Department of Computer Science & Information Technology (CSIT)
Guru GhasidasVishwavidyalaya, Bilaspur (C.G.)
(A Central University established by the Central University Act 2009 No. 25 of 2009)
SYLLABUS FOR M.Sc.(CS) CBCS based
Session 2021-22

Semester-I

S.No.	Subject Code	Title	Credits	Marks Internal/External		Total
1	MSC-101 (CORE- 1)	Design of Operating System	5	40	60	100
2	MSC-102 (CORE -2)	Artificial Intelligence	5	40	60	100
3	MSC-103 (CORE- 3)	Relational Data Base Management Systems	5	40	60	100
4	MSC-104 (CORE-4)	Advanced JAVA Programming	5	40	60	100
5	MSC-105 (Practical-1)	Programming Lab in JAVA	5			100
		Total	25			500

Semester-II

S.No.	Subject Code	Title	Credits	Marks InternalExternal		Total
1	**MSC-201** (CORE - 5)	Design and Analysis of Algorithm	5	40	60	100
2	**MSC-202** (CORE - 6)	Machine Learning	5	40	60	100
3	**MSC-203** (DSE - 1)	Neural Networks and Deep Learning	5	40	60	100
4	**MSC-204** (DSE - 2)	Web Technology	5	40	60	100
5	**MSC-205** (RM - 1)	Research Methodology	2	40	60	100
6	**MSC-206** (Practical - 2)	Programming Lab in Web Technology	5			100
		Total	27			600

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Semester-III

S.No.	Subject Code	Title	Credits	Marks Internal	External	Total
1	MSC-301 (CORE - 7)	Computer Graphics and Multimedia	5	40	60	100
2	MSC-302 (CORE - 8)	Compiler Design	5	40	60	100
3	MSC-303 (DSE - 3)	Data Mining and Data Warehousing	5	40	60	100
4	MSC-304 (DSE - 4)	Network Security	5	40	60	100
5	MSC-305 (OE – 1)	Open Elective*	5	40	60	100
6	MSC-306 (Practical – 3)	Programming Lab in Data Mining	5			100
		Total	**30**			**600**

* Open Elective will be decided after the information of availability of courses from other departments

Semester-IV

S.No.	Subject Code	Title	Credits	Total
1	MSC-401 Dissertation/Field Work/Internship/Project/Industry Visit	Major Project	18	500

GRAND TOTAL	**100**		**2200**

Open Elective offered by CSIT:
 1. Programming in C/C++
 2. Data Structure Using C/C++/Python/Java
 3. RDBMS
 4. Introduction to Information Technology
 5. Linux Operating System
 6. Soft Computing.

Note: The structure, marking scheme, courses can be changed by university/statutory body's direction whenever required.

MSc(CS)-101

Design of Operating System

COURSE OBJECTIVE:

The main objective of this course is to learn the fundamentals of Operating Systems. This course explores the mechanisms of OS to handle processes and threads and their communication and also learn the mechanisms involved in memory management in contemporary OS. It also includes and explores the file and secondary storage management system.

1. **Introduction**: Definition, Design Goals, Types, Batch processing, Multi-programming, Real time, Timesharing; Functions of Operating System.

2. **Process Management**: Process states, Process Control block, Schedulers, CPU Scheduling algorithms

3. **Inter process synchronization and communication**: need, Mutual exclusion, semaphore, and classicalproblems in concurrent programming, critical region and conditional critical region, Deadlock, Characteristics, prevention, resource allocation graphs.

4. **Memory Management**: Address Binding, Dynamic Loading and Linking Concepts, Logical and Physical, Addresses, Contiguous Allocation, Fragmentation, Paging, Segmentation, Virtual Memory, Demand, Paging, Page fault, Page replacement algorithms, Global Vs Local Allocation, Thrashing,

5. **File and Secondary** Storage Management: File Attributes, File Types, File Access Methods, Directory, Structure, File System Organization, Allocation Methods, Free Space management; Disk Structure, Logical and Physical View, Disk Head Scheduling, Formatting, Swap Management. UNIX/ LINUX/ WINDOWS/Android as an example of Operating systems

References**:**

1. Operating System Concepts 6/ed By Silberschatz and Galvin, Addison Wesley.
2. Operating Systems: Internals and Design Principles 5/ed By William Stalling, PHI.
3. Modern operating Systems ByTanenbaum, PHI.
4. Operating System Concepts By Peterson and Silberschatz, Addison Wesley.
5. Operating System Principles By P. B. Hansen, PHI.
6. The UNIX Operating System By K. Christian, John Wiley

COURSE OUTCOME:

The student will be

- Able to analyze the architecture of OS and basic architectural components involved in OS design.
- Able to analyze and design the applications to run in parallel either using process or thread models of different OS.
- Able to analyze the various device and resource management techniques.
- Able to understand the Mutual exclusion, Deadlock detection.
- Able to understand the file and secondary storage management system.

MSc(CS) -102

Artificial Intelligence

COURSE OBJECTIVE:

The main objective of this course work is to understanding the basic concept of AI and expert system. This course explores the basic concept of various searching techniques for problem solving approach. It also includes supervised and unsupervised learning for classification and pattern reorganization.

1. **Introduction**: Definitions and approaches, Foundation of A.I., Challenges in AI, Area and Applicationsof A.I., Intelligent Agents: meaning, types, environments, examples.

2. **ProblemSolving**: Problem solving as state space search, production system, writing production systemand solution for a Water jug problem; some AI classical problems (statements only) cannibal missionaries, tower of Hanoi, tic tac toe, 8-puzzle, Search techniques: Breadth First, and Depth-first, Best-First Search, Hill-climbing, Heuristics, A* algorithm, local and global maxima(minima),

3. **KnowledgeRepresentationandReasoning**: Predicate and prepositional logic, conversion of sentences towffs of predicate logic, Resolution, clause form, Skolem functions, Unification, Resolution inPropositional and predicate logic, Semantic Nets.

4. **PatternRecognition**: Meaning of pattern, Pattern Recognition, Classification, Supervised &Unsupervised Learning of classifiers, K-NN, K-MEANS algorithms.

5. **ExpertSystems**: Introduction, Advantages, components and participants in an expert system, Application

References:

1. Artificial Intelligence: E. Rich and K. Knight, Tata McGraw Hill.

2. Artificial Intelligence: A New Synthesis By Nilsson, Morgan Kaufmann.
3. Pattern Classification 2nd Edition By R.O. Duda, Hart, Stork (2001) ,John wiley, New York.
4. Pattern Recognition: Technique and Applications By Shinghal (2006) ,Oxford University Press, New Delhi

COURSE OUTCOME:

- The student will be able to analyze and understanding of the fundamental issues and challenges of AI and machine Expert System: like their applications, problem solving methods and complexity.
- Able to understanding of the strengths and weaknesses of many popular searching techniques, supervised and unsupervised approaches.

MSc(CS)– 103

Relational Data Base Management System

COURSE OBJECTIVE:

The objective of this course work is to understand and uses of the basic concept of database management system. This course explores how to update database content with SQL and transaction handling.

1. **Overview of Database Management** :Data, Information and knowledge, Increasing use of data as acorporate resource, data processing verses data management, file oriented approach verses databaseoriented approach to data management; data independence, database administration roles, DBMSarchitecture, different kinds of DBMS users, importance of data dictionary, contents of data dictionary,types of database languages. Data models: network, hierarchical, relational. Introduction to distributeddatabases.

2. **Relational Model**: Entity - Relationship model as a tool for conceptual design-entities attributes andrelationships. ER diagrams; Concept of keys: candidate key, primary key, alternate key, foreign key;Strong and weak entities, Case studies of ER modeling Generalization; specialization and aggregation.Converting an ER model into relational Schema. Extended ER features.

3. **Structured Query Language** :Relational Algebra: select, project, cross product different types of joins(inner join, outer joins, self-join); set operations, Tuple relational calculus, Domain relational calculus, Simple and complex queries using relational algebra, stand alone and embedded query languages, Introduction to SQL constructs (SELECT…FROM, WHERE… GROUP BY… HAVING…ORDERBY….), INSERT, DELETE, UPDATE, VIEW definition and use, Temporary tables, Nestedqueries, and

correlated nested queries, Integrity constraints: Not null, unique, check, primary key, foreignkey, references, Triggers. Embedded SQL and Application Programming Interfaces.

4. Relational Database Design: Normalization concept in logical model; Pitfalls in database design,update anomalies: Functional dependencies, Join dependencies, Normal forms (1NF, 2NF, 3NF). BoyceCodd Normal form, Decomposition, Multi-Valued Dependencies, 4NF, 5NF. Issues in physical design; Concepts of indexes, File organization for relational tables, De-normalization.

5. **Introduction to Query Processing and Protecting the Database & Data Organizations:** Parsing,translation, optimization, evaluation and overview of Query Processing. Protecting the Data Base -Integrity, Security and Recovery. Domain Constraints, Referential Integrity, Assertion, Triggers, Security& Authorization in SQL.

References:

1. Database system concept By H. Korth and A. Silberschatz, TMH.
2. Data Base Management System ByAlexies&Mathews,Vikas publication.
3. Data Base Management System By C. J. Date, Narosha Pub.
4. Data Base Management System By James Matin.
5. Principles of Database System By Ullman.
6. An Introduction to database systems By Bipin Desai, 2011 ed.,Galgotia Publication.
7. Database Management System By A. K. Majumdar&P.Bhattacharya, TMH

COURSE OUTCOME:

The students will be
- Able to Learn about database models.
- Able to Learn how to write simple as well as complex queries for retrieving data from database
- Able to learn how to update, insert and delete data.
- Able to Learn about functions and procedure and gain understanding on different Views
- Able to learn how to work with Triggers and design a database
- Able to learn how to ensure integrity related to multiple a related database updates.

MSc(CS)-104

Advanced Java Programming

COURSE OBJECTIVE:

To provide the ability to design console based, GUI based and web based applications. Students will also be able to understand integrated development environment to create, debug and run multi-tier and enterprise-level applications

1. **Basics of Core JAVA**: class, interface, exception handling, Collections: Collection Interfaces, Concrete Collections, Collections Framework, Multithreading: Creating thread and running it, Multiple Thread acting on single object, Synchronization, Thread communication, Thread group, Thread priorities, Daemon Thread, Life Cycle of Thread. I/O

2. **Networking**: Internet Addressing, InetAddress, Factory Methods, Instance Methods, TCP/IP Client Sockets, URL, URLConnection, TCP/IP Server Sockets, Datagrams. Java Database Connectivity (JDBC): Merging Data from Multiple Tables: Joining, Manipulating, Databases with JDBC, Prepared Statements, Transaction Processing, Stored Procedures.

3. **Servlets**: Servlet Overview and Architecture, Interface Servlet and the Servlet Life Cycle, Handling HTTP get Requests, Handling HTTP post Requests, Redirecting Requests to Other Resources, Session Tracking, Cookies, Session Tracking with HttpSession

4. **Java Server Pages (JSP)**: Introduction, JavaServer Pages Overview, A First Java Server Page Example, Implicit Objects, Scripting, Standard Actions, Directives, Custom Tag Libraries, Enterprise Java Bean: Preparing a Class to be a JavaBean, Creating a JavaBean, JavaBean Properties, Types of beans, Stateful Session bean, Stateless Session bean, Entity bean.

5. **Remote Method Invocation**: Defining the Remote Interface, Implementing the Remote Interface, Compiling and Executing the Server and the Client, Struts: Basics of Struts, Struts: What and Why?, Model1 vs Model2, Struts2 Features, Steps to create Struts application, Understanding Action class, Understanding struts.xml file

References:

7

1. "Advanced Java 2 Platform HOW TO PROGRAM" by H. M.Deitel, P. J. Deitel, S. E. Santry – Prentice Hall
2. "Effective Java" 3rd Ed by JoushaBlouch Addition-Wesley
3. "Murach's Java Servlet & JSP" 3rd Ed. by Joel Murach, Michael Urban
4. "Beginning Java™ EE 6 Platform with GlassFish

COURSE OUTCOME:

Student will be able to

- Develop Swing-based GUI
- Develop client/server applications and TCP/IP socket programming
- Update and retrieve the data from the databases using SQL
- Develop distributed applications using RMI
- Develop component-based Java software using JavaBeans
- Develop server side programs in the form of servlets.

SEMESTER-II

MSc(CS) 201

Analysis & Design of Algorithm

COURSE OBJECTIVE:

- This course aims to introduce the classic algorithms in various domains, and techniques for designing efficient algorithms.
- Introducing students to the general tools and techniques for analyzing computer algorithms.
- Equip the students with mathematical preliminaries required to analyses and design computer algorithms.

1. **Introduction**: Algorithm, Performance Analysis-Space complexity, Time complexity, AsymptoticNotation-Big oh notation, Omega notation, Theta notation and Little oh and omega notation, recurrence elation: Substitution method, Master methodDeterministic Algorithms

2. **Divideandconquer**: General method, applications-Binary search, Quick sort, Merge sort. Greedy method: General method, Greedy knapsack problem, Minimum cost spanning trees: prims andkruskal's algorithm, Single source shortest path problem: Dijkstra's Shortest Path Algorithm, Huffmancoding.

3. **DynamicProgramming**: General method, applications-Matrix chain multiplication, optimal binarysearch trees, Longest Common Sub sequence Problem. Back Tracking: 8-quen problem, GraphColoring, Hamiltonian Cycle, Branch and Bound: 0/1knapsack problem, travelling sales personproblemNon Deterministic Algorithms

4. **Intractableproblems**: Basic concepts, non-deterministic algorithms, NP-Hard and NP-Completeproblems, Classes P and NP, Reducibility, Satisfiability Problem, Cook's theorem.Approximation: Graph Coloring, Task scheduling, bin packing, Probabilistic algorithm: Numericalintegration, primality testing, Graph Algorithms: BFS and DFS and its applications.

5. **EvaluationofAlgorithm Lower** bound Techniques: Lower bound techniques, Comparison Techniques, reduction.

References:

1. The Design and Analysis of Computer Algorithms,A.Aho, J. Hopcroft and J.Ullman, Addison Wesley.
2. Fundamentals of Computer Algorithms, E. Horowitz and S. Sahani, Galgotia, New Delhi.

3. Introduction to the Design and Analysis of Algorithms,S.E.Goodman and S.T.Hedetniemi, McGrawHill.
4. Design Methods and Analysis of Algorithmic, G.Brassard and P.Bratley, PHI.
5. Design Methods and Analysis of Algorithms, S.K.Basu, PHI, 2005.
6. Introduction toAlgorithms, Thomas H Cormen, Charles E Leiserson, Ronald L Rivest, Clifford Stein,MIT Press
7. Rosen, Kenneth, Discrete Mathematics and Its Applications , McGraw-Hill Science

COURSE OUTCOME:

After successful completion of this course, students should be able to:

- Prove the correctness and analyze the running time of the basic algorithms for those classic problems in various domains.
- Apply the algorithms and design techniques to solve problems.
- Analyze the complexities of various problems in different domains.

MSc(CS)- 202

Machine Learning

COURSE OBJECTIVE:

- Differentiate between supervised, unsupervised machine learning approaches
- Ability to choose appropriate machine learning algorithm for solving a problem
- Design and adapt existing machine learning algorithms to suit applications
- Understand the underlying mathematical relationships across various machine learning algorithms
- Design and implement machine learning algorithms to real world applications

1. **Introduction**: Meaning and need of Machine Learning, Types of Machine Leaning: Supervised Learning, Unsupervised Learning, Semi Supervised Learning, Reinforcement Learning, Applications of MachineLearning, Type of Data in Machine Learning, Data Repository

2. **Introduction to Feature Analysis and Bayesian Theory:** Meaning of patterns and pattern classification, feature selection and curse of dimensionality, Bayesian theorem and concept learning, examples.

3. **Supervised Learning**: Introduction to supervised learning, its examples, classification models, classificationalgorithms with Implementation: k-nearest neighbor (KNN), Decision Tree, Random forest, Support VectorMachine (SVM),

4. **Unsupervised Learning:** Introduction to unsupervised learning, metrics for evaluating a feature, clustering,types of clustering techniques, partitioning, hierarchical and density based clustering

5. **Modeling a classifier**: Validation, classification and prediction accuracy, confusion matrix, learning, bootstrap aggregation (bagging) , boosting, ensembles for classification

References:

1. Pattern Classification 2nd Edition By R.O. Duda, Hart, Stork (2001),Johnwiley, New York.
2. Pattern Recognition: Technique and Applications By Shinghal (2006) ,Oxford University Press, NewDelhi.
3. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006

COURSE OUTCOME:

On completion of the course students will be expected to:

- Have a good understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.
- Have an understanding of the strengths and weaknesses of many popular machine learning approaches.
- Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.
- Be able to design and implement various machine learning algorithms in a range of real-world applications.

MSc(CS)-203

Neural Networks and Deep Learning

COURSE OBJECTIVE:

- To develop the skills to gain a basic understanding of neural networks.
- To Introduce students to different artificial neural networks and earning rules to from an application perspective
- To familiar with significant technological trends in neural networks and deep learning
- To develop inclination towards research.

1.Introduction: Biological neuron, artificial neuron, biological neuron vs. artificial neuron, evolution of neural networks, basic models of artificial neural networks(ANN) : connections, learning :- supervised,unsupervised, reinforcement, activation functions, important terminology of ANN. McCulloh-Pitts neuron, linearseparability, types of neural networks,

2. Perceptron Networks: Implementation of AND gate, OR gate, NAND gate etc., **Gradient descent algorithm**, implementation of AND gate, OR gate, NAND gate etc., Building a neural controller for obstacle avoidance, Pseudo inverse solution, nonlinear separability. **Back propagation (BP) networks**:Derivation of BP algorithmfor single hidden layer architecture, momentum terms, implementation of XOR problem using BPalgorithm.Modifiedmultilayer neural network, modified Back propagation (BP) algorithm

3. Other Neural network architectures: Radial basis function neural network (RBFNN): architecture, training algorithm, Implementation of XOR problem using RBF, Functional link artificial neural networks (FLANN): architecture, training, delta learning rule, Extreme Learning Machine (ELM): architecture, learning algorithm, Recurrent neural network (RNN): architecture, training algorithm, Back propagation through time (BPTT). Real time recurrent learning algorithm (RTRL), Self-organizingmap (SOP).

4. DeepLearning: Introduction, Long short term memory (LSTM) network, Convolution neural network, Boltzman Machine network.

5. Applications: function optimization, classification, prediction, detection.

Readings:

1. Neural Networks and Learning machines by Simon Haykin, PHI, 3rd Edition
2. Neural Network Design by M. Hagan, 2nd Edition, eBook

3. Principles of Soft Computing by S. N. Shivanandam and S. N. Deepa, Wiley, 2nd Edition
4. Artificial neural networks by B. Yegnanarayana, PHI.
5. Deep Learning by John D. Kelleher, MIT Press.
6. Neural networks and Deep learning by Charu C. Aggarwal, Springer, 1st Edition, 2018.

COURSE OUTCOME:

Students will able
- Build, train and apply neural networks for different applications
- Identify the key parameters of the neural network architectures.
- Understand the capabilities, challenges and consequences of deep learning.
- Gain the knowledge and skill to apply neural networks and deep learning in various real life problems.
- Level up his/her technical career, and take the definitive step in the world of AI.

MSc(CS)-204

Web Technology

COURSE OBJECTIVE:

- To understand, analyze and apply the role languages like HTML, CSS, XML, JavaScript and protocols in the workings of web and web applications.
- To understand about programming and know about the application of dynamic page functionality in web pages using CGI, JSP, and ASP.
- To create and communicate between client and server and create a good, effective and dynamic website.
  .

1 Internet Concept: Fundamental of Web ,History of Web, Web development overview, Domain NameSystem (DNS),DHCP,and SMTP and other servers ,Internet service provider (ISP), Concept of IP Address, Internet Protocol, TCP/IP Architecture ,Web Browser and Web Server.

2. **HTML and DHTML**:- HTML Tag, Rules of HTML, Text Formatting and Style, List, Adding Graphics toHTML Document, Tables and Layout , Linking Documents, Frame,

Forms, Project in HTML, Introductionto DHTML, CSS, Class and DIV, External Style Sheet.

3. **Scripting Languages**: Java Script (JS) in Web Page, Advantage of Java Script, JS object model and hierarchy ,Handling event, Operators and syntax of JS, JS Function, Client side JS Vs Server side JS ,JSsecurity, Introduction to VB Script, Operator and Syntax of VB Script, Dialog Boxes, Control and Loop, Function in VBS.

4. **XML**:Introduction to XML, XML in Action, Commercial Benefits of XML, Gaining Competitiveadvantage with XML, Programming in XML, XML Schema ,XSLT ,DOM structure model ,XML quiresand transformation.

5. **Active Server Page (ASP)**: Introduction ,Internet Information System (IIS),ASP object ,Server object, Filesystem object, session ,Accessing data base with an ASP page ,ODBC – ADO connection object, commonmethods and properties, ADO record set object .Introduction to ASP.Net.

References:

1. The complete Reference By Thomos A. Powell ,TMH publication
2. Web Technology: A Developers Perspective, N.P.Gopalan ,J.Akilandeswani,PHI Publication.
3. Java Script :The definite Guide By Flangam , O"Reilly
4. Java Script: Developers Resource by Kamran Husain and Jason Levitt PTR-PHI publication.
1. "Mastering VB Script" BPB Publication.
2. World Wide Web design with HTML by Xavier Tata McGraw Hill Publication.
3. XML By Example, Sean Mc GrathPentice Hall Publication.
4. Web Technology : A Developments Perspective , N.P. Gopalan, J. Akilandeswari, PHI Publication

COURSE OUTCOME:

Student will able be to
- Select and apply markup languages for processing, identifying, and presenting of information in web pages.
- Use scripting languages to transfer data and add interactive components to web pages

MSc(CS)-205

Research Methodology

COURSE OBJECTIVE:

This course is designed to enable students to:
- Identify and discuss the role and importance of research in the field of sciences.
- Identify and discuss the issues and concepts salient to the research process.
- Identify and discuss the complex issues inherent in selecting a research problem, selecting an appropriate research design, and implementing a research project.
- Identify and discuss the concepts and procedures of sampling, data collection, analysis and reporting.

UNIT I –RESEARCH FORMULATION AND DESIGN: Motivation and objectives – Research methods vs. Methodology. Types of research – Descriptive. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, concept of applied and basic research process, criteria of good research. Defining and formulating the research problem, selecting the problem, necessity of defining the problem, importance of literature review in defining a problem, literature review-primary and secondary sources, reviews, monograph, patents, research databases, web as a source, searching the web, critical literature review, identifying gap areas from literature and research database, development of working hypothesis.

UNIT II – DATA COLLECTION AND ANALYSIS: Accepts of method validation, observation and collection of data, methods of data collection, sampling methods, data processing and analysis strategies and tools, data analysis with statically package (Sigma STAT,SPSS for student t-test, ANOVA, etc.), hypothesis testing.

UNIT III –RESEARCH ETHICS, IPR AND SCHOLARY PUBLISHING: Ethics-ethical issues, ethical committees (human & animal); IPR- intellectual property rights and patent law, commercialization, copy right, royalty, trade related aspects of intellectual property rights (TRIPS); scholarly publishing- IMRAD concept and design of research paper, citation and acknowledgement, plagiarism, reproducibility and accountability.

UNIT IV –INTERPRETATION AND REPORT WRITING: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types

of reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for WritingResearch Reports, Conclusions.

References:

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
2. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International. 418p.
3. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, EssEssublications. 2 volumes.
4. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.

COURSE OUTCOME:

Students who successfully complete this course will be able to:
- Explain key research concepts and issues
- Read, comprehend, and explain research articles in their academic discipline.
- Demonstrate the ability to choose methods appropriate to research aims and objectives
- Understand the limitations of particular research methods
- Develop skills in qualitative and quantitative data analysis and presentation
- Develop advanced critical thinking skills
- Demonstrate enhanced writing skills
- Describe the appropriate statistical methods required for a particular research design
- Choose the appropriate research design and develop appropriate research hypothesis for a research project
- Develop an appropriate framework for research studies

SEMESTER-III

MSc(CS):301

Computer Graphics and Multimedia

COURSE OBJECTIVE:

- To introduce the use of the components of a graphics system and become familiar with building approach of graphics system components and algorithms related with them.
- To learn the basic principles of 3-dimensionalcomputer graphics.
- To provide an understanding of how to scan convert the basic geometrical primitives, how to transform the shapes to fit them as per the Picture definition.
- To provide an understanding of mapping from a world coordinates to device coordinates, clipping, and projections.

1. **Fundamentals of Computer Graphics**: Concepts and applications, Random and Raster scandevices,input-output devices: CRT, LCD, laser printer. Output primitives: Line drawing algorithm: DDA and Bresenha's; Circle generating algorithm: Bresenham's Midpoint algorithms, Ellipse: midpoint ellipse drawing algorithm. Antialiasing techniques: super sampling, pixel weighting, area sampling, pixel phasing Area filling: boundary fill algorithm, flood fill algorithm: Scan-line Polygon Fill Algorithm.

2. **Transformation, viewing, Clipping: 2-D Transformation**: Translation, scaling, rotation,reflection,shear, matrix representation of all homogeneous coordinates, composite transformations.Two dimensional viewing: Viewing pipeline Window-to-view port transformation. Clippingoperations: Line Clipping: Cohen Sutherland and Liang-barsky, Polygon Clipping: CohenSutherland-Hodgeman and Weiler – Atherton Polygon clipping.

3. **3D Transformation**, Visible Surface Detection and curves: Visible Surface detectionAlgorithm:Object based and image based methods, depth comparison, A-Buffer, Back face removal,Scan-line method, Depth Sorting Method Area subdivision method. 3-D Transformation: translation,scaling,rotation, reflection. Three- dimensional object representations 3-D Viewing Projections –parallel and perspective projection. Curved lines and Surfaces: Spline representations, Interpolatingand approximation curves, continuity conditions Bezier curves: concept and characteristics; B-Splinecurves: concept and characteristics.

4. **Color Models and Basic Concept of Animation**: Introduction of multimedia: Properties andapplications, types of medium, data stream characteristics, Basic File and Data format: BMP, JPEG,GIF, TIFF. Color models: RGB, YIQ, CMY, HSV. Animation:

Basic concept, animation languages,computer-based animation, methods of controlling animation, display of animation,animation techniques: onion skinning, motion cycling, masking, morphing, and transmission ofanimation, Multimedia Authoring tools.

5. Multimedia Systems: Data compression: storage space, coding requirements. Source, entropy andhybrid coding some basic compression technique: runlength code, Huffman code. JPEG: Imagepreparation, Lossy sequential DCT –based mode, expanded Lossy DCT based mode, Losslessmode,and hierarchical mode. MPEG, Huffman Encoding, LWZ compression.

Readings:

1. Principles of interactive compo Graphics; W.M. Newman & Robert F Sproull.
2. Computer Graphics By Rogers TMH
3. Introductions to Computer Graphics AnirbanMukhopadhyay&Arup Chattopadhyay
4. Schaum's outlines -computer Graphics Mc Graw Hill International Edition.5
5. Principles of Multimedia by Ranjan Parekh TMH
6. "Multimedia Systems Design", P. K.Andleigh& K. Thakrar, Prentice Hall Pvt. Ltd

COURSE OUTCOME:

Students will able to:
* To describe the general software architecture of programs that use 3D computer graphics.
* To discuss hardware system architecture for computer graphics.
* To use a current 3D graphics API (e.g., OpenGL or DirectX).
* To use the underlying algorithms, mathematical concepts, supporting computer graphics.

MSc(CS) -302

Compiler Design

COURSE OBJECTIVE:

- To understanding the fundamental principles in compiler design
- To make the student to understand the process involved in a compiler, create an overall view of various types of translators, linkers, loaders, and phases of a compiler.
- To understand syntax analysis, various types of parsers especially the top down approach, awareness among students the various types of bottom up parsers, understand the syntax analysis and, intermediate code generation, type checking, the role of symbol table and its organization, Code generation, machine independent code optimization and instruction scheduling.

1. **Basics of Compilers and Lexical Analysis**: Compilers and Translators, Bootstrap compiler, Phasesof Compiler, Compiler writing tools, Bootstrapping, Overview of one pass compiler, FiniteAutomation, Basics of DFA, NFA, Regular sets and Regular expressions.

2. **Syntax analysis & Parsing techniques**: Basics of context free grammars and derivation of parsetrees, Top down parsing and its implementation, Operator precedence parsing, Predicative top downparser, Bottom up parsing, Handel of right sentential form, LR parser, Canonical collection of sets,Construction of parsing action and GOTO table, Construction of LALR parsing table, Handlingambiguous grammar.

3. **Syntax directed definition and Translation**: L-attributed definition, Syntax directed translationscheme, Intermediate code generation, Representing three address statements, Syntax directedtranslation scheme to specify the translation of various programming language construct,Implementing increment and decrement operators, Array reference, Switch/case.

4. **Symbol table management & Error Handling**: Various approaches to symbol table organization,Representation of scope information in symbol table, Storage allocation activation of procedure andrecord, Static allocation and stack allocation. Error recovery, Error recovery in LR parsing,Predicative parsing error recovery.

5. **Code Optimization and Code Generation** : Introduction, Loop optimization, Eliminatinginduction variable, Eliminating local common sub expression, DAG, Eliminating global commonsub expression, loop unrolling, loop jamming, Problems hindering code generation, Straightforward code generation, Using DAG for code generation, Peephole optimization.

References:

1. Alfred V. Aho, Ravi Sethi, Jeffrey D. Ullman. "Compilers Principles, Techniques and Tools".Pearson Education, 2008.
2. O.G.Kakde, "Compiler Design", 2005, Laxmi Publication.
3. AdeshK.Pandey, "Concepts of Compiler Design", First Edition, S.K.Kataria&SonsPublication.
4. Steven S. Muchnick, "Advanced Compiler Design Implementation", Morgan Koffman, 1997.
5. AllenHolub, "Compiler Design in C", Prentice Hall of India

COURSE OUTCOME:

Student must be able
- To understand major concept areas of language translation and compiler design
- To develop an awareness of the function and complexity of compilers.
- To provide practical, hands on experience in compiler design
- To Identify the similarities and differences among various parsing techniques and grammar transformation techniques

MSc(CS)-303

Data Mining and Data Warehousing

COURSE OBJECTIVE:

- To introduce students to basic applications, concepts, and techniques of data mining.
- Understand and implement classical models and algorithms in data warehouses and data mining
- Characterize the kinds of patterns that can be discovered by association rule mining, classification and clustering
- Master data mining techniques in various applications like social, scientific and environmental context
- Develop skill in selecting the appropriate data mining algorithm for solving practical problems.
- To gain experience doing independent study and research.

1. **Data Mining:** Meaning, necessity, steps, Normal searching Vs. knowledge extraction

2. **Data Mining on different types of databases:** Relational, Data Warehouses, Transactional, Objectoriented, Object relational, Spatial, Temporal and time series, Text and multimedia, Heterogeneousand legacy.

3. **Data Warehouse:** Meaning, definition, OLTP vs. OLAP, Data cube, star schema, snow flakeschema, fact constellations, basic concepts in writing of DMQL, Three Tier Architecture of data warehouse, data mart, Indexing.

4. **Data Preprocessing:** Data cleaning, Data integration, Chi-square test, Data transformation, Datareduction, Dimensionality reduction: Principal component analysis (PCA), factor analysis (FA),Data compression: discrete Fourier Transform (DFT), discrete cosine transform (DCT), discrete Wavelettransform (DWT).

5. **Classification, Clustering and Prediction:** Meaning, k-nearest neighbourhood (k-NN), neuralnetwork based classification, Support vector machine (SVM) classifier, Naïve Bayes classifier and Decision tree. Performance measures of classification :confusion matrix, accuracy, F1score, specificity, sensitivity, ROC and AUC. Clustering: types of variables, distance measures, types of Clustering, Partioning Method: k-means,k-medoid clustering, unsupervised: Hierarchicalclustering, DBSCAN, Prediction using Regression, nonlinear regression and Neural Network, Performance Measures for prediction. Types of training: holdoutmethod, cross validation, leave-one-out method.

6. **Association rule mining:** Market basket analysis, support, confidence, Apriori algorithm with an example.

Readings:
1. Data Mining: Concepts and Techniques, Jiawei Han, MichelineKamber, Morgan KaufmannPublishes (Elsevier, 2nd edition), 2006
2. Data Mining Methods for Knowledge Discovery, Cios, Pedrycz, Swiniarski,KluwerAcademicPublishers, London – 1998.

COURSE OUTCOME:

After successfully completing the course students will able to
- Understand the functionality of the various data mining and data warehousing component
- Appreciate the strengths and limitations of various data mining and data warehousing models
- Explain the analyzing techniques of various data
- Describe different methodologies used in data mining and data ware housing.
- Compare different approaches of data ware housing and data mining with various technologies.

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MSc(CS)-304

Network Security

COURSE OBJECTIVE:

- The main goal of this course is to enable the students to develop the necessary skills for developing robust &high performance scalable network applications.
- To learn about raw sockets and socket programming.
- To understand simple network management protocols and basics of TCP &UDP sockets.
- To understand the principles and practices of cryptography and network security
- To understand the practical applications that have been implemented and are in use to provide network Security

1. **Foundations of Cryptography and security**: Security trends, The OSI Security architectureSecurity attack, services and mechanism, Ciphers and secret messages, Mathematical tools forcryptography: substitution techniques, modular arithmetic, Euclid's algorithm, finite fields, polynomial arithmetic.

2. **Symmetric Cipher**: Symmetric cipher model, Design Principles of Block Ciphers, Theory of Block,Cipher Design, Feistel cipher network structure, Data Encryption Standard (DES), Strength of DES,Triple DES ,Modes of operation.Advance encryption Standard (AES)- Evaluation criteria ofAES,AES cipher ,key distribution.

3**. Public Key cryptography and Hash function**: Prime numbers and testing for primarily, factoringlarge, numbers, Principles of public key cryptosystem, RSA algorithm. Key management: Diffie-Helman, Key exchange, Hash and Message authentication Code (MAC), Hash and MAC algorithms, Digital, signature.

4. **IP and Web security protocols**:Authentication application: Kerberos, Public key infrastructure.E-mail:Pretty Good Privacy (PGP), S/MIME. IP security, Web Security: Secure Socket layer (SSL) andTransport layer security, Secure Electronic Transaction (SET).

5**. System Security**: Firewall, and Intrusion Detection system (IDS), Malicious Software.

Readings
1. Cryptography and Network Security By William Stallings, 4th Edition Pearson Publication
2. Applied cryptography - protocols and algorithm By BuceSchneier, Springer Verlag 2003

3. Cryptography and Network Security By AtulKahate , TMH Publication.
4. Cryptography and Network Security By Behrouz A. Forouzan, First Edition, TMH Publication.
5. Network Security:Private Communication in Public World By Charlie Kaufman,RadiaPerlmanand Mike Speciner ,PHI Publication.

COURSE OUTCOME:

After successful completion of the course, students will be
- Familiar with protocols, network interfaces, and Design/performance issues in local area networks and wide area networks.
- Familiar with basics of Socket and Socket programming.
- Familiar with contemporary issues in networking technologies.
- Familiar with network tools and network programming.
- Familiar with client server programming, Conventional encryption algorithms for confidentiality and their design principles, Public key encryption algorithms and their design principles
- Able to use of message authentication codes, hash functions , digital signature and public key certificates

OPEN ELECTIVE

OPEN ELECTIVE-1

Linux operating System and Shell Programming

COURSE OBJECTIVE:

The objective of this course is to understand and make effective use of linux utilities and shell scripting language to solve problems. It also implement in C some standard linux utilities like MV,CP,LS etc. and develop the skills the necessary for systems programming including file system.

1. **INTRODUCTION TO LINUX**: History, The Linux Architecture, Features of Linux, Internal andExternal Commands, Command Structure, difference between Linux and Unix, various Linuxdistributions, basic commands.UTILITIES: file handling utilities, security by file permissions,process utilities, disk utilities, networking commands, Text processing utilities and backup utilities,Security commands. The vi editor, security by file Permissions.

2. **INTRODUCTION TO SHELLS**: Session, Standard Streams, Redirection, Pipes, Tee Command,Command Execution, Command-Line Editing, Quotes, Command Substitution, Job Control, Aliases,Variables, Predefined Variables, Options, Shell Edition Environment Customization. Filters. GREP:Operation, grep Family, Searching for File Content. SED: Scripts, Operation, Addresses, commands,Applications. AWK: Execution, Fields and Records, Scripts, Operations, Patterns, Actions,Associative Arrays, String Functions, String Functions, Mathematical Functions, User – Defined Functions, Using System commands in awk, Applications.

3. **INTERACTIVE KORN SHELL**: Korn Shell Features, Two Special Files, Variables, Output, Input, Exit Status of a Command, eval Command, Environmental Variables, Options, Startup Scripts, Command History, Command Execution Process. KORN SHELL PROGRAMMING: Basic Script concepts, Expressions, Decisions Making Selections, Repetition, special Parameters and Variables, changing Positional Parameters, Argument Validation, Debugging Scripts, Script Examples.

4. **INTERACTIVE C SHELL**: C shell features, Two Special Files, Variables, Output, Input, Exit Status of a Command, eval Command, Environmental Variables, On-Off Variables, Startup and Shutdown Scripts, Command History, Command Execution Scripts. C SHELL PROGRAMMING: Basic Script concepts, Expressions, Decisions: Making Selections, Repetition, special Parameters and Variables, changing Positional Parameters, Argument Validation, Debugging Scripts, Script Examples.

5. FILE MANAGEMENT: File Structures, System Calls for File Management – create, open, close,read, write, lseek, link, symlink, unlink, stat, fstat, lstat, chmod, chown, Directory API – opendir,readdir, closedir, mkdir, rmdir, umask.

References:
1. Sumitabha Das, "Unix Concepts and Applications", 4thEdition. TMH, 2006. (1, 2 units)
2. Behrouz A. Forouzan, Richard F. Gilbery, "Unix and shell Programming", 1stEdition, Cengage
1. Learning India, 2003.
2. Beginning Linux Programming, 4th Edition, N.Matthew, R.Stones,Wrox, Wiley India Edition.
3. Graham Glass, King Ables, "Unix for programmers and users", 3rd Edition, Pearson Education,
4. 2009.
5. N.B Venkateswarlu, "Advanced Unix programming", 2ndEdition, BS Publications, 2010.
6. YashwanthKanitkar," Unix Shell programming", 1stEdition, BPB Publisher, 2010.
7. Linux: Complete Reference, 6th Edition, Richard Petersen, Tata McGraw-Hill

COURSE OUTCOMES:

The student will be
- Able to understand the basic commands of linux operating system and can write shell scripts.
- Able to create file systems and directories and operate them.
- Able to work on file management system with file management commands.

OPEN ELECTIVE-II

Relational Data Base Management System

COURSE OBJECTIVE:

The objective of this course work is to understand and uses of the basic concept of database management system. This course explores how to update database content with SQL and transaction handling.

1. **Overview of Database Management** :Data, Information and knowledge, Increasing use of data as a corporate resource, data processing verses data management, file oriented approach verses database oriented approach to data management; data independence, database administration roles, DBMS architecture, different kinds of DBMS users, importance of data dictionary, contents of data dictionary, types of database languages. Data models: network, hierarchical, relational. Introduction to distributed databases.

2. **Relational Model**: Entity - Relationship model as a tool for conceptual design-entities attributes and relationships. ER diagrams; Concept of keys: candidate key, primary key, alternate key, foreign key; Strong and weak entities, Case studies of ER modeling Generalization; specialization and aggregation. Converting an ER model into relational Schema. Extended ER features.

3. **Structured Query Language** :Relational Algebra: select, project, cross product different types of joins(inner join, outer joins, self join); set operations, Tuple relational calculus, Domain relational calculus, Simple and complex queries using relational algebra, stand alone and embedded query languages, Introduction to SQL constructs (SELECT…FROM, WHERE… GROUP BY… HAVING…ORDERBY….), INSERT, DELETE, UPDATE, VIEW definition and use, Temporary tables, Nested queries, and correlated nested queries, Integrity constraints: Not null, unique, check, primary key, foreign key, references, Triggers. Embedded SQL and Application Programming Interfaces.

4**. Relational DatabaseDesign:** Normalization concept in logical model; Pitfalls in database design, update anomalies: Functional dependencies, Join dependencies, Normal forms (1NF, 2NF, 3NF). Boyce Codd Normal form, Decomposition, Multi-Valued Dependencies, 4NF, 5NF. Issues in physical design; Concepts of indexes, File organization for relational tables, De-normalization.

5. **Introduction to Query Processing and Protecting the Database & Data Organizations:** Parsing, translation, optimization, evaluation and overview of Query

Processing. Protecting the Data Base -Integrity, Security and Recovery. Domain Constraints, Referential Integrity, Assertion, Triggers, Security& Authorization in SQL.

References:
1. Database system concept By H. Korth and A. Silberschatz, TMH.
2. Data Base Management System By Alexies&Mathews ,Vikas publication.
3. Data Base Management System By C. J. Date ,Narosha Pub.

COURSE OUTCOME:

The students will be
- Able to learn about database models.
- Able to learn how to write simple as well as complex queries for retrieving data from database
- Able to learn how to update, insert and delete data.
- Able to Learn about functions and procedure and gain understanding on different Views
- Able to learn how to work with Triggers and design a database
- Able to learn how to ensure integrity related to multiple an related database updates.

OPEN ELECTIVE-III

Data Structure using C

COURSE OBJECTIVE:

The objective of this course is to understand the basic concepts of data structures and algorithms with C programming. This course describe the concept and application of stack, Queues, Trees and Graphs, It also explores the concepts about searching and sorting techniques.

1. **Introduction to Data Structures:** Definition of Data structure and Abstract data type. Basics of Algorithm. Classification of Data structures: Linear, Non-linear. Arrays: Definition & types of array, Memory representation of one & two dimensional array, Operations on DS. Linked List: Singly Linked list- Operation on it; doubly linked list- Operation on it; Circular linked list - Operation on it.Overview of C, loops, Functions: call by value and call by reference, Recursive function.Structure:Structure and applications of Structure in various DS. Pointer and applications of Pointer in dynamicmemory allocation.

2. **Stacks, Queues:** Stacks; Array representation of stack; Linked representation of stack; Various polish notation"s-Prefix, Postfix, infix; Evaluation of a postfix & Prefix

expression; Conversion from oneanother; Application of stack; Queues; Linked representation of queues;Dqueues; Circular queue;Priority queue.

3. **Trees**:Binary trees; Types of binary tree Representation of binary tree in memory; traversing binarytree; Binary search trees; Searching and inserting in binary search trees; Deleting in a binary search,tree; AVL search trees and operation on it . B trees: searching, insertion, deletion; Heap.

4. **Graphs :** Terminology & representation; Warshall algorithm; Shortest path; Minimum spanning tree;Kruskal&Dijkstara algorithm; Linked representation of graph; Operation on graph; Traversing a graph.

5. **Searching and Sorting:** Searching algorithm: linear search, binary search; sorting algorithms: Bubblesort, Insertion sort, Selection sort, Quick Sort, Merge sort and Heap sort.

References:
1. Programming in C "YashwantKanetkar", BPB Publications,Tenth Edition.
2. The C Programming Language "Kemigham and Ritche [Prentice Hall]"
3. Data Structure ByLipshutz, McGraw Hill.
4. Data Structure By Standish, Addison-Wesley.
5. Data structures Through C by G. S. Baluja.

COURSE OUTCOME:

The students will
* Be able to analyze algorithms and algorithm correctness.
* Have the ability to describe and their application of stack, queue graph and tree operation.
* Be able to use of searching and sorting techniques in different fields.

OPEN ELECTIVE-IV

Introduction to Information Technology

COURSE OBJECTIVE:

The objective of this course work is to provide basic concept of computer and its application. This course is also designed to familiar with a number of utility software, programming languages, basic concept of networking and overview of latest IT trends and technology.

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1. **Introduction**- Basics concept of IT, Concept of data and information, Generations and Classification of Computers, Organization of computers: CPU, Memory, Input and Output devices, File organizations.

2. **Software and Computer Languages**- Software, Types of software: System software, Application software, Utility software, Firmware. Generations and Types of Programming Languages, Programming Paradigms: procedural oriented and object oriented programming, Computer Security.

3. **Communications and Internet**- Data communications, Analog and digital signal, Communication media, Network topology, Network categories, The OSI model and TCP/IP model, Internet addressing, Internet Service Provider (ISP), Web browsers, URL, WWW, HTTP, E-mail, File transfer, Domain Name System (DNS), Wireless technology: GPS, Wi-Fi.

4. **Applications of IT**- IT in Home, Entertainment, Business, Industry, Science, Engineering andMedicine, Online banking, Online shopping, E-Learning, E-commerce, M-Commerce, E-Government.

5. **Latest IT Trends-** Artificial intelligence, Data warehousing, Data mining, Overview of geographicinformation system (GIS), Cloud computing, Information and communications technology (ICT),Parallel computing, Introduction to web services.

References:
1. Fundamental of Computer 5th Edition By V. Rajaraman, PHI Publication.
2. Introduction to Information Technology by V. Rajaraman, PHI Publication.
3. Information technology today By S. Jaiswal.
4. Fundamental of IT: Leon and Leon, Leon Tec World.
5. Introduction to Information Technology by Aksoy and DeNardis, Cengage Learning.

COURSE OUTCOME:

The student will be

- Able to apply knowledge of computers and utilities of number of software that is useful for students.

- Able to analyze use of programming languages and solution of the problem using programming languages. Able to analyze the application of networking and familiar with latest trends and technology

OPEN ELECTIVE-IV

Soft Computing

COURSE OBJECTIVE:

- To develop the skills to gain a basic understanding of neural networks.
- To Introduce students to different artificial neural networks and earning rules to from an application perspective
- To familiar with significant technological trends in neural networks and deep learning
- To develop inclination towards research.

Introduction – What is soft computing? Different tools of soft computing and itscomparison, area of application.

Artificial Neural Network : Overview of biological Neurosystem, Mathematical Models of Neurons, ANN architecture, Learning rules, Learning Paradigms-Supervised, Unsupervised and reinforcement Learning, ANN training Algorithms-perceptions, Training rules, Delta, Back propagation algorithm, Multilayer perceptron model, RBF (Radial basis function) neural network, Recurrent neural network, Self-Organizing Map (SOM), Introduction to convolution neural network (CNN) and deep learning.

Genetic Algorithm (GA): Basic Terminologies in Genetic Algorithms - Individuals, Genes, Fitness, Populations, Working Principle, Encoding methods, Fitness function, GA Operators- Reproduction; Crossover; Mutation, Convergence of GA, particle swarm optimization(PSO).

Fuzzy Logic – Type-1 Fuzzy logic: Basic definitions and terminology, Set theoretic operations, Membership function, Fuzzification and Defuzzification methods, Fuzzy inference System, Fuzzy rule Base, Fuzzy control system.

Reference Books:
1. Uncertain rule-based fuzzy logic systems: Introduction and new directions byJerry M.Mendel ,Prentic Hall of India .

2. Intelligent hybrid System : Neural Network ,Fuzzy Logic and Genetic Algorithmby Da Ruan ,Kluwer Academics publishers
3. Neural Network ,Fuzzy logic and Genetic Algorithm :Synthesis and applicationby S. Rajshekhran and G.A. Vijay Laxmi ,PHI publication.
4. Fuzzy logic with engineering applications by Timothy J Ross, Wiley Publication
5. Neural network by Simon Haykins: Prentice Hall of India.

COURSE OUTCOME:

Students will be able to
- Build, train and apply neural networks for different applications
- Identify the key parameters of the neural network architectures.
- Gain the knowledge and skill to apply neural networks in various real life problems.
  Level up his/her technical career, and take the definitive step in the world of AI.