 6<sup>th</sup> edition, Pearson education Asia.
- 2. Software Engineering Fundamentals, Ali Behforooz and Frederick J. Hudson (Oxford University Press).
- 3. Project Management with Scrum, Ken Schwaber.
- 4. Software Engineering- A precise approach, Pankaj Jalote Wiley Precise Precise Textbook.

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#### Faculty of Science and Technology Third Year B.Tech (Computer Science and Engineering) SEMESTER-VI CSEPCC-11 : Cloud Computing

# Teaching SchemeExamination SchemeLectures: 2 Hours/Week, 2 creditsESE - 70 MarksPractical: 2 Hour/Week, 1 creditISE - 30 MarksICA-25 MarksPOE-25 MarksPOE-25 MarksPOE-25 Marks

#### Introduction:

Cloud computing has recently emerged as one of the buzz words in the ICT industry. Numerous IT vendors are promising to offer computation, storage, and application hosting services and to provide coverage in several continents, offering service-level agreements (SLA)-backed performance and uptime promises for their services.

The course introduces to introduction to Cloud Computing, Virtual Machines Provisioning and Migration Services, understanding Services and Applications by Type, Integration of Private and Public Clouds, Understanding of Cloud Security, Legal Issues in Cloud Computing.

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#### **Prerequisites:**

Programming Skills, Database fundamentals & SQL, Operating Systems and Networking.

#### **Course Objectives:**

- 1. To understand the fundamental concepts and architecture of cloud computing.
- 2. To explore different cloud service models (IaaS, PaaS, SaaS) and deployment models.
- 3. To learn about virtual machines, migration services, and provisioning in cloud environments.
- 4. To analyze security challenges and risk management in cloud computing.
- 5. To evaluate cloud computing applications in business and understand financial and legal aspects.
- 6. To gain practical exposure to public and private cloud platforms.

#### **Course Outcomes:**

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

- 1. Apply the principles of cloud service and deployment models to select the most suitable solution for an organization's infrastructure needs.
- 2. Analyze virtual machine provisioning and migration techniques.
- 3. Choose a cloud deployment model suitable for an organization's hardware & software needs
- 4. Identify Security and Privacy concerns in cloud computing for data management.
- 5. Evaluate the business benefits of cloud computing.
- 6. Analyze cloud contracting models and jurisdictional issues.
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#### SECTION I

#### **UNIT 1: Introduction to Cloud Computing**

Cloud Computing in a Nutshell, Roots of Cloud Computing, Layers and Types of Clouds, Desired Features of a Cloud, Cloud Infrastructure Management, Defining Infrastructure as a Service (IaaS), IaaS workloads, Pods, aggregation, and silos, Defining Platform as a Service(PaaS), Defining Software as a Service (SaaS), SaaS characteristics, Vendor lock-in, Challenges and Risks,

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## **UNIT 2: Virtual Machines Provisioning and Migration Services**

Migrating into a Cloud, Introduction, Broad Approaches to Migrating into the Cloud, The Seven-Step Model of Migration into a Cloud. Virtual Machines Provisioning and Manageability, Virtual Machine Migration Services, VM Provisioning and Migration in Action, Provisioning in the Cloud Context, Salesforce. Command CRM SaaS, Defining Identity as a Service, What is an identity? Access Control and identity Management, Identity system codes of conduct, Defining Compliance as a Service (CaaS)

#### **UNIT 3: Working with Private and Public Cloud**

Private Cloud Definition, Characteristics of Private Cloud, Private Cloud deployment models, Cloud Stack: architecture and its compute, storage, networking, and IAM services, OpenStack: architecture and its compute, storage, networking, and IAM services. What is Public Cloud, Why Public Cloud, When to opt for Public Cloud, Basic compute, storage, and networking and IAM services of AWS, Microsoft Azure and Google Cloud platform? Designing elastic, highly available, and resilient infrastructure for varied application scenarios on AWS, Microsoft Azure and Google Cloud platform. Financial and technological implications of running an application on public cloud

#### **SECTION II**

#### UNIT 4: Understanding of Cloud Security

Securing the Cloud, The security boundary, Security service boundary, Security mapping, Securing Data, Brokered cloud storage access, Storage location and tenancy, Encryption Auditing and compliance, Gartner's seven cloud computing security Risks

#### **UNIT 5: Cloud Computing for Business**

Why Cloud, business perspective? Establishing your Cloud Vision, Buying Cloud Services Understanding Cloud Risk, Building ROI from Cloud Computing, the Challenge, Cloud Computing in Use

#### **UNIT 6: Legal Issues in Cloud Computing**

Introduction, Data Privacy and Security Issues, Cloud Contracting models, Jurisdictional Issues Raised by Virtualization and Data Location, Commercial and Business Considerations-A Cloud User's Viewpoint.

#### **Internal Continuous Assessment (ICA):**

Minimum 10 assignments must be of nature, which require students to identify and implement the use case scenarios for Cloud and Cloud enabled technologies mentioned above.

The experiments should include from below concepts:

#### **1. Introduction to Cloud Computing**

#### Discuss with students various services of cloud

- Set up a free-tier account on AWS/Azure/GCP.
- Explore the dashboard and understand various cloud services.

#### 2. Virtualization & Virtual Machines (VMs)

- Create and manage a virtual machine using VirtualBox or VMware.
- Deploy a VM on AWS (EC2 instance) or Azure.

#### 3. Cloud Storage

- Create and manage an S3 bucket (AWS) or Blob Storage (Azure).
- Upload, retrieve, and delete files from cloud storage.

#### 4. Load Balancing & Auto Scaling

- Deploy two EC2 instances and configure an AWS Load Balancer.
- Set up Auto Scaling to handle traffic changes dynamically.

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#### 5. Hosting a Static Website

- Upload HTML & CSS files to AWS S3 / Google Cloud Storage
- Hosting a Static Website Using Azure Storage
- Enable **public access** and view the website using a URL

#### 6. Docker & Containerization

- Install Docker and create a simple container.
- Deploy a web application using Docker.
- Push and pull images from Docker Hub.

#### 7. Kubernetes Basics

- Deploy a Kubernetes cluster on Minikube.
- Deploying a Kubernetes Cluster with Azure Kubernetes Service (AKS)
- Create and manage pods, deployments, and services.

#### 8. Server less Computing with AWS Lambda

- Create a simple AWS Lambda function.
- Creating a Server less Function with Azure Functions
- Trigger Lambda using AWS API Gateway or S3.

#### 9. Cloud Database Services

- Deploy and manage a MySQL/PostgreSQL database on AWS RDS.
- Configuring and Using Azure SQL Database
- Connect a cloud-based database with a local or cloud application.

#### **10. Cloud Database Basics**

- Set up a MySQL database in AWS RDS or Google Cloud SQL
- Connect it using MySQL Workbench or a simple Python script
- Implementing Identity and Access Management with Azure Active Directory

Implementing Multi-Factor Authentication (MFA) in Azure Active Directory

- Implementing Role-Based Access Control (RBAC) in Cloud Environments
- Monitoring and Detecting Threats Using Azure Security Center

#### **Text Book:**

- 1. Cloud Computing: Principles and paradigms By Raj Kumar Buyya, ames Broberg, Andrezei M.Goscinski, 2011 Cloud Computing, By Michael Miller, 2008.
- 2. Cloud Computing Bible by Barrie Sosinsky by WileyPublications
- 3. https://arpitapatel.files.wordpress.com/2014/10/cloud-computing-bible1.pdf
- 4. Cloud Computing for dummies, By Judith Hurwitz, Robin Bllor, Marcia Kaufman, Fern Halper, 2009. Download E-book
- 5. Cloud Computing: Black Book, by Kalish Jayaswal, J. Kallakurchi, Donald J. Houde, Dr. Deven Shah Kogent learning Solutions Inc. Dream techpress
- 6. Official documentation of OpenStack, CloudStack, AWS, Microsoft Azure, Google Cloud Platform.

#### **Reference Book:**

- 1. Cloud Security, A comprehensive Guide to Secure Cloud Computing by Krutz, Ronald L.; Vines, Russell Dean
- 2. Cloud computing: Implementation, management and security By Ritting house, John, W.
- 3. Mastering Cloud Computing, Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, McGraw Hill, 2013

NPTEL Course: 1. Cloud Computing, Prof. Soumya Kanti Ghosh, Department of Computer Science and Engineering, IIT Kharagpur

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#### Faculty of Science and Technology Third Year B.Tech (Computer Science and Engineering) SEMESTER-VI

#### **CSEPCC-12 : System Software**

Teaching Scheme	<b>Examination Scheme</b>
Lectures-3 Hours/week, 3 Credits	ESE –70 Marks
Practical- 2 Hours/week, 1 Credit	ISE – 30 Marks
	ICA – 25 Marks

#### Introduction:

System software is a type of software that manages hardware resources and provides essential services for application software. It includes operating systems, assemblers, compilers, linkers, loaders, and other utility programs that enable efficient system operation.

**Course Prerequisite:** Students shall have knowledge of theory of computation

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#### **Course Objectives:**

The objectives of this course are to:

- 1. Understand the fundamentals of system software, including system programming and compiler construction.
- 2. Explore the working of assemblers, linkers, loaders, and macro processors.
- 3. Learn the design and working of various compiler phases.
- 4. Understand code generation and optimization techniques.
- 5. Analyze real-world compiler architectures and debugging tools.
- 6. Apply system software concepts in practical implementations.

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#### **Course Outcomes:**

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

- 1. Understand the structure and functionality of system software components.
- 2. Implement basic assemblers, macro processors, and linkers.
- 3. Design and implement lexical analyzers and parsers.
- 4. Apply code optimization techniques for compiler efficiency.
- 5. Use debugging and profiling tools in compiler design.
- 6. Analyze real-world compilers and system software architectures.

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#### SECTION-I

#### UNIT-1 Introduction to System Software

Overview of System Software and its role, Differences between System and Application Software, Introduction to System Programming and Compiler Construction, Evolution of System Software

#### **UNIT-2** Assemblers and Linkers

Machine Language and Assembly Language, Design and Working of Assemblers, Two-Pass and Single-Pass Assemblers, Symbol Tables and Address Binding, Linkers and Loaders: Static and Dynamic Linking

#### **UNIT-3 Macro Processors and Operating System Components**

Macro Definitions and Expansion, Design of Macro Processors, System Calls and Their Role in System Programming, Process Management and Memory Management Basics

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#### **SECTION II**

#### **UNIT-4 Introduction to Compiler Design**

Phases of a Compiler, Lexical Analysis: Tokens, Lexical Errors, Finite Automata, Syntax Analysis: Parsing Techniques (Top-down and Bottom-up), Semantic Analysis: Syntax-Directed Translation

#### **UNIT-5** Code Generation and Optimization

Intermediate Code Generation, Code Generation Techniques, Code Optimization: Peephole Optimization, Local and Global Optimization, Register Allocation and Instruction Scheduling

#### UNIT-6 Linkers, Loaders, and Debuggers in Compiler Design

Relocation and Linking in Compilers, Static vs. Dynamic Linking in Compiler Construction, Debugging Tools and Profilers, Just-In-Time (JIT) Compilation

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#### **Text books:**

- 1. Leland L. Beck, Manjula D. Murthy System Software: An Introduction to Systems Programming (Pearson)
- 2. D. M. Dhamdhere System Programming and Operating Systems (McGraw Hill)
- 3. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman Compilers: Principles, Techniques, and Tools (Pearson) (a.k.a. "Dragon Book")
- 4. John R. Levine *Linkers and Loaders* (Morgan Kaufmann)

#### **Reference Books:**

- 1. Andrew S. Tanenbaum Modern Operating Systems (Pearson)
- 2. Kenneth C. Louden *Compiler Construction: Principles and Practice* (Cengage Learning)
- 3. Appel, Andrew W. Modern Compiler Implementation in C/Java (Cambridge University Press)
- 4. Uday P. Khedkar, Anshuman Nisargandh, Manjiri Joshi *Compiler Design: Implementation and Techniques* (McGraw Hill)
- 5. Ravi Sethi Programming Languages: Concepts and Constructs (Pearson)

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#### Faculty of Science and Technology Third Year B.Tech (Computer Science and Engineering) SEMESTER-VI Programme Elective Course - II CSEPEC-02A : Data Mining

Examination Scheme
ESE – 70 Marks
ISE –30 Marks
ICA - 25 Marks
POE- 25 Marks

#### Introduction:

Data Mining is the process of discovering patterns, correlations, and useful insights from large datasets using techniques from statistics, machine learning, and database systems.

#### **Course Prerequisite:**

Data Mining requires combination of technical, analytical, and problem-solving skills.

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#### **Course Objectives :**

- 1. Understand the Fundamentals of Data Mining.
- 2. Perform Data Preprocessing and Cleaning .
- 3. Apply Data Mining Techniques.

#### **Course Outcomes:**

#### At the end of this course, students will be able to

- 1. Examine the types of the data to be mined for a particular application.
- 2. Apply preprocessing statistical methods for any given raw data.
- 3. Select and apply proper data mining algorithms to build analytical applications
- 4. Comprehend the roles that data mining plays in various fields and manipulate different data mining techniques.
- 5. Demonstrate and apply a wide range of Clustering, Classification and association rule mining algorithms.

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#### **SECTION-I**

#### **UNIT 1: Introduction to Data Mining**

Data Mining Concept, Relation between Data Mining, Machine Learning, and Artificial Intelligence. Types of Data: Structured, Unstructured, Semi-structured.

**Overview of the data mining process**: problem definition, data collection, preprocessing, model building, evaluation, and deployment. Types of Data Mining, Basic Data Mining tasks, major issues in data mining, Data mining Applications, KDD (Knowledge Discovery in Databases) and their applications.

#### **UNIT 2: Data Preprocessing**

Need to Preprocess the data, major tasks in Data Preprocessing, Data Cleaning, Data integration, Data Reduction, Data Transformation and Data Dicretization.

#### UNIT 3: Mining Frequent Pattern and Classification in Data Mining

Key Concept of Frequent Pattern Mining, Frequent Pattern Mining Algorithms, Apriori Algorithm, FP- Growth Algorithm, Challenges in Frequent Pattern Mining,

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**Classification**: Decision trees(CART, ID3), Naive Baye's, k-Nearest Neighbors (k-NN), Support Vector Machines (SVM), Random Forest.

#### **SECTION-II**

#### **UNIT 4: Cluster Analysis- Basic Concept and Methods**

Cluster Analysis: What is Cluster Analysis?, Requirements for Cluster Analysis, Overview of Basic Clustering Methods, **Partitioning Methods**: k-Means, k-Medoids.

Hierarchical Methods : Agglomerative Algorithms and Divisive Clustering, BIRCH: Multiphase Hierarchical Clustering Using Clustering Feature Trees, Evaluation of Clustering.

#### **UNIT 5: Association Rules**

Introduction, Large Item sets, Basic Algorithms: Apriori Algorithm, Sampling Algorithm, Partitioning Algorithm, Parallel and Distributed Algorithms, Comparing Approaches, Incremental Rules, Advanced association rule-Techniques, Measuring the quality of rules.

#### **UNIT 6: Outlier Detection and Web Mining**

Introduction, Web and web content mining, web usage mining, web structure mining, web crawlers. **Outlier Detection** Outliers and Outlier Analysis, Outlier Detection Methods, Statistical Approaches, Clustering- Based Approaches, Classification-Based Approaches.

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#### Internal Continuous Assessment (ICA) :

Conduct minimum 08 experiments based on the following guidelines.

1. **Implement Data Preprocessing Techniques:** Clean, integrate, reduce, and transform a real-world dataset.

2. Explore Structured, Unstructured, and Semi-structured Data: Analyze and differentiate between data types.

3. Build a Decision Tree Classifier: Classify data using CART or ID3 algorithm.

4. **Implement the Apriori Algorithm for Association Rule Mining:** Find frequent item sets and association rules.

5. Apply k-Means Clustering: Group similar data points into clusters.

6. Implement FP-Growth Algorithm: Efficiently mine frequent item sets.

7. Build and Evaluate a Naive Bayes Classifier: Classify textual data using Naive Bayes.

8. Conduct Web Content and Web Usage Mining: Extract useful information from web pages and analyze user behavior.

9. Perform Outlier Detection: Detect anomalies in a given dataset.

10. Compare Classification Algorithms: Evaluate performance of k-NN, SVM, and Random Forest.

#### **Text Books:**

- 1. Margaret H. Dunham, "DATA MINING Introductory and Advanced Topics", PEARSON (Units 4,5)
- 2. Han, Kamber, Pei, "DATA MINING Concept and Techniques", 3<sup>rd</sup> Edition, ELSEVIER (Units 1,2,3,6)
- 3. Tan, Vipin Kumar, Steinbach, "Introduction to Data Mining", PEARSON (Unit 4)
- 4. G. K. Gupta, \Introduction to Data mining with case studies", PHI, second edition (Unit 6)

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#### **Reference Books:**

- 1. GalitShmueli, Nitin Patel, Peter Bruce, "Data mining For Business intelligence" Wiley Student Edition.
- 2. M.Berry and G. Linoff, "Mastering Data Mining", Wiley Student Edition



#### Faculty of Science and Technology Third Year B.Tech (Computer Science and Engineering) SEMESTER-VI Programme Elective Course - II CSEPEC-02B : Network Security

#### **Teaching Scheme**

Lectures–3 Hours/Week, 3 Credits Practical–2 Hours/Week, 1 Credits Examination Scheme ESE –70 Marks ISE – 30 Marks ICA – 25 Marks POE – 25 Marks

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#### Introduction:

Network security is the practice of protecting computer networks and their resources from unauthorized access, misuse, modification, or destruction. It encompasses policies, technologies, and strategies to ensure data integrity, confidentiality, and availability.

#### **Course Prerequisite:**

Students should have foundational knowledge in the areas of Computer Networks, Modular Arithmetic, and Programming Skills.

#### **Course Objectives:**

- 1. To learn different encryption methods, including symmetric and asymmetric encryption.
- 2. To study public-key cryptosystems like RSA, Diffie-Hellman, and Elliptic Curve Cryptography.
- 3. To explore cryptographic hash functions and message authentication techniques.
- 4. To understand digital signatures and their role in secure communication.
- 5. To learn about network access control, wireless security, and cloud security mechanisms.
- 6. To study email security and IP security protocols for secure data transmission.

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#### **Course Outcomes:**

#### Students will be able to:

- 1. Implement classical encryption techniques and block cipher standards like DES and AES.
- 2. Implement and analyze public-key cryptosystems
- 3. Apply cryptographic hash functions and message authentication techniques to ensure data integrity and security.
- 4. Analyze the role of digital signatures in authentication and secure communication.
- 5. Explain network access control mechanisms, cloud security principles, and wireless security protocols, including IEEE 802.1X and IEEE 802.11i
- 6. Demonstrate the working of Email and IP security solutions using protocols like S/MIME, PGP, and IPSec.

#### **SECTION-I**

#### UNIT-1: Fundamental Of Cryptography And Block Cipher Standard

Introduction: OSI Security Architecture, Classical Encryption techniques: Symmetric Cipher Model, Substitution Techniques, Transportation Techniques. Block Ciphers and Data Encryption Standards: Traditional Block Cipher Structure, The Data Encryption Standard, Advanced Encryption Standard: AES Transformation Functions, AES Key Expansion

#### **UNIT-2: Public key Cryptography and RSA**

Public Key Cryptography and RSA: Principles of Public-Key Cryptosystems, The RSA Algorithm. Other Public-Key Cryptosystems: Diffie-Hellman Key Exchange, Elgamal Cryptographic System, Elliptic Curve Arithmetic, Elliptic Curve Cryptography

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Applications of Cryptographic Hash Functions, Two Simple Hash Functions, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithm (SHA), SHA-3.

#### **SECTION-II**

#### **UNIT-4: Message Authentication Codes**

Message Authentication Requirements, Message Authentication Functions, Requirements for Message Authentication Codes, Security of MACs, MACs Based on Hash Functions: HMAC, Digital Signatures: Digital Signatures, Elgamal Digital Signature Scheme, Elliptic Curve Digital Signature Algorithm, Digital Signature Algorithm.

#### **UNIT-5: Network Access Control and Cloud Security**

Network Access Control, Extensible Authentication Protocol, IEEE 802.1X Port-Based Network Access Control. Wireless Network Security: Wireless Security, Mobile Device Security, IEEE 802.11 Wireless LAN Overview, IEEE 802.11i Wireless LAN Security.

#### **UNIT-6: Electronic Mail Security**

Internet Mail Architecture, Email Formats, Email Threats and Comprehensive Email Security, S/MIME, Pretty Good Privacy, IP Security: Overview, IP Security Policy, Encapsulating Security Payload.

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#### Internal Continuous Assessment (ICA) :

#### It should consist of the 08 practical based on the following guidelines.

- 1. Implementation of Substitution Cipher
- 2. Implementation of Poly alphabetic Cipher (Vigenere Cipher and Vernam Cipher)
- 3. Implementation of Transposition Cipher
- 4. Implementation of Play fair Cipher
- 5. Implementation of Secure file transfer in Client/Server environment (use any one of above method for encryption and decryption)
- 6. Write a program to simulate RSA algorithm
- 7. Implement key exchange using the Diffie-Hellman method.
- 8. Implement cryptographic hash function (SHA-1, SHA-256, and SHA-3 algorithms.)
- 9. Demonstrate access control in a cloud environment with role-based authentication.

#### **Text Books :**

- 1. Cryptography And Network Security Principles and Practices, William Stallings Pearson Education Limited, 7th Edition, 2017. ISBN-13: 978-0134444284 ISBN-10: 0134444280.
- 2. Cryptography and Network Security, Behrouz A. Forouzan, Tata McGraw-Hill, 2008, ISBN-13:978-0-13-187319-3. RV College of Engineering® Digital Communication Engineering 10
- 3. Computer Security: Principles and Practice, William Stallings, Lawrie Brown, Pearson Education Limited, 4th Edition. ISBN-10: 9780134794105.
- 4. Cryptography and Network Security, Atul Kahate, Tata McGraw-Hill, 2003, ISBN-81:203-2186-3.

#### **Reference Books :**

- 1. Network Security Essentials: Applications and Standards" William Stallings
- 2. Cryptography and Network Security: Principles and Practice" William Stallings
- 3. Computer Security: Principles and Practice" William Stallings and Lawrie Brown

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#### **Faculty of Science and Technology** Third Year B.Tech (Computer Science and Engineering) **SEMESTER-VI**

# **Programme Elective Course - II**

**CSEPEC-02C : Advanced Operating System** 

Teaching Scheme	Examination Scheme
Lectures – 3 Hours/week, 3 Credits	ESE - 70 Marks
Practical – 2 Hrs./week, 1 Credit	ISE – 30 Marks
	ICA – 25 Marks
	POE – 25 Marks

#### Introduction:

This course covers Operating Systems fundamentals, including OS architectures, process/thread management, Distributed Operating Systems synchronization, Real-Time Systems, and OS security..

Course Prerequisite: Students should have knowledge of Computer Systems, Operating Systems, basics of C programming language.

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#### **Course Objectives:**

- 1. To understand OS structure and describe the function of system calls in OS operations.
- 2. To apply techniques for creating, scheduling, and synchronizing processes and threads within an operating system.
- 3. To apply distributed OS synchronization methods and real-time scheduling techniques in practical scenarios.
- 4. To implement access control, authentication, and encryption methods to secure an operating system. reframe it

#### **Course Outcomes:**

#### Students will be able to:

- 1. Understand OS structures and describe the role of system calls.
- 2. Implement techniques for process and thread creation, scheduling, and synchronization
- 3. Apply distributed OS synchronization methods and real-time scheduling techniques.
- 4. Use access control, authentication, and encryption to strengthen OS security.

#### **SECTION-I**

#### **UNIT 1 - Introduction**

Overview of Operating Systems, OS Architecture, Monolithic, Microkernel, Hybrid System Calls, OS Design Goals, and Structure.

#### **UNIT 2 - Process and Thread Management**

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Process Management: Process States, Process Control Block (PCB), Process Creation and Termination, Context Switching Mechanism, System Calls for Process Management.

Thread Management: Difference Between Processes and Threads, Thread Models, Thread Creation, Scheduling, and Termination, Thread Synchronization Mechanisms

#### **UNIT 3 - Multiprocessor Operating Systems**

System Architectures, Structures of OS, OS design issues, Process synchronization, Process Scheduling.

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#### **SECTION II**

### **UNIT 4 - Distributed Operating Systems:**

System Architectures, Design issues, Communication models, clock synchronization, mutual exclusion, election algorithms, Distributed Deadlock detection

#### **UNIT 5 - Real-Time Operating Systems (RTOS)**

Real-Time Systems Overview, Hard Real-Time Vs Soft Real-Time Systems, Task Scheduling in RTOS: Periodic, Aperiodic, Sporadic Real-Time Scheduling Algorithms: Rate-Monotonic Scheduling (RMS), Earliest Deadline First (EDF), Memory Management in Real-Time Systems, Interrupt Handling in RTOS

#### **UNIT 6 – Operating System Security**

OS Security Models: Confidentiality, Integrity, Availability (CIA Triad), Access Control Mechanisms: Discretionary Access Control (DAC), Mandatory Access Control (MAC), Role-Based Access Control (RBAC), Authentication: Passwords, Biometrics, Two-factor Authentication, Cryptography in OS: Symmetric vs. Asymmetric Encryption Public Key Infrastructure (PKI) SSL/TLS Protocols, File System Encryption (e.g., dm-crypt, BitLocker)

#### International Continuous Assessment (ICA) :

It should consist of minimum 8 laboratory assignments on above topic:

- 1. Understand the different types of operating system architectures: Monolithic, Microkernel, and Hybrid.
- 2. Implementation of Process system calls: fork (), exec(), suspend() , resume()
- 3. Implement a process scheduler using Round-Robin or FIFO scheduling.
- 4. Create a multi-threaded application that demonstrates thread creation, scheduling, and termination using pthreads or Java Threads.
- 5. Implement a producer-consumer problem with shared memory and semaphores for process synchronization.
- 6. Implement an election algorithm (e.g., Bully or Ring) in a distributed system to elect a coordinator.
- 7. Implement a basic distributed deadlock detection algorithm.
- 8. Implement a task management system that handles periodic, aperiodic, and sporadic tasks in an RTOS.
- 9. Implement memory management for real-time systems, handling task and interrupt-based memory allocation.
- 10. Implement file encryption and decryption using symmetric or asymmetric encryption algorithms

#### **Text Books:**

- 1. Operating System concepts, Silberschatz, Galvin, 7th or 8th Edition (John Wiley).
- 2. Operating Systems: Internals and Design Principles by William Stallings, 5th Edition (PHI).
- 3. The design of Unix Operating Systems- Maurice J. Bach(PHI)

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#### **Reference Books:**

- 1. Operating system with case studies in UNIX, Netware and Windows NT by Achyut Godbole (TMGH).
- 2. Modern Operating Systems by Andrew S. Tanenbaum
- 3. Operating System Concepts by Abraham Silberschatz, Peter Baer Galvin, Greg Gagne
- 4. Linux Kernel Development by Robert Love
- 5. Real-Time Systems by Jane W. S. Liu

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#### Punyashlok Ahilyadevi Holkar Solapur University, Solapur Faculty of Science and Technology Third Year B.Tech (Computer Science and Engineering) SEMESTER-VI Programme Elective Course - II CSEPEC-02D : Management Information Systems

	<i>.</i>	
Teaching Scheme		<b>Examination Scheme</b>
Lectures - 3 Hours/week, 3 Credits		ESE – 70 Marks
Practical - 2 Hours/week, 1 Credit		ISE – 30 Marks
		ICA – 25 Marks
		POE – 25 Marks

**Introduction:** The purpose of learning this course "Management Information Systems" is to make the student understand the principles of Management Information Systems and develop MIS for different real world systems. Management Information Systems delves on the evolution, implementation and its advantages, providing comprehensive coverage of Decision Support System (DSS) as well as different modules-decision making process, components, classification, data models and designing of database systems.

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Course Prerequisite: Students shall have knowledge of Management Information Systems.

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#### **Course Objectives**:

The objectives of this course are to:

- 1. To understand and asses the importance of information and its role in business.
- 2. To develop data analysing skills in students to evaluate information and the tools used for information processing.

#### **Course Outcomes:**

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

- 1. Student can elaborate basic infrastructure and strategies used in information systems.
- 2. Student can apply professional ethical codes of conduct as appropriate to industry and organizational environments.
- 3. Students can design information systems using principles of Communication Technologies.

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4. Students will be able to develop secure information systems

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#### **SECTION-I**

#### **UNIT 1 - Information Systems in Global Business Today**

The Role of Information Systems in Business Today, How information systems are transforming business, What is new in information system. Business Processes and Information systems, Systems for collaboration and social business, Tools and technologies for collaboration and social business

#### **UNIT 2 - Information Systems, Organizations, and Strategy**

Organizations and it's features, How Information Systems Impact on Organizations, Competitive strategies using information systems, Challenges posed by strategic information systems

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## **UNIT 3 - Ethical and Social Issues in Information Systems**

Understanding Ethical, Social, political issues raised by information systems, principles for conduct in ethical decisions, Contemporary information systems technology, Challenges to the protection individual privacy and intellectual property.

#### **SECTION II**

#### **UNIT 4 - IT Infrastructure and Emerging Technologies**

IT Infrastructure, Infrastructure Components, Contemporary Hardware Platform Trends, Contemporary Software Platform Trends, Management Issues

UNIT 5 - Foundations of Business Intelligence: Databases and Information Management (07)

Organizing Data in a Traditional File Environment, Major Capabilities of Database Management Systems, Using Databases to Improve Business Performance and Decision Making, Managing Data Resources, Telecommunications, the internet, and Wireless Technology: Principles Components of Telecommunications Network & Ket Networking Technologies, Different types of networks, principle technologies and standards for wireless networking, communication, internet access.

#### **UNIT 6 - Security Management of Information Technology**

Introduction, Tools of Security Management, Internetworked Security Defences, Encryption, Firewalls, Denial of Service Attacks, E-mail Monitoring, Other Security Measures, security codes, Security Monitors, Fault Tolerant Systems, and Disaster Recovery, System Control & Audits, Information Systems Controls, Auditing IT Security.

#### **UNIT 7 - E-commerce: Digital Markets, Digital Goods**

Features of e-commerce. Digital Markets, Digital Goods, principles ecommerce business and revenue models, e-commerce transformed marketing, e-commerce business-to-business transaction, Role of M-commerce in business & its applications, issues related building e-commerce.

#### **Internal Continuous Assessment (ICA):**

It should consist of laboratory assignments as follows:

- 1. To Study features of Information Systems & Organization, How information systems impact on organization.
- 2. To Design & Develop Patient Information Systems.
- 3. A Transaction Processing System (TPS) for Payroll Processing Systems. (Mini project)
- 4. Medicine Information Systems.
- 5. Development of practical Time table generation of Information System for a College. (Mini project)
- 6. Design and implementation of Online store (Mini project)
- 7. Automobile Service Centre.
- 8. Development of a safe and secure Internet banking system. (Mini project) \_\_\_\_\_

#### **Text Books:**

- 1. Management Information Systems: Managing the Digital Firm, 15th Edition by Kenneth C. Laudon and Jane Laudon, Pearson Education
- 2. Management Information Systems: James A O'Brien, George M Marakas, Ramesh Behi. (Tenth Edition), McGraw Hill Publication.

#### **Reference Books:**

- 1. Information Technology for Management: Transforming Organizations in the Digital Economy, Efraim Turban, 6th Edition, Wiley Edition
- 2. Management Information Systems: Shubhalakshmi Joshi, Smita Vaze, Biztantra

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#### Faculty of Science and Technology Third Year B.Tech (Computer Science and Engineering) SEMESTER-VI Programme Elective Course - III CSEPEC-03A : Internet Of Things

Teaching Scheme	<b>Examination Scheme</b>
Lectures – 3 Hrs./week, 3 Credits	ESE - 70 Marks
Tutorial-01Hrs/Week, 1 Credit	ISE – 30 Marks
	ICA - 25 Marks

#### Introduction:

The Internet of Things (IoT) is a rapidly growing technology that connects physical devices, sensors, and systems to exchange data over the internet It integrates sensors, actuators, and platforms to enhance efficiency. IoT relies on data analytics and security to ensure reliable, scalable, and intelligent applications across various industries and domains.

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#### **Course Prerequisites:**

- 1. Fundamentals of Communication and computer network.
- 2. Micro controller, Network Security and Web programming.

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#### **Course Objectives:**

- 1. To introduce the fundamental concepts of the Internet of Things (IoT).
- 2. To explore the components of IoT architecture and understand various platforms within the IoT ecosystem.
- 3. To emphasize the importance of data analytics and security in IoT for secure and efficient data handling.
- 4. To develop practical skills in designing and implementing IoT applications using sensors, actuators, and IoT architecture to solve real-world problems.

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#### **Course Outcomes:**

- 1. Explain what Internet of Things is.
- 2. Describe components of IoT Architecture and platforms of IoT ecosystem.
- 3. Elaborate the need for data analytics and security in IoT
- 4. Design and implement IoT application using sensor, actuator and IoT architecture.

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#### SECTION – I

#### **UNIT 1: Introduction to IoT**

Definition, Applications and characteristics of IoT, Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies, IoT Levels

#### UNIT 2: IoT Architecture and Communication Technologies

IoT Architecture by Oracle, Sources of IoT, M2M Communication, IoT/M2M systems, layers and design standards, Communication Technologies

#### **UNIT 3: Elements of IoT**

Sensor Technology, Participatory Sensing – Industrial IoT and Automotive IoT, Actuator, Sensor Data Communication Protocols, RFID, WSN Technology

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#### **SECTION – II**

#### **UNIT 4: IoT Standards and Connectivity**

Constrained Application Protocols (CoAP), Representational State Transfer (REST), Zigbee / IEEE 802.15.4, Bluetooth and its low energy profile, IEEE 802.15 WPAN, 6LoWPAN

#### **UNIT 5: IoT Security and Business model**

Introduction to IoT Privacy, Security and Vulnerabilities, Use case and Misuse cases, IoT Security Tomography and Layered attacker model, Business model and business model innovation for IoT, Value Creation in the IoT, Business model scenarios for IoT

#### **UNIT 6: Case Studies**

Domain Specific IoTs: Home Automation, Smart Cities, Environments, Energy, Agriculture, Industry, Health and Lifestyle

#### **Internal Continuous Assessment (ICA) :**

Minimum 8-10 assignments on the above topics.

#### **Text Book :**

- 1. Internet of Things: A Hands-on approach, ArshdeepBahga, Vijay Madisetti, Universities Press (Unit 1 and 6)
- 2. IoT Architecture and Design Principles, Raj Kamal, McGraw Hill Education (Unit 2, 3 & 5)
- 3. Building the IoT with IPv6 and MIPv6, Daniel Minoli, Wiley Publication (Unit 4)
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#### **Reference Books:**

1. The Internet of Things: Applications and Protocols, Wiley publications. Author(s): Oliver Hersent, David Boswarthick, Omar Elloumi

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#### Faculty of Science and Technology Third Year B.Tech (Computer Science and Engineering) SEMESTER-VI Programme Elective Course - III CSEPEC-03B : Big Data Analytics

Teaching Scheme	Examination Scheme
Lectures : 3 Hours /Week, 3 Credits	ESE - 70 Marks
Tutorial-01Hrs/Week, 1 Credit	ISE – 30 Marks
	ICA – 25 Marks

#### Introduction

Big Data Analytics involves processing and analyzing vast datasets to uncover patterns, trends, and insights. It utilizes technologies like Hadoop, Spark, and NoSQL, along with machine learning and cloud computing, to support real-time decision-making. It is widely used in business, healthcare, finance, and IoT for data-driven solutions.

#### **Course Prerequisites**

Basic knowledge of mathematics (linear algebra, probability, statistics), programming (Python, R, SQL, Java/Scala), and **databases** (SQL, NoSQL). Understanding of big data frameworks (Hadoop, Spark), and data visualization (Tableau, Matplotlib) is essential.

#### **Course Objectives:**

- 1. Explain the fundamentals of Big Data, its characteristics (Volume, Variety, Velocity, Veracity), and its impact on businesses and decision-making.
- 2. Explore Hadoop, Spark, NoSQL databases, and distributed computing frameworks for handling large-scale data.
- 3. Utilize streaming data technologies (Apache Spark Streaming, Flink) for real-time decisionmaking.

#### **Course Outcomes:**

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

- 1. Comprehend limitations of conventional DBMS and recognize need for Big Data Analytics.
- 2. Compare Big data processing technologies and choose appropriate one for a given scenario.
- 3. Use Various Big data technologies for Big data analytics
- 4. Implement Write Map Reduce program to process Big Data.

#### **SECTION – I**

#### **UNIT 1: Introduction to Types of Digital Data**

Classification of Digital Data, Structured Data, Sources of structured data, Ease with Structured data, Semi-Structured data, sources of semi-structured data, Unstructured data, sources of unstructured data, Issues with terminology, Dealing with unstructured data, Place me in the basket.

#### **UNIT 2: Introduction to Big Data**

Big data, What is big data? Why big data?, Other characteristics of data which are not definitional traits of big data, Challenges with big data, Big data stack, Exercises - Puzzle, Fill in the blanks.

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## **UNIT 3: Big Data Analytics**

Big Data Analytics, Analytics 1.0, Analytics 2.0, Analytics 3.0, Traditional BI vs. Big Data Environment, Terminologies used in Big Data Environment, Big Data Technology Landscape, NoSQL Databases, NoSQL Vs. RDBMS, NewSQL, Hadoop, Hadoop 1.0 vs. Hadoop 2.0, Exercises, Data Science is multidisciplinary, Data Scientist - Your new best friend.

#### **UNIT 4: Introduction to Hadoop**

Introducing Hadoop, Why not RDBMS, Distributed Computing Challenges, A Brief History of Hadoop, Hadoop Overview, Hadoop Components, High Level Architecture of Hadoop, Hadoop Distributed File System, HDFS Architecture, Daemons Related to HDFS, Working with HDFS Command, Special Features of Hadoop, Processing Data With Hadoop, Introduction How Map Reduce Works, Map Reduce Example, Word Count Example using Java Managing Resources and Applications with YARN Introduction, Limitation of Hadoop

1.0, Hadoop 2: HDFS, Hadoop 2: YARN, Interacting with Hadoop EcoSystem Hive, Pig, HBase, Sqoop.

#### **SECTION – II**

#### **UNIT 5: Introduction to MongoDB**

Recap of NoSQL databases, MongoDB - CRUD, MongoDB- Arrays, Java Scripts, Cursors, Map Reduce Programming, Aggregations.

#### **UNIT 6: Introduction to Cassandra**

Features of Cassandra, CQLSH - CRUD, Collections, Counter, List, Set, Map, Tracing.

#### **UNIT 7: Introduction to Hive**

What is Hive? History of Hive and Recent Releases of Hive, Hive Features, Hive Integration and Work Flow, Hive Data Units, Hive Architecture, Hive Primitive and Collection Data Types, Hive File Format, Hive Query Language(HQL)-Statements - DDL,DML Hive Partitions - Bucketing, Views, Sub Query, Joins, Hive User Defined Function, Aggregations in Hive, Group by and Having, Serialization and Deserialization, Hive Analytic Functions.

#### **UNIT 8: Introduction to Pig**

Introducing Pig, History and Anatomy of Pig, Pig on Hadoop, Pig Philosophy, ETL Processing, Pig Latin Overview, Word count example using Pig.

#### **Text Book :**

- 1. Big Data and Analytics, Seema Acharya, Subhashini Chellappan, Wiley India Pvt. Ltd.
- 2. Hadoop: The Definitive Guide, 3rd Edition, Tom White, O'reilly Media.
- 3. Programming Hive, Edward Rutherglen, Dean Wampler, Jason Rutherglen, Edward Capriolo. -O'reilly Media.
- 4. The Definitive Guide to MongoDB: A Complete Guide to Dealing with Big Data Using MongoDB (Definitive Guide Apress) 2e by David Hows, Eelco Plugge, Peter Membrey, Tim Hawkins.
- 5. Programming Pig, by Alan Gates O'reilly Media.
- 6. Cassandra: The Definitive Guide, Eben Hewitt O'reilly Media.

#### **Reference Book :**

1. Big Data For Dummies, Judith Hurwitz, Alan Nugent, Dr. Fern Halper, Marcia Kaufman, Wiley Brand.

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- 2. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses (Wiley CIO), Michael Minelli, Michele Chambers, Ambiga Dhiraj : John Wiley & Sons.
- 3. Mining of Massive Datasets, Anand Rajaraman, Jure Leskovec, Jeff rey D. Ullman, Cambridge University Press.
- 4. Hadoop in Action, Chuck Lam, Dreamtech Press, ISBN : 978-81-7722-813-7.



#### Punyashlok Ahilyadevi Holkar Solapur University, Solapur Faculty of Science and Technology Third Year B.Tech (Computer Science and Engineering) SEMESTER-VI Programme Elective Course - III CSEPEC-03C: Artificial Neural Network

Teaching Scheme	<b>Examination Scheme</b>
Lectures - 3 Hours/Week, 3 credits	ESE –70 Marks
Tutorial-01Hrs/Week, 1 Credit	ISE – 30 Marks
	ICA-25 Marks

#### Introduction:

This course introduces the fundamental concepts of Artificial Neural Networks (ANNs), a branch of artificial intelligence inspired by biological neural networks. It covers the architecture, learning mechanisms, and various models of ANNs, such as perceptrons, multilayer networks, and convolutional neural networks. Students will learn how neural networks are trained using different learning algorithms and how they can be applied to solve real-world problems like pattern recognition, classification, and prediction. The course also explores the relationship between biological and artificial neural systems, providing a foundation for advanced deep learning applications.

#### **Course Prerequisite:**

Basic knowledge of computer architecture, Artificial Intelligence, Basic Programming (Python preferred), Data Structures and Algorithms.

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#### **Course Objectives:**

- 1. To provide students with a basic understanding of the fundamentals and applications of artificial neural networks
- 2. To identify the learning algorithms and to know the issues of various feed forward and feedback neural networks.
- 3. To understand the basic concepts of Associative Learning and pattern classification.
- 4. To solve real world problems using the concept of Artificial Neural Networks.
- 5. To gain exposure in the field of neural networks and relate the human neural system into the digital world
- 6. To provide knowledge of computation and dynamical systems using neural networks

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#### **Course Outcomes:**

On completion of the course, learner will be able to -

- 1. Understand the basic features of neural systems and be able to build the neural model.
- 2. Perform the training of neural networks using various learning rules.
- 3. Grasping the use of Associative learning Neural Network.
- 4. Describe the concept of Competitive Neural Networks.
- 5. Implement the concept of Convolutional Neural Networks and its models.
- 6. Use a new tool /tools to solve a wide variety of real-world problems.

#### **SECTION - I**

#### **UNIT-1**: Introduction to ANN

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Introduction to ANN, History of Neural Network, Structure and working of Biological Neural Network, Neural net architecture, Topology of neural network architecture, Features, Characteristics, Types, Activation functions, Models of neuron-Mc Culloch & Pitts model, Perceptron, Adaline model Basic learning laws, Applications of neural networks, Comparison of BNN and ANN.

#### **UNIT-2** : Learning Algorithms

Learning and Memory, Learning Algorithms, Numbers of hidden nodes, Error Correction and radient Decent Rules, Perceptron Learning Algorithms, Supervised Learning Backpropagation,

Multilayered Network Architectures, Back Propagation Learning Algorithm, Feed Forward and feedback neural networks, example and applications.

#### **UNIT-3:** Associative Learning

Introduction, Associative Learning, Hopfield network, Error Performance in Hopfield networks, simulated annealing, Boltzmann machine and Boltzmann learning, State transition diagram and false minima problem, stochastic update, simulated annealing.

Basic functional units of ANN for pattern recognition tasks: Pattern association, pattern classification and pattern mapping tasks.

#### **SECTION II**

#### **UNIT-4: Competitive learning Neural Network**

Components of CL network, Pattern clustering and feature mapping network, ART networks, Features of ART models, character recognition using ART network. Self-Organization Maps (SOM): Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of Feature Map, Computer Simulations, Learning Vector Quantization, Adaptive Pattern Classification

#### **UNIT- 5: Convolution Neural Network**

Building blocks of CNNs, Architectures, convolution / pooling layers, Padding, Strided convolutions, Convolutions over volumes, SoftMax regression, Deep Learning frameworks, Training and testing on different distributions, Bias and Variance with mismatched data distributions, Transfer learning, multi-task learning, end-to-end deep learning, Introduction to CNN models: LeNet -5, AlexNet, VGG -16, Residual Networks

#### **UNIT- 6: Applications of ANN**

Pattern classification – Recognition of Olympic games symbols, Recognition of printed Characters. Neocognitron – Recognition of handwritten characters. NET Talk: to convert English text to speech. Recognition of consonant vowel (CV) segments, texture classification and segmentation

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#### **Text Books:**

- 1. Neural Networks a Comprehensive Foundations, Simon Haykin, PHI edition.
- 2. Laurene Fausett: Fundamentals of Neural Networks: Architectures, Algorithms & Apps, Pearson, 2004.
- 3. An introduction to neural networks, Gurney, Kevin, CRC press.

# Reference Books:

- 1. Artificial Neural Networks B. Vegnanarayana Prentice Hall of India P Ltd ,2005
- 2. Neural Networks in Computer Inteligance- Li Min Fu, Mc-Graw Hill Education, 2003
- 3. Neural Networks -James A Freeman David M S Kapura, Pearson Education, 2004.
- 4. Introduction to Artificial Neural Systems- Jacek M. Zurada, JAICO Publishing House Ed., 2006.

#### **E-Books:**

- 1. <u>https://www.pdfdrive.com/neural-networks-a-comprehensive-foundationpdf-18774300.html</u>
- 2. <u>https://www.pdfdrive.com/elements-of-artificial-neural-networks-e17103719.html</u>
- 3. <u>https://www.pdfdrive.com/neural-networks-methodology-and-applications-e38107895.html</u>

#### **MOOC Courses:**

1. https://nptel.ac.in/courses

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2. <u>https://www.coursera.org/projects/predicting-weather-artificial-neural-networks</u>



Faculty of Science and Technology

Third Year B.Tech (Computer Science and Engineering)

#### **SEMESTER-VI**

**CSESEC-02**: Projects on Industrial Application

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#### **Teaching Scheme**

**Examination Scheme** Practical-4 Hours/week, 2 Credits ICA – 25 Marks POE – 50 Marks

#### Introduction:

Projects focusing on industrial applications aim to bridge the gap between academic learning and real-world industry needs. These projects provide students with hands-on experience in designing, developing, and implementing solutions that address practical industrial challenges.

#### **Course Prerequisite:**

To successfully undertake projects on industrial applications, students should have a strong foundation in relevant technical, analytical, and problem-solving skills.

#### **Course Objectives:**

- 1. Understanding Industrial Requirements Identify challenges faced in industries like healthcare, finance, logistics, or manufacturing.
- 2. Technology Implementation Develop a working solution using programming, databases, networking, cloud computing, IoT, etc.
- 3. Efficiency & Automation Improve productivity, reduce manual effort, and optimize processes.
- 4. Security & Compliance Ensure the system is secure and follows industry regulations.
- 5. Scalability & Performance Design a system that can handle increasing workloads efficiently.
- 6. User-Friendly Design Develop an intuitive and easy-to-use interface for end-users.

#### **Course Outcomes:**

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

- 1. Develop a Fully Functional Software/System A web app, mobile app, database system, or automation tool applicable to an industrial sector.
- 2. Apply Engineering Concepts Use programming, data structures, algorithms, networking, and security in a real-world scenario.
- 3. Improve Problem-Solving Skills Learn to analyze industrial challenges and create effective solutions.
- 4. Understand Deployment & Maintenance Implement CI/CD pipelines, cloud integration, and post-deployment monitoring.
- 5. Enhance Teamwork & Communication Work collaboratively, document findings, and present a professional-level project report.
- 6. Meet Industry Standards Ensure the project aligns with software development best practices, including security, performance, and compliance.

#### Note:

- 1. Group Size: Each group should consist of 3 to 5 students (or as per faculty guidelines).
- 2. Diverse Skill Sets: Teams should have a mix of skills (coding, database management, documentation, testing, etc.).
- 3. Faculty Approval: Group formation and project topics should be approved by the faculty before starting.
- 4. No Changes After Formation: Once groups are finalized, switching members is not allowed unless there is a valid reason.



#### Punyashlok Ahilyadevi Holkar Solapur University, Solapur Faculty of Science and Technology Third Year B.Tech (Computer Science and Engineering) **SEMESTER-VI**

Honors in Artificial Intelligence and Machine Learning **CSEHON-04A : Deep Learning** 

Examination Scheme
ESE - 70 Marks
ISE - 30 Marks
ICA - 25 Marks

#### Introduction:

Deep Learning is one of the most exciting and promising segments of Artificial Intelligence and machine learning technologies. Advancements in deep learning are being seen in various real world applications. This course is designed to help master deep learning techniques and build using Tensor Flow, an open-source software library developed by Google for the purpose of conducting machine learning and deep neural networks. It is one of the most popular software platforms used for deep learning and contains powerful tools to help you build and implement artificial neural networks. With this Tensor flow course, you''ll build expertise in deep learning models, learn to operate Tensor Flow to manage neural networks and interpret the results.

Course Prerequisite: A basic course in Artificial Intelligence, Machine Learning, Reinforcement Learning & Natural Language processing.

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#### **Course Objectives:**

- 1. Learn how to use Tensor Flow for building and testing Deep Learning models.
- 2. Compare various CNN architectures
- 3. Know the importance of Regularization and Optimization techniques in Deep Learning networks
- 4. Learn Deep Learning models for working with sequential data
- 5. Get motivated to deal with functioning of the most common types of Auto encoders and apply such mechanisms to various learning problems.

#### **Course Outcomes:**

After successful completion of the course student will be able to:

- 1. Demonstrate the fundamentals of Deep Learning.
- 2. Describe the concepts of Tensor Flow, its main functions, operations and the execution pipeline.
- 3. Improve deep learning models using Regularization and Optimization techniques.
- 4. Compare the Convolution Neural Network architectures and use them as per the application.
- 5. Design and implement Sequence Neural Network systems and solve real-world problems.
- 6. Demonstrate the working of Auto encoders and use them for real-life applications.

#### **SECTION-I**

#### **UNIT 1 - Introduction to Deep learning**

History of Deep Learning- A Probabilistic Theory of Deep Learning, Introduction to Deep Feed forward Networks, Gradient Based Learning, Hidden Units Architecture-Design, Back propagation Algorithm

#### **UNIT 2 – Tensor Flow for Deep learning**

Introduction to TensorFlow using Python: Computational Graph, Key Highlights, Creating a Graph, Regression example, Gradient Descent, Tensor Board, Modularity, Sharing Variables, Keras,

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Preprocessing and Data Augmentation of Images and Datasets using TensorFlow.

## **UNIT 3 – Regularization and Optimization Techniques**

Regularization: Need of Regularization, L2 Regularization, L1 Regularization, Early Stopping and Dropout,

Optimization: Challenges in NN Optimization, Gradient Descent Approaches,

Parameter Initialization Approach, Adaptive Approaches - AdaGrad, RMSProp and Adam, Introduction to Batch Normalization

#### **SECTION II**

#### UNIT 4 – Evolution of CNN in Deep Learning

Review of CNN Architecture, Introduction of various CNN Architectures: LeNet, AlexNet, VGG, GoogleNet, ResNet and UNet, Comparison of CNN Architectures, Evaluation Parameters, Applications of CNN in Image Classification and Object Detection

#### **UNIT 5 – Sequence Modeling**

Recurrent and Recursive Nets: Recurrent Neural Networks, Bidirectional RNN, Encoder Decoder Architectures, Introduction to Long Short-Term Memory (LSTM) and Temporal Dependencies, Gated Recurrent Units (GRUs), Applications of RNN in Real World- Image Captioning and Time Series Forecasting and Prediction

#### **UNIT 6 – Encoder Decoder Models**

Autoencoder: Encoder-Decoder Model, Training & Learning Manifold Space, Regularized Autoencoders: Sparse, De-noising and Contractive, Deep Autoencoder:

Architecture and Working, Variational Autoencoders: Limitations of Autoencoders,

Loss Function, Re-parameterization Trick, Latent Space Visualization, Applications of Autoencoders and Variational Autoencoders-Dimensionality Reduction, Image De-noising and Compression

#### Text books:

- 1. Charu C. Aggarwal, Neural Networks and Deep Learning, Springer International Publishing, 2018.
- 2. Ian Goodfellow, Yoshua Bengio and Aaron Courville, Deep Learning, MIT Press, 2016.

#### **Reference Books:**

- 1. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer-Verlag, 2006.
- 2. Duda, Richard, Peter Hart, and David Stork, Pattern Classification, 2<sup>nd</sup> edition, Wiley-Interscience, 2000.
- 3. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.
- 4. Reza Zadeh, Bharath Ramsundar, TensorFlow for Deep Learning, 1st edition, O'Reilly Media Inc, 2018.
- 5. Zaccone, Giancarlo, Deep Learning with TensorFlow, 2nd edition, Packt Publishing, 2018.

**Internal Continuous Assessment (ICA):** Minimum 8 to 10 Experiments/Assignments. Covering, but not limited to, the topic mentioned below:

- 1. Implementation of basic neural network (Depp network) for Handwritten digit recognition using MNIST dataset.
- 2. Implementation of CNN for Pet Image classification using MNIST dataset
- 3. Implementation of CNN model for animal image classification using Fashion MNIST dataset
- 4. Implementation of CNN for flower Image classification
- 5. Build a Keras classification Model using CIFAR-10 and CIFAR-100 dataset.
- 6. Implementation of sentiment analysis using LSTM using Amazon Alexa reviews Dataset.
- 7. Implementation of Airline sentiment analysis using LSTM using Tweeter reviews Dataset.
- 8. Build a MLP model to demonstrate the effect of Batch Normalization using Keras.

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9. Transfer learning using ResNet50 for image recognition

10. Build a Keras classification Model on the Diabetes Dataset

11. **Problem Statement:** Forecasting stock prices has been a difficult task for many of the researchers and analysts. There are a lot of complicated financial indicators, as a result of which the fluctuation of the stock market is highly volatile. The prediction of the market value is of great importance to help in maximizing the profit of stock option purchase while keeping the risk low. Objective: Use LSTM approach to predict stock market indices on the dataset prices.csv.

Note: Prices dataset are fetched from Yahoo Finance, fundamentals are from Nasdaq Financials, extended by some fields from EDGAR SEC databases.

12. **Problem Statement:** Forecasting stock prices has been a difficult task for many of the researchers and analysts. There are a lot of complicated financial indicators, as a result of which the fluctuation of the stock market is highly volatile. The prediction of the market value is of great importance to help in maximizing the profit of stock option purchase while keeping the risk low. Objective: Use LSTM approach to predict stock market indices on the dataset prices.csv.

Note: Prices dataset are fetched from Yahoo Finance, fundamentals are from Nasdaq Financials, extended by some fields from EDGAR SEC databases.

13. **Problem Statement:** Sentiment Analysis is one of the common problems that companies are working on. The most important application of sentiment analysis comes while working on natural language processing tasks. The motive of your company behind building a sentiment analyzer is to determine employee concerns and to develop programs to help improve the likelihood of employees remaining in their jobs. Objective: Use LSTM to perform sentiment analysis in Keras.

Note: Use the inbuilt dataset imdb from keras.datasets for this task.

14. **Problem Statement:** Forecasting stock prices has been a difficult task for many of the researchers and analysts. There are a lot of complicated financial indicators, as a result of which the fluctuation of the stock market is highly volatile. The prediction of the market value is of great importance to help in maximizing the profit of stock option purchase while keeping the risk low. Objective: Use LSTM approach to predict stock market indices on the dataset prices.csv.

Note: Prices dataset are fetched from Yahoo Finance, fundamentals are from Nasdaq Financials,

extended by some fields from EDGAR SEC databases.

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#### **Online Resources:**

- 1. <u>https://www.tensorflow.org/tutorials/images/data\_augmentation</u>
- 2. <u>https://towardsai.net/p/machine-learning/improving-artificial-neural-network-with-regularization-and-optimization</u>
- 3. <u>https://towardsdatascience.com/regularization-techniques-for-neural-networks-e55f295f2866</u>
- 4. https://www.kaggle.com/sid321axn/regularization-techniques-in-deep-learning
- 5. 5.<u>https://medium.com/@minions.k/optimization-techniques-popularly-used-in-deep-learning-3c219ec8e0cc</u>
- 6. <u>https://www.jeremyjordan.me/variational-autoencoders</u>



#### Punyashlok Ahilyadevi Holkar Solapur University, Solapur Faculty of Science and Technology Third Year B.Tech (Computer Science and Engineering)

#### **SEMESTER-VI**

## Honors in Cyber Security

**CSEHON-04B : Information Auditing And Monitoring** 

Teaching Scheme	Examination Scheme
Lectures-3 Hours/week, 3 Credits	ESE –70 Marks
Practical-2 Hours/week, 1 Credits	ISE – 30 Marks
	ICA – 25 Marks

#### Introduction:

This course introduces Information Auditing and Monitoring, which deals with the fundamentals of audit trails, compliance, and security monitoring. The course also covers theoretical and practical aspects of penetration testing, vulnerability assessment, and countermeasure techniques to enhance cyber security resilience.

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# Course Prerequisite:

Students enrolling in this course should have prior knowledge of

- 1. Basic concepts of cyber security
- 2. Networking fundamentals including network protocols,
- 3. Operating system concepts and administration (Windows/Linux).
- 4. Fundamentals of ethical hacking and penetration testing.
- 5. Awareness of security threats, malware, and risk management.

#### **Course Objectives:**

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

- 1. Understand the principles and importance of information auditing and compliance.
- 2. Utilize monitoring tools and traffic analysis techniques for security assessment.
- 3. Develop expertise in penetration testing and vulnerability assessment methodologies.
- 4. Implement countermeasure strategies to mitigate security threats and vulnerabilities.
- 5. Analyze and document penetration testing reports with adherence to industry standards and compliance regulations.

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#### **Course Outcomes:**

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

- 1. Apply the Audit and Audit trails techniques.
- 2. Make use of monitoring and traffic analysis.
- 3. Have the desired knowledge on penetration testing and vulnerability assessment.
- 4. Apply the desired knowledge on penetration testing and vulnerability assessment.
- 5. Come up with counter measure techniques.

#### **SECTION - I**

#### **UNIT-1 Auditing and Audittrails**

Accountability, Compliance, Audit Trails, Reporting timeline, Record Retention, External Auditors, Laws, Cloud Security Auditing (SOC 2, ISO 27017), Risk-based Auditing.

#### **UNIT-2 Monitoring**

Monitoring tools, Warning banner, Traffic analysis, Trend analysis, Introduction to SIEM (Security Information and Event Management), IDS/IPS, AI in Cyber security.

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### **UNIT-3 Information Security Performance Metrics and Audit**

Security Metrics and Reporting, Common Issues and Variances of Performance Metrics, Introduction to Security Audit, Servers and Storage devices, Infrastructure and Networks, Information Security Methodologies (Black-box, White-box, Greybox), Phases of Information Security Audit and Strategies, Red Team vs. Blue Team Strategies.

#### **SECTION II**

#### **UNIT-4 Penetration Testing & Vulnerability Assessment**

Customers and Legal Agreements, Penetration Testing Planning and Scheduling, Pre-Penetration Testing Checklist, Information Gathering, Vulnerability Analysis, External Penetration Testing, OWASP Top 10 Vulnerabilities, Cloud Penetration Testing (AWS, Azure, GCP).

#### **UNIT-5 Penetration Testing & Vulnerabilityassessment-2**

Internal Network Penetration Testing, Penetration testing for Denial of Service, Password Cracking, Social-Engineering, Stolen Laptop, PDAs and Cell phones, Application, Physical Security, Database, VoIP, VPN, War Dialing, Virus and Trojan Detection, Log Management, File Integrity Checking, Bluetooth and Handheld Device, Mobile Security (Android & iOS).

#### **UNIT-6 Counter Measures**

Email Security, Security Patches, Data Leakage, Penetration Testing Deliverables and Conclusion, Penetration Testing Report and Documentation Writing, Penetration Testing Report Analysis, PostTesting Actions, Ethics of a Penetration Tester.

#### **Internal Continuous Assessment (ICA):**

ICA shall consist of a minimum of 8-10 practical assignments from the labs listed below.

#### 1: Introduction to Audit Trails & amp; Compliance

Objective: Understand audit trails, compliance frameworks, and logging mechanisms.

#### Tools: Windows Event Viewer, Linux syslog, Splunk

#### 2: Security Monitoring with SIEM & amp; IDS/IPS

Objective: Set up Security Information and Event Management (SIEM) and analyze network threats.

Tools: Splunk, ELK (Elasticsearch, Logstash, Kibana), Snort

#### 3: Traffic Analysis & amp; Packet Sniffing

Objective: Analyze network traffic for suspicious activity.

Tools: Wireshark, tcpdump

#### 4: Penetration Testing & amp; Vulnerability Assessment

Objective: Perform ethical hacking techniques to find vulnerabilities.

Tools: Kali Linux, Metasploit, Nmap, Nikto

#### 5: Web Application Security & amp; OWASP Top 10

Objective: Learn about web security vulnerabilities and mitigation.

Tools: Burp Suite, OWASP ZAP, DVWA (Damn Vulnerable Web App)

#### **6: Internal Network Penetration Testing**

Objective: Simulate attacks on internal network services.

Tools: Kali Linux, Responder, CrackMapExec

#### 7: Mobile & amp; IoT Security Testing

Objective: Assess mobile and IoT device security.

Tools: Android Emulator, MobSF, IoT Pentesting Toolkit

#### 8: Countermeasures & amp; Security Hardening

Objective: Implement security best practices to protect systems.

Tools: Windows Group Policy, Linux Firewall (iptables), SELinux

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#### 9: Penetration Testing Report Writing

Objective: Document penetration testing findings professionally.

Tools: Microsoft Word, LaTeX

#### 10: AI & amp; Machine Learning for Cybersecurity

Objective: Explore AI-driven threat detection and anomaly detection.

Tools: IBM Watson, OpenAI API, ELK Stack

#### Text books:

- 1. Assessing Information Security (strategies, tactics, logic and framework) by A Vladimirov, K.Gavrilenko, and A. Michajlowski
- 2. Information Security Audit & Monitoring (IBM ICE Publication)
- 3. Computer Security Fundamentals by Chuck Easttom
- 4. The Basics of Hacking and Penetration Testing by Patrick Engebretson
- 5. Email Security: How to Keep Your Network Safe from Spam, Phishing, and Malware- by Justin Reilly
- 6. AI in Cyber Security: Threat Intelligence and Defense Strategies by Leslie F. Sikos

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#### **Reference Books:**

- 1. https://www.sans.org/readingroom/whitepapers/threats/implementing-vulnerability-management-process-34180
- 2. http://csrc.nist.gov/publications/nistpubs/800-40-Ver2/SP800-40v2.pd
- 3. Security Metrics: A Beginner's Guide– by Caroline Wong
- 4. The Red Team Field Manual (RTFM)– by Ben Clark
- 5. Penetration Testing: A Hands-On Introduction to Hacking" by Georgia Weidman
- 6. Practical IoT Hacking" by Fotios Chantzis, Ioannis Stais
- 7. Metasploit: The Penetration Tester's Guide" by David Kennedy, Jim O'Gorman, Devon Kearns
- 8. AI in Cyber Security: Threat Intelligence and Defense Strategies" by Leslie F. Sikos
- 9. NIST Cyber Security Framework
- 10. Hacking Exposed: Network Security Secrets & Solutions" by Stuart McClure, Joel Scambray, George Kurtz



#### Punyashlok Ahilyadevi Holkar Solapur University, Solapur Faculty of Science and Technology Third Year B.Tech (Computer Science and Engineering) SEMESTER-VI Honors in Data Science CSEHON-04C : Predictive Analytics

Teaching Scheme	<b>Examination Scheme</b>
Lectures–03 Hours/week, 3 Credits	ESE –70 Marks
Practical-02 Hours/week, 1 Credits	ISE – 30 Marks
	ICA- 25 Marks

#### **Introduction :**

Predictive analytics uses historical data, statistical algorithms, and machine learning techniques to identify future outcomes. It helps businesses optimize decisions, reduce risks, and improve efficiency. Applications include fraud detection, customer behavior analysis, and demand forecasting. By leveraging data patterns, predictive analytics transforms raw information into actionable insights for strategic growth.

## **Course Prerequisite:** Students shall have knowledge of Machine Learning.

#### **Course Objectives:**

- 1. Explore data cleaning, transformation, and feature engineering for predictive modeling.
- 2. Apply regression, classification, clustering, and time-series forecasting methods.
- 3. Utilize machine learning algorithms for predictive modeling and decision-making.
- 4. Assess model performance using accuracy metrics, validation techniques, and error analysis.

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#### **Course Outcomes:**

- 1. Explore the predictive analytics and identify common use cases.
- 2. Analyze and interpret data.

3. Identify and apply appropriate algorithms for developing predictive model.

4. Make the decision using data classification algorithms.

#### **SECTION-I**

#### **UNIT-1 Entering the Arena**

Exploring predictive analysis, adding business values, starting predictive analytic project, ongoing predictive analysis, surveying the marketplace,

#### **UNIT-2** Predictive analytics in the wild

Online marketing and retail, implementing a recommender system, Target marketing, personalization.

#### **UNIT-3 Data types and associated techniques**

Recognizing your data types, identifying data categories, generating predictive analytics, connecting to related disciplines

#### **UNIT-4** Complexities of data

Finding value in your data, constantly changing your data, complexities in searching your data, exploration of raw data.

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#### **SECTION II**

#### **UNIT-5 Applying Models**

Modelling data: Models and simulations, categorizing model. Healthcare analytics case studies: Google flu trends, Cancer survivability predictors, Social and marketing analytics case studies: Target store predicts pregnant women, Twitter-based predictors of earthquakes, Twitter-based predictors of political campaign outcomes, Twitter-based predictors of the stock market.

#### **UNIT-6 Identifying similarities in data**

Explaining data clustering, converting raw data into matrix: Creating a matrix of terms in documents, term selection, identifying groups in data: K-means clustering algorithm, clustering by nearest neighbours, Finding Association in data items.

#### **UNIT-7** Predicting the future using data classification

Explaining data classification, introducing data classification to business, exploring the data classification process, using data classification predict the future: Decision tree, algorithm for generating decision trees, support vector machines.

#### **UNIT-8** Developing a Road map for predictive analytics model

Ensemble methods to boost prediction accuracy: naïve bayes classification algorithms, the markov model, linear regression, neural networks, Listing the objectives, Processing the data: Identifying the data, cleaning the data, generating the derive data, reducing the dimensionality of data, applying principal component analysis, structuring the data: extracting, transforming and loading the data, keeping the data up to date, outlining testing and test

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#### **Internal Continuous Assessment (ICA) :**

Develop a predictive analysis model using the any dataset for the real time case studies. Tasks to be performed are: Data exploration and analysis

- 1. Data pre-processing improve the quality of data for model building.
- 2. Train classification algorithm or consider any machine learning algorithm.
- 3. Split data into training and testing data.
- 4. Evaluate the performance of the model based on prediction on testing data sets.
- 5. Select the best suitable model for the given data set based on evaluation result
- 6. Tune the selected model to improve its performance.
- 7. Use hyper parameter tuning process using grid search technique.
- 8. Develop the interface for prediction of new data.

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#### Text books:

1. Predictive Analytics for dummies A Wiley brand: Anasse Bari, Mohamed Chaouchi, Tommy Jung. 2nd edition, published by John Wiley & Sons.

#### **Reference Books:**

- 1. Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die 2nd Edition, Kindle Edition by Eric Siegel (Author) Format: Kindle Edition
- 2. Olivia Parr Rud "Data Mining Cookbook: Modeling Data for Marketing, Risk, and Customer Relationship Management", Wiley, 2001.
- 3. Risk Management in Global Supply Chains", Wiley, 2012.

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#### Punyashlok Ahilyadevi Holkar Solapur University, Solapur Faculty of Science and Technology Third Year B.Tech (Computer Science and Engineering) SEMESTER-VI Multidisciplinary Minor in Data Science CSEMDM-04A: Predictive Analytics

Teaching Scheme	Examination Scheme
Lectures - 2 Hours/week, 2 Credits	ESE –70 Marks
Practical – 2 Hours/week, 1 Credit	ISE – 30 Marks
	ICA- 25 Marks

#### **Introduction :**

Predictive analytics uses historical data, statistical algorithms, and machine learning techniques to identify future outcomes. It helps businesses optimize decisions, reduce risks, and improve efficiency. Applications include fraud detection, customer behavior analysis, and demand forecasting. By leveraging data patterns, predictive analytics transforms raw information into actionable insights for strategic growth.

Course Prerequisite: Basic understanding of Machine Learning, Statistics, and Python Programming

#### **Course Objectives:**

- 1. Explore data cleaning, transformation, and feature engineering for predictive modeling.
- 2. Apply regression, classification, clustering, and time-series forecasting methods.
- 3. Utilize machine learning algorithms for predictive modeling and decision-making.
- 4. Assess model performance using accuracy metrics, validation techniques, and error analysis.

#### **Course Outcomes:**

1. Explore the predictive analytics and identify common use cases.

2. Analyze and interpret data.

- 3. Identify and apply appropriate algorithms for developing predictive model.
- 4. Make the decision using data classification algorithms.

#### **SECTION - I**

#### **UNIT-1 Introduction to Predictive Analytics**

Understanding predictive analytics and its importance, Business value of predictive analytics Key applications in healthcare, finance, e-commerce, and social media, Predictive modelling lifecycle, surveying the marketplace

#### **UNIT-2** Predictive analytics in the wild

Online marketing and retail, implementing a recommender system, Target marketing, personalization.

#### UNIT-3 Data types and associated techniques

Recognizing your data types, identifying data categories, generating predictive analytics, connecting to related disciplines

#### **UNIT-4** Complexities of data

Finding value in your data, constantly changing your data, complexities in searching your data, exploration of raw data.

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#### **SECTION II**

#### **UNIT-5 Applying Models**

Modelling data: Models and simulations, categorizing model. Healthcare analytics case studies: Google flu trends, Cancer survivability predictors, Social and marketing analytics case studies: Target store predicts pregnant women, Twitter-based predictors of earthquakes, Twitter-based predictors of political campaign outcomes, Twitter-based predictors of the stock market.

#### **UNIT-6 Identifying similarities in data**

Explaining data clustering, converting raw data into matrix: Creating a matrix of terms in documents, term selection, identifying groups in data: K-means clustering algorithm, clustering by nearest neighbours, Finding Association in data items.

#### **UNIT-7** Predicting the future using data classification

Explaining data classification, introducing data classification to business, exploring the data classification process, using data classification predict the future: Decision tree, algorithm for generating decision trees, support vector machines.

#### UNIT-8 Developing a Road map for predictive analytics model

Ensemble methods to boost prediction accuracy: naïve bayes classification algorithms, the markov model, linear regression, neural networks, Listing the objectives, Processing the data: Identifying the data, cleaning the data, generating the derive data, reducing the dimensionality of data, applying principal component analysis, structuring the data: extracting, transforming and loading the data, keeping the data up to date, outlining testing and test.

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#### Internal Continuous Assessment (ICA) :

Develop a predictive analysis model using the any dataset for the real time case studies. Tasks to be performed are: Data exploration and analysis

- 1. Data pre-processing improve the quality of data for model building.
- 2. Train classification algorithm or consider any machine learning algorithm.
- 3. Split data into training and testing data.
- 4. Evaluate the performance of the model based on prediction on testing data sets.
- 5. Select the best suitable model for the given data set based on evaluation result
- 6. Tune the selected model to improve its performance.
- 7. Use hyper parameter tuning process using grid search technique.
- 8. Develop the interface for prediction of new data.

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#### Text books:

1. Predictive Analytics for dummies A Wiley brand: Anasse Bari, Mohamed Chaouchi, Tommy Jung. 2nd edition, published by John Wiley & Sons.

#### **Reference Books:**

- 1. Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die 2nd Edition, Kindle Edition by Eric Siegel (Author) Format: Kindle Edition
- 2. Olivia Parr Rud "Data Mining Cookbook: Modeling Data for Marketing, Risk, and Customer Relationship Management", Wiley, 2001.
- 3. Risk Management in Global Supply Chains", Wiley, 2012.

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#### Punyashlok Ahilyadevi Holkar Solapur University, Solapur Faculty of Science and Technology Third Year B.Tech (Computer Science and Engineering) SEMESTER-VI Multidisciplinary Minor in Software Engineering CSEMDM-04B: Management Information Systems

Teaching Scheme	Examination Scheme
Lectures - 2 Hours/week, 2 Credits	ESE – 70 Marks
Practical - 2 Hours/week, 1 Credit	ISE – 30 Marks
	ICA – 25 Marks

**Introduction:** The purpose of learning this course "Management Information Systems" is to make the student understand the principles of Management Information Systems and develop MIS for different real world systems. Management Information Systems delves on the evolution, implementation and its advantages, providing comprehensive coverage of Decision Support System (DSS) as well as different modules-decision making process, components, classification, data models and designing of database systems.

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Course Prerequisite: Students shall have knowledge of Management Information Systems.

#### **Course Objectives**:

The objectives of this course are to:

- 1. To understand and asses the importance of information and its role in business.
- 2. To develop data analysing skills in students to evaluate information and the tools used for information processing.

#### **Course Outcomes:**

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

1. Student can elaborate basic infrastructure and strategies used in information systems.

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- 2. Student can apply professional ethical codes of conduct as appropriate to industry and organizational environments.
- 3. Students can design information systems using principles of Communication Technologies.
- 4. Students will be able to develop secure information systems

#### **SECTION-I**

#### UNIT 1 - Information Systems in Global Business Today

The Role of Information Systems in Business Today, How information systems are transforming business, What is new in information system. Business Processes and Information systems, Systems for collaboration and social business.

#### UNIT 2 - Information Systems, Organizations, and Strategy

Organizations and it's features, How Information Systems Impact on Organizations, Competitive strategies using information systems, Challenges posed by strategic information systems

#### **UNIT 3 - Ethical and Social Issues in Information Systems**

Understanding Ethical, Social, political issues raised by information systems, principles for conduct in ethical decisions, Contemporary information systems technology, Challenges to the protection individual privacy and intellectual property.

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#### **SECTION II**

## **UNIT 4 - IT Infrastructure and Emerging Technologies**

IT Infrastructure, Infrastructure Components, Contemporary Hardware Platform Trends, Contemporary Software Platform Trends, Management Issues

#### UNIT 5 - Foundations of Business Intelligence: Databases and Information Management (07)

Organizing Data in a Traditional File Environment, Major Capabilities of Database Management Systems, Using Databases to Improve Business Performance and Decision Making, Managing Data Resources, Telecommunications, the internet.

#### **UNIT 6 - Security Management of Information Technology**

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Introduction, Tools of Security Management, Internetworked Security Defences, Encryption, Firewalls, Denial of Service Attacks, E-mail Monitoring, security codes, Security Monitors.

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#### Internal Continuous Assessment (ICA):

It should consist of laboratory assignments as follows:

- 1. To Study features of Information Systems & Organization, How information systems impact on organization.
- 2. To Design & Develop Patient Information Systems.
- 3. A Transaction Processing System (TPS) for Payroll Processing Systems. (Mini project)
- 4. Medicine Information Systems.
- 5. Development of practical Time table generation of Information System for a College. (Mini project)
- 6. Design of Online store (Mini project)
- 7. Automobile Service Centre.
- 8. To study the safe and secure Internet banking system. (Mini project)

#### **Text Books:**

- 1. Management Information Systems: Managing the Digital Firm, 15th Edition by Kenneth C. Laudon and Jane Laudon, Pearson Education
- 2. Management Information Systems: James A O'Brien, George M Marakas, Ramesh Behi. (Tenth Edition), McGraw Hill Publication.

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#### **Reference Books:**

- 1. Information Technology for Management: Transforming Organizations in the Digital Economy, Efraim Turban, 6th Edition, Wiley Edition
- 2. Management Information Systems: Shubhalakshmi Joshi, Smita Vaze, Biztantra