

SYLLABUS
for
M.Sc. IT (One Year Program)
(2026 Onwards)
Master of Science (IT)
Programme
As Per
New Education Policy (NEP-2020)



DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
SCHOOL OF ENGINEERING AND TECHNOLOGY
HEMVATI NANDAN BAHUGUNA GARHWAL UNIVERSITY
A CENTRAL UNIVERSITY
SRINGAR GARHWAL – (246174)

Program Structure

Semester	Course Category	Course Title	Credits		Total Credit
			T	P	
1	Discipline Specific Core [DSC]	Network Security and Cryptography	5	-	5
		Design and Analysis of Algorithms	3	2	5
		Machine Learning	3	2	5
		Compiler Design	5	-	5
	Discipline Specific Elective [DSE]	Cloud Computing / Android Application Dev / Computer Vision / MOOC	3	1	4
	Or				
	Multi-Disciplinary Elective [MDE]	Genetic Algorithm and Application	3	1	4
	SEC (Non-CGPA Course)	SEC- Academic Library Systems and Services or Entrepreneurship & Startup Awareness	-	-	-
	Total				24

Semester	Course Category	Course Title	Credits		Total Credit
			T	P	
2	Discipline Specific Core [DSC]	Project Work	-	10	10
		Data Warehousing and Data Mining	5	-	5
		E-Commerce	5	-	5
	Discipline Specific Elective [DSE]	Artificial Intelligence/ Image Processing / NLP /MOOC	3	1	4
	Or				
	Multi-Disciplinary Elective [MDE]	Bioinformatics	3	1	4
	SEC (Non-CGPA Course)	SEC- Community outreach activities	-	-	-
	Total				24

SEMESTER 1

Course: Network Security and Cryptography (SET/CSE/O-MIT/DSC101)

Course Objectives

This course provides an understanding of the fundamentals of network security and cryptography, including encryption techniques, authentication, digital signatures, and network security protocols. It enables students to analyze security threats and apply cryptographic methods to secure communication and protect information systems.

Course Outcomes

1. Explain the fundamentals of cryptography, network security, and security threats.
2. Apply symmetric and public-key encryption techniques for secure communication.
3. Analyze hash functions, message authentication, and digital signature mechanisms.
4. Evaluate authentication protocols and network security services.

Assess system security mechanisms, including firewalls, malware protection, and trusted systems

UNIT 1: Introduction of Cryptography: Introduction To security: Attacks, Services and Mechanisms, Security, Attacks, Security Services, Conventional Encryption: Classical Techniques, Conventional Encryption Model, and steganography, Classical Encryption Techniques. Modern Techniques: Simplified DES, Block Cipher Principles, DES Standard, DES Strength, Differential and Linear Cryptanalysis, Block Cipher Design Principles, Block Cipher Modes of Operations.

UNIT 2: Conventional Encryption Algorithms: Triples DES, Blowfish, International Data Encryption Algorithm, RCS, CAST-128, CR2 Placement and Encryption Function, Key Distribution, Random Number Generation, Placement of Encryption Function.

UNIT 3: Public Key Encryption: Public-Key Cryptography: Principles of Public-Key Cryptosystems, RSA Algorithm, Key, Key Management, Fermat's and Euler's Theorem, Primality, Chinese Remainder Theorem. Hash Functions: Message Authentication and Hash Functions: Authentication Requirements, Authentication Functions, Message Authentication Codes, Hash Function Birthday Attacks, Security of Hash Function and MACS, MD5 Message Digest Algorithm, Secure Hash Algorithm (SHA),

UNIT 4: Digital Signatures: Digital Signature, Authentication Protocol, Digital Signature Standard (DDS) Proof of Digital Signature Algorithm.

UNIT 5: Network and System Security: Authentication Applications: Kerberos X-509, Directory Authentication Service, Electronic Mail Security, Pretty Good Privacy (PGP), S/MIME Security: Architecture, Authentication Header, Encapsulating Security Payloads, Combining Security Associations, Key Management, Web Security: Secure Socket Layer and Transport Layer Security, Secure Electronic Transaction (Set), System Security: Intruders, Viruses, Firewall Design Principles, Trusted Systems.

References:

1. William Stallings, "Cryptography and Network Security: Principles and Practice" Prentice hall, New Jersey
2. Johannes A. Buchmann, "Introduction to Cryptography" Springer-Verlag
3. Atul Kahate, "Cryptography and Network Security" TMH
4. Network Security Bible : Eric Cole, Wiley dreamtech India Pvt. Ltd
5. Practical Cryptography "Bruce Schneier" Wiley dreamtech India Pvt. Ltd.

SEMESTER 1

Course: Design and Analysis of Algorithms (SET/CSE/O-MIT/DSC102)

Course Objectives:

This course introduces the fundamental concepts of algorithm design and analysis, data structures, and computational complexity. It enables students to design efficient algorithms, analyze their performance, and apply advanced algorithmic techniques to solve complex computational problems.

Course Outcomes

1. Explain the fundamentals of algorithms, asymptotic analysis, and computational complexity.
2. Apply appropriate data structures and sorting techniques to solve computational problems efficiently.
3. Design algorithms using dynamic programming, greedy, backtracking, and branch-and-bound techniques.
4. Analyze and implement graph algorithms for solving real-world problems.
5. Evaluate advanced algorithmic concepts, including randomized algorithms, string matching, NP-completeness, and approximation algorithms.

UNIT 1: Introduction of C programming, data types, constant, variables, keywords, comments, decision control instruction, operators & types of operators, case control instruction, functions and pointers, arrays, structure and union, string and string functions.

UNIT 2: Introduction: Algorithms, Analysis of Algorithms, Design of Algorithms, and Complexity of Algorithms, Asymptotic Notations, Growth of function, Recurrences. Sorting in polynomial Time: Insertion sort, Merge sort, Heap sort, and Quick sort Sorting in Linear Time: Counting sort, Radix Sort, Bucket Sort Medians and order statistics.

UNIT 3: Elementary Data Structure: Stacks, Queues, Linked list, Binary Search Tree, Hash Table. Advanced Data Structure: Red Black Trees, Splay Trees, Augmenting Data Structure Binomial Heap, B-Tree, Fibonacci Heap, and Data structure for Disjoint Sets. Union-find Algorithm, Dictionaries and priority Queues, mergeable heaps, concatenable queues.

UNIT 4: Advanced Design and Analysis Techniques: Dynamic Programming, Greedy Algorithm, Backtracking, Branch-and-Bound, Amortized Analysis. Graph Algorithms: Elementary Graph Algorithms, Breadth First search, Depth First search, Minimum Spanning Tree, Kruskal's Algorithms, Prim's Algorithms, Single Source Shortest Path, All pair Shortest Path, Maximum flow and Traveling Salesman Problem. Randomized Algorithms, String Matching, NP-Hard and NP-Completeness Approximation Algorithms, Sorting Network, Matrix Operations, Polynomials and the FFT, Number Theoretic Algorithms.

References:

1. Horowitz Sahani, "Fundamentals of Computer Algorithms." Galgotia
2. Cormen Leiserson et al, "Introduction to Algorithms", PHI
3. Brassard Bratley, "Fundamentals of Algorithms" PHI
4. M.T. Goodrich et al, "Algorithms Design" John Wiley
5. A.V. Aho et al. "The Design and analysis of Algorithms" Person Education
6. Algorithms and Data Structure: Baldwin Scragg, Wiley dreamtech

SEMESTER 1

Course: Machine Learning (SET/CSE/O-MIT/DSC103)
Course Objectives: This course introduces the fundamental concepts and techniques of machine learning, including supervised, unsupervised, and reinforcement learning. It enables students to develop predictive models using decision trees, Bayesian learning, neural networks, genetic algorithms, and data mining techniques for solving real-world problems.
Course Outcomes 1. Explain the fundamental concepts, types, and applications of machine learning. 2. Apply decision tree and Bayesian learning algorithms for classification and prediction tasks. 3. Design and implement artificial neural networks for solving learning problems. 4. Analyze optimization techniques using genetic algorithms and evolutionary learning methods. 5. Apply classification and clustering techniques to extract meaningful patterns from data.
Unit 1: Introduction: Well-Posed learning problems, Basic concepts, Designing a learning system, Issues in machine learning. Types of machine learning: Learning associations, Supervised learning, Unsupervised learning, Reinforcement learning
Unit 2: Decision Tree Learning: Decision tree representation, appropriate problems for decision tree learning, Univariate Trees (Classification and Regression), Multivariate Trees, Basic Decision Tree Learning algorithms, Hypothesis space search in decision tree learning, Inductive bias in decision tree learning, Issues in decision tree learning.
Unit 3: Bayesian Learning: Bayes theorem and concept learning, Bayes optimal classifier, Gibbs algorithms, Naive Bayes Classifier, Bayesian belief networks, The EM algorithm.
Unit 4: Artificial Neural Network: Neural network representation, Neural Networks as a paradigm for parallel processing, Linear discrimination, pairwise separation, Gradient Descent, Logistic discrimination, Perceptron, Training a perceptron, Multilayer perceptron, Back propagation Algorithm. Recurrent Networks, dynamically modifying network structure.
Unit 5: Genetic Algorithms: Basic concepts, Hypothesis space search, Genetic programming, Models of evolution and learning, Parallelizing Genetic Algorithms.
Unit 6: Data Mining Techniques for Analysis: Classification: Decision tree induction, Bayes classification, Rule-based classification, Support Vector Machines, Classification Using Frequent Patterns, k-Nearest-Neighbor, Fuzzy-set approach Classifier, Clustering: K-Means, k-Medoids, Agglomerative versus Divisive Hierarchical Clustering Distance Measures in Algorithmic Methods, Mean-shift Clustering
References: 1. Mitchell T.M., Machine Learning, McGraw Hill 2. Bishop C., Pattern Recognition and Machine Learning, Springer-Verlag 3. Stephen Marsland, Machine Learning: An Algorithmic Perspective, CRC Press

SEMESTER 1

Course: Compiler Design (SET/CSE/O-MIT/DSC104)

Course Objectives:

This course introduces the principles and phases of compiler design, including lexical, syntax, and semantic analysis, intermediate code generation, error handling, code optimization, and code generation. It enables students to understand the design and implementation of compilers for translating high-level programming languages into efficient machine code.

Course Outcomes

1. Explain the structure, phases, and components of a compiler.
2. Apply lexical and syntax analysis techniques using parsing methods and compiler generation tools.
3. Generate intermediate code and manage runtime memory for program execution.
4. Analyze and implement error detection and recovery techniques in different compiler phases.
5. Evaluate code optimization and code generation techniques to improve program execution efficiency.

Unit 1: Compiler Structure: Compilers and Translators, Various Phases of Compiler, Pass Structure of Compiler, Bootstrapping of Compiler. Programming Language: High level languages, lexical and syntactic structure of a language, Data elements, Data Structure, Operations, Assignments, Program unit, Data Environments, Parameter Transmission. Lexical Analysis: The role of Lexical Analyzer, A Simple approach to the design of Lexical Analyzer, Regular Expressions, Transition Diagrams, Finite state Machines, Implementation of Lexical Analyzer, Lexical Analyzer Generator: LEX, Capabilities of Lexical Analyzer.

Unit 2: The Syntactic Specification of Programming Languages: CFG, Derivation and Parse tree, Ambiguity, Capabilities of EFG. Basic Parsing Techniques: Top-Down parsers with backtracking, Recursive descent Parsers, Predictive Parser, Bottom-up Parsers, Shift-Reduce Parsing, Operator Precedence Parsers, LR parsers (SLR, Canonical LR, LALR) Syntax Analyzer Generator: YACC

Unit 3: Intermediate Code Generation: Different Intermediate forms: Three address code, Quadruples and Triples, Syntax Directed Translation mechanism and attributed definition. Translation of Declaration, Assignment, Control flow, Boolean expression, Array References in arithmetic expressions, procedure calls, case statements, postfix translation. Run Time Memory Management: Static and Dynamic storage allocation, stack based memory allocation schemes, Symbol Table management.

Unit 4: Error Detection and Recovery: Lexical phase errors. Syntactic phase errors, semantic errors.

Unit 5: Code Optimization and Code Generation: Local optimization, Peephole optimization, Basic blocks and flow Graphs, DAG, Data flow analyzer, Machine Model, Order of evaluation, Register allocation and code selection.

References:

1. Alfred V Aho, Jeffrey D. Ullman, "Principles of Compiler Design", Narosa
2. A.V. Aho, R. Sethi and J.D.Ullman, "Compiler Principle, Tech and tools" AW
3. H.C. Holub "Compiler Design in C", Printice Hall Inc.
4. Apple, "Modern Computer Implementation in C: Basic Design" Cambridge Press
5. Modern Compiler Design: Dick Grune, Wiley dreamtech India Pvt. Ltd.
6. Starting Out with Modern Compiler “ David Gaddis Wiley dreamtech India Pvt. Ltd.

SEMESTER 1

Course: Cloud Computing (SET/CSE/O-MIT/DSE1.1)

Course Objectives:

This course introduces the fundamental concepts, architecture, and service models of cloud computing. It enables students to understand cloud technologies, data management, virtualization, governance, security, and migration strategies for deploying and managing cloud-based applications and services.

Course Outcomes

1. Explain the fundamentals, architecture, and service models of cloud computing.
2. Apply cloud technologies and services for deploying and managing applications.
3. Analyze cloud data management, storage, virtualization, and security mechanisms.
4. Evaluate cloud governance, standards, and deployment models for enterprise applications.
5. Assess cloud migration strategies and emerging trends in cloud computing.

Unit 1: Introduction- Objectives, From collaborative to the Cloud – A short history Client Server Computing, Peer-to-Peer Computing, Distributed Computing, Collaborative Computing, Cloud Computing, Functioning of Cloud Computing, Cloud Architecture, Cloud Storage, Cloud Services, Industrial Applications. Business Values, Introduction-Objectives, Service Modeling, Infrastructure Services, Platform Services, Software Services - Software as service modes- Massively scaled software as a service- Scale of Economy, Management and Administration. Inside Cloud Computing- Introduction- Objectives, Feeling Sensational about Organization, Making Strategy Decisions- Governance Issues- Monitoring Business Processes- IT Cost Management,

Unit 2: Cloud Service Administration- Service Level Agreements and Monitoring-Support Services Accounting Services, Resource Management- IT Security- Performance Management Provisioning- Service Management, Untangling Software Dependencies. Cloud Computing Technology- Introduction-Objectives, Clients – Mobile – Thin – Thick, Security - Data Linkage - Offloading Work - Logging - Forensics - Development – Auditing, Network- Basic Public Internet- The Accelerated Internet- Optimised Internet Overlay- Site-to-Site VPN- Cloud Providers- Cloud Consumers - Pipe Size- Redundancy, Services- Identity- Integration- Mapping- Payments- Search.

Unit 3: Accessing the Cloud- Introduction-Objectives, Platforms- Web Application Framework Web Hosting Services- Proprietary Methods, Web Applications- API's in Cloud Computing, Browsers for Cloud Computing- Internet Explorer- Mozilla Firefox- Safari Chrome. Data Management- Introduction- Objectives, Data Security- Data Location- Data Control Securing data for transport, Scalability and Cloud Services- Large Scale Data Processing Databases and Data Stores- Data Archival.

Unit 4: Information Storage in Cloud Computing- Introduction- Objectives, Storage as a Service, Storage Providers- Amazon Simple Storage Service- Nirvanix- Google Bigtable Datastore MobileMe- Live Mesh, Storage Security, Merits and Demerits of Storage. Discovery of Private and Hybrid Clouds- Introduction- Objectives, Need for PrivacyDefining a private cloud- Public, Private, and Hybrid Clouds – A Comparison, Examining the Economics of the private cloud- Assessing capital expenditures- Vendor Private Cloud Offerings, The Up Key Vendors- Service Oriented- Systems Integrators- Technology Enablers.

Unit 5: Cloud Computing Standards- Introduction- Objectives, Best Practices and Standards, Practical Issues- Interoperability- Portability- Integration- Security, Standards Organizations and Groups- Cloud Security Alliance- Distributed Management Task Force (DMTF)- National Institute of Standards and Technology (NIST)- Open Cloud Consortium (OCC)- Open Grid Forum (OGF)- Object Management Group (OMG)- Storage Networking Industry Association (SNIA)- Cloud Computing Interoperability Forum (CCIF)- Vertical Groups. Desktop and Device Management- Introduction- Objectives, Desktop Virtualization- Across Industries- Client Desktops, Desktop placement in the cloud- Merits- Desktop as a Service (DaaS), Desktop Management- Watching the four areas- Asset Management.

Unit 6: Cloud Governance-Introduction-objectives, IT Governance, Deciding the Governor, Risk Assessment of running the cloud- Understanding possible risks- Performance monitoring and measurement- Measurement Methods, Working of Governance- Establishment of the Governance Body- IT Service Performance – Monitoring and Measuring- Cataloging control and Compliance Data.

SEMESTER 1

Migrating to the Cloud- Introduction- Objectives, Cloud Services for individuals- Available Services - Skytap Solution, Cloud Services Aimed at the mid – market, Enterprise Class Cloud Offerings- MS Exchange - VMotion- VMWare vCenter Converter- Hyper – V Live Migration, Migration- Applications needed for migration - Moving existing data to cloud Using the Wave approach.

Unit 7: Migrating to the Cloud- Introduction- Objectives, Analyzing the Services- Establishing a Baseline and Metrics- Tools, Best Practices- Finding the Right vendor- Phased-in Vs Flashcut Approaches- Bringing in Creativity, How Cloud computing might evolve- Researcher Predictions- Responding to Changes- Getting ready.

References

1. Rajkumar Buyya, James Broberg, and Andrzej Goscinski, Cloud Computing: Principles and Paradigms, Wiley.
2. Barrie Sosinsky, Cloud Computing Bible, Wiley.
3. Thomas Erl, Ricardo Puttini, and Zaigham Mahmood, Cloud Computing: Concepts, Technology & Architecture, Pearson.
4. Anthony T. Velte, Toby J. Velte, and Robert Elsenpeter, Cloud Computing: A Practical Approach, McGraw-Hill.
5. Kai Hwang, Geoffrey C. Fox, and Jack J. Dongarra, Distributed and Cloud Computing: From Parallel Processing to the Internet of Things, Morgan Kaufmann (Elsevier).

SEMESTER 1

Course: Android Application Development (SET/CSE/O-MIT/DSE1.2)
Course Objectives: This course introduces the fundamentals of Android application development, including application architecture, user interface design, data management, networking, and deployment. It enables students to design, develop, test, and deploy Android applications using Android Studio and the Android SDK
Course Outcomes 1. Explain the architecture, components, and development environment of Android applications. 2. Design Android applications using activities, intents, services, and application resources. 3. Develop interactive user interfaces using layouts, animations, and Android UI components. 4. Apply Android APIs for data storage, networking, content sharing, and web services. 5. Test, debug, and deploy Android applications for real-world use.
Unit 1: Introduction to Android: The Android Platform, Android SDK, Android Studio installation, Android Installation, building First Android application, Understanding Anatomy of Android Application, Android Manifest file. Unit 2: Android Application Design Essentials: Anatomy of an Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions. Unit 3: Android User Interface Design Essentials: User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation. Testing Android applications, Publishing Android application, Using Android preferences, Managing Application resources in a hierarchy, working with different types of resources. Unit 4: Using Common Android APIs: Using Android Data and Storage APIs, managing data using Sqlite, Sharing Data between Applications with Content Providers, Using Android networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.
References: 1. Meier Reto and Lake Ian, “Professional Android”, Wrox 2. John Horton, Android Programming for Beginners, Packt Publishing

SEMESTER 1

Course: Computer Vision (SET/CSE/O-MIT/DSE1.3)

Course Objectives:

This course introduces the fundamentals of image processing and computer vision, including image acquisition, enhancement, feature extraction, object representation, and 3D vision. It enables students to analyze visual data and develop computer vision solutions for real-world applications such as object detection, face recognition, and motion analysis.

Course Outcomes

1. Explain the fundamentals of image processing, image formation, and preprocessing techniques.
2. Apply edge, line, and region-based methods for image analysis and feature extraction.
3. Analyze computer vision techniques for object representation, motion analysis, and 3D vision.
4. Evaluate computer vision algorithms for object detection, tracking, and scene understanding.
5. Develop computer vision solutions for applications such as face recognition, road sign detection, and gait analysis.

Unit 1: Fundamentals of Image Processing: Sources of imagery, Physics of imaging, Representing, acquiring and displaying images, Grayscale, color, noise, lens distortion, and filtering. Preprocessing, and image correction, Enhancing features and correcting imperfections, Addressing noise, lens distortion, and blurring.

Unit 2: Computer Vision Paradigms: Bottom-up, top-down, neural net, feedback, Pixels, lines, boundaries, regions, and object representations, Low-level, intermediate-level and high-level vision, Historical and illustrative examples. Finding Edges and Lines: Finding edges (low-level), Gradients, zero crossing detectors, line models, Roberts, Sobel, Canny, Finding and grouping lines (intermediate-level), Boundary tracing, line fitting, Hough transform.

Unit 3: Region Processing and 3D Vision: Finding elementary regions (low-level), Merging, splitting and grouping regions (intermediate-level), Grouping and analyzing lines and regions (high-level), Stereo and Motion, Optical Flow, Motion Understanding Representing the environment and Matching, Clouds, generalized cylinders, semantic nets, Matching line and region groups to object representations (high-level).

Unit 4: Applications: Face detection, Face recognition, Foreground and background separation, object detection and tracking, combining views from multiple cameras, Identifying road signs, Gait analysis.

References:

1. Digital Image Processing - R.C. Gonzalez and R.E. Woods, Third Edition, Pearson, 2014
2. Computer & Machine Vision - E. R. Davies, Fourth Edition, Academic Press, 2012
3. Computer Vision - A Modern Approach - D.A. Forsyth and J. Ponce, PHI Pvt. Ltd, 2009
4. Image Processing, Analysis and Machine Vision - M. Sonka, V. Hlavac, and R. Boyle, Thomson Asia Pvt. Ltd., Singapore, 2001

SEMESTER 1

Course: Genetic Algorithm and Application (SET/CSE/O-MIT/MDE1.1)

Course Objectives:

This course introduces the principles and techniques of genetic algorithms and evolutionary computation for solving optimization problems. It enables students to understand genetic operators, hybrid optimization approaches, and real-world applications of genetic algorithms in machine learning, data mining, engineering, and intelligent systems.

Course Outcomes

1. Explain the fundamentals of genetic algorithms and evolutionary computation.
2. Apply genetic algorithm components, including encoding, selection, crossover, and mutation, to optimization problems.
3. Analyze optimization strategies and constraint-handling techniques using genetic algorithms.
4. Evaluate advanced genetic algorithm variants and hybrid evolutionary approaches.
5. Apply genetic algorithms to solve real-world problems in machine learning, data mining, scheduling, and engineering applications.

Unit 1: Introduction to Genetic Algorithms: Introduction to optimization techniques, conventional optimization vs evolutionary optimization, basics of evolutionary computation, biological inspiration of genetic algorithms, Darwin's theory of evolution, chromosome, gene, population, fitness function, genotype and phenotype, history and development of genetic algorithms, advantages and limitations of genetic algorithms, applications of genetic algorithms.

Unit 2: Genetic Algorithm Fundamentals: Structure and working of genetic algorithm, representation schemes, binary encoding, permutation encoding, value encoding, tree encoding, population initialization, fitness evaluation, parent selection techniques, roulette wheel selection, tournament selection, rank selection, elitism, reproduction strategies, termination criteria.

Unit 3: Genetic Operators and Optimization: Crossover techniques, single point crossover, two point crossover, multipoint crossover, uniform crossover, mutation techniques, bit flip mutation, swap mutation, inversion mutation, adaptive mutation, parameter tuning, convergence of genetic algorithms, optimization problems using genetic algorithms, constraints handling techniques.

Unit 4: Advanced Genetic Algorithms and Hybrid Approaches: Variants of genetic algorithms, adaptive genetic algorithms, parallel genetic algorithms, hybrid genetic algorithms, genetic programming, multi-objective optimization, comparison of genetic algorithms with simulated annealing, particle swarm optimization, neural networks, swarm intelligence approaches.

Unit 5: Applications of Genetic Algorithms: Genetic algorithms in machine learning, feature selection, data mining, scheduling problems, travelling salesman problem, robotics and control systems, network optimization, image processing applications, medical diagnosis systems, financial prediction, real-world case studies and industrial applications.

References:

1. David E. Goldberg – *Genetic Algorithms in Search, Optimization and Machine Learning*, Pearson Education.
2. Melanie Mitchell – *An Introduction to Genetic Algorithms*, MIT Press.
3. S. Rajasekaran and G.A. Vijayalakshmi Pai – *Neural Networks, Fuzzy Logic and Genetic Algorithms*, PHI Learning.
4. A.E. Eiben and J.E. Smith – *Introduction to Evolutionary Computing*, Springer.
5. Zbigniew Michalewicz – *Genetic Algorithms + Data Structures = Evolution Programs*, Springer.

SEMESTER 2

Course: Data Warehousing and Data Mining (SET/CSE/O-MIT/DSC201)

Course Objectives

This course introduces the concepts of data warehousing and data mining, including data preprocessing, association analysis, classification, clustering, and web mining. It enables students to analyze large datasets and apply data mining techniques to discover meaningful patterns and support decision-making.

Course Outcomes

1. Explain the fundamentals of data warehousing, OLAP, and data mining techniques.
2. Apply data preprocessing and association rule mining techniques to extract useful patterns from data.
3. Analyze classification and clustering algorithms for predictive and descriptive data analysis.
4. Evaluate web mining techniques and data mining methods for complex data sources.
5. Apply data mining techniques to solve real-world problems and support intelligent decision-making.

UNIT 1: Introduction to data mining, need for data warehousing and data mining, application potential, keywords and techniques. Data Warehousing and On line analytical Processing (OLAP): Aggregation operations, models for data warehousing, star schema, fact and dimension tables, conceptualization of data warehouse and multidimensional databases, Relationship between warehouse and mining.

UNIT 2: Data mining primitives: Data preprocessing, data integration, data transformation. Definition and specification of a generic data mining task. Description of Data mining query language with examples. Association analysis: Different methods for mining association rules in transaction based data bases. Illustration of confidence and support. Multidimensional and multilevel association rules. Classification of association rules. Association rule algorithms – A priori and frequent pattern growth.

UNIT 3: Classification and Prediction: Different classification algorithms. Use of genie index, decision tree induction, Bayesian classification, neural network technique of back propagation, fuzzy set theory and genetic algorithms. Clustering: Partition based clustering, hierarchical clustering, model based clustering for continuous and discrete data. Scalability of clustering algorithms. Parallel approaches for clustering.

UNIT 4: Web mining: Web usage mining, web content mining, web log attributes. Data mining issues in object oriented data bases, spatial data bases and multimedia data bases and text data bases.

References:

1. J. Han, M. Kamber, “Data Mining Concepts and Techniques”, Harcourt India Pvt Ltd, 2001.
2. M. Dunham, “ Data Mining : introductory and Advanced Topics”, Pearson Pub, 2003.
3. A.K. Pujari, “Data Mining Techniques”, Universities Press.

SEMESTER 2

Course: E-Commerce (SET/CSE/O-MIT/DSC202)

Course Objectives:

This course introduces the fundamentals of electronic commerce, including e-commerce technologies, network infrastructure, web security, electronic payment systems, and legal aspects. It enables students to understand secure online business transactions and the technologies that support modern e-commerce applications.

Course Outcomes

1. Explain the fundamentals, architecture, and business applications of electronic commerce.
2. Analyze the network infrastructure and mobile technologies that support e-commerce systems.
3. Apply web security mechanisms and firewall technologies to secure online transactions.
4. Evaluate encryption techniques and digital security methods for electronic communication.
5. Analyze electronic payment systems, e-commerce regulations, and legal issues in digital business.

UNIT 1: Introduction: Electronic Commerce - Technology and Prospects, Definition of E-Commerce, Economic potential of electronic commerce, Incentives for engaging in electronic commerce, forces behind E-Commerce, Advantages and Disadvantages, Architectural framework, Impact of E-Commerce on business.

UNIT 2: Network Infrastructure of E-Commerce: Internet and Intranet based E Commerce Issues, problems and prospects, Network Infrastructure, Network Access Equipments, Broadband telecommunication (ATM, ISDN, FRAME RELAY). Mobile Commerce: Introduction, Wireless Application Protocol, WAP Technology, Mobile Information device, Mobile Computing Applications.

UNIT 3: Web Security: Security Issues on web, Importance of Firewall, components of Firewall, Transaction security, Emerging client server, Security Threats, Network Security, Factors to consider in Firewall design, Limitation of Firewalls.

UNIT 4: Encryption: Encryption techniques, Symmetric Encryption-Keys and data encryption standard, Triple encryption. Asymmetric encryption-Secret key encryption, public and private pair key encryption, Digital Signature, Virtual Private Network.

UNIT 5: Electronic Payments: Overview, The SET protocol, payment Gateway, certificate, digital Tokens, Smart card, credit card, magnetic strip card, E Checks, Credit/Debit card based EPS, online Banking EDI Application in business, E-Commerce Law, Forms of Agreement, Govt. policies and Agenda.

References:

1. Ravi Kalakota, Andrew Winston, "Frontiers of Electronic Commerce" Addison Wesley.
2. Bajaj and Nag. "E-Commerce the cutting edge of Business". TMH.
3. P. Loshin, John Vacca, "Electronic Commerce" Firewall Media, N.Delhi.
4. E Business and Commerce: Brahm Cazner, Wiley dreamtech.

SEMESTER 2

Course: Artificial Intelligence (SET/CSE/O-MIT/DSE2.1)
Course Objectives: This course introduces the fundamental concepts of Artificial Intelligence, including knowledge representation, search techniques, reasoning, planning, and intelligent system design. It enables students to understand AI methodologies and apply them to solve real-world problems involving decision-making, perception, and learning.
Course Outcomes 1. Explain the fundamentals, concepts, and applications of Artificial Intelligence. 2. Apply search strategies and heuristic techniques to solve AI problems. 3. Analyze knowledge representation and reasoning using predicate logic and rule-based systems. 4. Evaluate planning and decision-making techniques for intelligent agents and problem-solving. 5. Apply AI techniques in knowledge-based systems, image processing, and natural language processing.
Unit 1 Introduction: Definition and meaning of artificial intelligence, A.I. techniques, pattern recognition, Level of, speech recognition representation in A.I. properties of internal representation.
Unit 2: Production System: Different types of tracing, strategies, graph search strategies, Heuristic graph, search procedure, AND/OR graph, relationship between decompositional and compatible systems, searching Gate Tree, min max search game playing, actual game playing.
Unit 3: Introduction to Predicate Calculus: Predicates and Arguments, connectives, Simplifications of strategies, extracting answers from Resolution Refutation. Control strategies.
Unit 4: Rule Based Deduction Systems: Forward and backward deduction system, resolving with AND/OR graph, computation, deduction and program synthesis, central knowledge for rules based deduct systems. Managing Plans of Action: Plan interpreter, planning decisions, execution monitoring and re-planning domain of application robot motion planning and game playing.
Unit 5: Structural Object Representation: Semantic networks semantic market matching deductive operations on structured objects.
Unit 6: Architectural for A.I. Systems: Knowledge, acquisitions representation IMAGES PROCESSING, Natural language processing.
References: 1. Introduction to artificial Intelligence Eugene Charnik Drew MC mott 2. Artificial Intelligence Elaine Rice. 3. Principal of Artificial Intelligence, Nelson, Springer-Verlag. 4. Artificial Intelligence Application Programming: Tim Jones, Wiley dreamtech.

SEMESTER 2

Course: Image Processing (SET/CSE/O-MIT/DSE2.2)

Course Objectives:

This course introduces the fundamentals of digital image processing, including image enhancement, restoration, compression, segmentation, and object recognition. It enables students to analyze digital images and apply image processing techniques for solving real-world computer vision and multimedia applications.

Course Outcomes

6. Explain the fundamentals of digital image processing and image acquisition.
7. Apply image enhancement and filtering techniques in spatial and frequency domains.
8. Analyze image restoration and compression methods for efficient image representation.
9. Apply morphological operations and image segmentation techniques for image analysis.
10. Evaluate object representation and recognition techniques for image processing applications.

Unit 1: Processing, Examples of Digital Image Processing application, Fundamental steps in Digital Image processing, Components of Image Processing system Fundamentals: Elements of Visual Perception, Light and Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Some basic Relationships between Pixels, Linear and Nonlinear Operations.

Unit 2: Image Enhancement in the spatial domain: Background, Some basic gray level transformation, Introduction of Histogram processing, Enhancement using Arithmetic/Logic operations, Basics of spatial filtering, Smoothing spatial filters, Sharpening spatial filters, Image Enhancement in the Frequency Domain: Introduction.

Unit 3: Image Restoration: Model of the Image Degradation/Restoration process, Noise Models, Restoration in the presence of noise only spatial filtering, Inverse filtering, Minimum Mean Square Error (Wiener) filtering, Geometric mean filter, Geometric Transformations, Image Compression: Fundamentals, Lossy Compression, Lossless Compression, Image Compression models, Error-free Compression: Variable length coding, LZW coding, Bit plane coding, Run length coding, Introduction to JPEG.

Unit 4: Morphology: Dilation, Erosion, Opening and Closing, Hit-and Miss transform, Morphological Algorithms: Boundry Extraction, Region filling, Extraction of connected components, Convex Hull, Image Segmentation: Definition, characteristics of segmentation Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region based segmentation. Introduction to Representation and Description, Introduction to Object Recognition.

References

1. Digital Image Processing: Rafael C. Gonzalez and Richard E. Woods. Addison Wesley.
2. Fundamentals of Digital Image Processing. Anil K. Jain, PHI.
3. Digital Image Processing and Analysis: B. Chanda and D. Dutta Majumber, PHI.
4. Image Processing in C: Dwayne Phillips, BPB.

SEMESTER 2

Course: Natural Language Processing (SET/CSE/O-MIT/DSE2.3)
Course Objectives: This course introduces the fundamental concepts of Natural Language Processing (NLP), including language modeling, syntax, semantics, pragmatics, and machine translation. It enables students to develop computational techniques for analyzing, understanding, and generating natural language.
Course Outcomes 1. Explain the fundamentals of natural language processing, regular expressions, automata, and language models. 2. Apply part-of-speech tagging, parsing, and grammar-based techniques for syntactic analysis. 3. Analyze semantic representations and lexical processing for language understanding. 4. Evaluate semantic analysis, word sense disambiguation, and information retrieval techniques. 5. Apply NLP techniques to discourse analysis, conversational agents, natural language generation, and machine translation.
Unit 1: Regular expressions and automata, Morphology and Finite State transducers, N – grams. Unit 2: Word classes and part of speech tagging, Context free grammars for English, Parsing with context free grammars. Unit 3: Features and Unifications, Lexicalized and Probabilistic parsing. Semantics: Representing meaning, Unit 4: Semantic analysis, Lexical semantics, Word Scene Disambiguation and Information retrieval. Unit 5: Pragmatics: Discourse, Dialog and Conversational Agents, Natural Language Generation, Machine Translation.
References: 1. Daniel, Jurafsky and Martin, Speech and Language Processing, Pearson, 2003.

SEMESTER 2

Course: Bioinformatics- (SET/CSE/O-MIT/MDE2.1)

Course Objectives

This course aims to provide students with a fundamental understanding of biological systems and bioinformatics concepts. It introduces sequence analysis, genomics, proteomics, and computational approaches for analyzing biological data. The course also develops knowledge of molecular modeling, drug design, and bioinformatics tools used in modern biological and pharmaceutical research.

Course Outcomes

1. Explain the structure and function of biological systems and molecular processes.
2. Apply sequence alignment techniques and biological database search tools.
3. Analyze genomic and proteomic data using bioinformatics methods.
4. Demonstrate the principles of molecular modeling and computer-aided drug design.

UNIT 1: Fundamentals of Biological Systems: Introduction to cells: Structure of prokaryotic and eukaryotic cells. Cell organelles and their functions. Molecules of life: Introduction to carbohydrates, proteins, lipids and nucleic acids – Different structural forms and functional organizations. DNA replication, transcription and translation. Gene regulation.

UNIT 2: Sequence Analysis: Introduction to Sequence alignment, Substitution matrices, Scoring matrices –PAM and BLOSUM. Local and Global alignment concepts, dot plot, dynamic programming methodology, Multiple sequence alignment- Progressive alignment. Database searches for homologous sequences – FASTA and BLAST versions.

UNIT 3: Genomics and Proteomics: Functional Genomics: Gene expression analysis by cDNA micro arrays, SAGE, Strategies for generating ESTs and full length inserts; EST clustering and assembly; EST databases- DBEST, UNIGENE Proteomics: Protein and RNA structure prediction, polypeptic composition, secondary and tertiary structure, algorithms for modeling protein folding, structure prediction, proteomics, protein classification, experimental techniques, ligand screening, post-translational modification prediction.

UNIT 4: Computer Aided Drug Design: Introduction to the concepts of molecular modeling. Molecular structure and internal energy. Macromolecular modeling. Design of ligands for known macromolecular target sites. Drug – receptor interactions. Classical SAR/QSAR studies and their implications to the 3-D modeler. Molecular Docking. Structure-based drug design for all classes of targets.

References:

1. Andreqas D. Baxevanis, B. F. Francis Ouellette. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins John Wiley and Sons, New York (1998).
2. C. Rastogi, Namita Mendiratta, Parag Rastogi. Bioinformatics-concepts, skills, Applications.
3. Bioinformatics Sequence and Genome Analysis. 2001. David W. Mount. Cold Spring Harbor Laboratory Press.
4. Andrew, R. Leach Molecular modeling: Principles and applications Prentice Hall Publications.