# SYLLABUS

## MSc (CS/IT)

### 3rd SEMESTER

To produce world-class professionals who have excellent analytical skills, communication skills, team building spirit and ability to work in cross cultural environment.

To produce international quality IT professionals, who can independently design, develop and implement computer applications.

Professionals who dedicate themselves to mankind, who are environment conscious, follow social norms and ethics.


**School of Computer Science & IT,**

**Devi Ahilya Vishwa Vidyalaya, Indore**

**www.scs.dauniv.ac.in**

Course Name: **MSc (CS/IT) 3rd Semester**

Subject Code: **CS-5613**

Subject Name: **Computer Networks**

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**Aim of the Subject**

Understand the fundamental concepts and basic principles of computer networks.

**Learning Outcomes**

The students are expected to learn following after completion of the course:

- Familiarity with network terminologies, reference model, applications of network, design
- issues and the way computer network works.
- Problems associated with broadcast network and multiple access control protocols, knowledge of IEEE 802.3, 802.4 and 802.5, 802.11
- Design issues related to Network layer like routing, addressing and their protocols.
- Idea about client server architecture and working of DNS, HTTP and E Mail.
- Security issues in computer network and Introduction to Cryptographic algorithms and
- Digital Signature.

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## Unit 1

Introduction: Overview, Goal and Applications of Computer Networks; Network Classification - LAN, MAN, WAN, Internetworks and topologies; Network Software - Protocol hierarchies, Design issues for the layers, Connection Oriented and Connection less services, Service primitives, Relationship between Services and Protocols; Switching Techniques – Circuit Switching and Packet Switching; Reference models – OSI and TCP/IP, comparison and critique of OSI and TCP/IP reference models.

Physical layer: Guided Transmission Media- Magnetic Media, Twisted Pairs, Coaxial Cable, Power Lines, Fiber Optics; Wireless Transmission- Electromagnetic Spectrum, Radio Transmission, Microwave Transmission; digital modulation and multiplexing; The public switched telephone network - Structure of telephone network; The mobile telephone system - Generations of mobile phones.

## Unit 2

Data Link Layer: Design issues – Services, Framing, Error Control and Flow Control; Error Detection Techniques - Parity Check and Cyclic Redundancy Check (CRC); Error Correction

Technique - Hamming code; Elementary Data Link Protocols - Unrestricted Simplex Protocol, Simplex Stop-and-Wait Protocol; Sliding Window Protocols - One-Bit Sliding Window Protocol, protocol using Go Back N and Selective Repeat; Data link layer in the Internet - PPP.

**Unit 3**

Medium Access Sublayer: Channel Allocation problem; Multiple access protocols- Pure Aloha, Slotted Aloha, CSMA Protocols, CSMA/CD, Collision-Free Protocols, wireless LAN protocols; IEEE MAC Sublayer protocols - Ethernet, Fast Ethernet, Gigabit Ethernet, wireless LANs and broadband wireless, Bluetooth; High speed LANs – Fast Ethernet, FDDI; Wireless LANs; Data Link Layer Switching – Bridges and Switches, their difference with Repeaters, Hubs, Routers and Gateways.

**Unit 4**

Network Layer: Design issues - Store-and-forward packet switching, services, implementation of connectionless and connection-oriented service, VC and datagram networks; Routing algorithms - Optimality Principle, Shortest Path Routing, Flooding, Distance Vector Routing, Link State Routing, Hierarchical Routing, Broadcast Routing, Multicast Routing, routing in Mobile hosts, routing in Ad Hoc networks; Congestion Control algorithms - General principle of Congestion control, leaky bucket algorithm, Token Bucket Algorithm; Internetworking - network difference, network connection, tunneling; The Network Layer in the Internet - Internet Protocol, Internet addressing and Internet Control protocols, ARP, DHCP and Mobile IP, Internet routing protocols - RIP, OSPF, BGP.

**Unit 5**

Transport Layer: Transport Services; Elements of transport protocols - Addressing, Connection establishment, Connection release, Error control and Flow control, Multiplexing; The Internet Transport Protocols - UDP and TCP, The TCP Service Model, The TCP Protocol.

Application layer: DNS, E-mail Protocols (SMTP, POP3, IMAP, MIME), WWW and HTTP, FTP, TELNET; Network Security - Cryptography, Symmetric Key Algorithms, Public key Algorithms and Digital Signatures.

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**Text Book(s)**

1. Andrew S. Tanenbaum and David J. Wetherall, Computer Networks, 5th Edition,

**Reference Material(s)**

1.Pearson-Prentice Hall, 2011. 1. Behrouz A. Frouzan, Data Communications and Networking, McGraw-Hill Education, 5th Edition, 2013.

2. William Stallings, Data and Computer Communications, Pearson-Prentice Hall, 8 th Edition, 2007.

3. James F. Kurore & K

Course Name: **MSc (CS/IT) 3rd Semester**

Subject Code: **CS-5713**

Subject Name: **Data Analytics using R**

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**Aim of the Subject**

This course aims to provide a solid foundation for the fundamental concepts of machine learning and its applications and prepare students for advanced research and real-time problem solving in machine learning and related fields.

**Learning Outcomes**

The students are expected to learn following after completion of the course:

- The students are expected to learn the following after completion of the course: Fundamentals of data analytics and R
- Development of software programmes that leverages data analytic approaches and copes with massive data-sets.
- To learn numerous machine learning techniques needed for data analytics.

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**Unit 1**

Introduction: What is Data Analytics?, The Data Analytics Process, Different Types of Data: Quantitative, Categorical. Graphical Summaries of Data: Pie Chart, Bar

Graph, Pareto Chart, Histogram. Measuring the Center of Quantitative Data: Mean, Median, Mode. Measuring the Variability of Quantitative Data: Range, Standard

Deviation, and Variance.

**Unit 2**

Overview of R, R data types : Vectors, Matrices, Factors, Lists, Data Frames, reading and writing data, Control structures, functions, scoping rules, dates and times. Introduction to Data Cleansing, Missing and Repeated Values, Feature Engineering, Outliers and Errors, Finding Outliers, Cleaning Data with R.

**Unit 3**

Regression: Simple Linear Regression, Multiple Regression, Assessing Performance, Ridge Regression, Feature Selection & Lasso, Nearest Neighbors & Kernel Regression.

**Unit 4**

Classification: Linear Classifiers & Logistic Regression, Learning Linear Classifiers, Overfitting & Regularization in Logistic Regression, Decision Trees, Preventing Overfitting in Decision Trees, Handling Missing Data, Boosting, Precision-Recall, Scaling to Huge Datasets & Online Learning.

**Unit 5**

Clustering & Retrieval: Nearest Neighbor Search, Clustering with k-means, Mixture Models, Mixed Membership Modeling via Latent Dirichlet Allocation, Hierarchical Clustering

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**Text Book(s)**

[ 1 ]Allan G. Bluman, Elementary Statistics: A Step By Step Approach, 10 th Edition, Mc Graw-Hill, 2017 .

[ 2 ] Tom Mitchell, Machine Learning, First Edition, McGraw Hill 1997 .

[ 3 ] Use R resources on tutorial point.

**Reference Material(s)**

Coursera and Edx Moocs on Data Analytics

Course Name: **MSc (CS/IT) 3rd Semester**

Subject Code: **CS-5123**

Subject Name: **Theory of Computation**

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**Aim of the Subject**

The aim of theory of computation is to develop a formal mathematical model of computation that reflects the real world computers.

**Learning Outcomes**

The students are expected to learn following after completion of the course:

- Key notions of computation, such as algorithm, computability, undecidability and complexity, through problem solving.
- The models of computation, including formal languages, grammars, automata and their connections.
- Analyze and designg finite automata, pushdown automata, Turing machines, formal
- languages, and grammars.

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**Unit 1**

Theory of Automata: String, Alphabet and Languages, Finite Automata, Finite State machine, Basic Definition. Description of a Finite Automaton, Deterministic Finite Accepters Transition Graphs, Languages, Non-deterministic Finite Acceptors- Definition, Finite Automata with ϵ-moves, Equivalence of Deterministic and Nondeterministic Finite Accepters, Conversion of NDFA to DFA, Removal of ϵ transition

from ϵ – NDFA, Minimization of Finite Automata –Definition and Construction.

Mealy and Moore models Definitions, Transformation of Mealy Machine into Moore

Machine and vice-versa.

**Unit 2**

Properties of Regular Sets: Pumping lemma for regular set, Closure properties of

regular set. Formal Language: Basic Definition, Chomsky Classification of languages, Regular Expression and Connection between Regular Expressions and Regular Languages.

**Unit 3**

Regular Grammars – Right and Left Linear Grammars, Equivalence between Regular

Languages and Regular Grammars. Context-Free Grammars: Leftmost and Rightmost

Derivations, Derivation Trees, Parsing and Ambiguity, Simplification of CFGs. Chomsky Normal Form, Greibach Normal Form, Cocke-Kasami- Younger Algorithm, Properties of Context-Free Languages.

**Unit 4**

Pushdown Automata: Definition, Non-deterministic Pushdown Automata, Pushdown Automata for Context Free Languages Context-Free Grammars for Pushdown Automata. Deterministic Pushdown Automata and Deterministic Context-Free Languages.

**Unit 5**

Turing Machine: Definition of Standard Turing Machine, Turing Machine as Language Accepters and Transducers.

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**Text Book(s)**

J. E. Hopcroft, R. Motwani and J.D Ullman, Introduction to Theory, Languages and Computation; Second Edition, Addison-Wesley, 2001 Narosa Publishing House.

**Reference Material(s)**

1. Mishra and Chandrasekaran, Theory of Computer Science (Automata, language and Computation), 2nd Ed. Prentice Hall of India.

2. Peter Linz, An Introduction to Formal Languages and Automata, Narosa

3. Martin, J.C.: Introduction to Languages and the Theor

Course Name: **MSc (CS/IT) 3rd Semester**

Subject Code: **CS-4211**

Subject Name: **Object Oriented Programming using JAVA**

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**Aim of the Subject**

To give students a good understanding of basic concepts of object-oriented program design using JAVA. To teach and enable students to develop object-oriented programming skills within the Java language; to enable students to develop object-oriented Java program solutions to small application problems.

**Learning Outcomes**

The students are expected to learn following after completion of the course:

- Understand basic principles of object-oriented program design using Java.
- Understand the basic and some advanced issues related to writing classes and methods
- such as data, visibility, scope, method parameters, object references, and nested classes.
- Understand the basic ideas behind class hierarchies, polymorphism, and programming to
- interfaces.
- Get exposure to exceptions and basic I/O streams.
- Develop solid Java programming skills and the ability to put in practice the acquired
- knowledge and understanding of the Java language and object-oriented design in relatively simple
- case studies

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**Unit 1**

Introduction to Java: Features of Java, Object-oriented Programming Overview, Introduction of Java Technologies, Java Applets and Applications, Java Platform, Java Program structure, Basic Building Blocks (comments, character set, constants), Data Types, Variables, Operators, Expressions, Typecasting, Control Structures, Loops, Memory concepts, Introduction to Class, Objects, Methods and Instance Variables, Naming Conventions, Constructors, Method Overloading, Static Method, Static Field, Math Class, this reference, Garbage collection and finalize method.

**Unit 2**

String Handling: The String Constructors, String Operations, Character Exaction, String Comparison, String Buffer. Arrays: Creating an array, Enhanced for Statement, Passing Multidimensional Arrays, Arrays to Method, Variable-Length Argument lists, Using Command-line Arguments. Wrapper Class : Introduction to wrapper classes. Inheritance: Relationship between Superclasses and Subclasses, Using super, Constructor in Subclasses, The Object Class, Object Copying in Java. Polymorphism: Method Overriding, Upcasting, Dynamic Method Dispatch, final Field, Method and classes, Abstract classes and Methods, instance of operator, Downcasting, Class class, Runtime type Identification

**Unit 3**

Packages and Interfaces: Defining a Package, Understanding CLASSPATH, Access Protection, Importing packages, Creating own Packages. Defining an Interface, Properties of Interface, Advantages of Interface Achieving Multiple Inheritance through Interfaces, Variables in Interfaces, Comparable Interface. Exception Handling: Introduction, keywords, Types of Exceptions, Java Exception Hierarchy, finally Block, Chained Exceptions, Declaring new Exception Types, Preconditions and Post-conditions. Streams and Files: Introduction, Data Hierarchy, Files and Streams, Sequential-access Text Files, Object Serialization, Random-Access files, Java Stream Class Hierarchy.

**Unit 4**

Multithreading: Introduction, Java Thread Model, Thread priorities, Thread life cycle, Creating Thread, Thread Execution, Thread Synchronization, Classes and Interfaces in java.util.concurrent, Monitor and Monitor Locks, Inter-Thread Communication. Introduction To GUI : Introduction, Overview of swing Components, Introduction to Event Handling, Common GUI Event Type and Listener Interfaces, Adapter Classes, Layout Managers Applets: Applet Basics, Applet Architecture, Applet Life Cycle Methods, Applet HTML Tag and Attributes, Executing Applet in Web Browser and in Appletviewer.

**Unit 5**

Generic and Collection API: Introduction, Motivation for Generic Methods, Generic Methods: Implementation and Compile- time Translation Issues, Overloading Generic Methods, Generic Classes, Raw Types, Generic and Inheritance Database connectivity: JDBC, The design of JDBC, Executing Queries. New Feature of Java: Java Reflection API, Auto boxing, Annotations, Regular Expressions.

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**Text Book(s)**

1. Java 2: The Complete Reference by Herbert Schildt, Tata McGraw- Hill, 8th Edition,

2011.

**Reference Material(s)**

1. The Java Programming Language, Ken Arnold , James Gosling , David Holmes, 3rd Edition, Pearson Education, 2000.

2. Head First Java, Kathy Sierra, Bert Bates, O'Reilly Publication, 2nd Edition, 2005.

Course Name: **MSc (CS/IT) 3rd Semester**

Subject Code: **CS-4508**

Subject Name: **Computer Graphics and Multimedia**

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**Aim of the Subject**

This course aims to combine theoretical approaches with modern techniques of computer graphics and multimedia to design graphics software systems.

**Learning Outcomes**

The students are expected to learn following after completion of the course:

- Students will develop an understanding of how to scan convert the basic geometrical shapes and how to transform the shapes to fit them as per the picture definition.
- Students will acquire an understanding of world coordinates, device coordinates, clipping, and 2-dimensional transformations.
- Students will learn the basics of 3-dimensional transformations in computer graphics.
- Students will learn various polygon filling algorithms and applications of these algorithms to different problems.
- Students will learn about multimedia and different colour models along with their applications.

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**Unit 1**

Introduction to Computer Graphics, Application of Graphics, Display Devices:

Refresh Cathode -Ray Tubes, Raster Scan Displays, Random Scan Displays, Color CRT Monitors, Flat Panel Displays. Video cards/display cards, Input Devices: Mouse, Trackball, Space ball, Data Glove, Joystick, Light pen, Scanner, Digital Camera, Touch Panels, Voice Systems. Hardcopy Devices: Printers and Plotters. Graphics Primitives: Line Generation Algorithms: DDA algorithm, Bresenham's algorithm, Graphics Primitives: Circle Generation Algorithms: Midpoint Circle algorithm, Bresenham's circle generation algorithm, Ellipse Generation algorithm.

**Unit 2**

Two Dimensional Transformations: Translation, Scaling, Rotation, Reflection, Shear, Homogenous coordinate system, composite transformations, raster method of transformation Two Dimensional Viewing: Window to Viewport coordinate transformation. Clipping: Clipping operations, Point clipping, Line clipping: Cohen Sutherland Algorithm, Liang Barsky Algorithm. Polygon clipping: Sutherland- Hodgeman Algorithm.

**Unit 3**

Three Dimensional transformations: 3D Geometry, 3D display techniques, 3D translation, scaling, reflection, rotation, shearing transformations.

**Unit 4**

Polygon filling Algorithms: Scan Line Polygon filling algorithm, Inside - Outside Tests, Boundary-Fill algorithm, Flood - Fill algorithm, 4-connected approach, 8-connected approach.

**Unit 5**

Colour Models and Colour Applications: Colour models: Properties of Light. Standard Primaries and the Chromaticity Diagram, RGB Colour Model, CMY Colour Model, HSV Colour Model, YIQ colour model. Advancements in the technology in Computer Graphics. Multimedia: Introduction, Multimedia applications, Multimedia data and File formats.

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**Text Book(s)**

1. Donald Hearn and M. Pauline Baker, Computer Graphics: C Version, Second Edition, Prentice Hall of India.

2. Tay Vaughan, Multimedia: Making it Works, Seventh Edition, Tata McGraw-Hill Professional, New Delhi.

**Reference Material(s)**

1. David F. Rogers, Procedural Elements for Computer Graphics, Tata Mc-Graw-Hill Publishing Company Ltd.,New Delhi, 2001.

2. James D. Foley, Andries van Dam, Steven K. Feiner, John F. Hughes, Computer Graphics: Principles and Practice in C, Second Edition