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PERIYAR MANIAMMAI INSTITUTE OF SCIENCE & TECHNOLOGY
(Deemed to be University)
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# CURRICULUM & SYLLABUS

# for

# M.Sc. COMPUTER SCIENCE

## (Based on Outcome Based Education)

## Learning Outcomes based Curriculum Framework
(LOCF)

# (I - IV Semester)

# REGULATIONS – 2023

**CURRICULUM for M. Sc** (Computer Science)
**REGULATIONS – 2023**
(Applicable to the students admitted from the Academic year 2023 – 2024 onwards)

**Semester-I**

| Sub. Code | Subject Name | Credits | | | | Hours | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Total | L | T | P | Total |
| YCS101 | Advanced Operating System | 4 | 1 | 0 | 5 | 4 | 1 | 0 | 5 |
| YCS102 | Internet of Things | 3 | 1 | 0 | 4 | 3 | 1 | 0 | 4 |
| YCS103 | Advanced Computer Architecture | 3 | 1 | 0 | 4 | 3 | 1 | 0 | 4 |
| YCS104 | Advanced Database Management Systems | 3 | 1 | 0 | 4 | 3 | 1 | 0 | 4 |
| YCS105 | Web Technologies | 3 | 1 | 0 | 4 | 3 | 1 | 0 | 4 |
| **Laboratory** | | | | | | | | | |
| YCS106 | Advanced Database Management Systems Laboratory | 0 | 0 | 1 | 1 | 0 | 0 | 2 | 2 |
| YCS107 | Web Technologies Laboratory | 0 | 0 | 1 | 1 | 0 | 0 | 2 | 2 |
| | **Total** | **16** | **5** | **2** | **23** | **16** | **5** | **4** | **25** |

**Semester-II**

| Sub.Code | Subject Name | Credits | | | | Hour | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | L | T | P | Total | L | T | P | Total |
| YCS201 | Virtual and Augmented reality | 4 | 1 | 0 | 5 | 4 | 1 | 0 | 5 |
| YCS202 | Advanced Java Programming | 3 | 1 | 0 | 4 | 3 | 1 | 0 | 4 |
| YCS203 | Machine Learning | 3 | 1 | 0 | 4 | 3 | 1 | 0 | 4 |
| **Elective-1** | | | | | | | | | |
| YCS204A | Human Computer Interactions | 3 | 1 | 0 | 4 | 3 | 1 | 0 | 4 |
| YCS204B | Pattern Recognition | 3 | 1 | 0 | | 3 | 1 | 0 | |
| YCS204C | Artificial Intelligence | 3 | 1 | 0 | | 3 | 1 | 0 | |
| **Elective-2** | | | | | | | | | |
| YCS205A | Parallel Processing | 3 | 1 | 0 | 4 | 3 | 1 | 0 | 4 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| YCS205B | Soft Computing | 3 | 1 | 0 | | 3 | 1 | 0 | |
| YCS205C | Pervasive Computing | 3 | 1 | 0 | | 3 | 1 | 0 | |
| **Laboratory** | | | | | | | | | |
| YCS206 | Advanced Java Programming Laboratory | 0 | 0 | 1 | 1 | 0 | 0 | 2 | 2 |
| YCS207 | Machine Learning Laboratory | 0 | 0 | 1 | 1 | 0 | 0 | 2 | 2 |
| | **Total** | **16** | **5** | **2** | **23** | **16** | **5** | **4** | **25** |

**Semester-III**

| **Sub.Code** | **Subject Name** | **Credits** | | | | **Hours** | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | **L** | **T** | **P** | **Total** | **L** | **T** | **P** | **Total** |
| YCS301 | Deep Learning | 4 | 1 | 0 | 5 | 4 | 1 | 0 | 5 |
| YCS302 | Wireless Networks | 3 | 1 | 0 | 4 | 3 | 1 | 0 | 4 |
| YCS303 | Big Data and Analytics | 3 | 1 | 0 | 4 | 3 | 1 | 0 | 4 |
| **Elective-3** | | | | | | | | | |
| YCS304A | Network Security | 3 | 1 | 0 | 4 | 3 | 1 | 0 | 4 |
| YCS304B | Mobile Ad Hoc Networks | 3 | 1 | 0 | | 3 | 1 | 0 | |
| YCS304C | Block Chain Management | 3 | 1 | 0 | | 3 | 1 | 0 | |
| **Elective-4** | | | | | | | | | |
| YCS305A | Computer Simulation and Modeling | 3 | 1 | 0 | 4 | 3 | 1 | 0 | 4 |
| YCS305B | Natural Language Processing | 3 | 1 | 0 | | 3 | 1 | 0 | |
| YCS305C | Embedded System | 3 | 1 | 0 | | 3 | 1 | 0 | |
| **Laboratory** | | | | | | | | | |
| YCS306 | Wireless Networks Laboratory | 0 | 0 | 1 | 1 | 0 | 0 | 2 | 2 |
| YCS307 | Big Data and Analytics Laboratory | 0 | 0 | 1 | 1 | 0 | 0 | 2 | 2 |
| | **Total** | **16** | **5** | **2** | **23** | **16** | **5** | **4** | **25** |

**Semester-IV**

| **Sub.Code** | **Subject Name** | **L** | **T** | **P** | **Credits** | **L** | **T** | **P** | **Hours** |
|---|---|---|---|---|---|---|---|---|---|
| YCS401 | Project Work | - | - | - | 16 | - | - | - | - |

| COURSE CODE | | | YCS101 | L | T | P | C |
|---|---|---|---|---|---|---|---|
| COURSE NAME | | | ADVANCED OPERATING SYSTEMS | 4 | 1 | 0 | 5 |
| C | P | A | | L | T | P | H |
| 4 | 0.5 | 0.5 | | 4 | 1 | 0 | 5 |
| PREREQUISITE | | | Operating Systems | | | | |

**COURSE OUTCOMES:**

| Course outcomes: | | Domain | Level |
|---|---|---|---|
| CO1 | **Generalize** the functions, types, advanced concepts in operating system, and the process concepts. | Cognitive | Understand |
| CO2 | **Analyze** deadlock situations, the reason for deadlock, recovery of deadlocks and how to avoid deadlocks. | Cognitive<br>Psychomotor | Analyze<br>Set |
| CO3 | **Illustrate** and **analyze** the concepts of distributed operating systems, issues and file system coding in distributed system. | Cognitive | Analyze |
| CO4 | **Distinguish** the need of Real time operating system and describe about security issues and applications of real time operating system. | Cognitive<br>Affective | Understand<br>Organization |
| CO5 | **Explain** the information about the Linux operating system and iOS architecture, layers and their functions | Cognitive<br>Psychomotor | Understand<br>Orgination |

**Unit I PROCESS SYNCHRONIZATION** : **12+3 Hours**

Overview - Introduction – Functions of an operating system – Design approaches – Why advance operating systems – Types of advanced operating systems. Synchronization mechanisms: Introduction – Concept of a process –Concurrent processes – The critical section problem – Other synchronization problems. Process deadlocks: Introduction – preliminaries – models of deadlocks

**Unit II DISTRIBUTED OPERATING SYSTEMS** **12+3 Hours**

Issues – Communication Primitives – Lamport's Logical Clocks – Deadlock handling strategies – Issues in deadlock detection and resolution-distributed file systems –design issues – Case studies – The Sun Network File System-Coda.

**Unit III REAL TIME OPERATING SYSTEMS** **12+3 Hours**

Introduction – Applications of Real Time Systems– Basic Model of Real Time System – Characteristics – Safety and Reliability - Real Time Task Scheduling

**Unit IV OPERATING SYSTEMS FOR HANDHELD SYSTEMS** **12+3 Hours**

Requirements – Technology Overview – Handheld Operating Systems – Palm OS - Android – Architecture of android –Securing handheld systems

**Unit - V LINUX AND IOS LINUX SYSTEM** **12+3 Hours**

Introduction – Memory Management – Process Scheduling – Scheduling Policy - Managing I/O devices – Accessing Files- iOS: Architecture and SDK Framework - Media Layer - Services Layer - Core OS Layer - File System.

| HOURS | LECTURE | TUTORIAL | TOTAL |
|---|---|---|---|
| | 60 | 15 | 75 |

**TEXT BOOKS**


1. MukeshSinghal and Niranjan G. Shivaratri, "Advanced Concepts in Operating Systems – Distributed Database, and Multiprocessor Operating Systems", Tata McGraw-Hill Publishers, 2011.
2. Rajib Mall, "Real-Time Systems: Theory and Practice", Pearson Education India Publishers, Second Edition, 2008.
3. Daniel.P.Bovet & Marco Cesati, "Understanding the Linux kernel", O'Reilly Publishers, 3rd edition, 2005.

**REFERENCES**

1. Neil Smyth, "iPhone iOS 4 Development Essentials – Xcode", Payload media Publishers, Fourth Edition 2011.
2. Yoon Seok Pyo, HanCheol Cho, RyuWoon Jung, TaeHoon Lim, "ROS Robot Programming From the basic concept to practical programming and robot application", ROBOTICS Co.,Ltd, 2017.
3. Pramod Chandra P.Bhatt, "An Introduction To Operating Systems, Concept And Practice", PHI publishers, Third edition, 2013.
4. Andrew S. Tanenbaum, "Modern Operating System", Prentice-Hall, Inc, Third edition, 2008.
5. AnisKoubaa, "Robot Operating System (ROS) The Complete Reference (Volume 1)", Springer Publishers, First Edition, 2016.

**E-REFERENCES**

1. https://onlinecourses.nptel.ac.in/noc21_cs44

## Mapping of Course Outcomes (CO) with Programme Outcomes (PO):

| M.Sc. CS | PO | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 1 | 2 |
| CO1 | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 0 |
| CO2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| CO3 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 0 |
| CO4 | 2 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 |
| CO5 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 0 |
| Average | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 2 |

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

| COURSE CODE | | | YCS102 | L | T | P | C |
|---|---|---|---|---|---|---|---|
| COURSE NAME | | | INTERNET OF THINGS | 3 | 1 | 0 | 4 |
| C | P | A | | L | T | P | H |
| 3.5 | 0.3 | 0.2 | | 3 | 1 | 0 | 4 |
| PREREQUISITE | | | Sensors, Wireless Communication | | | | |

**COURSE OUTCOMES:**

| Course outcomes: | | Domain | Level |
|---|---|---|---|
| CO1 | **Define** the basics of IoT and its characteristics | Cognitive | Remember |
| CO2 | **Generalize** the building blocks of IoT from physical and logical context | Cognitive<br>Psychomotor | Understand<br>Perception |
| CO3 | **Apply** the functionality of various architectures and protocols of IoT | Cognitive<br>Affective | Apply<br>Receive |
| CO4 | **Illustrate** the importance of Web of Things and Cloud of Things | Cognitive<br>Psychomotor<br>Affective | Apply<br>Mechanism<br>Respond |
| CO5 | **Analyze** the applications of IoT in various domains and analyze the real-world design constraints | Cognitive | Analyze |

**Unit I INTRODUCTION TO INTERNET OF THINGS** **9+3 Hours**

Introduction to IoT- Elements of an IoT- Technology drivers- Business drivers- Typical IoT applications- Trends and implications- Physical design of IoT- Logical design of IoT-IoT levels and deployment templates.- IoT in Home automation, smart cities, Energy, agriculture, retail, logistics, environment, health &life style and industry

**Unit II TECHNOLOGIES FOR IoT** **9+3 Hours**

IoT enabling technologies-M2M, – IEEE 802.15.4, WSN- sensors, actuators, WSN protocols, RFID, NFC, Zigbee, GSM, GPRS, Bluetooth- Cloud computing, Big Data analytics, Communication protocols, Embedded systems.

**Unit III IoT PROTOCOLS** **9+3 Hours**

IoT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and LoRaWAN – Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks – Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT

**Unit IV DESIGN AND DEVELOPMENT** **9+3 Hours**

Design Methodology - Embedded computing logic – Microcontroller-Arduino - Board details Node MCU- ESP8266- Pin configuration- interfacing. Introduction to python- python package for IoT.

**Unit V IoT APPLICATIONS** **9+3 Hours**

Home Automation -Smart Lighting -Smart Appliances - Intrusion Detection - Smoke/Gas Detectors - Smart cities. Case Studies: e.g. sensor body-area-network.

| HOURS | LECTURE | TUTORIAL | TOTAL |
|---|---|---|---|
| | 45 | 15 | 60 |

**TEXT BOOKS**


1. ArshdeepBahga, Vijay Madisetti, “Internet of Things – A hands-on approach”, Universities Press, 2017
2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, ―IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017

**REFERENCES**

1. Olivier Hersent, David Boswarthick, Omar Elloumi , ―The Internet of Things – Key applications and Protocols, Wiley, 2012.

**E-REFERENCES**

1. https://nptel.ac.in/courses/106105166/
2. https://nptel.ac.in/courses/108108098/
3. https://www.arduino.cc/.

## Mapping of Course Outcomes (CO) with Programme Outcomes (PO):

| M.Sc. CS | PO | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 1 | 2 |
| CO1 | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 0 |
| CO2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| CO3 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 0 |
| CO4 | 2 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 |
| CO5 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 0 |
| Average | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 2 |

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

| COURSE CODE | | | YCS103 | L | T | P | C |
|---|---|---|---|---|---|---|---|
| COURSE NAME | | | ADVANCED COMPUTER ARCHITECTURE | 3 | 1 | 0 | 4 |
| C | P | A | | L | T | P | H |
| 3.5 | 0.3 | 0.2 | | 3 | 1 | 0 | 4 |
| PREREQUISITE | | | Computer Architecture | | | | |

**COURSE OUTCOMES:**

| Course outcomes: | | Domain | Level |
|---|---|---|---|
| CO1 | **Define** the various models of parallel computer and tell the state of computing | Cognitive Psychomotor | Remember Perception |
| CO2 | **Understand** the working principles of system interconnect architectures and know about Paralleling | Cognitive Psychomotor | Understand Set |
| CO3 | **Analyse** processor Technologies and understand the hierarchy of memory. | Cognitive Psychomotor | Analyze Perception |
| CO4 | **Devise** the Multiprocessor System interconnects and know its connection mechanism | Cognitive Affective | Evaluate Organization |
| CO5 | **Design** and **illustrate** Models and Arrays | Cognitive | Create |

**Unit I PARALLEL COMPUTER MODELS** **9+3 Hours**

The state of computing - Multiprocessors and multicomputers – Multivector and SIMD computers.

**Unit II PROGRAM AND NETWORK PROPERTIES** **9+3 Hours**

Conditions of parallelism – Program partitioning and scheduling – program flow mechanisms – system interconnect architectures.

**Unit III PROCESSORS AND MEMORY HIERARCHY** **9+3 Hours**

Advanced processor Technology – Super scalar and vector processors – Linear Pipeline Processors – Nonlinear pipeline Processors.

**Unit IV MULTIPROCESSORS AND MULTICOMPUTER** **9+3 Hours**

Multiprocessor System interconnects – Message Passing Mechanisms – SIMD Computer Organizations – The Connection Machine CM 5 – Fine-Grain Multicomputers.

**Unit V SOFTWARE FOR PARALLEL PROGRAMMING** **9+3 Hours**

- Parallel Programming Models – Parallel Languages and Compilers – Dependence Analysis of Data Arrays.

| HOURS | LECTURE | TUTORIAL | TOTAL |
|---|---|---|---|
| | 45 | 15 | 60 |

**TEXT BOOKS**

1. Kai Hwang, "Advanced Computer Architecture "McGraw-Hill International Edn., Singapore , 1993.

**REFERENCES**

1. Kai Hwang and Faye A.Briggs, "Computer Architecture and Parallel Processing", McGraw- Hill International Editions, Singapore , 1985.
2. Michael J.Quinn, "Parallel Computing, Theory and Practice", McGraw-Hill International Edn., Singapore , 1994.

**E-REFERENCES**

1. https://nptel.ac.in/noc/courses/noc19/SEM2/noc19-cs62

**Mapping of Course Outcomes (CO) with Programme Outcomes (PO):**

| M.Sc CS | PO | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **1** | **2** |
| **CO1** | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 0 |
| **CO2** | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| **CO3** | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 0 |
| **CO4** | 2 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 |
| **CO5** | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 0 |
| **Average** | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 2 |

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

| COURSE CODE | | | YCS104 | L | T | P | C |
|---|---|---|---|---|---|---|---|
| COURSE NAME | | | ADVANCED DATABASE MANAGEMENT SYSTEMS | 3 | 1 | 0 | 4 |
| C | P | A | | L | T | P | H |
| 4 | 0 | 0 | | 3 | 1 | 0 | 4 |
| PREREQUISITE | | | Database Management System | | | | |

**COURSE OUTCOMES:**

| Course outcomes: | | Domain | Level |
|---|---|---|---|
| CO1 | **Describe** purpose of database in relational models and designing of schema | Cognitive | Remember |
| CO2 | **Illustrate** functioning of various SQL queries and special functions | Cognitive | Analyse |
| CO3 | **Analyse** various security issues and find the apt recoverability method | Cognitive | Analyse |
| CO4 | **Understand** and **Explain** the characteristics of distributed database | Cognitive | Understand |
| CO5 | **Identify** and **Explain** Need for Data Analysis in Business intelligence | Cognitive | Create |

**Unit I INTRODUCTION** **9+3 Hours**

Purpose of Database Systems -View of Data -Database Languages -Data Storage and Querying-Transaction Management –Storage Management –Data Mining and Information Retrieval -Speciality Databases - Database Users and Administrators–Relational Databases: Introduction to the Relational Model -Structure of Relational Databases-Database Schema -Keys-Schema Diagrams - Relational Query Languages - Relational Operations.

**Unit II ADVANCED SQL** **9+3 Hours**

Constraints- SQL CREATE INDEX- SQL functions-The GROUP BY statement The HAVING clause-SQL special functions- SQL alias- SQL join – Sub queries- Recursive queries-Data control language-Views and assertion- PL/SQL- a basic introduction-Triggers- Event condition action model-Functions and procedures-Embedded SQL and dynamic SQL- The java way to access RDBMS: JDBC- SQLJ.

**Unit III TRANSACTION PROCESSING AND SECURITY:** **9+3 Hours**

Defining a transaction in DBMS-Defining a concurrent transaction in DBMS- Serializability and Recoverability- Enhanced lock-based and timestamp based concepts-Multiple granularity-Multi version schemes-optimistic concurrency control techniques-Deadlock handling-Recovery in DBMS-write Ahead logging protocol-Advanced recovery techniques-Use of SQL in recovery -RAID. Data security: Data security issues Discretionary access control- Mandatory access control- Role based access control- SQL injection Statistical databases- Introduction to flow control.

**Unit IV DISTRIBUTED DBMS** **9+3 Hours**

The Evolution of Distributed Database Management Systems -DDBMS Advantages and Disadvantages - Distributed Processing and Databases - Characteristics of Distributed DBMS -DDBMS Components - Levels of Data and Process Distribution -Distribution Transparency -Transaction Transparency-Distributed Database Design - Client/Server vs. DDBMS.

**Unit V BUSINESS INTELLIGENCE AND DATA WAREHOUSE** **9+3 Hours**

The Need for Data Analysis -Business Intelligence and Architecture -Data Warehouse-OLAP -Star Schemas -Implementing a Data Warehouse -SQL Extensions for OLAP. Database Connectivity - Internet

| | | | |
|---|---|---|---|
| Databases. Security and authorization: Access control- Discretionary access control-Mandatory access control – security for internet applications-Issues related to security-case study. | | | |
| **HOURS** | **LECTURE** | **TUTORIAL** | **TOTAL** |
| | **45** | **15** | **60** |

**TEXT BOOKS**

1. Rini Chakrabarti, Shilbadra Dasgupta, Subhash K. Shinde," Advanced Database Management System", KLSI, Dreamtech press, 2014.
2. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", McGraw Hill, Third Edition 2004.

**REFERENCES**

1. Henry F Korth, Abraham Silberschatz, S. Sudharshan, "Database System Concepts", Fifth Edition, McGraw Hill, 2006.

**E-REFERENCES**

1. https://nptel.ac.in/courses/106/105/106105175/
2. https://onlinecourses.nptel.ac.in/noc21_cs04

## Mapping of Course Outcomes (CO) with Programme Outcomes (PO):

| M.Sc. CS | PO | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **1** | **2** |
| **CO1** | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 0 |
| **CO2** | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| **CO3** | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 0 |
| **CO4** | 2 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 |
| **CO5** | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 0 |
| **Average** | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 2 |

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

| COURSE CODE | | | YCS105 | L | T | P | C |
|---|---|---|---|---|---|---|---|
| COURSE NAME | | | WEB TECHNOLOGIES | 3 | 1 | 0 | 4 |
| C | P | A | | L | T | P | H |
| 4 | 0 | 0 | | 3 | 1 | 0 | 4 |
| PREREQUISITE | | | Python Programming | | | | |

**COURSE OUTCOMES:**

| Course outcomes: | | Domain | Level |
|---|---|---|---|
| CO1 | Define the technologies used in Web design and development | Cognitive | Remember |
| CO2 | Discuss various techniques Python for Web technologies | Cognitive | Understand |
| CO3 | Explain and apply Django for Web technologies | Cognitive | Apply |
| CO4 | Illustrate Flutter and to examine application | Cognitive | Apply |
| CO5 | Design and Develop an application with data base using Sqlite | Cognitive | Create |

| Unit I Web Technologies | 9+3 Hours |
|---|---|
| Introduction to Web Technologies – The Internet - WWW- Frontend Vs Backend Development Technologies - Programming Languages And Frameworks - Data bases – Future of web technology - Python for web development - A roadmap for web development with Python. | |
| **Unit II Python** | **9+3 Hours** |
| Introduction to Python – variables –data types –numbers – casting –string - boolean – operators – array – control structures – Input output – functions. | |
| **Unit III Django** | **9+3 Hours** |
| Django Introduction – Installation – Project - Apache configuration – virtual environment set up – admin Interface – Django app – Django module – Django view –Django template – Django forms – Django sessions –cookies. | |
| **Unit IV Flutter** | **9+3 Hours** |
| Introduction – Installation – Architecture of flutter framework - Introduction to Dart programming – widget – Layout –Gesture - state management – animation – data base concepts. | |
| **Unit V SQlite** | **9+3 Hours** |
| Introduction – Installation – commands – data type –create –attach- detach – insert – drop – update – delete – order by – group by – having – Sqlite –Python. | |

| HOURS | LECTURE | TUTORIAL | TOTAL |
|---|---|---|---|
| | 45 | 15 | 60 |

**TEXT BOOKS**

1. "Web Enabled Commercial Application Development Using HTML, DHTML, JavaScript, Perl CGI", Ivan Bayross, BPB Publication.
2. Python Programming a Modular Approach with Graphics, Database, Mobile, and Web Applications – SheetalTaneja, Naveen Kumar – Pearson Publication, 2018

**REFERENCES**


1. Reema Thareja "Python Programming", Oxford University Press, 2017
2. Lambert – Cengage "Fundamentals of Python Programming", Publications, 2017
3. E. Balagurusamy "Problem Solving using Python", McGraw Hill Education Ltd.


**E-REFERENCES**

1. https://www.goodcore.co.uk/blog/web-technologies/
2. https://www.educative.io/blog/web-development-in-python#suited
3. https://www.w3schools.com/PYTHON/,
4. geeksforgeeks.org/python-programming-language
5. https://www.javatpoint.com/django-tutorial
6. https://www.tutorialspoint.com/flutter/
7. https://www.tutorialspoint.com/sqlite/index.htm

## Mapping of Course Outcomes (CO) with Programme Outcomes (PO):

| M.Sc. CS | PO | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 1 | 2 |
| CO1 | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 0 |
| CO2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| CO3 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 0 |
| CO4 | 2 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 |
| CO5 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 0 |
| Average | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 2 |

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

| COURSE CODE | | | YCS106 | L | T | P | C |
|---|---|---|---|---|---|---|---|
| COURSE NAME | | | ADVANCED DATABASE MANAGEMENT SYSTEMS LABORATORY | 0 | 0 | 1 | 1 |
| C | P | A | | L | T | P | H |
| 0 | 1 | 0 | | 0 | 0 | 2 | 2 |
| PREREQUISITE | | | Database Management Systems | | | | |

**COURSE OUTCOMES:**

| Course outcomes: | | Domain | Level |
|---|---|---|---|
| CO1 | **Describe** purpose of database in relational models and designing of schema | Psychomotor | Perception |
| CO2 | **Describe** functioning of various SQL queries and special functions | Psychomotor | Perception |
| CO3 | **Identify** various security issues and find the apt recoverability method | Psychomotor | Perception |
| CO4 | **Explain** the characteristics of distributed database | Psychomotor | Set |
| CO5 | **Explain** Need for Data Analysis in Business intelligence | Psychomotor | Set |

| | |
|---|---|
| **Unit I INTRODUCTION** | **3 Hours** |
| Lab Exercise: Creating table with and without constraints, Inserting/Deleting/updating records in a table, saving (Commit) and Undoing (rollback). | |
| **Unit II ADVANCED SQL** | **3 Hours** |
| Lab Exercise: Altering a table, dropping/truncating, renaming, Backing up/restoring a database. | |
| **Unit III TRANSACTION PROCESSING AND SECURITY** | **3 Hours** |
| Lab Exercise: For a set of relation schemas, creating a table and perform simple queries with aggregate functions, data function, math functions. | |
| **Unit IV DISTRIBUTED DBMS** | **3 Hours** |
| Lab Exercise: Embed PI/SQL in a high level host language such as C/Java. | |
| **Unit V BUSINESS INTELLIGENCE AND DATA WAREHOUSE** | **3 Hours** |
| Lab Exercise: Creating connection with database. | |

| HOURS | Practical | TOTAL |
|---|---|---|
| | 15 | 15 |

| COURSE CODE | | | YCS107 | L | T | P | C |
|---|---|---|---|---|---|---|---|
| COURSE NAME | | | WEB TECHNOLOGIES LABORATORY | 0 | 0 | 1 | 1 |
| C | P | A | | L | T | P | H |
| 0 | 1 | 0 | | 0 | 0 | 2 | 2 |
| PREREQUISITE | | | Python Programming | | | | |

**COURSE OUTCOMES:**

| Course outcomes: | | Domain | Level |
|---|---|---|---|
| CO1 | **Explain** the technologies used in Web design and development | Psychomotor | Set |
| CO2 | **Follow** various techniques Python for Web technologies | Psychomotor | Guided Response |
| CO3 | **Manipulate** the technologies using Django | Psychomotor | Mechanism |
| CO4 | **Construct** applications using Flutter | Psychomotor | Mechanism |
| CO5 | **Construct** an application with data base using Sqlite | Psychomotor | Mechanism |

| | |
|---|---|
| **Unit I Web Technologies** | **3 Hours** |
| **Lab Exercises** :<br>Creating a web site , Creating a home page | |
| **Unit II Python** | **3 Hours** |
| **Lab Exercises** :<br>Working with forms, Generic List and detail view | |
| **Unit III Django** | **3 Hours** |
| **Lab Exercises** :<br>Working with sessions, cookies | |
| **Unit IV Flutter** | **3 Hours** |
| **Lab Exercises**<br>Working with Mobile / Web App | |
| **Unit V SQlite** | **3 Hours** |
| **Lab exercises:**<br>Working with database connectivity | |

| HOURS | Practical | TOTAL |
|---|---|---|
| | 15 | 15 |

**Mapping of Course Outcomes (CO) with Programme Outcomes (PO):**

| M.Sc. CS | PO | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 1 | 2 |
| CO1 | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 0 |
| CO2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| CO3 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 0 |
| CO4 | 2 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 |
| CO5 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 0 |
| Average | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 2 |

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

| COURSE CODE | | | YCS201 | L | T | P | C |
|---|---|---|---|---|---|---|---|
| COURSE NAME | | | VIRTUAL AND AUGMENTED REALITY | 4 | 1 | 0 | 5 |
| C | P | A | | L | T | P | H |
| 4 | 0.5 | 0.5 | | 4 | 1 | 0 | 5 |
| PREREQUISITE | | | Nil | | | | |

| Course outcomes: | | Domain | Level |
|---|---|---|---|
| CO1 | To **recall** the overview of virtual reality and its environment | Cognitive | Remember |
| CO2 | To **understand** user Interface and characteristics of necessary Input devices | Cognitive<br>Psychomotor | Understand<br>Set |
| CO3 | To **illustrate** virtual reality environment and virtual reality database | Cognitive<br>Affective | Apply<br>Receive |
| CO4 | To **discuss** 3D interaction Techniques and the 3D Manipulation Tasks | Cognitive<br>Psychomotor | Analyze<br>Origination |
| CO5 | To **design** and **construct** visualization techniques | Cognitive<br>Affective | Create<br>Respond |

**Unit I Virtual Reality And Virtual Environments** — **12+3 Hours**

The historical development of VR: Scientific landmarks Computer Graphics, Real-time computer graphics, Flight simulation, Virtual environments, Requirements for VR, benefits of Virtual reality. Hardware technologies for 3d user interfaces: Visual Displays Auditory Displays, Haptic Displays, Choosing Output Devices for 3D User Interfaces.

**Unit II 3D User Interface Input Hardware** — **12+3 Hours**

Input device characteristics, Desktop input devices, Tracking Devices, 3D Mice, Special Purpose Input Devices, Direct Human Input, Home - Brewed Input Devices, Choosing Input Devices for 3D Interfaces.

**Unit III Software Technologies** — **12+3 Hours**

Database - World Space, World Coordinate, World Environment, Objects - Geometry, Position / Orientation, Hierarchy, Bounding Volume, Scripts and other attributes, VR Environment - VR Database, Tessellated Data, LODs, Cullers and Occluders, Lights and Cameras, Scripts, Interaction - Simple, Feedback, Graphical User Interface, Control Panel, 2D Controls, Hardware Controls, Room / Stage / Area Descriptions, World Authoring and Playback, VR toolkits, Available software in the market.

**Unit IV 3D Interaction Techniques** — **12+3 Hours**

3D Manipulation Tasks, Manipulation Techniques And Input Devices, Interaction Techniques For 3D Manipulation, Deign Guidelines - 3D Travel Tasks, Travel Techniques, Design Guidelines - Theoretical Foundations Of Wayfinding, User CenteredWayfinding Support, Environment CenteredWayfinding Support, Evaluating Wayfinding Aids, Design Guidelines - System Control, Classification, Graphical Menus, Voice Commands, Gestrual Commands, Tools, Mutimodal System Control Techniques, Design Guidelines, Case Study: Mixing System Control Methods, Symbolic Input Tasks, Symbolic Input Techniques, Design Guidelines, Beyond Text And Number Entry.

DESIGNING AND DEVELOPING 3D USER INTERFACES: Strategies For Designing And Developing Guidelines And Evaluation.

VIRTUAL REALITY APPLICATIONS: Engineering, Architecture, Education, Medicine, Entertainment, Science, Training.

**Unit V Augmented Reality** — **12+3 Hours**

Augmented and Mixed Reality, 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.

| HOURS | LECTURE | TUTORIAL | TOTAL |
|---|---|---|---|
| | 60 | 15 | 75 |

**TEXT BOOKS**

1. Alan B Craig, William R Sherman and Jeffrey D Will, "Developing Virtual Reality Applications: Foundations of Effective Design", Morgan Kaufmann, 2017.
2. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", 2015.
3. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, "3D User Interfaces, Theory and Practice",Addison Wesley, USA, 2015.
4. Oliver Bimber and Ramesh Raskar, "Spatial Augmented Reality: Meging Real and Virtual Worlds", 2015.
5. Burdea, Grigore C and Philippe Coiffet, "Virtual Reality Technology", Wiley Interscience, India, 2013.

**REFERENCES**

1. John Vince, "Virtual Reality Systems", Addison Wesley, 1995.
2. Howard Rheingold, "Virtual Reality: The Revolutionary Technology and how it Promises to Transform Society",Simon and Schuster, 1991.
3. William R Sherman and Alan B Craig, "Understanding Virtual Reality: Interface, Application and Design (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002
4. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013

**E-REFERENCES**

1. https://www.goodcore.co.uk/blog/Augmented reality/
2. https://www.educative.io/blog/Augmented/development-in-python#suited

**Mapping of Course Outcomes (CO) with Programme Outcomes (PO):**

| M.Sc. CS | PO | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 1 | 2 |
| CO1 | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 0 |
| CO2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| CO3 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 0 |
| CO4 | 2 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 |
| CO5 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 0 |
| Average | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 2 |

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

| COURSE CODE | | | YCS202 | L | T | P | C |
|---|---|---|---|---|---|---|---|
| COURSE NAME | | | ADVANCED JAVA PROGRAMMNG | 3 | 1 | 0 | 4 |
| C | P | A | | L | T | P | H |
| 4 | 0 | 0 | | 3 | 1 | 0 | 4 |
| PREREQUISITE | | | Java, Object Oriented Programming Concepts | | | | |

| Course outcomes: | | Domain | Level |
|---|---|---|---|
| CO1 | To **understand** the Applications using Swing Components. | Cognitive | Understand |
| CO2 | **Illustrate** distributed applications using remote method invocation | Cognitive | Understand |
| CO3 | **Create** DATABASE Connectivity using Java database connectivity | Cognitive | Create |
| CO4 | **Outline** the JavaScript language & the Document Object Model | Cognitive | Analyze |
| CO5 | **Appraise** the Well-Formed XML with different types of XML Schemas | Cognitive | Evaluate |

**Unit I INTRODUCTION** **9+3 Hours**

Java Swing - Features – Classes and Packages – MVC architecture – Swing basic components – Buttons – Labels – List – Combo box – Menu Simple AWT application using Swing Components.

**Unit II RMI** **9+3 Hours**

Remote Method Invocation and JDBC- RMI overview - RMI architecture - Example demonstrating RMI. Database Handling: Accessing Database using JDBC.

**Unit III JAVA IN WEB** **9+3 Hours**

Java Scripts: JavaScript language syntax, Built In Functions, HTML Forms, HTML DOM, XML: XML documents, XML schemes, and Extensible Style Language (XSL), Introduction to AJAX.

**Unit IV SERVLET AND JSP** **9+3 Hours**

Servlet: Introduction to servlet - Developing and Deploying Servlets - Handling Request and Response - Reading Servlet Parameters - Cookies - Session Tracking. Java Server Pages: Basic JSP Architecture - Life Cycle of JSP - JSP Tags and Expressions – Directives- JSP applications. Java Creating and using JavaBean components –Setting and retrieving JavaBean components – Java Server Faces Application.

**Unit V HIBERNATE, SPRING, STRUTS** **9+3 Hours**

Introduction to Hibernate – Advantages – Architecture –Spring Framework -Struts Framework: Introduction to Struts- Struts Architecture.

| HOURS | LECTURE | TUTORIAL | TOTAL |
|---|---|---|---|
| | 45 | 15 | 60 |

**TEXT BOOKS**


1. Herbert Schildt - JAVA 2 (The Complete Reference)- Ninth Edition, TMH, 2014.
2. Jim Keogh, “The Complete Reference J2EE, Tata McGraw-Hill, 2017.

**REFERENCES**


1. Brian Cole, Robert Eckstein, James Elliott, Marc Loy, David Wood, Java Swing, O'Reilly Publishers, Second Edition, 2012
2. Patrick Naughton, "The Java Hand Book, Tata McGraw Hill, 2017.
3. Kogent Solutions, Java Server Programming Java Ee5 Black Book, Dreamtech Press, 2018


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1. https://www.tutorialspoint.com/javascript
2. https://www.tutorialspoint.com/java_xml
3. https://www.tutorialspoint.com/ajax
4. https://www.w3schools.com/


## Mapping of Course Outcomes (CO) with Programme Outcomes (PO):

| M.Sc. CS | PO | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 1 | 2 |
| CO1 | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 0 |
| CO2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| CO3 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 0 |
| CO4 | 2 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 |
| CO5 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 0 |
| Average | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 2 |

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

| COURSE CODE | | | YCS203 | L | T | P | C |
|---|---|---|---|---|---|---|---|
| COURSE NAME | | | MACHINE LEARNING | 3 | 1 | 0 | 4 |
| C | P | A | | L | T | P | H |
| 4 | 0 | 0 | | 3 | 1 | 0 | 4 |
| PREREQUISITE | | | Artificial Intelligence, Fuzzy Logics | | | | |

| Course outcomes: | | Domain | Level |
|---|---|---|---|
| CO1 | **Identify** and **explain** the objectives of artificial Intelligence | Cognitive | Remember |
| CO2 | **Summarize** various machine learning models | Cognitive | Understand |
| CO3 | **Apply** the learning objective into Distance Based Models | Cognitive | Apply |
| CO4 | **Classify** the tree and Rule Models | Cognitive | Analyze |
| CO5 | **Analyzing** the idea about Reinforcement Learning | Cognitive | Analyze |

**Unit I FOUNDATIONS OF LEARNING** **9+3 Hours**

Introduction Artificial Intelligence - Characteristics of AI – AI problems and Problem solving methods- Components of learning – learning models – geometric models – probabilistic models – logic models – grouping and grading – learning versus design – types of learning – supervised – unsupervised – reinforcement – theory of learning – feasibility of learning – error and noise – training versus testing – theory of generalization – generalization bound –bias and variance – learning curve.

**Unit II LINEAR MODELS** **9+3 Hours**

Linear classification – univariate linear regression – multivariate linear regression – regularized regression – Logistic regression – perceptrons – multilayer neural networks – learning neural networks structures – support vector machines – soft margin SVM – generalization and over fitting – regularization – validation

**Unit III DISTANCE-BASED MODELS** **9+3 Hours**

Nearest neighbor models – K-means – clustering around medoids – silhouettes – hierarchical clustering – k-d trees – locality sensitive hashing – non - parametric regression – ensemble learning – bagging and random forests – boosting – meta learning.

**Unit IV TREE AND RULE MODELS** **9+3 Hours**

Decision trees – learning decision trees – ranking and probability estimation trees – Regression trees – clustering trees – learning ordered rule lists – learning unordered rule lists – descriptive rule learning – association rule mining – first -order rule learning

**Unit V REINFORCEMENT LEARNING** **9+3 Hours**

Passive reinforcement learning – direct utility estimation – adaptive dynamic programming – temporal - difference learning – active reinforcement learning – exploration – learning an action utility function – Generalization in reinforcement learning – policy search – applications in game playing – applications in robot control.

| HOURS | LECTURE | TUTORIAL | TOTAL |
|---|---|---|---|
| | 45 | 15 | 60 |

**TEXT BOOKS**

1. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill Publication, 2nd Edition, 2011.
2. Y. S. Abu - Mostafa, M. Magdon-Ismail, and H.-T. Lin, "Learning from Data", AML Book Publishers, 2017.
3. P. Flach, "Machine Learning: The art and science of algorithms that make sense of data", Cambridge University Press, 2012.

**REFERENCES**

1. K. P. Murphy, "Machine Learning: A probabilistic perspective", MIT Press, 2012.
2. C. M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2007.
3. D. Barber, "Bayesian Reasoning and Machine Learning", Cambridge University Press, 2012..

**E-REFERENCES**

1. https://nptel.ac.in/courses/106/106/106106139/
2. https://nptel.ac.in/courses/106/105/106105152/

**Mapping of Course Outcomes (CO) with Programme Outcomes (PO):**

| M.Sc. CS | PO | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 1 | 2 |
| CO1 | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 0 |
| CO2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| CO3 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 0 |
| CO4 | 2 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 |
| CO5 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 0 |
| Average | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 2 |

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

| COURSE CODE | | | YCS206 | L | T | P | C |
|---|---|---|---|---|---|---|---|
| COURSE NAME | | | ADVANCED JAVA PROGRAMMNG LABORATORY | 0 | 0 | 1 | 1 |
| C | P | A | | L | T | P | H |
| 0 | 1 | 0 | | 0 | 0 | 2 | 2 |
| PREREQUISITE | | | Java, Object Oriented Programming Concepts | | | | |

| Course outcomes: | | Domain | Level |
|---|---|---|---|
| CO1 | **Describe** the Applications using Swing Components. | Psychomotor | Perception |
| CO2 | **Describe** distributed applications using remote method invocation | Psychomotor | Perception |
| CO3 | **Create** DATABASE Connectivity using Java database connectivity | Psychomotor | Origination |
| CO4 | **Identify** the JavaScript language & the Document Object Model | Psychomotor | Perception |
| CO5 | **Choose** the Well-Formed XML with different types of XML Schemas | Psychomotor | Perception |

**Unit I INTRODUCTION** — **3 Hours**

**Lab Exercise:**

1. Create a Frame using AWT implement mouseClicked(), mouseEntered() and mouseExited() events.Frame should become visible when mouse enters it
2. Using AWT, create buttons, change background colors.

**Unit II RMI** — **4 Hours**

**Lab Exercise:** Create a program to execute Select Query using JDBC and implement RMI server.

**Unit III JAVA IN WEB** — **4 Hours**

**Lab Exercise:** Create a program to display cookie ID, display a String, Create a Check boxes.

**Unit IV SERVLET AND JSP** — **4 Hours**

**Lab Exercise:** Develop remote interface and implement your Java/RMI server and create your server.

| HOURS | PRACTICAL | TOTAL |
|---|---|---|
| | 15 | 15 |

| COURSE CODE | | | YCS207 | L | T | P | C |
|---|---|---|---|---|---|---|---|
| COURSE NAME | | | MACHINE LEARNING LABORATORY | 0 | 0 | 1 | 1 |
| C | P | A | | L | T | P | H |
| 0 | 1 | 0 | | 0 | 0 | 2 | 2 |
| PREREQUISITE | | | Artificial Intelligence, Fuzzy Logics | | | | |

| Course outcomes: | | Domain | Level |
|---|---|---|---|
| CO1 | **Explain** the objectives of artificial Intelligence | Psychomotor | Set |
| CO2 | **Describe** various machine learning models | Psychomotor | Perception |
| CO3 | **Arrange** the learning objective into Distance Based Models | Psychomotor | Origination |
| CO4 | **Describe** the tree and Rule Models | Psychomotor | Perception |
| CO5 | **Construct** the idea about Reinforcement Learning | Psychomotor | Mechanism |

**Lab Exercise :**

1. Implement and demonstrate the FIND-S algorithm.
2. Implement and demonstrate the candidate-Elimination algorithm.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm.
4. Build artificial neural network by implementing the back propagation algorithm.
5. Write a program to implement the naïve Bayesian classifier for a set of training data.
6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built in java classes /API can be used to write the programs. Calculate the accuracy, precision and recall for data set.
7. Write a program to construct a Bayesian network considering medical data.
8. Apply EM algorithm to cluster a set of data stored in a file.

| HOURS | PRACTICAL | TOTAL |
|---|---|---|
| | 15 | 15 |

| COURSE CODE | | | YCS301 | L | T | P | C |
|---|---|---|---|---|---|---|---|
| COURSE NAME | | | DEEP LEARNING | 4 | 1 | 0 | 5 |
| C | P | A | | L | T | P | H |
| 3 | 0.5 | 0.5 | | 4 | 1 | 0 | 5 |
| PREREQUISITE | | | Artificial Intelligence | | | | |

| Course outcomes: | | Domain | Level |
|---|---|---|---|
| CO1 | **Describe** the mathematical, statistical and computational challenges of building neural networks | Cognitive<br>Psychomotor | Remember<br>Set |
| CO2 | **Understand** dimensionality reduction techniques | Cognitive<br>Psychomotor | Understand<br>Perception |
| CO3 | **Manipulate** deep learning techniques to support real-time applications | Cognitive<br>Psychomotor<br>Affective | Apply<br>Origination<br>Receive |
| CO4 | **Analyze** optimization and generalization techniques in deep learning | Cognitive<br>Psychomotor<br>Affective | Analyze<br>Perception<br>Respond |
| CO5 | **Illustrate** neural and spatial transformers | Cognitive<br>Psychomotor | Analyze<br>Mechanism |

**Unit I INTRODUCTION** **12+3 Hours**

Introduction to machine learning- Linear models (SVMs and Perceptrons, logistic regression)- Intro to Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates.

**Unit II DEEP NETWORKS** **12+3 Hours**

History of Deep Learning- A Probabilistic Theory of Deep Learning- Back propagation and regularization, batch normalization- VC Dimension and Neural Nets-Deep Vs Shallow Networks Convolutional Networks- Generative Adversarial Networks (GAN), Semi-supervised Learning.

**Unit III DIMENTIONALITY REDUCTION** **12+3 Hours**

Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyperparameter optimization.

**Unit IV OPTIMIZATION AND GENERALIZATION** **12+3 Hours**

Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience**.**

**Unit V CASE STUDY AND APPLICATIONS** **12+3 Hours**

Imagenet- Detection-Audio WaveNet-Natural Language Processing Word2Vec - Joint Detection BioInformatics- Face Recognition- Scene Understanding- Gathering Image Captions.

| HOURS | LECTURE | TUTORIAL | TOTAL |
|---|---|---|---|

| | | | |
|---|---|---|---|
| | **60** | **15** | **75** |

**TEXT BOOKS**

1. Cosma Rohilla Shalizi, Advanced Data Analysis from an Elementary Point of View, 2015.
2. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.
3. Ian Goodfellow, Yoshua Bengio, Aaron Courville, Deep Learning, MIT Press, 2016.
4. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.

**REFERENCES**

1. K. P. Murphy, "Machine Learning: A probabilistic perspective", MIT Press, 2012.
2. C. M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2007.
3. D. Barber, "Bayesian Reasoning and Machine Learning", Cambridge University Press,2012

**E-REFERENCES**

1. https://nptel.ac.in/courses/106/106/106106184
2. https://onlinecourses.nptel.ac.in/noc20_cs62

## Mapping of Course Outcomes (CO) with Programme Outcomes (PO):

| **M.Sc. CS** | **PO** | | | | | | | **PSO** | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **1** | **2** |
| **CO1** | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 0 |
| **CO2** | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| **CO3** | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 0 |
| **CO4** | 2 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 |
| **CO5** | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 0 |
| **Average** | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 2 |

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

| COURSE CODE | | | YCS302 | L | T | P | C |
|---|---|---|---|---|---|---|---|
| COURSE NAME | | | WIRELESS NETWORKS | 3 | 1 | 0 | 4 |
| C | P | A | | L | T | P | H |
| 4 | 0 | 0 | | 3 | 1 | 0 | 4 |
| PREREQUISITE | | | Computer Networks | | | | |

| Course outcomes: | | Domain | Level |
|---|---|---|---|
| CO1 | **Define** the basic WSN technology and supporting protocols, with emphasis place on standardization basic sensor systems and provide a survey of sensor technology. | Cognitive | Remember |
| CO2 | **Illustrate** medium access control protocols and address physical layer issues. | Cognitive | Understand |
| CO3 | **Examine** key routing protocols for sensor networks and main design issues. | Cognitive | Apply |
| CO4 | **Analyse** transport layer protocols for sensor networks, and design requirements. | Cognitive | Analyse |
| CO5 | **Represent** the Sensor management, sensor network middleware, operating systems. | Cognitive | Understand |

| **Unit I Wireless Networks** | **9+3 Hours** |
|---|---|
| Introduction Evolution of wireless networks – Challenges - Transmission fundamentals: Analog and digital data transmission - Transmission media - Modulation techniques for wireless systems - Multiple access for wireless systems - Performance increasing techniques for wireless networks. | |
| **Unit II Wireless LAN** | **9+3 Hours** |
| Introduction to Wireless LANs – WLAN Equipment, Topologies, Technologies, IEEE 802.11 WLAN – Architecture and Services - Physical Layer - MAC Sub Layer –MAC Management Sub Layer, Other IEEE 802.11 Standards. | |
| **Unit III Wireless Personal Area Networks** | **9+3 Hours** |
| Introduction – Bluetooth: Architecture - Protocol Stack - Physical Connection – Mac mechanism – Frame format – Connection management –Low Rate and High Rate WPAN, Zig Bee Technology IEEE 802.15.4: Components – Network topologies – PHY – MAC. | |
| **Unit IV Ad-hoc Wireless Networks** | **9+3 Hours** |
| Introduction- Characteristics of Adhoc Networks - Classifications of MAC Protocols: Connection Based protocols, Reservation Mechanism - Table driven Routing protocols: DSDV, WRP - On Demand routing protocols: DSR, AODV, TORA –Routing Protocol with Efficient Flooding Mechanism: OLSR - Hierarchical routing protocols – CBRP, FSR. | |
| **Unit V Wireless Sensor Networks** | **9+3 Hours** |
| Introduction - Challenges for wireless sensor networks - Comparison of sensor network with ad-hoc network - Single node architecture: Hardware components - Energy consumption of sensor nodes - Network architecture: Sensor network scenarios - Design principles – Operating systems. | |

| HOURS | LECTURE | TUTORIAL | TOTAL |
|---|---|---|---|
| | 45 | 15 | 60 |

**TEXT BOOKS**

1. Nicopolitidis P, "Wireless Networks", John Wiley and Sons, New York, 2010.
2. Vijay K Garg, Wireless Communication and Networking, Morgan Kaufmann Publishers 2010.
3. Siva Ram Murthy C.Manoj B S, "Ad Hoc Wireless Networks: Architectures and Protocols", Prentice Hall, 2012.

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1. Holger Karl and Andreas Willig, "Protocol and Architecture for Wireless Sensor Networks", John Willey Publication, 2011.
2. Kaveh Pahlavan, "Principles of wireless networks", Prentice-Hall of India, 2013.

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1. https://www.te.com/usa-en/industries/sensor-solutions/insights/sensors-sleep-apnea-whitepaper.html
2. https://www.bluetooth.com/blog/smart-building-use-cases/
3. https://wballiance.com/wp-content/uploads/2019/03/Case-Study_VAST-Networks-Mobile-DataOffload.pdf
4. https://www.postscapes.com/agtech/#case-studies

## Mapping of Course Outcomes (CO) with Programme Outcomes (PO):

| M.Sc. CS | PO | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 1 | 2 |
| CO1 | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 0 |
| CO2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| CO3 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 0 |
| CO4 | 2 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 |
| CO5 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 0 |
| Average | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 2 |

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

| COURSE CODE | | | YCS303 | L | T | P | C |
|---|---|---|---|---|---|---|---|
| COURSE NAME | | | BIG DATA AND ANALYTICS | 3 | 1 | 0 | 4 |
| C | P | A | | L | T | P | H |
| 4 | 0 | 0 | | 3 | 1 | 0 | 4 |
| PREREQUISITE | | | Data Mining and Data warehousing | | | | |

| Course outcomes: | | Domain | Level |
|---|---|---|---|
| CO1 | ***Describe*** the building blocks of Big Data. | Cognitive | Remember |
| CO2 | ***Understand*** the fundamentals of various big data analysis techniques and its various applications. | Cognitive | Understand |
| CO3 | ***Explain*** the Difference between SQL and NoSQL and its types and various NoSQL databases. | Cognitive | Apply |
| CO4 | ***Classify*** the components of Hadoop and its architecture | Cognitive | Analyze |
| CO5 | ***Prescribe*** the HADOOP and Map Reduce technologies associated with big data analytics Explore on Big Data applications. | Cognitive | Create |

**Unit I INTRODUCTION TO BIG DATA** **9+3 Hours**

Data, Characteristics of data and Types of digital data: Unstructured, Semi-structured and Structured, Sources of data, Working with unstructured data, Evolution and Definition of big data, Characteristics and Need of big data, Challenges of big data, Data environment versus big data environment.

**UNIT II BIG DATA ANALYTICS** **9+3 Hours**

Overview of business intelligence, Data science and Analytics, Meaning and Characteristics of big data analytics, Need of big data analytics, Classification of analytics, Challenges to big data analytics, Importance of big data analytics, Basic terminologies in big data environment.

**Unit III BIG DATA TECHNOLOGIES AND DATABASES** **9+3 Hours**

Introduction to NoSQL, Uses, Features and Types, Need, Advantages, Disadvantages and Application of NoSQL, Overview of NewSQL, Comparing SQL, NoSQL and NewSQL, Introduction to MongoDB and its needs, Characteristics of MongoDB, Introduction of apache cassandra and its needs, Characteristics of Cassandra

**Unit IV HADOOP FOUNDATION FOR ANALYTICS** **9+3 Hours**

History, Needs, Features, Key advantage and Versions of Hadoop, Essential of Hadoop ecosystems, RDBMS versus Hadoop, Key aspects and Components of Hadoop, Hadoop architectures.

**Unit V HADOOP MAP REDUCE AND YARN FRAMEWORK** **9+3 Hours**

Introduction to Map Reduce, Processing data with Hadoop using Map Reduce, Introduction to YARN, Components, Need and Challenges of YARN, Dissecting YARN, Map Reduce application, Data serialization and Working with common serialization formats, Big data serialization formats.

| HOURS | LECTURE | TUTORIAL | TOTAL |
|---|---|---|---|
| | 45 | 15 | 60 |

**TEXT BOOKS**

1. Seema Acharya and Subhashini Chellappan, “Big Data and Analytics”, Wiley India Pvt. Ltd., 2016.

**REFERENCES**


1. "Big Data" by Judith Hurwitz, Alan Nugent, Dr. Fern Halper and Marcia Kaufman, Wiley Publications, 2014.
2. Minelli, M., Chambers, M., &Dhiraj, A. (2013). Big data, big analytics: emerging business intelligence and analytic trends for today's businesses. John Wiley &Sons.Michael, ISBN no: 9781118-14760-354995.
3. Sadalage, P. J., & Fowler, M. (2013). NoSQL distilled: a brief guide to the emerging world of polyglot persistence. Pearson Education. ISBN no: 13:978-0-321-82662-6.
4. "Big Data Imperatives : Enterprise Big Data Warehouse, BI Implementations and Analytics" by SoumendraMohanty, MadhuJagadeesh and HarshaSrivatsa, Apress Media, Springer Science + Business Media New York, 2013.
5. "Hadoop: The definitive Guide", Tom White, O'Reilly Media, 2010.
6. Tom White, (2012). Hadoop: The Definitive Guide, (Third Edition), O'Reilley. ISBN no: 978-1-491-90163-2 4.
7. Eric Sammer, (2012). Hadoop Operations, (First Edition) O'Reilley., ISBN no: 978- 1149327057
8. Alan Gates, (2011). Programming Pig, (First Edition),O'Reilley. ISBN no: 978-1- 449-302641.
9. Alex Holmes, (2012). Hadoop in Practice, Manning Publ. ISBN no: 9781617292224.
10. ECapriolo, D Wampler, and JRutherglen, (2012), Programming Hive, O'Reilley.


**E-REFERENCES**


1. Hadoop: http://hadoop.apache.org/,
2. Hadoop:https://www.edureka.co/blog/hadoop-tutorial
3. Hive: https://cwiki.apache.org/confluence/display/Hive/Home
4. Piglatin: http://pig.apache.org/docs/r0.7.0/tutorial.html


## Mapping of Course Outcomes (CO) with Programme Outcomes (PO):

| M.Sc CS | PO | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 1 | 2 |
| CO1 | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 0 |
| CO2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| CO3 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 0 |
| CO4 | 2 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 |
| CO5 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 0 |
| Average | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 2 |

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

| COURSE CODE | | | YCS306 | L | T | P | C |
|---|---|---|---|---|---|---|---|
| COURSE NAME | | | WIRELESS NETWORKS LABORATORY | 0 | 0 | 1 | 1 |
| C | P | A | | L | T | P | H |
| 0 | 1 | 0 | | 0 | 0 | 2 | 2 |
| PREREQUISITE | | | Computer Networks | | | | |

| Course outcomes: | | Domain | Level |
|---|---|---|---|
| CO1 | **Describe** the basic WSN technology | Psychomotor | Perception |
| CO2 | **Identify** medium access control protocols and address physical layer issues. | Psychomotor | Perception |
| CO3 | **Choose** key routing protocols for sensor networks and main design issues. | Psychomotor | Perception |
| CO4 | **Organize** transport layer protocols for sensor networks, and design requirements. | Psychomotor | Mechanism |
| CO5 | **Identify** the Sensor management, sensor network middleware, operating systems. | Psychomotor | Perception |

**Lab Exercise**:

1. 802.11 Association and Channels
2. Wireless fidelity
3. Multi-hop routing-TCP Performance
4. Dynamic Ad-hoc Routing
5. RFID Basics
6. Data throughput
7. Rate Control
8. Back pressure Scheduling
9. MAC Contention Window and RTS
10. 802.11 fairness and comparison.

| HOURS | PRACTICAL | TOTAL |
|---|---|---|
| | 15 | 15 |

**Mapping of Course Outcomes (CO) with Programme Outcomes (PO):**

| M.Sc. CS | PO | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 1 | 2 |
| CO1 | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 0 |
| CO2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| CO3 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 0 |
| CO4 | 2 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 |
| CO5 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 0 |
| Average | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 2 |

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

| COURSE CODE | | | YCS307 | L | T | P | C |
|---|---|---|---|---|---|---|---|
| COURSE NAME | | | BIG DATA AND ANALYTICS LABORATORY | 0 | 0 | 1 | 1 |
| C | P | A | | L | T | P | H |
| 0 | 1 | 0 | | 0 | 0 | 2 | 2 |
| PREREQUISITE | | | Data Mining and Data warehousing | | | | |

| Course outcomes: | | Domain | Level |
|---|---|---|---|
| CO1 | ***Explain*** the building blocks of Big Data. | Psychomotor | Set |
| CO2 | ***Describe*** the fundamentals of various big data analysis techniques and its various applications. | Psychomotor | Perception |
| CO3 | ***Explain*** the Difference between SQL and NoSQL and its types and various NoSQL databases. | Psychomotor | Set |
| CO4 | ***Differentiate*** the components of Hadoop and its architecture. | Psychomotor | Perception |
| CO5 | ***Construct*** the HADOOP and Map Reduce technologies associated with big data analytics Explore on Big Data applications. | Psychomotor | Mechanism |

**Lab exercise:**

**Excel:**

1. How to Calculate Summary Statistics in Excel
   a. Two ways to calculate a measure of central tendency and dispersion using Excel (data analysis tools; type in the formula).
2. Generate Comparative Statistics in Excel
   a. Paired t-test
3. Create Graphs in Excel.

**R Programming**

4. Installation of R-Studio on windows.
5. Reading different types of data sets (.txt, .csv) from web and disk and writing in file in specific disk location using R.
6. Reading XML dataset in R.
7. Find the data distributions using box and scatter plot.
8. Find the outliers using plot.
9. Plot the histogram, bar chart and pie chart on sample data.

**Hadoop:**

10. File management task in Hadoop.
11. Word count Map reduce program to understand Map reduce Paradigm
12. Map reduce program to analyze time-temperature statistics and generate report.
13. Implement Matrix multiplication with Hadoop Map reduce.
14. Hive databases, tables, views functions and indexes

| HOURS | Practical | TOTAL |
|---|---|---|
| | 15 | 15 |

**E-REFERENCES**

1. http://www.r-bloggers.com/how-to-perform-a-logistic-regression-in-r/
2. http://www.ats.ucla.edu/stat/r/dae/rreg.htm

3. http://www.coastal.edu/kingw/statistics/R-tutorials/logistic.html
4. http://www.ats.ucla.edu/stat/r/data/binary.csv

**SOFTWARE AND HARDWARE REQUIREMENTS**:
**SOFTWARE**: MS Excel, R Software, R Studio Software, VMware, Java JDK 1.8, Hadoop 3.3.5.
**HARDWARE**: Intel Desktop Computers with 4 GB RAM.

**Mapping of Course Outcomes (CO) with Programme Outcomes (PO):**

| M.Sc. CS | PO | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 1 | 2 |
| CO1 | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 0 |
| CO2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| CO3 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 0 |
| CO4 | 2 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 |
| CO5 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 0 |
| Average | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 2 |

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

| COURSE CODE | | | YCS204A | L | T | P | C |
|---|---|---|---|---|---|---|---|
| COURSE NAME | | | HUMAN COMPUTER INTERACTION | 3 | 1 | 0 | 4 |
| C | P | A | | L | T | P | H |
| 3.5 | 0.3 | 0.2 | | 3 | 1 | 0 | 4 |
| PREREQUISITE | | | | | | | |

| Course outcomes: | | Domain | Level |
|---|---|---|---|
| CO1 | **Illustrate** ergonomics and various interaction | Cognitive Psychomotor | Understand Perception |
| CO2 | **Describes** design basics and prototyping | Cognitive Psychomotor | Remember Mechanism |
| CO3 | **Apply** the Golden rules and human computer interaction patterns | Cognitive | Apply |
| CO4 | **Analyse** user participation and Interaction | Cognitive Psychomotor | Analyze Perception |
| CO5 | **Describes** adaptive help system and user support system | Cognitive Psychomotor | Understand Set |

**Unit I THE INTERACTION** **9+3 Hours**

Introduction – Models of interaction – Frameworks and HCI Ergonomics – Interaction styles – Elements of the WIMP interface – Interactivity – The context of the interactions. Paradigms : Introduction – Paradigms for interaction.

**UNIT II INTERACTION DESIGN BASICS** **9+3 Hours**

Introduction – What is design? – User focus – Scenarios – Navigation design – Screen design and layout – Interaction and prototyping. HCL in the Software Process : Introduction – The software lifecycle – Usability engineering – interactive design and prototyping – Design rationate.

**Unit III DESIGN RULES** **9+3 Hours**

Introduction – Principles to support usability – Standards – Guidelines – Golden rules and heuristics – HCI patterns. Implementation Support : Introduction – Elements of windowing systems – Programming the application Using toolkits – User interface management systems.

**Unit IV EVALUATION TECHNIQUES** **9+3 Hours**

What is evaluation – Goals of evaluation – Evaluation through expert analysis – Evaluation through user participation – Choosing an evaluation method. Universal Design: Introduction – Universal design principles – Multi-modal interaction – Designing for diversity – Summary

**Unit V USER SUPPORT** **9+3 Hours**

Introduction Requirements of user support – Approaches to; user support – Adaptive help systems designing user support systems.

| HOURS | LECTURE | TUTORIAL | TOTAL |
|---|---|---|---|
| | 45 | 15 | 60 |

**TEXT BOOKS**

1. Human - Computer Interaction, Third Edition, "Alan Dix, Janet Finlay, Gregory D. Abowd and Russell Beale", Pearson Education, 2004.

**REFERENCES**

1. Human – Computer Interaction in the New Millennium, "John C. Carroll", Pearson Education" 2002.

**E-REFERENCES**

1. https://onlinecourses.nptel.ac.in/noc19_cs86/
2. https://nptel.ac.in/courses/106/103/106103115/
3. https://nptel.ac.in/courses/106/106/106106177/

**Mapping of Course Outcomes (CO) with Programme Outcomes (PO):**

| M.Sc. | PO | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **1** | **2** |
| **CO1** | 3 | 2 | 1 | 1 | 0 | 1 | **0** | 1 | 1 |
| **CO2** | 0 | 1 | 3 | 2 | 0 | 2 | **0** | 2 | 2 |
| **CO3** | 1 | 2 | 3 | 0 | 0 | 2 | **0** | 2 | 2 |
| **CO4** | 1 | 2 | 3 | 1 | 0 | 2 | **0** | 1 | 2 |
| **CO5** | 0 | 3 | 0 | 1 | 0 | 2 | **0** | 1 | 2 |
| **Average** | 1 | 2 | 2 | 1 | 0 | 2 | **0** | 1 | 2 |

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

| Course Code | | | YCS204B | L | T | P | C |
|---|---|---|---|---|---|---|---|
| | | | | 3 | 1 | 0 | 4 |
| Course Name | | | PATTERN RECOGNITION | | | | |
| C | P | A | | L | T | P | C |
| 3.5 | 0.3 | 0.2 | | 3 | 1 | 0 | 4 |

**PREREQUISITE:** Nil

| COURSE OUTCOMES | | DOMAIN | LEVEL |
|---|---|---|---|
| After the completion of the course, students will be able to | | | |
| **CO1** | To **Illustrate** Pattern Classifiers and Perception | Cognitive Psychomotor | Remember Set |
| **CO2** | To **generalize** different clustering models. | Cognitive Psychomotor | Understand Perception |
| **CO3** | **Choose** feature extraction and structural pattern recognition. | Cognitive Affective | Apply Receive |
| **CO4** | **Illustrate** the hidden Markov model and Support Vector Machines | Cognitive Affective | Analyze Respond |
| **CO5** | **Appraise** fuzzy pattern classifier | Cognitive Psychomotor | Evaluate Mechanism |

| UNIT I | PATTERN CLASSIFIER | 9+3 Hours |
|---|---|---|

Overview of Pattern recognition – Discriminant functions – Supervised learning – Parametric estimation – Maximum Likelihood Estimation – Bayesian parameter Estimation – Problems with Bayes approach– Pattern classification by distance functions – Minimum distance pattern classifier

| UNIT II | CLUSTERING | 9+3 Hours |
|---|---|---|

Clustering for unsupervised learning and classification – Clustering concept – C Means algorithm – Hierarchical clustering – Graph theoretic approach to pattern Clustering – Validity of Clusters.

| UNIT III | FEATURE EXTRACTION AND STRUCTURAL PATTERN RECOGNITION | 9+3 Hours |
|---|---|---|

Transforms – Feature selection through functional approximation – Binary selection -Elements of formal grammars - Syntactic description - Stochastic grammars - Structural representation.

| UNIT IV | HIDDEN MARKOV MODELS AND SUPPORT VECTOR MACHINE | 9+3 Hours |
|---|---|---|

State Machines – Hidden Markov Models – Training-classification-support vector machine-Feature selection.

| UNIT V | RECENT ADVANCES | 9+3 Hours |
|---|---|---|

Fuzzy logic – Fuzzy Pattern Classifiers – Pattern Classification using Genetic Algorithms – Case Study Using Fuzzy Pattern Classifiers and Perception.

| LECTURE | TUTORIAL | PRACTICAL | TOTAL |
|---|---|---|---|
| 45 | 15 | 0 | 60 |

**TEXT BOOKS:**


1. M. Narasimha Murthy and V. Susheela Devi, “Pattern Recognition”, Springer 2011.
2. S.Theodoridis and K.Koutroumbas, “Pattern Recognition”, 4th Ed., Academic Press, 2009.


**REFERENCES:**


1. Robert J.Schalkoff, “Pattern Recognition Statistical, Structural and Neural Approaches”, John Wiley & Sons Inc., New York, 1992.
2. C.M.Bishop, “Pattern Recognition and Machine Learning”, Springer, 2006.
3. R.O.Duda, P.E.Hart and D.G.Stork, “Pattern Classification”, John Wiley, 2001 6. Andrew Webb, “Stastical Pattern Recognition”, Arnold publishers, London, 1999.

**Mapping of Course Outcomes (CO) with Programme Outcomes (PO):**

| M.Sc. | PO | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **1** | **2** |
| **CO1** | 3 | 2 | 1 | 1 | 0 | 1 | **0** | 1 | 1 |
| **CO2** | 0 | 1 | 3 | 2 | 0 | 2 | **0** | 2 | 2 |
| **CO3** | 1 | 2 | 3 | 0 | 0 | 2 | **0** | 2 | 2 |
| **CO4** | 1 | 2 | 3 | 1 | 0 | 2 | **0** | 1 | 2 |
| **CO5** | 0 | 3 | 0 | 1 | 0 | 2 | **0** | 1 | 2 |
| **Average** | 1 | 2 | 2 | 1 | 0 | 2 | **0** | 1 | 2 |

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

| Course Code | | | YCS204C | L | T | P | C |
|---|---|---|---|---|---|---|---|
| | | | | 3 | 1 | 0 | 4 |
| Course Name | | | ARTIFICIAL INTELLIGENCE | | | | |
| C | P | A | | L | T | P | H |
| 3.8 | 0 | 0.2 | | 3 | 1 | 0 | 4 |

**PREREQUISITE:** Nil

| COURSE OUTCOMES | | DOMAIN | LEVEL |
|---|---|---|---|
| CO1 | Analyse AI problems and Space Search | Cognitive | Remember |
| CO2 | Discuss various search techniques | Cognitive | Understand |
| CO3 | Apply Logic and relationships | Cognitive r Affective | Apply Receive |
| CO4 | Illustrates the knowledge based on rules | Cognitive Affective | Analyze Respond |
| CO5 | Describes expert system and various perceptions | Cognitive | Understand |

| UNIT I | Introduction: | 9+3 Hours |
|---|---|---|

AI Problems - Al techniques - Criteria for success. Problems, Problem Spaces, Search: State space search - Production Systems

| UNIT II | Heuristic Search techniques: | 9+3 Hours |
|---|---|---|

Generate and Test - Hill Climbing- Best-First - Means-end analysis. Knowledge representation issues: Representations and mappings -Approaches to Knowledge representations -Issues in Knowledge representations - Frame Problem.

| UNIT III | Using Predicate logic: | 9+3 Hours |
|---|---|---|

Representing simple facts in logic - Representing Instance and Is a relationships - Computable functions and predicates - Resolution.

| UNIT IV | Representing knowledge using rules: | 9+3 Hours |
|---|---|---|

Procedural Vs Declarative knowledge – Logic programming - Forward Vs Backward reasoning - Matching - Control knowledge.

| UNIT V | Game playing | 9+3 Hours |
|---|---|---|

The minimax search procedure – Expert System - Perception and Action

| LECTURE | TUTORIAL | PRACTICAL | TOTAL |
|---|---|---|---|
| 45 | 15 | - | 60 |

**TEXT BOOKS:**

1. Elaine Rich and Kevin Knight," Artificial Intelligence", Tata McGraw Hill Publishers company Pvt Ltd, Second Edition, 1991.

**REFERENCES:**

1. S. Rajasekaran and G.A.V. Pai, “Neural Networks, Fuzzy Logic and Genetic Algorithms”, PHI, 2003.Emereo Pty Limited, July 2008.
2. Ahmar, Abbas, “Grid Computing - A Practical Guide to technology and Applications”, Charles River media, 2003.
3. Vojislav Kecman, “Learning & Soft Computing Support Vector Machines, Neural Networks, and Fuzzy Logic Models”, Pearson Education, New Delhi,2006

**Mapping of Course Outcomes (CO) with Programme Outcomes (PO):**

| M.Sc. | PO | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **1** | **2** |
| **CO1** | 3 | 2 | 1 | 1 | 0 | 1 | **0** | 1 | 1 |
| **CO2** | 0 | 1 | 3 | 2 | 0 | 2 | **0** | 2 | 2 |
| **CO3** | 1 | 2 | 3 | 0 | 0 | 2 | **0** | 2 | 2 |
| **CO4** | 1 | 2 | 3 | 1 | 0 | 2 | **0** | 1 | 2 |
| **CO5** | 0 | 3 | 0 | 1 | 0 | 2 | **0** | 1 | 2 |
| **Average** | 1 | 2 | 2 | 1 | 0 | 2 | **0** | 1 | 2 |

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

| Course Code | | | YCS205A | L | T | P | C |
|---|---|---|---|---|---|---|---|
| | | | | 3 | 1 | 0 | 4 |
| Course Name | | | PARALLEL PROCESSING | | | | |
| C | P | A | | L | T | P | H |
| 3.8 | 0 | 0.2 | | 3 | 1 | 0 | 4 |

**PREREQUISITE:** Nil

| COURSE OUTCOMES | | DOMAIN | LEVEL |
|---|---|---|---|
| After the completion of the course, students will be able to | | | |
| **CO1** | **Analyse** parallel processing structures and application | Cognitive | Remember |
| **CO2** | **Distinguish** memory and input-Output systems | Cognitive | Understand |
| **CO3** | **Explain** Pipelining and vector Processing | Cognitive<br>Affective | Apply<br>Receive |
| **CO4** | **Illustrates** vector and optimization methods | Cognitive<br>Affective | Analyze<br>Respond |
| **CO5** | **Prescribe** Multiprocessors structures and operating systems | Cognitive | Analyze |

| UNIT I | 9+3 Hours |
|---|---|
| Introduction to Parallel Processing – Evolution of Computer Systems – Parallelism in Uniprocessor Systems – Parallel Computer Structures – Architectural Classification Schemes– Parallel Processing Applications. | |

| UNIT II | 9+3 Hours |
|---|---|
| Memory and Input-Output Subsystems – Hierarchical Memory Structure# – Virtual Memory System – Memory Allocation and Management – Cache Memories and Management – Input-Output Subsystems. | |

| UNIT III | 9+3 Hours |
|---|---|
| Principles of Pipelining and Vector Processing – Pipelining : An Overlapped Parallelism – Instruction and Arithmetic Pipelines – Principles of Designing Pipelined Processors – Vector Processing Requirements. | |

| UNIT IV | 9+3 Hours |
|---|---|
| Vectorization and Optimization methods – Parallel Languages for Vector Processing – Design of Vectorizing Compiler – Optimization of Vector Functions – SIMD Array Processors – SIMD Interconnection Networks | |

| UNIT V | 9+3 Hours |
|---|---|
| Multiprocessors Architecture and Programming – Functional Structures – Interconnection Networks - Parallel Memory Organizations – Multiprocessor Operating Systems – Language Features to Exploit Parallelism – Multiprocessor Scheduling Strategies. | |

| LECTURE | TUTORIAL | PRACTICAL | TOTAL |
|---|---|---|---|
| 45 | 15 | - | 60 |

**TEXT BOOKS:**

1. Kai Hwang and Faye A. Briggs,Computer Architecture and Parallel Processing,McGraw Hill International Edition, 1985.

**REFERENCES:**

1. Richard Kain, Advanced Computer Architecture, PHI, 1999.
2. V. Rajaraman and C. Siva Ram Murthy, Parallel Computers, Architecture and Programming, PHI, 2000.

**Mapping of Course Outcomes (CO) with Programme Outcomes (PO):**

| M.Sc CS | PO | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **1** | **2** |
| **CO1** | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 0 |
| **CO2** | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| **CO3** | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 0 |
| **CO4** | 2 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 |
| **CO5** | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 0 |
| **Average** | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 2 |

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

| Course Code | | | YCS205B | L | T | P | C |
|---|---|---|---|---|---|---|---|
| | | | | 3 | 1 | 0 | 4 |
| Course Name | | | SOFT COMPUTING | | | | |
| C | P | A | | L | T | P | H |
| 3.5 | 0.3 | 0.2 | | 3 | 1 | 0 | 4 |

**PREREQUISITE:** Data Mining and Data warehousing

| Course Outcomes | | Domain | Level |
|---|---|---|---|
| After the completion of the course, students will be able to | | | |
| **CO1** | ***Understand*** the basic knowledge of Fuzzy sets, Fuzzy Rules and Fuzzy Reasoning to developing Fuzzy Inference Systems. | Cognitive Psychomotor | Remember Set |
| **CO2** | ***Understand*** the various optimization techniques. | Cognitive Psychomotor | Understand Perception |
| **CO3** | ***Apply*** specific supervised and unsupervised neural networks to find approximate solutions to real world problems. | Cognitive Psychomotor Affective | Apply Origination Receive |
| **CO4** | ***Analyse*** the various Neuro Fuzzy systems. | Cognitive Psychomotor Affective | Analyze Perception Respond |
| **CO5** | ***Create*** Computational Intelligence techniques to various real world problems. | Cognitive Psychomotor | Create Mechanism |

| **UNIT I** | **FUZZY SET THEORY** | **9+3 Hours** |
|---|---|---|

Introduction to Neuro – Fuzzy and Soft Computing – Fuzzy Sets – Basic Definition and Terminology – Set – Theoretic Operations – Member Function Formulation and Parameterization – Fuzzy Rules and Fuzzy Reasoning – Extension Principle and Fuzzy Relations – Fuzzy If Then Rules – Fuzzy Reasoning – Fuzzy Inference Systems – Mamdani Fuzzy Models – Sugeno Fuzzy Models – Tsukamoto Fuzzy Models – Input Space Partitioning and Fuzzy Modeling.

| **UNIT II** | **OPTIMIZATION** | **9+3 Hours** |
|---|---|---|

Derivative based Optimization – Descent Methods – The Method of Steepest Descent – Classical Newton's Method – Step Size Determination – Derivative Free Optimization – Genetic Algorithms – Simulated Annealing – Random Search – Downhill Simplex Search.

| **UNIT III** | **NEURAL NETWORKS** | **9+3 Hours** |
|---|---|---|

Supervised Learning Neural Networks – Perceptrons – AdalineBackpropagation Multilayer perceptrons – Radial Basis Function Networks – Unsupervised Learning and Other Neural Networks – Competitive Learning Networks – Kohonen Self – Organizing Networks – Learning Vector Quantization – Hebbian Learning.

| **UNIT IV** | **NEURO FUZZY MODELING** | **9+3 Hours** |
|---|---|---|

Adaptive Neuro – Fuzzy Inference Systems – Architecture – Hybrid Learning Algorithm – Learning Methods that Cross fertilize ANFIS and RBFN – Coactive Neuro Fuzzy Modeling – Framework – Neuron Functions for Adaptive Networks – Neuro Fuzzy Spectrum.

| **UNIT V** | **APPLICATION OF COMPUTATIONAL INTELLIGENCE** | **9+3 Hours** |
|---|---|---|

Printed Character Recognition – Inverse Kinematics Problems – Automobile Fuel Efficiency Prediction – Soft Computing for Color Recipe Prediction.

| LECTURE | TUTORIAL | PRACTICAL | TOTAL |
|---|---|---|---|
| 45 | 15 | - | 60 |

**Text Book:**

J.S.R. Jang, C.T. Sun and E. Mizutani, "Neuro Fuzzy and Soft Computing", PHI, Pearson Education, 2004.

**REFERENCES:**

1. Timothy J. Ross, "Fuzzy Logic with Engineering Application, "McGraw Hill, 1977.

2. Davis E. Goldberg, "Genetic Algorithms Search, Optimization and Machine Learning", AddisionWesley, 1989.
3. S. Rajasekaran and G.A.V. Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI, 2003.Emereo Pty Limited, July 2008.
4. Ahmar, Abbas, "Grid Computing - A Practical Guide to technology and Applications", Charles River media, 2003.
5. Vojislav Kecman, "Learning & Soft Computing Support Vector Machines, Neural Networks, and Fuzzy Logic Models", Pearson Education, New Delhi,2006.

**Mapping of Course Outcomes (CO) with Programme Outcomes (PO):**

| M.Sc. | PO | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **1** | **2** |
| **CO1** | 3 | 2 | 1 | 1 | 0 | 1 | **0** | 1 | 1 |
| **CO2** | 0 | 1 | 3 | 2 | 0 | 2 | **0** | 2 | 2 |
| **CO3** | 1 | 2 | 3 | 0 | 0 | 2 | **0** | 2 | 2 |
| **CO4** | 1 | 2 | 3 | 1 | 0 | 2 | **0** | 1 | 2 |
| **CO5** | 0 | 3 | 0 | 1 | 0 | 2 | **0** | 1 | 2 |
| **Average** | 1 | 2 | 2 | 1 | 0 | 2 | **0** | 1 | 2 |

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

| Course Code | | | YCS205C | L | T | P | C |
|---|---|---|---|---|---|---|---|
| Course Name | | | PERVASIVE COMPUTING | 3 | 1 | 0 | 4 |
| C | P | A | | L | T | P | H |
| 3.5 | 0.3 | 0.2 | | 3 | 1 | 0 | 4 |
| PREREQUISITE: | | | Computer Networks | | | | |

**COURSE OUTCOMES:**

| **Course outcomes:** After the completion of the course, students will be able to | | **Domain** | **Level** |
|---|---|---|---|
| **CO1:** | ***Understand*** the basics of pervasive computing | Cognitive Psychomotor | Remember Set |
| **CO2** | ***Apply*** the pervasive computing techniques for human machine interfaces. | Cognitive Psychomotor | Understand Perception |
| **CO3** | ***Design*** web-based applications using XML, WAP and WML. | Cognitive Psychomotor Affective | Apply Origination Receive |
| **CO4** | ***Apply*** the pervasive computing techniques for speech-based applications. | Cognitive Psychomotor Affective | Apply Perception Respond |
| **CO5** | D***escribe*** the PDA characteristics and standards. | Cognitive Psychomotor | Annalyze Mechanism |

| **Unit - IPervasive Computing:** | **9+3 Hours** |
|---|---|
| Past, Present and Future - Pervasive Computing Market – mBusiness – Application examples: Retail, Airline check-in and booking – Health care – Car information system – E-mail access via WAP and voice. | |
| **Unit – IIDevice Technology:** | **9+3 Hours** |
| Hardware – Human Machine Interfaces – Biometrics – Operating Systems – Java for Pervasive devices. | |
| **Unit – IIIDevice Connectivity** | **9+3 Hours** |
| Protocols – Security – Device Management - Web Application Concepts: WWW architecture – Protocols – Transcoding - Client Authentication via Internet. | |
| **Unit - IVWAP and Beyond** | **9+3 Hours** |
| Components of the WAP architecture – WAP infrastructure – WAP security issues – WML – WAP push – Products – i-Mode - Voice Technology: Basics of Speech recognition- Voice Standards – Speech applications – Speech and Pervasive Computing. | |
| **Unit – V PDA** | **9+3 Hours** |
| Device Categories – PDA operation Systems – Device Characteristics – Software Components - Standards – Mobile Applications - PDA Browsers - Pervasive Web Application architecture: Background – Development of Pervasive Computing web applications - Pervasive application architecture. | |

| HOURS | LECTURE | TUTORIAL | TOTAL |
|---|---|---|---|
| | 45 | 15 | 60 |

**TEXT BOOKS**

1. Pervasive Computing, Technology and Architecture of Mobile Internet Applications, JochenBurkhardt, Horst Henn, Stefan Hepper, Thomas Schaech & Klaus Rindtorff, Pearson Education, 2006.

**REFERENCES**

1. Fundamentals of Mobile and Pervasive Computing, Frank Adelstein, Sandeep KS Gupta, Golden Richard III, Loren Schwiebert, McGraw Hill edition, 2006.

**Mapping of Course Outcomes (CO) with Programme Outcomes (PO):**

| M.Sc. | PO | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **1** | **2** |
| **CO1** | 3 | 2 | 1 | 1 | 0 | 1 | **0** | 1 | 1 |
| **CO2** | 0 | 1 | 3 | 2 | 0 | 2 | **0** | 2 | 2 |
| **CO3** | 1 | 2 | 3 | 0 | 0 | 2 | **0** | 2 | 2 |
| **CO4** | 1 | 2 | 3 | 1 | 0 | 2 | **0** | 1 | 2 |
| **CO5** | 0 | 3 | 0 | 1 | 0 | 2 | **0** | 1 | 2 |
| **Average** | 1 | 2 | 2 | 1 | 0 | 2 | **0** | 1 | 2 |

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

| Course Code | | | YCS304A | L | T | P | C |
|---|---|---|---|---|---|---|---|
| | | | | 3 | 1 | 0 | 4 |
| Course Name | | | NETWORK SECURITY | | | | |
| C | P | A | | L | T | P | H |
| 3.8 | 0 | 0.2 | | 3 | 1 | 0 | 4 |

**PREREQUISITE:**
Intermediate to advanced programming knowledge. Knowledge of basic computer networking principles. Knowledge of basic information security principles.

| COURSE OUTCOMES | | DOMAIN | LEVEL |
|---|---|---|---|
| After the completion of the course, students will be able to | | | |
| **CO1** | **Describe** fundamentals of cryptography and its application to network security. | Cognitive | Remember |
| **CO2** | **Understand** the Public-Key Infrastructure | Cognitive | Understand |
| **CO3** | **Generalize** security protocols for protecting data on networks and able to digitally sign emails and files | Cognitive Affective | Apply Respond |
| **CO4** | **Manipulate** vulnerability assessments and password audits and able to configure simple firewall architectures | Cognitive | Apply |
| **CO5** | **Categorize** various security measures in networks | Cognitive | Analyze |

| UNIT I | | 9+3 Hours |
|---|---|---|
| Overview-Symmetric Ciphers: Classical Encryption Techniques | | |
| **UNIT II** | | **9+3 Hours** |
| Symmetric Ciphers: Block ciphers and the Data Encryption Standards Public-key Encryption and Hash Functions: Public-Key Cryptography and RSA | | |
| **UNIT III** | | **9+3 Hours** |
| Network Security Practices: Authentication applications-Electronic Mail Security | | |
| **UNIT IV** | | **9+3 Hours** |
| Network Security Practices: IP Security-Web Security | | |
| **UNIT V** | | **9+3 Hours** |
| System Security: Intruders-Malicious Software-Firewalls | | |

| LECTURE | TUTORIAL | PRACTICAL | TOTAL |
|---|---|---|---|
| 45 | 15 | - | 60 |

**TEXT BOOKS:**

1. William Stallings, Cryptography and Network Security-Principles and Practices, Prentice-Hall, Third edition, 2003

**REFERENCES:**

1. Johannes A. Buchaman, Introduction to cryptography, Springer-Verlag 2000.
2. AtulKahate, Cryptography and Network Security, Tata McGraw Hill. 2007

**Mapping of Course Outcomes (CO) with Programme Outcomes (PO):**

| M.Sc. CS | PO | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 1 | 2 |
| CO1 | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 0 |
| CO2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| CO3 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 0 |
| CO4 | 2 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 |
| CO5 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 0 |
| Average | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 2 |

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

| Course Code | | | YCS304B | L | T | P | C |
|---|---|---|---|---|---|---|---|
| Course Name | | | MOBILE AD-HOC NETWORKS | 3 | 1 | 0 | 4 |
| C | P | A | | L | T | P | H |
| 3.5 | 0.3 | 0.2 | | 3 | 1 | 0 | 4 |
| PREREQUISITE: | | | Computer Networks | | | | |

**COURSE OUTCOMES:**

| **Course outcomes:** After the completion of the course, students will be able to | | **Domain** | **Level** |
|---|---|---|---|
| **CO1:** | ***Define*** the scenario of Mobile Ad hoc Networks in the world of Computer Networks. | Cognitive<br>Psychomotor | Remember<br>Set |
| **CO2** | ***Express*** the design issues and goals of MAC Protocols. | Cognitive<br>Psychomotor | Understand<br>Perception |
| **CO3** | ***Discuss*** the Routing Protocols in MANET. | Cognitive<br>Psychomotor<br>Affective | Understand<br>Origination<br>Receive |
| **CO4** | ***Explain*** the Security issues in adhoc networks. | Cognitive<br>Psychomotor<br>Affective | Apply<br>Perception<br>Respond |
| **CO5** | ***Illustrate*** the recent trends in the Wireless Networks. | Cognitive<br>Psychomotor | Analyze<br>Mechanism |

**Unit - I Introduction** **9+3 Hours**

IIntroduction to ad-hoc networks – definition, characteristics features, applications. Characteristics of wireless channel, ad-hoc mobility models: indoor and outdoor models.

**Unit – II MAC Protocols** **9+3 Hours**

Design issues, goals and classification. Contention based protocols – with reservation, scheduling algorithms, protocols using directional antennas. IEEE standards: 802.11a, 802.11b, 802.11g, 802.15. HIPERLAN.

**Unit – III Network Protocols:** **9+3 Hours**

Routing Protocols: Design issues, goals and classification. Proactive Vs reactive routing, unicast routing algorithms, Multicast routing algorithms, hybrid routing algorithm, energy aware routing algorithm, hierarchical routing, QoS aware routing.

**Unit - IV End – End Delivery And Security** **9+3 Hours**

Transport Layer: Issues in designing – Transport layer classification, adhoc transport protocols. Security issues in adhoc networks: issues and challenges, network security attacks, secure routing protocols.

**Unit – V Cross Layer Design** **9+3 Hours**

Cross layer Design: Need for cross layer design, cross layer optimization, parameter optimization techniques, cross layer cautionary perspective. Integration of adhoc with Mobile IP networks.

| HOURS | LECTURE | TUTORIAL | TOTAL |
|---|---|---|---|
| | 45 | 15 | 60 |

**TEXT BOOKS**


1. C. Siva Ram Murthy and B. S. Manoj, Ad hoc Wireless Networks Architecture and Protocols, 2nd edition, Pearson Edition, 2007.
2. Charles E. Perkins, Ad hoc Networking, Addison – Wesley, 2000.

**REFERENCES**

1. Stefano Basagni, Marco Conti, Silvia Giordano and Ivan stojmenovic, Mobile ad-hoc networking, Wiley-IEEE press, 2004.
2. Mohammad Ilyas, The handbook of ad-hoc wireless networks, CRC press, 2002.
3. T. Camp, J. Boleng, and V. Davies " A Survey of Mobility Models for Ad-hoc Network"
4. Research, "Wireless Commun, and Mobile Comp.. Special Issue on Mobile Ad-hoc Networking Research, Trends and Applications, Vol. 2, no. 5, 2002, pp. 483 – 502.
5. A survey of integrating IP mobility protocols and Mobile Ad-hoc networks, Fekri M. bduljalil and Shrikant K. Bodhe, IEEE communication Survey and tutorials, no: 12007.

**Mapping of Course Outcomes (CO) with Programme Outcomes (PO):**

| M.Sc. | PO | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **1** | **2** |
| **CO1** | 3 | 2 | 1 | 1 | 0 | 1 | **0** | 1 | 1 |
| **CO2** | 0 | 1 | 3 | 2 | 0 | 2 | **0** | 2 | 2 |
| **CO3** | 1 | 2 | 3 | 0 | 0 | 2 | **0** | 2 | 2 |
| **CO4** | 1 | 2 | 3 | 1 | 0 | 2 | **0** | 1 | 2 |
| **CO5** | 0 | 3 | 0 | 1 | 0 | 2 | **0** | 1 | 2 |
| **Average** | 1 | 2 | 2 | 1 | 0 | 2 | **0** | 1 | 2 |

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

| Course Code | | | YCS304C | L | T | P | C |
|---|---|---|---|---|---|---|---|
| | | | | 3 | 1 | 0 | 4 |
| Course Name | | | BLOCKCHAIN MANAGEMENT | | | | |
| C | P | A | | L | T | P | H |
| 3.8 | 0 | 0.2 | | 3 | 1 | 0 | 4 |

**PREREQUISITE:**
Knowing Block chain technology and its application in various domains, Knowledge of Decentralized Applications, Decentralization.

| COURSE OUTCOMES | | DOMAIN | LEVEL |
|---|---|---|---|
| After the completion of the course, students will be able to | | | |
| **CO1** | **Discuss** the basic concepts and technology used for blockchain | Cognitive | Understand |
| **CO2** | **Describe** the primitives of the distributed computing and cryptography related to blockchain. | Cognitive | Remember |
| **CO3** | **Organize** the concepts of Bitcoin and their usage and Implement Ethereum block chain contract. | Cognitive Affective | Apply Organization |
| **CO4** | **Apply** security features in blockchain technologies | Cognitive | Apply |
| **CO5** | **Design** smart contract in real world applications | Cognitive | Create |

| UNIT I | 9+3 Hours |
|---|---|
| Block Chain :Introduction to crypto economics - Byzantine agreement - Extensions of BFT (Ripple, Stellar) - Blockchain Dynamics - Public and private blockchains - Hard and soft forks - Sharding Side chain - Verifiers – trust, cost and speed - Proof of work and other models.s | |
| **UNIT II** | **9+3 Hours** |
| Smart Contracts - Distributed Virtual Machines, Smart Contracts, Oracles - Basics of contract law - Smartcontracts and their potential Trust in Algorithms, - Integration with existing legal systems - OpenZeplin, OpenLaw- Writing smart contracts. | |
| **UNIT III** | **9+3 Hours** |
| Cryptography and Other Technologies: Application of Cryptography to Blockchain - Using hash functions to chain blocks - Digital Signatures to sign transactions - Using hash functions for Proof-of-Work. - Putting the technology together – examples of implementations with their tradeoffs. | |
| **UNIT IV** | **9+3 Hours** |
| Implementation: Supply Chain and Identity on Blockchain - Blockchain interaction with existing infrastructure – Trust in blockchain data - Scaling Blockchain – reading and writing data. Differentiate nodes, sparse data and Merkle trees - Fixing on the fly – Layer 2 solutions - Lightning and Ethereum state channels | |
| **UNIT V** | **9+3 Hours** |
| Bitcoin - The big picture of the industry – size, growth, structure, players - Bitcoin versus Crypto-currencies versus Blockchain - Distributed Ledger Technology (DLT) - Strategic analysis of the space –Major players: Blockchain platforms, regulators, application providers, etc. - Bitcoin, HyperLedger, Ethereum, Litecoin, Zcash . | |

| LECTURE | TUTORIAL | PRACTICAL | TOTAL |
|---|---|---|---|
| 45 | 15 | - | 60 |

**TEXT BOOKS:**

1. Blockchain Revolution: How the Technology BehindBitcoin and Other Cryptocurrencies Is Changing the World, Don Tapscott and Alex Tapscott, Portfolio, 2018

**REFERENCES:**

1. The Age of Cryptocurrency: How Bitcoin and the Blockchain Are Challenging the Global Economic Order, Paul Vigna and Michael J. Casey, Picador. 2016
2. Blockchain Technology Explained: The Ultimate Beginner's Guide AboutBlockchain Wallet,

Mining, Bitcoin, Ethereum, Litecoin, Zcash, Monero, Ripple, Dash, IOTA And Smart Contracts, Alan T. Norman, CreateSpace Independent Publishing Platform, 2017

**Mapping of Course Outcomes (CO) with Programme Outcomes (PO):**

| M.Sc CS | PO | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 1 | 2 |
| CO1 | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 0 |
| CO2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| CO3 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 0 |
| CO4 | 2 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 |
| CO5 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 0 |
| Average | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 2 |

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

| COURSE CODE | | | YCS305A | L | T | P | C |
|---|---|---|---|---|---|---|---|
| COURSE NAME | | | COMPUTER SIMULATION AND MODELING | 3 | 1 | 0 | 4 |
| C | P | A | | L | T | P | H |
| 3 | 0.5 | 0.5 | | 3 | 1 | 0 | 4 |
| PREREQUISITE | | | Nil | | | | |

| Course outcomes: | | Domain | Level |
|---|---|---|---|
| CO1 | **Understand** the functions, types, advanced concepts in operating system, and the process concepts. | Cognitive Psychomotor | Remember Perception |
| CO2 | **Describe** deadlock situations, the reason for deadlock, recovery of deadlocks and how to avoid deadlocks. | Cognitive Psychomotor | Understand Perception |
| CO3 | **Understand** and **analyze** the concepts of distributed operating systems, issues and file system coding in distributed system. | Cognitive Psychomotor Affective | Analyze Perception Receive |
| CO4 | **Explain** the need of Real time operating system and describe about security issues and applications of real time operating system. | Cognitive Psychomotor Affective | Apply Mechanism Respond |
| CO5 | **Organize** the information about the Linux operating system and iOS architecture, layers and their functions | Cognitive Psychomotor | Create Origination |

**Unit I Introduction to Simulation:** **9+3 Hours**

When Simulation is the Appropriate Tool- When Simulation is not Appropriate- Advantages and Disadvantages of Simulation- Areas of Application- Systems and System Environment- Components of a SystemDiscrete and Continuous Systems- Model of aSystem- Types of Models- DiscreteEvent System Simulation –Steps in a simulation study.Simulation Examples: Simulation of Queuing Systems, Simulation of Inventory Systems.

**Unit II Simulation Software:** **9+3 Hours**

History of Simulation Software- Selection of Simulation Software- Simulation in JAVA, Simulation in GPSS, Simulation in SSF- Simulation software – Experimentation and Statistical and analysis tools .

**Unit III Statistical Models in Simulation** **9+3 Hours**

Review of Terminology and Concepts- Useful Statistical Models- Discrete Distributions- Continuous Distributions- Poisson process. Queuing models- Characteristics of queuing systems.

**Unit IV Random-Number Generation:** **9+3 Hours**

Properties of Random Numbers-Generation of Pseudo- Random Numbers-Techniques for Generating Random Numbers-Linear congruential Method- Random number streams -Tests for random numbers Frequency tests - Test for Autocorrelation. Random-Variate Generation: Inverse Transform Technique-Exponential Distribution-Uniform Distribution- Weibull Distribution.

**Unit - V Input Modeling:** **9+3 Hours**

Data Collection - Identifying the Distribution with Data- parameter estimation- goodness of fit tests. Verification and Validation of Simulation Models: Model Building, Verification, and Validation-Verification of Simulation Models Calibration and Validation of Models.

| HOURS | LECTURE | TUTORIAL | TOTAL |
|---|---|---|---|
| | 45 | 15 | 60 |

**TEXT BOOKS**

1.MukeshSinghal and Niranjan G. Shivaratri, "Advanced Concepts in Operating Systems –Jerry Banks, John S. Carson, II Barry L. Nelson., Discrete-Event System Simulation, FourthEdition, PHI Edition, 2009.

**REFERENCES**

1. E.Winsberg, Science in the age of computer simulation, Chicago: University Press, 2010.

**E-REFERENCES**

https://onlinecourses.nptel.ac.in/noc21_cs44

**Mapping of Course Outcomes (CO) with Programme Outcomes (PO):**

| M.Sc. | PO | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **1** | **2** |
| **CO1** | 3 | 2 | 1 | 1 | 0 | 1 | **0** | 1 | 1 |
| **CO2** | 0 | 1 | 3 | 2 | 0 | 2 | **0** | 2 | 2 |
| **CO3** | 1 | 2 | 3 | 0 | 0 | 2 | **0** | 2 | 2 |
| **CO4** | 1 | 2 | 3 | 1 | 0 | 2 | **0** | 1 | 2 |
| **CO5** | 0 | 3 | 0 | 1 | 0 | 2 | **0** | 1 | 2 |
| **Average** | 1 | 2 | 2 | 1 | 0 | 2 | **0** | 1 | 2 |

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

| Course Code | | | YCS305B | L | T | P | C |
|---|---|---|---|---|---|---|---|
| Course Name | | | NATURAL LANGUAGE PROCESSING | 3 | 1 | 0 | 4 |
| C | P | A | | L | T | P | H |
| 3 | 0.7 | 0.3 | | 3 | 1 | 0 | 4 |

**PREREQUISITE: Nil**

| COURSE OUTCOMES: | | Domain | Level |
|---|---|---|---|
| CO1 | **Define** the Language Processing and vector space representation | Cognitive Psychomotor | Remember Set |
| CO2 | **Describe**s Transducers and Matrix Factorization | Cognitive Psychomotor | Understand Guided Response |
| CO3 | **Organize** phonological rules and spelling errors in NLP | Cognitive Affective | Apply Receiving |
| CO4 | **Examine** the correct Spelling and Pronunciation in NLP | Cognitive Affective | Apply Responding |
| CO5 | Categorize the various models and algorithm for speech recognition | Cognitive | Analyze |

**Unit - I INTRODUCTION OF NLP** **9+3 Hours**

Knowledge in Speech and Language processing, ambiguity and models and algorithm, language and understanding, brief history. Regular Expressions, Automata, Similarity Computation: Regular Expressions, patterns, FA, Formal Language, NFSA, Regular Language and FSAs, Raw Text Extraction and Tokenization, Extracting Terms from Tokens, Vector Space Representation and Normalization, Similarity Computation in Text.

**Unit – II MORPHOLOGY AND FINITE-STATE TRANSDUCERS** **9+3 Hours**

Inflection, Derivational Morphology, Finite-State Morphological Parsing, The Lexicon and Morphotactics, Morphological Parsing with Finite State Transducers, Combining FST Lexicon and Rules, Lexicon-free FSTs: The Porter Stemmer, Human Morphological Processing. Matrix Factorization and Topic Modeling: Introduction, Singular Value Decomposition, Nonnegative Matrix Factorization, Probabilistic Latent Semantic Analysis, Latent Dirichlet Allocation.

**Unit – IIICOMPUTATIONAL PHONOLOGY AND TEXT-TO-SPEECH** **9+3 Hours**

Speech Sounds and Phonetic Transcription, The Phoneme and Phonological Rules, Phonological Rules and Transducers, Advanced Issues in Computational Phonology, Machine Learning of Phonological Rules, Mapping Text to Phones for TTS, Prosody in TTS. Probabilistic Models of Pronunciation and Spelling: Dealing with Spelling Errors, Spelling Error Patterns, Detecting NonWord Errors, Probabilistic Models, Applying the Bayesian method to spelling, Minimum Edit Distance, English Pronunciation Variation, The Bayesian method for pronunciation and Weighted Automata, Pronunciation in Humans.

**Unit - IV N-GRAMS** **9+3 Hours**

Counting Words in Corpora, Simple (Unsmoothed) N-grams, Smoothing, Backoff, Deleted Interpolation, N-grams for Spelling and Pronunciation, Entropy .

**Unit – V HMMS AND SPEECH RECOGNITION** **9+3 Hours**

Speech Recognition Architecture, Overview of Hidden Markov Models, The Viterbi Algorithm Revisited, Advanced Methods for Decoding, Acoustic Processing of Speech, Computing Acoustic Probabilities, Training a Speech Recognizer, Waveform Generation for Speech Synthesis, Human Speech Recognition.

| HOURS | LECTURE | TUTORIAL | TOTAL |
|---|---|---|---|
| | 45 | 15 | 60 |

**TEXT BOOKS**

1. Daniel Jurafsky and James H.Martin Speech and Language Processing(2nd Edition),Prentice Hall:2 edition,2008.
2. Machine Learning for Text by Charu C.Aggarwal,Springer,2018 edition
3. Foundations of Statistical Natural Language Processing by Christopher D.Manning and HinrichSchuetze,MIT press, 1999

**REFERENCES**

1. Steven Bird, Ewan Klein and Edward Loper Natural Language Processing with Python, O'Reilly Media;1 edition,2009
2. Roland R.Hausser, Foundations of Computational Linguistics: HumanComputer Communication in Natural Language, Paperback,MIT press,2011

**Mapping of Course Outcomes (CO) with Programme Outcomes (PO):**

| M.Sc. | PO | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **1** | **2** |
| **CO1** | 3 | 2 | 1 | 1 | 0 | 1 | **0** | 1 | 1 |
| **CO2** | 0 | 1 | 3 | 2 | 0 | 2 | **0** | 2 | 2 |
| **CO3** | 1 | 2 | 3 | 0 | 0 | 2 | **0** | 2 | 2 |
| **CO4** | 1 | 2 | 3 | 1 | 0 | 2 | **0** | 1 | 2 |
| **CO5** | 0 | 3 | 0 | 1 | 0 | 2 | **0** | 1 | 2 |
| **Average** | 1 | 2 | 2 | 1 | 0 | 2 | **0** | 1 | 2 |

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation

| Course Code | | | YCS305C | L | T | P | C |
|---|---|---|---|---|---|---|---|
| Courese Name | | | EMBEDDED SYSTEMS | 3 | 1 | 0 | 4 |
| C | P | A | | L | T | P | H |
| 3.5 | 0.3 | 0.2 | | 3 | 1 | 0 | 4 |
| PREREQUISITE | | | | | | | |

**OBJECTIVE:**
To provide fundamental concept of Embedded systems and real time operating systems.

| Course outcomes: | | Domain | Level |
|---|---|---|---|
| CO1: | **Describe** the various processor and memory devices used in the embedded system | Cognitive Psychomotor | Remembering Set |
| CO2 | **Discuss** the fundamental concepts of programming in C and C++ | Cognitive Psychomotor | Understanding Mechanism |
| CO3 | **Organize** the software for modelling process | Cognitive Affective | Apply Receiving |
| CO4 | **Categorize** the various interrupts and scheduling Models | Cognitive | Analyze |
| CO5 | **Prescribe** the correct hardware and software code design | Cognitive | Create |

**Unit - I** **9+3 Hours**

Introduction to Embedded systems – processor in the system – software embedded into a system – structural units in a processor – processor, memory selection, Memory devices - Allocation of memory to program segments and blocks and memory map of a system.

**Unit - II** **9+3 Hours**

Device drivers – Interrupt servicing mechanisms – context and periods for context switching - Programming concepts and Embedded programming in C and C++: Software programming in ALP and in high level language 'C' – 'C' program elements: Header source files and preprocessor directives – Macros and functions: Data types – data structures – modifiers – statements – loops and pointers – Embedded programming in C++ and Java.

**Unit - III** **9+3 Hours**

Program modeling concepts in single and multiprocessor systems – software – development process: modeling process for software analysis – programming model for event controlled or response time constrained real time program- modeling of multiprocessor systems. Multiple processes – sharing data by multiple tasks and routines – inter process communications.

**Unit - IV** **9+3 Hours**

Real time operating systems: OS services – IO sub systems – Real time and embedded operating systems – Interrupt routines in RTOS environment – RTOS task scheduling models, Interrupt latency and response times of the task as performance metrics – performance metrics in scheduling models.

**Unit - V** **9+3 Hours**

Hardware Software code design: Embedded system project management – Embedded system design and Co-design Issues – Design Cycle – uses of target system – use of software tools for development – use of scopes and logic analysers for system hardware tests – issues in embedded system design.

| HOURS | LECTURE | TUTORIAL | TOTAL |
|---|---|---|---|
| | 45 | 15 | 60 |

**TEXT BOOKS**

1 Embedded systems – Architecture, Programming and Design By Raj Kamal – TMH, 2007.

**REFERENCES**

1. Mohamed Ali Maszidi& Janice GillispieMaszidi, "The 8051 Microcontroller and Embedded System", Pearson Publishers.

**Mapping of Course Outcomes (CO) with Programme Outcomes (PO):**

| M.Sc CS | PO | | | | | | | PSO | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 1 | 2 |
| CO1 | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 0 |
| CO2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| CO3 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 1 | 0 |
| CO4 | 2 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 |
| CO5 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 0 |
| Average | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 1 | 2 |

3–High Relation, 2–Medium Relation, 1–Low Relation, 0–No Relation