DESIGN PATTERNS

(Professional Elective -V)
(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 make the students understand the basic concepts of Design patterns.
2. To understand the various Design patterns.
3. To understand the importance of design patterns for development of a reusable product.

Unit I - Introduction

Introduction: What Is a Design Pattern? Design Patterns in Smalltalk MVC, Describing Design Patterns, The Catalog of Design Patterns, Organizing the Catalog, How Design Patterns Solve Design Problems, How to Select a Design Pattern, How to Use a Design Pattern.

Unit II – A Case Study

A Case Study: Designing a Document Editor: Design Problems, Document Structure, Formatting, Embellishing the User Interface, Supporting Multiple Look-and-Feel Standards, Supporting Multiple Window Systems, User Operations Spelling Checking and Hyphenation, Summary What to Expect from Design Patterns.

Unit III – Creational Patterns

Creational Patterns: Abstract Factory, Builder, Factory Method, Prototype, Singleton, Discussion of Creational Patterns.

Unit IV – Structural Patterns

Structural Patterns: Adapter, Bridge and Composite, Decorator, façade, Flyweight, Proxy.

Unit V – Behavioral Patterns

Behavioral Patterns: Chain of Responsibility, Command, Interpreter, Iterator, Mediator, Memento, Observer, State, Strategy, Template Method, Visitor, Discussion of Behavioral Patterns.

Course Outcomes: At the end of the course, a student is able to

CO 1	:	Appreciate the basic concepts of design patterns and able to know how to select and use the design patterns
CO 2	:	Identify the design pattern in the existing code and use of creational patterns.
CO 3	:	Apply and use the structural patterns
CO 4	:	Identify and use the behavioral patterns
CO 5	:	Find and catalog patterns in the object oriented software

Text Books:

1. Design Patterns: Elements of Reusable Object-Oriented Software, Erich Gamma, Richard Helm, Ralph Johnson and John Vlissides, Addison-Wesley, 1995.
2. Java™ Design Patterns: A Tutorial, James W. Cooper, Addison Wesley, 2000.

References:

1. Patterns in Java: A Catalog of Reusable Design Patterns Illustrated with UML, Volume 2, Mark Grand, Wiley DreamTech.
2. Patterns in Java, Volume 2, Mark Grand, Wiley DreamTech, 2008.
3. Java Enterprise Design Patterns, Mark Grand, Wiley DreamTech, 2006.

REAL TIME SYSTEMS

(Professional Elective – V)

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 introduce students to the fundamental problems, concepts, and approaches in the design and analysis of real-time systems
2. To study issues related to the design and analysis of systems with real-time constraints.
3. To let students get practical insight into theoretical concepts using open-source environment.
4. To study various practical issues in building real-time systems
5. An ability to learn emerging concepts in theory and applications of computer science such as distributed real-time systems, multiprocessor real-time systems

Unit I - Introduction to Real-Time Systems

Concept of Real-Time Systems, Concept of Real-Time Tasks, Principles of Scheduling, Real-time pre-emption, FreeRTOS API, Setting up the FreeRTOS API Chain

Unit II - Static Scheduling

Clock Driven Scheduling - Concept, Implementation; Cyclic Structured Scheduling - Concept, Example; Fixed Priority Scheduling - Concept, Example; Monotonic Scheduling - Concept, Example;

Unit III - Dynamic Scheduling

Tasks with short response time Theory - Concept, Example; Dynamic Priority Scheduling; Earliest Deadline First - Theory, Example;

Unit IV - Non Periodic Jobs

Aperiodic Jobs - Concept, Example; Sporadic Jobs - Concept, Example; The Deferrable Server - Theory, Example;

Unit V - Real-Time Operating Systems

Overview; FreeRTOS Kernel; Multi-core Realtime systems; Multi-core Scheduling - Shared Resources, Scheduling Methods;

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

CO 1	:	Understand the need to create a real-time system
CO 2	:	Understand the job structure and the parameters need to schedule a task.
CO 3	:	Schedule a set of tasks with static scheduling mechanism
CO 4	:	Determine the appropriateness of a dynamic scheduler
CO 5	:	Understand the Multi-core computer architectures for real-time systems

Text Book:

1. Real-Time Systems, Jane Liu, Prentice Hall, 2000.

Reference:

1. MicroC OS II: The Real Time Kernel
2. Real-time systems design and analysis: Tools for the practitioner, 4th Edition, Philip ALaplante
3. https:///www.freertos.org

COMPUTER FORENSICS

(Professional Elective – V)

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. The course makes the students to learn how to implement the computer forensics methodology and what are the steps taken by computer forensic scientist when data is deleted.
2. The prime goal would be to collect the evidence by following search and seizure methods including various network forensic tools.
3. The Students would be able to help law enforcement agencies in their investigations of digital related crimes, mobile phones, including the development of tools.

Unit I - Computer Forensics Fundamentals

What is Computer Forensics? Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/ Employment Proceedings, Computer Forensics Services, Benefits of Professional Forensics Methodology, Steps taken by Computer Forensics Specialists.

Types of Computer Forensics Technology: Types of Military Computer. Forensic Technology, Types of Law Enforcement - Computer Forensic Technology - Types of Business Computer Forensic Technology

Computer Forensics Evidence and Capture: Data Recovery Defined - Data Back-up and Recovery - The Role of Back-up in Data Recovery - The Data- Recovery Solution Evidence Collection and Data Seizure: Why Collect Evidence? Collection Options - Obstacles - Types of Evidence - The Rules of Evidence - Volatile Evidence - General Procedure - Collection and Archiving - Methods of Collection - Artifacts - Collection Steps - Controlling Contamination: The Chain of Custody

Unit II - Duplication and Preservation of Digital Evidence

Preserving the Digital Crime Scene - Computer Evidence Processing Steps - Legal Aspects of Collecting and Preserving Computer Forensic Evidence.

Computer Image Verification and Authentication: Special Needs of Evidential Authentication - Practical Consideration - Practical Implementation.

Unit III - Computer Forensics Analysis and Validation

Determining what data to collect and analyze, validating forensic data, addressing data-hiding techniques, performing remote acquisitions Network Forensics: Network forensics overview, performing live acquisitions, developing standard procedures for network forensics, using network tools, examining the honey net project.

Processing Crime and Incident Scenes: Identifying digital evidence, collecting evidence in private-sector incident scenes. Processing law enforcement crime scenes, preparing for a search, securing a computer incident or crime scene, seizing digital evidence at the scene, storing digital evidence, obtain a digital hash, reviewing a case.

Unit IV - Current Computer Forensic Tools

Evaluating computer forensic tool needs, computer forensics software tools, computer forensics hardware tools, validating and testing forensics software.

E-Mail Investigations: Exploring the role of e-mail in investigation, exploring the roles of the client and server in e-mail, investigating e-mail crimes and violation, understanding e-mail servers. Using specialized e-mail forensic tools.

Unit V - Cell Phone and Mobile Device Forensics

Understanding mobile device forensics, understanding acquisition procedures for cell phones and mobile devices.
Working with Windows and DOS Systems: understanding file systems, exploring Microsoft File Structures, Examining NTFS disks, Understanding whole disk encryption, windows registry, Microsoft startup tasks, MS-DOS startup tasks, virtual machines.

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

CO 1 : Implement the computer forensics methodology and steps taken by computer forensic scientist.
CO 2 : Recover the data deleted by the criminals and take back up.
CO 3 : Collect the evidence by following data seizure methods.
CO 4 : Understand the standard procedures for network forensics and develop various network forensic tools.
C0 5 : Know how help law enforcement agencies in their investigations of digital related crimes.

Text Books:

1. Computer Forensics: Computer Crime Investigation, John R. Vacca, Firewall Media, New Delhi.
2. Computer Forensics and Investigations, Nelson, Phillips Enfinger and Steuart, Cengage Learning.

References:

1. Real Digital Forensics , Keith J. Jones, Richard Bejtlich and Curtis W. Rose, Addison-Wesley / Pearson Education
2. Forensic Compiling: A Practitioner'sGuide, Tony Sammes and Brian Jenkinson, Springer.
3. Computer Evidence Collection & Presentation, Christopher L.T. Brown, Firewall Media.
4. Homeland Security: Techniques & Technologies, Jesus Mena, Firewall Media.
5. Software Forensics: Collecting Evidence from the Scene of a Digital Crime, Robert M.Slade, TMH 2005
6. Windows Forensics, Chad Steel, Wiley India.

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PREDICTIVE ANALYTICS

(Professional Elective -V)
(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. Acquire knowledge of predictive analytics tools and environment, Various methods used for predictive analytics
2. Understand different methods and techniques such as linear regression, logistic regression, objective segmentation, forecasting and feature extraction methods for predictive analytics
3. Apply the methods and the techniques for solving predictive analytics problems
4. Illustrate the methods and the techniques with suitable examples
5. Create a system for solving problems in predictive analytics

Unit I - Introduction to Predictive Analytics and Linear Regression (NOS 2101)

What and Why Analytics, Introduction to Tools and Environment, Application of Modelling in Business, Databases & Types of data and variables, Data Modelling Techniques, Missing imputations etc. Need for Business Modelling, Regression — Concepts, Blue property-assumptions-Least Square Estimation, Variable Rationalization, and Model Building etc.

Unit II - Logistic Regression (NOS 2101)

Model Theory, Model fit Statistics, Model Conclusion, Analytics applications to various Business Domains etc. Regression Vs Segmentation — supervised and Unsupervised Learning, Tree Building — Regression, Classification, Overfitting, Pruning and complexity, Multiple Decision Trees etc.

Unit III - Objective Segmentation (NOS 2101):

Regression Vs Segmentation — supervised and Unsupervised Learning, Tree Building — Regression, Classification, Overfitting, Pruning and complexity, Multiple Decision Trees etc. Develop Knowledge, Skill and Competences (NOS 9005)
Introduction to Knowledge skills & competences, Training & Development, Learning & Development, Policies and Record keeping. etc.

Unit IV -Time Series Methods IForecasting, Feature Extraction (NOS 2101)

Arima, Measures of Forecast Accuracy, STL approach, Extract features from generated model as Height. Average, Energy etc and Analyze for prediction.

Unit V - Working with Documents (NOS 0703)

Standard Operating Procedures for documentation and knowledge sharing, Defining purpose and scope documents, Understanding structure of documents — case studies, art ides, white papers, technical reports, minutes of meeting etc., Style and format, Intellectual Property and Copyright, Document preparation tools — Vision, PowerPoint, Word, Excel etc., Version Control, Accessing and updating corporate knowledge base, Peer review and feedback.

*** NOS: National Occupational Standards**

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

CO 1 : Acquire the knowledge of predictive analytics tools and environment, various methods used for predictive analytics
CO 2 : Understand different methods and techniques such as linear regression, logistic regression, objective segmentation, forecasting and feature extraction methods for predictive analytics

CO 3 : Apply the methods and the techniques for solving predictive analytics problems
CO 4 : Illustrate the methods and the techniques with suitable examples
CO 5 : Create a system for solving given problem in predictive analytics

Text Book:

1. Student's Handbook for Associate Analytics-III, NASSCOM

Reference:

1. An Introduction to Statistical Learning with Applications in R, Gareth James, Daniel Witten, Trevor Hastie and Robert Tibshirani, springer-Verlag, 2013.

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INFORMATION SECURITY INCIDENT RESPONSE & MANAGEMENT

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

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. Students will have an understanding of the key themes and principles of information security management and be able to apply these principles in designing solutions to managing security risks effectively.
2. Students will understand how to apply the principles of information security management in a variety of contexts.
3. Students will have an appreciation of the interrelationship between the various elements of information security management and its role in protecting organizations.

Unit I - Managing Information Security Services

Configuring Network Devices, Identifying Unauthorized Devices, Testing the Traffic Filtering Devices, Configuring Router, Configuring Modes — Router/Global/Interface/Line/Privilege EXEC/ROM/User EXEC, Configuring a banner/Firewall/Bastion Host NPN server etc.

Unit II - Troubleshooting Network Devices and Services

Introduction & Methodology of Troubleshooting, Troubleshooting of Network Communication-Connectivity-Network Devices-Network Slowdowns-Systems-Modems etc.

Unit III - Information Security Incident Management & Data Backup

Information Security Incident Management overview-Handling-Response, Incident Response Roles and Responsibilities, Incident Response Process etc. Data Back introduction, Types of Data Backup and its techniques, Developing an Effective Data Backup Strategy and Plan, Security Policy for Back Procedures.

Unit IV - Log Correlation

Computer Security Logs, Configuring& Analyzing Windows Logs, Log Management-Functions & Challenges, Centralized Logging and Architecture, Time Synchronization — NTP/NIST etc. Develop Knowledge Skill and competences (NOS 9005)

Unit V - Handling Network Security Incidents

Network Reconnaissance Incidents, Network Scanning Security Incidents, Network Attacks and Security Incidents, Detecting DoS Attack, DoS Response Strategies, Preventing/stopping a DoS Incident etc.
Handling Malicious Code Incidents: Incident Handling Preparation, Incident Prevention, Detection of Malicious Code, Containment Strategy) Evidence Gathering and Handling, Eradication and Recovery, Recommendations etc., Project.

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

CO 1	:	Understand today's information security challenges, particularly in the area of Critical Information Infrastructure and the urgency to better secure these assets
CO 2	:	Understand how important security principles must be adhered to when securing the infrastructures.
CO 3	:	Understand the importance of balancing security, operational effectiveness and cost
CO 4	:	Analyze and to aptly secure the cyber perimeter of the infrastructures against cyber attacks
CO 5	:	Aid an organization in its response and recovery from cyber-attacks and to further enhance its security implementations

Text Books:

1. Managing Information Security Risks: The Octave Approach, Christopher Alberts, and Audrey Dorofee, Addison Wesley, 2002
2. Cryptography and Network Security: Principles and Practices, William Stallings, 4th Edition, Prentice Hall / Pearson Education Inc., 2005

Reference:

1. https://www.sans.org/reading-room/whitepapers/incident/security-incident-handling-small-organizations-32979

37457

NEURAL NETWORKS AND FUZZY LOGIC

(Professional Elective-V)
(EEE)

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

Course Objectives: This course facilitates students to learn

1. To introduce the basics of Neural Networks and essentials of Artificial Neural Networks with Single Layer and Multilayer Feed Forward Networks and to deal with Associate Memories.
2. To introduce the basics of Fuzzy sets and Fuzzy Logic system components.

Unit I - Introduction to Neural Networks

Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Hodgkin-Huxley Neuron Model, Integrate and Fire Neuron Model, Spiking Neuron Model, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN.

Essentials of Artificial Neural Networks: Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Neural Dynamics (Activation and Synaptic), Leaning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application.

Unit II - Single Layer Feed Forward Neural Networks

Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Convergence theorem, Limitations of the Perceptron Model, Applications.

Multilayer Feed-forward Neural Networks: Credit Assignment Problem, Generalized Dalta Rule, Derivation of Back-propagation (BP) Training, Summary of Back-propagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements.

Unit III - Associative Memories

Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concept of Associative Memory (Associative Matrix, Association Rules, Hamming Distance The Linear Associator, Matrix Memories, Content Addressable Memory), Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms : Storage and Recall Algorithm, BAM Energy Function, Proof of BAM Stability Theorem. Architecture of Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis, Capacity of the Hopfield Network. Summary and Discussion of Instance / Memory Based Learning Algorithms, Applications.

Unit IV - 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 System Components: Fuzzification, Membership value assignment, development of rule base and decision making system, De-fuzzification to crisp sets, De-fuzzification methods.

Unit V - Neural Network Applications

Process identification, control, fault diagnosis and load forecasting.
Fuzzy logic applications: Fuzzy logic control and Fuzzy classification.

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

CO 1 : To understand the basics of neural networks and organization of BNN model. This chapter gives idea of applications of ANN. To learn how to solve problems of ANN with different architectures.

CO 2 : To get idea of layered and feed forward neural network. This unit explains how to use convergence in artificial networks. To get idea of multi layered feed forward neural network. This unit explains how to use back-propagation algorithm which is computer gradient method.

CO 3 : To learn how to calculate associative memories and associative matrix memories. To design Bidirectional Associative memories and memory based learning algorithms.

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

CO 5 : To understand fuzzification and de-fuzzification methods.

Text Books:

1. Neural Networks, Fuzzy logic, Genetic Algorithms: Synthesis and Applications, Rajasekharan and Rai, PHI Publication.
2. Introduction to Artificial Neural Systems, Jacek M. Zuarda, Jaico Publishing House, 1997.

References:

1. Neural and Fuzzy Systems: Foundation, Architectures and Applications, N. Yadaiah and S. Bapi Raju, Pearson Education.
2. Neural Networks, James A Freeman and Davis Skapura, Pearson, 2002.
3. Neural Networks, Simon Hykins, Pearson Education.
4. Neural Engineering, C. Eliasmith and C H Anderson, PH.I
5. Neural Networks and Fuzzy Logic System, Bork Kosk, PHI.