CRYPTOGRAPHY AND NETWORK SECURITY

Instruction	:	3 Periods / week	Sessional Marks	: 30
Tutorial	:	1 Period / week	End Examination Marks	: 70
Credits	:	3	End Exam Duration	: 3 Hours

Course Objectives:

1. Understand security concepts, Ethics in Network Security.
2. Understand security threats, and the security services and mechanisms to counter them.
3. Comprehend and apply relevant cryptographic techniques.
4. Comprehend security services and mechanisms in the network protocol stack.
5. Comprehend and apply authentication services and mechanisms.
6. Comprehend and apply email and web security services and mechanisms.
7. Comprehend computer and network access control.

Unit I - Introduction

Security Attacks (Interruption, Interception, Modification and Fabrication), Passive and Active Attacks, Security Services (Confidentiality Authentication, Integrity, Non-repudiation, Access Control and Availability) and Mechanisms, A Model for Internet Work Security, Steganography, Internet Standards and RFCs.

Unit II – Symmetric Encryption and Message Confidentiality

Symmetric Encryption Principles, Symmetric Block Encryption Algorithms, Cipher Block Modes of Operation, Location of Encryption Devices, Key Distribution, Approaches of Message Authentication, Secure Hash Functions and HMAC.

Public-Key Cryptography Principles, Public-Key Cryptography Algorithms, Digital Signatures, Key Management.

Unit III – Key distribution and user Authentication

Kerberos, X.509 Directory Authentication Services, Public-Key Infrastructure.
Electronic Mail Security: Pretty Good Privacy (PGP) and S/MIME.

Unit IV – IP Security

IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations, Key Management.
Web Security Considerations, Secure Socket Layer (SSL) and Transport layer Security (TLS), Secure Electronic Transaction (SET).

Unit V – Network Management Security

Basics Concepts of SNMP, SNMPv1 Community facility and SNMPV3, Intruders, Viruses and Related Threats.
Firewall Design Principles, Trusted Systems, Intruder Detection Systems, Common Criteria for Information Technology Security Evaluation.
Advanced Persistent Threats

Course Outcomes: At the end of the course, the student should be able to

CO 1	:	Understand the theory of fundamental cryptography, encryption and decryption algorithm
CO 2	:	Build a secure authentication system.
CO 3	:	Understand the key management principles and implement the digital signature.
CO 4	:	Develop the secured IP and the secured Web for electronic transactions
CO 5	:	Familiar with the classification of intruders, viruses and study the mechanisms to counter them and be familiar with the concepts of Firewalls, Trusted systems and IDS.

Text Books:

1. Network Security Essentials: Applications and Standards, William Stallings, 4th Edition Pearson Education.
2. Cryptography and Network Security, B.A.Forouzan and D.Mukhopadhyay, 2nd Edition, TMH, 2010.

References:

1. Cryptography and Network Security, William Stallings, 3rd Edition, PHI/Pearson.
2. Advanced Persistent Threat: Understanding the Danger and How to Protect Your Organization , Dr. Eric Cole, Elsevier
3. Hack Proofing Your Network, Ryan Russell, Dan Kaminsky, Rain Forest Puppy, Joe Grand, David Ahmad, Hal Flynn Ido Dubrawsky, Steve W.Manzuik and Ryan Permeh, 2nd Edition, Wiley Dreamtech.
4. Network Security: The Complete Reference, Robert Bragg and Mark Rhodes, TMH.

35402

LINUX PROGRAMMING

(Common to CSE & IT)

Instruction	:	3 Periods / week	Sessional Marks	:	30
Tutorial	:	1 Period / week	End Examination Marks	:	70
Credits	:	3	End Exam Duration	:	3 Hours

Course Objectives:

1. Review basic concepts covered in the core Operating Systems course prerequisite as they are realized in the Linux platform.
2. Effectively use a variety of tools for Linux application development.
3. To develop the skills necessary for systems programming including file system programming, process and signal management, and inter-process communication.
4. Create socket base applications.

Unit I - Files

Files: Files concept, File System Structure, Inodes, File Attributes, File types, Library functions, the standard I/O and formatted I/O in C, stream errors, kernel support for files, System calls, file descriptors, low level file Access- File structure related system calls(File APIs), file and record locking, file and directory management Directory file APIs, Symbolic links& hard links.

Unit II - Process, Signals

Process: Process concept, Kernel support for process, process attributes, process control - process creation, waiting for a process, process termination, zombie process, orphan process APIs.
Signals: Introduction to signals, Signal generation and handling, Kernel support for signal, Signal function, unreliable signal, reliable signal, kill, raise, alarm, pause, abort, sleep functions.

Unit III - IPC, Message Queues, Semaphores

IPC: Introduction to IPC, Pipes, FIFOs, Introduction to three types of IPC – message queues, semaphores and shared memory.
Message Queues: Kernel support for messages, Unix system V APIs for messages, client/server example.
Semaphores: Kernel support for semaphores, Unix system V APIs for semaphores.

Unit IV - Shared Memory, Multithreaded Programming

Shared Memory: Kernel support for shared memory, Unix system V APIs for shared memory, semaphore and shared memory example.
Multithreaded Programming: Differences between threads and processes, Thread structure and uses. Threads and Lightweight Processes, POSIX Thread APIs, Creating Threads. Thread Attributes. Thread Synchronization with semaphores and with Mutexes, Example programs.

Unit V - Sockets, Advanced I/O

Sockets: Introduction to Sockets, Socket Addresses, Socket system calls for connection oriented protocol and connectionless protocol, example, client/server programs.
Advanced I/O: Introduction, Non-Blocking I/O, Record Locking, I/O Multiplexing, select and pselect Functions, Poll Function, Asynchronous I/O, POSIX Asynchronous I/O **readv** and **writev** functions, **readn** and **written**-functions, Memory-Mapped I/O

Course Outcomes: At the end of the course, the student should be able to

CO 1 : Implement a simple file system.
CO 2 : Implement the process abstraction and asynchronous event handling
CO 3 : Implement IPC Mechanisms, Messages Queues and Semaphores and related API's.
CO 4 : Design server programs based on various design alternatives
CO 5 : Be familiar with using sockets to implement client-server environment and Advanced I/O.

Text Books:

1. Advanced Programming in the UNIX Environment, W Richard Stevens and Stephen A Rago, 3rd Edition, Addison Wesley / Pearson Education Inc., 2013.
2. Unix System Programming using C++, T.Chan, PHI.

References:

1. Unix Network Programming, W R Stevens, PHI.
2. Unix Internals: The New Frontiers, Uresh Vahalia, Pearson Education.
3. Unix for Programmers and Users, Graham Glass and King Ables, 3rd Edition, Pearson Education.
4. Unix Network Programming, W R. Stevens, 1st Edition, PHI.

DATA MINING

(Professional Elective – II)

Instruction	:	3 Periods / week	Sessional Marks	:	30
Tutorial	:	1 Period / week	End Examination Marks	:	70
Credits	:	3	End Exam Duration	:	3 Hours

Prerequisites: Basic knowledge of RDBMS (relational database management system) concepts with hands-on exposure (includes design & implementation of table structures).

Course Objectives:

1. To demonstrate the value of Data mining in solving real-world problems.
2. To demonstrate Understanding of foundational concepts underlying Data mining.
3. To demonstrate Understanding of algorithms commonly used to perform various Data mining tasks.

Unit I - Introduction to Data Mining

Different types of data used for Datamining, Extraction of different kinds of patterns, Technologies Used in datamining, Applications of datamining, major issues in data mining.

Getting to Know Your Data

Data Objects and Attribute Types, Basic Statistical Descriptions of Data, Data Visualization, Measuring Data Similarity and Dissimilarity.

Unit II - Data Preprocessing, Data Warehousing and Online Analytical Processing

Data Preprocessing: An Overview, Data Quality: Why Preprocess the Data? Major Tasks in Data Preprocessing, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.

Data Warehousing and Online Analytical Processing: Data Warehouse: Basic Concepts Data Warehouse Modeling: Data Cube and OLAP, Data Warehouse Design and Usage, Data Warehouse Implementation, Data Generalization by Attribute-Oriented Induction.

Unit III - Mining Frequent Patterns, Associations, and Correlations: Basic Concepts and Methods

Basic Concepts, Frequent Item set Mining Methods, Which Patterns Are Interesting?—Pattern Evaluation Methods, Pattern Mining in Multilevel, Multidimensional Space,

Classification: Basic Concepts

Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification, Model Evaluation and Selection, Lazy Learners (or Learning from Your Neighbors)

Unit IV - Cluster Analysis: Basic Concepts and Methods

Cluster Analysis, Partitioning Methods, Evaluation of Clustering

Outlier Detection:

Outliers and Outlier Analysis, Outlier Detection Methods, Statistical Approaches, Proximity-Based Approaches, Clustering-Based Approaches, Classification-Based Approaches.

Unit V - Data Mining Trends and Research Frontiers

Mining Complex Data Types, Other Methodologies of Data Mining, Data Mining Applications, Data Mining and Society, Data Mining Trends.
Mining High-Dimensional Data and Colossal Patterns, Additional Topics Regarding Classification, Clustering High-Dimensional Data.

Course Outcomes: At the end of the course, the student should be able to:

CO 1 : Display a comprehensive understanding of different data mining tasks and the algorithms most appropriate for addressing them.
CO 2 : Assess raw input data and process it to provide suitable input for a range of Data mining algorithms.
CO 3 : Discover and measure interesting patterns from different kinds of databases and also apply technique of classification to implement supervised learning mechanisms
CO 4 : Apply the techniques of clustering, and outlier data to implement unsupervised learning mechanisms.
CO 5 : Evaluate and select appropriate Data mining algorithm for different Data Mining tasks.

Text Books:

1. Data Mining: Concepts and Techniques, Jiawei Han and Micheline Kamber, 3rd Edition, Morgan Kaufman Publishers, Elsevier, 2012.
2. Introduction to Data Mining, Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Pearson Education, 2007

References:

1. Data Mining Techniques, Michael Berry and Gordon Linoff, Wiley Publishing, 2004.
2. The Data Warehouse Toolkit, Kimball and Ross, Second Edition, John Wiley & Sons, 2002.
3. Data Mining: The Textbook, Charu C Agarwal, Springer, 2015.

37456/37403

AD HOC AND SENSOR NETWORKS

(Professional Elective-II)
(Common to CSE & IT)

Instruction	:	3 Periods / week	Sessional Marks	:	30
Tutorial	:	1 Period / week	End Examination Marks	:	70
Credits	:	3	End Exam Duration	:	3 Hours

Course Objectives:

1. To understand the applications of adhoc and sensor networks
2. To understand the MAC and transport protocols for adhoc networks
3. To understand the concepts of sensor networks
4. To understand the security of sensor networks

Unit I - Introduction to Ad Hoc Wireless Networks

Characteristics of MANETs, Applications of MANETs, Challenges.
Routing in MANETs: Topology-based versus Position-based approaches, Topology based routing protocols, Position based routing, Other Routing Protocols.

Unit II - Data Transmission in MANETs

The Broadcast Storm, Multicasting, Geocasting
TCP over Ad Hoc Networks: TCP Protocol overview, TCP and MANETs, Solutions for TCP over Ad Hoc

Unit III - Basics of Wireless Sensors and Applications

Introduction, The Mica Mote, Sensing and Communication Range, Design issues, Energy consumption, Clustering of Sensors, Applications of WSNs.
Data Retrieval In Sensor Networks: Classification of WSNs, MAC layer, Routing layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs.

Unit IV - Security

Security in Ad hoc Wireless Networks, Key Management, Secure Routing, Cooperation in MANETs, Intrusion Detection Systems.
Sensor Network Platforms and Tools: Sensor Network Hardware, Sensor Network Programming Challenges, Node-Level Software Platforms

Unit V - Operating System

TinyOS Imperative Language: nesC, Dataflow style language: T1nyGALS, Node- Level Simulators, ns-2 and its sensor network extension, TOSSIM

Course Outcomes: At the end of the course, the student should be able to

CO 1	:	Understand basics of MANETs and routing protocols
CO 2	:	Understand how TCP modified for wireless networks
CO 3	:	Design of different layers of WSN
CO 4	:	Understand issues and challenges of security in WSNs
CO 5	:	Design and implement sensor network protocols in the NesC/TinyOS

Text Books:

1. Ad Hoc and Sensor Networks: Theory and Applications, Carlos De Morais Cordeiro and Dharma R Agrawal, World Scientific Publications / Cambridge University Press, 2006.
2. Wireless Sensor Networks: An Information Processing Approach, Feng Zhao and Leonidas Guibas, Elsevier Science imprint, Morgan Kauffman Publishers, Reprint 2009.

References:

1. Ad Hoc Wireless Networks: Architectures and Protocols, C.Siva Ram Murthy and B.S.Murthy, Pearson Education, 2004.
2. Wireless Sensor Networks: Principles and Practice, Fei Hu and Xiaojun Cao, An Auerbach book, CRC Press, Taylor & Francis Group, 2010.
3. Wireless Ad Hoc Mobile Wireless Networks: Principles, Protocols and Applications, Subir Kumar Sarkar, et al., Auerbach Publications, Taylor & Francis Group, 2008.
4. Ad Hoc Networking, Charles E.Perkins, Pearson Education, 2001.
5. Wireless Ad Hoc Networking, Shih-Liri W and Yu-Chee Tseng, Auerbach Publications, Taylor & Francis Group, 2007

ADVANCED DATABASES

(Professional Elective – II)

Instruction	:	3 Periods / week	Sessional Marks	:	30
Tutorial	:	1 Period / week	End Examination Marks	:	70
Credits	:	3	End Exam Duration	:	3 Hours

Course Objectives:

1. To enhance the previous knowledge of database systems by deepening the understanding of the theoretical and practical aspects of the database technologies, and showing the need for distributed database technology to tackle deficiencies of the centralized database systems.
2. To introduce basic principles and implementation techniques of distributed database systems.
3. To expose active and emerging research issues in distributed database systems and application development.

Unit I - Principles of Distributed Databases

Features of Distributed versus Centralized Databases, Principles Of Distributed Databases, Levels Of Distribution Transparency, Reference Architecture for Distributed Databases, Types of Data Fragmentation, Integrity Constraints in Distributed Databases.

Unit II - Translation of Global Queries to Fragment Queries

Equivalence Transformations for Queries, Transforming Global Queries into Fragment Queries, Distributed Grouping and Aggregate Functions, Evaluation of Parametric Queries.
Optimization of Access Strategies: A Framework for Query Optimization, Join Queries, General Queries.

Unit III - The Management of Distributed Transactions

A Framework for Transaction Management, Supporting Atomicity of Distributed Transactions, Concurrency Control for Distributed Transactions, Architectural Aspects of Distributed Transactions.
Concurrency Control: Foundation of Distributed Concurrency Control, Distributed Deadlocks, and Concurrency Control based on Timestamps, Optimistic Methods for Distributed Concurrency Control.
Reliability, Basic Concepts, Non-blocking Commitment Protocols, Reliability and concurrency Control, Determining a Consistent View of the Network, Detection and Resolution of Inconsistency, Checkpoints and Cold Restart, Distributed Database Administration, Catalogue Management in Distributed Databases, Authorization and Protection

Unit IV - Architectural Issues

Alternative Client/Server Architectures, Cache Consistency Object Management, Object Identifier Management, Pointer Swizzling, Object Migration, Distributed Object Storage, Object Query Processing, Object Query Processor Architectures, Query Processing Issues, Query Execution , Transaction Management, Transaction Management in Object DBMSs , Transactions as Objects.

Unit V - Database Integration

Scheme Translation, Scheme Integration, Query Processing Query Processing Layers in Distributed Multi-DBMSs, Query Optimization Issues. Transaction Management Transaction and Computation Model Multi-database Concurrency Control, Multi-database Recovery, Object Orientation and Interoperability Object Management Architecture CORBA and Database Interoperability Distributed Component Model COM/OLE and Database Interoperability, PUSH-Based Technologies.
Current trends: No SQL and New SQL data management issues on the cloud, Stream data management.

Course Outcomes: At the end of the course, the student should be able to

CO 1 : Understand issues related to Distributed database Design
CO 2 : Apply Partitioning techniques to databases
CO 3 : Design and develop query processing strategies.
CO 4 : Understand transaction processing and concurrency control in distributed databases
CO 5 : Learn distributed concurrency control based on the distinguished copy techniques and the voting methods

Text Books:

1. Principles of Distributed Database Systems, M T Ozsu and Patrick Valduriez, Prentice Hall, 2011
2. Distributed Database System: Principles and Systems, S. Ceri and G. Pelaggati, MGH, 2008.

References:

1. Database System Concepts, Abraham Silberschatz, Henry Korth and S Sudarshan, 5th Edition, McGraw-Hill.
2. Distributed Database Management Systems: A Practical Approach, Saeed K. Rahimi and Frank S. Haug, Wiley-IEEE Computer Society Press, 2010.

35405

BIG DATA ANALYTICS

(Professional Elective – II)
(Common to CSE & IT)

Instruction	:	3 Periods / week	Sessional Marks	: 30
Tutorial	:	1 Period / week	End Examination Marks	: 70
Credits	:	3	End Exam Duration	: 3 Hours

Prerequisites: Database Management Systems

Course Objectives:

1. To acquire knowledge of Big data and its evolution, Various kinds of data and systems for handling the data
2. To understand nature of Big data and the systems for handling such data
3. To apply MapReduce paradigm for solving big data problem
4. To illustrate NoSQL databases such as Hbase with suitable examples
5. To Learn social media and mobile analytics

Unit I – Data Management

Data Management (NOS 2101): Design Data Architecture and manage the data for analysis, understand various sources of Data like Sensors/signal/GPS etc. Data Management, Data Quality (noise, outliers, missing values, duplicate data) and Data Preprocessing. Export all the data onto Cloud ex. AWS/Rackspace etc.
Maintain Healthy, Safe & Secure Working Environment (NOS 9003): Introduction, workplace safety. Report Accidents & Emergencies, Protect health & safety as your work, course conclusion, assessment

Unit II – Big Data Tools

Big Data Tools (NOS 2101): Introduction to Big Data tools like Hadoop, Spark, Impala etc., Data ETL process, Identify gaps in the data and follow-up for decision making.
Provide Data information in Standard Formats (NOS 9004): Introduction, Knowledge Management. Standardized reporting & companies, Decision Models, course conclusion. Assessment.

Unit III – Big Data Analytic

Big Data Analytic: Run descriptive to understand the nature of the available data, collate all the data sources to suffice business requirement, Run descriptive statistics for all the variables and observer the data ranges, Outlier detection and elimination.

Unit IV – Machine Learning Algorithms

Machine Learning Algorithms (NOS 9003): Hypothesis testing and determining the multiple analytical methodologies, Train Model on 213 sample data using various Statistical/Machine learning algorithms, Test model on 1/3 sample for prediction etc.

Unit V – Data Visualization (NOS 9004)

Data Visualization (NOS 2101): Prepare the data for Visualization, Use tools like Tableau, QlickView and 03, Draw insights out of Visualization tool. Product Implementation
Mobile Analytics: Introducing Mobile Analytics, Define Mobile Analytics, Mobile Analytics and Web Analytics, Types of Results from Mobile Analytics, Types of Applications for Mobile Analytics, Introducing Mobile Analytics Tools.

*** NOS: National Occupational Standards**

Course Outcomes: At the end of the course, the student should be able to

CO 1 : Define and examine Bigdata and its evolution, various kinds of data and systems for handling the data
CO 2 : Explain Bigdata management using the systems such as Hadoop
CO 3 : Demonstrate application of MapReduce paradigm for solving big data problems such as word count
CO 4 : Articulate NoSQL databases and their underlying structures with suitable examples
CO 5 : Describe social media and mobile analytics and state tools for such analysis

Text Books:

1. Student's Handbook for Associate Analytics. NASSCOM
2. Big Data and Analytics, Seema Acharya and Subhasini Chellappan, Wiley Publications.
3. Big Data, Black Book: Covers Hadoop 2, MapReduce, Hive, YARN, Pig, R and Data Visualization, DreamTech Press, 2015.

References:

1. Introduction to Data Mining, Tan, Steinbach and Kumar, Addison Wesley, 2006
2. Data Mining Analysis and Concepts, M. Zaki and W. Meira, online version available: http:/Iwww.dataminingbook.info/uploadslbook.pdf
3. Mining of Massive Datasets, Jure Leskovec, Anand Rajaraman and Jeffrey D. Ullman.
4. http://www.vistrails.org!i ndex.phplCourse:_Big_Data_Analysis.
5. Business Intelligence: Practice, Technologies and Management, Rajiv Sabherwal and Irma Becerra-Fernandez, John Wiley, 2011.
6. Business Intelligence Roadmap: The Complete Project Lifecycle for Decision-Support Applications, Larissa T. Moss and Shaku Atre, Addison-Wesley, 2003.
7. Oracle Business Intelligence : The Condensed Guide to Analysis and Reporting, Yuli Vasiliev, SPD Shroff, 2012

INFORMATION SECURITY ASSESSMENTS & AUDITS

(Professional Elective – II)
(Common to CSE & IT)

Instruction	:	3 Periods / week	Sessional Marks	: 30
Tutorial	:	1 Period / week	End Examination Marks	: 70
Credits	:	3	End Exam Duration	: 3 Hours

Course Objectives:

1. To examine the role of information systems security and audit in enhancing digital asset safeguarding, data integrity, system effectiveness, and system efficiency.
2. To explain the nature of threats and vulnerabilities to information processes and security concepts; and how effective technical and managerial solutions can be devised.
3. To explain the key activities and techniques in performing risk management and information systems control.
4. To achieve professional qualification as Certified Information Systems Auditor (CISA).

Unit I - Information Security Performance Metrics and Audit

Security Metrics and Reporting, Common Issues and Variances of Performance Metrics, Introduction to Security Audit, Servers and Storage devices, Infrastructure and Networks, Communication Routes, Information Security Methodologies (Black-box, White-box, Grey-box), Phases of Information Security Audit and Strategies, Ethics of an Information Security Auditor etc. Maintain Healthy, Safe & Sec tire working environment (NOS 9003).

Unit II - Information Security Audit Tasks, Reports and Post Auditing Actions

Pre-audit checklist, Information Gathering, Vulnerability Analysis, External Security Audit, Internal Network Security Audit, Firewall Security Audit, IDS Security Auditing, Social Engineering Security Auditing, Web Application Security Auditing, Information Security Audit Deliverable & Writing Report, Result Analysis, Post Auditing Actions, Report Retention etc. Provide Data information in Standard formats (NOS 9004).

Unit III – Vulnerability Management

Information Security Vulnerabilities — Threats and Vulnerabilities, Human-based Social Engineering, Computer- based Social Engineering, Social Media Countermeasures, Vulnerability Management — Vulnerability Scanning, Testing, Threat management, Remediation etc.

Unit IV – Information Security Assessments

Vulnerability Assessment, Classification, Types of Vulnerability Assessment, Vulnerability Assessment Phases, Vulnerability Analysis Stages, Characteristics of a Good Vulnerability Assessment Solutions &Considerations, Vulnerability Assessment Reports — Tools and choosing a right Tool, Information Security Risk Assessment, Risk Treatment, Residual Risk, Risk Acceptance, Risk Management Feedback Loops etc.

Unit V – Configuration Reviews

Introduction to Configuration Management, Configuration Management Requirements-Plan-Control, Development of configuration Control Policies, Testing Configuration Management etc.

Course Outcomes: At the end of the course, the student should be able to

CO 1 : Demonstrate the knowledge of information systems risk management to assess and manage risks in organizations.

CO 2 : Understand the technical nature of information systems threats and the technical and managerial solutions to manage them.

CO 3 : Evaluate and examine innovative controls relating to business processes and using different control objectives, activities and metrics to monitor and maintenance.

CO 4 : Apply appropriate techniques to handle the information systems audit life cycle and the main types of information systems audit.

CO 5 : Appreciate the professional code of ethics of the Information Systems Audit and Control Association

Text Books:

1. Assessing Information Security: Strategies, Tactics, Logic and Framework, A Vladimirov, K. Gavrilenko and A.Michajlowski, 1st Edition, IT Governance Publishing, 2010.
2. The Art of Computer Virus Research and Defense, Peter Szor, Addison-Wesley, 2005.

References:

1. http://csrc.nist.gov/publications/nistpubs/800-40-Ver2/SP800-40v2.pdf
2. https://www.sans.ord/reading-room/whitepapers/threats/implementino-vulnerability-management-process¬34180

GENETIC ALGORITHMS
(Professional Elective -III)

Instruction	:	3 Periods / week	Sessional Marks	:	30
Tutorial	:	1 Period / week	End Examination Marks	:	70
Credits	:	3	End Exam Duration	:	3 Hours

Course Objectives

1. To be familiar with the basic concept of GA.
2. To learn and analyze the mathematical foundations for Genetic algorithm.
3. To study the various GA operators and their utilization.
4. To study and develop applications based on Genetic Algorithms.
5. To understand the genetic based machine learning and applications.

Unit I - Introduction to Genetic Algorithms

Introduction to genetic algorithms, Robustness of Traditional Optimization and Search methods, Goals of optimization, GA versus Traditional methods, Simple GA, Genetic Algorithms at work, Similarity Templates, Learning the Lingo.

Unit II - Mathematical Foundations of Genetic Algorithms

The fundamental theorem, Schema processing at work, the 2-armed & k-armed Bandit problem, the Building Block Hypothesis, the Minimal deceptive problem, Schemata Revisited.

Unit III - GA Operators

Data structures, Reproduction: Roulette-wheel Selection, Boltzmann Selection, Tournament Selection, Rank Selection, Steady state selection, Crossover& mutation, A time to Reproduce, Cross, Main Program, Mapping objective functions to fitness forum, Fitness scaling, Codings, A multi-parameter, Mapped, Fixed-point Coding, Discretion, Constraints.

Unit IV - Applications of GA

The rise of GA – GA application of Historical Interaction, De Jong & Function optimization, Current applications of GA.

Unit V - Advanced Operators and Techniques In Genetic Search

Dominance, Diploidy, and Abeyance, Inversion and Other Reordering Operators, Other Micro-operators, Niche and Speciation, Multiobjective Optimization, Knowledge-Based Techniques.

Course Outcomes: At the end of the course, the student should be able to

CO 1	:	Understand the concepts of Genetic algorithm
CO 2	:	Familiarize with the mathematical concepts required for genetic algorithms.
CO 3	:	Familiarize with the basic Genetic Algorithm operators.
CO 4	:	Write basic genetic programs is obtained.
CO 5	:	Identify the potential utilization of the GA.

Text Books:

1. Genetic Algorithms in Search, Optimization & Machine Learning, David E. Gold Berg, Pearson Education, 2013.
2. An Introduction to Genetic Algorithms, M.Mitchell, MIT Press, 1996.

References:

1. Neural Networks, Fuzzy Logic and Genetic Algorithms, Rajasekaran S. and Vijayalakshmi Pai G.A., PHI, 2003.
2. Optimization for Engineering Design: Algorithms and Examples, Kalyanmoy Deb, PHI 1995.
3. Recent Advances in Memetic Algorithms, Hart, W.E., Krasnogor, N. and Smith, J.E., Springer Berlin Heidelberg, New York, 2005.

37408

ARTIFICIAL NEURAL NETWORKS

(Professional Elective – III)

Instruction	:	3 Periods / week	Sessional Marks	:	30
Tutorial	:	1 Period / week	End Examination Marks	:	70
Credits	:	3	End Exam Duration	:	3 Hours

Course Objectives:

1. Learn knowledge representation, concepts of artificial intelligence and Neural Networks
2. Understand Learning process models
3. Apply single layer and Multilayer perception to the knowledge
4. Understand back propagation and network architectures
5. Understand Fuzzification and Defuzzification methods
6. Model Neuro-Fuzzy dynamics systems

Unit I - Introduction

What is a neural network? Human Brain, Models of a Neuron, Neural networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks

Learning Process – Error Correction Learning, Memory Based Learning, Hebbian Learning

Unit II - Learning Process

Competitive, Boltzmann Learning, Credit Assignment Problem, Memory, Adaption, Statistical Nature of the Learning Process

Single Layer Perceptrons – Adaptive filtering problem, Unconstrained Organization Techniques, Linear least square filters, least mean square algorithm, learning rules, perception convergence theorem, Relation between perception and Bayes classifier for a Gaussian Environment

Unit III - Multilayer Perceptron

Back propagation algorithm, XOR problem, Heuristics, Output representation and decision rule, Feature detection

Back Propagation - Back propagation and differentiation, Hessian matrix, Generalization, Cross validation, Network pruning techniques, Virtues and limitations of back propagation learning, supervised learning.

Unit IV - Self-Organization Maps

Two basic feature mapping models, Self-organization map,SOM algorithm, properties of feature map, learning vector quantization, Adaptive pattern classification, Hierarchal Vector quantilizer, contexmel Maps

Unit V - Classical And Fuzzy Sets

Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions.

Fuzzy Logic Systems Components: Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods.

Course Outcomes: At the end of the course, the student should be able to

CO 1 : Understand the basics of neural networks and organization of Biological Neural Network (BNN) model and illustrates the idea of applications of Artificial Neural Networks (ANN). To learn how to solve problems of ANN with different architectures.

CO 2 : Get idea of layered and feed forward neural network. To know how to use convergence in artificial networks and to get idea of multilayer feed forward neural networks. To learn how to simulate back-propagation algorithm with computer gradient method.

CO 3 : Learn how to calculate associative memories and associative matrix memories. To design Bi-directional Associative memories and memory based learning algorithms.

CO 4 : Design a fuzzy based system and membership functions of different systems which consists of triangular and trapezoidal functions.

CO 5 : Understand fuzzification and de-fuzzification methods.

Text Books:

1. Neural Networks: A Comprehensive Foundations, Simon Hhaykin, 2nd Edition, Pearson Education, 2004
2. Neural Networks, Fuzzy Logic, Genetic Algorithms: Synthesis and Applications, Rajasekharan and Rai, PHI Publication.

References:

1. Artificial Neural Networks, B.Vegnanarayana, Prentice Hall of India, 2005
2. Neural Networks in Computer Intelligence, Li Min Fu, TMH, 2003
3. Neural Networks, James A Freeman David and M S Kapura, Pearson Education, 2004

E-COMMERCE

(Professional Elective – III)

Instruction	:	3 Periods / week	Sessional Marks	:	30
Tutorial	:	1 Period / week	End Examination Marks	:	70
Credits	:	3	End Exam Duration	:	3 Hours

Course Objectives:

1. Identify the major categories and trends of e-commerce applications.
2. Identify the essential processes of an e-commerce system.
3. Define various electronic payment types and associated security risks and the ways to protect against them.
4. Discuss the benefits and trade-offs of various e-commerce.
5. Understand the main technologies behind e-commerce systems and how these technologies interact.
6. Identify several factors and web store requirements needed to succeed in e-commerce.

Unit I - Introduction to Electronic Commerce

Electronic Commerce-Frame work, anatomy of E-Commerce applications, E-Commerce Consumer applications, E-Commerce organization applications.

Consumer Oriented Electronic commerce - Mercantile Process models, Merchantile process models from consumers and merchant's perspective.

Unit II - Electronic Payment Systems

Electronic payment systems –Introduction, Types of Electronic payment systems, Digital Token-Based, Smart Cards, Credit Cards, Risks in Electronic Payment systems.

Unit III - Inter Organizational Commerce and EDI

Inter Organizational Commerce and EDI - EDI, EDI Implementation, Value added networks.

Intra Organizational Commerce - work Flow Automation, Customization and internal Commerce, Supply chain Management.

Unit IV - Corporate Digital Library

Corporate Digital Library - Document Library, digital Document types, corporate Data Warehouses.

Advertising and Marketing - Information based marketing, Advertising on Internet, on-line marketing process, market research.

Unit V - Consumer Search and Resource Discovery

Consumer Search and Resource Discovery - Information search and Retrieval, Commerce Catalogues, Information Filtering.

Multimedia and Digital Video- key multimedia concepts, Digital Video and electronic Commerce, Desktop video processing, Desktop video conferencing.

Course Outcomes: At the end of the course, the student should be able to

CO 1	:	Understand the basic concepts of e-commerce and their different elements.
CO 2	:	Summarize the main reasons for adaptation of e-commerce and e-business and barriers that may restrict adaptation.
CO 3	:	Use resources to define the extent of adaptation of the internet as communication medium for consumers and businesses.

CO 4 : Outline the business challenges of introducing e-business and e-commerce to an organization.

CO 5 : Understand the process of searching and retrieving information and different multimedia techniques

Text Books:

1. Frontiers of Electronic Commerce, Ravi Kalakota, Whinston, 9th Edition, Pearson Education, 2009.
2. E-Commerce Fundamentals and Applications, Hendry Chan, Raymond Lee, Tharam Dillon and Ellizabeth Chang, John Wiley, 2011.

References:

1. Doing Business on the Internet: E-Commerce, S.Jaiswal, Galgotia, 2003.
2. E-Commerce: A Managerial Perspective, Efrain Turbon, Jae Lee, David King and H.Michael Chang, 1st Edition, Pearson Education, 2009.
3. Electronic Commerce: Framework, Technologies and Applications, B. Bhaskar, 3rd Edition, Tata McGraw-Hill, 2007.

INTERNET OF THINGS

(Professional Elective –IV)
(Common to CSE & IT)

Instruction	:	3 Periods / week	Sessional Marks	:	30
Tutorial	:	1 Period / week	End Examination Marks	:	70
Credits	:	3	End Exam Duration	:	3 Hours

Prerequisites: Data Communications and Computer Networks

Course Objectives:

1. To introduce the terminology, technology and its applications
2. To introduce the concept of M2M (machine to machine) with necessary protocols
3. To introduce the Python Scripting Language which is used in many IoT devices
4. To introduce the Raspberry PI platform, that is widely used in IoT applications
5. To introduce the implementation of web based services on IoT devices

Unit I - Introduction to Internet of Things

Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT communication models, IoT Communication APIs
IoT enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates
Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle

Unit II - IoT and M2M

Software defined networks, network function virtualization, difference between SDN and NFV for IoT
Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER

Unit III - Introduction to Python

Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling.
Python packages - JSON, XML, HTTPLib, URLLib, MTPLib

Unit IV - IoT Physical Devices and Endpoints

Introduction to Raspberry PI-Interfaces (serial, SPI, I2C)
Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins.

Unit V - IoT Physical Servers and Cloud Offerings

Introduction to Cloud Storage models and communication APIs Webserver – Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API

Course Outcomes: At the end of the course, the student should be able to

CO 1	:	Understand the characteristics, protocols and communication models required for logical design of IOT.
CO 2	:	Gain knowledge of IOT enabling technologies and domain areas of application.
CO 3	:	Understand of the hardware platforms for implementing an IOT. The student will have the ability to interface the IOT based Board with different peripheral devices such as keyboard, display device and serial communication devices.

CO 4 : Understand of the details of requirements gathering and specification of an IOT based system. The student will have the ability to integrate devices and develop an application.

CO 5 : Implement an IOT based system using python language.

Text Books:

1. Internet of Things: A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015.
2. Getting Started with Raspberry Pi, Matt Richardson and Shawn Wallace, O'Reilly (SPD), 2014.

References:

1. Getting Started with Sensors: Measure the World with Electronics, Arduino, and Raspberry, KimmoKarvinen and TeroKarvenien, 1st Edition, Shroff/O'Reilly, 2014.
2. Getting Started with Arduino: The Open Source, Massimo Banzi, Shroff Publishers & Distributors Private Ltd.
3. Getting Started with Raspberry Pi, Richardson Matt, Shroff Publishers & Distributers Private Limited.
4. Arduino Projects for Dummies, Brock Craft, Wiley.

35411

SOFTWARE TESTING METHODOLOGIES

(Professional Elective – IV)
(Common to CSE & IT)

Instruction	:	3 Periods / week	Sessional Marks	:	30
Tutorial	:	1	End Exam Marks	:	70
Credits	:	3	End Exam Duration	:	3 Hours

Prerequisites: Software Engineering

Course Objectives:

1. To acquire knowledge on basic principles, concepts on different testing techniques and methodologies and to demonstrate how they can uncover different errors (bugs).
2. To understand the taxonomy of bugs & testing and the stages at which different tests are to be performed.
3. To design the test cases and execute to uncover errors related to internal processing logic within modules, interfacing, and functionality of software.
4. To gain theory and knowledge to design and & implement testing tools with an aim to enhance the performance of testing.

Unit I – Introduction and Overview of Testing

Purpose of testing, Dichotomies, model for testing, consequences of bugs, taxonomy of bugs. Overview of Unit & integration testing, and white box & black box testing.

Unit II - Flow Graphs, Path Testing, Paths, Path Products and Regular Expressions

Flow Graphs, Path Testing: Basic concepts of path testing, predicates, path predicates and achievable paths, path sensitizing, path instrumentation, application of path testing.
Paths, Path Products and Regular Expressions: Path products and path expression, reduction procedure, applications, regular expressions and flow anomaly detection.

Unit III - Dataflow Testing and Domain Testing

Dataflow Testing: Basics of dataflow testing, strategies in dataflow testing, application of dataflow testing.
Domain Testing: Domains and paths, domain testing, domains and interface testing, domains and testability.

Unit IV – Logic Based Testing, States, State Graphs and Transition Testing

Logic Based Testing: Overview, decision tables, path expressions, kv charts, specifications.
States, State Graphs and Transition Testing: Overview, state bugs, transition bugs, state testing.

Unit V - Graph Matrices and Application

Integration Testing, Graph Matrices and Application: Motivational overview, matrix of graph, relations, power of a matrix, node reduction algorithm, building tools.
System and Acceptance Testing: Functional system testing, Non-functional system testing, Acceptance testing.
Testing Object Oriented Systems: Introduction to Object Oriented testing concepts, Differences in OO Testing.

Course Outcomes: At the end of the course, the student will be able to

CO 1 : Apply basic concepts of testing, path testing, and predicate testing for testing code.
CO 2 : Derive path expressions for a flow graph and know its usage for various applications.
CO 3 : Acquire knowledge of domain errors, type's domain bugs and sources of domain errors.

CO 4 : Appreciate the purpose of logic based testing using decision tables, reduction using KV charts and integration testing as a phase of testing.

CO 5 : Represent a problem using graph matrices, node reduction algorithm, understand the functional and non- functional system testing techniques.

CO 6 : Select test cases for Acceptance testing based on required criteria, and understand different concepts of Object Oriented testing.

Text Books:

1. Software Testing Techniques, Boris Beizer, 2nd Edition, Dreamtech, 2009.
2. Software Testing: Principles and Practices, Srinivasan D and Gopalaswamy R, Pearson Education, 2008.

References:

1. Software Testing and Quality Assurance: Theory and Practice, Sagar Naik, Wiley, 2008.
2. Software Testing in Real World, Edward Kit, Pearson Education, 2008.
3. Effective methods of Software Testing, E. William Perry, 3rd Edition, John Wiley, 2006.

INFORMATION RETRIEVAL SYSTEMS
(Professional Elective –IV)

Instruction	:	3 Periods / week	Sessional Marks	: 30
Tutorial	:	1 Period / week	End Examination Marks	: 70
Credits	:	3	End Exam Duration	: 3 Hours

Course Objectives:

1. To use different information retrieval techniques in various application areas
2. To apply IR principles to locate relevant information large collections of data
3. To analyze performance of retrieval systems when dealing with unmanaged data sources
4. To implement retrieval systems for web search tasks.

Unit I - Introduction

Definition, Objectives, Functional Overview, Relationship to DBMS, Digital libraries and Data Warehouses.
Information Retrieval System Capabilities - Search, Browse, Miscellaneous.

Unit II - Cataloging and Indexing

Objectives, Indexing Process, Automatic Indexing, Information Extraction, Data Structures: Introduction, Stemming Algorithms, Inverted file structures, N - gram data structure, PAT data structure, Signature file structure, Hypertext data structure
Automatic Indexing: Classes of automatic indexing, Statistical indexing, Natural language, Concept indexing, Hypertext linkages

Unit III - Document and Term Clustering

Introduction, Thesaurus generation, Item clustering, Hierarchy of clusters
User Search Techniques: Search statements and binding, Similarity measures and ranking, Relevance feedback, Selective dissemination of information search, Weighted searches of Boolean systems, Searching the Internet and hypertext - Information Visualization Introduction, Cognition and perception, Information visualization technologies.

Unit IV - Text Search Algorithms

Introduction, Software text search algorithms, Hardware text search systems.
Information System Evaluation: Introduction, Measures used in system evaluation, Measurement example – TREC results.

Unit V - Multimedia Information Retrieval

Models and Languages – Data Modeling, Query Languages, Indexing and Searching.
Libraries and Bibliographical Systems – Online IR Systems, OPACs, Digital Libraries.

Course Outcomes: At the end of the course, the student should be able to

CO 1	:	Understand the data structures like Inverted Indices used in Information retrieval systems
CO 2	:	Understand the basics of web search
CO 3	:	Understand the different techniques for compression of an index including the dictionary and its posting list
CO 4	:	Understand the different components of an Information retrieval system
CO 5	:	Develop the ability of develop a complete IR system from scratch

Text Books:

1. Information Storage and Retrieval Systems: Theory and Implementation, Kowalski, Gerald and Mark T Maybury, Kluwer Academic Press, 2000.
2. Modern Information Retrieval, Ricardo Baeza-Yates, Pearson Education, 2007.
3. Information Retrieval: Algorithms and Heuristics, David A Grossman and Ophir Frieder, 2nd Edition, Springer, 2004.

References:

1. Information Retrieval Data Structures and Algorithms, William B Frakes and Ricardo Baeza - Yates, Pearson Education, 1992.
2. Information Storage and Retrieval, Robert Korfhage, John Wiley & Sons.
3. Introduction to Information Retrieval, Christopher D. Manning and Prabhakar Raghavan, Cambridge University Press, 2008

37382

MOBILE APPLICATION DEVELOPMENT LAB

Practical	: 3 Periods / week	Sessional Marks	:	30
Credits	: 2	End Examination Marks	:	70
		End Exam Duration	:	3 Hours

Course Objectives:

1. To understand the fundamentals of Android operating systems
2. To acquire the skills of using Android software development tools
3. To be able to develop software with reasonable complexity on mobile platform
4. To be able to deploy software to mobile devices
5. To be able to debug programs running on mobile devices

Lab Programs:

Week 1:
Create "Hello World" application. That will display "Hello World" in the middle of the screen in the red color with white background.

Week 2:
To understand Activity, Intent
Create sample application with login module. (Check username and password)
On successful login, go to next screen. And on failing login, alert user using Toast.
Also pass username to next screen.

Week 3:
Create login application where you will have to validate Email ID (Username). Till the username and password is not validated, login button should remain disabled.
On successful login, open browser with any URL. And on failing login, alert user using Toast

Week 4:
a. Create an application (Using Implicit Intents)
   - To call specific entered number by user in the EditText
   - To open any URL inside the application

b. Understanding Notifications in android
   - Create an application to display notifications on the status bar.

Week 5:
Understanding Fragments:
Create an application to add the fragments to an activity during runtime.

Week 6:
Understanding Dialog windows
Create an application to display the alert dialog or progress dialog based on user choice

Week 7:
Adapter views in android
a. Create an application that will pass some number to the next screen and on the next screen that number of items should be display in the list.
b. Create spinner with strings taken from resource folder (res >> value folder).
On changing spinner value, change image.

Week 8:
Image Views in Android:
a. Create an application to display a set of images using Gallery view and then display the selected image in image view
b. Create an application to display a set of images using Grid view and then display the selected image in another screen.

Week 9:

a. Understand Menu option.
   - Create an application that will change color of the screen, based on selected options from the menu.

b. Shared Preferences:
   - Create an application that creates and saves the Shared Preferences in Android.

Week 10:

a. Create an application to write and read the contents of a file stored on internal memory.

b. Create an application to create a file on external memory and read file from the sdcard and display that file content to the screen.

Week 11:

SQLite Database:

Create an application to make Insert, Update, Delete and retrieve operation on the database.

Week 12:

Understanding content providers and permissions:
Create an application to read phonebook contacts using content providers and display in list.

Course Outcomes: At the end of the course, the student should be able to

CO 1	:	Comprehend the role of Activities in Android applications and develop apps using two or more activities.
CO 2	:	Develop Layouts and views in android using sample applications
CO 3	:	Demonstrate the ways of storing data persistently in Android using databases, shared preferences and files
CO 4	:	Appreciate and apply content providers for sharing data between applications.
CO 5	:	Comprehend the scheme of storing and reading data from internal and external memory.