Course Title: Data Warehousing and Data Mining
Course no: CSC- 451 Full Marks**:** 60+20+20
Credit hours: 3 Pass Marks**:** 24+8+8

Nature of course: Theory (3 Hrs.) + Lab (3 Hrs.)

Course Synopsis: Analysis of advanced aspect of data warehousing and data mining.

Goal: This course introduces advanced aspects of data warehousing and data mining, encompassing the principles, research results and commercial application of the current technologies

Course Contents:

Unit- 1 **5 Hrs.**

Concepts of Data Warehouse and Data Mining including its functionalities, stages of Knowledge discovery in database(KDD) , Setting up a KDD environment, Issues in Data Warehouse and Data Mining, Application of Data Warehouse and Data Mining

Unit-2 **4 Hrs.**

DBMS vs. Data Warehouse, Data marts, Metadata, Multidimensional data model, Data Cubes, Schemas for Multidimensional Database: Stars, Snowflakes and Fact Constellations.

Unit- 3 **6 Hrs.**

Data Warehouse Architecture, Distributed and Virtual Data Warehouse, Data Warehouse Manager, OLTP, OLAP, MOLAP, HOLAP, types of OLAP, servers.

Unit- 4 **4 Hrs.**

Computation of Data Cubes, modeling: OLAP data, OLAP queries, Data Warehouse back end tools, tuning and testing of Data Warehouse.

Unit- 5 **4Hrs.**

Data Mining definition and Task, KDD versus Data Mining, Data Mining techniques, tools and application.

Unit- 6 **5Hrs.**

Data mining query languages, data specification, specifying knowledge, hierarchy specification, pattern presentation & visualization specification, data mining languages and standardization of data mining.

Unit- 7 **6 Hrs.**

Mining Association Rules in Large Databases: Association Rule Mining, why Association Mining is necessary, Pros and Cons of Association Rules, Apriori Algorithm.

Unit- 8 **7 Hrs.**

Classification and Prediction: Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Introduction to Regression, Types of Regression, Introduction to clustering, K-mean and K-Mediod Algorithms.

Unit- 9 **4 Hrs.**

Mining Complex Types of Data: Mining Text Databases, Mining the World Wide Web, Mining Multimedia and Spatial Databases.

Laboratory Works: Cover all the concept of datawarehouse and mining mention in a course

Samples

1. Creating a simple data warehouse
2. OLAP operations: Roll Up, Drill Down, Slice, Dice through SQL- Server
3. Concepts of data cleaning and preparing for operation
4. Association rule mining though data mining tools
5. Data Classification through data mining tools
6. Clustering through data mining tools
7. Data visualization through data mining tools

Reference books:

1. Data Mining Concepts and Techniques, Morgan Kaufmann J. Han, M Kamber Second Edition ISBN: 978-1-55860-901-3
2. Data Warehousing in the Real World – Sam Anahory and Dennis Murray, Pearson Edition Asia.
3. Data Mining Techniques – Arun K Pujari, University Press.
4. Data Mining- Pieter Adriaans, DolfZantinge
5. Data Mining, Alex Berson,StephenSmith,KorthTheorling,TMH.
6. Data Mining, Adriaans, Addison-Wesley Longman.

Course Title: Internship

Course no: CSC-452 **Full Marks**: 200

Credit hours: 6 **Pass Marks**: 80

Nature of course: Project

Course Synopsis

The students are required to complete a six credit (minimum ten weeks/180 hour long) internship as a part of the course requirement. Industry is a crucial requirement of the Internship course and this will have to be secured before getting started with the course. The work that the students perform during the Internship will have to be supervised by the faculty members as well as by representatives from the participating Industries. The internship experience is expected to enable the students to assist in the resolution of complex problem associated with Database systems.

At the end of the Internship, the student(s) are required to write a report on their internship work. Such a report needs to be structured according to the prescribed format. The Report forms a major aspect of the evaluation of the Internship work.

Goal

Main goal is to assist students in focusing their interests, thus aiding in their professional carrier. It gives students the opportunity to re-examine their career objectives and explore the variety of opportunities in the field of computer networking.

Preparation

Students, the advisors, and the industry/organization, with which the student team is affiliated, will have to agree on a problem that needs to be addressed during the internship. An internship is designed by the advisor and the student according to mutual interests, needs and availability of related industry/organization. To develop a rewarding program, at the beginning of the internship, the advisor and student are asked to establish an internship plan, in the form of written objectives and goals, and to develop a strategy for attaining those goals. The plan may include a schedule of activities that need to be carried out in order to reach a solution for the problem being addressed. The internship plan is not intended to be rigid. Advisor may be unable

to assess certain responsibilities until the student demonstrates his or her ability. The plan should be flexible and subject to revision. The advisor and student should assess the student's progress throughout the term of the internship both to evaluate the student's performance, and to establish new directions as needed.

Role of the Advisor

Advisors are expected to share their experience, insight, and enthusiasm with the student throughout the internship. They should continually monitor the progress of the student, assessing written and oral communications and guiding the development of the student's technical and managerial skills, effectiveness and presentation of self. Advisors are expected to submit a post-internship evaluation of the student's accomplishments and abilities and of the internship program in general.

Role of the Student

In order for the internship to be a mutually beneficial experience, a student should begin with a definition of his/her objectives and specific interests for the minimum of 10-week/180 hour period to ensure that appropriate activities and projects are selected by the advisor and the student. The student will be responsible for the timely completion and professional quality of all activities and projects assigned. The student is expected to speak frequently with the advisor on his/her progress and interest in other projects, as well as to discuss observations and questions about meetings, projects and other activities with which he/she is involved.

The student is required to submit to Advisor, within the first two weeks of the internship, a brief plan for the internship.

Internship Group Size and document preparation

- Each group must be of maximum 4 Students
- Each student should prepare Individual document on the basis of his/her part in the group project.
- Supervisors must be assigned to each group

Domain/Scope of Internship (Project Implementation /Research)

-Bank

-Hospitals

-Software Companies

-NTC, Ncell and other Telecommunication Sectors

-Government Organizations (IT Related) etc

Report Format

APA Format

Tentative Contents of Report

- Abstract
- Introduction (organization +Work Done)
- Statement of the problem and Objective
- Literature Review and methodology (Optional)
- System Analysis
- System Design
- Implementation
- System Testing
- Limitation/future enhancement
- Conclusion
- References and Bibliography

Evaluation Criteria

Proposal Defense : 10% weight {Evaluated by Supervisor and Mentor}

Mid-Term : 30% weight {Evaluated by Supervisor and Mentor}

End-Term : 60% weight.

Proposal Defese (At beginning of the internship)

- Topic Selection with Proposal (5 of total)
- Presentation (5% of total).

Mid-Term (After 2 month)

- Program Design (10% of total)
- Demo Presentation (10% of total).
- Viva (10% of total)

End-Term (After Completion of internship and before final Exam)

- Depth of work (15% of total)
- Report (25% of total)
- Viva (10% of total)
- Presentation (10% of total)

Note: External examiner assigned from TU will be present in final presentation. External Examiner along with Supervisors, Mentor will evaluate internship of students. Proportion of the marks will be same for all evaluators.

Course Title: Advanced Networking with IPv6
Course no: CSC-453 Full Marks: 60+20+20
Credit hours: 3 Pass Marks: 24+8+8
Nature of course: Theory (3 Hrs.) + Lab (3 Hrs.)

Course Synopsis: Study of Advanced Networking with IPv6

Goal: The course covers about: principles underlying IPv6 Network Design; Internet routing protocols (unicast, multicast and unidirectional) with IPv6; algorithmic issues related to the Internet; IPv6 Migration; measurement and performance; next generation Internet (IPv6, QoS) and applications.

Course Contents:

1 Networking Protocols **6Hrs.**

1.1 OSI Model
1.2 Internet IP/UDP/TCP
1.3 Routing in the Internet & CIDR
1.4 Multicasting
1.5 Unidirectional Link Routing

2 Next Generation Internet **8Hrs.**

2.1 Internet Protocol Version 6 (IPv6)
2.2 History of IPv6
2.3 IPv6 Header Format
2.4 Feature of IPv6
2.5 International trends and standards
2.6 IPv6Addressing (Unicast, Anycast & Multicast)

3 ICMPv6 and Neighbor Discovery **6Hrs.**

3.1 ICMPv6 General Message Format
3.2 ICMP Error and Information Message Types
3.3 Neighbor Discovery Processes and Messages
3.4 Path MTU Discovery
3.5 MLD overview

4 Security and Quality of Service in IPv6 **6Hrs.**

4.1 Types of Threats
4.2 Security Techniques
4.3 IPSEC Framework
4.4 QoS Paradigms
4.5 QoS in IPv6 Protocols

5 IPv6 Routing **4Hrs.**

5.1 RIPng
5.2 OSPF for IPv6
5.3 BGP extensions for IPv6
5.4 PIM-SM & DVMRP for IPv6

6 IPv4/IPv6 Transition Mechanisms **8Hrs.**

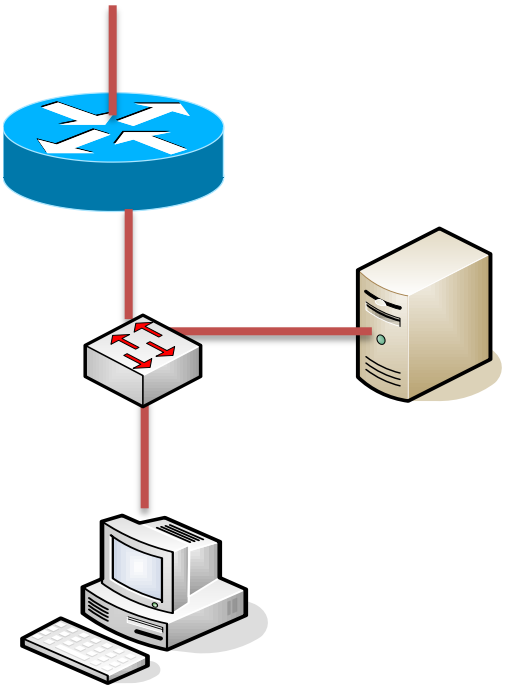
6.1 Migration Strategies
6.2 Tunneling
- 6.2.1 Automatic Tunneling
- 6.2.2 Configured tunneling

6.3 Dual Stack
6.4 Translation
- 6.4.1 NAT-PT

7 IPv6 Network and Server Deployment **7Hrs.**

7.1 IPv6 Network Configuration in Linux and Windows Machines
7.2 IPv6 enabled WEB/PROXY/DNS/MAIL Server Configuration
7.3 IPv6 Deployment: Challenges and Risks
7.4 IPv6 and the NGN

Laboratory work: For the lab work, one PC to one student either in virtual environment or real environment will be provided. Students will be divided into group of 3 students. The working environment and machine connectivity will look like the following:



Tools Needed: TCPDUMP & WIRESHARK, VMWare Environment, Linux/FreeBSD, Windows

Lab 1: Enable IPv6 in Windows/Linux
Lab 2: IPv6 Header Analysis
Lab 3: IPv6 Packet analysis (neighbor/router solicitation/discovery)
Lab 4: Unicast Routing Implementation using Zebra-OSPF & OSPF phase analysis
Lab 5: Multicast Routing Implementation using XORP-PIM/SM & PIM/SM phase analysis
Lab 6: IPv6 DNS/WEB/Proxy implementation & test
Lab 7: Case Study

Reference Book:

1. *Silvia Hagen:* IPv6 Essentials, O'reilly
2. *Joseph Davies:* Understanding IPv6; eastern economy edition
3. *J. F. Kurose and K. W. Ross:* Computer Networking - A Top-Down Approach Featuring the Internet, Addison-Wesley, 2000.
4. *S. A. Thomas:* IPng and the TCP/IP Protocols, Wiley, 1995
5. *O. Hersent, D. Gurle, J.-P. Petit:* IP Telephony, Addison-Wesley, 2000.
6. *Lecture Notes and Related RFCs*

Prerequisite: Networking & Communications Fundamentals

Course Title: Distributed Networking
Course no: CSC-454 Full Marks: 60+20+20
Credit hours: 3 Pass Marks: 24+8+8

Nature of course: Theory (3 Hrs.) + Lab (3 Hrs.)

Course Synopsis: Design and development of distributed networking system.

Goal: The course covers about: the function and structure of communications sub-nets, network architectures and their protocols, approaches to the organisation of sub-nets and their architectures, processes of network and protocol design, role of network standards and their relationship to products, Network OS, Distributed Object Network and advance applications.

Course contents:

Unit 1: 8Hrs

Protocols-functions, design, implementation and testing, Architectures, Standards and Protocols-TCP OSI/IP, connectionless and connection-oriented protocols, protocol stacks, Internetworking-bridges and routers, Internet design and evolution.

Unit 2: 8Hrs

Network Design, Performance, Operation and Management-architecture, interoperability and open systems issues, Introduction to Distributed Systems-client/server model, workstations.

Unit 3: 8Hrs

Inter-process Communication: API for Internet protocols, External data representation and Marshalling, Client server architecture, Peer-to-peer architecture, Client-Server communication and Group communication

Unit 4: 8Hrs

Distributed Objects and Remote Invocation: Communication between distributed objects, Remote Procedure Call, Remote Object Invocation, Message- and Stream-oriented communication, Distributed Web-Based Systems, Common Carrier Services

Unit 5: 8hrs

Distributed OS: network operating systems, Distributed File systems, Distributed synchronization, Distributed object-based systems, Fault Tolerant Computing Systems.

Unit 6: 5hrs

Advance Application: Grid Computing and Application, virtualization and cloud computing

Laboratory: the laboratories include the installation and configuration of Distributed (network) OS, implementation of Distributed Web based systems, RMI and RPC programming and implementation with JAVA and conceptualization of grid and cloud applications.

Reference Books:

1. Comer DE, (1995), Internet working with TCP/IP Vol. 1, 3e, Prentice-Hall.
2. Hagit Attiya, Jennifer Welch, Distributed Computing: Fundamentals, Simulations, and Advanced Topics, 2nd Edition, March 2004
3. Distributed Systems: Principles and Paradigms - Andrew Tanenbaum and Maarten van Steen, Prentice Hall, 2007

Prerequisite: Networking and Communications Fundamentals

Course Title: Network Security
Course no: CSC-455 Full Marks: 60+20+20
Credit hours: 3 Pass Marks: 24+8+8

Nature of course: Theory (3 Hrs.) + Lab (3 Hrs.)

Course Synopsis: Study of different network security concepts and methods

Goal: In this age of universal electronic connectivity, viruses and hackers, electronic eavesdropping, and electronic fraud, security is paramount. This course provides a practical survey of the principles and practice of network security.

Course Contents:

1. **Introduction** 6**hrs**.

   1.1 Computer Security Concepts
   1.2 The OSI Security Architecture
   1.3 Security Attacks
   1.4 Security Services
   1.5 Security Mechanisms
   1.6 A Model for Network Security

2. **Key Management and Distribution** 5**Hrs.**

   2.1 Symmetric Key Distribution Using Symmetric Encryption
   2.2 Symmetric Key Distribution Using Asymmetric Encryption
   2.3 Distribution of Public Keys
   2.4 X.509 Certicates
   2.5 Public Key Infrastructure

3. **User Authentication Protocols** **6Hrs.**

   3.1 Remote User Authentication Principles
   3.2 Remote User Authentication Using Symmetric Encryption
   3.3 Kerberos
   3.4 Remote User Authentication Using Asymmetric Encryption
   3.5 Federated Identity Management

4. **Transport-Level Security** **6Hrs.**

   4.1 Web Security Issues
   4.2 Secure Sockets Layer (SSL)
   4.3 Transport Layer Security (TLS)
   4.4 HTTPS

4.5 Secure Shell (SSH)

5. Wireless Network Security **7Hrs.**

5.1 IEEE 802.11 Wireless LAN Overview
5.2 IEEE 802.11i Wireless LAN Security
5.3 Wireless Application Protocol Overview
5.4 Wireless Transport Layer Security
5.5 WAP End-to-End Security

6. Electronic Mail Security **3Hrs.**

6.1 Pretty Good Privacy (PGP)
6.2 S/MIME
6.3 DomainKeys Identified Mail (DKIM)

7. IP Security **8Hrs.**

7.1 IP Security Overview
7.2 IP Security Policy
7.3 Encapsulating Security Payload
7.4 Combining Security Associations
7.5 Internet Key Exchange
7.6 Cryptographic Suites

8. Cyber Security Overview **4Hrs.**

Laboratory Work: All the features covered in this syllabus.

Reference Book:

Cryptography and Network Security: Principles and Practice, 5/E,**William Stallings,** ISBN-10: 0136097049, Prentice Hall, India Limited

Course Title: **Multimedia Database**
Course No: CSC-456
Credit hours : 3

Nature of course: Theory (3 Hrs.) + Lab (3 Hrs.)

Course Synopsis: Advanced aspects of multimedia database, indexing and retrieval

Goal: To study advanced aspects of indexing, storage device, retrieval of multimedia information encompassing the principles, research results and commercial application of the current technologies.

Course Contents:

Unit 1: Multimedia introduction **3 Hrs**

Introduction to multimedia databases, issues related to multimedia data types, media types, text document information retrieval, indexing

Unit 2: Multimedia Data types and formats **3 Hrs**

Text, vector graphics and animation, digital images and digital video, major characteristics and requirements of multimedia data and applications

Unit 3: Multimedia database design issues **2 Hrs**

MIRS architecture, data models and user interface, User Interface design and feature Extraction, Indexing and similarity measure

Unit 4: Text Document Indexing and retrieval **5 Hrs**

Automatic text document indexing and Boolean Retrieval model, Vector space retrieval model, probabilistic model and cluster-based retrieval model, Nontraditional IR methods, Performance measurement, WWW search engines

Unit 5: Indexing and retrieval of audio **2 Hrs**

Audio properties and classification, Speech recognition and retrieval, Music indexing and retrieval

Unit 6: Image Indexing and retrieval **5 Hrs**

Colour –based image indexing and retrieval techniques, Image retrieval based on shape, on texture, Compressed image data, integrated image indexing

Unit 7 : Multimedia Indexing and retrieval **5 Hrs**

Video shot detection or segmentation, video indexing and retrieval, Video representation and abstraction, Architecture of multimedia Information Management, user interface with example

Unit 8: Techniques and data structures for efficient multimedia similarity search **5 Hrs**

Filter process, B+ and B trees, Clustering, Multidimensional B+ tree, K-d trees, Grid files, Tree family

Unit 9: System support for distributed multimedia databases **5 Hrs**

QoS management, Design goals, Data storage devices and management, Data placement on disks, Disk scheduling and admission control, Server configuration and network connection

Unit 10: Multimedia computer architectures and operating system **4 Hrs**

Process architectures, Computer architectures, Design issues of MOS, QoS support, Multimedia networks, Transport protocols, Synchronous presentation

Unit 11 : Measurement of multimedia information retrieval effectiveness **3 Hrs**

Human Judgment data, Recall and precision pari, Percentage of Weighted Hits, Similarity Ranking, Factors affecting retrieval effectiveness

Unit 12: Products, application and new development **3 Hrs**

Multimedia search engine, Digital libraries, Video –on-demand, Multimedia security, MPEG-7, Multimedia database applications

Laboratory work: There should be labs related to Multimedia Database

Reference books:

1. Gunjoun Lu, Multimedia database management systems
2. G. Lu, Multimedia Database Management Systems, Artech House, 1999.
3. T. Shih, Distributed Multimedia Databases: Techniques and Applications, IRM Press, 2002.
4. V.S. Subrahmanian, Principles of Multimedia Database Systems, Morgan Kaufmann, 1998.

Course Title: Distributed and Object Oriented Database
Course no: CSC-457 Full Marks: 60+20+20
Credit hours: 3 Pass Marks: 24+8+8

Nature of course: Theory (3 Hrs.) + Lab (3 Hrs.)

Course Synopsis: Design and development of distributed and Object oriented database systems

Goal: This course introduces fundamental concept and implementation of object oriented and distributed database systems with focus on data distribution, query processing, transaction processing, concurrency control and recovery.

Course Contents:

Unit 1: 12 hrs.

1.1 Introduction to Distributed Database: Distributed Data Processing, Concept of Distributed Database. Distributed vs Centralized Database System; advantages and Application. Transparency, performance and reliability. Problem areas of Distributed Database. Integrity Constraints in Distributed Databases.

1.2 Distributed Database Architectures: DBMS standardization. Architectural models for Distributed DBMS – autonomy, distribution and heterogeneity. Distributed Database architecture – Client/Server, Peer-to-Peer distributed systems, MDBS Architecture. Distributed Catalog management.

1.3 Distributed Database Design: Design strategies and issues. Data Replication. Data Fragmentation – Horizontal, Vertical and Mixed. Resource allocation. Semantic Data Control in Distributed DBMS.

Unit 2: 17 hrs.

2.1 Distributed Query Processing: Query Decomposition and Data localization for distributed data, join ordering, semi-join strategy, Distributed Query optimization methods.

2.2 Distributed Transaction Management: The concept and role of transaction. Properties of transactions-Atomicity, Consistency, Isolation and Durability. Architectural aspects of Distributed Transaction, Transaction Serialization.

2.3 Distributed Concurrency Control: Lock-based and Timestamp-based Concurrency Control methods. Optimistic method for Concurrency Control. Deadlock management- prevention, avoidance detection, and resolution. Non-serializable schedule and nested distributed transaction.

2.4 Reliability of Distributed DBMS and Recovery: Concept and measures of reliability, Failure analysis, types of failures. Distributed Reliability Protocols. Recovery techniques. Two Phase Commit , Presumed abort, Presumed commit. Three phase commit, Partitions, Scalability of Replication.

Unit 3: 16 hrs.

3.1 Object Oriented Database Concept: Data types and Object, Evolution of Object Oriented Concepts, Characteristics of Object Oriented Data Model. Object Hierarchies - Generalization, Specialization, Aggregation. Object Schema. Inter-object Relationships, Similarities and difference between Object Oriented Database model and Other Data models.

3.2 OODBMS Architecture Approach: The Extended Relational Model Approach. Semantic Database Approach, Object Oriented Programming Language Extension Approach, DBMS Generator Approach, the Object Definition Language and the Object Query Language.

3.3 The Object Oriented DBMS Architecture, Performance Issue in Object Oriented DBMS, Application Selection for Object Oriented DBMS, the Database Design for an Object Relational DBMS. The Structured Typed and ADTs, Object identity, Extending the ER Model ,Storage and Access Methods, Query Processing Query Optimization, Data Access API(ODBC,DB Library, DAO,ADO,JDBC,OLEDB), Distributed Computing Concept in COM, COBRA.

Laboratory works: All distributed and OO database components mentioned in this course.

(Practical implementation in Oracle 9i or Oracle 10g covering both Distributed and Object Oriented Database Features)

Reference Book:

1. Principles of Distributed Database Systems; Ozsu, M. Tamer and Patrick Valduriez. Pearson Education.
2. Object Oriented Database System – Approaches and Architectures ; C.S.R. Prabhu, PHI
3. Silberschatz,Abraham, Henry F. Korth and S. Sudarshan: Database System Concepts; McGrawHill International Edition.
4. Gerald V. Post: Database Management System – McGraw Hill International Edition.
5. Peter Rob, Carlos Coronnel: Database Systems – Design, Implementation and Management; Course Technology.
6. R.Cattel: "Object Data management",(1993),Addison-Wesley

Prerequisite:	Relational Database Management System, SQL, Computer Network , Object Oriented Programming Languages
Homework Assignment:	Assignment should be given throughout the semester.

Course Title: Cloud Computing
Course No: CSC-458 Full Marks: 60+20+20
Credit Hours: 3 Pass Marks: 24+8+8

Nature of the course: Theory (3Hrs.) + Lab (3Hrs.)

Course synopsis: This course gives an introduction to cloud computing and its techniques. The topics covered include; introduction to cloud computing, cloud architecture, cloud service models, Service Oriented Architectures, security in cloud computing, disaster management in clouds.

Goal: Cloud computing has become a great solution for providing a flexible, on-demand, and dynamically scalable computing infrastructure for many applications. Cloud computing also presents a significant technology trends, and it is already obvious that it is reshaping information technology processes and the IT marketplace. Thus objective of this course is to introduce the aspects of cloud computing issues.

Course Contents:

Unit1: Introduction 10 Hrs.

Defining the Cloud, The Emergence of Cloud Computing, Cloud-Based Services, Grid Computing or Cloud Computing, Components of Cloud Computing, Cloud Computing Deployment Models: Public, Private, Hybrid, Benefits of Using a Cloud Model, Legal Issues in Using Cloud Models, Characteristics of Cloud Computing, Evolution of Cloud Computing, Challenges for the Cloud computing, Grid Computing, Distributed Computing in Grid and Cloud

Unit2: Cloud Service Models 15 Hrs.

Communication-as-a-Service (CaaS): Advantages of CaaS, Fully Integrated, Enterprise-Class Unified Communications, Infrastructure-as-a-Service (IaaS): Modern On-Demand Computing, Amazon's Elastic Cloud, Amazon EC2 Service Characteristics, Monitoring-as-a-Service (MaaS), Protection Against Internal and External Threats, Platform-as-a-Service (PaaS): The Traditional On-Premises Model, The New Cloud Model, Key Characteristics of PaaS, Software-as-a-Service (SaaS): SaaS Implementation Issues, Key Characteristics of SaaS, Benefits of the SaaS Model, Jericho Cloud Cube Model

Unit 3: Building Cloud Networks 9 Hrs.

Evolution from Managed service providers (MSP) to Cloud Computing, Single Purpose architectures to multi-purpose architectures, Data center virtualization, Cloud data center, Service Oriented Architectures (SOA), Combining and SOA, Characterizing SOA, Open Source Software in data centers

Unit 5 : Security in Cloud Computing **11 Hrs.**

Cloud Security Challenges, Software-as-a-Service Security: Security management, Risk Management, Security Monitoring and Incident Response, Security Architecture Design, Vulnerability Assessment, Data Privacy and Security, Application Security, Virtual Machine Security, disaster Recovery, Disasters in cloud, Disaster management

Laboratory work: As a part of lab work, the students are highly encouraged

- To simulate the concept of virtualization using virtualization programs/systems.
- To understand and practice examples of cloud services and applications.
- To understand and implement distributed storage and security issues in cloud computing.

Reference Books:

1. ***Cloud Computing: Implementation Management and Security***, John W. Rittinghouse and James F. Ransome (Recommended for Unit 1, 2, 3 4)

2. ***Cloud Application architecture***, George Reese (Recommended for Unit 4)

3. ***Cloud Computing for Dummies***, Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper(Recommended for Unit 3)

4. ***Handbook of cloud computing***, Borko Furht, Armando Escalante (Recommended for Unit 1)

5. **Cloud Computing and SOA Convergence in your Enterprise**, a step by step guide, David S. Linthicum (Recommended for Unit 1, 2, 3)

Course Title: Geographical Information System
Course no: CSC-459 Full Marks: 60+20+20
Credit hours: 3 Pass Marks: 24+8+8

Nature of course: Theory (3 Hrs.) + Lab (3 Hrs.)

Course Synopsis: Basic concepts of Geographical Information System

Goal: The course covers about spatial data modelling and database design, capturing the real world, spatial analysis and visualization, overview of open GIS

Course Contents:

Unit 1: Introduction 6hrs.

1.1 Overview, History and concepts of GIS
1.2 Scope and application areas of GIS
1.3 Purpose and benefits of GIS
1.4 Functional components of GIS
1.5 Importance of GPS and remote sensing data in GIS

Unit2: Digital mapping concept 3 hrs.

2.1 Map concept: map elements, map layers, map scales and representation
2.2 Map projection: coordinate system and projection system

Unit 3: spatial data modeling and database design 9 hrs.

3.1 introduction to geographic phenomena and data modeling
3.2 spatial relationships and topology
3.3 scale and resolution
3.4 vector, raster and digital terrain model
3.5 Spatial database design with the concepts of geodatabase.

Unit 4: capturing the real world 8hrs.

4.1 different methods of data capture
4.2 map projection and spatial reference
4.3 data preparation, conversion and integration
4.4 quality aspects of spatial data
4.5 GPS
4.6 Remote Sensing

Unit 5: spatial analysis and visualization 7hrs.

5.1 spatial analysis
i. overlay
ii. buffering

5.2 map outputs and its basic elements

Unit 6: introduction to spatial data infrastructure **8hrs.**

6.1 SDI concepts and its current trend
6.2 The concept of metadata and clearing house
6.3 Critical factors around SDIs

Unit 7: Open GIS **4hrs.**

7.1 Introduction of open concept in GIS
7.2 Open source software for spatial data analysis
7.3 Web Based GIS system
7.4 System Analysis and Design with GIS

Laboratory work: The lab should cover at least the concepts given the chapters

Reference books:

1- Principles of geographic information systems: An introductory textbook, international institute for Geo-information science and Earth observation, the Netherlands- By rolf De By, Richard A. knippers, yuxian sun
2- ESRI guide to GIS analysis Andy Mitchell, ESRI press, Red lands
3- GIS Cook BOOK

Course Title: Decision Support System
Course No: CSC-460 Full Marks**:** 60 + 20 +20
Credit Hrs: 3 Pass Marks**:** 20 + 8 + 8

Nature of course: Theory (3 Hrs.) + Lab (3 Hrs.)

Course Synopsis: This course covers introduction to decision support systems; DSS components; Decision making; DSS software and hardware; developing DSS; DSS models; types of DSS; data mining; artificial intelligence and expert Systems.

Goal: The course is devoted to introduce decision support systems; show their relationship to other computer-based information systems, demonstrate DSS development approaches, and show students how to utilize DSS capacities to support different types of decisions.

Course Contents:

Unit 1: Decision Making and Computerized Support

1.1. Management Support Systems: An Overview 3 Hrs.
Managers and Decision-Making; Managerial Decision-Making and Information Systems; Managers and Computer Support; Computerized Decision Support and the Supporting Technologies; A Framework for Decision Support; The Concept of Decision Support Systems; Group Support Systems; Enterprise Information Systems; Knowledge Management Systems; Expert Systems; Artificial Neural Networks; Advanced Intelligent Decision Support Systems; Hybrid Support Systems

1.2. Decision-Making Systems, Modeling, and Support 5 Hrs.
Decision-Making: Introduction and Definitions; Systems; Models; Phases of the Decision-Making Process; Decision-Making: The Intelligence Phase; Decision-Making: The Design Phase; Decision-Making: The Choice Phase; Decision-Making: The Implementation Phase; How Decisions Are Supported; Personality Types, Gender, Human Cognition, and Decision Styles; The Decision-Makers

Unit 2: Decision Support Systems

2.1. Decision Support Systems: An Overview 3 Hrs.
DSS Configurations; What Is a DSS?; Characteristics and Capabilities of DSS; Components of DSS; The Data Management Subsystem; The Model Management Subsystem; The User Interface (Dialog) Subsystem; The Knowledge-Based Management Subsystem; The User; DSS Hardware; DSS Classifications

2.2. Modeling and Analysis 4 Hrs.

MSS Modeling; Static and Dynamic Models; Certainty, Uncertainty, and Risk; Influence Diagrams; MSS Modeling with Spreadsheets; Decision Analysis of a Few Alternatives (Decision Tables and Decision Trees); The Structure of MSS Mathematical Models; Mathematical Programming Optimization; Multiple Goals, Sensitivity Analysis, What-If, and Goal Seeking; Problem-Solving Search Methods; Heuristic Programming; Simulation; Visual Interactive Modeling and Visual Interactive Simulation; Quantitative Software Packages; Model Base Management

2.3.Business Intelligence: Data Warehousing, Data Acquisition, Data Mining, Business Analytics, and Visualization 4 Hrs.

The Nature and Sources of Data; Data Collection, Problems, and Quality; The Web/Internet and Commercial Database Services; Database Management Systems in Decision Support Systems/ Business Intelligence; Database Organization and Structures; Data Warehousing; Data Marts; Business Intelligence/Business Analytics; Online Analytical Processing (OLAP); Data Mining; Data Visualization, Multidimensionality, and Real-Time Analytics; Geographic Information Systems; Business Intelligence and the Web: Web Intelligence/Web Analytics

2.4. Decision Support System Development 3 Hrs.

Introduction to DSS Development; The Traditional System Development Life Cycle; Alternative Development Methodologies; Prototyping: The DSS Development Methodology; Change Management; DSS Technology Levels and Tools; DSS Development Platforms; DSS Development Tool Selection; Team-Developed DSS; End User Developed DSS; Putting The DSS Together

Unit 3: Knowledge Management

3.1. Knowledge Management 5 Hrs.

Introduction to Knowledge Management; Organizational Learning and Transformation; Knowledge Management Initiatives; Approaches to Knowledge Management; Information Technology in Knowledge Management; Knowledge Management Systems Implementation; Roles of People in Knowledge Management; Ensuring Success of Knowledge Management

Unit 4: Intelligent Decision Support Systems

4.1. Artificial Intelligence and Expert Systems: Knowledge-Based Systems 5 Hrs.

Concepts and Definitions of Artificial Intelligence; Evolution of Artificial Intelligence; The Artificial Intelligence Field; Basic Concepts of Expert Systems; Applications of Expert Systems; Structure of Expert Systems; How Expert Systems Work; Problem Areas Suitable for Expert Systems; Benefits and Capabilities of Expert Systems; Problems and Limitations of Expert Systems; Expert System Success Factors; Types of Expert Systems; Expert Systems on the Web

4.2. Knowledge Acquisition, Representation, and Reasoning 5 Hrs.

Concepts of Knowledge Engineering; Scope and Types of Knowledge; Methods of Knowledge Acquisition from Experts; Knowledge Acquisition from Multiple Experts; Automated Knowledge Acquisition from Data and Documents; Knowledge Verification and Validation; Representation of Knowledge; Reasoning in Rule-Based Systems; Explanation and

Metaknowledge; Inferencing with Uncertainty; Expert Systems Development; Knowledge Acquisition and the Internet

4.3. Advanced Intelligent Systems **5 Hrs.**

Machine-Learning Techniques; Case-Based Reasoning; Basic Concept of Neural Computing; Learning in Artificial Neural Networks; Developing Neural Network-Based Systems; Genetic Algorithms Fundamentals; Developing Genetic Algorithm Applications; Fuzzy Logic Fundamentals; Developing Integrated Advanced Systems

4.4. Intelligent Systems over the Internet **3 Hrs.**

Web-Based Intelligent Systems; Intelligent Agents: An Overview; Characteristics of Agents; Why Intelligent Agents?; Classification and Types of Agents; Internet-Based Software Agents; DSS Agents and Multi-Agents; Semantic Web: Representing Knowledge for Intelligent Agents; Web-Based Recommendation Systems; Managerial Issues of Intelligent Agents

Laboratory Work: The laboratory should contain the concepts of artificial intelligence that are applicable to the development of decision support systems.

Reference Books:

1. Decision Support Systems and Intelligent Systems, Seventh Edition, Efraim Turban, Jay E. Aronson, Richard V. McCarthy, Prentice-Hall of India, 2007
2. Decision Support Systems, A Knowledge-Based Approach, Clyde W. Holsapple and Andrew B. Whinston
3. Decision Support Systems For Business Intelligence by Vicki L. Sauter