

HINDUSTHAN
COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution)

Coimbatore – 641032



DEPARTMENT OF COMPUTER APPLICATIONS

Curriculum and ODD Semesters Syllabus for the Batch

2025 – 2027 (R2024)

2024 – 2026 (R2024)



Hindusthan College of Engineering and Technology

An Autonomous Institution, Approved by AICTE, New Delhi, Affiliated to Anna University, Chennai
Accredited by NBA (AERO, AGRI, AUTO, CIVIL, CSE, ECE, EEE, FOOD TECH, IT, MECH, MCTS, MBA, MCA)

Accredited by NAAC 'A++' Grade with CGPA of 3.69 out of 4 in Cycle 2

NIRF - India Ranking 2024 Engineering Band: 201-300, Innovation Band: 11-50

Othakalmandapam Post, Valley Campus, Coimbatore - 641 032, Tamil Nadu, INDIA

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DETAILS OF REVISED CURRICULUM & SYLLABUS

CBCS PATTERN

POSTGRADUATE PROGRAMMES

MCA. COMPUTER APPLICATIONS (PG)

REGULATION-2024

(For the students admitted during the academic year 2025-2026 and onwards)

SEMESTER I – BRIDGE COURSE

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	24CA1291	PoP& OOPS	BRIDGE	3	0	0	-	100	0	100
2.	24CA1292	Fundamentals Of Web Designing	BRIDGE	3	0	0	-	100	0	100
PRACTICAL										
3.	24CA1091	PoP& OOPS LAB	BRIDGE	0	0	3	-	100	0	100
Total				6	0	3	0	300	0	300

SEMESTER I – REGULAR COURSE

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	24CA1201	Data Communication and Networking	PCC	3	0	0	3	40	60	100
2.	24CA1202R	Database Management Systems	PCC	3	0	0	3	40	60	100
3.	24CA1203	Java Programming	PCC	3	1	0	4	40	60	100
4.	24CA1204	Research Methodology IPR and Technical Presentation	RMC	3	0	0	3	40	60	100
5.	24CA1251	Web Technology(T+L)	PCC	3	0	2	4	50	50	100
6.	24MA1152	Probability and Statistics for Data Analytics with R Programming(T+L)	FC	3	0	2	4	50	50	100
PRACTICAL										
7.	24CA1001R	Database Management System Lab	EEC	0	0	3	1.5	60	40	100
8.	24CA1002	Java Programming Lab	EEC	0	0	3	1.5	60	40	100
Total				18	1	10	24	380	420	800

SEMESTER II – BRIDGE COURSE

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	24CA2291	Software Engineering	BRIDGE	3	0	0	-	100	0	100
2.	24CA2292	Operating System	BRIDGE	3	0	0	-	100	0	100
PRACTICAL										
3.	24CA2091	Software Engineering Tools Lab	BRIDGE	0	0	3	-	100	0	100
Total				8	0	2	0	300	0	300

SEMESTER II – REGULAR COURSE

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	24CA2201	Data Structures and Algorithms	PCC	3	1	0	4	40	60	100
2.	24CA2202	Python Programming	PCC	3	1	0	4	40	60	100
3.	24CA2251	Dev Ops and Full Stack Development(T+L)	PCC	3	0	2	4	50	50	100
4.	24CA2252	Cryptography and Network Security(T+L)	PCC	3	0	2	4	50	50	100
5.	24EC2251	Embedded System and Sensors (T + L)	PCC	2	0	2	3	50	50	100
6.	24CA23XX	Professional Elective I	PEC	3	0	0	3	40	60	100
PRACTICAL										
7.	24CA2001	Data Structures and Algorithms Lab	EEC	0	0	3	1.5	60	40	100
8.	24CA2002	Data Incentive Computing Lab	EEC	0	0	3	1.5	60	40	100
Total				17	2	12	25	390	410	800

SEMESTER III

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	XXXX	Machine Learning	PCC	3	1	0	4	40	60	100
2.	XXXX	Software Testing (T + L)	PCC	3	0	2	4	50	50	100
3.	24EC3251	Internet of Things (T+L)	PCC	3	0	2	4	50	50	100
4.	24CAXXXX	Professional Elective I	PEC	3	0	0	3	40	60	100
5.	24CAXXXX	Professional Elective II	PEC	3	0	0	3	40	60	100
6.	24CAXXXX	Professional Elective III	PEC	3	0	0	3	40	60	100
PRACTICAL										
7.	24CA3801	Mini Project Lab	EEC	0	0	3	1.5	60	40	100
8.	XXXX	Machine Learning Lab	EEC	0	0	3	1.5	60	40	100
Total				18	1	10	24	370	430	800

SEMESTER IV

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	24CA4901	Project Work	EEC	0	0	18	9	60	40	100
2	XXXX	Software Project Management	EEC	3	0	0	3	40	60	100
Total				3	0	18	12	100	100	200

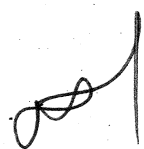
LIST OF PROFESSIONAL ELECTIVES

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
PROFESSIONAL ELECTIVE I										
1	24CA2301	Accounting and Financial Management	PE	3	0	0	3	40	60	100
2	24CA2302	Block Chain Technologies	PE	3	0	0	3	40	60	100
3	24CA2303	Cyber Security	PE	3	0	0	3	40	60	100
4	24CA2304	Digital Logic and Computer Organization	PE	3	0	0	3	40	60	100
5	24CA2305	E-Learning Techniques	PE	3	0	0	3	40	60	100
6	24CA2306	Green Computing	PE	3	0	0	3	40	60	100
7	24CA2307	Human Computer Interaction	PE	3	0	0	3	40	60	100
8	24CA2308	Professional Ethics	PE	3	0	0	3	40	60	100
PROFESSIONAL ELECTIVE II, III, IV										
1.	24CA3301	Cloud Computing	PE	3	0	0	3	40	60	100
2.	24CA3302	E- Commerce	PE	3	0	0	3	40	60	100
3.	24CA3303	Ethical Hacking	PE	3	0	0	3	40	60	100
4.	24CA3304	Mixed Reality	PE	3	0	0	3	40	60	100
5.	24CA3305	Organizational Behavior	PE	3	0	0	3	40	60	100
6.	24CA3306	Semantic Web Services	PE	3	0	0	3	40	60	100
7.	24CA3307	Service Oriented Architectures and Microservices	PE	3	0	0	3	40	60	100
8.	24CA3308	Social Network Analysis	PE	3	0	0	3	40	60	100
9.	24CA3309	Soft Computing Techniques	PE	3	0	0	3	40	60	100
10.	24CA3310	Software Testing and Automation	PE	3	0	0	3	40	60	100
11.	24CA3311	Agile Methodologies	PE	3	0	0	3	40	60	100

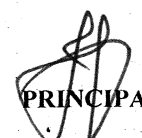
CREDIT DISTRIBUTION

	PCC	PEC	FC	RMC	EEC	Total
Credits	45	12	4	3	21	85
Credits %	52.9	14.1	4.7	3.5	24.7	100


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 PRINCIPAL

DEPARTMENT OF COMPUTER APPLICATIONS

SYLLABUS REVISION DETAILS FOR THE REGULATION 2024 – ACADEMIC YEAR 2025-26 ODD SEMESTER

S. NO	COURSE CODE/COURSE NAME	SUGGESTION BY EXPERTS	EXISTING CONTENT (IN THE AY2024-25 ODD)	REVISED CONTENT (FOR AY 2025-26 ODD)	TYPE OF REVISION DELETION INSERTION MODIFICATION	PERCENTAGE OF REVISION
1	24CA1202 – Database Management Systems	Suggestions to the revise syllabus.	UNIT I INTRODUCTION TO DATABASES AND CONCEPTUAL MODELLING Database & Database Users. Characteristics of the Database Approach advantages of using DBMS. Data Models, Schemas & Instances. DBMS & Data Independence. System Architecture for DBMS and Data Dictionary, Database Users Data Base languages & Interfaces. Data Modeling using the Entity-Relationship Model - Entity types, Entity sets, Attributes and Keys, Relationship, Relationship Types, Structural Constraints, Enhanced ER Model- Specialization Generalization, Constraints on Specialization Generalization- Data Flow Diagram UNIT-II RELATIONAL MODEL, LANGUAGES & SYSTEMS Relational Data Model Concepts and Constraints. Relational Algebra - select, project, set theoretic, join operations. Overview of Relational Calculus. SQL - A Relational Database Language. Data- Joins, Views, Integrity Constraints,	UNIT I INTRODUCTION TO DATABASES AND CONCEPTUAL MODELLING Database & Database Users. Characteristics of the Database Approach advantages of using DBMS. Data Models, Schemas & Instances. DBMS Architecture & Data Independence. System Architecture for DBMS and Data Dictionary, Database Users Data Base languages & Interfaces. Data Modeling using the Entity-Relationship Model - Entity types, Entity Sets, Attributes and Keys, Relationship, Relationship Types, Week Entity Types, Structural Constraints, Enhanced ER Model- Specialization Generalization. UNIT II RELATIONAL DATABASES Introduction to the Relational Model – Database Schema, Introduction to SQL – SQL data Definition, Basic Structure of SQL Queries , Aggregate Functions, Nested Sub Queries – Intermediate SQL – Joins, Views, Integrity Constraints,	Content Revised	40%

Definition commands, View and Queries, Advanced SQL – Accessing SQL from transaction commands, Specifying Programming Language, Cursors, Constraints & Indexes in SQL		
UNIT III DATABASE DESIGN	UNIT III DATABASE DESIGN	
Entity-Relationship model – E-R Diagrams – Enhanced-ER Model – ER-to-Relational Mapping – Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form	Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form	
UNIT IV TRANSACTIONS, CONCURRENCY CONTROL, RECOVERY TECHNIQUES	UNIT IV TRANSACTIONS, CONCURRENCY CONTROL	
Basic concept; ACID properties; transaction state; implementation of atomicity and durability-- concurrent executions; basic idea of serializability – view and conflict serializability Recovery Techniques Failure Classification – Storage Structure – Recovery and Atomicity Log Based Recovery – Shadow Paging – stable storage implementation – data access; recovery and atomicity – log based recovery, deferred database modification – immediate database modification – checkpoints.	Basic concept; ACID properties Transaction Concept, A Simple Transaction Model Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity, Transactions as SQL Statements, Concurrency Control – Lock-Based Protocols , Deadlock Handling, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols	

DEPARTMENT OF COMPUTER APPLICATIONS

SYLLABUS REVISION DETAILS FOR THE REGULATION 2024 – ACADEMIC YEAR 2025-26 ODD SEMESTER

			UNIT V EMERGING FIELDS IN DBMS Distributed databases; Basic idea of data storage- data replication and data fragmentation horizontal, vertical and mixed fragmentation. Concepts of Multimedia databases - Object oriented data base management systems - Data Warehousing & mining.	UNIT V NO SQL DATABASES NoSQL Database - Types of NoSQL Database, History of NoSQL Databases, Features, Relational database vs NoSQL database example, Mongo DB – Getting Started MongoDB and MongoDB Shell, Data Types, CRUD Operations, Indexing, Creating, Updating and Deleting Documents, Aggregation, Replication and Sharding, Interfacing with Mongo DB		
24CA1001 – Database Management Systems Lab	Suggestions to revise the syllabus	1. Draw ER Diagram for an Application. 2. Construct DFD for an Application. 3. Execute a DDL, DML, DCL and TCL commands for a Table 4. Execute SQL Functions 5. Execute various Joins and Sub Queries 6. Given an Scenario, Apply Normalization at all levels. 7. Write PL/SQL Procedure for an application using Exception Handling. 8. Write PL/SQL Procedure for an application using Cursors. 9. Write a PL/SQL program for an application using Functions. 10. Write a PL/SQL block for transaction operations of a typical application using Triggers 11. Case Study using any of the real life database applications from the following list Inventory Management for a E	1. Design a database system based on the choice of the user domain: Perform Conceptual and Logical Design 2. Relational Database Implementation: DDL Operations, DML Operations, Aggregate Functions & Complex Queries 3. Views, Joins, and Advanced SQL 4. Constraints and Procedural SQL 5. Normalization and Functional Dependencies 6. Transactions and ACID Properties 7. Concurrency Control and Deadlocks 8. MongoDB NoSQL Database 9. Design and develop a fully functional database system based on a domain of your choice	68%	6	

			Mart Grocery Shop • Society Financial Management ☐ Build Entity Model diagram. The diagram should align with the business and functional goals stated in the application. ☐ Apply Normalization rules in designing the tables in scope. ☐ Prepared applicable views, triggers (for auditing purposes), functions for enabling enterprise grade features. Build PL SQL / Stored Procedures for Complex Functionalities, ex EOD Batch Processing for calculating the EMI for Gold Loan for each eligible Customer.	10. Design and develop a NoSQL-based application using MongoDB for a domain of your choice	
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SEMESTER I – BRIDGE COURSE

24CA1291

PoP AND OOPS

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3	0	0	-

COURSE OBJECTIVE

- 1.To Understand the basics concepts in C programming
- 2.To learn and apply arrays and pointers in C.
- 3.To gain knowledge in fundamentals of Object-Oriented Programming.
- 4.To gain proficiency in usage of classes and objects.
- 5.To explore advanced features of object-oriented programming

Pre Requisite Nil

UNIT I INTRODUCTION

Process of programming – Variables- Operators – Loops- Break statement – Continue Statement- Data Types in C – ASCII Code - Operators Expressions Associatively - Precedence of operators - Expression evaluation – Functions

9

UNIT II ARRAYS AND POINTERS

Arrays in C -Pointers in C -Programming using arrays and pointers -Sizeof operator -Returning pointers from functions – Recursion -Multidimensional Arrays and Pointers- Structures in C -Singly Linked Lists - Doubly Linked Lists- File Handling

9

UNIT III EVOLUTION OF OOP LANGUAGES

Why OOPS –Characteristics of OOPS - Introduction to C++ - Programs with IO and Loop - Arrays and Strings- Function Overloading -Operator Overloading - Dynamic Memory Management

9

UNIT IV CLASSES AND OBJECTS

Access Specifiers - Constructors, Destructors and Object Lifetime - Copy Constructor and Copy Assignment Operator- Constants - Static Members - friend Function and friend Class

9

UNIT V ADVANCED FEATURES

Overloading Operator for User Defined Types-Namespace -Inheritance -Virtual Function Table - Type casting and cast operators -Multiple Inheritance – Exceptions –Template -Closing Comments

9

Theory Hours : 3

Tutorial Hours : 0

Practical Hours : 0

Total Hours: 45 Hrs

COURSE OUTCOME

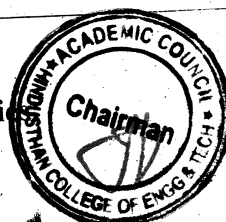
- CO1: Illustrate and explain the basic computer concepts and programming principles of C language.
 CO2: Demonstrate the applications of derived data types such as arrays, pointers, strings and functions.
 CO3: Build programs in C++ using Overloading,
 CO4: Develop skills in handling exceptions, working with classes and objects,
 CO5: Construct C++ programs using advanced features of Oops

REFERENCES

- R1. C++ Programming for Beginners An Object Oriented Language, Hong Lei, 2021
 R2. Effective C: An Introduction to Professional C Programming, Robert C. Seacord, 2020.

KPR
 Course coordinator
 25/6/25

A. S. Jayar
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Chairman - BoS
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PROGRAMME OUTCOMES (PO's & PSO')

3/2/1/- → Indicate the Strength of Correlation 3 – Strong; 2 – Medium; 1 – Weak

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	3	-	1	3	1	-	-	1	-	-
CO2	3	-	2	3	2	-	-	1	1	-
CO3	3	-	3	3	2	-	-	-	2	-
CO4	3	-	3	3	2	-	-	-	1	-
CO5	3	-	3	3	2	1	1	1	1	-

COURSE ASSESSMENT METHODS

DIRECT	1. Continuous Assessment 2. Assignment / Activity	INDIRECT	1. Course Exit Survey
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25/6/25

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24CA1292

FUNDAMENTALS OF WEB DESIGNING

L	T	P	C
3	0	0	-

COURSE OBJECTIVE

1. To introduce the fundamentals of Internet, and the principles of web design.
2. To construct basic websites using HTML.
3. To Design basic websites using and Cascading Style Sheets.
4. Knowledge in advanced features of Cascading Style Sheets.
5. To build dynamic web pages with validation using Java Script objects and by applying different event handling mechanisms.

Pre Requisite Nil

UNIT I - INTRODUCTION TO WWW

Internet Standards – Introduction to WWW – WWW Architecture – SMTP – POP3 – File Transfer Protocol – 9
 Overview of HTTP, HTTP request – response — Generation of dynamic web pages

UNIT II - UI DESIGN

Markup Language (HTML): Introduction to HTML and HTML5 - Formatting and Fonts -Commenting Code – 9
 Anchors – Backgrounds – Images – Hyperlinks – Lists

UNIT III - CASCADING STYLE SHEET (CSS)

The need for CSS, Introduction to CSS – Basic syntax and structure - Inline Styles – Embedding Style Sheets . 9
 - Linking External Style Sheets

UNIT IV - CASCADING STYLE SHEET (CSS)

Backgrounds - Manipulating text - Margins and Padding - Positioning using CSS. 9

UNIT V - SCRIPTING LANGUAGES

HTML – forms – frames – tables – web page design - JavaScript introduction – control structures – functions 9
 – arrays – objects – simple web applications.

Theory Hours : 3

Tutorial Hours : 0

Practical Hours : 0

Total Hours: 45 Hrs

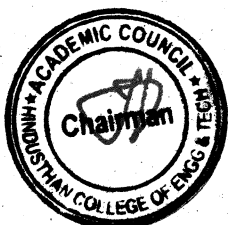
COURSE OUTCOME

- CO1: Gain Proficiency in concepts of World Wide Web, and the requirements of effective web design
 CO2: Develop web pages using the HTML
 CO3: Construct web page using CSS features with different layouts as per need of applications.
 CO4: Develop web pages using advanced features of CSS.
 CO5: Use the JavaScript to develop the dynamic web pages.

REFERENCES

- R1. Harvey & Paul Deitel & Associates, Harvey Deitel and Abbey Deitel, "Internet and World Wide Web - How To Program", Fifth Edition, Pearson Education, 2011.
 R2. Thomas A. Powell, "HTML & CSS: The Complete Reference", Fifth Edition Tata McGraw-Hill 2010.
 R3. Thomas A Powell, Fritz Schneider, "JavaScript: The Complete Reference", Third Edition, Tata McGraw Hill, 2013.
 R4. Margaret Levine Young, "Internet and WWW", 2nd Edition, Tata McGraw Hill, 2002

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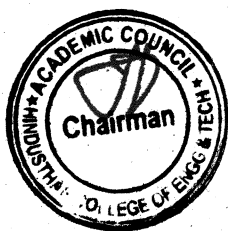
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R3. Jeff Rule, Dynamic HTML: The HTML Developer's Guide, Addison-Wesley, 1999.R4. William Stallings, "Computer Organization and Architecture – Designing for Performance", Tenth Edition, Pearson Education, 2016.

PROGRAMME OUTCOMES (PO's & PSO's) 3/2/1/- → Indicate the Strength of Correlation 3 – Strong; 2 – Medium; 1 – Weak										
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	3	2	1	2	-	-	-	1	-	-
CO2	3	2	2	3	-	-	-	1	1	-
CO3	3	2	3	3	1	-	-	1	-	-
CO4	3	3	3	3	2	-	-	2	1	-
CO5	3	3	3	3	2	1	2	2	1	1
COURSE ASSESSMENT METHODS										
DIRECT	1. Continuous Assessment 2. Assignment / Activity					INDIRECT	1. Course Exit Survey			

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24CA1091

PoP AND OOPS LAB

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2	0	2	-

**COURSE
OBJECTIVE**

1. Able to understand the fundamental properties of C Language.
2. Knowledge of implementing data structures in C programming.
3. Understanding sorting and searching algorithms.
4. Understand the syntax of C++ and writing simple to advanced programs.
5. To understand the need and role of object-oriented programming for real-world applications.
6. Understand the concept of virtual functions.

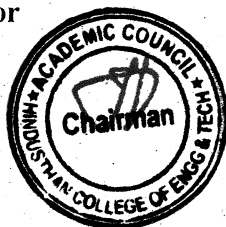
Pre Requisite Nil

- | | |
|---|---|
| 1. Write a C program to check whether a number is even or odd | 6 |
| 2. Write a C Program to Check Leap Year | 6 |
| 3. Write a C Program to Find Factorial of a Number | 3 |
| 4. Write a program to search a given element in array using linear search. | 6 |
| 5. To find the smallest and largest element from a given array. | 3 |
| To Sort n numbers using bubble sort using function sub program. | 3 |
| Write a C++ program to perform String Concatenation | |
| <ul style="list-style-type: none"> • using Arrays • Using Functions • Using Arrays & functions | 3 |
| Using Pointers & Functions | |
| Write a C++ Program to illustrate the use of Constructors and Destructors and Constructor Overloading. | 6 |
| Write a program to Illustrate Friend Function and Friend Class. | 3 |
| Write C++ Programs and incorporating various forms of Inheritance. | 3 |
| Write a C++ Program to illustrate Virtual functions | 3 |

Theory Hours :0**Tutorial Hours : 0****Practical Hours :3****Total Hours: 45****COURSE OUTCOME**

- CO1: Develop a strong foundation in C programming by practicing basic algorithmic problem-solving.
- CO2: Able to identify the appropriate data structures and algorithms for solving real world problems and implement various kinds of searching and sorting techniques.
- CO3: Demonstrate the ability to manipulate strings using arrays in C++.
- CO4: Develop programs in C++ using advanced concepts in OOPS.
- CO5: Design and implement C++ programs that utilize inheritance and virtual functions.

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REFERENCES

1. The C++ Programming Language (4th Edition) By Bjarne Stroustrup, 2013
2. C Programming Language (2nd Edition) By Brian W. Kernighan & Dennis M. Ritchie, 2015
3. Stanley B. Lippman, Josée Lajoie, Barbara E. C++ Primer. Moo, Addison-Wesley Professional: 2020
4. Object-Oriented Programming in C++ (4th Edition), Robert Lafore, Sams Publishing, 2021
5. E. Balagurusamy, Object Oriented Programming with C++, 8th Edition, Paperback September 2020.

PROGRAMME OUTCOMES (PO's & PSO's)										
3/2/1/- → Indicate the Strength of Correlation 3 – Strong; 2 – Medium; 1 – Weak										
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	3	2	1	2	-	-	-	1	1	-
CO2	3	2	2	3	-	-	-	1	1	-
CO3	3	2	3	3	1	-	-	1	1	-
CO4	3	3	3	3	2	-	-	2	1	-
CO5	3	3	3	3	2	1	2	2	2	-
COURSE ASSESSMENT METHODS										
DIRECT	1. Demonstration 2. End Semester Examination					INDIRECT	1. Course Exit Survey			



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SEMESTER I – REGULAR COURSE

24CA1201

DATA COMMUNICATION AND NETWORKING

L	T	P	C
3	0	0	3

COURSE OBJECTIVE

1. To explore the different types of networking concept and their applications.
2. To analyze the operation and protocols of wired and wireless LANs, including their architectures and technologies.
3. To analyze the networking protocols and standards to facilitate interoperability and efficient data exchange.
4. To explore the mechanisms for connection establishment and release in transport layer protocols.
5. To compare the architecture and operation of popular internet applications such as email clients, web browsers, and FTP clients.

Pre Requisite

Good understanding of how to use computers, including knowledge of operating systems

UNIT I INTRODUCTION OF NETWORKS

Uses of computer networks - Network hardware - Network software - Reference models - Physical Layer: Theoretical basis for data communication - Guided transmission media: Twisted pairs - Coaxial cable - Fiber Optics - Unguided transmission: The Electromagnetic spectrum - Radio wave transmission- Micro wave transmission -Infrared transmission.

6

UNIT II DATA LINK LAYER

Data Link Layer - Framing - Flow Control - Error Control - Error detection and correction: Types of Errors, Block Coding - Cyclic Codes - Checksum- Forward Error Correction: Hamming Distance - Data Link Control: DLC Services - Data-Link Layer Protocols - HDLC. Wired LANs & Wireless LANs.

9

UNIT III NETWORK LAYER

Switching - Circuit Switched Networks - Packet Switching - Structure of a Switch - Routing algorithms: Shortest Path events - Distance Vector Routing - Link State Routing - Congestion control algorithms: Traffic aware routing - Admission Control - Internetworking: Tunneling - Internetwork Routing - Packet Fragmentation.

12

UNIT IV TRANSPORT LAYER

Transport Service primitives - Connection Establishment and Release- Elements of transport protocols: Addressing - Connection Establishment and Release - The internet transport protocols: UDP - RPC - TCP: Service Model.

10

UNIT V APPLICATION LAYER

Domain Name System: The DNS Name Space - Resource Records - Name Servers - Electronic mail: Architecture and Services - The User Agents - Message Formats - Message Transfer and Delivery - World Wide Web: Architectural overview - Static and Dynamic Web Pages - HTTP - Mobile Web - Web Search.

8

Theory Hours : 3

Tutorial Hours : 0

Practical Hours : 0

Total Hours: 45
Hours**COURSE OUTCOME**

- CO1. Identify the theoretical concepts underlying data communication at the Physical Layer.
 CO2. Evaluate the suitability of different Data Link Layer protocols for particular network environments.
 CO3. Apply various routing protocols, demonstrate the best routing between nodes and describe the network functionalities for a given application.
 CO4. Demonstrate understanding of transport layer services and protocols.
 CO5. Develop innovative solutions for addressing specific application layer communication requirements and challenges.

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REFERENCES

1. Andrew S. Tanenbaum, David J Wetherall, Nick Feamster, "Computer Networks", 6th Edition, Pearson Education., New Delhi, 2022.
2. Forouzan Behrouz A., "Data Communication and Networking", 5th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2018.
3. William Stallings, "Data and Computer Communication", Pearson Education, 10th Edition, 2018.

PROGRAMME OUTCOMES (PO's & PSO's)										
3/2/1/- → Indicate the Strength of Correlation 3 – Strong; 2 – Medium; 1 – Weak										
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	3	-	-	-	-	-	2	-	-	-
CO2	3	3	3	-	-	3	-	-	-	-
CO3	3	3	3	1	-	-	-	-	3	-
CO4	3	-	-	-	3	3	-	-	3	-
CO5	3	-	-	-	3	3	2	1	3	1
COURSE ASSESSMENT METHODS										
DIRECT		1. Continuous Assessment I and II 2. Assignment / Activity 3. Demonstration 4. End Semester Examination				INDIRECT		1. Course Exit Survey		

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COURSE OBJECTIVE

1. To introduce students to the foundational concepts of database systems and equip them with the skills to perform conceptual data modeling using ER/EER diagrams
2. To enable students to define, manipulate, and query relational databases using SQL, and to implement advanced database logic through functions, procedures, and triggers.
3. To enable students to systematically analyze data relationships and apply normalization techniques to design robust, anomaly-free relational database schemas.
4. To equip students with the knowledge to understand transaction management principles, ensure data consistency and isolation in multi-user environments, and apply various concurrency control mechanisms.
5. Introduce students to the diverse landscape of NoSQL databases, differentiate them from traditional relational systems, and provide practical proficiency in MongoDB operations, architecture, and application development interfacing.

Pre Requisite **Basic Skills in programming concepts**

UNIT I INTRODUCTION

Database & Database Users. Characteristics of the Database Approach advantages of using DBMS. Data Models, Schemas & Instances. DBMS Architecture & Data Independence. System Architecture for DBMS and Data Dictionary, Database Users Data Base languages & Interfaces. Data Modeling using the Entity-Relationship Model -Entity types, Entity Sets, Attributes and Keys, Relationship, Relationship Types, Weak Entity Types, Structural Constraints, Enhanced ER Model- Specialization Generalization, Constraints on Specialization Generalization

9

UNIT II RELATIONAL DATABASES

Introduction to the Relational Model – Database Schema, Introduction to SQL – SQL data Definition, Basic Structure of SQL Queries , Aggregate Functions, Nested Sub Queries – Intermediate SQL – Joins, Views, Integrity Constraints, Advanced SQL – Accessing SQL from Programming Language, Functions and Procedures, Triggers.

9

UNIT III DATABASE DESIGN

Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form.

8

UNIT IV TRANSACTIONS, CONCURRENCY CONTROL

Basic concept; ACID properties Transaction Concept, A Simple Transaction Model ,Storage Structure, Transaction Atomicity and Durability, Transaction Isolation, Serializability, Transaction Isolation and Atomicity, Transactions as SQL Statements, Concurrency Control - Lock-Based Protocols , Deadlock Handling, Multiple Granularity, Timestamp-Based Protocols, Validation-Based Protocols

12

UNIT V NO SQL DATABASES

NoSQL Database - Types of NoSQL Database, History of NoSQL Databases, Features , Relational database vs NoSQL database example, Mongo DB – Getting Started MongoDB and MongoDB Shell , Data Types, CRUD Operations, Indexing, Creating, Updating and Deleting Documents, Aggregation, Replication and Sharding, Interfacing with Mongo DB

7

Theory Hours : 3

Tutorial Hours : 0

Practical Hours : 0

Total Hours: 45
Hrs

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COURSE OUTCOME:

CO1: Upon completion, students will be able to articulate core DBMS principles and effectively design comprehensive ER/EER models for real-world data requirements.

CO2: Upon Completion, students will be able to write complex SQL queries involving joins and subqueries, enforce integrity constraints, and develop stored program units for database automation.

CO3: Upon Completion, students will be able to identify functional dependencies, perform lossless and dependency-preserving decompositions, and transform database relations into 3NF, BCNF, and 4NF.

CO4: Upon Completion, Students will be able to explain ACID properties, analyze transaction schedules for serializability, and describe different concurrency control protocols including their deadlock handling strategies.

CO5: Upon Completion, Students will be able to identify various NoSQL database types and their use cases, perform CRUD operations and indexing in MongoDB, conceptually understand its scaling mechanisms, and develop basic applications that interact with MongoDB using a programming language driver.

REFERENCES:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Seventh Edition, McGraw Hill, 2020.
2. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson Education, 2017
3. Dr. B Chandra, Mastering PL/SQL Through Illustrations, © BPB Publications, India, 2021
4. Amit Phaltankar, Juned Ahsan, Michael Harrison, Liviu Nedov MONGODB FUNDAMENTALS A hands-on guide to using MongoDB and Atlas in the real world, Published by Packt Publishing Ltd, 2020

PROGRAMME OUTCOMES (PO's & PSO's)										
3/2/1/- → Indicate the Strength of Correlation 3 – Strong; 2 – Medium; 1 – Weak										
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	3	3	2	3	-	-	-	-	3	3
CO2	3	3	-	3	-	-	-	-	3	3
CO3	3	3	-	-	-	-	3	-	3	3
CO4	3	3	-	-	-	-	3	-	3	3
CO5	3	3	2	3	-	-	-	1	3	3
COURSE ASSESSMENT METHODS										
DIRECT	1. Continuous Assessment I and II 2. Assignment / Activity 3. Demonstration 4. End Semester Examination					INDIRECT	1. Course Exit Survey			

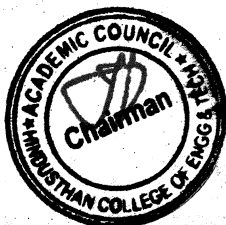
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JAVA PROGRAMMING

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COURSE OBJECTIVE

1. To impart the fundamental concepts of core JAVA.
2. To explain the concepts of Multithreading
3. To explore the skills in program development using Exception handling and I/O programming
4. To gain the built-in knowledge of standalone and web applications.
5. To understand the concepts needed for database connectivity.

Pre Requisite

Familiarity with programming language such as C/C++, data structures and algorithms.

UNIT 1 - INTRODUCTION

Introduction –JDK Installation and Path Specification - Java Application Structure - Data types – Variables – Arrays – Operators - Control Structures– Class – Objects – Methods – Overloading Methods - Constructors – “This” keyword - Garbage Collection. 9

UNIT 2 – OOPS

Nested classes – Inheritance – Using super keyword - Access specifier- Encapsulation- Interface- Polymorphism– Multi Level hierarchy – Method Overriding - Dynamic Method Dispatch – The Object class – Abstract classes -Package. 15

UNIT III - EXCEPTION HANDLING & THREADS

Exception handling – Using try catch – Nested try- throw – throws – finally – Built in exceptions – user defined exceptions - Threads – Thread model – Creating a thread – Thread priorities – Synchronization – Multithreading – String Handling – Tokenizer – Wrappers. 14

UNIT IV - AWT, FRAMES& APPLETS

AWT controls - Frames – Applet structure – HTML Applet Tag – Event Handling -Event Listeners - Applet Programming 17

UNIT V FILES & DATABASES

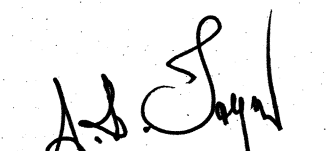
Networking – RMI- I/O streams – Reading/Writing console – Files - Manipulating Databases with JDBC – Java Collections. 5

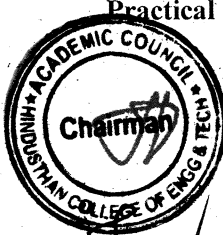
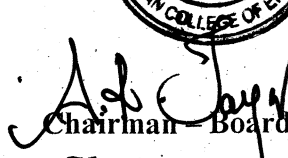
Theory Hours : 3

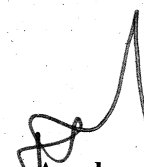
Tutorial Hours : 1

Practical Hours : 0

Total Hours: 60 Hrs


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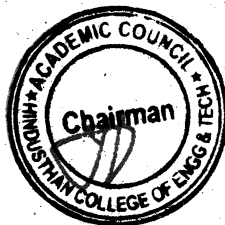
COURSE OUTCOMES

- CO1. Create applications using classes and objects
 CO2. Design new applications by applying reusability and Packages concept
 CO3. Apply Multithreading concepts to execute parallelism Exception handling.
 CO4. Solve programs using Frames, Event handlers and Applets
 CO5. Compute rich applications using I/O, Files, JDBC and System/Utility classes

REFERENCES

- R1- Herbert Schildt, "JAVA - The Complete Reference", twelfth Edition 2021, McGraw-Hill Education,
 R2- Rashmi Kanta Das, "Core Java for Beginners", Third Edition, First Reprint 2015, Vikas Publishing House Pvt Ltd, ISBN – 978-93259-6850-9.
 R3-Deitel, Deitel, "Java How To Program, Late Objects, Global Edition", PHI, 2019

PROGRAMME OUTCOMES (PO's & PSO's) 3/2/1/- → Indicate the Strength of Correlation 3 – Strong; 2 – Medium; 1 – Weak										
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-
CO2	3	3	3	3	2	-	-	3	3	-
CO3	3	-	3	-	-	-	-	-	-	-
CO4	3	3	-	-	-	-	-	-	-	2
CO5	3	3	3	3	2	1	1	3	3	2
COURSE ASSESSMENT METHODS										
DIRECT	1. Continuous Assessment I and II 2. Assignment / Activity 3. Demonstration 4. End Semester Examination					INDIRECT	1. Course Exit Survey			



A.B. Jay
 Course coordinator
 25/6/25

A.B. Jay
 Chairman – Board of Studies
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COURSE OBJECTIVE

1. Apply critical thinking skills to define research objectives, identify gaps in existing literature, and formulate hypotheses to address research problems effectively.
2. Analyze different data collection methods, apply sampling techniques, and evaluate data pre-processing strategies to ensure the reliability and validity of research data.
3. Evaluate statistical analysis techniques, interpret research findings accurately, and synthesize results to draw meaningful conclusions and recommendations.
4. To critically analyze and apply the principles and legal frameworks of Intellectual Property Rights (IPR) and patents in real-world scenarios.
5. To develop the ability to critically evaluate, synthesize, and present advanced research findings through technical seminars and publications.

Pre Requisite**Skills to read and comprehend technical research paper.****UNIT I RESEARCH PROBLEM FORMULATION**

Definition and Motivation - Objective of Research - Steps in Research Process; Characteristics of Good Research - Ethics in Research - Types of Research - Research Approaches, Problem Definition and Formulation - Hypothesis - Literature Review - Identifying research gaps.

6

UNIT II DATA COLLECTION

Sampling - Sampling Techniques - Sampling error - Primary and Secondary Data - Data Collection Methods - Data Preprocessing - Data Validation and its types - data presentation- types of tables and illustrations.

9

UNIT III DATA ANALYSIS, INTERPRETATION AND REPORTING (12)

Method vs methodology - test of hypothesis - measures of central tendency and variation - Data Analysis- Statistical Analysis; Multivariate Analysis; Correlation Analysis; Regression Analysis; Principle Component Analysis.

Guidelines for writing Journal and Thesis: Abstract, introduction, methodology, results and discussion, conclusion, Bibliography and References - Appendix - plagiarism, Citation and listing system of documents

- Styles and methods

12

UNIT IV IPR AND PATENTS

IPR - Concept of IPR, types of IPR - Patent, Designs, Trademarks and Trade secrets, Geographical indications, Copy rights, types and features of IPR agreement.

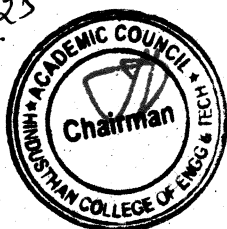
PATENTS - Law of Patents, Patent Searches, Ownership, Transfer Patentability Design Patents - Double Patenting - Assignment of Patent Rights - Patent Application Process - Prosecuting the Application, Term and Maintenance of Patents. Ownership Rights - Sole and Joint Inventors - Licensing of Patent Rights - Patent Infringement, New Developments in Patent Law.

9

UNIT V TECHNICAL SEMINAR / TECHNICAL PUBLICATIONS (9)

Importance and objectives of technical seminars and publications - Types of technical publications: journals, conferences, white papers, technical reports - Structure of a research paper - Technical paper writing - understanding the peer review process and publication.

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Students should independently read and comprehend research papers, conduct thorough literature reviews, and identify key components and trends in their field of study. They should present their findings clearly to a review team, ensure academic integrity through plagiarism checks, and successfully submit manuscripts for publication.

– technical presentation – Submitting manuscript for right journal or conference for publication.

Theory Hours : 45

Tutorial Hours : 0

Practical Hours : 0

Total Hours: 45

9

COURSE OUTCOME

CO1. Evaluate research objectives critically, synthesize information from literature reviews to identify gaps in knowledge, and formulate clear and testable hypotheses.

CO2. Demonstrate the ability to assess the appropriateness of data collection methods, justify sampling techniques, and implement data preprocessing steps effectively.

CO3. Applying statistical analysis methods, interpreting complex data sets, and synthesizing research findings coherently

CO4. Evaluate and manage complex IPR and patent-related issues, including searches, ownership, licensing, and infringement, while integrating the latest developments in patent law.

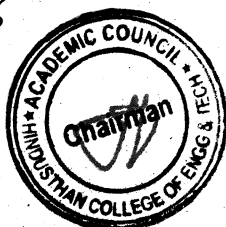
CO5. Proficiently create, review, and submit high-quality research papers, demonstrating a deep understanding of their field and adherence to academic and ethical standards.

REFERENCES

1. Cooper Donald R, Schindler Pamela S and Sharma JK, "Business Research Methods", Tata McGraw Hill Education, 11e (2012).
2. Soumitro Banerjee, "Research methodology for natural sciences", IISc Press, Kolkata, 2022,
3. The Institute of Company Secretaries of India, Statutory body under an Act of parliament, "Professional Programme Intellectual Property Rights, Law and practice", September 2013.

PROGRAMME OUTCOMES (PO's & PSO's)										
3/2/1/- → Indicate the Strength of Correlation 3 – Strong; 2 – Medium; 1 – Weak										
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	3	2	2	2	-	-	2	2	3	-
CO2	3	2	2	2	-	-	2	2	2	-
CO3	3	2	3	2	-	-	2	2	3	-
CO4	3	2	3	2	-	-	2	2	2	2
CO5	3	2	3	2	-	-	2	2	3	2
COURSE ASSESSMENT METHODS										
DIRECT		1. Continuous Assessment I and II 2. Assignment / Activity 3. Demonstration 4. End Semester Examination				INDIRECT			1. Course Exit Survey	

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COURSE OBJECTIVE

1. Gain Knowledge in the basics of world wide web and HTML
2. Get equipped both CSS and JavaScript, enabling them to build interactive websites.
3. Comprehensive understanding of advanced JavaScript techniques and DOM manipulation
4. To make use of JS Libraries and Framework to create applications
5. To design and develop backend components using Node JS

Pre Requisite Nil

UNIT I - HTML

Internet Standards – Introduction to WWW – WWW Architecture – SMTP – POP3 – File Transfer Protocol - Overview of HTTP, HTTP Request – Response – Web Server and its type - Introduction HTML – HTML Elements – Semantics – Attributes –Headings-Paragraph-Styles – Tables – forms-Formatting – Quotations – Computer Code- Comments & Colors- HTML CSS– Links & Images –Lists-Classes-Layout.

1. *You have been hired as a web developer by an educational institution to create a comprehensive and informative multi-page HTML website. The website should include multiple pages, each showcasing different aspects of the institution. You need to use a variety of HTML elements such as headings, paragraphs, and styles to create a structured and engaging layout. Emphasize the use of semantic HTML to enhance accessibility and improve SEO, ensuring that search engines can easily index the content.*

10

UNIT II – CSS & JAVASCRIPT

Cascading Style Sheet (CSS3): The Need for CSS – Basic Syntax and Structure Inline Styles – Embedding Style Sheets - Linking External Style Sheets – CSS fundamentals: Syntax- Ruleset: Styling Techniques : Backgrounds - Manipulating text - Margins and Padding - Positioning Using CSS -Responsive Web Design- CSS Animation – Css CSS Preprocessor Javascript Fundamentals : JavaScript Basics - Control Flow Statements - Loops - Expression and Operators - Objects - Functions.

2. *Create a web page with the following deliverables*

Home Page:

- Create a visually appealing home page that includes a background image or color, styled text, and well-spaced sections using margins and padding.
- Use embedded style sheets to define the CSS rules for this page.

About Us Page:

- Develop an "About Us" page that uses an external style sheet linked to the HTML.
- Apply various text manipulation techniques to improve readability and presentation.

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Programs Page:

- Design a "Programs" page that demonstrates CSS positioning techniques to organize content effectively.
- Include a responsive layout that adapts to different screen sizes.

Contact Page:

- Create a "Contact" page that includes a form styled using CSS.
- Implement animations to enhance user interaction (e.g., button hover effects, form field focus animations).

CSS Preprocessor Implementation:

- Show the use of a CSS preprocessor by including the preprocessed CSS code and the generated CSS file.

UNIT III – ADVANCED JAVASCRIPT

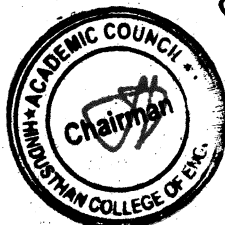
Regular Expression - Events - OOPs - Inheritance and Prototype Chain - Memory Management - Promises - Iterators and generators - Validations - Exception Handling - Global Objects -JS this Keyword - Strict Mode - setTimeout() and setInterval() Method - typeOf Operator - Debugging - Local Storage - Callback - Closures - JS defer - scope - Void. JavaScript DOM Manipulation: Manipulating the DOM with

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JavaScript - Handling events and user interactions with JavaScript- Debugging and troubleshooting JavaScript code.

3. Developing an Interactive Student Management System Using JavaScript Fundamentals. The system should have the following deliverables given below

1. Add Student Functionality:

- Create a form in HTML to input student details (ID, name, age, grade, contact).
- Write a JavaScript function to validate and add the student object to an array.

2. View Students:

- Develop a function to display all student records in a structured format.
- Use loops to iterate through the array of student objects and output their details to the console or webpage.

3. Update Student:

- Implement a function to update a student's details.
- Use control flow statements to search for the student by ID and update the relevant fields.

4. Delete Student:

- Write a function to delete a student record based on a unique identifier (e.g., student ID).
- Use array methods and loops to find and remove the student object from the array.

5. Search Student:

- Implement a search functionality that allows users to find a student by name or ID.
- Use loops and control flow statements to match the search criteria and display the result.

UNIT IV - JAVASCRIPT LIBRARIES AND FRAMEWORKS

Introduction to ES6 - Introduction to TypeScript - Key Features of TypeScript - Structure of TypeScript - Need for Typescript - JavaScript Libraries: JQuery, Json : Introduction - Data types - Schema - Javascript Json.

4. Developing a Contact Management System with DOM Manipulation and Advanced JavaScript Features

You are required to build a Contact Management System where users can add, edit, delete, and search for contacts. The application should utilize advanced JavaScript features for effective DOM manipulation, event handling, and data validation.

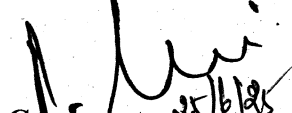
Develop the Contact Management System with the following features:

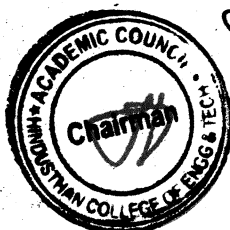
- Add new contacts with validation.
- Edit existing contacts.
- Delete contacts.
- Search for contacts.
- Validate contact details using regular expressions.
- Use DOM manipulation to dynamically update the contact list.
- Store contacts in the local storage for data persistence.
- Handle errors gracefully and provide user feedback.
- Implement asynchronous operations with callbacks and promises.
- Use closures to manage private data within functions.
- Apply the this keyword and strict mode correctly.
- Use setTimeout() and setInterval() for timed operations.
- Debug and troubleshoot the code effectively.
- Integrate CSS for a responsive and user-friendly interface.

Express and NODEJS

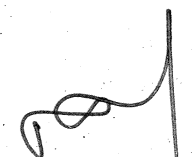
Express JS Express - Restful Services - Introducing Express - Building Your First Web Server - Nodemon - Environment Variables - Route Parameters - **NODEJS** : Introduction - Installation - Console - Repl Commands - Package Manager - Command Line Options - Functions - Global Objects - Timer - Error Handling - Dns - Callbacks - Events - Web Module - Node.js Mysql - RESTful API.

5. Building a RESTful Web Service for a Bookstore


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You have been hired to develop a RESTful web service for a bookstore using Express.js. The web service should manage a collection of books, allowing users to perform CRUD (Create, Read, Update, Delete) operations. To enhance development efficiency, you will use Nodemon for automatic server restarts and environment variables to manage configuration settings. The service should also handle route parameters for specific operations. Create code snippets for the following

❑ **Setup and Initialization:**

- Initialize a new Node.js project.
- Install Express.js and Nodemon.
- Create the main application file (e.g., app.js).

❑ **Creating the Server:**

- Set up an Express server that listens on a port specified in environment variables.
- Use Nodemon to automatically restart the server during development.

❑ **Environment Variables:**

- Create a .env file to store environment variables.
- Use the dotenv package to load environment variables into your application.

❑ **Routing and CRUD Operations:**

- Define routes for the following endpoints:
 - POST /books: Add a new book to the collection.
 - GET /books: Retrieve a list of all books.
 - GET /books/:id: Retrieve a specific book by ID.
 - PUT /books/:id: Update the details of a specific book by ID.
 - DELETE /books/:id: Delete a specific book by ID.

❑ **Handling Route Parameters:**

- Use route parameters to handle operations on specific books.
- Implement middleware to validate and process route parameters.

❑ **Error Handling and Responses:**

- Implement error handling to manage cases where a book is not found or input data is invalid.
- Return appropriate HTTP status codes and response messages for each operation.

❑ **Testing and Documentation:**

- Test all endpoints using a tool like Postman or curl.
- Document the API endpoints and their usage.

Theory Hours : 3

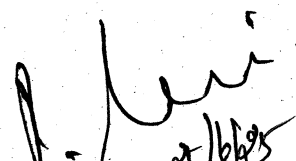
Tutorial Hours : 0

Practical Hours : 2

Total Hours: 60
Hours

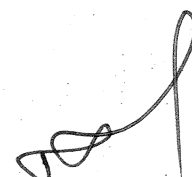
COURSE OUTCOME

- CO1. Demonstrate the knowledge of fundamental elements and concepts related to Web clients and servers
 CO2. Design Static Client Side web documents using markup languages and style sheets
 CO3. Design and Implement interactive Websites using client-side scripting.
 CO4. Design application using JavaScript Libraries and Frameworks
 CO5. Implement Web Applications using Express and Node JS


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COURSE OBJECTIVE

1. To design a relational database system by performing conceptual modeling and mapping it to a logical schema using a domain of the student's choice.
2. To implement a relational database system using SQL by creating schemas with constraints, performing data operations, constructing views and joins, and applying procedural SQL for validation and automation.
3. To analyze functional dependencies and apply normalization techniques to design efficient and consistent relational schemas.
4. To implement database transaction management, ACID properties, and concurrency control techniques including locking and deadlock handling.
5. To develop a NoSQL-based application using MongoDB by performing document modeling, CRUD operations, indexing, aggregation, and integration with a programming language.

Hour
s**Name of the Experiment**

- 1 Design a database system based on the choice of the user domain.

Perform Conceptual and Logical Design**Conceptual Design**

- Identify key entities, attributes (including composite and multi-valued), relationships, cardinalities, and constraints.
- Represent as an ER diagram using any chosen domain.

6

Logical Design

- Map ER to relational tables.
- Identify primary keys and foreign keys.
- Explain how ER components were translated.

- 2 Relational Database Implementation

DDL Operations

- Create relational schemas using CREATE TABLE.
- Implement appropriate constraints (PRIMARY KEY, FOREIGN KEY, NOT NULL, CHECK).

3

DML Operations

- Perform INSERT, SELECT, UPDATE, DELETE.

Aggregate Functions & Complex Queries

- Use functions like SUM, AVG, COUNT, MAX, MIN.
- Write complex queries with nested subqueries and GROUP BY, HAVING.

- 3 Views, Joins, and Advanced SQL

Views

- Create and manage CREATE VIEW, DROP VIEW.
- Query views.

3

Joins

- Perform INNER, LEFT, RIGHT, FULL OUTER JOINS.
- Use views with joins.

- 4 Constraints and Procedural SQL

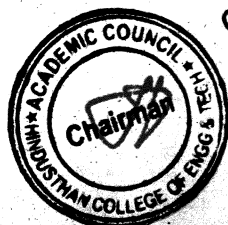
Integrity Constraints

- Implement and test CHECK, UNIQUE, and FOREIGN KEY constraints.

3

Stored Procedures, Functions, and Triggers

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- Create simple PROCEDURE, FUNCTION, and TRIGGER objects for validations or audits.

5 Normalization and Functional Dependencies

Functional Dependency Analysis

- Compute attribute closures and candidate keys.

Normalization

- Convert a dataset from UNF → 1NF → 2NF → 3NF → BCNF.
- Ensure lossless join and dependency preservation.

Higher Normal Forms (4NF, 5NF)

- Identify and eliminate multi-valued and join dependencies.

6 Transactions and ACID Properties

Transaction Concepts

- Define and simulate a transaction state diagram with domain-based examples.

Transaction Implementation

- Execute transactions using BEGIN, COMMIT, ROLLBACK.
- Simulate crash recovery (via delayed commit check).

Consistency via Constraints

- Write SQL that violates a CHECK constraint to demonstrate constraint enforcement.

7 Concurrency Control and Deadlocks

Simulating Concurrency Anomalies

- Lost update, dirty read, unrepeatable read using parallel sessions.

Lock-Based Solutions

- Demonstrate Two-Phase Locking (2PL).
- Draw and analyze a Wait-for Graph.
- Simulate and resolve deadlocks.

8 MongoDB NoSQL Database

MongoDB Fundamentals

- Understand document structure and data types.
- Perform CRUD operations.

Indexing and Aggregation

- Use createIndex(), and MongoDB Aggregation Framework.

MongoDB Application Integration

- Create a basic app using Node.js, Python, or Java with MongoDB driver.
- Perform basic database operations with error handling.

9 Design and develop a fully functional database system based on a domain of your choice

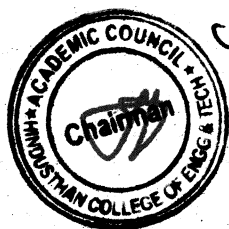
Suggested Domains for SQL are Listed Below

1. University/Campus Management System
2. Library Management System
3. Hospital Patient and Doctor Scheduling System
4. Online Examination System
5. Employee Attendance and Payroll System
6. Inventory and Warehouse Management
7. Hospital Patient and Doctor Scheduling System
8. Hotel Reservation System

The system must demonstrate the complete lifecycle of database design and implementation, covering the following:

- Perform **Conceptual Design** using an ER diagram with clear identification of entities, attributes, relationships, cardinalities, and constraints.
- Convert the ER model to **Logical Design**, identifying all relational schemas with

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- primary and foreign keys.
- Implement the **Relational Database** using DDL and DML statements (CREATE TABLE, INSERT, UPDATE, DELETE, SELECT).
- Write complex **queries** using aggregate functions, GROUP BY, HAVING, and **nested subqueries**.
- Create and query **Views** and apply **JOIN operations** (INNER, OUTER, LEFT, RIGHT).
- Apply **Constraints** and develop **PL/SQL components** (Procedures, Functions, Triggers).
- Normalize your database up to **BCNF**, and where applicable, address **multi-valued and join dependencies** (4NF and 5NF).
- Demonstrate **Transaction Management**, **ACID properties**, and **simulate concurrency issues** (lost update, dirty read, unrepeatable read).
- Apply **locking mechanisms** and show **deadlock handling** with wait-for graphs.

10 Design and develop a NoSQL-based application using MongoDB for a domain of your choice

Suggested Domains for NO SQL are Listed Below

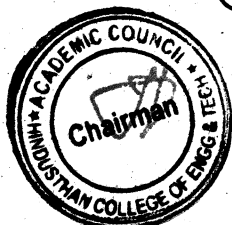
1. Online Retail Store / Product Catalog (e-Commerce)
2. Citizen Service Portal for Complaints and Requests
3. Healthcare Tracker for Fitness & Remote Patient Monitoring
4. Food Delivery and Rating System
5. Smart Farming Data Monitoring
6. Logistics and Fleet Tracking
7. Travel Itinerary and User Feedback Management
8. Restaurant Menu and Order Tracking
9. Job Portal with Resumes, Applications, Recruiters

The system must demonstrate the core features of MongoDB and integration with an application using a programming language of your choice (Node.js, Python, or Java). Your project should include the following:

1. **Document Modeling and Schema Design**
 - Define collections with appropriately structured documents using MongoDB's flexible schema.
 - Demonstrate use of various **data types**, embedded documents, and arrays to represent real-world entities and relationships.
2. **CRUD Operations**
 - Implement **Create, Read, Update, and Delete** operations using MongoDB queries for multiple use-case scenarios.
 - Handle multi-document interactions using proper update and filter operators.
3. **Indexing and Query Optimization**
 - Create and use indexes using `createIndex()` to improve query performance.
 - Compare query execution with and without indexes (optional performance profiling).
4. **Aggregation Framework**
 - Use the **MongoDB Aggregation Pipeline** to process and analyze data, e.g., generating reports, grouping records, filtering by criteria, and computing summary statistics.
5. **Application Development and Integration**
 - Build a basic front-end or CLI-based application in **Node.js, Python, or Java**

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to connect with your MongoDB database using official drivers.

- Demonstrate error handling for operations such as invalid inputs, connection errors, or failed writes.

6. Advanced Features (Optional Enhancements)

- Implement pagination, sorting, or search features.
- Use MongoDB Atlas (cloud-based) for deployment and remote access.
- Apply **validation rules** or **schema constraints** using MongoDB's schema validation feature.

Theory Hours : 0

Tutorial Hours : 0

Practical Hours : 3

Total Hours: 45
Hrs

COURSE OUTCOME

CO1 : Students will be able to identify entities, relationships, and constraints, draw an ER diagram, and convert it into normalized relational tables with appropriate primary and foreign keys.

CO2 : Students will be able to define database structures with appropriate constraints, perform CRUD and aggregate operations, create and query views using joins, and implement stored procedures, functions, and triggers to enhance database functionality.

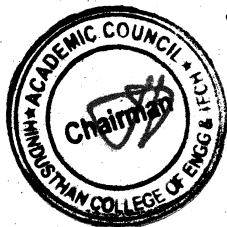
CO3 : Students will be able to identify candidate keys, compute attribute closures, normalize relations up to BCNF, and resolve multi-valued and join dependencies to achieve 4NF and 5NF while ensuring lossless join and dependency preservation.

CO4 : Students will be able to simulate transactions with commit and rollback, enforce consistency using constraints, identify concurrency anomalies, apply two-phase locking, and analyze deadlocks using wait-for graphs.

CO5 : Students will be able to design document-based schemas, execute CRUD and aggregation queries, create indexes, and build a simple application using Node.js, Python, or Java with MongoDB for backend operations.

PROGRAMME OUTCOMES (PO's & PSO's)										
3/2/1/- → Indicate the Strength of Correlation 3 – Strong; 2 – Medium; 1 – Weak										
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	3	3	3	3	-	-	-	-	3	3
CO2	3	3	3	3	-	-	-	-	3	3
CO3	3	3	3	-	-	-	1	-	3	3
CO4	3	3	3	-	-	-	-	-	3	3
CO5	3	3	3	3	-	-	-	2	3	3
COURSE ASSESSMENT METHODS										
DIRECT	1. Continuous Assessment I and II 2. Assignment / Activity 3. Demonstration 4. End Semester Examination					INDIRECT	1. Course Exit Survey			

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JAVA PROGRAMMING LAB

L	T	P	C
0	0	3	1.5

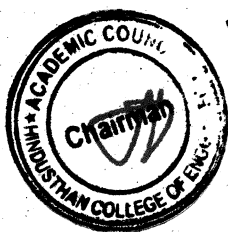
COURSE
OBJECTIVE

1. To apply the object concepts, array of objects, control structure and constructor in Java programs.
2. To build programs to learn inheritances, interface, packages, applets and graphics
3. To construct programs to use exceptions and handle various events.
4. To develop programs to apply i/o concepts, multithreading and access database from GUI.
5. To implement applets in real world applications

Pre-requisite : Basic Knowledge in Programming and OOPs Concepts

S.no	Description of the experiments	practical hours
OBJECT, ARRAYS, CONTROL STRUCTURE AND CONSTRUCTOR		
1	a. Write a program to calculate employee payroll using arrays and structures. Create 2 classes to perform payroll calculation and for input and output display. Based on basic pay create array to calculate HRA, DA, MA, PF and net pay.	3
	b. Write a program for complex number operation using constructors	
INHERITANCE		
2	Give an array of size N which contains the marks of a student in N subjects, the task is to calculate the CGPA of the student. Write a program for marksheet preparation using 3 classes to get, calculate and display mark statement using inheritance. Note: Consider all marks to be out of 100 for each subject.	3
INTERFACE AND PACKAGE		
3	a. Create an interface for declaring variables and methods and create two classes for performing calculation and execution to find voter eligibility. b. Create a package for flat water maintenance bill, import the package in a class file to get input and display the final detailed bill. Note: Calculate water bill based on water consumption as given below: Rate (Rs/m ³), Charges (Rs) Usage (m ³), for 0 - 20 m ³ -> Rs.0.50/-, for 21 - 35 m ³ -> Rs.0.90/- , for > 35 m ³ -> Rs.1.30/-	3
OVERLOADING, OVER-RIDING AND MULTITHREADING		
4	a. Write a program to calculate the area of square, rectangle and triangle. Create a method area, perform method over riding and overloading using the method area. b. Write a program to display 16 times tables up to 16 using multithreading	3
USER-DEFINED AND PRE-DEFINED EXCEPTION HANDLER		
5	a. A company consists of 1000 employees over 50 years. Each employee is assigned with unique id number up to 1000. Write a program to check the details of the employee using employee id. Generate user-defined exception handler if the employee id is not in the database. b. Create build-in exceptions using try and catch block. Arise exception in try block and handle the build-in exception in catch block. Execute the exception code in separate class to check arithmetic	6

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exception, array index out of bound exception, negative array size exception and number format exception.

STRING CLASS AND STRING TOKENIZER

- 6 Get strings as input. Use switch statements to select the string functions like insert, append, delete, concatenate, find and replace. Read input and perform the actions using string buffer functions. 6

Get multiple statements as string input. Use full stop as String tokenizer. Using while loop count the tokens and display the string in separate line by sorting the string.

- 7 **FILES AND STREAMS** 3

Assign a variable to receive the units of electricity consumed, the task is to calculate the electricity bill using Files and streams, provided 1 to 100 units – Rs.10/unit, 100 to 200 units – Rs.15/unit, 200 to 300 units – Rs.20/unit and above 300 units – Rs.25/unit.

VECTOR AND WRAPPER CLASS

- 8 A cone shaped tank is used to store water with 9 feet height and 14 feet diameter. Calculate the volume using vector and wrapper class by providing input values during run time, round off the values if needed and use $\pi=3.14$. Formula to calculate volume is $v=1/3*\pi*r^2*h$ 3

NETWORKING OPERATION

- 9 Create a client port, server port, buffer size and datagram socket. Connect both ports in two different command prompts and interchange text message between both the ports 3

AWT CONTROLS

- 10 Use applet viewer to get personal details using text box for receiving name, check box group for gender details, text box with scroll bar for address details, List for qualification details, Choice option for country details and button to submit details. Using ActionListener() add the details and print the details. 3

APPLET & FRAMES

Create a class mouse extend applet implementing MouseListener, MouseMotionListener. Override both methods using action commands performed by mouse events and print the mouse events like mouse

- 11 pressed, released, clicked, dragged, moved, entered and exited. 6
Create a class KeyEvent extend Applet implementing KeyListener. Override both method using action commands performed by key events and print keyboard events like pressed, released and typed.

Create class using frame concept implementing WindowListener() and MouseListener()

DATABASE

- 12 Create an Oracle or MySQL or SQL Server database that gets inserted, updated and deleted of a person's Aadhaar records when it is invoked in a GUI form to do so. 3

Total Instructional hours 45

COURSE OUTCOME

CO1. Create object for the class and to input the values during run time.

CO2. Write programs in inheritance and achieve reusability. Moreover, to implement interface, package, applet and graphics

CO3. Develop programs to understand built in exception and custom exception.

CO4. Construct programs in I/O Stream classes and threads, as well to connect databases.

CO5. Extend client with server programs using network operations.

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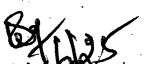


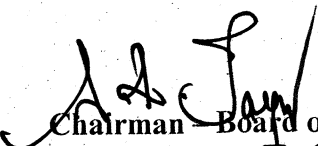
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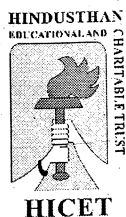
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PROGRAMME OUTCOMES (PO's & PSO's) 3/2/1/- → Indicate the Strength of Correlation 3 – Strong; 2 – Medium; 1 – Weak										
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	1	3	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-	-	-	-
CO3	-	3	3	3	-	3	-	2	2	2
CO4	-	-	-	-	-	-	-	-	-	-
CO5	-	-	3	3	1	3	-	-	-	-
COURSE ASSESSMENT METHODS										
DIRECT	1. Continuous Assessment I and II 2. Assignment / Activity 3. Demonstration 4. End Semester Examination					INDIRECT	1. Course Exit Survey			


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DETAILS OF REVISED CURRICULUM & SYLLABUS

CBCS PATTERN

POSTGRADUATE PROGRAMMES

MCA. COMPUTER APPLICATIONS (PG)

REGULATION-2024

(For the students admitted during the academic year 2024-2025)

BATCH 2024 – 2026

SEMESTER I – BRIDGE COURSE

S.No	Course Code	Course Title	Category	L	T	P		C	CIA	ESE	TOT.
THEORY											
1.	24CA1291	PoP& OOPS	BRIDGE	3	0	0		-	100	0	100
2.	24CA1292	Fundamentals Of Web Designing	BRIDGE	3	0	0		-	100	0	100
PRACTICAL											
3.	24CA1091	PoP& OOPS LAB	BRIDGE	0	0	3		-	100	0	100
Total				6	0	3		0	300	0	300

SEMESTER I – REGULAR COURSE

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	24CA1201	Data Communication and Networking	PCC	3	0	0	3	40	60	100
2.	24CA1202	Database Management Systems	PCC	3	0	0	3	40	60	100
3.	24CA1203	Java Programming	PCC	3	1	0	4	40	60	100
4.	24CA1204	Research Methodology IPR and Technical Presentation	RMC	3	0	0	3	40	60	100
5.	24CA1251	Web Technology(T+L)	PCC	3	0	2	4	50	50	100
6.	24MA1152	Probability and Statistics for Data Analytics with R Programming(T+L)	FC	3	0	2	4	50	50	100
PRACTICAL										
7.	24CA1001	Database Management System Lab	EEC	0	0	3	1.5	60	40	100
8.	24CA1002	Java Programming Lab	EEC	0	0	3	1.5	60	40	100
Total				18	1	10	24	380	420	800

SEMESTER II – BRIDGE COURSE

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	24CA2291	Software Engineering	BRIDGE	3	0	0	-	100	0	100
2.	24CA2292	Operating System	BRIDGE	3	0	0	-	100	0	100
PRACTICAL										
3.	24CA2091	Software Engineering Tools Lab	BRIDGE	0	0	3	-	100	0	100
Total				8	0	2	0	300	0	300

SEMESTER II – REGULAR COURSE

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	24CA2201	Data Structures and Algorithms	PCC	3	1	0	4	40	60	100
2.	24CA2202	Python Programming	PCC	3	1	0	4	40	60	100
3.	24CA2251	Dev Ops and Full Stack Development (T+L)	PCC	3	0	2	4	50	50	100
4.	24CA2252	Cryptography and Network Security(T+L)	PCC	3	0	2	4	50	50	100
5.	24EC2251	Embedded System and Sensors (T + L)	PCC	2	0	2	3	50	50	100
6.	24CA2302	Artificial Intelligence	PEC	3	0	0	3	40	60	100
PRACTICAL										
7.	24CA2001	Data Structures and Algorithms Lab	EEC	0	0	3	1.5	60	40	100
8.	24CA2002	Python Programming Lab	EEC	0	0	3	1.5	60	40	100
Total				17	2	12	25	390	410	800

SEMESTER III

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1.	24CA3252	Software Testing (T + L)	PCC	3	0	2	4	50	50	100
2.	24CA3201	Machine Learning	PCC	3	1	0	4	40	60	100
3.	24EE3251	Internet of Things (T+L)	PCC	3	0	2	4	50	50	100
4.	24CA3301	Cloud Computing	PEC	3	0	0	3	40	60	100
5.	24CA3303	Ethical hacking	PEC	3	0	0	3	40	60	100
6.	24CA3311	Agile Methodologies	PEC	3	0	0	3	40	60	100
PRACTICAL										
7.	24CA3801	Mini Project Lab	EEC	0	0	3	1.5	60	40	100
8.	24CA3001	Machine Learning Lab	EEC	0	0	3	1.5	60	40	100
Total				18	1	10	24	370	430	800

SEMESTER IV

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	24CA4901	Project Work	EEC	0	0	18	9 ✓	60	40	100
2	XXXX	Software Project Management	EEC	3	0	0	3 ✓	40	60	100
Total				3	0	18	12	100	100	200

PROFESSIONAL ELECTIVE II, III, IV										
1.	24CA3301	Cloud Computing	PE	3	0	0	3	40	60	100
2.	24CA3302	E- Commerce	PE	3	0	0	3	40	60	100
3.	24CA3303	Ethical Hacking	PE	3	0	0	3	40	60	100
4.	24CA3304	Mixed Reality	PE	3	0	0	3	40	60	100
5.	24CA3305	Organizational Behavior	PE	3	0	0	3	40	60	100
6.	24CA3306	Semantic Web Services	PE	3	0	0	3	40	60	100
7.	24CA3307	Service Oriented Architectures and Microservices	PE	3	0	0	3	40	60	100
8.	24CA3308	Social Network Analysis	PE	3	0	0	3	40	60	100
9.	24CA3309	Soft Computing Techniques	PE	3	0	0	3	40	60	100
10.	24CA3310	Software Testing and Automation	PE	3	0	0	3	40	60	100
11.	24CA3311	Agile Methodologies	PE	3	0	0	3	40	60	100

III SEMESTER – NEW COURSES

R2024	
24CA3252	Software Testing (T+L)
24CA3201	Machine Learning
24CA3001	Machine Learning Lab
24CA3311	Agile Methodologies (PE)

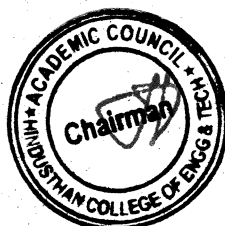
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Regulation 2024 – Batch 2024 - 2026
Semester III – Regular Courses

24CA3201

MACHINE LEARNING

L	T	P	C
3	1	0	4

**COURSE
OBJECTIVE**

- 1.To provide the foundational ML methods and advanced techniques like transfer and self-supervised learning.
- 2.Explore various classification algorithms, including decision trees, SVMs, and regularization techniques.
- 3.Develop skills to apply ensemble models, perform clustering, and execute feature space reduction effectively.
- 4.Understand the structure and function of probabilistic graphical models including Bayesian and Markov networks.
- 5.Build skills in neural networks and reinforcement learning for creating intelligent, adaptive systems.

Pre-Requisite NIL**UNIT-I FUNDAMENTALS OF MACHINE LEARNING**

Introduction to Machine Learning (ML) - Essential concepts of ML – Types of Machine learning methods – Early trends in Machine learning – Data understanding, representation and visualization – Hypothesis - Modelling in Machine learning - Classification: Probability theory and Bayes rule – Generative vs. discriminative training – Self-supervised Learning and Transfer learning.

10

UNIT-II CLASSIFICATION TECHNIQUES

Regularization techniques - Decision Tree based Learning algorithms – Induction algorithms – Regression trees - Instance based Learning - Support Vector Machines: Hard and soft margin – Functional and Geometric margin - Maximum margin linear separators – Kernels for learning nonlinear functions

12

UNIT-III CLUSTERING AND SUPERVISED LEARNING TECHNIQUES

Ensemble Learning: Using committees of multiple hypotheses. Bagging - Random Forest - Adaptive Boosting, Stacking and DECORATE - Active learning with ensembles – Clustering – K-means Clustering– Hierarchical Clustering.

11

UNIT-IV PROBABILISTIC LEARNING MODEL

Bayesian Learning - Naive Bayes Algorithm - Introduction to Graphs – Bayesian Belief Networks - Inference in Graphical Models - Markov Chain – Markov Model - Hidden Markov Models – Inference – Learning - Generalization – Undirected Graphical Models

14

UNIT-V ANN & REINFORCEMENT LEARNING

Artificial Neural Networks – Structure and Activation functions – Perceptron – Multi Layer Perceptron - Back Propagation – Gradient descent training - Radial Basis function Neural Network-Overview of Reinforcement Learning - Components of Reinforcement Learning - Model Based Learning - Model Free Learning - Q Learning.

13

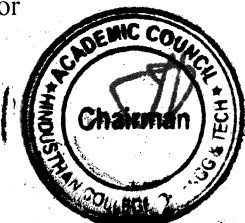
Theory Hours: 3**Tutorial Hours: 1****Practical Hours: 0****Total Hours: 60
Hours****COURSE OUTCOME**

- **CO1:** Gain knowledge about the machine learning methods such as supervised, unsupervised, reinforcement, self-supervised, and transfer learning.
- **CO2:** Apply classification and regularization techniques to solve supervised learning problems.
- **CO3:** Analyze and implement ensemble models, clustering techniques, and reduce feature space effectively.

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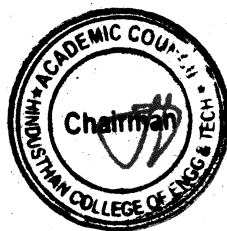
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- **CO4:** Develop probabilistic models and apply Bayesian inference and graphical model-based learning.
- **CO5:** Design and train neural networks and apply reinforcement learning algorithms in adaptive environments.

REFERENCES:

1. Machine Learning For Absolute Beginners: by Oliver Theobald (3rd Edition, 2024).
2. Hands-On Machine Learning with Scikit-Learn, Keras & TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems: by Aurélien Géron (3rd Edition, 2022).
3. The Hundred-Page Machine Learning Book: by Andriy Burkov (2021).
4. Foundations of Machine Learning: by Mehryar Mohri, Afshin Rostamizadeh, and Ameet Talwalkar (2019).
5. Machine Learning with Python: Principles and Practical Techniques, Author: Parteek Bhatia, January 2025

PROGRAMME OUTCOMES (PO's & PSO's) 3/2/1/- → Indicate the Strength of Correlation 3 – Strong; 2 – Medium; 1 – Weak										
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	3	-
CO2	3	3	3	3	-	-	-	-	3	-
CO3	3	3	3	3	-	-	-	-	3	3
CO4	3	3	-	-	-	-	-	-	3	3
CO5	3	3	3	3	-	-	-	2	3	3
COURSE ASSESSMENT METHODS										
DIRECT	1. Continuous Assessment I and II 2. Assignment / Activity 3. Demonstration 4. End Semester Examination					INDIRECT	1. Course Exit Survey			



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SOFTWARE TESTING

L	T	P	C
3	0	2	4

**COURSE
OBJECTIVE**

1. To show how black-box and white-box testing methods can be used to find and fix bugs in software.
2. To Employ black-box and white-box techniques on basic programs to verify correctness and uncover defects.
3. To Examine how localization, configuration, and compatibility factors influence software performance and the user experience.
4. To Interpret test results, bug trends, and documentation quality to enhance the effectiveness of software testing efforts.
5. To Utilize bug tracking systems and reporting strategies to systematically manage and communicate software issues.

Pre-Requisite NIL

UNIT I: INTRODUCTION- Overview of Testing as an Organizational Activity- Understanding Bugs and Software Bugs- Common Reasons for Bugs- Cost Implications of Bugs -Responsibilities of a Software Tester- Software Development Process; Product Components- Software Development Life Cycle (SDLC) Models- Realities and Challenges in Software Testing. 12

UNIT II: TESTING FUNDAMENTALS- Examining Software Specifications- Testing Software with "Blinders On" (Black-Box Testing)- Examining the Code: "X-Ray Glasses" (White-Box Testing). 11

Lab Program 1: Black-Box Testing – Even or Odd Checker. Tool Used- IDLE (Python)

Lab Program 2: White-Box Testing – Grading System. Tool Used- unittest (Python)

UNIT III: TESTING TYPES- Configuration Testing and Compatibility Testing Overview-Platform and Application Version Compatibility- Standards and Guidelines in Testing-Foreign Language Testing: Translation and Localization Issues- Configuration and Compatibility Issues in Software Usability Testing Concepts- Website Testing Techniques: Black Box Testing, Gray Box Testing, White Box Testing. 13

Lab Program 3: Black Box, White Box, and Usability Testing – Calculator Program. Tool Used- (Pytest)

Lab Program 4: Compatibility and Configuration Testing – Greeting Program. Tool Used- Manual (Python)

UNIT IV: AUTOMATED TESTING AND TEST TOOLS- Benefits of Automated Testing-Overview of Test Tools and Software Automation-Random Testing Techniques-Bug Bashes and Beta Testing-Test Documentation - Writing and Tracking Test Cases: Planning, Design, Procedures- Organizing and Tracking TestCases-overview of SELENIUM. 13

Lab Program 5: Automated Unit Testing with unittest (Addition Function). Tool Used- unittest (Pytest)

Lab Program 6: Random Testing & Bug Bash Simulation (Password Strength Checker). Tool Used- faker (Python Package)

UNIT V: REPORTING THE FINDINGS- Reproducing Bugs-Bug Life Cycle Management Using Bug Tracking Systems-Measuring Testing Success: KPIs and SLAs-Software Quality Assurance: Case Study on Test Life Cycle. 11

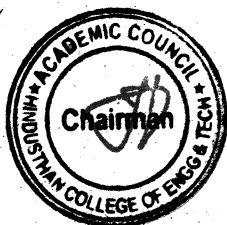
Theory Hours: 3

Tutorial Hours: 0

Practical Hours: 2

Total Hours: 60
Hours

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COURSE OUTCOME

CO1: show how black-box and white-box testing methods can be used to find and fix bugs in software.

CO2: Implement structured testing approaches on simple programs to validate functionality and identify errors.

CO3: Solve how issues with language settings, setup options, and device compatibility can impact how well software works.

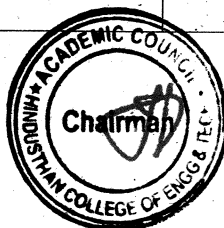
CO4: Evaluate test outcomes and documentation to identify patterns in bugs and improve testing effectiveness.

CO5: Manage software issues efficiently using bug tracking tools and structured reporting methods.

REFERENCES

1. **Foundations of Software Testing: ISTQB Certification Authors:** Dorothy Graham, Erik van Veenendaal, Rex Black, **Edition:** 5th Edition (October 2024), **Publisher:** Cengage Learning.
2. **Software Testing Foundations, Authors:** Andreas Spillner, Tilo Linz, Hans Schaefer, **Edition:** 5th Edition (July 2021), **Publisher:** Rocky Nook.
3. **The Art of Software Testing, Author:** Glenford J. Myers, Corey Sandler, Tom Badgett, **Edition:** 3rd Edition (2011), **Publisher:** Wiley.

PROGRAMME OUTCOMES (PO's & PSO's)										
3/2/1/- → Indicate the Strength of Correlation 3 – Strong; 2 – Medium; 1 – Weak										
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-
CO2	2	3	-	3	-	-	3	-	3	-
CO3	-	0	-	3	-	-	3	-	3	-
CO4	-	0	-	3	-	-	3	-	3	-
CO5	-	3	1	-	-	-	-	1	0	-
COURSE ASSESSMENT METHODS										
DIRECT	1. Continuous Assessment I and II 2. Assignment / Activity 3. Demonstration 4. End Semester Examination					INDIRECT	1. Course Exit Survey			



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CLOUD COMPUTING

L	T	P	C
3	0	0	3

**COURSE
OBJECTIVE**

1. To learn recent cloud computing paradigms.
2. To introduce the concept of Virtualization and the secured cloud environment.
3. Grasp the fundamental concepts and components of cloud architecture.
4. To understand the concepts and programming models in parallel and distributed computing environment.
5. Thorough understanding of cloud security principles and practices

Pre Requisite Nil**UNIT I - INTRODUCTION**

Cloud models-Evolution of Cloud Computing –System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture – On-demand Provisioning – Elasticity in Cloud – deployment models – service models-cloud service providers **10**

UNIT II - VIRTUALIZATION

Basics of Virtualization - Types of Virtualizations - Implementation Levels of Virtualization - Virtualization Structures - Tools and Mechanisms – resource sharing and resource pooling - Desktop Virtualization – Server Virtualization. **11**

UNIT III - CLOUD INFRASTRUCTURE

Architectural Design of Compute and Storage Clouds – Layered Cloud Architecture Development – Design Challenges - Inter Cloud Resource Management – Resource Provisioning and Platform Deployment – Global Exchange of Cloud Resources. **10**

UNIT IV - PROGRAMMING MODEL

Parallel and Distributed Programming Paradigms – Map Reduce, Twister and Iterative Map Reduce – Hadoop Library from Apache – Mapping Applications - Programming Support. **6**

UNIT V - SECURITY IN THE CLOUD

Security Overview – Cloud Security Challenges – Access control mechanisms – Security Governance – Risk Management – Security Monitoring – Security Architecture Design – Virtual Machine Security. **8**

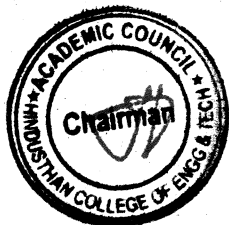
**Total Hours: 45
Hours****Theory Hours : 45****Tutorial Hours : 0****Practical Hours : 0****COURSE OUTCOME**

- CO1: Describe the various cloud programming models and apply them to solve problems on the cloud.
 CO2: Build cloud architecture and demonstrate its role in resource sharing and pooling.
 CO3: Explain the core concepts of the cloud computing paradigm.
 CO4: Get clear knowledge of various cloud models and their services, characteristics, advantages and Challenges.
 CO5: Interpret the security issues and propose solutions using security architectures, access control mechanisms, and risk management techniques.

REFERENCES

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, Distributed and Cloud Computing, From Parallel Processing to the Internet of Things, 2012, 1 st Edition, Morgan Kaufmann Publishers.
2. Katarina Stanoevska-Slabeva, Thomas Wozniak, SantiRistol, Grid and Cloud Computing – A Business Perspective on Technology and Applications, 2010, Springer
3. John W.Rittinghouse and James F.Ransome, Cloud Computing: Implementation, Management, and Security”, 2010, CRC Press.
4. Toby Velte, Anthony Velte, Robert Elsenpeter, Cloud Computing, A Practical Approach, 2009, TMH.
5. George Reese, Cloud Application Architectures: Building Applications and Infrastructure in the Cloud O'Reilly, 2009.

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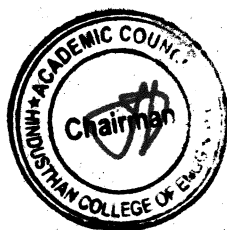


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PROGRAMME OUTCOMES (PO's & PSO's) 3/2/1/- → Indicate the Strength of Correlation 3 – Strong; 2 – Medium; 1 – Weak										
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	3	1	-	-	-	-	-	-	3	-
CO2	-	-	3	3	-	-	-	-	-	-
CO3	3	-	3	-	-	-	3	-	3	-
CO4	3	-	3	-	-	-	-	2	3	-
CO5	3	-	-	3	1	-	3	2	-	-
COURSE ASSESSMENT METHODS										
DIRECT	1. Continuous Assessment I and II 2. Assignment / Activity 3. Demonstration 4. End Semester Examination					INDIRECT	1. Course Exit Survey			



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ETHICAL HACKING

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3	0	0	3

COURSE OBJECTIVE

1. To provide foundational knowledge of ethical hacking concepts, hacker types, attack phases, security principles, and legal and ethical frameworks.
2. To explore and apply techniques for foot printing, scanning, and enumeration using industry-standard tools.
3. Learn methods of system hacking and prevention techniques
4. To understand web service vulnerabilities and session hijacking techniques along with their detection and prevention
5. To learn about access control, firewall configuration, and intrusion detection/prevention systems for network security

Pre-Requisite NIL**UNIT-I INTRODUCTION TO ETHICAL HACKING**

Introduction to Ethical Hacking - Importance of Security – Elements of Security – Phases of an Attack -Types of Hackers (Black Hat, White Hat, Gray Hat)--Cybersecurity Concepts-Five Phases of Ethical Hacking-Legal and Ethical Issues in Hacking-Cyber Laws and Compliance

7

UNIT-II FOOTPRINTING, SCANNING AND ENUMERATION

Types of Footprinting-Information Gathering Techniques-Using Search Engines for Information-Social Engineering Techniques-Tools for Foot printing - Introduction to Scanning – Objectives – Scanning Methodology – Tools – Introduction to Enumeration – Enumeration Techniques – Enumeration Procedure – Tools.

10

UNIT-III SYSTEM HACKING

Introduction – Cracking Passwords – Password Cracking Websites – Password Guessing – Password Cracking Tools – Password Cracking Counter measures – Escalating Privileges – Executing Applications – Keyloggers and Spyware

9

UNIT-IV HACKING WEB SERVICES & SESSION HIJACKING

Web Vulnerabilities: SQL Injection, XSS, CSRF, authentication bypass, web service flaws, missing HTTP security headers.Session Hijacking: Overview, phases, types, and common tools.

9

UNIT-V NETWORK PROTECTION SYSTEMS

Access Control Lists. – Cisco Adaptive Security Appliance Firewall – Configuration and Risk Analysis Tools for Firewalls and Routers – Intrusion Detection and Prevention Systems – NetworkBased and Host-Based IDSs and IPSs

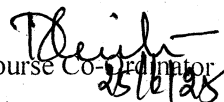
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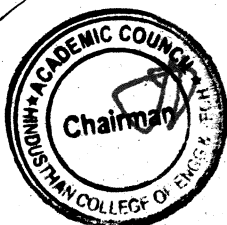
Theory Hours: 3**Tutorial Hours: 0****Practical Hours: 0****Total Hours: 45Hours****COURSE OUTCOME**

- CO1: Understands ethical hacking principles, security elements, hacker types, attack phases, and legal frameworks including cyber laws and compliance
- CO 2. Capable of identifying and utilizing suitable tools for effective footprinting and network reconnaissance.
- CO 3. Identify and exploit system vulnerabilities and implement measures to secure systems.
- CO 4. Able to identify web vulnerabilities and session hijacking methods, and apply appropriate security measures
- CO5. Able to configure and analyze firewalls, and implement IDS/IPS to protect networks effectively.

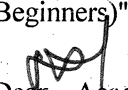
REFERENCES:

1. Hacking: Unveiling the Secrets of Cybersecurity and Ethical Hacking (2024 Guide for Beginners)" by

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Alec Jensen

2. Certified Ethical Hacker (CEH) Study Guide: In-Depth Guidance and Practice Matt Walker O'Reilly Media.
3. Ethical Hacking 2024 - A Hands-On Guide to Career-Based Hacking J. Clarke Code Academy on January 1, 2024.

PROGRAMME OUTCOMES (PO's & PSO's) 3/2/1/- → Indicate the Strength of Correlation 3 – Strong; 2 – Medium; 1 – Weak										
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	3	3	3	3	-	-	-	3	3	3
CO2	3	3	3	3	-	-	-	3	3	3
CO3	3	3	3	3	-	-	-	3	3	3
CO4	3	3	3	3	-	-	-	3	3	3
CO5	3	3	3	3	1	1	-	3	3	3
COURSE ASSESSMENT METHODS										
DIRECT	1. Continuous Assessment I and II 2. Assignment / Activity 3. Demonstration 4. End Semester Examination					INDIRECT	1. Course Exit Survey			



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AGILE METHODOLOGIES

L	T	P	C
3	0	0	3

**COURSE
OBJECTIVE**

1. To provide knowledge about agile software development practices.
2. To provide a good understanding of software design and a set of software technologies and APIs.
3. To do a detailed examination of Agile development and testing techniques.
4. To explore the benefits and pitfalls of working in an Agile team.
5. To understand Agile development and testing

Pre-Requisite NIL**UNIT I AGILE METHODOLOGY**

Theories for Agile Management – Agile Software Development – Traditional Model vs. Agile Model - Classification of Agile Methods – Agile Manifesto and Principles – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams - Agility in Design, Testing – Agile Documentations – Agile Drivers, Capabilities and Values.

7

UNIT II AGILE PROCESSES

Lean Production - SCRUM, Crystal, Feature Driven Development- Adaptive Software Development - Extreme Programming: Method Overview – Lifecycle – Work Products, Roles and Practices

6

UNIT III AGILITY AND KNOWLEDGE MANAGEMENT

Agile Information Systems – Agile Decision Making – Earl's Schools of KM – Institutional Knowledge Evolution Cycle – Development, Acquisition, Refinement, Distribution, Deployment, Leveraging – KM in Software Engineering – Managing Software Knowledge – Challenges of Migrating to Agile Methodologies.

13

UNIT IV AGILITY AND REQUIREMENTS ENGINEERING

Agile Processes in RE–Current Agile Practices – Variance – Overview of RE Using Agile – Managing Unstable Requirements – Requirements Elicitation – Agile Requirements Abstraction Model – Requirements Management in Agile Environment, Agile Requirements Prioritization. – Agile Requirements Modeling and Generation.

12

UNIT V AGILITY AND QUALITY ASSURANCE

Agile Product Development – Agile Metrics – Feature Driven Development (FDD) – Financial and Production Metrics in FDD – Agile Approach to Quality Assurance - Test Driven Development – Agile Approach in Global Software Development - Agile Scrum - Scrum Master – Scaling Projects using Scrum

7

Theory Hours: 45**Tutorial Hours: 0****Practical Hours: 0****Total Hours: 45
Hours****COURSE OUTCOME**

CO1: Realize the importance of interacting with business stakeholders in determining the requirements for a software system

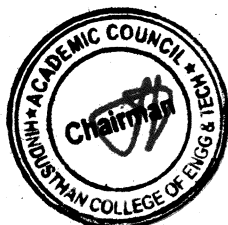
CO2: Perform iterative software development processes: how to plan them, how to execute them.

CO3: Point out the impact of social aspects on software development success.

CO4: Develop techniques and tools for improving team collaboration and software quality.

CO5: Show how agile approaches can be scaled up to the enterprise level

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REFERENCES

1. David J. Anderson and Eli Schragenheim,, "Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results", Illustrated Edition, Prentice Hall PTR, 2004 2.
2. Orit Hazza and YaepI Dubinsky, "Agile Software Engineering,: Undergraduate Topics in Computer Science, Springer Verlag, First Edition,2009 3.
3. Craig Larman, "Agile and Iterative Development: A Manager's Guide", Pearson Education, Second Impression, 2007.
4. Kevin C. Desouza, "Agile Information Systems: Conceptualization, Construction, and Management", Elsevier, Butterworth-Heinemann, First Edition,2007 5.

PROGRAMME OUTCOMES (PO's & PSO's) 3/2/1/- → Indicate the Strength of Correlation 3 – Strong; 2 – Medium; 1 – Weak										
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-
CO2	3	3	2	3	-	-	2	-	-	-
CO3	3	-	-	-	-	-	-	-	-	2
CO4	3	3	2	3	2	3	-	3	2	-
CO5	3	-	-	-	-	3	2	3	2	-
COURSE ASSESSMENT METHODS										
DIRECT	1. Continuous Assessment I and II 2. Assignment / Activity 3. Demonstration 4. End Semester Examination					INDIRECT	1. Course Exit Survey			



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MACHINE LEARNING LAB

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COURSE OBJECTIVE

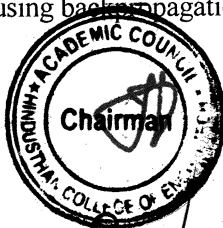
1. Understand and visualize datasets to identify patterns, missing values, and data distributions.
- 2: Implement and evaluate supervised learning algorithms such as Decision Trees, SVMs.
- 3: Explore ensemble learning methods and instance-based techniques with performance evaluation.
- 4: Apply regression techniques and analyze their use in predictive modeling.
- 5: Develop and train neural networks for pattern recognition and real-world applications.

Pre Requisite**Basic Knowledge in Programming.**

S.NO	Description of the experiments	Practical Hours
1	1. Use a dataset (e.g., Iris or MNIST) to perform data understanding and visualization. 2. Explore data distributions, identify missing values, and create visualizations to represent data characteristics.	6
2	1. Write a program to demonstrate the working of the decision tree classifiers. 2. Write a program to Implement the K-Nearest Neighbors (KNN) classifier on a dataset. 3. Use Support Vector Machines (SVM) with a linear kernel and analyze the margin.	10
3	1. Apply AdaBoost on a weak classifier and observe performance improvement. 2. Write program to perform K-Means Clustering and visualize the clusters	9
4	1. Implement Naive Bayes learning algorithm for a sample training data set. 2. Build a program in Hidden Markov Model (HMM) using hmmlearn for sequence data.	9
5	1. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets. 2. Implement facial recognition application with artificial neural network 3. Implement a small neural network with forward and backward pass using NumPy.	11

Practical Hours : 3**Total Hours:
45Hours****COURSE OUTCOME**

- CO1: Perform data analysis and visualization to understand data characteristics and prepare for modeling.
 CO2: Implement decision tree algorithms and apply techniques to prevent overfitting.
 CO3: Build and evaluate classification models using SVM and Naive Bayes.
 CO4: Develop and evaluate regression models using linear regression techniques.
 CO5: Design and train artificial neural networks using backpropagation for real-time applications.



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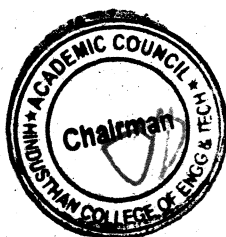
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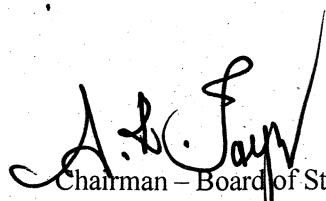
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PROGRAMME OUTCOMES (PO's & PSO's) 3/2/1/- → Indicate the Strength of Correlation 3 – Strong; 2 – Medium; 1 – Weak										
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	3	3	3	3	-	-	-	3	3	3
CO2	3	3	3	3	-	-	-	3	3	3
CO3	3	3	3	3	-	-	-	3	3	3
CO4	3	3	3	3	-	-	-	3	3	3
CO5	3	3	3	3	-	-	-	3	3	3
COURSE ASSESSMENT METHODS										
DIRECT	1. Continuous Assessment I and II 2. Assignment / Activity 3. Demonstration 4. End Semester Examination					INDIRECT	1. Course Exit Survey			




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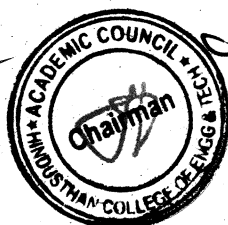

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COURSE OBJECTIVE					
1. Equip students with practical problem-solving skills. 2. Familiarize students with software lifecycle models and relevant artifacts. 3. Foster creativity and innovation through the development of unique projects. 4. Enhance skills in report writing, presentation, and demonstration. 5. Encourage user-based testing and gather valuable feedback from the project's benefiting society.					
Pre Requisite	NIL				
Sl. No.	Description of the Experiments				
1.	Students shall develop creative or innovative project.				
2.	Need to submit a report, presentation with demo.				
3.	User Based Testing and feedback from the benefited society required. Students can select topics from either one of the following domain • Application based or • Algorithms-based projects • Data Analysis Projects				
4.	• Simulation Projects • Optimization Projects • Automation Projects • Web Development Projects • Mobile App Development Projects				
Theory Hours : 0	Tutorial Hours : 0	Practical Hours : 3		Total Hours: 45	
COURSE OUTCOME					
CO1. To Create practical solutions to identified problem. CO2. Use software lifecycle model and other artifacts appropriate for problem. CO3. Identify and master tools required for the project implementation. CO4. Plan and work systematically towards completion of a project work. CO5. Will be enable to integrate all the modules and perform required testing					

PROGRAMME OUTCOMES (PO's & PSO's) 3/2/1/- → Indicate the Strength of Correlation 3 – Strong; 2 – Medium; 1 – Weak										
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	3	3	3	2	1	3	1	1	1	1
CO2	3	3	2	1	1	-	1	1	1	1
CO3	3	3	2	2	1		1	1	3	1

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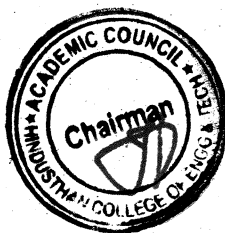
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CO4	3	3	3	1	2	2	1	1	3	2
CO5	3	3	3	2	3	-	-	-	3	2
COURSE ASSESSMENT METHODS										
DIRECT	1. Continuous Assessment I and II 2. Assignment / Activity 3. Demonstration 4. End Semester Examination					INDIRECT	1. Course Exit Survey			



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PROFESSIONAL ELECTIVE

COURSE OBJECTIVE

1. Understand the fundamental concepts of Information Technology, its relationship with business, and the impact of E-Commerce on business transformation.
2. Explore the essential building blocks of E-Commerce, including Electronic Data Interchange, barcoding, RFID, and Business Process Reengineering.
3. Examine legal issues, risks, and technologies associated with cyber security in the context of E-Commerce.
4. Explore the legal framework governing E-Commerce, with a focus on the IT Act 2000 and its provisions.
5. Analyze real-world case studies to understand the application of E-Commerce principles and strategies.

Pre Requisite **NIL**

INTRODUCTION

Information technology and Business-E-Commerce-EDI-E-Commerce types-E-Commerce and World Wide Web-Internet Connectivity-E-Commerce – case studies leading the Transformation-E-Governance case studies leading the Transformation – - Internet communication protocols-Internet services and Resources-Internet Mail-Internet search-issues of concern-Browsers-HTML Java-Internet 2

9

BULIDING BLOCKS FOR E-COMMERCE

Electronic Data Interchange -. costs and benefits – Components of EDI systems- EDI Implementation issues- Identification and tracking tools-The EAN, EANCOM- riticle numbering-bar coding – EAN location numbering –RFID-Business Process Reengineering-Approaches to BBR-Strategic alignment model-BBR Methodology-Management of change- change management – the change management in the government – the implementation plan

9

CYBER SECURITY

Legal issues – Risks – paper documents vs electronic document-technology for authenticating electronic document-Laws for E-Commerce - Cyber-attack-hacking-firewalls-Intrusion Detection System-Secure Socket layer-authentication and assurance of data integrity-cryptography based solutions-digital signature-the protocols for secured messaging-guidelines for cryptography policy-Virtual Private Network. Cybercrimes and Information technology act 2000- cyber forensics

9

IT ACT 2000

Trust in the Electronic environment-electronic authentication-paper-vs electronic world-The IT act 2000-cybercrimes under the IT act.

9

Public key infra-structure- PKI and Certifying Authorities – Electronic payment systems and internet banking-payment gateway-Internet banking-PayPal- Secure Electronic Transaction protocol-electronic cash- electronic cheque- elements of electronic payments

CASE STUDIES

E-Commerce Case Studies- E-Commerce in India- Indiatimes.com-Rediff.com-Bazee.com-Steel Authority of India-Amul- the taste of India

9

Theory Hours : 3

Tutorial Hours : 0

Practical Hours : 0

Total Hours: 45

COURSE OUTCOME

CO1. Gain knowledge about various types of E-Commerce, Internet communication protocols, and key technologies shaping the digital landscape.

CO2. Explore the critical building blocks of E-Commerce and different types of prevailing business models employed by leading industrial leaders.

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CO3. Develop an understanding of key cyber security measures such as firewalls, Intrusion Detection Systems, encryption, and secure communication protocols.

CO4. Gain knowledge about trust in the electronic environment, electronic authentication, and the role of Public Key Infrastructure (PKI) in securing digital transactions.

CO5. Develop insights into successful E-Commerce implementations through case studies of prominent companies, including their challenges and achievements.

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3. Sanjay Mohapatra, "E-Commerce Strategy: Text and Cases", Springer, 2020.
4. C.S.R. Prabhu, E-Governance: Concepts and Case Studies, Springer, 2018.
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PROGRAMME OUTCOMES (PO's & PSO's) 3/2/1/- → Indicate the Strength of Correlation 3 – Strong; 2 – Medium; 1 – Weak										
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	3	-	-	3	-	-	-	-	-	-
CO2	3	2	-	3	3	-	1	-	2	-
CO3	3	2	-	3	1	-	-	1	2	-
CO4	3	1	-	2	1	-	-	2	1	-
CO5	3	-	-	2	-	-	-	1	-	1
COURSE ASSESSMENT METHODS										
DIRECT	1. Continuous Assessment I and II 2. Assignment / Activity 3. Demonstration 4. End Semester Examination					INDIRECT	1. Course Exit Survey			



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MIXED REALITY

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3	0	0	3

COURSE OBJECTIVE

1. Gain an understanding of Virtual Reality (VR) and Augmented Reality (AR), including their definitions, key components, and benefits.
2. Explore the computing architectures of VR and AR.
3. Learn the principles of modeling in Mixed Reality (MR), covering geometric modeling, kinematics modeling, physical modeling, and behavior modeling.
4. Develop proficiency in programming for VR and MR, exploring toolkits, scene graphs, and human factors in VR.
5. Explore various applications of MR in different fields.

Pre Requisite NIL**INTRODUCTION**

Introduction to Virtual Reality (VR)–Definition– Three I's of VR–VRVs3DComputer Graphics - Benefits - Components of VR– Introduction to AR – System Structure– Key Technology in AR –3DVision–Approaches–AlternativeInterfaceParadigms–SpatialAR–InputDevices–3DPositionTrackers – Performance Parameters – Types of Trackers – Navigation and Manipulation Interfaces –Gesture Interfaces – Types of Gesture Input Devices – Output Devices – Graphics Display –Human Visual System – Personal Graphics Displays – Large Volume Displays – Sound Displays –Human Auditory System.

9

AR & VR COMPUTING ARCHITECTURE

Computing Architectures of VR –Workstation Based Architectures – SGI Infinite Reality Architecture – Distributed VR Architectures – Multi-pipeline Synchronization–AR Architecture - Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality, wireless displays in educational augmented reality applications, mobile projection interfaces, marker-less tracking for augmented reality, enhancing interactivity in AR environments, evaluating AR systems.

9

MRMODELING

Modeling – Geometric Modeling – Virtual Object Shape – Object Visual Appearance – KinematicsModeling– TransformationMatrices–ObjectPosition–TransformationInvariants–Object Hierarchies– ViewingThe3DWorld–PhysicalModeling–CollisionDetection–Surface Deformation–ForceComputation–ForceSmoothingAndMapping–BehaviorModeling–ModelManagement.

9

MR PROGRAMMING

VR Programming – Toolkits and Scene Graphs – World Toolkit – Java 3D – Comparison of World Tool kit and Java3D – GHOST – People Shop – Human Factors in VR – Methodology and Terminology – VR Health and Safety Issues – VR and Society –Mixed Reality Coding –Trajectories through Mixed Reality Performance – Mobile Interface Design – Quantitative Evaluation – Qualitative Evaluation.

9

APPLICATIONS

Medical Applications of MR – Education, Arts and Entertainment – Military MR Applications – Emerging Applications of MR –MR Applications in Manufacturing – Applications of MR in Robotics – Information Visualization – Wearable Computing – Games

9

Theory Hours : 3**Tutorial Hours : 0****Practical Hours : 0****Total Hours: 45****COURSE OUTCOME**

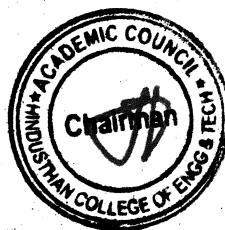
CO1. Explain the fundamentals of AR and VR systems

CO2. Knowledge of different computing architectures used in VR and AR,

CO3. Acquire skills in creating virtual object shapes, understanding object hierarchies, and applying modeling techniques for realistic interactions in MR environments.

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CO4. Able to use VR programming toolkits, design interfaces for VR applications, and address health and safety issues related to VR.

CO5. Gain insights into real-world applications of MR and understand its impact on diverse fields, paving the way for creative and practical use in their future endeavors.

REFERENCES

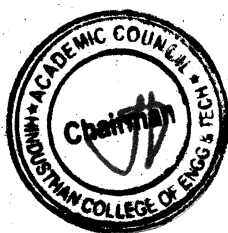
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R3. Charles Palmer, John Williamson, "Virtual Reality Blueprints: Create Compelling VR Experiences for Mobile", Packt Publisher, 2018.

R4. Jason Jerald, "The VR Book: Human-Centered Design for Virtual Reality" Association for Computing Machinery and Morgan, Claypool Publishers, 2015

PROGRAMME OUTCOMES (PO's & PSO's) 3/2/1/- → Indicate the Strength of Correlation 3 – Strong; 2 – Medium; 1 – Weak										
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
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CO4	3	1	-	2	1	-	-	2	1	-
CO5	3	-	-	2	-	-	-	1	-	-
COURSE ASSESSMENT METHODS										
DIRECT	1. Continuous Assessment I and II 2. Assignment / Activity 3. Demonstration 4. End Semester Examination					INDIRECT	1. Course Exit Survey			



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COURSE OBJECTIVE

1. Gain Foundational understanding of organizational behavior models and key elements of organizational structure.
2. To gain insight about various aspects related to individuals' behavior in an organization.
3. To comprehend the foundations of Group behavior in organization
4. To expose students to various leadership styles and the influence of Power and politics in organization.
5. To enable students familiar with organizational culture and the dynamics of organizational behavior.

Pre Requisite **NIL**

INTRODUCTION

Manager's functions, roles and skills. Organizational behavior: Definition – contributing disciplines - challenges and opportunities – Developing an OB Model - Organizational behavior models. Organization structure: key elements – common organizational designs - determinants. 9

INDIVIDUAL BEHAVIOR

Personality: Definition - determinants – MBTI, Big Five, 16 PF and other personality traits. Values – terminal Vs instrumental values. Emotions - Emotional Labour – Emotional Intelligence. Attitude – components – major job attitudes. Job satisfaction: causes – consequences. Perception – factors influencing perception – attribution theory. Motivation – early theories – contemporary theories. 9

GROUP BEHAVIOR

Groups: Meaning – stages of group development – properties – group decision making. Teams: Types – creating effective teams. Communication: Functions – process – direction of communication – interpersonal communication – organizational communication – barriers. 9

LEADERSHIP AND POWER

Leadership: Meaning – trait theories, behavioural theories, contingency theories. Power – bases of power – power tactics. Politics – causes and consequences. Impression Management. 9

ORGANIZATIONAL CULTURE AND DYNAMICS

Organizational culture: Definition – functions – creating and sustaining culture. Organizational change: forces – planned change – resistance to change – approaches to manage change. Stress: Meaning – potential sources – consequences of stress – Managing stress. 9

Theory Hours : 3

Tutorial Hours : 0

Practical Hours : 0

Total Hours: 45

COURSE OUTCOME

CO1. Able to describe the functions and roles of managers, identify key elements of organizational behavior models, and analyze organizational structures.

CO2. Understand aspects like personality, learning, emotions, attitudes, perceptions, motivation etc which affects individual's behaviour in an organization. .

CO3. Able to analyze group dynamics, identify factors influencing perception and communication, and understand the role of groups and teams in organizations.

CO4. Develop insights into leadership styles, understand power dynamics, and analyze the influence of politics in organizational settings.

CO5. Able to analyze organizational culture, understand the dynamics of change, and propose strategies for managing stress in organizational contexts

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R2 - Steven McShane and Mary Von Glinow, "Organizational Behavior", 4th Edition, 2019.

R3- Schermerhorn, Hunt and Osborn, "Organizational behavior", John Wiley, 9th Edition, 2011.

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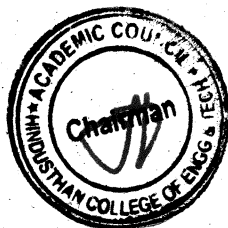
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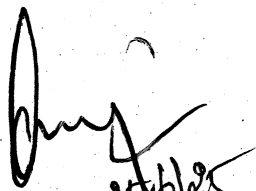
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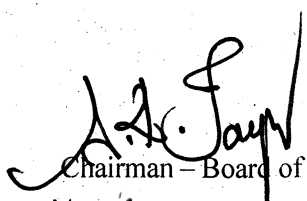
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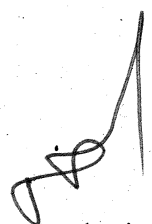
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PROGRAMME OUTCOMES (PO's & PSO's) 3/2/1/- → Indicate the Strength of Correlation 3 – Strong; 2 – Medium; 1 – Weak										
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
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CO2	3	2	-	3	3	-	1	-	-	-
CO3	3	2	-	3	1	-	-	1	1	-
CO4	3	1	-	2	1	-	-	2	1	-
CO5	3	-	-	2	-	-	-	1	-	-
COURSE ASSESSMENT METHODS										
DIRECT	1. Continuous Assessment I and II 2. Assignment / Activity 3. Demonstration 4. End Semester Examination					INDIRECT	1. Course Exit Survey			




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COURSE OBJECTIVE

1. Gain knowledge on fundamental concepts of fuzzy logic.
2. Overview of neural networks, covering neurons, artificial neurons, activation functions, neural network architecture.
3. Explore back propagation networks, including the architecture of perceptron models, single-layer and multilayer artificial neural networks.
4. Gain knowledge on Competitive neural networks
5. Cover the basic concepts, working principles, procedures, representations, initialization, selection, genetic operators (mutation, crossover), and applications of genetic algorithms.

Pre Requisite **NIL**

FUZZY COMPUTING

Basic Concepts of Fuzzy Logic, Fuzzy Sets and Crisp Sets, Fuzzy Set Theory and Operations, Properties of Fuzzy Sets, Fuzzy and Crisp Relations, Fuzzy to Crisp Conversion Membership Functions, Interference in Fuzzy Logic, Fuzzy If – Then Rules, Fuzzy Implications and Fuzzy Algorithms, Fuzzification and Defuzzification, Fuzzy Controller, Industrial Applications.

9

FUNDAMENTALS OF NEURAL NETWORKS

Neuron, Nerve Structure and Synapse, Artificial Neuron and its Model, Activation Functions, Neural Network Architecture: Single Layer and Multilayer Feed Forward Networks, Recurrent Networks. Various Learning techniques, Perception and convergence Rule. Auto-Associative and Hetero-Associative Memory.

9

BACKPROPAGATION NETWORKS

Back Propagation Networks) Architecture: Perceptron Model, Solution, Single Layer Artificial Neural Network, Multilayer Perceptron Model; Back Propagation Learning Methods, Effect of Learning Rule Co – Efficient; Back Propagation Algorithm, Factors Affecting Back Propagation Training, Applications

9

COMPETITIVE NEURAL NETWORKS

Kohonen's Self Organizing Map – SOM Architecture, learning procedure – Application; Learning Vector Quantization – learning by LVQ; Adaptive Resonance Theory – Learning procedure –Applications.

9

GENETIC ALGORITHM

Basic Concepts, Working Principle, Procedures of GA, Flow Chart of GA, Genetic Representations, (Encoding) Initialization and Selection, Genetic Operators, Mutation, Generational Cycle, Applications

9

Theory Hours : 3

Tutorial Hours : 0

Practical Hours : 0

Total Hours: 45

COURSE OUTCOME

CO1. Gain a solid understanding of fuzzy logic principles and their practical applications, preparing them for real-world problem-solving using fuzzy computing.

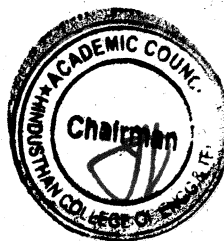
CO2. Acquire a foundational understanding of neural networks, enabling them to comprehend their structure, functioning, and learning mechanisms.

CO3. Master the principles of back propagation networks, gaining proficiency in designing and implementing neural networks with back propagation learning.

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CO4. Understand the principles of competitive neural networks and their applications, allowing them to design and apply these networks to solve specific problems.

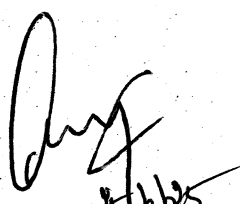
CO5. Equipped with the knowledge to apply genetic algorithms for optimization and problem-solving, fostering a deep understanding of evolutionary computation principles on projects.

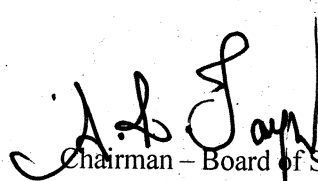
REFERENCES

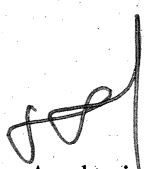
1. J.S.R. Jang, C.T. Sun and E. Mizutani, "Neuro – Fuzzy and Soft Computing", Pearson Education, 2004.
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3. S. N. Sivanandam, S. N. Deepa, "Principles of Soft Computing", Third Edition, Wiley, 2018.
4. Simon Haykin, "Neural Networks and Learning Machines", Pearson, 3rd Edition, 2009.
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PROGRAMME OUTCOMES (PO's & PSO's) 3/2/1/- → Indicate the Strength of Correlation 3 – Strong; 2 – Medium; 1 – Weak										
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	3	-	-	3	-	-	-	-	-	-
CO2	3	2	-	3	3	-	1	-	1	-
CO3	3	2	-	3	1	-	-	1	-	-
CO4	3	1	-	2	1	-	-	2	1	-
CO5	3	-	-	2	-	-	-	1	-	-
COURSE ASSESSMENT METHODS										
DIRECT	1. Continuous Assessment I and II 2. Assignment / Activity 3. Demonstration 4. End Semester Examination					INDIRECT	1. Course Exit Survey			




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SEMANTIC WEB SERVICES

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COURSE OBJECTIVE

1. To learn the fundamentals of semantic web and to conceptualize and depict ontology for semantic web.
2. Gain proficiency in languages essential for the semantic web.
3. Understand the processes and methods involved in ontology learning for the semantic web.
4. Comprehend the need for ontology management, the development process, ontology mapping, and the evolution of ontologies.
5. Explore various applications of semantic web technologies, including web services, semantic web services, security issues, and applications in specific domains.

Pre Requisite NIL**THE QUEST FOR SEMANTICS**

Building Models – Calculating with Knowledge – Exchanging Information – Semantic Web Technologies – Layers – Architecture – Components – Types – Ontological Commitments – Ontological Categories – Philosophical Background – Sample Knowledge Representation Ontologies – Top Level Ontologies – Linguistic Ontologies – Domain Ontologies – Semantic Web – Need – Foundation. 9

LANGUAGES FOR SEMANTIC WEB AND ONTOLOGIES

Web Documents in XML – RDF – Schema – Web Resource Description using RDF – RDF Properties – Topic Maps and RDF – Overview – Syntax Structure – Semantics – Pragmatics – Traditional Ontology Languages – LOOM – OKBC – OCML – FLogic Ontology Markup Languages – SHOE – OIL – DAML + OIL – OWL 9

ONTOLOGY LEARNING FOR SEMANTIC WEB

Taxonomy for Ontology Learning – Layered Approach – Phases of Ontology Learning – Importing and Processing Ontologies and Documents – Ontology Learning Algorithms – Methods for Evaluating Ontologies 9

ONTOLOGY MANAGEMENT AND TOOLS

Overview – Need for Management – Development Process – Target Ontology – Ontology Mapping – Skills Management System – Ontological Class – Constraints – Issues, Evolution – Development Of Tools And Tool Suites – Ontology Merge Tools – Ontology Based Annotation Tools. 9

APPLICATIONS

Web Services – Semantic Web Services – Case Study for Specific Domain – Security Issues – Web Data Exchange and Syndication – Semantic Wikis – Semantic Portals – Semantic Metadata in Data Formats – Semantic Web in Life Sciences – Ontologies for Standardizations – Rule Interchange Format 9

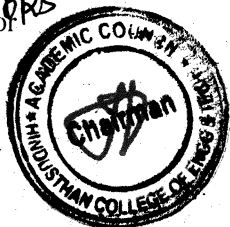
Theory Hours : 3**Tutorial Hours : 0****Practical Hours : 0****Total Hours; 45****COURSE OUTCOME**

- CO1. Equipped with a solid understanding of semantic web technologies, ontological commitments, and different types of ontologies.
- CO2. Develop skills in working with semantic web languages and ontologies, facilitating effective knowledge representation.
- CO3. Capable of employing ontology learning algorithms, importing and processing ontologies, and evaluating the quality of ontologies.
- CO4. Proficient in managing ontologies, dealing with issues in development, and utilizing ontology management tools effectively.
- CO5. Gain insights into practical applications of semantic web technologies across different domains, including web services, life sciences, and data formats.

REFERENCES

1. Pascal Hitzler, Markus Krotzsch, Sebastian Rudolph "Foundations of Semantic Web Technologies", Chapman &

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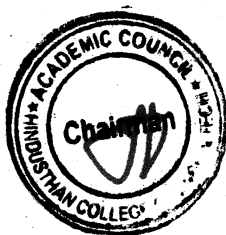
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4. Alexander Maedche, "Ontology Learning for the Semantic Web", Springer, 2002.
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PROGRAMME OUTCOMES (PO's & PSO's) 3/2/1/- → Indicate the Strength of Correlation 3 – Strong; 2 – Medium; 1 – Weak										
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CO5	3	-	-	2	-	-	-	1	-	-
COURSE ASSESSMENT METHODS										
DIRECT	1. Continuous Assessment I and II 2. Assignment / Activity 3. Demonstration 4. End Semester Examination					INDIRECT	1. Course Exit Survey			



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SERVICE ORIENTED ARCHITECTURES AND MICROSERVICES

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1: To introduce the fundamental concepts and principles of Service-Oriented Architecture

COURSE (SOA).

- OBJECTIVE 2:** To enable students to understand the core tenets of service orientation.
- 3: To provide practical experience in building and analyzing Java EE enterprise applications
- 4: To explore the underlying technologies and standards used in service design.
- 5: To empower students to implement SOA using modern Microservices architecture,.

Pre Requisite

NIL

UNIT I - SOFTWARE ENGINEERING PRACTICES

Need for Software Architecture – Types of IT Architecture – Pattern & Style – Architecting Process for Software Applications – High Level Architecture – Solution Architecture – Software Platforms – Enterprise Applications

9

UNIT II – SOA AND MICROSERVICE ARCHITECTURE BASICS

SOA and MSA – Basics – Evolution of SOA & MSA – Emergence of MSA – Enterprise-wide SOA – Strawman and SOA Reference Architecture – OOAD Process & SOAD Proce

9

UNIT III - CONTENTS SERVICE – ORIENTED ENTERPRISE APPLICATIONS

Considerations for Service-Oriented Enterprise Applications – Patterns for SOA – Pattern Based Architecture for Service-Oriented Enterprise Applications: Reference Model of Service Oriented Java EE Enterprise Application – SOA Programming Models,

9

UNIT IV - SERVICE ORIENTED ANALYSIS AND DESIGN

Principles of Service Design – Design of Activity, Data, Client, Business Process Services – Resilience Services – Technologies for SOA

9

UNIT V MICROSERVICE ARCHITECTURE

Introduction to Micro Services – Micro Services in Depth, Micro Services Architecture – Architecture for Digital Business – Indispensable Cloud

9

Theory Hours:
45

Tutorial Hours : 0

Practical Hours : 0

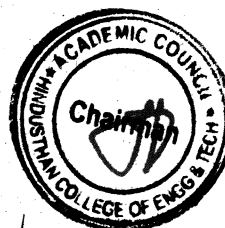
Total Hours:
45 Hours

COURSE OUTCOME

- CO1 Analyze and design SOA based solutions.
- CO2: Understand the basic principles of Service Orientation.
- CO3: Implement and analyze Java EE Enterprise Application
- CO4: Understand the technology underlying service design.
- CO5: Implement SOA with Micro Services applications

REFERENCES:

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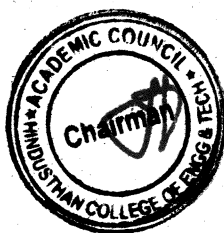
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PROGRAMME OUTCOMES (PO's & PSO's)

3/2/1/- □ Indicate the Strength of Correlation 3 – Strong; 2 – Medium; 1 – Weak

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
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COURSE ASSESSMENT METHODS										
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SOCIAL NETWORK ANALYSIS

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3			3
	0	0	

1: To introduce the foundational concepts and algorithms in network analysis.

COURSE 2: To provide a comprehensive understanding of knowledge representation techniques.

OBJECTIVE 3: To equip students with data mining techniques and methodologies

4: To develop hands-on experience with tools for social network data extraction and mining.

5: To instill the principles and practices of designing secure social network applications

NIL

Pre Requisite

UNIT I - INTRODUCTION

Social Network Analysis: Definition and Features – The Development of Social Network Analysis – Basic Graph Theoretical Concepts of Social Network Analysis – Ties, Density, Path, Length, Distance, Betweenness, Centrality, Clique – Electronic Sources for Network Analysis – Electronic Discussion Networks, Blogs and Online Communities, Web-based Networks – Applications of Social Network Analysis.

9

UNIT II – SOCIAL NETWORK ANALYSIS

Introduction to Social Networks Profiles – Types of Commercial Social Network Profiles (CSNP) – Quantitative and Qualitative Analysis of CSNP – Analysis of Social Networks Extracted from Log Files – Data Mining Methods Related to SNA and Log Mining – Clustering Techniques – Case Study

9

UNIT III - SEMANTIC TECHNOLOGY FOR SOCIAL NETWORK ANALYSIS

Introduction to Ontology-based Knowledge Representation – Ontology Languages for the Semantic Web – RDF and OWL – Modeling Social Network Data – Network Data Representation, Ontological Representation of Social Individuals and Relationships – Aggregating and Reasoning with Social Network Data – Advanced Representations.

9

UNIT IV - SOCIAL NETWORK MINING

Detecting and Discovering Communities in Social Network: Evaluating Communities – Methods for Community Detection – Trust factor- Applications of Community Mining Algorithms – Ethical Practices in Social Network Mining – Understanding and Predicting Human Behavior for Social Communities – Decentralized Online Social Networks – Multi-Relational Characterization of Dynamic Social Network Communities – Inferential Methods in Social Network Analysis.

9

UNIT V VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS

Visualization of Social Networks Node-Edge Diagrams – Random Layout – Force-Directed Layout

9

– Tree Layout – Matrix Representations – Matrix and Node-Link Diagrams – Hybrid Representations – Visualizing Online Social Networks – Applications – Covert Networks – Community Welfare – Collaboration Networks – Co-Citation Networks – Data Privacy in Social Networks.

Course Co-Ordinator

Chairman – Board of Studies

Dean - Academics

Chairman - BoS
MCA - HICET

Dean (Academics)
HICET

Theory Hours:
45

Tutorial Hours : 0

Practical Hours : 0

Total Hours:
45 Hours

COURSE OUTCOME

CO1 Understand basic principles behind network analysis algorithms and develop practical skills in network analysis.

CO2: Model and represent knowledge for social semantic Web.

CO3: Apply data mining techniques on social networks

CO4: Use extraction and mining tools for analyzing Social networks.

CO5: Design secure social network applications.

REFERENCES:

1. Peter Mika, "Social Networks and the Semantic Web", Springer, First Edition, 2007.
2. Borko Furht, "Handbook of Social Network Technologies and Applications", Springer, 2010.
3. Song Yang, Franziska B. Keller, Lu Zheng, "Social Network Analysis: Methods and Examples", Sage Publication, First Edition, 2016.
4. Guandong Xu, Yanchun Zhang, Lin Li, "Web Mining and Social Networking Techniques and Applications", Springer, 2011.
5. Max Chevalier, Christine Julien, Chantal Soulé-Dupuy, "Collaborative and Social Information Retrieval and Access: Techniques for Improved User Modelling", IGI Global, 2009.

PROGRAMME OUTCOMES (PO's & PSO's)										
3/2/1/- → Indicate the Strength of Correlation 3 – Strong; 2 – Medium; 1 – Weak										
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2
CO1	3	-	-	3	-	-	-	-	-	-
CO2	3	2	-	3	3	-	1	-	2	-
CO3	3	2	-	3	1	-	-	1	2	-
CO4	3	1	-	2	1	-	-	2	1	-
CO5	3	-	-	2	-	-	-	1	-	1
COURSE ASSESSMENT METHODS										
DIRECT	1. Continuous Assessment I and II 2. Assignment / Activity 3. Demonstration 4. End Semester Examination					INDIRECT	1. Course Exit Survey			

Course Co-Ordinator



Chairman – Board of Studies

Chairman - BoS
MCA - HICET

Dean - Academics

Dean (Academics)
HICET

DEPARTMENT OF COMPUTER APPLICATIONS

(I) Syllabus Revision for the Regulations 2024

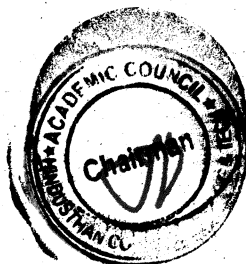
S.No	Courses in which revision has been done	Action taken	Percentage Syllabus Revised
1.	Database Management Systems	Modified	40%
2	Database Management Systems Lab	Modified	68%

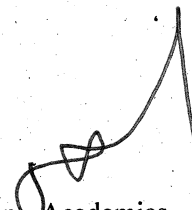
Overall Percentage of revision made in the BoS: 12.5 %

(II) New Course Introduced

S. No	Regulation	Course Code with Name	Credits
1	R2024	Machine Learning (T)	4
2	R2024	Machine Learning Lab	1.5
3	R2024	Software Testing (T+L)	4
4	R2024	Agile Methodologies	3


Chairman, Board of Studies
Chairman - BoS
MCA - HICET




Dean Academics
Dean (Academics)
HICET