VISION OF THE DEPARTMENT:

To educate students with conceptual knowledge and technical skills in the field of Information Technology with moral and ethical values to achieve excellence in academic, industry and research centric environments.

MISSION OF THE DEPARTMENT:

1. To inculcate in students a firm foundation in theory and practice of IT skills coupled with the thought process for disruptive innovation and research methodologies, to keep pace with emerging technologies.

2. To provide a conducive environment for all academic, administrative and interdisciplinary research activities using state-of-the-art technologies.

3. To stimulate the growth of graduates and doctorates, who will enter the workforce as productive IT engineers, researchers and entrepreneurs with necessary soft skills, and continue higher professional education with competence in the global market.

4. To enable seamless collaboration with the IT industry and Government for consultancy and sponsored research.

5. To cater to cross-cultural, multinational and demographic diversity of students.

6. To educate the students on the social, ethical, and moral values needed to make significant contributions to society.
1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):
   I. To prepare students to excel in research or to succeed in Information Technology Profession by adapting to the rapid advances in new emerging technologies through rigorous graduate education.
   II. To provide students with a solid foundation in mathematical, scientific and engineering fundamentals required to provide IT solutions to real-world problems of Industries, Businesses and Society.
   III. To train students with good computer science and engineering knowledge so as to comprehend, analyze, design and create novel products and novel IT services.
   IV. To inculcate students in solving real-time problems through IT knowledge and with attention to team work, effective communication skills and critical thinking.
   V. To provide student with an academic environment aware of excellence, leadership, ethical codes and guidelines, learning and teamwork for a successful professional career.

2. PROGRAMME OUTCOMES (POs):
   On successful completion of the programme, the students will acquire the following:

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<td>1</td>
<td>An ability to independently carry out research/investigation and development work to solve practical problems.</td>
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<td>An ability to write and present a substantial technical report/document.</td>
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<td>A degree of mastery over the field of Information Technology.</td>
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<td>An ability to comprehend, select and adopt appropriate and emerging computing and communication technologies to solve the challenging problems of this information era.</td>
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<td>An ability to recognize the need for applying efficient software and hardware based solutions to improve the quality of life.</td>
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<td>An ability to function effectively as an individual and a team member, in project and product development and to follow professional ethics in the career.</td>
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## OPEN ELECTIVE COURSES (OEC)
*(out of 6 courses one course must be selected)*

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## AUDIT COURSES (AC)
Registration for any of these courses is optional to students

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OBJECTIVES:
I. This course provides a sound and rigorous treatment of the basic principles for a proper understanding of the subject matter and for confidence in applying these principles to practical problem solving
II. This course provides a solid undergraduate foundation in both probability theory and mathematical statistics and at the same time provides an indication of the relevance and importance of the theory in solving problems in the real world
III. To introduce the basic concepts of one dimensional and two dimensional Random Variables
IV. To provide information about Estimation theory, Correlation, Regression and Testing of hypothesis
V. To enable the students to use the concepts of multivariate normal distribution and principal components analysis

UNIT I ONE DIMENSIONAL RANDOM VARIABLES

UNIT II TWO DIMENSIONAL RANDOM VARIABLES
Joint distributions – Marginal and Conditional distributions – Functions of two dimensional random variables – Regression Curve – Correlation.

UNIT III ESTIMATION THEORY

UNIT IV TESTING OF HYPOTHESES
Sampling distributions – Type I and Type II errors – Tests based on Normal, t, Chi-Square and F distributions for testing of mean, variance and proportions – Tests for Independence of attributes and Goodness of fit.

UNIT V MULTIVARIATE ANALYSIS

TOTAL: 60 PERIODS

OUTCOMES:
At the end of the course, students will be able to
• Use the appropriate and relevant, fundamental and applied mathematical and statistics knowledge and methodologies in solving practical problem.
• Bring together and flexibly apply knowledge to characterize, analyse and solve a wide range of problems.
• Understand the balance between the complexity/accuracy of the mathematical/statistical models used and the timeliness of the delivery of the solution.
• Steeped in research methods and rigor.
• Develop critical thinking based on empirical evidence and the scientific approach to knowledge development.
REFERENCES:

IF5151 ADVANCED DATA STRUCTURES AND ALGORITHMIC L T P C
3 0 0 3

OBJECTIVES:
- To understand the usage of algorithms in computing.
- To understand and learn the algorithm design techniques.
- To learn and use hierarchical data structures and its operations.
- To learn the usage of graphs and its applications.
- To study about NP Completeness of problems.

UNIT I ALGORITHMS IN COMPUTING 9

Suggested Activities:
- Flipped classroom on divide & conquer strategy (Merge Sort, Quick Sort).
- External learning – Solving recurrence relations using Master’s method.
- Formulation of recurrence relations for various recursive algorithms (such as Tower of Hanoi, Staircase problem).
- Assignment on finding order of growth for exponent and logarithmic time algorithms.

Suggested Evaluation Methods:
- Assignments on formulation of recurrence relations, Master’s method, finding order of growth for algorithms.
- Quizzes on divide and conquer strategy.

UNIT II ALGORITHM DESIGN TECHNIQUES 8
Suggested Activities:
- Flipped classroom on basics of algorithm design strategies.
- Assignment on applying suitable algorithm design technique for solving real time problems/scenario such as Checker Board/Sequence Alignment/Puzzle Solving/Data Compression.
- Assignment on analysis of time complexity for memorization algorithms and Huffman Coding.

Suggested Evaluation Methods:
- Assignments on Knapsack problems.
- Quizzes on algorithm design strategies.
- Demonstration for practical learning.

UNIT III  
HIERARCHICAL DATA STRUCTURES


Suggested Activities:
- Flipped classroom on AVL trees and binary heap concepts.
- External learning – Fibonacci heap operations.
- Assignment on choosing and apply a suitable tree/heap structure for solving a given real time problem/scenario such as the implementation of trees/heaps/PDF document creation.
- Assignment on analysis of time complexity for B-Trees and Binomial Heaps.

Suggested Evaluation Methods:
- Assignments on binomial heap operations.
- Quizzes on AVL trees, binary heaps, time complexity of trees.
- Demonstration of practical learning.

UNIT IV  
GRAPH ALGORITHMS


Suggested Activities:
- Flipped classroom on basics of graphs and graph operations.
- External learning – Applications of graphs and DFS.
- Analysis of time complexity for Dijkstra’s algorithm and Floyd Warshall algorithm.
- Practical – To choose and apply a suitable graph algorithms for solving a real time problem/scenario such as network routing/shortest path updation in maps/relationship mining in graphs.

Suggested Evaluation Methods:
- Assignments on analysis of time complexity for Dijkstra’s algorithm and Floyd Warshall algorithm.
- Quizzes on graph operations.
- Demonstration of practical learning.
UNIT V  NP-COMPLETE AND NP –HARD


Suggested Activities:
- Flipped classroom on basics of approximation algorithms.
- External learning – Subset sum problem.
- Assignments on solving traveling salesman problem using approximation technique.
- Exploration of any two NP-complete problems with proofs.

Suggested Evaluation Methods:
- Assignments on NP-complete problems with proofs, traveling salesman problem using approximation techniques.
- Quizzes on approximation algorithms.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Apply suitable algorithms in real time computing.
2. Apply suitable design strategies to solve problems in an efficient manner.
3. Apply suitable hierarchical data structures to solve practical problems.
4. Design algorithms using graph structures to solve real-life problems.
5. Solve NP Complete problems efficiently.
6. Design data structures and algorithms that are appropriate for real time problems.

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OBJECTIVES:
- To understand the object oriented concepts of Java and learn GUI based application development and network programming.
- To learn client side scripting languages to create dynamic web pages.
- To build dynamic web sites using databases and server side technologies.
- To understand the importance of advanced frameworks.
- To integrate all the features of web technologies for application development.

UNIT I  JAVA FUNDAMENTALS  9

Suggested Activities:
- Flipped classroom on basics of Java.
- Learning and implementation of the following topics:
  - Java frame and applet based application development.
  - Java I/O streams for text and binary data operations to read from and write to files.
  - Java based thread implementation using thread priorities.
  - Java networking applications using sockets and datagrams.
  - Java applications using generic collections.

Suggested Evaluation Methods:
- Quiz on Java fundamentals.
- Tutorial – Advanced Java features.

UNIT II  WEB AND SCRIPTING  9

Suggested Activities:
- Learning and implementation of the following topics
  - Developing complex web forms using HTML5 and validating using Javascript.
  - Enhancing website appearance with style sheets.
  - Validating sting data using regular expressions.
  - Traversal of HTML5 document using HTML DOM.
- External learning – Usage of Angular JS in simple web applications.

Suggested Evaluation Methods:
- Quizzes on HTML5 features and Java scripts.
- Presentation on Jquery and Angular JS features.

UNIT III  WEB APPLICATION DEVELOPMENT  9
Suggested Activities:
- Learning and Implementation of the following topics
  - Develop a database application using JDBC.
  - Develop a servlet program that illustrates the usage of cookies and sessions.
  - Create a shopping cart application and guest book web apps using JSF.
  - Validate user input of an application such as singing contest using JSP.
- Flipped classroom on MVC architecture.
- External learning – Development of dynamic web applications.

Suggested Evaluation Methods:
- Quiz on JDBC.
- Quiz on cookies, JSF and Java Beans.
- Demonstration of web applications developed using servlets, JSP and JSF.

UNIT IV DISTRIBUTED OBJECTS


Suggested Activities:
- Learning and implementation of the following topics
  - Create XML schema for specifying and validating the structure of an XML document.
  - Retrieve and manipulate XML data programmatically.
- External learning – Creation of an AJAX-enabled version of the feedback form with appropriate fields.
- External learning – Creation of a SOAP and RESTful web services.

Suggested Evaluation Methods:
- Quiz on RMI, XML and web services.
- Demonstration of RMI, XML and web services implementation.

UNIT V ADVANCED FRAMEWORKS


Suggested Activities:
Learning and Implementation of the following topics
- Create a simple application using struts.
- Hibernate framework based O/R mapping.
- To create simple applications using Spring framework.

Suggested Evaluation Methods:
- Demonstration of Hibernate, Struts and Spring framework based application.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Have knowledge on Java based implementation of object oriented features.
2. Develop dynamic websites using client side technologies.
3. Develop dynamic web applications with database connectivity using server side technologies.
4. Create distributed applications using RMI and web services.
5. Design and develop applications using advanced frameworks.
6. Apply client and server side technologies for developing web applications with distributed objects and advanced framework features.

REFERENCES:
7. http://nptel.ac.in/courses/106105084/

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IF5101 ADVANCED NETWORKS

OBJECTIVES:
- To learn about the principles and practices of advanced computer networking concepts.
- To understand the importance of Quality of Service in IP networks.
- To explore the need for IPv6 and manage the MPLS technology in networks.
- To learn about SDN architecture and OpenFlow for network virtualization.
- To gain an in-depth knowledge of Network Virtualization Function.

UNIT I INTRODUCTION

Suggested Activities:
- Flipped classroom on network externalities and economies of scale.
- External learning – Inter-continental backbone network and Autonomous Systems model of the Internet.
- Computing the playout time of packets.
Suggested Evaluation Methods:
- Quiz and discussion on network externalities and economies of scale.
- Assignments on inter-continental backbone network and autonomous systems.

UNIT II QUALITY OF SERVICE

Suggested Activities:
- Design the network topology and the appropriate traffic characteristics using simulators such as Riverbed.
- Experiment with various parameters and compute the throughput across the link.

Suggested Evaluation Methods:
- Assess the computation of the QoS parameters theoretically.
- Compare with the simulated parameters.

UNIT III Ipv6 and MPLS

Suggested Activities:
- Configure MPLS network GNS3 / any open-source tools.
- Identify how ping and traceroute work in MPLS network.
- Practical – Simulate network recovery and restoration scenarios.

Suggested Evaluation Methods:
- Assessment on different network topology.
- Evaluation of the practical.

UNIT IV SOFTWARE DEFINED NETWORKING

Suggested Activities:
- Configure OpenFlow switches.
- View switch configuration and capability using dpctl command in mininet.

Suggested Evaluation Methods:
- Evaluate some basic SDN applications using various open-sourced SDN controllers.
- Evaluate for various commands.

UNIT V NETWORK FUNCTION VIRTUALIZATION
Suggested Activities:
- Create and manipulate software defined components.
- Developing SDN in a big data application (application-driven network control).

Suggested Evaluation Methods:
- Evaluating the manipulations for different scenarios.
- Assessing the effect of big data application in SDN.

PRACTICAL EXERCISES:
1. Generate network traffic with a Web Browser. Using Wireshark capture the traffic flow for various protocols.
2. Build a simple network in Packet Tracer and observe how data flows in the network.
3. Analyze traffic flows statistics during network tests.
4. Start capturing packets and use telnet to login and enter the password. Use Wireshark and capture in order to identify and reassemble the password from the captured network traffic.
5. Configure MPLS LDP sessions between two directly connected routers.
6. Write a simple monitoring module that counts all packets going to or leaving host (mininet/ryu).
7. Configure Openflow switches with dpctl command.
8. Create a simple_switch application that keeps track of where the host with each MAC address is located and accordingly sends packets towards the destination and not flood all ports.
9. Develop a Ryu SDN switch application with load balancing. Implement a round robin mechanism for deciding the forwarding port when installing the flows in the switch.
10. Write a simple firewarming module that blocks traffic between 2 hosts.

OUTCOMES:
On completion of the course, the student will be able to:
- Explain the advancements in Ethernet Technologies.
- Configure and manage different concepts of QoS polices in IP networks.
- Configure and manage the IPv6 addressing based network.
- Design a MPLS based network and able to provide QoS, TE services.
- Implement the SDN concepts and manage SDN controller.
- Explain network function virtualization techniques and apply the emerging technologies for various case studies.

REFERENCES:
OBJECTIVES:
To impart knowledge and skills required for research and IPR:
- Problem formulation, analysis and solutions.
- Technical paper writing / presentation without violating professional ethics
- Patent drafting and filing patents.

UNIT I RESEARCH PROBLEM FORMULATION 6
Meaning of research problem- Sources of research problem, criteria characteristics of a good research problem, errors in selecting a research problem, scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, necessary instrumentations

UNIT II LITERATURE REVIEW 6
Effective literature studies approaches, analysis, plagiarism, and research ethics.

UNIT III TECHNICAL WRITING / PRESENTATION 6
Effective technical writing, how to write report, paper, developing a research proposal, format of research proposal, a presentation and assessment by a review committee.

UNIT IV INTRODUCTION TO INTELLECTUAL PROPERTY RIGHTS (IPR) 6

UNIT V INTELLECTUAL PROPERTY RIGHTS (IPR) 6

TOTAL: 30 PERIODS
OUTCOMES:
1. Ability to formulate research problem
2. Ability to carry out research analysis
3. Ability to follow research ethics
4. Ability to understand that today’s world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity
5. Ability to understand about IPR and filing patents in R & D.

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IF5161 ADVANCED DATA STRUCTURES AND ALGORITHMS LABORATORY L T P C 0 0 4 2

OBJECTIVES:
- To learn the design strategies of various algorithms.
- To learn how to analyze the complexities of algorithms.
- To learn and understand the usage of advanced tree structures.
- To familiarize with the usage of heap structures.
- To understand the usage of graph structures and spanning trees.

LIST OF EXPERIMENTS:
Implement the following programs using C/ Python:
1. Iterative and recursive algorithms and its complexity analysis.
2. Merge sort algorithm analysis using divide and conquer approach.
3. Quick sort algorithm using randomized algorithmic approach.
5. Activity selection and Huffman coding using greedy approach.
7. Basic heaps operations.
8. Binomial heap operations.
9. Representation of graphs and graph traversals
10. A spanning tree for a given graph using Prim’s algorithm.
11. Shortest path of a given graph using Dijkstra’s algorithm and Bellman Ford algorithm.
12. All pair shortest path of a given graph using Floyd Warshall’s algorithm.

TOTAL: 60 PERIODS
OUTCOMES:
On completion of the course, the students will be able to:
1. Design and implement iterative and recursive algorithms with minimum complexity.
2. Design and develop efficient algorithms for practical problems by adopting suitable algorithm design strategies.
3. Design and implement basic and advanced data structures extensively.
4. Apply suitable hierarchical data structures based on real time problems.
5. Design algorithms using graph structures.
6. Implement real world applications by proper usage of data structures and algorithms.

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IF5162 WEB TECHNOLOGIES LABORATORY

OBJECTIVES:
- To develop simple Java programs using object orientation concepts.
- To program using files and threads for concurrent operations.
- To design attractive GUI using framework.
- To create more dynamic web pages using CSS, JavaScript and AJAX.
- To develop mobile based web applications in cloud environment.

LIST OF EXPERIMENTS:
1. Simple Java programs using arrays and lists.
2. Object orientation program using inheritance and polymorphism.
4. Simple GUI application development using applet and SWING.
5. Implement multithread program for concurrent operations.
6. Develop program to set priority and synchronize java threads.
7. Input and Output manipulation on files (Read/Write).
8. Java programs on generic and collections.
10. Dynamic web page creation using Javascript, JQuery and AJAX.
11. Develop servlet and JSF application with JDBC access.
12. Manage sessions in JSP using cookies.
14. Android application for location based service.
15. Develop cloud based web application.

TOTAL: 60 PERIODS
OUTCOMES:
On completion of the course, the students will be able to:
1. Implement object oriented concepts using Java language
2. Develop GUI application by including I/O streams and threads.
3. Create web pages with proper client-side features
4. Design dynamic web pages with server-side and other technologies
5. Develop simple android based mobile application
6. Deploy web applications in a cloud based environment.

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IF5201 SOFTWARE DESIGN METHODOLOGIES
OBJECTIVES:
- To gain knowledge about various software development lifecycle (SDLC) models, software development techniques and its application in real world context.
- To understand process, process improvement, requirements engineering and requirements management.
- To be aware of designing a software considering the various perspectives of end user. To learn to develop a software component using coding standards and facilitate code reuse.
- To use advanced software testing techniques.
- To analyze the software using metrics and measurement and predict the complexity and the risk associated with projects.

UNIT I INTRODUCTION AND FORMAL METHODS

Suggested Activities:
- Identify and propose ways to build quality software to stop deterioration due to change.
- Assignments like the following: Giving reasons for your answer based on the type of system being developed, suggest the most appropriate generic software process model that might be used as a basis for managing the development of the following systems (not limited to):
  - A system to control anti-lock braking in a car.
  - A virtual reality system to support software maintenance.
  - A university accounting system that replaces an existing system.
- An interactive travel planning system that helps users plan journeys with the lowest environment impact.
- Using the FDD feature template, define a feature set for a web browser.

Suggested Evaluation Methods:
- Assignments on the selection of suitable software process models for a given software specification.
- Tutorial – Identification of sample application for each process model and justification of the same stating reasons.

UNIT II REQUIREMENTS ENGINEERING AND MANAGEMENT


Suggested Activities:
- External Learning – Using open-source tools for RE to understand the requirements traceability and interdependency among the functionalities provided by the software project.
- External Learning – Requirements elicitation mechanisms and selection of an appropriate strategy.

Suggested Evaluation Methods:
- Tutorial on various Requirements elicitation mechanisms and selection of an appropriate strategy.
- Assignment on requirements categorization (considering contradicting, omission, commission of requirements) in a software project.
- Assignment on Selection of suitable software process models for a given software specification.

UNIT III SOFTWARE DESIGN AND SOFTWARE IMPLEMENTATION


Suggested Activities:
- Draw the activity network representation of the tasks.
- Determine ES, EF, and LS, LF for every task.
- Develop the Gantt chart representation for the project.

Suggested Evaluation Methods:
- Assignments on software design and modeling.
- Tutorial problems on UML Modeling.
- Quiz on software design methods and its implementation.
UNIT IV SOFTWARE PRACTICES, PROCESSES AND ARCHITECTURE


Suggested Activities:
- In-class activity on application specific product and process view.
- Develop a complete process framework for any project like healthcare system.
- A class project may be given as follows: Develop a debugging plan that will provide language and system oriented hints that have been learnt. Begin with the outline of topics that will be revived by the class and your instructor. Publish the debugging plan for others in your local environment.

Suggested Evaluation Methods:
- Assignment on testing sample application and understand the differences in selecting of test cases from the test suite.
- Tutorial problems on software development methodologies.
- Quiz on software development methodologies and software engineering practices.

UNIT V SOFTWARE PROJECT MANAGEMENT


Suggested Activities:
- Perform software project management for any project like automobile in which the driver commands the steering wheel and provides vision.
- Develop a schedule timeline.
- Develop Mini projects (Software Project Categories – PHP Projects, Data Mining, Android Projects, Smart Card/Biometrics, Dotnet Projects, Web Based Projects, Information Security, IOS Projects, Artificial Intelligence, Embedded Projects)

Suggested Evaluation Methods:
- Assignment on testing sample application and understanding the differences in the selection of test cases from the test suite.
- Tutorial problems on risk management, configuration management, quality management, planning and scheduling.
- Quiz on risk management, configuration management, quality management, planning and scheduling.

PRACTICAL EXERCISES:
Design, develop, implement and test any one of the following projects:
1. Data Mining.
2. Embedded Projects, Smart Card/Biometrics.
3. Web Based Projects.
5. Artificial Intelligence.

The road map for the project will be the following:
- Identify and propose ways to build quality software for the chosen project.
- Identify, justify and develop an appropriate generic software process model for the
chosen project.
- Using the FDD feature template, define a feature set for the chosen project.
- Perform requirements elicitation mechanisms on the selected project and justify the selection of an appropriate strategy.
- Categorize the requirements (considering contradicting, omission, commission of requirements) in a software project.
- Perform analysis.
- Develop a complete process framework.
- Design and model for the chosen project.
- Draw the activity network representation of the tasks for the chosen project.
- Determine ES, EF, and LS, LF for every task.
- Develop the Gantt chart representation for the project.
- Perform software project management tasks.

**TOTAL: 75 PERIODS**

**OUTCOMES:**
On completion of the course, the students will be able to:
- Analytically apply general principles of software development in the development of complex software and software-intensive systems.
- Understand methods and techniques for advanced software development and also be able to use these in various development situations.
- Apply testing techniques for object-oriented software and web-based systems.
- Familiarize with the basic concepts of Software design and implementation.
- Apply various software metrics on software quality products.
- Apply various skills on real-time projects.

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OBJECTIVES:
- To expose students to real-world systems artifacts in operating systems.
- To understand the solutions for critical problems of an Operating system.
- To gain knowledge on Distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols.
- To gain insight on to the distributed resource management components viz. the algorithms for implementation of distributed shared memory, recovery and commit protocols.
- To know the components and management aspects of Real time, Mobile operating systems.

UNIT I OPERATING SYSTEM BASICS 6

Suggested Activities:
- Practical – Solution to producer consumer problem in communicating sequential processes.
- Assignment on deadlock prevention.
- External learning – Models of deadlock and resources.

Suggested Evaluation Methods:
- Verifying the correctness of the solution for the given problem.
- Quiz on synchronization problems.

UNIT II DISTRIBUTED OPERATING SYSTEM 11

Suggested Activities:
- Practical – Write a program in any language for clock synchronization of events occur during chat based on time stamp and a logical counter.
- Practical – Write a program to enforce causal ordering of messages of a system with multiple processes.
- External learning – Global state recording algorithm to identify deadlocks in distributed systems.

Suggested Evaluation Methods:
- Evaluation of the order of events based on clock and counter values in the practical exercise.
- Evaluation of the delivery of messages from one process to other with the justification for the order of delivery in the practical exercise.
- Quiz on distributed deadlock detection.
UNIT III DISTRIBUTEDRESOURCE MANAGEMENT


Suggested Activities:
- Practical – Implementing a system for resource management in distributed environment with appropriate modules to access files from a remote system using any programming language. Use multithreading concept and ensure provisions for new user registration and authentication of existing users.
- Practical – Create a file in FreeBSD and perform read and write operations.
- Study the following files in FreeBSD: file.c, sysfile.c [file creation, reading and writing]

Suggested Evaluation Methods:
- Evaluation of the understanding of the file concepts in FreeBSD.
- Implementation evaluation of small file problem in FreeBSD.
- Quiz on FreeBSD study files and other parts of the module.

UNIT IV REAL TIME & MOBILE OPERATINGSYSTEMS


Suggested Activities:
- Mini project (group) for developing real time application.
- Assignments on file systems.

Suggested Evaluation Methods:
- Evaluation of the mini project.
- Quiz on file system.

UNIT V CASE STUDIES


Suggested Activities:
- External learning – Process start up and disk partion in FreeBSD
- Study of the following files in FreeBSD:
  - proc.c[set up first user process, create new process, allocating process, exit of process, process states and scheduling], swtch.S [context switch]
  - proc.h [per-CPU state and per-process state],
- Write a user program to check and print the state of a process (current/all/specified) in FreeBSD.
SUGGESTED EVALUATION METHODS:
- Quiz on FreeBSD study files and other parts of the Module.

PRACTICAL EXERCISES:
1. Introduction to Linux and shell programming. (4 hours)
2. Write a program to implement a distributed chat server using TCP socket.
3. Write a program to implement client server RPC and client server based program using RMI.
4. Write a multi-threaded client server program.
5. Write a program to simulate the functioning of Lamports logical clock and Lamports vector clock.
6. Write a program to implement Christian’s algorithm and Berkeley algorithm.
7. Write a program to check grep and pipe commands in FreeBSD.
8. Write a program to do file permission and directory file permission in FreeBSD.
9. Write a program to building multi-threaded and multi-process application.

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Articulate the main concepts, key ideas, strengths and limitations of operating systems.
2. Analyze the structure and basic architectural components of OS.
3. Have an understanding of high-level OS kernel structure.
4. Used gained insight into hardware-software interactions for compute and I/O.
5. Acquire practical skills in system tracing and performance analysis.
6. Explore research ideas in system structure and behaviour.

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OBJECTIVES:
- To provide a hands-on experience in R and Weka tool.
- To use the R packages for performing data preprocessing.
- To learn using Weka tool for data preprocessing.
- To familiarize the usage of R commands for visualizing data.
- To write and deploy simple algorithms as Map-Reduce tasks.

LIST OF EXPERIEMNTS:
1. Install standalone R. Install and configure Hadoop. Finally install R-hadoop.
2. Use R tool to explore various commands for descriptive data analytics using benchmark datasets.
3. Explore various variable and row filters in R for cleaning data.
4. Use R commands for probability distributions and probability statistics.
5. Formulate real business problems scenarios to hypothesis and solve using R statistical testing features.
6. Apply various plot features in R on sample data sets and visualize.
7. Write and execute word count, word search and pattern search problems from large text files using Map Reduce programs.
8. Write simple Map Reduce functions for sorting, grouping, joining, projecting, and filtering benchmark data sets.
10. Install Weka tool and explore various data preprocessing options using benchmark data sets.

TOTAL: 30 PERIODS

OUTCOME:
On completion of the course, the students will be able to:
1. Learn to install and use R.
2. Write and execute various data preprocessing experiments in the R platform.
3. Execute data cleaning processes on voluminous data sets.
4. Develop, implement and deploy simple data handling algorithms such as Map Reduce functions.
5. Learn to apply R functions on various applications.
6. Learn to install and use Weka tool.

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PO1 PO2 PO3 PO4 PO5 PO6
OBJECTIVES:
- To understand the concept of virtualization.
- To understand the various issues in virtualization.
- To familiarize themselves with the types of virtualization.
- To compare and analyze various virtual machines.
- To explore the virtualization tools and products.

UNIT I INTRODUCTION TO VIRTUALIZATION

Suggested Activities:
- Quizzes on process virtual machines and system virtual machines.
- Practical – Install Oracle Virtual Box/Vmware Workstation and create a blackboard application [Hint: One VM should act as a master and other VMs acts as a listeners, when any content is written by the master VM, the content should be displayed in all the Listener VMs].

Suggested Evaluation Methods:
- Report submission and evaluation of the working of application in virtual environment.

UNIT II SERVER VIRTUALIZATION

Suggested Activities
- Install any one Sever Virtualization Tool (Vmxware Esx,Xen,KVM) and run and create two VM and configure one vm as Web Server and another as File Server.

Suggested Evaluation Methods
- Review the Working of Installed Server Virtualization Tools (Access the Service offered by Remote Virtual machine via web browser)

UNIT III NETWORK VIRTUALIZATION

Suggested Activities:
- Create and configure a VLAN using Cisco packet tracer.
- Connect the Created VLANs using router in Cisco packet tracer.

Suggested Evaluation Methods:
- Demo – Inter VLAN Communication.
UNIT IV  STORAGE VIRTUALIZATION


Suggested Activities:
- Setup Iscsi in Linux Machine.

Suggested Evaluation Methods:
- Created storage luns should be accessed from target/remote system.

UNIT V  APPLYING VIRTUALIZATION


Suggested Activities:
- Mini project – Must use any virtualization Concept.

Suggested Evaluation Methods:
- Demonstration of the mini project.

OUTCOMES:
On completion of the course, the students will be able to:
- Create a virtual machine and to extend it to a virtual network.
- Discuss on various virtual machine.
- Compile all types of virtualization techniques and utilize them in design of virtual machines.
- Apply the concepts of virtualization in network and storage.
- Explore the various virtualization tools.
- Be able to use cisco packet tracer to simulate network virtualization.

REFERENCES:
OBJECTIVES:
- To learn about the design of the Unix operating system.
- To become familiar with the various data structures used.
- To learn the various low-level algorithms used in Unix.
- To understand the various Unix system calls.
- To explore the process and memory management concepts.

UNIT I OVERVIEW

Suggested Activities:
- External learning – Usage of disk blocks and buffer cache.
- Assignment on system calls related to various UNIX commands.

Suggested Evaluation Methods:
- Quizzes on services of OS.
- Quizzes on advantages and disadvantages of buffer cache.

UNIT II FILE SUBSYSTEM
Internal Representation of Files: Inodes – Structure of a Regular File – Directories – Conversion of a Path Name to an Inode – Super Block – Inode Assignment to a New File – Allocation of Disk Blocks.

Suggested Activities:
- Quizzes on inode.
- Practical – Implement superblock structure to handle the allocation and releasing of inode.
Suggested Evaluation Methods:
- Demonstration of the practical implementation.
- Assignment on disk block allocation.

UNIT III  SYSTEM CALLS FOR THE FILE SYSTEM  9
Open – Read – Write – File and Record Locking – Adjusting the Position of File I/O – lseek –
close – File Creation – Creation of Special Files – Changing Directory – Root – Owner –
Unlink.

Suggested Activities:
- Practical – Implement the following UNIX commands using System calls in C
  Program: cat and mv
- Practical – Write a C program to determine the size of a file using the lseek
  command. Once you found out the size, calculate the number of blocks assigned for
  the file.
- Practical – Write two simple programs pipe reader.c and pipe writer.c that use a
  named pipe to communicate. The pipe reader program will set up a named pipe
  using mkfifo(), open it read only, and read strings from it until it
  exit. The writer will open the named pipe file, read strings from the user and write
  them to the named pipe. When the user enters exit, the program will write the string
  to the pipe and then exit.

Suggested Evaluation Methods:
- Demonstration of the practical implementations and quizzes on the implementations.

UNIT IV  PROCESSES  10
Process States and Transitions – Layout of System Memory – The Context of a Process –
Saving the Context of a Process – Manipulation of the Process Address Space – Process
– Invoking other programs – User Id of a Process – Changing the size of a Process – Shell –
System Boot and the INIT Process.

Suggested Activities:
- Practical – Write a program in C that creates a child process, waits for the
  termination of the child and lists its PID, together with the state in which the process
  was terminated (in decimal and hexadecimal)
- Practical – In a C program, print the address of the variable and enter into a long loop
  (say using while (1)). Start three to four processes of the same program and observe
  the printed address values. Show how two processes which are members of the
  relationship parent child are concurrent from execution point of view, initially the child
  is copy of the parent, but every process has its own data.

Suggested Evaluation Methods:
- Demonstration of the practical implementations and quizzes on the implementations.

UNIT V  MEMORY MANAGEMENT AND I/O  8
Memory Management Policies – Swapping – Demand Paging – The I/O Subsystem: Driver
Interface – Disk Drivers – Terminal Drivers.

Suggested Activities:
- Practical – Implement memory management Policies (Group Activity)
- Practical – Modify the functionality of basic commands in xv6 system (Group
  Activity)
**Suggested Evaluation Methods:**
- Demonstration of the mini project.

**OUTCOMES:**
On completion of the course, the students will be able to:

1. Understand UNIX architecture and describe the component of operating system.
2. Explain how they interact with computer hardware.
3. Deeper understanding of system calls in Unix operating system.
4. Apply the concepts of operating systems design to practical problems.
5. Design and implement the subsystems of an operating system.
6. Critically analyze different data structures and algorithms used in the building of a kernel.

**REFERENCES:**

**OBJECTIVES:**
- To learn the fundamentals of 5G internet.
- To understand the concept of small cells in 5G mobile networks.
- To learn the mobile clouds in 5G network context.
- To understand the role of cognitive radios in 5G networks.
- To learn the security issues in 5G networks.

**UNIT I**
**PERVASIVE CONNECTED WORLD AND 5G INTERNET**

Suggested Activities:
- Flipped classroom on Ten Pillars of 5G.
- Assignment on millimeter wave mobile communication.
- External learning – 5G in global level.

Suggested Evaluation Methods:
- Viva voce on assignment topic.
- Group discussion on different generations of telecommunication networks.
- Quiz on spectrum allocation strategies for 5G.

UNIT II SMALL CELLS FOR 5G MOBILE NETWORKS

Suggested Activities:
- Flipped classroom on types of small cells.
- Assignments on issues in femto cells.
- External learning – Small cell challenges.

Suggested Evaluation Methods:
- Viva Voce on assignment topic.
- Quizzes on the drawbacks of dense deployment of wifi systems.

UNIT III COOPERATION FOR NEXT GENERATION WIRELESS NETWORKS

Suggested Activities:
- Flipped classroom on network coding.
- External learning – Cooperative MAC protocols.
- Assignment on packet exchange in PRCSMA.

Suggested Evaluation Methods:
- Viva voce on assignment topic.
- Quiz on NCCARQ operation under realistic channel conditions.
- Practical – Assessing the performance of NC-aided MAC protocols in event-driven C++ simulator.

UNIT IV MOBILE CLOUDS AND COGNITIVE RADIO

Suggested Activities:
- External learning – Network coding.
- Assignment on spectrum optimization using cognitive radio.
- External learning – Key Requirements and Challenges for 5G Cognitive Terminals.
- Assignment on component of a cognitive radio terminal.
Suggested Evaluation Methods:
- Viva voce on assignment topics.
- Quiz on carrier aggregation.

UNIT V SECURITY & SELF ORGANISING NETWORKS


Suggested Activities:
- External learning – 5G communications system architecture.
- Flipped classroom on security issues and challenges in communication systems.
- Assignment on centralised 5G mobile botnet.

Suggested Evaluation Methods:
- Viva voce on assignment topics.
- Quiz on D-SON and C-SON architectures.
- Group discussion on attacks on 4G Access Network.

OUTCOMES:
On completion of the course, the students will be able to:
1. Compare the 5G network with older generations of networks.
2. Identify suitable small cells for different applications in 5G networks.
3. Simulate 5G network scenarios.
4. Connect applications to mobile cloud.
5. Design applications with 5G network support.
6. Analyze the security risks in 5G networks.

REFERENCES:
OBJECTIVES:
- To learn about the physical layer and MAC layer of WSNs.
- To understand the data centric computing to be followed in WSNs.
- To study about the routing protocols followed in WSNs.
- To study about data aggregation and in–network processing.
- To explore various motes, sensor network operating systems, databases and development platforms.

UNIT I FUNDAMENTALS OF WSN

Suggested Activities:
- External learning – Exploring various sensors, the corresponding actuators, various motes and their configuration (sensors supported, microcontroller and the clock speed, Flash, RAM, Battery capacity, RF transceivers and data rate supported).
- Flipped classroom on accuracy, hysterisis and resolution of sensors.
- Exploring energy required for transmission, receiving and channel sensing.

Suggested Evaluation Methods:
- Assignments on various types of sensors, actuators and motes.
- Quiz and discussion on accuracy, hysteresis and resolution of sensors.
- Assignments on problem solving related to energy consumption in WSNs.

UNIT II MAC LAYER OF WSN AND ZIGBEE STANDARD

Suggested Activities:
- External learning – A study of Wireless HART, 6LoWPAN and ISA 100.11a standards.
- Flipped classroom on different roles of nodes in WSNs and different types of ZigBee devices.
- Analyzing duty cycle and sleep cycle of S-MAC protocol.

Suggested Evaluation Methods:
- Assignments on various standards available for WSNs.
- Quiz and discussion on roles of nodes and different types of ZigBee devices.
- Assignments on solving problems related to duty cycle of S-MAC protocol.

UNIT III DATA CENTRIC COMPUTING IN WSN
Suggested Activities:
- Flipped classroom on data centric computing and information centric networks.
- Assignments on analyzing the generation and consumption of energy with non-conventional energy sources.
- External learning – Sensor network platforms and tools and sensor network databases.

Suggested Evaluation Methods:
- Quiz and discussion on data-centric computing and Information-centric networks.
- Assignments on solving problems regarding generation and consumption of energy sources.
- Assignments on sensor network platforms, tools and sensor network databases.

UNIT IV Synchronization, Localization and Tracking in WSNs

Suggested Activities:
- External learning – Exploring tracking of objects using ultrasonic sensors and camera nodes.
- Exploring the idea of smart cities using Object Tracking Sensor Networks (OTSN).
- Flipped classroom on scene analysis, GPS, RFID and location based services.

Suggested Evaluation Methods:
- Assignments on tracking of objects using ultrasonic sensors and camera nodes.
- Practical – Designing WSNs to locate and track moving objects using ultrasonic sensors or camera nodes for smart cities.
- Quiz and discussion on scene analysis, GPS, RFID and location based services.

UNIT V Sensor Network Platforms and Tools

Suggested Activities:
- Explore various network simulators available to carry out experiments in WSNs and various WSN testbeds: WISBED, SensLAB, MoteLAB, CitySense and Sensei
- Flipped classroom on Contiki OS and COOJA IDE
- Practical – Developing Arduino sketches and WSN simulation in ns-3.

Evaluation Methods:
- Assignments on various WSN simulators and WSN testbeds
- Quiz and discussion on Contiki OS and COOJA IDE
- Writing Arduino sketches for socially relevant projects and creating a sensor network topology in ns–2.35 with Mannasim patch or in ns–3

TOTAL: 45 PERIODS
OUTCOMES:
On completion of the course, the students will be able to:
1. Understand different types of sensors, their actuators and the architecture of motes.
2. Design the topology of WSNs using different types of ZigBee devices and understanding their roles.
4. Apply appropriate localization techniques for different scenarios.
5. Manage sensor networks by synchronizing the time, locating and tracking objects.
6. Carry out experiments in simulators and real sensors.

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IF5084 SOFTWARE ARCHITECTURE AND PRINCIPLES L T P C
3 0 0 3

OBJECTIVES:
- To study the basics of software architecture and drivers.
- To be exposed to architectural styles and views.
- To study the need for software architectural standards.
- To be familiar with architectural patterns.
- To understand the basics of software architecture documentation and tools.

UNIT I INTRODUCTION 9

Suggested Activities:
- Study of the problem in a detailed fashion.
- Identifying the underlying software architecture.
Suggested Evaluation Methods:
- Case studies evaluation – Keyword in Context; Mobile robotics; Cruise control.

UNIT II ARCHITECTURAL REQUIREMENTS

Suggested Activities:
- Draw a mind map of quality attributes.
- Identify the quality attributes of a given system.

Suggested Evaluation Methods:
- Evaluating the mind map for Railway Reservation System.
- Quality Attributes for food management system.

UNIT III ARCHITECTURAL PATTERNS

Suggested Activities:
- Case studies for styles like Data flow systems, Call-and-return systems, Virtual machines, Independent components, Data-centered systems (repositories) etc.
- Match appropriate software architectures to applications.

Suggested Evaluation Methods:
- Evaluate various style of Architectural pattern for a given system.
- Assignment on various styles of different architecture.

UNIT IV ARCHITECTURAL VIEWS

Suggested Activities:
- Study of need for organizational standards.
- Case studies for understanding the choice of architectural views.

Suggested Evaluation Methods:
- Exploring the various views for cruise control system, mobile robot system, etc.
- Assignment for identifying the choice of views for a keyword in context system.

UNIT V DOCUMENTATION AND TOOLS

Suggested Activities:
- Documentation for Keyword in Context; Mobile robotics; Cruise control.
- In class discussion for identifying tools that match the current style in software architecture design.
Suggested Evaluation Methods:
- Documentation of Software architecture systems like internet information systems, automotive systems, scenario-based architectural analysis etc...
- Exploring tools like Open Model Sphere etc

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Explain influence of software architecture on business and technical activities.
2. Identify key architectural structures.
3. Use styles and views to specify architecture.
4. Design document for a given architecture.
5. Able to match appropriate software architectures to applications.
6. Develop standard process and to follow standard practices.

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IF5072 ARTIFICIAL INTELLIGENCE

OBJECTIVES:
- To know the underlying structure behind intelligence mathematically.
- To know the logical implications in computational intelligence.
- To know the automated learning techniques.
- To study the techniques of Knowledge Representation.
- To explore Artificial Intelligence techniques in real–time scenarios.
UNIT I INTELLIGENT AGENTS AND KNOWLEDGE REPRESENTATION 9

Suggested Activities:
- Flipped classroom on intelligent agents, means of knowledge representation
- Assignment on exercise questions on PEAS formulation from the text-book.
- Examples of knowledge representation through different methods and reasoning.
- Practical – Ontology creation using Protégé.

Suggested Evaluation Methods:
- Tutorial on intelligent agents and PEAS formulation.
- Assignments on semantic nets, frames.
- Quizzes on agents.
- Practical – Programming exercises on object oriented structure, semantic nets and frames.

UNIT II SEARCH TECHNIQUES 9

Suggested Activities:
- Flipped classroom on uninformed search and searching with costs.
- In-class activity – Solve puzzles with uninformed and informed searches.
- Practical – Implementation of search through Python/ Other languages.

Suggested Evaluation Methods:
- Tutorial – Different types of searches.
- Assignments on uninformed and informed searches.
- Quizzes on heuristic methods.
- Practical – Programming exercises on different search strategies.

UNIT III REASONING WITH LOWER ORDER LOGICS 9

Suggested Activities:
- Reasoning methods through puzzles and real life scenarios.
- Implementation: Inference through prolog/ python.

Suggested Evaluation Methods:
- Tutorial – Inference methods.
- Assignments on theorem proving and resolution.
- Quizzes on basics of logic – syntax and semantics.
- Practical – Programming exercises for theorem proving.

UNIT IV ARTIFICIAL INTELLIGENCE PLANNING 9
Suggested Activities:
- Flipped classroom on planning methods.
- Assignments on derivation of plan through partial order plan, graph plan and hierarchical plan.

Suggested Evaluation Methods:
- Tutorial – Different planning methods.
- Assignments on graph plan, SAT plan.
- Quizzes on planning in non-deterministic domains.
- Practical – Programming exercises on planning with PDDL/PDL/Python.

UNIT V LEARNING TECHNIQUES


Suggested Activities:
- Flipped classroom on theoretical study of learning methods
- Assignment on solving problem in statistical learning
- Practical – Programming exercises using Python/other programming languages.

Suggested Evaluation Methods:
- Tutorial – Learning methods.
- Assignments on statistical methods in learning.
- Quizzes on learning methods.
- Practical – Programming exercises on Statistical learning.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Understand the search techniques.
2. Apply the search techniques to real-time problems.
3. Apply the reasoning techniques to real world problems.
4. Understand the representation of knowledge.
5. Understand the learning techniques.
6. Apply AI techniques in developing real world applications.

REFERENCES:
4. NPTEL Artificial Intelligence Course by Prof. Dasgupta – http://nptel.ac.in/courses/106105079/2
### OBJECTIVES:
- To evaluate different computer systems based on performance metrics.
- To explore parallelism in instruction and processor functional block.
- To understand the fundamentals of Graphics processing unit.
- To compare different approaches of memory interfacing in multiprocessor.
- To understand and analyze interconnection in multicore.

### UNIT I
**INSTRUCTION LEVEL PARALLELISM**


**Suggested Activities:**
- Flipped classroom on classes of processor.
- External learning – Static (compiler) scheduling for instruction execution.
- Survey on multi core and draw a mind map on trends of multicore processor.

**Suggested Evaluation Methods:**
- Quizzes on out of order scheduling.
- Group discussion on how to reduce CPI lesser than 1.

### UNIT II
**THREAD–LEVEL PARALLELISM**

Suggested Activities:
- Flipped classroom on Flynn taxonomy.
- External learning – True and false sharing.
- Survey on memory consistency protocol.

Suggested Evaluation Methods:
- Quizzes on memory consistency.
- Group discussion on memory models.

UNIT III  SIMD AND GPU ARCHITECTURES  8

Suggested Activities:
- Flipped class on evolution of GPU.
- External learning – Vector architecture.
- Survey on multi core and draw a mind map on trends of multicore.

Suggested Evaluation Methods:
- Quizzes on multicore and GPU.
- Group discussion on GPU vs. Vector architecture.

UNIT IV  MEMORY HIERARCHY DESIGN  9

Suggested Activities:
- Flipped classroom on memory hierarchy in Intel i7 and ARM Cortex.
- Practical – Implement a simple functional model for memory mapping in cache using C/C++.
- Study hit/miss rates for various access patterns. Experiment with different replacement policies.

Suggested Evaluation Methods:
- Mock test for problems on memory mapping.
- Quizzes on memory management in ARM and Intel processor.

UNIT V  INTERCONNECT AND STORAGE  9

Suggested Activities:
- Flipped classroom on static and dynamic interconnection.
- Practical – Implement a simple map reduce program for counting a word.
- Case study on ware house scale computers

Suggested Evaluation Methods:
- Mock test for problems on types of interconnection.
- Quizzes on large scale computer programming.

TOTAL: 45 PERIODS
OUTCOMES:
On completion of the course, the students should be able to:
1. Compare and evaluate the performance of various architectures.
2. Design a coherent and consistent memory system for multiprocessor.
3. Analyze the requirements of large systems to select and build the right infrastructure
4. Design and analyze memory and interconnection system for processor.
5. Distinguish and model multiprocessor architecture styles.
6. Point out the hazards present in a pipeline and suggest remedies

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IF5001  REASONING METHODS IN COMPUTER SCIENCE  L T P C
3 0 0 3

OBJECTIVES:
- To know the mathematical background of Logic.
- To learn the basics of Lower Order Logic.
- To study the background of Higher Order Logic.
- To explore the real world applications with Lower Order Logic.
- To explore the real world applications with Higher Order Logic.

UNIT I  PROPOSITION LOGIC  9
Introduction to Logic – Foundation in mathematics – Natural Deduction – Formal language Syntax and Semantics – Normal Forms – Applications in AI.

Suggested Activities:
- Flipped classroom on natural deduction.
- In-class activity – Solving puzzles through proposition logic.
- Practical – Programming exercises for SAT solver.
Suggested Evaluation Methods
- Quiz on formal proof methods.
- Assignments on natural deduction and SAT Solvers.
- Programming exercises on resolution and SAT Solvers.

UNIT II  
**PREDICATE LOGIC**  9
Syntax and semantics – Natural Deduction rules – Expressiveness – Micromodels of software – Inference mechanisms in AI.

Suggested Activities:
- Flipped classroom on micromodels of software.
- In-class activity – Problem solving exercise on natural deduction rules.

Suggested Evaluation Methods:
- Quiz on reasoning methods.
- Assignments on inference mechanisms in AI.

UNIT III  
**MODAL LOGIC**  9
Higher order logic – Modal logic syntax – Semantics – Accessibility relation – Types of modal logic – Natural deduction.

Suggested Activities:
- Flipped classroom on types of modal logic.
- In-class activity – Entailment through Kripke semantics.

Suggested Evaluation Methods
- Quiz on different accessibility relations.
- Assignments on Kripke structures.

UNIT IV  
**TEMPORAL LOGIC**  9

Suggested Activities:
- Flipped classroom on applications.
- In-class activity – Solving problems with model checking.

Suggested Evaluation Methods:
- Quiz on Model Logic with types, temporal logic syntax and semantics.
- Assignment on semantics.
- Programming assignment on Model Checking.

UNIT V  
**EPISTEMIC LOGIC**  9
Logic of knowledge – Syntax – Semantics – Natural Deduction – Multi-agent reasoning – Applications in Distributed systems.

Suggested Activities:
- Flipped classroom on multi-agent reasoning.
- In-class activity – Solving puzzles like Muddy Children and Three Wise Men puzzle.

Suggested Evaluation Methods:
- Quiz on Reasoning methods using Muddy Children and Three Wise Men puzzle.
- Assignment on deduction and other reasoning methods.

TOTAL: 45 PERIODS
OUTCOMES:
On completion of the course, the students will be able to:
1. Understand the mathematical underpinnings of Logic
2. Apply Proposition Logic to Computer Science domains
3. Understand the reasoning process of Predicate Logic
4. Understand the advantages of Higher Order Logic over Lower Order Logic
5. Apply Temporal Logic to Distributed Systems
6. Design Multiagent systems using Epistemic Logic

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IF5078 DISTRIBUTED AND CLOUD COMPUTING L T P C 3 0 2 4

OBJECTIVES:
- To learn distributed communication.
- To understand distributed resource management.
- To study the basics of cloud computing.
- To study about virtualization and cloud resource management.
- Be able to install and use current cloud technologies.

UNIT I INTRODUCTION TO DISTRIBUTED SYSTEM AND COMMUNICATION 8
Suggested Activities:
- Practical – Implement clock synchronization in distributed system using Lamport’s algorithm.
- Practical – Create and distribute a Torrent file to share a file in LAN environment.

Suggested Evaluation Methods:
- Demonstration and assessment of the working of the implemented algorithm.

UNIT II DISTRIBUTED RESOURCE MANAGEMENT 10

Suggested Activities:
- Practical – Implement Election Algorithm.
- Practical – Implement any one deadlock detection Algorithm.

Suggested Evaluation Methods:
- Demonstration and assessment of the working of the implemented algorithm.

UNIT III CLOUD COMPUTING, ARCHITECTURE MODELS AND SERVICES 9

Suggested Activities:
- Practical – Use Google Collaboration Tools: Create Google Docs, Sheets, and Slides and share it with others.
- Practical – Explore public cloud services including Amazon, Google, Sales force, and Digital Ocean etc.

Suggested Evaluation Methods:
- Quizzes on different service models and deployment models.
- Report submission – Comparison of various services provided by different Cloud Service Provider (Configuration of VM, Cost, Network Bandwidth etc).

UNIT IV CLOUD ENABLING TECHNOLOGIES 10

Suggested Activities:
- Create a simple web service using Python Flask /Java /any language [Web Service: Client-server model should be implemented using socket/http].
- Install Oracle Virtual Box/Vmware Workstation and Create a blackboard application[Hint: One VM should act as a master and other VMs acts as a listeners, when any content is written by the master VM, the content should be displayed in all the Listener VMs].
Suggested Evaluation Methods:
- Review of the Web Service Implementation: Proper Connection should be established between the client and server to make use of the service offered by the Server.
- Assessment of the workings of installed Virtualization Tools.
- Review the workings of application in virtual environment [Implemented using basic echo and chat concepts].

UNIT V CLOUD MANAGEMENT, SECURITY AND COMPUTING PLATFORMS


Suggested Activities:
- Practical – Use security tools like ACUNETIX, ETTERCAP to scan web applications on the cloud, cloud networks for finding vulnerabilities, verifying leakage of information to an unauthorized third party.
- Practical – Install and configure OpenStack all– in– one using Devstack/Packstack and Launch VMs in OpenStack through dashboard:

Suggested Evaluation Methods:
- Report Submission – A detailed report describing vulnerabilities along with the suitable action that can be taken to remedy the loopholes.
- Evaluation of the practical: OpenStack Dashboard should be accessed through web browser and the working of the instances must be verified by logging in to it/pinging the instance.

PRACTICAL EXERCISES:

1. Connect a minimum of 3 nodes and implement a group chat amongst them.
2. Implement any one of the message ordering algorithms on the previously implemented system.
3. Implement an election algorithm to elect a co–ordinator for the system.
4. Perform clock synchronization on the system, with the co–ordinator node’s time as reference.Create a VM image which has a C compiler along with an operating system and do the following experiments
5. Install Virtualbox with different flavours of linux or windows OS on top of windows7 or 8.
6. Install Google App Engine/Heroku and run a run a simple webapp using python/java.
7. Install and run Openstack using Packstack/Devstack
8. Create two VMs in Openstack and exchange data.
9. Simulate a cloud scenario using Cloud Sim and run a scheduling algorithm not present in Cloud Sim.
10. Install hadoop and manipulate a large dataset and run on Hadoop.

TOTAL: 75 PERIODS
OUTCOMES:
On completion of the course, the students will be able to:
1. Appreciate distributed communication, distributed resource management.
2. Articulate the main concepts, key technologies, strengths and limitations of cloud computing.
3. Learn the key and enabling technologies that help in the development of cloud.
4. Develop the ability to understand and use the architecture of compute and storage cloud, service and delivery models.
5. Explain the core issues of cloud computing such as resource management and security.
6. Choose the appropriate technologies, algorithms and approaches for implementation and use of cloud.

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IF5074 BUILDING INTERNET OF THINGS L T P C
3 0 2 4

OBJECTIVES:
- To understand the fundamentals of Internet of Things.
- To build a small low cost embedded system using Arduino / Raspberry Pi or equivalent boards.
- To learn communication protocols that is frequently used in IoT ecosystems.
- To explore the ways of processing enormous amount of data generated in IoT based systems.
- To understand the role of cloud computing in IoT and to become familiar with various cloud offerings.
UNIT I  ENABLING TECHNOLOGIES AND REFERENCE MODELS


Suggested Activities:
- Flipped classroom on enabling technologies.
- External learning – Exploring proprietary protocols used in IoT and M2M.
- Analyzing the required level of design for different IoT based ecosystems.

Suggested Evaluation Methods:
- Quiz and discussion on enabling technologies (WSN, Cloud and Big Data).
- Assignments on proprietary protocols used in IoT and M2M.
- Deciding the level and designing the IoT framework for case studies.

UNIT II  DESIGN OF END DEVICES


Suggested Activities:
- Flipped classroom on open source movement in hardware and SDLC for embedded systems.
- Explore the variants of Arduino Boards, Atmel Microcontrollers, Cypress Pioneer and NXP Freedom.
- Learning to write Arduino Sketches and Python Programs.

Suggested Evaluation Methods:
- Quiz and discussion on open source movement in hardware and SDLC for embedded systems.
- Assignments on Arduino boards, Atmel Microcontrollers, Cypress Pioneer and NXP Freedom.
- Practical – Developing Arduino Scripts and Python Programs.

UNIT III  IoT PROTOCOLS

MAC Layer Protocols – IEEE 802.15.4 – G And E Variants of IEEE 802.15.4 – IEEE 802.11ah – IEEE 1901.2a – LoRaWAN – 6LoWPAN – From 6LoWPAN to 6Lo – NB IoT – REST Based Protocols – SCADA, CoAP and MQTT

Suggested Activities:
- External learning – Explore various software tools that support Coap and MQTT.
- Flipped classroom on role of Ipv6 in designing IoT based systems.

Suggested Evaluation Methods:
- Assignments on software tools that support Coap and MQTT.
- Quiz and discussion on role of Ipv6 in IoT based systems.
- Assignments on the IoT policy of Meity (Government of India).
UNIT IV DATA ANALYTICS


Suggested Activities:
- External learning – Exploring popular machine learning algorithms (both supervised and unsupervised).
- Flipped classroom on MapReduce programming.
- Learning dataflow programming using open source software library.

Suggested Evaluation Methods:
- Assignments on supervised, unsupervised and reinforcement algorithms.
- Quiz and discussion on MapReduce programming.
- Practicing data flow programming languages using libraries like Tensorflow/CNTK/Theano etc.

UNIT V CLOUD OFFERINGS


Suggested Activities:
- Flipped classroom on cloud models and type of clouds.
- External learning – Django framework.

Suggested Evaluation Methods:
- Quiz and discussion on cloud models and types of clouds.
- Developing web apps for IoT ecosystems using Django framework.

PRACTICAL EXERCISE:

1. Develop a BLINK sketch in Arduino.
2. Develop an Arduino sketch that repeats an LED to glow brightly, decrease the brightness, switches off the LED, increases the brightness and LED glows with maximum intensity (a sketch for fading).
3. Develop an Arduino sketch that takes sensor readings for five seconds during the startup, and tracks the highest and lowest values it gets. These sensor readings during the first five seconds of the sketch execution define the minimum and maximum of expected values for the readings taken during the loop (a sketch for calibrating a sensor).
4. Develop an Arduino sketch that reads the value of a variable resistor as an analog input and changes blink rate of the LED.
5. Develop an Arduino sketch to use a piezo element to detect the vibration.
6. Develop a Python program to control an LED using Raspberry Pi.
7. Develop a Python program to interface an LED with a switch using Raspberry Pi.
8. Implement a map reduce program that produces a weather data set.
9. Implement an application that stores big data in Hbase/Mongo DB using Hadoop/R.
10. Use Google Collaboration Tools: Create Google Docs, Sheets, and Slides and share it with others.
11. Miniproject.

TOTAL: 75 PERIODS
OUTCOMES:
On completion of the course, the students will be able to:
1. Understand the enabling technologies and reference models of IoT.
3. Apply appropriate protocols in various parts of IoT based systems.
4. Understand Big Data tools and technologies and apply them in IoT based systems.
5. Design and deploy IoT based systems and connect them to cloud offerings.
6. Design IoT systems for various real time applications.

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IF 5081 INFORMATION RETRIEVAL L T P C 3 0 2 4

OBJECTIVES:
- To understand the basics of Information Retrieval with pertinence to modelling, Query operations and indexing.
- To get an understanding of machine learning techniques for text classification and clustering.
- To understand the various applications of Information Retrieval giving emphasis to Multimedia IR and Web Search.
- To understand the concepts of digital libraries.
- To learn the procedure for recommendation system.

UNIT I INTRODUCTION 9
Suggested Activities:
- Install Lucene, LingPipe, and Gate.

Suggested Evaluation Methods:
- Group discussion on applications of vector space model.

UNIT II PREPROCESSING
9

Suggested Activities:
- Construct manually a frequency table for the collection of documents after removing stop words.
- Index the frequency table using Latent semantic indexing techniques.

Suggested Evaluation Methods:
- Apply query document information and analyze manually the performance of the retrieval.

UNIT III METRICS
9

Suggested Activities:
- Assignments on problems on precision and recall like the following:
  - An IR system returns 8 relevant documents and 10 non-relevant documents. There are a total of 20 relevant documents in the collection. What is the precision of the system on this search and what is its recall?

Suggested Evaluation Methods:
- Group discussion on metrics.

UNIT IV CATEGORIZATION AND CLUSTERING
9

Suggested Activities:
- Categorize documents by topic using classifiers and build groups of self-organized documents using clustering algorithms.

Suggested Evaluation Methods:
- Analyze the algorithm by changing the input set.
UNIT V  EXTRACTION AND INTEGRATION


Suggested Activities:
- External learning – Survey on recommendation process that takes place in various online shopping portals.

Suggested Evaluation Methods:
- Group discussion on recommendation process in a real time scenario.

PRACTICAL EXERCISES:

Implement the following exercises using python libraries.

1. Construct a vector space model for the collection of text documents and also compute the similarity between them. (4 hrs)
2. Perform the preprocessing on any text document collection. (4 hrs)
3. Classification and clustering approach on standard text database and also compute performance measures Precision, Recall and F-measure (4 hrs)
4. Construct a search engine index with an optional backend database to manage large document collections. (4 hrs)
5. Parse XML text and compute topic specific page rank. (4 hrs)
6. Mini project. (10 hrs)

TOTAL: 75PERIODS

OUTCOMES:
On completion of the course, the students will be able to:

1. Build an Information Retrieval system using the available tools.
2. Identify and design the various components of an Information Retrieval system.
3. Apply machine learning techniques to text classification and clustering which is used for efficient Information Retrieval.
4. Analyze the Web content structure.
5. Analyze the approaches used for recommendation systems.
6. Design an efficient search engine.

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IF5092                      ANALYSIS OF SOCIAL NETWORKS                      L T P C
                                3 0 2 4

OBJECTIVES:
- To understand the concept of semantic web and related applications.
- To learn knowledge representation using ontology.
- To understand human behavior in social web and related communities.
- To learn visualization of social networks.
- To understand the importance of security and privacy in social networks.

UNIT I       INTRODUCTION TO SOCIAL NETWORKS

Suggested Activities:
- Given a social graph derive the various graph metrics.
- Group discussion on pros and cons of various online discussion forums.
- Convert a graph into equivalent matrix representation.

Suggested Evaluation Methods:
- Assignment on graph metrics.
- Report submission on features of online social forums.
- Quizzes on graph and matrix representations.
UNIT II  ONTOLOGY FOR SOCIAL NETWORK ANALYSIS


Suggested Activities:
- Group activity – Defining concepts and relations for sample scenarios using benchmark ontology.
- Practical – Developing ontology using tools.
- Assignment on inferring the entities involved from a sample RDF schema.

Suggested Evaluation Methods:
- Report submission on benchmark ontology.
- Quizzes and assignments on RDF/FOAF and other related vocabulary.

UNIT III  SOCIAL MEDIA MINING AND SEARCH


Suggested Activities:
- Group discussion on the pros and cons of communities in social networks.
- Charting the metrics for evaluating real time online communities.

Suggested Evaluation Methods:
- Group assignment on evaluating real time social network communities.
- Assignment on scenario based comparative analysis of community discovery.
- Open book quizzes on Recommender Systems for specific social networking scenarios.

UNIT IV  SOCIAL NETWORK INFRASTRUCTURES AND COMMUNITIES


Suggested Activities:
- User interaction data collection from real time social network applications.
- Comparison of behavior models in social networks using sample data.

Suggested Evaluation Methods:
- Tutorial – Scenarios to identify suitable web accessibility testing.
- Group projects – Use open source data collection tools and predict user behavior.
UNIT V PRIVACY IN SOCIAL NETWORKS AND VISUALIZATION


Suggested Activities:
- Case studies on applications of social network analysis.
- In-class activities – Network visualization using benchmark data and network visualization tools.

Suggested Evaluation Methods:
- Assignments on chart work for modeling social networks using node-edge diagrams.
- Mini project on applications of social network analysis.

PRACTICAL EXERCISES:
1. Download and install open source social network analysis tools like UCINET, Net Miner, Smart Network Analyzer, Pajek, Gephi and explore the visualization and analytical features of that tool using sample real world data.
2. Construct any graph representing a real life social network scenario, feed the same as a matrix input to any tool and explore the graph theoretical metrics of the graph and note down your observations and inferences on those values.
3. Download any RDF schema on tourism and explore various tags in the schema. To analyzing, open them using a Word Editor. Highlight the subject, predicate and object in each file. If necessary use the RDF validator service by W3C to obtain the triplets.
4. Download and install any open source RDF/Ontology editing tool like protégé, Onto Studio, etc. Try the following in that tool: (i) Load existing RDF schema and visualize and (ii) Add, modify and delete RDF
5. Do the following using W3C RDF Validator: (i) Enter a URI or paste an RDF/XML document and parse the RDF and (ii) Visualize the RDF/XML as Triples and/or Graph.
6. Download any benchmark FOAF ontology/RDF and study the various FOAF classes used in that RDF/Ontology.
7. Download and install Gephi tool and explore importing graph file formats from (i) Spreadsheet import wizard, (ii) Database import. Also use the statistics and metrics framework in Gephi to calculate the following: Betweenness Centrality, Closeness, Diameter, Clustering Coefficient, Page Rank.
8. Load different social network data into Gephi tool and perform community detection using the features available and also compute the shortest path.
9. Explore various forced layout and random forest algorithms in Gephi tool to create a network layout. Compare the outputs of various layouts algorithms.
10. Study of various bibliometric RDFs and visualization of citation networks.

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Convert a social network data into its equivalent graph data and derive social graph metrics.
2. Develop social blogs with necessary tags.
3. Design and develop ontology for various domains.
4. Predict human behavior in social web and related communities using community prediction and mining algorithms.
5. Design and develop trust models for social networks.
6. Visualize social network data and quantify its structural properties.
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IF5077 DIGITAL IMAGE PROCESSING TECHNIQUES L T P C 3 0 2 4

OBJECTIVES:
• To learn about the basic concepts of Digital Image Processing and various Image Transforms.
• To familiarize the student with the Image Enhancement Techniques.
• To expose the student to a broad range of Image Processing Techniques and their Applications.
• To appreciate the use of current technologies those are specific to Image Processing Systems.
• To expose the students to real-world applications of Image Processing.

UNIT I FUNDAMENTALS OF IMAGE PROCESSING 9

Suggested Activities:
• Discussion on Image Processing applications.
• External learning – Open Source Tools like Octave/SciLab/OpenCV.
• External learning – Matlab/Octave Toolboxes.
• Installation of OpenCV/SciLab.
• Numerical Problems in Pixel connectivity and Distance measures.

Suggested Evaluation Methods:
• Tutorial problems in image operations, image connectivity and distance measures.
• Assignment on sampling, quantization and image operations.
• Quizzes on image types.

UNIT II IMAGE ENHANCEMENT 9

Suggested Activities:
• Discussion of Mathematical Transforms.
• Numerical problem solving using Fourier Transform.
• Numerical problem solving in Image Enhancement.
• External learning – Image Noise and its types.

Suggested Evaluation Methods:
• Tutorial – Image transforms.
• Assignments on histogram specification, histogram equalization and spatial filters.
• Quizzes on noise modeling.

UNIT III IMAGE RESTORATION AND MULTI-RESOLUTION ANALYSIS 9

Suggested Activities:
• Discussion on Image Artefacts and Blur.
• Discussion of Role of Wavelet Transforms in Filter and Analysis.
• Numerical problem solving in Wavelet Transforms.
• External learning – Image restoration algorithms.

Suggested Evaluation Methods:
• Tutorial – Wavelet transforms.
• Assignment problems on order statistics and multi-resolution expansions.
• Quizzes on wavelet transforms.

UNIT IV IMAGESEGMENTATIONANDFEATUREEXTRACTION 9

Suggested Activities:
• Flipped classroom on importance of segmentation.
• External learning – Feature selection and reduction.
• External learning – Image salient features.
• Assignment on numerical problems in texture computation.
Suggested Evaluation Methods:
- Tutorial – Image segmentation and edge detection.
- Assignment problems on feature extraction and reduction.
- Quizzes on feature selection and extraction.

UNIT V IMAGE PROCESSING APPLICATIONS

Suggested Activities:
- Discussion on machine learning in image processing.
- Discussion on image classifiers.
- External learning – Study of visual effects, image processing in security, forensic applications.

Suggested Evaluation Methods:
- Tutorial – Image classifier and clustering.
- Assignment problems on support vector machines and EM algorithm.
- Quizzes on image processing applications.

PRACTICAL EXERCISES:
1. Implementation of Reading and Writing of Images in Matlab and OpenCV/Octave/SciLab.
2. Implementation of simple spatial filters like Low Pass Filters and High Pass Filters in Matlab/OpenCV.
3. Implementation of Histogram Techniques in Matlab/Octave/OpenCV.
10. Implementation of Feature extraction Fingerprint using Matlab/Octave.

TOTAL: 75PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Implement basic Image Processing Operations.
2. Apply and develop new techniques in the areas of Image Enhancement and Restoration.
3. Understand the Image segmentation algorithms.
4. Extract features from Images.
5. Apply classifier and Clustering algorithms for Image classification and Clustering.
6. Design and develop an image processing application that uses different concepts of Image Processing.
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IF5075 COMPUTER VISION L T P C 3 0 2 4

OBJECTIVES:
- To provide knowledge about computer vision algorithms.
- To understand the basic concepts of camera calibration, stereoscopic imaging and higher level image processing operations.
- To familiarize the student with the image processing facilities in Matlab and its equivalent open source tools like OpenCV.
- To appreciate the use of computer vision in Industrial applications and to understand the role of computer vision.
- To understand and implement Object detection and Object tracking Algorithms.

UNIT I FUNDAMENTALS OF VISION 9

Suggested Activities:
- Installation of OpenCV.
- Numerical Problems on Filtering, Masking, Smoothing and sharpening.

Suggested Evaluation Methods:
- Quizzes on various camera models and its effect.
- Practical – Programming assignments on types of filters for different applications.
UNIT II IMAGE SEGMENTATION and CAMERA CALLIBRATION


Suggested Activities
- Flipped classroom on importance of segmentation.
- External learning – Various camera calibration methods.

Suggested Evaluation Methods
- Quizzes on various segmentation methods.
- Practical – Programming assignments on edge and shape detection methods.

UNIT III FEATURE DETECTION AND TRACKING


Suggested Activities
- Flipped classroom on various feature reduction methods.
- External learning – Optical flow algorithms.

Suggested Evaluation Methods
- Quizzes on various feature detection methods.
- Practical – Programming assignments on object tracking algorithms.

UNIT IV SHAPE FROM CUES AND OBJECT DETECTION


Suggested Activities
- Flipped classroom on pedestrian detection methods.
- Assignments on numerical problems on Shading and Texture Model based Vision.
- Assignments on numerical problems on AdaBoost and Random Decision Forests.

Suggested Evaluation Methods
- Quizzes on methods to identify the shape of an object in an image.
- Practical – Programming assignments on algorithms and methods used for identification of objects.

UNIT V COMPUTER VISION APPLICATION


Suggested Activities
- External learning – Exploring advancement in computer vision.
- Discussion on Emotion Recognition methods.

Suggested Evaluation Methods
- Quizzes on various real time computer vision application.
- Group discussion on methods to solve the real world problems in computer vision applications.
PRACTICAL EXERCISE:
1. Implementation of Noise removal algorithms using OpenCV.
2. Implementation of Object detection based on Edge detection algorithms on any application using OpenCV.
3. Implementation of Perspective projection of the lane borders using OpenCV.
4. Implementations of Feature Extraction of an object using SIFT in OpenCV.
5. Implementation of Feature Extraction of an object using SURF in OpenCV.
6. Implementation of Emotion Recognition in OpenCV.
7. Implementation of Gesture Recognition in OpenCV.
8. Implementation of Face Detection in OpenCV.
9. Implementation of Object detection using AdaBoost in OpenCV.

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Implement basic computer vision algorithms.
2. Familiar with the use of MATLAB and OpenCV environment.
3. Apply and develop various object detection methods.
4. Design and implement industrial applications that incorporate different concepts of Image Processing.
5. Analyze different Object detection algorithms used in Computer Vision.
6. Understand the proper use of shape and Shape related cue features for Computer Vision Applications.

REFERENCES:
OBJECTIVES:
- To understand the basic ideas and principles of Neural Networks
- To understand the basic concepts of Big Data and Statistical Data Analysis
- To familiarize the student with The Image Processing facilities like Tensorflow and Keras
- To appreciate the use of Deep Learning Applications
- To understand and implement Deep Learning Architectures

UNIT I  BASICS OF NEURAL NETWORKS  9
Basic concept of Neurons – Perceptron Algorithm – Feed Forward and Back Propagation Networks.

Suggested Activities:
- Discussion of role of Neural Networks.
- Practical – Installation of TensorFlow and Keras.

Suggested Evaluation Methods:
- Tutorial – Perceptron.
- Assignment problems on backpropagation networks.
- Quizzes on Neural Networks.

UNIT II  INTRODUCTION TO DEEP LEARNING  9

Suggested Activities:
- Discussion of role of Gradient Descent in Deep Learning.
- External learning – Feature extraction and feature learning.
- Discussion of Gradient Descent Problem.

Suggested Evaluation Methods
- Tutorial – Gradient descent in deep learning.
- Assignment problems in optimization.
- Quizzes on deep learning regularization and optimization.

UNIT III  CONVOLUTIONAL NEURAL NETWORKS  9
CNN Architectures – Convolution – Pooling Layers – Transfer Learning – Image Classification using Transfer Learning

Suggested Activities:
- Discussion of role of Convolutional Networks in Machine Learning.
- External learning – Concept of convolution and need for Pooling.

Suggested Evaluation Methods:
- Tutorial – Image classification and recurrent nets.
- Assignment problems in image classification performances.
- Quizzes on Convolutional Neural Networks.
UNIT IV MORE DEEP LEARNING ARCHITECTURES

Suggested Activities:
- Discussion of role of Deep Learning architectures.
- External learning – Compression of features using Autoencoders.

Suggested Evaluation Methods:
- Tutorial – LSTM and Autoencoders.
- Assignment problems in deep generative models, Deep Belief Networks.
- Quizzes on deep learning architectures.

UNIT V APPLICATIONS OF DEEP LEARNING

Suggested Activities:
- Discussion of role of Deep Learning in Image and NLP applications.
- External learning – NLP concepts.

Suggested Evaluation Methods:
- Tutorial – Image segmentation.
- Assignment problems in parsing and sentiment analysis.
- Quizzes on deep learning architectures.

PRACTICAL EXERCISES:
1. Implement Simple Programs like vector addition in TensorFlow.
2. Implement a simple problem like regression model in Keras.
4. Implement a Feed-Forward Network in TensorFlow/Keras.
5. Implement an Image Classifier using CNN in TensorFlow/Keras.
6. Implement a Transfer Learning concept in Image Classification.
8. Implement a SimpleLSTM using TensorFlow/Keras.
9. Implement an Opinion Mining in Recurrent Neural network.
10. Implement an Object Detection using CNN.
11. Mini Project

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Understand the role of Deep learning in Machine Learning Applications.
2. To get familiar with the use of TensorFlow/Keras in Deep Learning Applications.
3. To design and implement Deep Learning Applications.
5. To design and implement Convolutional Neural Networks.
6. To know about applications of Deep Learning in NLP and Image Processing.
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IF5080  HUMAN COMPUTER INTERACTION TECHNIQUES  L T P C
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OBJECTIVES:
- To learn the principles and fundamentals of HCI.
- To understand components of interfaces and screens, including windows, menus and controls.
- To understand user interface design principles, and apply them to designing an interface.
- To learn user interface designs through usability inspection and user models.
- To understand the rationale and guidelines for an effective interface design methodology.

UNIT I  DESIGN PROCESS
Suggested Activities:
- Flipped classroom on knowledge on the HCI design process.
- External learning – Exploration of various human computer interfaces.

Suggested Evaluation Methods:
- Tutorials – HCI design process.
- Assignment on comparison of various interfaces.

UNIT II  DESIGN AND EVALUATION OF INTERACTIVE SYSTEMS  9

Suggested Activities:
- Flipped classroom on designing a good User Interface system based on design rules.
- External learning – Techniques related to evaluation of HCI design.

Suggested Evaluation Methods:
- Tutorial – Usage of design rules to create interfaces.
- Assignment on applying evaluation techniques on different user interfaces.

UNIT III  COMMUNICATION MODELS  9

Suggested Activities:
- Flipped classroom on basic knowledge of various models used in HCI design.
- External learning – Design and implementation of various models used in HCI design.

Suggested Evaluation Methods:
- Tutorial – Task models.
- Assignment on dialog models and task models.

UNIT IV  EXPERIMENTAL DESIGN AND STATISTICAL ANALYSIS OF HCI  9

Suggested Activities:
- Flipped classroom on basic concepts of probability and statistics.
- External learning – Practical problems related to hypothesis testing.

Suggested Evaluation Methods:
- Tutorial – Statistical testing related to UI evaluation parameters.
- Assignment on problems on hypothesis testing for UI parameters.
UNIT V  DIALOGUE AND CURRENT TRENDS

Dialogue Notations and Design – Dialogue Need – Dialogue Design Notations – Graphical –
Based systems – Groupware – Applications – Ubiquitous Computing – Applications – HCI
for Smart Environment – HCI for Scientific Applications, Medical Applications – HCI for
Assistive Technology.

Suggested Activities:
• Flipped classroom on basic concepts of dialogue notations and design.
• External learning – Study of how Virtual Reality interface are used in various real-
time applications.

Suggested Evaluation Methods:
• Tutorial – Recent trends in human computer interface systems.
• Assignment on dialogue notation representation for various interfaces.

PRACTICAL EXERCISES:
1. Study of UI Development Tools like scratch, React, Adobe XD, Flash, Wix, Bootstrap
   and Angular js.
2. Study of user interfaces of common applications like Facebook, UberEats, Twitter,
   IRCTC, Anna university Sems, Amazon etc. Prepare a comparative Design
document.
3. Design and development of simple user interface for an E-commerce website.
4. Design and development of the user interface of a university Web portal.
5. Design and development of movie ticket booking interface for Physically Challenged
   people. Prepare design document for the following interfaces which should include
   the design process, design methodology and the design rules used in the
   development of the UI application. The document should also justify the chosen
   methodology for the given application. Using an evaluation technique, evaluate the
   way in which user experiences with your proposed design would be satisfiable to the
   end user.
7. Implementation of user interfaces for video streaming application which caters to the
   need of older people.
8. Design and development of mobile application interfaces for chat bots.
9. Design and development of novel user interfaces for any wearable device.
10. Design and develop an interface for geographical information system.

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Interpret the contributions of human factors and technical constraints on human-
   computer interaction.
2. Evaluate the role of current HCI theories in the design of software.
3. Design and develop interfaces related to real applications.
4. Apply exploratory and experimental research methods in HCI.
5. Familiarize with principles and guidelines of user centered interface design process,
   evaluation methodologies and tools to analyze the interfaces.
6. Implement human computer interfaces for different applications using various tools
   and technologies.
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IF5083 PATTERN RECOGNITION

OBJECTIVES:

- To provide basic knowledge about the fundamentals of pattern recognition and its application.
- To understand about unsupervised algorithms suitable for pattern classification.
- To familiarize with the feature selection algorithms and method of implementing them in applications.
- To learn about the basis of algorithm used for training and testing the dataset.
- To learn basic fuzzy system and neural network architectures, for applications in pattern recognition, image processing, and computer vision.

UNIT I PATTERN CLASSIFIER


Suggested Activities:

- Discussion on pattern recognition application like image classification.
- Installation of Matlab.
- Assignment on numerical problem solving on Naive Bayesian classifier.
Suggested Evaluation Methods:
- Quizzes on importance of classifier in recognizing various patterns.
- Practical – Programming assignments on implementation of Bayes theorem.

UNIT II CLUSTERING
Clustering Concept – Hierarchical Clustering Procedures – Partitional Clustering – Clustering of Large Data Sets – EM Algorithm – Grid Based Clustering– Density Based Clustering.

Suggested Activities:
- Assignments on numerical problem solving using hierarchical Clustering in Matlab.
- Assignments on numerical problem solving using EM Algorithm in Matlab.

Suggested Evaluation Methods:
- Quizzes on various clustering methods in pattern recognition.
- Practical – Programming assignments on the working of clustering algorithms on various applications.

UNIT III FEATURE EXTRACTION AND SELECTION
Entropy Minimization – Karhunenloeve Transformation – Feature Selection through Functions Approximation – Binary Feature Selection – K-NN.

Suggested Activities:
- Assignment on numerical problem solving using K-NN algorithm.
- Assignment on numerical problem solving using Decision Tree algorithm.

Suggested Evaluation Methods:
- Quizzes on various feature selection methods.
- Practical – Programming assignments on various feature extraction algorithms for various applications.

UNIT IV HIDDEN MARKOV MODELS AND SUPPORT VECTOR MACHINE

Suggested Activities:
- Assignments on numerical problem solving using HMM algorithm in Matlab.
- Assignments on numerical problem solving using SVM classifier in Matlab.

Suggested Evaluation Methods:
- Quizzes on various Markov models.
- Practical – Programming assignments on working of SVM and HMM over real world application.

UNIT V RECENT ADVANCES
Fuzzy Classification: Fuzzy Set Theory, Fuzzy and Crisp Classification, Fuzzy Clustering, Fuzzy Pattern Recognition– Introduction to Neural Networks: Elementary Neural Network for Pattern Recognition, Hebbnet, Perceptron, ADALINE, and Back Propagation.

Suggested Activities:
- Numerical problem solving on simple neuron in Matlab.
- Numerical problem solving on custom neural networks in Matlab.
**Suggested Evaluation Methods:**
- Quizzes on various fuzzy classification methods.
- Practical – Programming assignments on neural network for pattern recognition applications.

**PRACTICAL EXERCISE:**
1. Implementation of Image classification using Hebbnet method in Matlab.
3. Implementation of Fuzzy pattern recognition in Matlab/OpenCV.
4. Implementation of Feature extraction using KL transform Matlab/OpenCV.
5. Implementation of Clustering using partitional based clustering in Matlab/OpenCV.
6. Implementation of Clustering using density based clustering in Matlab/OpenCV.
7. Implementation of Classification using SVM in Matlab/OpenCV.
8. Implementation of Classification using HMM in Matlab/OpenCV.
9. Implementation of Classification using Bayes in Matlab/OpenCV.
10. Implementation of Neural Network methods using OpenCV.

**TOTAL: 75 PERIODS**

**OUTCOMES:**
On completion of the course, the students will be able to:
1. Implement basic pattern classifier algorithms.
2. Have knowledge about the working principle of unsupervised algorithm
3. Have knowledge about functionality of classifiers
4. Perceive the recent advancement in pattern recognition
5. Apply SVM and HMM algorithms for real time applications.
6. Implement advanced methodologies over image processing applications.

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OBJECTIVES:
- To learn the fundamentals of autonomous driving.
- To study the different ways of sensing internal states of Autonomous Ground Vehicles (AGVs).
- To learn the environment perception for autonomous driving.
- To explore the navigation techniques of AGVs.
- To learn the fundamentals of vehicle control systems and connected vehicles.

UNIT I  INTRODUCTION TO AUTONOMOUS DRIVING


Suggested Activities:
- Flipped classroom on autonomous driving system architecture.
- External learning – Building blocks of typical Unmanned Aerial Vehicles.
- Flipped classroom on robot operating system.
- External learning – Applications of autonomous vehicles (aerial, under water, ground vehicles).
- Assignment on the design requirement specifications of autonomous vehicles (aerial, under water, ground vehicles).

Suggested Evaluation Methods:
- Viva voce on assignment topics.
- Quizzes on Advanced Driver Assistance Systems (ADAS).
- Group Discussion on Google’s self-driving car.

UNIT II  SENSORS FOR AUTONOMOUS GROUND VEHICLES


Suggested Activities:
- Flipped Classroom on sensor characteristics.
- External learning – Exploring Velodyne Lidar sensor dataset in Veloview software.

Suggested Evaluation Methods:
- Practical-Experiments on interfacing IMU sensor to Raspberry Pi board and recording the acceleration of a dummy vehicle.
- Practical-Experiments on interfacing Lidar/RADAR sensor to Raspberry Pi board and recording the distances to the nearby objects.
- Practical-Experiments on interfacing camera to Raspberry Pi board and capturing images/videos.

UNIT III  ENVIRONMENT PERCEPTION AND MODELING

Road Recognition: Basic Mean Shift Algorithm, Mean Shift Clustering, Mean Shift Segmentation, Mean Shift Tracking, Road Recognition Algorithm –Vehicle Detection and Tracking: Generating ROIs, Multi Resolution Vehicle Hypothesis, Vehicle Validation using Gabor Features and SVM, Boosted Gabor Features –Multiple Sensor Based Multiple Object Tracking.
Suggested Activities:
- Flipped classroom on Basic Mean Shift Algorithm.
- External learning – Lane detection algorithm.
- Flipped classroom on vehicle tracking.

Suggested Evaluation Methods:
- Practical – Implementation of Mean Shift Clustering / Mean Shift Segmentation Algorithm.
- Practical – Experiments on stationary obstacle detection algorithm using Lidar sensor.

UNIT IV NAVIGATION FUNDAMENTALS

Suggested Activities:
- Flipped classroom on GPS orbits/GPS Signals.
- External learning – Indian Regional Navigation Satellite System (IRNSS).
- Assignment on the working principles of Google Map.

Suggested Evaluation Methods:
- Quizzes on GNSS signal structure.
- Viva Voce on assignment topics.
- Practical – Simulation of Waypoint Navigation Algorithm.

UNIT V VEHICLE CONTROL AND CONNECTED VEHICLE
Vehicle Control: Cruise Control, Anti-lock Brake Systems, Steering Control and Lane Following, Parking – Connected Vehicles: Vehicle to Vehicle Communication, Vehicle to Infrastructure Communication.

Suggested Activities:
- Flipped classroom on cruise control.
- External learning – Study on proportional integral derivative (PID) control.
- Assignment – Communication protocols for connected vehicles.

Suggested Evaluation Methods:
- Viva Voce on assignment topic.
- Practical – Experiment on simple velocity control.
- Practical – Experiment on simple longitudinal motion control.

PRACTICAL EXERCISES:
1. Write a python program to read Lidar sensor data and write it in a text file.
2. Write an Arduino sketch to operate DC motors through motor driver.
3. Write a python program on Raspberry Pi board to control the movement of pan-tilt platform with 5v dc motors.
4. Write a python program to read the IMU sensor values through I2C bus in Raspberry Pi board.
5. Develop an Arduino application to drive a simple rover with four wheels in a random path.
6. Write a python program to send the location of a rover with GPS to Firebase real-time database.
7. Develop a Lidar sensor assisted application to implement 2D collision cone based obstacle avoidance for rovers.
8. Develop an application using python program to control the pan-tilt motion of a camera and to take pictures/videos in the field of view of the camera.
10. Develop a convolutional neural network model to detect road lanes in videos.
11. Mini Project.

OUTCOMES:
On completion of the course, the students will be able to:
1. Identify the requirements and design challenges of AGVs.
2. Select suitable sensors to sense the internal state and external world of AGVs.
3. Implement lane detection, road detection & vehicle detection algorithms.
4. Simulate/implement ground vehicle navigation algorithms.
5. Simulate/implement ground vehicle control systems.
6. Design communication protocols for connected vehicles.

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IF5002 OPEN SOURCE TECHNOLOGIES

OBJECTIVES:
- To introduce the essence of free software.
- To understand the basic shell commands needed for running applications in Linux.
- To learn the working of server side web applications using Flask.
- To understand the back-end framework of NoSql databases with connection to Python.
- To provide an exposure to open hardware.
UNIT I INTRODUCTION

Suggested Activities:
- Flipped classroom on free software varieties, GPL.
- Programming small pieces of fresh snippets.
- Complete the program from the given starter code.

Suggested Evaluation Methods:
- Quizzes on various distributions of Linux.
- Programming assignments on shell commands and LAMP.

UNIT II PYTHON PROGRAMMING

Suggested Activities:
- Flipped classroom on overview of Python
- In-class activity – Programming small pieces of fresh snippets.
- In-class activity – Complete the program from the given starter code.

Suggested Evaluation Methods:
- Quizzes on conditionals and string manipulation.
- Programming assignments on functions.
- Assignment on finding the total number of commits in Git.

UNIT III WEB DEVELOPMENT WITH PYTHON

Suggested Activities:
- Flipped classroom on basic HTML coding techniques.
- Practical – Programming small pieces of fresh snippets.
- Complete the program from the given starter code.

Suggested Evaluation Methods:
- Quizzes on bootstrap method.
- Programming assignments on Flask.

UNIT IV WORKING WITH DATABASES

Suggested Activities:
- Flipped classroom on working with relational databases.
- Programming small pieces of fresh snippets.
- Complete the program from the given starter code.

Suggested Evaluation Methods:
- Quizzes on NoSQL.
- Programming assignments on MongoDB.
- Total number of commits in Git.
UNIT V OPEN HARDWARE

Raspberry Pi – Arduino – Installation of Portable OS – Building Web Applications with Raspberry Pi and Arduino

Suggested Activities:
- Flipped classroom on overview of available portable devices
- Programming small pieces of fresh snippets.
- Practical – Complete the program from the given starter code.

Suggested Evaluation Methods:
- Quizzes on different components of the unit.
- Programming assignments on web application.

PRACTICAL EXERCISES:
1. Use of Linux shell commands.
2. Programming a simple application such as a calendar using Python.
3. Working with git commands.
4. Working with dynamic websites using HTML.
5. Working with HTML – bootstrap strategies.
6. Installation of Flask and creating websites with Flask.
7. Design a website with Flask – HTML – Bootstrap.
8. Installation and working with Mongodb.
9. Creation of website with Flask+Mongodb+HTML.
10. Installation of Linux OS in open hardware.

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Use shell commands for executing programs and applications.
2. Use Git for collaboration and maintaining different versions.
3. Develop a web application using Flask framework.
4. Work with NoSQL structures.
5. Develop a server side web application using Python.
6. Explore the features of open hardware.

REFERENCES:
OBJECTIVES:
- To understand the basics of GPU architectures.
- To write programs for massively parallel processors using CUDA/OpenCL.
- To understand the issues in mapping algorithms for GPUs.
- To understand different GPU programming models.
- To analyze performance of algorithms on GPUs.

UNIT I  GPU ARCHITECTURE

Suggested Activities:
- Assignment on surveying machines in the lab and identifying the configuration of the GPUs in them.
- Practical – Download the CUDA toolkit and setup the CUDA environment.
- Practical – Write simple CUDA code and vary the parameters to understand the concept of threads, blocks and grids.

Suggested Evaluation Methods:
- Evaluation of the assignment by checking the configuration.
- Demonstrate the CUDA setup by running simple and sample programs.

UNIT II  CUDA PROGRAMMING
CUDA Basics – Multi GPU – Multi GPU Solutions – Optimizing CUDA Applications: Problem Decomposition, Memory Considerations, Transfers, Thread Usage, Resource Contentions.
Suggested Activities:
- Code walkthrough of sample CUDA programs.
- Practical – Execute sample CUDA programs with different memory options.

Suggested Evaluation Methods:
- Evaluation of the practical by checking the trace of the CUDA programs.
- Evaluation of the practical by checking the output corresponding to different memory options.

UNIT III PROGRAMMING ISSUES

Suggested Activities:
- Code walkthrough of sample CUDA programs with synchronization within thread blocks and across thread blocks.
- Practical – Write CUDA programs with and without pitched memory and compare.

Suggested Evaluation Methods:
- Quiz on synchronization options.
- Evaluation of the practical.

UNIT IV OPENCL BASICS

Suggested Activities:
- Code walkthrough of sample OpenCL programs.
- Practical – Execute sample OpenCL programs with different memory options.

Suggested Evaluation Methods:
- Evaluation of the practical by checking the trace of the OpenCL programs.
- Evaluation of the practical by checking the output corresponding to different memory options.

UNIT V ALGORITHMS ON GPU
Parallel Patterns: Convolution, Prefix Sum, Sparse Matrix – Matrix Multiplication – Programming Heterogeneous Cluster.

Suggested Activities:
- Assignment on studying and analyzing programs in CUDA/OpenCL to perform graph traversal, tree traversal.
- Assignment on studying and analyzing sample programs for matrix multiplication and analyzing their performance.

Suggested Evaluation Methods:
- Check the output of the CUDA/OpenCL programs.
- Check Performance chart.

PRACTICAL EXERCISES: 30
1. Implement matrix multiplication using CUDA. Experiment with different matrix sizes and kernel launch options and compare the performance. (4 hours)
2. Implement vector reduction using CUDA, and check output with CUDA profiler.
3. Implement matrix multiplication with tiling and shared memory.
4. Implement various performance tuning techniques for matrix multiplication.
5. Implement matrix multiplication using OpenCL.
6. Implement vector reduction using OpenCL.
7. Implement graph traversal using CUDA
8. Implement image processing algorithms using CUDA
9. Experiment with advanced features such as dynamic parallelism
10. Mini project: Choose an application and implement using GPU and do performance analysis.

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Describe GPU Architecture.
2. Write programs using CUDA, identify issues and debug them.
3. Implement efficient algorithms in GPUs for common application kernels, such as matrix multiplication.
4. Write simple programs using OpenCL.
5. Given a problem, identify efficient parallel programming patterns to solve it.
6. Compare different GPU programming paradigms.

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OBJECTIVES:
- To understand the basic principles of service orientation.
- To analyze various software architectures.
- To introduce service oriented and microservices architecture.
- To analyze and implement a web service based applications.
- To understand the technology underlying service design and microservices applications.

UNIT I SOFTWARE ENGINEERING PRACTICES

Suggested Activities:
- Sample application for each type of architecture.
- Study of popular enterprise applications.
- Cloud computing platforms comparison.
- DevOPs solution fundamentals.

Suggested Evaluation Methods:
- Quiz on various concepts.
- Simple development based on the solutions and study.

UNIT II SOA AND MICROSERVICE ARCHITECTURE BASICS

Suggested Activities:
- Applications of SOA and MSA.
- OOAD and SOAD comparison.
- Identifying simple services based on SOA and MSA.

Suggested Evaluation Methods:
- Case studies of various SOA applications.
- Application based comparison.

UNIT III WEB SERVICES

Suggested Activities:
- XML processing.
- Exploring the structure of SOAP, WSDL and UDDI.
- Creation of web services in Java/.NET/Python environment.
- RESTful web services.
- Study of middleware services for IoT.
Suggested Evaluation Methods:
- Implementing XML, DOM and SAX.
- Programming exercises.

UNIT IV SERVICE ORIENTED ANALYSIS AND DESIGN

Suggested Activities:
- Study for various service design.
- SOA best practices case studies.

Suggested Evaluation Methods:
- Quiz on service design principles.
- Practical – Programming exercises on service orchestration.

UNIT V MICROSERVICE BASED APPLICATIONS

Suggested Activities:
- Implementation of microservices architecture with python.
- Creation of container services.
- Cloud deployment.

Suggested Evaluation Methods:
- Microservice based application case study.
- Cloud deployment in different platforms.

PRACTICAL EXERCISES:
3. Creation of WSDL and SOAP Request and Response and exploring UDDI.
4. Developing RESTful web services in Java / Python framework, deploy and consume in different environment using Web Service Interoperable Technology (WSIT).
5. Developing RESTful web services in .NET framework, deploy and consume in different environment using Web Service Interoperable Technology (WSIT).
7. Composing web services using BPEL workflow engine.
8. Creation of an application following Micro Service Architecture (MSA) using HTTP (and REST) and Remote Procedure Call (RPC) over Advanced Message Queuing Protocol (AMQP) in Python environment with Flask-Nameko framework.
9. Creation of an application following Micro Service Architecture (MSA) using Microservices frameworks for Java (Spring Boot, Jersey, Swagger)
10. Mini project.
Requirements:
OUTCOMES:
On completion of the course, the students will be able to:
1. Analyze and design SOA based solutions.
2. Understand the basic principles of service orientation.
3. Analyze and implement a web service based applications.
4. Understand the technology underlying service design.
5. Implement SOA with Microservices applications.
6. Classify and make reasonable decision on the adoption of different SOA platforms.

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IF5004 CRYPTOGRAPHY AND INFORMATION SECURITY

OBJECTIVES:
- To understand the mathematics behind Cryptography.
- To understand the standard algorithms used to provide confidentiality, Integrity and authenticity.
- To understand Cryptographic theories and Systems.
- To get a working knowledge of layer wise security in order to build secure systems.
- To understand necessary approaches and techniques to build protection mechanisms in order to secure computer networks.
UNIT I  INTRODUCTION TO SECURITY AND MATHEMATICAL FOUNDATIONS


Suggested Activities:
- In-class activity – Cryptanalysis of classical cryptography.
- In-class activity – Solve some examples related to number theory and the theorem.
- Demonstration on Cryptool.

Suggested Evaluation Methods:
- Assignment problems on first three activities.
- Quiz on external learning.
- Group discussion on tool demonstration.

UNIT II  SYMMETRIC CRYPTOGRAPHY


Suggested Activities:
- External learning – Attacks on DES and AES and Cryptanalysis.
- Practical – Study of a various attacks related to symmetric key encryption.

Suggested Evaluation Methods:
- Assignment on problems on cryptographic algorithms.
- Quiz on DES and AES attacks.

UNIT III  ASYMMETRIC KEY CRYPTOGRAPHY


Suggested Activities:
- External learning – Familiarizing with public and private key in asymmetric cryptography.
- Practical – Verify the message integrity using hashing techniques.

Suggested Evaluation Methods:
- Tutorial – ECC.
- Quiz on various hashing and authentication techniques.

UNIT IV  NETWORK SECURITY

Suggested Activities:
- Understand the components of x.509 certificate.
- Demonstration of email security.
- Practical – Experiment with SSL in web server.
- External learning – Understanding how the existing firewalls work and their usages.

Suggested Evaluation Methods:
- Group discussion on demonstration.
- Quiz on layer-wise security protocols.

UNIT V  SYSTEM SECURITY

Suggested Activities:
- External learning – Designing trusted OS.
- Case study – Applications that use Blockchain technology.

Suggested Evaluation Methods:
- Group Discussion – various applications that use Block chain technology.
- Group discussion – The need for Ethical Hacking.

PRACTICAL EXERCISES:
1. Write a program to perform encryption and decryption using the following algorithms.
   a. Caesar cipher, Affine Cipher.
   b. Hill Cipher, Playfair Cipher.
   c. Transposition Cipher.
2. Perform Cryptographic attack on the ciphertext generated using any of the algorithm implemented in exercise 1.
3. Implementation of symmetric cryptographic algorithms such as DES, AES, etc.
4. Implementation of RSA algorithm and demonstration of the key generation and encryption process.
5. Generation of Keys between two end parties using Diffie Hellman Key Exchange.
6. Write a program to generate message digest for the given message using the SHA/MD5 algorithm and verify the integrity of message.
7. Write a program to sign and verify a document using DSA algorithm.
8. Perform Penetration testing on a web application to gather information about the system, then initiate XSS and SQL injection attacks using tools in kali Linux.
9. Hands–on with Software and Hardware firewall configuration and intrusion detection using SNORT
10. Configuring and utilizing network protection components like VPNs, anti–virus software, anti–spyware, etc.

TOTAL: 75 PERIODS
OUTCOMES:
On completion of the course, the students will be able to:
1. Understand the fundamentals of network security, security architecture, threats and vulnerabilities.
2. Apply the different cryptographic operations of symmetric cryptographic algorithms.
3. Apply the different cryptographic operations of public key cryptography.
4. Apply the various Authentication schemes to simulate different applications.
5. Understand various Security practices and System security standards
6. Know the state of art technologies like Ethical Hacking, Block chain etc.

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IF5005 SOFTWARE QUALITY ASSURANCE AND TESTING L T P C 3 0 2 4

OBJECTIVES:
- To give a clear picture on quality management, documentation and controlling for software quality.
- To provide knowledge on standards, models and tools used for quality management.
- To perform measurement and assessment of software quality.
- To introduce the basics and necessity of Software testing.
- To introduce various testing techniques along with software production.

UNIT I INTRODUCTION TO SOFTWARE QUALITY & ARCHITECTURE 9
Suggested Activities:
- External learning – Software Quality models.
- Preparation of Report on Quality plans.

Suggested Evaluation Methods:
- Assignment – Quality models and Quality Plans.

UNIT II  SQA COMPONENTS AND PROJECT LIFE CYCLE

Suggested Activities:
- Discussion Forum – Software Quality Assurance Components.
- External learning – Quality assurance tools.

Suggested Evaluation Methods:
- Quiz – Software Quality Assurance Components.
- Assignment – Quality assurance tools.

UNIT III  SOFTWARE QUALITY INFRASTRUCTURE

Suggested Activities:
- Discussion forum – Configuration management audit.
- Discussion forum – Documentation control.

Suggested Evaluation Methods:
- Assignment – Configuration management audit report.
- Quiz – Documentation control.

UNIT IV  SOFTWARE QUALITY MANAGEMENT, METRICS & STANDARDS

Suggested Activities:
- Discussion – ISO Quality standards.
- External learning – Software Quality metrics.

Suggested Evaluation Methods:
- Assignment – ISO Quality standards.
- Quiz – Process and Product metrics.
UNIT V  SOFTWARE TESTING

Definition and objectives – Software testing strategies – Software test classifications – White box testing: Data processing, Calculation correctness tests, McCabe’s cyclomatic complexity metrics, Software qualification and reusability testing, Advantages and disadvantages of white box testing – Black box testing: Equivalence classes for output correctness tests, Revision factor testing classes, Transition factor testing classes, Advantages and disadvantages of black box testing– Implementation: The testing process – Test case design – Automated testing – Alpha and beta site testing programs.

Suggested Activities:
- Discussion on Test case generation and testing methods.

Suggested Evaluation Methods:
- Assignment on Test case generation tools.
- Quiz on testing procedures.

PRACTICAL EXERCISES:
2. Generation of Quality Assessment report of Plan documents.
5. Quality Assessment of Configuration management documents.
7. Automatic Test case generation for Black box testing.
8. Automatic Test case generation for White box testing.
9. Automation of Black box testing.
10. Automation of White box testing.

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Learn document, control and manage software quality with the aid of tools and standards.
2. Distinguish various software quality models.
3. Measure and assess Software Quality through process and product metrics.
4. Distinguish the Software quality standards.
5. Perform automated testing using test tools.
6. Document the testing procedures.

REFERENCES:
OBJECTIVES:
- To learn fuzzy logic, fuzzification and defuzzification.
- To design a soft computing system required to address a computational task.
- To learn and apply artificial neural networks, fuzzy sets and fuzzy logic, and genetic algorithms in problem solving and use of heuristics based on human experience.
- To introduce the ideas of fuzzy sets, fuzzy logic To become familiar with neural networks that can learn from available examples and generalize to form appropriate rules for inferencing systems.
- To familiarize with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations.

UNIT I Fuzzy Computing 9

Suggested Activities:
- Practical – Install MatLab Fuzzy Logic toolbox and ANN toolbox to design and simulate systems.

Suggested Evaluation Methods:
- Quiz on basic concepts of fuzzy logic and operations.

UNIT II Fundamentals of Neural Networks 9
Suggested Activities:
- Practical – Develop a supervised model to train neural net that uses the AND/OR/XOR two input binary/bipolar input and output data and learn linear models to understand the importance of initialization parameters.

Suggested Evaluation Methods:
- Evaluation of the practical implementation with appropriate input set.

UNIT III COMPETETIVE NEURAL NETWORKS

Suggested Activities:
- Practical – Develop an unsupervised model to train neural net that uses any dataset and plot the cluster of patterns.

Suggested Evaluation Methods:
- Evaluation of the practical implementation with appropriate input set.

UNIT IV GENETIC ALGORITHM

Suggested Activities:
- Practical – Implement GA for the Travelling Salesman problem to find the shortest path that visits all cities in a set exactly once.

Suggested Evaluation Methods:
- Implementation evaluation by testing the code on different route maps and checking the optimal solution.

UNIT V HYBRID SYSTEMS

Suggested Activities:
- Practical – Develop adaptive neuro-fuzzy hybrid technique to train NAND gate with two binary and targets and observe the training performance.

Suggested Evaluation Methods:
- Group discussion on developing a hybrid system for solving a problem.
- Evaluation of the practical implementation.

PRACTICAL EXERCISES:
Implement the following exercises using any programming language:
1. Develop an application that fraud detection systems from data using fuzzy logic.
2. Develop a system to implement Neural Networks techniques to define predictive models for fraud detection.
3. Develop a system that can optimize the solution of the fraud detection system developed by fuzzy logic.
4. Implement Pareto-based approaches to solve MOOPs.
5. Develop a hybrid system by integrating neural networks, fuzzy logic and genetic algorithms for any real time application.

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Identify and describe soft computing techniques and their roles in building intelligent machines.
2. Recognize the feasibility of applying a soft computing methodology for a particular problem.
3. Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
4. Apply genetic algorithms to optimization problems.
5. Design neural networks to pattern classification and regression problems using soft computing approach.
6. Describe the importance of tolerance of imprecision and uncertainty to a design of robust and low-cost intelligent machines.

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OBJECTIVES:
- To understand the concepts of machine learning.
- To appreciate supervised and unsupervised learning and their applications.
- To understand the theoretical and practical aspects of Probabilistic Graphical Models.
- To appreciate the concepts and algorithms of reinforcement learning.
- To learn aspects of computational learning theory.

UNIT I  INTRODUCTION

Suggested Activities:
- Install python and explore the packages required for machine learning including numpy, scikit-learn, and matplotlib, IPython, hmmptk and pgmpy.

Suggested Evaluation Methods:
- Quiz on different applications of machine learning.

UNIT II  SUPERVISED LEARNING I

Suggested Activities:
- Practical – Collection of data from different resources and summarize the data.
- Practical – Build linear, multi-linear, logistic Regression model to predict the data.

Suggested Evaluation Methods:
- Evaluation of the practical implementations using the test set.
- Group discussion on basics of classification and regression.

UNIT III  SUPERVISED LEARNING II

Suggested Activities:
- Practical – Develop SVM model for a two class problem, whose training points are distributed in a 2D plane and improve the performance of the model by applying kernel methods.
- Practical – Implement bagging approach for credit card analysis.

Suggested Evaluation Methods:
- Tutorial – Kernel methods.
- Evaluation of the practical implementations using appropriate test set.
- Group discussion on back propagation.
UNIT IV UNSUPERVISED LEARNING


Suggested Activities:
- Implement k means algorithm to cluster the traffic data set based on accident type.

Suggested Evaluation Methods:
- Tutorial on model selection and validation.
- Evaluation of the practical implementation using appropriate test set.

UNIT V PROBABILISTIC GRAPHICAL MODELS


Suggested Activities:
- Assignment on solving numerical problem using HMM.

Suggested Evaluation Methods:
- Group discussion on graphical models.

PRACTICAL EXERCISES:

Implement the following exercise using python libraries on UCI Machine Learning Repository.
1. Develop an application that makes predictions from data using Linear Regression.
2. Develop an application that makes predictions from data using Logistic Regression.
3. Develop a system to implement classifier using SVM / Neural Networks.
4. Develop a system that can automatically group articles by similarity using K–Means Clustering & PCA.
5. Develop a system that can extract the word from the given sentences using Hidden Markov model.

OUTCOMES:

On completion of the course, the students will be able to:
1. Implement a neural network for an application of your choice using an available tool.
2. Implement probabilistic discriminative and generative algorithms for an application of your choice and analyze the results.
3. Use a tool to implement typical clustering algorithms for different types of applications.
4. Design and implement an HMM for a sequence model type of application.
5. Implement a PGM for any real time application using an open source tool.
6. Identify applications suitable for different types of machine learning with suitable justification.

REFERENCES:
OBJECTIVES:
- To learn the fundamentals of semantic web and to conceptualize and depict Ontology for semantic web.
- To understand the languages for semantic web.
- To learn about the ontology learning algorithms and to utilize in the development of an application.
- To know the fundamental concepts of ontology management.
- To learn the applications related to semantic web.

UNIT I
THE QUEST FOR SEMANTICS

Suggested Activities:
- Flipped classroom on semantic web background and tutorial activity in class.
- Brainstorming session on various knowledge representation formats in class.

Suggested Evaluation Methods:
- Tutorial – Semantic web basics.
- Quizzes on knowledge representation formats.
UNIT II  LANGUAGES FOR SEMANTIC WEB AND ONTOLOGIES


Suggested Activities:
- Flipped classroom on comparison of various semantic web related languages and tutorial activity in class.

Suggested Evaluation Methods:
- Quizzes on various ontology related languages.

UNIT III  ONTOLOGY LEARNING FOR SEMANTIC WEB


Suggested Activities:
- Flipped classroom on natural language processing techniques like statistical text analysis, term extraction, Word sense disambiguation, concept extraction and tutorial activity in class.
- External reading – https://nlp.stanford.edu/fsnlp/

Suggested Evaluation Methods
- Tutorials – Language processing techniques.

UNIT IV  ONTOLOGY MANAGEMENT AND TOOLS


Suggested Activities:
- Flipped classroom on study of various ontology related tools.

Suggested Evaluation Methods
- Tutorials – Ontology related tools like Protege, Ontolingua, Webonto.

UNIT V  APPLICATIONS


Suggested Activities:
- Flipped classroom on other applications of semantic web.

Suggested Evaluation Methods
- Quizzes on semantic web applications.

PRACTICAL EXERCISES:
1. Design of simple ontology on their domain of interest using Protege like tool.
2. Create RDF document using PHP library EasyRdf.
3. Use OWL language to represent relationships, properties and to provide inferences from created ontology.
4. Term extraction and Term disambiguation from corpus using Alchemy like API.
5. Use of any tool to apply SAPRQL queries and implement reasoning for avoiding inconsistencies.
7. Development of Simple application like chat bot, semantic search engine creation using Topic map data models extracted from Ontopia/Mappa.
8. Creating intelligent expert systems using semantic Wikis like SMW+

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Create ontology for a given domain.
2. Develop an application using ontology languages and tools.
3. Understand the concepts of semantic Web.
4. Use ontology related tools and technologies for application creation.
5. Design and develop applications using semantic web.
6. Understand the standards related to semantic web.

REFERENCES:
OBJECTIVES:
- To understand the basic issues and needs of text mining.
- To appreciate the different aspects of text categorization and clustering.
- To understand the role played by text mining in Information retrieval and extraction.
- To appreciate the use of probabilistic models and its principles applicable in text mining.
- To appreciate the current trends in text mining on various systems.

UNIT I  INTRODUCTION  8

Suggested Activities:
- Develop a web application for search engine.
- Tokenize the given text information using any parser.
- Practical – Implement all the preprocessing steps needed for text mining.

Suggested Evaluation Methods:
- Practical assessment may be conducted in laboratory environment to implement any preprocessing steps.

UNIT II  TEXT CATEGORIZATION AND CLUSTERING  10

Suggested Activities:
- Role playing to be carried out for groups of students for the understanding of the working principles of clustering and classification.

Suggested Evaluation Methods:
- Assignment on analyzing the performance of different clustering and classification algorithms and showing the best performance of each algorithm for any specific application.

UNIT III  TEXT MINING FOR INFORMATION RETRIEVAL AND INFORMATION EXTRACTION  10
Suggested Activities:
- In class activity – Name entity and relation extraction using role play game.
- In class activity – Show the working principle of searching technique.

Suggested Evaluation Methods:
- Assignment on developing Flash or animated presentation for explaining the working principles of any one algorithm for information retrieval and extraction.

UNIT IV PROBABILISTIC MODELS 9

Suggested Activities:
- In-class activity – Document clustering and Information Extraction.
- External learning – Markov models and entropy models.

Suggested Evaluation Methods:
- Tutorials – Topic modeling to show its behavior on different data types.

UNIT V RECENT TRENDS 8

Suggested Activities:
- In-class activity – Visualization Approaches.
- External learning – Understanding text mining applications and case studies.

Suggested Evaluation Methods:
- Assignment on extracting the sentiment expressed in the given sentence using opinion word.
- Tutorials – Methodologies available to detect the spam in opinion mining.

PRACTICAL EXERCISES: 30
1. Study Natural Language toolkit (NLTK) and explore the features within that.
2. Study experiment for implement simple text processing operations like character count, word count, stop word removal, etc.,
3. Write a Java program for parsing and tokenizing the given text using NLTK.
4. Write a Java program to implement the named entity recognition and part of speech tagging.
5. Write a Java program to extract the specific pattern for gene – gene and protein – protein interaction information
6. Install RapidMiner and Vega tools and explore the features.
7. Classify any given data set using two classification algorithms using RapidMiner.
8. Clustering the given data set using two clustering algorithms using RapidMiner.
10. Clustering the given data set using two clustering algorithms using Vega Tool.

TOTAL: 75 PERIODS
OUTCOMES:
On completion of the course, the students will be able to:
1. Identify the different features that can be mined from text and web documents.
2. Use available open source classification and clustering tools on some standard text data sets.
3. Modify existing classification/clustering algorithms in terms of functionality or features used.
4. Design a system that uses text mining to improve the functions of an existing open source search engine.
5. Implement a text mining system that can be used for an application of your choice.
6. Use the opinion mining concepts to extract the sentiment from the large database.

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IF5009 E-LEARNING TECHNIQUES

OBJECTIVES:
- To learn the various E-learning approaches and Components.
- To understand the key elements of Design Thinking.
- To explore the models for E-learning courseware development.
- To learn about E-learning Authoring tools.
- To Know about Evaluation and management of E-learning solutions.

UNIT I INTRODUCTION
Suggested Activities:
- External learning – E-learning approaches and Components.
- Discussion on design thinking.

Suggested Evaluation Methods:
- Assignment – E-learning approaches and Components.
- Quiz on design thinking.

UNIT II DESIGNING E-LEARNING COURSE CONTENT


Suggested Activities:
- Discussion – Design models.
- External learning – E-learning instructional methods.

Suggested Evaluation Methods:
- Assignment on design models of e-learning.
- Quiz on e-learning instructional methods.

UNIT III CREATING INTERACTIVE CONTENT


Suggested Activities:
- Discussion – Creation of story boards.
- External learning – Types of authoring tools.

Suggested Evaluation Methods:
- Assignment – Story Boards creation.
- Quiz – Authoring tools.

UNIT IV LEARNING PLATFORMS


Suggested Activities:
- Discussion – LMS categories for E-learning.
- External learning – Functional areas e-learning.

Suggested Evaluation Methods:
- Assignment on proprietary and open source LMS.
- Quiz on LMS solutions.

UNIT V COURSE DELIVERY AND EVALUATION

Components of an Instructor Led or Facilitated Course – Planning and Documenting Activities – Facilitating Learners Activities – E-learning Methods and Delivery Formats – Using Communication Tools for E-learning – Course Evaluation
Suggested Activities:
- Discussion – Planning and Documentation.
- External learning – Evaluation and delivery methods.

Suggested Evaluation Methods:
- Assignment on planning and documentation.
- Quiz on evaluation and delivery methods.

PRACTICAL EXERCISES:
1. Creation of Users and Schedule users Vs Courses in Moodle.
2. Preparation and Organization of Course Contents in Moodle.
3. Aligning the course objectives, Assessments and evaluation methods of Courseware in Moodle.
4. Courseware Content generation with various instructional formats.
5. Adding communication tools in Moodle for effective collaboration.
6. Creation of instructor led courses in Moodle.
7. Creation of self-learning courses in Moodle.
8. Implementation of various Evaluation strategies of Courseware in Moodle.
9. Implementation of various delivery strategies in Moodle.
10. Assessing the Quality of Multimedia Courseware in Moodle.

TOTAL: 75 PERIODS

OUTCOMES:
On completion of course, the students will be able to:
1. Distinguish the phases of activities in models of E-learning.
2. Identify appropriate instructional methods and delivery strategies.
3. Choose appropriate E-learning Authoring tools.
5. Evaluate the E-learning courseware.
6. Manage the E-learning courseware.

REFERENCES:
IF5010  DATA WAREHOUSING AND DATA MINING  L T P C
3 0 2 4

OBJECTIVES:

- To get exposed to the concepts of Data warehousing Architecture and Implementation.
- To analyze the mining techniques for realistic data, and also to conceptualize Data Mining and the need for pre-processing.
- To characterize the kinds of patterns that can be discovered by association rule mining.
- To implement classification and clustering techniques on large datasets.
- To identify Business applications and Trends of Data mining.

UNIT I  DATA WAREHOUSE


Suggested Activities:

- Practical – Data warehouse modeling using a real time scenario.
- Assignment on describing the similarities and the differences of the multidimensional models, and analyzing their respective advantages and disadvantages.
- Practical – Implementing various OLAP operations on a multidimensional data.
- Practical – Execute multi-dimensional data model using SQL queries.
- Discussion on the advantages of indexing structures.

Suggested Evaluation Methods:

- Tutorials – Case study on OLAP schema level representation and OLAP operations.
- Assignment on OLAP operation and schema level representation.
- Tutorials – Building a data warehouse using open source tools.

UNIT II  DATA MINING & DATA PREPROCESSING


Suggested Activities:

- Discussion on Knowledge Discovery Database.
- Assignments on numerical problems on smoothing, normalization and attribute subset selection.
- Assignments on evaluation of attribute relevance analysis on a real time application data warehouse.
- Assignments on evaluation of information gain of an attribute in a real time database.

Suggested Evaluation Methods:

- Tutorial – Data cleaning.
- Assignment on data integration and transformation.
- Assignment on data reduction and data discretization.
- Quizzes on data pre-processing.
UNIT III   ASSOCIATION RULE MINING

Introduction – Data Mining Functionalities – Association Rule Mining – Mining Frequent Itemsets with and without Candidate Generation – Mining Various Kinds of Association Rules – Constraint – Based Association Mining.

Suggested Activities:
- Discussion and problem solving of different association rule mining algorithms (Apriori algorithms and FP-Growth algorithms).
- Practical – Implementation of association rule mining using data mining tools such as Weka.
- Practical – Comparing the performance of each algorithm with various kinds of large data sets.

Suggested Evaluation Methods:
- Quizzes on Apriori and FP-Growth algorithms.
- Tutorials – Different real time applications of association rule mining.

UNIT IV   CLASSIFICATION & PREDICTION

Classification versus Prediction – Data preparation for Classification and Prediction – Classification by Decision Tree Introduction – Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction – Accuracy and Error Measures – Evaluating the Accuracy of a Classifier or Predictor – Ensemble Methods – Model Section.

Suggested Activities:
- Discussion on tree pruning.
- Assignment on calculation of the computational complexities and accuracy of the classification algorithms.
- Discussion on different real-time applications of classification and evaluating the accuracy of a classifier.
- Assignment on solving classification algorithms.
- Assignment on Comparativel study on different classification algorithms.

Suggested Evaluation Methods:
- Quizzes on decision tree classification methods.
- Tutorial – Bayesian classification methods.
- Assignment on support vector machines.

UNIT V   CLUSTERING


Suggested Activities:
- Comparative study on the various clustering algorithms.
- Discussion on real time applications of outlier analysis.
- Practical – Implementation of clustering algorithms using data mining tools.
- Practical – Design and implement a clustering method that finds clusters in large data cubes effectively and efficiently.
- Assignment on comparative study of clustering algorithms in terms of the following criteria: shapes of clusters that can be determined, input parameters that must be specified and limitations.
• Assignment on categorizing kinds of constraints that can be imposed on the clusters produced and analyzing how to perform clustering efficiently under such kinds of constraints.
• Practical – Develop an application where the border between normal objects and outliers is often unclear, so that the degree to which an object is an outlier has to be well estimated.

Suggested Evaluation Methods:
• Quizzes on partitioning methods.
• Tutorial – Outlier analysis.
• Assignment on density-based, grid-based and model-based clustering methods.

PRACTICAL EXERCISES:

1. Design and implement multi-dimensional data models namely Star, Snowflake and Fact Constellation schemas for any one enterprise (ex. Banking, Insurance, Finance, Healthcare, manufacturing, Automobiles, sales etc) using open source tools like Pentaho Data Integration Tool, Pentaho Business Analytics; or other data warehouse tools like Microsoft-SSIS, Informatica, Business Objects, etc.
2. Install and explore the explorer, experimenter, knowledge flow and simple CLI features of Weka.
3. Create new .arff files and try loading the same in weka tool. Try importing sample data sets from the following data sources using Weka: File, Database, and Websource.
4. Open IRIS data set and explore the various descriptive data metrics available in Weka. Try different data sets and compare the descriptive metrics.
5. Explore various options in Weka for preprocessing data and apply (like Discretization Filters, Resample filter, etc.) on each dataset.
6. Load retail dataset into Weka and run Aprior algorithm with different support and confidence values. Study the rules generated. Apply different discretization filters on numerical attributes and run the Aprior association rule algorithm. Study the rules generated. Derive interesting insights and observe the effect of discretization in the rule generation process.
7. Load IRIS dataset into Weka and run ID3, J48 classification algorithm, study the classifier output. Compute entropy values, Kappa statistic. Extract if-then rules from decision tree generated by classifier, observe the confusion matrix and derive Accuracy, F-measure, TP rate, FP rate, Precision and recall values. Apply cross-validation strategy with various fold levels and compare the accuracy results.
8. Load the IRIS each dataset into Weka and perform Naïve-bayes classification and k-Nearest Neighbor classification, Interpret the results obtained. Compare classification results of ID3, J48, Naïve-Bayes and k-NN classifiers for each dataset, and reduce which classifier is performing best and poor for each dataset and justify.
9. Load each dataset into Weka and run simple k-means clustering algorithm with different values of k (number of desired clusters). Study the clusters formed. Observe the sum of squared errors and centroids, and derive insights. Explore visualization features of weka to visualize the clusters.
10. Load any weather dataset into Weka and build Linear Regression model. Study the cluster formed. Use training set option. Interpret the regression model and derive patterns and conclusions from the regression results.
11. Use options cross-validation and percentage split and repeat running the Linear Regression Model. Observe the results and derive meaningful results.
12. Try few of the above exercises using Orange Canvas Tool.

TOTAL: 75 PERIODS
OUTCOMES:
On completion of the course, the students will be able to:
1. Design, create and maintain data warehouses.
2. Understand large data sets and data preprocessing.
3. Characterize the kinds of patterns that can be discovered by association rule mining.
4. Evaluate various mining techniques on complex data.
5. Discover the knowledge imbibed in the high dimensional system.
6. Evolve multidimensional intelligent model from typical system.

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IF5011 BIOINFORMATICS L T P C
3 0 2 4

OBJECTIVES:
- To get exposed to Bioinformatics Technologies.
- To solve various problems in biologicalsciences- sequence analysis.
- To solve various problems in gene expression analysis, biomedicalimage analysis.
- To solve various problems in metabolic pathway analysis.
- To be familiar with working of bioinformatics models in MatLab.
UNIT I  INTRODUCTION

Suggested Activities:
- Exploring about Biological Data Integration System.

Suggested Evaluation Methods:
- Quizzes on need of bioinformatics for real world scenario.
- Practical – Programming assignments on methods used for integrating biological data.

UNIT II  BIOINFORMATICS TOOL BOX
Sequence Analysis – NGS – Graph Theory – Gene Ontology – Importing Data and Deploying.

Suggested Activities:
- Analyzing biomedical data using data mining tool in MatLab.

Suggested Evaluation Methods:
- Quizzes on various bioinformatics tools and its usage.
- Practical – Programming assignments on methods to analyze bio data using any one data mining tool.

UNIT III  BIOLOGICAL DATA ANALYSIS
Microarray Data Analysis – Mass Spectrometry Data Analysis – Statistical Classification of Biological Data.

Suggested Activities:
- Flipped classroom on statistical classification of biological data.

Suggested Evaluation Methods:
- Quizzes on various data analysis methods.
- Practical – Programming assignments on various classification methods.

UNIT IV  IMAGE PROCESSING

Suggested Activities:
- Extract the key features for biological image in MatLab.
- Implementing Spatial Transformations for image in MatLab.

Suggested Evaluation Methods:
- Quizzes on transformations used in bio-images.
- Practical – Programming assignments on applying various image processing methods on a simple bio application.
UNIT V SYSTEMS BIOLOGY


Suggested Activities
- Implementing sensitivity analysis for biology data in MatLab.

Suggested Evaluation Methods
- Quizzes on system biology.
- Practical – Programming assignments on analyzing sensitivity metrics for bio data.

PRACTICAL EXERCISES:

1. MATLAB basic commands.
2. Sequence analysis tools including functions for pairwise, MSA and phylogenetic tree construction.
3. Microarray data import from GEO and affymetrix and expression analysis and normalization.
4. Microarray image analysis.
5. Gene expression data analysis from gene ontology.
6. Mass spectrometry data import and base line correction and normalization.
7. Model creation and simulation using simbiology.
8. Node knock out of model generated in simbiology using graph theory.
10. Pharmacokinetic population fitting.

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Develop models for Biological Data.
2. Implement image processing Techniques to Bioinformatics Data.
3. Implement Micro Array analysis over Genome Expression.
4. Understand the study of simbiology.
5. Understand the pharmacokinetic modeling.
6. Understand the working model of biological data in Matlab.

REFERENCES:
OBJECTIVES:
- To learn about Automata theory and Regular Expressions.
- To learn the concepts in the design of compilers.
- To learn about the runtime store organization.
- To know the data structures used to implement symbol tables.
- To be familiar with garbage collection.

UNIT I INTRODUCTION TO AUTOMATA THEORY AND REGULAR EXPRESSIONS

Suggested Activities:
- Flipped classroom on Finite Automata and Regular Expressions.
- External learning -
  - Automata, basics of finite automata, NFA, DFA.
  - Finite state machines – regular expressions.
- Installation of Ubuntu and study of lexical analysis tools and generators.

Suggested Evaluation Methods:
- Tutorial – NFA to DFA conversion.
- Assignment on DFA state reduction, construction of automata.
- Quizzes on Regular Expressions.
- Assignment on numerical problems in regular expressions.
- Assignment on numerical problems in conversion of NFA to DFA.

UNIT II LEXICAL ANALYSIS
Suggested Activities:
- Flipped classroom:
  - Compilers and interpreters.
  - The compilation process and the anatomy of a compiler.
  - Bootstrapping.
- External learning – The role of the lexical analyzer, Finite state machines and Regular expressions.
- Assignment on numerical problems in State reduction.

Suggested Evaluation Methods:
- Tutorial – Lexical Analysis.
- Assignment on Lex construction of regular grammars,
- Quizzes on compiler stages,

UNIT III  SYNTAX ANALYSIS  9

Suggested Activities:
- Flipped classroom:
  - Languages.
  - Writing grammars for programming languages.
  - Transformations on grammars.
- External learning – Parser generators and writing grammars for programming language constructs.
- Assignment on numeric problems in parser construction.

Suggested Evaluation Methods:
- Tutorial – LR, SLR Parsers.
- Assignment problems on Yacc parser construction.
- Quizzes on parsing concepts.

UNIT IV  INTERMEDIATE CODE GENERATION  9

Suggested Activities:
- Flipped classroom on attributes grammars.
- External learning – Type checking, intermediate code and abstract machines.
- Assignment on numerical problems in syntax directed translation.

Suggested Evaluation Methods:
- Tutorial – Syntax directed translations.
- Assignment problems on intermediate code generation.
- Quizzes on type checking.
UNIT V        CODE GENERATION AND OPTIMIZATION


Suggested Activities:
- Flipped classroom on target machine.
- External learning –
  - Code generation.
  - Elementary optimizations. Basic blocks.
  - Dataflow analysis.
- Assignment on numerical problems in code generation.

Suggested Evaluation Methods:
- Tutorial – Code generation.
- Assignment problems in optimization.
- Quizzes on optimization concepts.

PRACTICAL EXERCISES: 30
1. Implement and perform Lexical analysis of a sample text file consisting of some random texts.
2. Write a C program for a simple calculator.
3. Implementation of Lexers using FLEXfor the above simple calculator.
5. Use Parser of YACC and check out the output of simple calculator.
6. Implementation of Semantic Analyzers using YACC.
7. Write a C program for a symbol table and integrate it with YACC.
8. Perform semantic analysis including static checking, intermediate representations and attribute grammars.
10. Implement a simple code optimization routine.

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Understand the concept of lexical analysis and construction of deterministic and non-deterministic automata.
2. Understand the concept of parsing and construction of parser.
3. Study the concept of intermediate code generation techniques.
4. Study the programming language design, target machine design and run time environment of compilers.
5. Study the compiler construction tools.
6. Obtain knowledge to construct a prototype compiler for a subset of a programming language.

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IF5088 MOBILE APPLICATION DEVELOPMENT L T P C
3 0 2 4

OBJECTIVES:
- To understand the need and characteristics of mobile applications.
- To design the right user interface for mobile application.
- To understand the design issues in the development of mobile applications.
- To understand the development procedures for mobile application.
- To develop mobile applications using various tools and platforms.

UNIT I INTRODUCTION

Suggested Activities:
- Flipped classroom on survey on mobile application models.
- External learning - mobile application design using frameworks and tools.

Suggested Evaluation Methods:
- Quiz - questionnaire related to mobile application models.
- Assignment - evaluate using learning content management system like Moodle.

UNIT II USER INTERFACE
Generic UI development – Designing the right UI – Multimodal and Multichannel UI – Gesture based UI – Screen Elements and Layouts – Voice XML.

Suggested Activities:
- Flipped classroom on discussion on UI for mobile application like voice and gestures.
- External learning - survey on different view elements for mobile application.
Suggested Evaluation Methods:
- Quiz - questionnaire related to user interface design for mobile applications.
- Assignment - evaluate using learning content management system like Moodle.

UNIT III APPLICATION DESIGN 9

Suggested Activities:
- Flipped classroom on discussion on memory constraints for mobile application design.
- External learning - survey on resource management and concurrent operations.

Suggested Evaluation Methods:
- Quiz - questionnaire related to memory constraints in design for mobile applications.
- Assignment - evaluate using learning content management system like Moodle.

UNIT IV APPLICATION DEVELOPMENT I 9

Suggested Activities:
- Simple Android application development like user account creation.
- Android application accessing the mobile database to view user data.

Suggested Evaluation Methods:
- Evaluation based on the demonstrated application functionality using emulators.

UNIT V APPLICATION DEVELOPMENT II 9

Suggested Activities:
- Application accessing Internet for communication like web application.
- Android application accessing GPS for location based service.

Suggested Evaluation Methods:
- Evaluation based on the demonstrated application functionality using emulators.

PRACTICAL EXERCISES: 30
1. Develop an application that uses GUI components, Font and Colours.
2. Develop an application that uses Layout Managers and event listeners.
3. Develop a native calculator application.
4. Write an application that draws basic graphical primitives on the screen.
5. Develop an application that makes use of database.
6. Write an application that makes use of internet for communication (mobile web app).
7. Develop a native application that uses GPS location information.
8. Implement an application that writes data to the SD card.
9. Implement an application that creates an alert upon receiving a message.
10. Write a mobile application that creates alarm clock.

TOTAL: 75 PERIODS
OUTCOMES:
On completion of the course, the students will be able to:
1. Design the right user interface for mobile application.
2. Implement mobile application using UI toolkits and frameworks.
3. Design a mobile application that is aware of the resource constraints of mobile devices.
4. Develop web based mobile application that accesses internet and location data.
5. Implement android application to use telephony for SMS communication.
6. Implement android application with multimedia support.

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IF5013 CYBER FORENSICS L T P C 3 0 2 4

OBJECTIVES:
- To provide an understanding Computer forensics fundamentals.
- To analyze various computer forensics technologies.
- To identify methods for data recovery.
- To apply the methods for preservation of digital evidence.
- To learn about the types of attacks and remedial actions in the context of systems, networks, images and video.

UNIT I INCIDENT AND INCIDENT RESPONSE 9
Suggested Activities:
- Survey of forensics tools such as WinHex, EnCase, FTK, or ProDiscover.
- External learning - Demonstrate some of the mechanisms used by malicious attackers as well as forensic experts to disrupt computer networks and manipulate information access.

Suggested Evaluation Methods:
- Demonstration on forensic tools
- Assignment on solving with sample cyber crime reports.

UNIT II  FILE STORAGE AND DATA RECOVERY  

Suggested Activities:
- Flipped classroom and activity.
- External learning - Tools for data storage and access, bypassing filtered [blocked] ports, reviewing Internet activity, open source forensic tools for file storage and data recovery will be introduced.

Suggested Evaluation Methods:
- Total quantity of files recovered from the disk for reconstruction.
- Quiz on forensic analysis of file system.

UNIT III  NETWORK AND EMAIL FORENSICS  

Suggested Activities:
- External learning - Familiarizing with Port Redirection tools: Quick ‘n Easy FTP Server, FPIPE and FPORT.
- Practical - Study of the forensics tools.

Suggested Evaluation Methods:
- Demonstration of Port Redirection tools.
- Practical - Assessment of real-time problems like email analysis for tracing.

UNIT IV  SYSTEM FORENSICS  

Suggested Activities:
- Demonstration of MD5Hash tool.
- Practical - IE Activity analysis.

Suggested Evaluation Methods:
- Assignment on live windows and Linux investigation
- Quiz on ethical hacking.
UNIT V  IMAGE AND VIDEO FORENSICS


Suggested Activities:
- External learning - Steganography.
- Practical – Install and use Steganalysis tool.

Suggested Evaluation Methods:
- Assignment on forgery detection in images.
- Quiz on locating and recovering graphics files.

PRACTICAL EXERCISES:
1. Demonstrate some of the mechanisms used by malicious attackers as well as forensic experts to disrupt computer networks and manipulate information access.
2. Demonstrate FTK Imager to access data’s evidence. It is used to quickly preview and create a forensically sound image of the disk if the preview warrants such action.
3. Demonstrate how data can be modified within a file or hidden on a disk without the data being saved as a file.
   b. MD5Hash (Freeware download from www.digitaldetective.co.uk/freetools/md5.asp).
   c. Text editor (Notepad is good enough).
4. Demonstrate how an attacker could exploit a machine and obtain access to a server with a filtered port by piping another unfiltered port.
   b. FPIPE (Freeware download from http://www.foundstone.com)
   c. FPORT (Freeware download from www.digitaldetective.co.uk/freetools/md5.asp).
5. Show how the encrypted Internet Explorer cache may be viewed using some freely available tools.
6. Demonstrate the typical use of steganography.
7. Demonstrate mobile forensics with software:
   a. BitPim.
   b. Mobile Phone Examiner (MPE+).
8. Trace an Email.
   a. eMailTrackerPro.

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Recognize attacks on systems.
2. Design a counter attack incident response and incident-response methodology.
3. Illustrate the methods for data recovery, evidence collection and data seizure.
4. Understand network and email attacks and forensic investigation with tools.
5. Use Forensic tools and collect evidences of a computer crime.
6. Analyze various image encryption/decryption, steganography and fraud in image.
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IF5014  BIOMETRICS  L T P C  3 0 2 4

OBJECTIVES:
- To understand the basic ideas and principles in biometrics.
- To understand the basic concepts of statistical data analysis for validating the biometrics projects.
- To familiarize the student with the image processing facilities in Matlab and its equivalent open source tools like OpenCV.
- To appreciate the use of biometrics industrial applications and to understand the role of biometrics in modern security environment.
- To understand the role of multi-biometrics.

UNIT I  BIOMETRICSFUNDAMENTALS  9

Suggested Activities:
- Flipped classroom on applications of biometrics.
- External learning - Practical problems in accuracy computations.
- Numerical Problems in Biometrics accuracy computations.

Suggested Evaluation Methods:
- Tutorial - Performance measures.
- Assignment problems on computation of error and performance measures
- Quizzes on biometrics applications.
UNIT II FINGERPRINT AND FACIAL SCAN
Finger Scan – Features – Components – Operation Steps – Competing Finger Scan
Technologies Strength and Weakness – Types of Algorithms Used for Interpretation. Facial
Scan – Features Components – Operation Steps – Competing Facial Scan Technologies –
Strength – Weakness.

Suggested Activities:
- Flipped classroom on applications of fingerprint and face biometrics applications.
- External learning - Physiological biometrics.

Suggested Evaluation Methods:
- Assignment problems in fingerprint scan.
- Quizzes on fingerprint and face biometrics.

UNIT III ADDITIONAL PHYSIOLOGICAL BIOMETRICS
Retina Biometrics – Iris Scan – Features – Components – Competing Iris Scan
Technologies – Strength and Weakness – Vein Pattern of Palm – Basics of Hand Geometry
– Sign Language.

Suggested Activities:
- Discussion of iris identification in Matlab.
- Discussion of sound production mechanisms.
- External learning - Practical problems on iris localization and Indian Sign Language.

Suggested Evaluation Methods:
- Tutorial - Iris scan.
- Assignment problems on performance measures of iris scan.
- Quizzes on physiological measures.

UNIT IV BEHAVIOR BIOMETRICS
Behavior Biometrics – Signature Scan – Keystrokes – Multimodality and Combining
Biometrics for Improving Performance – Voice Scan-Features – Components – Operation
Steps–Competing Voice Scan Technologies–Strength and Weakness.

Suggested Activities:
- Discussion of hand scan in Matlab.
- Discussion of multimodal biometrics.
- External learning - Practical problems on signature and keystroke biometrics in
  OpenCV.

Suggested Evaluation Methods:
- Tutorial - Keystroke metrics.
- Assignment problems on performance measures of behavior metrics
- Quizzes on behavior biometrics.

UNIT V BIOMETRICS APPLICATION DEVELOPMENT
Biometrics – Standard Development Organizations – Information Security and Biometric
Standards – BioAPI Consortium - Privacy Issues – Comparing Privacy Factor of Different

Suggested Activities:
- Discussion of biometric standards.
- External learning - Practical issues of privacy and confidentiality.
- External Learning - Biometric standards.
Suggested Evaluation Methods:
- Tutorial - Information security.
- Assignment problems in privacy in biometric systems.
- Quizzes on biometrics standards.

PRACTICAL EXERCISES:
1. Reading and writing of a biometric image like fingerprint or face.
2. Image Enhancement of biometric image by removing blur and noise.
3. Implementation of finger localization in OpenCV.
4. Implementation of face localizations in OpenCV.
5. Implementation of simple fingerprint and face identification.
6. Extraction of IRIS features in Matlab/OpenCV.
7. Implementation of voice acquisition in Matlab.
8. Implementation of fusion of biometrics in Matlab/OpenCV.
10. Develop an authentication system using keyboard strokes in Matlab/Octave.
11. Mini project.

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Implement basic biometrics related algorithms.
2. Familiar with the types of Physiological and Behavioral Biometrics.
3. Design and implement an industrial application that incorporates different concepts of biometrics.
4. Critically analyze different approaches of Biometrics to implement mini projects in industrial environment and in security related projects.
5. Know the Biometric standards.
6. Know the Biometrics Application development.

REFERENCES:
OBJECTIVES:
- To decompose a blockchain system’s fundamental components, how they fit together and examine a decentralization using blockchain.
- To explain how Cryptocurrency works, from when a transaction is created to when it is considered part of the blockchain.
- To explain the components of Ethereum and Programming Languages for Ethereum.
- To study the basics Hyperledger and Web3.
- To provide a details of alternative blockchain and blockchain projects in different perspective.

UNIT I INTRODUCTION TO BLOCKCHAIN

Suggested Activities:
- External learning - programming to create your own blockchain.
- Flipped classroom on studying blockchain security issues.

Suggested Evaluation Methods:
- Practical assessment to be conducted to evaluate the program for creating blockchain.

UNIT II INTRODUCTION TO CRYPTOCURRENCY

Suggested Activities:
- External learning - creating the Wallets.
- Flipped classroom on showing the tracking process of transaction in Cryptocurrency.

Suggested Evaluation Methods:
- Assignment to be given on Cryptocurrency failures.

UNIT III ETHEREUM

Suggested Activities:
- External learning - For exploring Ethereum tools like Ganache and GO.
- Implement Ethereum development environment.

Suggested Evaluation Methods:
- Practical assessment on developing smart contract on private Blockchain.
UNIT IV   WEB3 AND HYPERLEDGER


Suggested Activities:
- Creating and deploying a business network on Hyperledger Composer Playground.
- Implementing Business Network in Blockchain using HyperLedger Fabric.

Suggested Evaluation Methods:
- Practical assessment on developing business network on Hyperledger Fabric.

UNIT V    ALTERNATIVE BLOCK CHAINS AND NEXT EMERGING TRENDS


Suggested Activities:
- External learning - blockchain using Multichain.
- Study about blockchain frameworks and business applications.

Suggested Evaluation Methods:
- Practical assessment on developing blockchain using Multichain for banking system.

PRACTICAL EXERCISES:

1. Construct the simple blockchain based application to store and retrieve the cryptocurrencies.
2. Create the wallet to send the digital currencies from one account to another account.
4. Develop the environment for Ethereum by using Ganache.
5. Create the nodes on Ethereum blockchain and mine the blockchain.
6. Learn Solidity programming language and develop simple Ethereum based applications.
7. Build the decentralized app and deploy it to provide Ethereum environment.
8. Build a simple application using hyperledger in blockchain environment.
9. Design a smart contract and test it in a Ethereum environment.
10. Develop a block chain based applications which is suitable for your online shopping services.

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Understand the technology components of Blockchain and how it works behind-the-scenes.
2. Aware of different approaches to developing decentralized applications.
3. Understand the Bitcoin and its limitations by comparing with other alternative coins.
4. Establish deep understanding of the Ethereum model, its consensus model, code execution.
5. Understand the architectural components of a Hyperledger and its development framework.
6. Come to know the Alternative blockchains and emerging trends in blockchain.
REFERENCES:

IF5016 MULTIMEDIA TECHNOLOGIES L T P C 3 0 2 4

OBJECTIVES:
- To enrich student learning in Multimedia systems.
- To train the students to acquire knowledge in multimedia related technologies.
- To acquire knowledge about multimedia techniques to enhance quality of service.
- To acquire knowledge in the development of multimedia systems.
- To learn about the multimedia elements in a comprehensive way.

UNIT I INTRODUCTION TO MULTIMEDIA ELEMENTS 9

Suggested Activities:
- Flipped classroom on multimedia primitives.

Suggested Evaluation Methods:
- Quizzes on properties of multimedia system.

UNIT II MULTIMEDIA COMPRESSION 9

Suggested Activities:
- Flipped classroom on compression of different techniques.

Suggested Evaluation Methods:
- Assignment hybrid coding.
- Quizzes on different JPEG activities.
UNIT III MULTIMEDIA ARCHITECTURES 9

Suggested Activities:
- Flipped classroom on concepts of Multimedia hardware architectures.
- External learning - Digital Repositories.

Suggested Evaluation Methods:
- Tutorial - Digital copyrights.
- Quizzes on different architectures.

UNIT IV MULTIMEDIA OPERATING SYSTEM AND DATABASES 9

Suggested Activities:
- Flipped classroom on multimedia database and indexing structures.
- External learning - Data structures for storing multimedia data.

Suggested Evaluation Methods:
- Demonstration of EL.
- Quizzes on device and memory management.

UNIT V MULTIMEDIA COMMUNICATION & APPLICATIONS 9

Suggested Activities:
- External learning - Mixed reality.

Suggested Evaluation Methods:
- Quizzes on virtual reality and augmented reality.

PRACTICAL EXERCISES: 30
1. Creating and editing various fonts and adding special effects to text using tools like Fontographer, Blender, Photoshop and flash
2. Editing various images (Image restoration, Changing colour image to Grey scale and vice versa) and adding special effects to images using tools like Photoshop, Gimp and flash
3. Creating and Editing various video clippings and adding special effects using tools like Adobe Premier Pro
4. Creating and Editing various audio files and adding special effects using tools like SoundForge and Audacity
5. Creating three dimensional models and animations using tools like Blender, 3DS Max, Unity
6. Working on Text compression algorithms like Run length and Huffman
7. Implementation of transformations like DCT and FFT
8. Designing User Interfaces and developing simple games using multimedia elements
9. Creating simple multimedia applications using Authoring tools like Flash, Macromedia Director.
10. Mini Project(4 Periods)

TOTAL: 75 PERIODS
OUTCOMES:
On completion of the course, the students will be able to:
1. Handle the multimedia elements effectively.
2. Encode and decode the multimedia elements.
3. Understand the underlying multimedia computing architectures used for media development.
4. Develop effective strategies to deliver Quality-of-Experience in Multimedia applications.
5. Design and implement algorithms and techniques related to multimedia objects.
6. Design and develop multimedia applications in various domains.

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UNIT I  DISTRIBUTED DATABASES

Suggested Activities:
- Practical - Design of distributed database with fragmentation using any DBMS.
- Flipped classroom on distributed transaction protocols.
- Practical - Writing distributed queries and optimizing the queries.

Suggested Evaluation Methods:
- Evaluation of practical implementation.
- Quizzes on distributed transaction protocols.
- Tutorial - Distributed queries and optimization.

UNIT II  NOSQL DATABASES

Suggested Activities:
- Practical - Exploring MongoDB using JAVA/Python/Ruby/PHP.
- Practical - Perform database operations using MongoDB/Cassandra/HYPE.
- Practical - Scenario based query development for database applications.

Suggested Evaluation Methods:
- Evaluation of the database operations.
- Tutorial - Scenarios to analyze the need for DB in various applications.
- Quizzes on MongoDB basics.

UNIT III  ADVANCED DATABASE SYSTEMS

Suggested Activities:
- Individual/group activities for application specific data handling.
- Discussion about advantages and drawbacks of transaction models for different applications involving spatial-temporal data.

Suggested Evaluation Methods:
- Assignment on application specific data handling.
- Quizzes on different transaction models.

UNIT IV  XML AND DATAWAREHOUSE
UNIT V      INFORMATION RETRIEVAL AND WEB SEARCH


Suggested Activities:
- Flipped classroom on basics of IR concepts.
- Practical - Evaluation measures of IR.

Suggested Evaluation Methods:
- Quizzes on basic IR concepts.
- Demonstration for practical learning.

PRACTICAL EXERCISES: 30
1. Create a distributed database using horizontal and vertical fragmentation in any DBMS.
2. Creation of distributed queries using the fragmented data created.
3. Create a document based database using mongodb and manipulate the data.
4. Create a data warehouse and perform OLAP operations in an unstructured data environment.
5. Create a database to store multimedia elements and perform data retrieval operations.
6. Create a temporal database and explore the usage of temporal queries in it.
8. Given an XML document, traverse the document using DOM and SAX parser.
9. Design a web crawler to extract the information from the websites containing product reviews and classify the reviews as either positive or negative.
10. Create an information retrieval system which processes the corpus of documents and create TF/IDF for the keywords extracted from the documents. Create an inverted index to enable an efficient retrieval process.

OUTCOMES:
On completion of the course, the students will be able to:
1. Design a distributed database system and execute distributed queries.
2. Use NoSQL database systems and manipulate the data associated with it.
3. Have knowledge on advanced database system concepts.
4. Design a data warehouse system and apply OLAP operations.
5. Design XML database systems and validating with XML schema.
6. Have knowledge on information retrieval concepts and apply it in web databases.
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IF5018 LINKED OPEN DATA L T P C
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OBJECTIVES:
- To understand the computational aspects of creation, storage & retrieval of Linked Open Data (LOD).
- To learn about Web of Data.
- To understand knowledge representation languages like RDF and OWL.
- To learn about querying using SPARQL.
- To understand the publishing & consumption of LOD in WWW.

UNIT I INTRODUCTION TO LINKED OPEN DATA 9
Introduction to Linked Data (LD) and the Semantic Web – Linked Data Structure for Sophisticated Processing – Introducing Big Lynx Productions – Principles of Linked Data – URLs, RDF Data Model, RDF Serialisation, Relationship Links, Identity Links, Vocabulary Links.

Suggested Activities:
- Study on various RDF literals with examples.
- Browsing for various linked open data on the web.
- Sample scenarios and RDF construction.
Suggested Evaluation Methods:
- Assignments on RDF literals and open data.
- Quiz on all topics of the Unit.

UNIT II  WEB OF DATA  9

Suggested Activities:
- Data collection using tools.
- Use tools to understand properties of collected data.
- Create simple applications using open data.

Suggested Evaluation Methods:
- Group assignments on application creation.
- Quiz on different types of Web of Data.

UNIT III  ONTOLOGICAL LANGUAGES  9

Suggested Activities:
- Study of ontology development tools.
- Case studies on real time domain specific ontology.
- Simple ontology creation using open source (Protégé and OntoStudio) tool.

Suggested Evaluation Methods:
- Group assignment on Ontology design and creation.
- Open book quiz on ontology DPLA and BIBO.

UNIT IV  INTRODUCTION TO SPARQL  9
Introduction – Querying with SPARQL: Submitting a Query – Types of Query: ASK, SELECT, CONSTRUCT, DESCRIBE – Unary and Binary Operators – Updating Linked Data with SPARQL: Adding, Deleting Data from Graph, Loading and Clearing a Graph, Other Graph Management Operations – SPARQL Protocol – Reasoning using RDFS and OWL.

Suggested Activities:
- Exercises on basics of SPARQL like data type, query types, etc.
- Solving exercises on graph data and querying.
- Exercises on SPARQL operators.

Suggested Evaluation Methods:
- Quiz on SPARQL queries.
- Assignment on case studies and equivalent SPARQL queries.
UNIT V  PUBLISHING & CONSUMING LINKED OPEN DATA


Suggested Activities:
- Survey exercise on real RDF/XML files.
- Case studies on Linked Data Applications.
- Student Presentation on applications.

Suggested Evaluation Methods:
- Quiz on all topics in Unit V.
- Assignments on Linked open data applications.

PRACTICAL EXERCISES:
1. Download any RDF schema on tourism and explore various tags in the schema. To visualise, open them using a Word Editor. Highlight the subject, predicate and object in each file. If necessary use the RDF validator service by W3C to obtain the triplets.
2. Convert any RDF into graph.
3. Handling RDF in java: Set up Jena in Eclipse. Then create and manipulate RDF graphs for domains like tourism, festivals, living thing, etc.
4. Download and install any open source RDF/Ontology editing tool like protégé, Onto Studio, etc. Try the following in that tool:
   a. Load existing RDF schema and visualize.
   b. Add, modify and delete RDF.
5. Do the following using W3C RDF Validator:
   a. Enter a URI or paste an RDF/XML document and parse the RDF.
   b. Visualize the RDF/XML as Triples and/or Graph.
6. Formulate natural language queries as SPARQL 1.0 queries and execute them against the DBpedia SPARQL endpoint (http://dbpedia.org/isparql).
7. Interpret the SPARQL queries executed in DBpedia SPARQL endpoint in natural language.
8. Create a simple RDFS forward-chaining inference engine with the following requirements:
   a. Use Jena to store and load triples.
   b. Use SPARQL queries to infer all new triples.
9. Open the pizza ontology in Protégé. Run Protégé on a linux computer with the command protege. The pizza ontology is found in the bookmarks in the “Open OWL ontology from URI” menu. Browse the class hierarchy, the property hierarchies and the individuals and note how the ontology describes the domain of pizzas.
   a. Find hasIngredient. What is the domain and range of this property? What are the subproperties of hasIngredient? What is the inverse property of hasIngredient? What property characteristics does hasIngredient have?.
   b. Find Margherita and see how it is defined as a pizza with only cheese and tomato topping. Look at the definition of VegetarianPizza. Is a Margherita pizza a vegetarian pizza? Why why not?.
10. Mini projects on developing simple applications Serving RDF and HTML with Custom Server Side Scripts and serving Linked Data from Relational Databases.

TOTAL: 75 PERIODS
OUTCOMES:
On completion of the course, the students will be able to:
1. Design methodologies for publishing & consuming LOD.
2. Construct RDF for domain specific data using tools.
3. Use SPARQL to query LOD.
4. Infer and reason from Domain specific RDF data.
5. Create and deploy simple applications using web open data.
6. Design algorithms for handling LOD using large scale machine learning.

REFERENCES:
UNIT I VIDEO FUNDAMENTALS

Suggested Activities:
- In-class activity - Numerical problems on sampling and standard conversions.
- Flipped classroom on description about video features.

Suggested Evaluation Methods:
- Assignments on sampling and standard conversions.
- Quiz on video features.

UNIT II MOTION ESTIMATION AND VIDEO SEGMENTATION
Fundamentals of Motion Estimation – Optical flow – 2D and 3D Motion Estimation – Block based point correspondences – Gradient Based Intensity Matching – Feature Matching – Frequency Domain Motion Estimation – Video Segmentation.

Suggested Activities:
- In-class activity - Numerical problems on motion estimation.
- External learning - Survey on optical flow techniques.

Suggested Evaluation Methods:
- Online quiz on optical flow techniques.
- Assignments on numerical problems in motion estimation.

UNIT III FUNDAMENTAL DATA ANALYSIS

Suggested Activities:
- In-class activity - Graphical presentation of data for visualization.
- Flipped classroom on description about analytic processes and tools.

Suggested Evaluation Methods:
- Assignments on data visualization.
- Quiz on questionnaires on analytic tools.

UNIT IV MINING DATA STREAMS AND VIDEO ANALYTICS

Suggested Activities:
- Flipped classroom on discussion on streaming data.
- External learning - Survey on video based content retrieval.

Suggested Evaluation Methods:
- Quiz on questionnaires on data streams.
- Assignments on video based content retrieval.
UNIT V EMERGING TRENDS

Suggested Activities:
- External learning - Survey on Affective Video Content Analysis.
- Flipped classroom on discussion on forensic video analysis.

Suggested Evaluation Methods:
- Assignments on affective video content analysis.
- Quiz on questionnaires on forensic video analysis.

PRACTICAL EXERCISES:
1. Choose appropriate features for video segmentation for given sample video.
2. Compute two dimension motion estimation using block based match technique.
3. Calculate the motion estimation based on Frequency domain.
4. Compare the video features extracted from a given video dataset using graphical representation.
5. Compute the number of distinct elements found in the given sample data stream.
6. Detect shot boundary for given sample video.
7. Parse the given sample video for indexing and faster retrieval.
8. Generate an automatic video trailer for given sample video.
9. Design simple application using video inpainting technique.
10. Mini project for video categorization based on content analysis.

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Compute basic video processing functions.
2. Segment video based on its features.
3. Compute optical flow and motion estimation.
4. Visualize data using graphical presentation for analysis.
5. Index and retrieve videos for faster access.
6. Design applications for video analytics in current trend.

REFERENCES:
OBJECTIVES:
- To impart the fundamental aspects and principles of mixed reality technologies.
- To know the internals of the hardware and software components involved in the development of mixed reality enabled applications.
- To learn about the graphical processing units and their architectures.
- To gain knowledge about mixed reality application development.
- To know the technologies involved in the development of mixed reality based applications.

UNIT I        INTRODUCTION

Suggested Activities:
- Flipped classroom on Uses of MR applications.
- Videos-Experience the virtual reality effect.
- Assignment on comparison of VR with traditional multimedia applications.

Suggested Evaluation Methods:
- Tutorial - Applications of MR.
- Quizzes on the displayed video and the special effects.

UNIT II        MR COMPUTING ARCHITECTURE
Suggested Activities:
- Flipped classroom on basic graphics pipeline.
- External learning - Different types of Graphics architectures and workstations.
- Practical - GPU programming on simple modeling and rendering.

Suggested Evaluation Methods:
- Tutorial - Graphics pipelines.
- Brainstorming session on GPU architecture.
- Quizzes on graphical architectures.
- Demonstration of GPU related simple modeling and rendering programs.

UNIT III MR MODELING
9

Suggested Activities:
- Flipped classroom on modeling three dimensional objects.
- External learning - Collision detection algorithms.
- Practical - Creating three dimensional models.

Suggested Evaluation Methods:
- Tutorial - Three dimensional modeling techniques.
- Brainstorming session on collision detection algorithms.
- Demonstration of three dimensional scene creation.

UNIT IV PROGRAMMING AND APPLICATIONS
9

Suggested Activities:
- External learning - Different types of programming toolkits and Learn different types of available VR applications.
- Practical - Create VR scenes using any toolkit and develop applications.

Suggested Evaluation Methods:
- Tutorial - VR tool comparison.
- Brainstorming session on tools and technologies used in VR.
- Evaluate the developed VR application.
- Demonstration of the created VR applications.

UNIT V MIXED REALITY TECHNOLOGIES
9
Suggested Activities:
- External learning - Different types of sensing and tracking devices for creating mixed reality environments.
- Practical - Create MR scenes using any toolkit and develop applications.

Suggested Evaluation Methods:
- Demonstration and evaluation of the developed MR application.
- Tutorial - Mobile interface design.
- Brainstorming on efficient usage of various MR technologies.

PRACTICAL EXERCISES:
1. Study of tools like Unity, Maya, 3DS MAX, AR toolkit, Vuforia and Blender.
2. Use the primitive objects and apply various projection methods by handling camera.
3. Download objects from asset store and apply various lighting and shading effects.
4. Model three dimensional objects using various modelling techniques and apply textures over them.
5. Create three dimensional realistic scenes and develop simple virtual reality enabled mobile applications which have limited interactivity.
6. Add audio and text special effects to the developed application.
7. Develop VR enabled applications using motion trackers and sensors incorporating full haptic interactivity.
8. Develop AR enabled applications with interactivity like E learning environment, Virtual walkthroughs and visualization of historic places.
10. Develop simple MR enabled gaming applications.

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Familiarize with the basic concepts of mixed reality.
2. Understand the tools and technologies related to Mixed Reality.
4. Develop the Virtual Reality applications in different domains.
5. Design of various models using modeling techniques.

REFERENCES:
1. Charles Palmer, John Williamson, “Virtual Reality Blueprints: Create Compelling VR Experiences for Mobile”, Packt Publisher, 2018
IF5087 VISUALIZATION TECHNIQUES

OBJECTIVES:
- To understand the fundamentals of data visualization.
- To know the working principles of various information visualization tools.
- To acquire knowledge about the issues in data representation.
- To visualize the complex engineering design.
- To gain skill in designing real time interactive information visualization system.

UNIT I INTRODUCTION


Suggested Activities:
- Blended Learning - Displaying Different types visualization images.
- Flipped classroom on task of representing information.
- External learning - Problems related to acquiring data.

Suggested Evaluation Methods:
- Tutorial - Different data visualizing images.
- Assignment on different data acquiring methods.
- Quizzes on issues and solutions in different visualization applications.

UNIT II DATA REPRESENTATION


Suggested Activities:
- Blended learning - Human visual and auditory system.
- Flipped classroom on color formats.
- External learning - Survey on different human computer interaction and types of user interface.
Suggested Evaluation Methods:
- Assignment on human visual and auditory system.
- Quizzes on various color format.
- Assignment on human computer interaction user interface.

UNIT III DATA PRESENTATION

Suggested Activities:
- Blended learning - Drawing charts for display.
- Flipped classroom on various presentation techniques.
- External learning - Different font and font styles, symbols and Gesture representation.

Suggested Evaluation Methods:
- Assignment on chart preparation.
- Tutorial - Various presentation techniques.
- Assignment on gesture presentation.

UNIT IV INTERACTION AND DESIGN

Suggested Activities:
- Flipped classroom on various interacting techniques.
- External learning - Interaction facilities and high level support for animation design.

Suggested Evaluation Methods:
- Tutorial - Interaction models.
- Assignment on animation design.

UNIT V CURRENT TRENDS

Suggested Activities:
- External learning - Mini project for designing and implementing a innovative interfaces.
- Flipped classroom on implementation of virtual reality environment.

Suggested Evaluation Methods:
- Demonstration of the mini project.
- Tutorial - Virtual reality application.
PRACTICAL EXERCISES:
1. Creating Interoperable Web Visualization Components using Candela tool.
2. Implementing Line and Stacked charts with Labels and Notes using Datawrapper tool.
4. Use Myheatmap tool to View Geographic Data Interactively.
5. Visualizing TSV, CSV, DSV data using Rawgraph.
8. Visualizing Complex Historical Data using Palladio tool.
10. Implementing a Real Time Application using VTK tool as mini project.

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Apply mathematics and basic science knowledge for designing information visualizing System.
2. Collect data ethically and solve engineering problem in visualizing the information.
3. Implement algorithms and techniques for interactive information visualization.
4. Conduct experiments by applying various modern visualization tool and solve the space layout problem.
5. Analyze and design system to visualize multidisciplinary multivariate Data individually or in teams.
6. Develop a cost effective and a scalable information visualization system.

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OBJECTIVES:
- To understand the basics of geometry processing.
- To understand the fundamentals of pipelined rasterization rendering of meshed objects and curved surfaces.
- To understand and work with advanced rendering methods such as radiosity.
- To design programs for advanced animation methods.
- To become proficient in graphics programming using OpenGL.

UNIT I  FUNDAMENTALS  9

Suggested Activities:
- Practical - Basic application to be implemented for vectors and matrices.
- Practical - Apply various implementations of the graphics algorithms and analyze.
- Practical - Execute some shader application and fix the warnings and errors.

Suggested Evaluation Methods:
- Quiz to check the understanding of the graphics concepts (like graphics hardware, displays and standards).
- Assessing the understanding of various basic graphics algorithms through programming assessment by using vectors and matrices.

UNIT II  TRANSFORMATIONS  9

Suggested Activities:
- Flipped classroom on rasterization.
- Practical - Execute any shader application and set viewports, windows, draw polylines and explore the keyboard and mouse interaction routines.
- Familiarize with transformations and hierarchical in OpenGL using a matrix stack.

Suggested Evaluation Methods:
- Quizzes on rasterization schemes.
- Assessing the understanding of the basic elements available in the OpenGL environment through the programming structs.
- Demonstration on transformations hierarchies using matrix stack.

UNIT III  FRACTALS  9
Suggested Activities:
- Flipped classroom on various algorithms used to generate the fractals.
- Practical - Generation of fractals using Python and Numpy
- Practical - Run any shader application and set viewports, windows, fractal rendering and explore the keyboard and mouse interaction routines.

Suggested Evaluation Methods:
- Quiz on Fractals.
- Demonstration the generation of fractals using Python and Numpy.
- Assessing the understanding of generation of fractals by changing the various parameters in the OpenGL environment through the programming structs.

UNIT IV  ADVANCED GRAPHICS  9

Suggested Activities:
- Flipped classroom on Texture Synthesis and photo realistic rendering
- Run the shader application and add the texture and shadow.
- Analyze few more shaders - Toon/Cell, Cook-Torrance, Oren-Nayar, Gradient.

Suggested Evaluation Methods:
- Quiz on advanced graphics techniques (like texture synthesis and photo realistic rendering).
- Demonstration of shader application exploring texture and shadow features.
- Discussion on bi-directional reflectance distribution function after analyzing the various shader models.

UNIT V  ANIMATION  9
Overview of Animation Techniques – Key framing, Computer Animation – Motion Capture and Editing–Forward/Inverse Kinematics– 3D Computer Animation for Applications Such as Games and Virtual Environments – Character Animation Techniques Such as Synthesizing their Body Movements – Facial Expressions and Skin Movements – Behaviors in Crowded Scenes.

Suggested Activities:
- Exploration of various animation techniques and tools (Self Study).
- Carry out small projects like Design of small animation movies using any tools with good aesthetic sense.

Suggested Evaluation Methods:
- Discussion on various animation techniques and tools.
- Projects may be evaluated base on the theme, design, creativity, tools and aesthetic sense.

PRACTICAL EXERCISE:
1. Introduction to Programming in OpenGL.
2. Write a program to draw the following points: (0.0,0.0), (20.0,0.0), (20.0,20.0), (0.0,20.0) and (10.0,25.0). For this purpose, use the GL_POINTS primitive.
3. Re-write the previous program in order to draw a house. The house consists of two figures: a square and a triangle. The first four points given above define the square, while the last three points define the triangle. For this purpose, use the GL_QUADS and GL_TRIANGLES primitives.
4. Write a program to color to primitives like cube, triangle and perform 2D rotation using OpenGL.
5. Modify the above program extending the 2D rotation to 3D with a simple 3D Orthographic Projection.
6. Write a program to roll a wheel on a horizontal line using OpenGL.
7. Draw the Koch snowflake (or some other variation of the Koch curve) using python.
8. Create a rotating cube with lighting using OpenGL.
9. Create a scene consisting of multiple spheres and cubes, apply a different texture to each object, and give a bumpy-looking appearance to each surface using normal mapping.
10. Create 10 seconds Walking animation with a rigged character using any animation tool.

OUTCOMES:
On completion of the course, the students will be able to:
1. Prepare for the emerging field of digital modelling and fabrication based on the competence gained.
2. Understand and apply 3d graphics algorithms related to transformations, illumination, texturing, etc. With the aid of software libraries.
3. Develop interactive applications using 3d graphics
4. Investigate and apply software libraries for 3d graphics and related software needs.
5. Understand the issues relevant to computer animation.
6. Describe and synthesise character animation techniques, including motion, changing their facial expressions and crowd behaviour.

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OBJECTIVES:
- To enrich student learning in fundamentals of multimedia coding and standards.
- To train the students to acquire knowledge in text coding.
- To acquire knowledge behind theory of image and video coding & decoding with standards.
- To learn principles of audio coding and standards.
- To get comprehensive learning in multimedia standard content description and formats.

UNIT I  LOSSLESS AND LOSSY CODING  9

Suggested Activities:
- Flipped classroom on text coding concepts.
- Practical - Implement basic text coding and decoding algorithm using Python.
- Case study of WinZip, RAR.

Suggested Evaluation Methods:
- Estimate complexity and coding efficiency of a given algorithm.
- Assignment on numerical problem solving in coding theory.
- Assignment on numerical problems in coding theory.

UNIT II IMAGE PROCESSING AND CODING  9

Suggested Activities:
- Flipped classroom on different image coding techniques.
- Practical - Demonstration of EXIF format for given camera.
- Practical - Implementing effects quantization, color change.
- Analyze effects of change in RGB components in a digital color image.
- Case study of Google’s WebP image format.

Suggested Evaluation Methods:
- Evaluation of the practical implementations.
- Assignment on image file formats.
- Quizzes on colour models.

UNIT III VIDEO PROCESSING AND CODING  9
Suggested Activities:
- Flipped classroom on concepts of video coding standards.
- Assignment on calculation of file size in different resolution and standards.
- Assignment on complexity estimation of different motion vector search methods.
- Assignment on measurement of video quality using tools.
- Practical - Implementation of effects quantization, Chroma sub-sampling etc.
- Case study of Google's WebM video format.
- Mini project on processing of coded video.

Suggested Evaluation Methods:
- Evaluation of the practical implementation.
- Evaluation of the mini project.
- Quizzes on MPEG standards.

UNIT IV AUDIO PROCESSING AND CODING

Suggested Activities:
- Flipped classroom on audio coding standards.
- External learning - Dolby, DTS systems in Cinema theatres.
- Assignment on numerical problems on digital audio.
- Practical - Implementation of surround sound.
- Case study of a multi-channel home theatre system.

Suggested Evaluation Methods:
- Assignment on numerical problems on digital audio.
- Real-time demonstration of surround sound.
- Quizzes on Surround audio.

UNIT V MULTIMEDIA CONTENT DESCRIPTION AND FRAMEWORK

Suggested Activities:
- Designing the structure and user interface.
- Case study of media coding used by YouTube, Netflix.
- External learning - Media streaming for TV.

Suggested Evaluation Methods:
- Responsive web design using hypermedia.
- Demonstration of media streaming through internet.
- Quizzes on multimedia frameworks.

PRACTICAL EXERCISES:
1. Implement Shannon Fano, Huffman, and adaptive Huffman coding techniques.
2. Develop and implement Dictionary based coding and decoding methods.
3. Implement Arithmetic coding and decoding algorithms.
4. Develop and implement transform coding with DCT / Wavelet based algorithm.
5. Implement color balancing and Gamma correction methods.
6. Implement different modules of JPEG algorithms.
7. Implement color processing in video.
8. Implement different modules of MPEG–1 / H.261 standards.
9. Develop tool for editing MIDI musical files.
10. Implement different modules of MP–3, AAC standards.
11. Create multimedia contents with standard multimedia content description interface and frameworks.

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Articulate the concepts and techniques used in multimedia basics and standard coding techniques.
2. Develop competence in implementing text coding.
3. Design and implement algorithms for image and video coding.
4. Choose and analyze suitable audio coding for a given multimedia application.
5. Design and develop multimedia projects with standard content formats and frameworks.

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OBJECTIVES:
- To understand the basics of business analytics and its life cycle.
- To gain knowledge about fundamental business analytics.
- To learn modeling for uncertainty and statistical inference.
- To understand analytics using Hadoop and Map Reduce frameworks.
- To acquire insight on other analytical frameworks.

UNIT I  OVERVIEW OF BUSINESS ANALYTICS

Suggested Activities:
- Case studies on applications involving business analytics.
- Converting real time decision making problems into hypothesis.
- Group discussion on entrepreneurial opportunities in Business Analytics.

Suggested Evaluation Methods:
- Assignment on business scenario and business analytical life cycle process.
- Group presentation on big data applications with societal need.
- Quiz on case studies.

UNIT II  ESSENTIALS OF BUSINESS ANALYTICS

Suggested Activities:
- Solve numerical problems on basic statistics.
- Explore chart wizard in MS Excel Case using sample real time data for data visualization.
- Use R tool for data visualization.

Suggested Evaluation Methods:
- Assignment on descriptive analytics using benchmark data.
- Quiz on data visualization for univariate, bivariate data.

UNIT III  MODELING UNCERTAINTY AND STATISTICAL INFERENCE

Suggested Activities:
- Solving numerical problems in sampling, probability, probability distributions and hypothesis testing.
- Converting real time decision making problems into hypothesis.
Suggested Evaluation Methods:
- Assignments on hypothesis testing.
- Group presentation on real time applications involving data sampling and hypothesis testing.
- Quizzes on topics like sampling and probability.

UNIT IV ANALYTICS USING HADOOP AND MAPREDUCE FRAMEWORK

Suggested Activities:
- Practical – Install and configure Hadoop.
- Practical – Use web based tools to monitor Hadoop setup.
- Practical – Design and develop MapReduce tasks for word count, searching involving text corpus etc.

Suggested Evaluation Methods:
- Evaluation of the practical implementations.
- Quizzes on topics like HDFS and extensions to MapReduce.

UNIT V OTHER DATA ANALYTICAL FRAMEWORKS
Overview of Application development Languages for Hadoop – PigLatin – Hive – Hive Query Language (HQL) – Introduction to Pentaho, JAQL – Introduction to Apache: Sqoop, Drill and Spark, Cloudera Impala – Introduction to NoSQL Databases – Hbase and MongoDB.

Suggested Activities:
- Practical – Installation of NoSQL database like MongoDB.
- Practical – Demonstration on Sharding in MongoDB.
- Practical – Install and run Pig
- Practical – Write PigLatin scripts to sort, group, join, project, and filter data.
- Design and develop algorithms to be executed in MapReduce involving numerical methods for analytics.

Suggested Evaluation Methods:
- Mini Project (Group) – Real time data collection, saving in NoSQL, implement analytical techniques using Map-Reduce Tasks and Result Projection.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the student will be able to:
- Identify the real world business problems and model with analytical solutions.
- Solve analytical problem with relevant mathematics background knowledge.
- Convert any real world decision making problem to hypothesis and apply suitable statistical testing.
- Write and Demonstrate simple applications involving analytics using Hadoop and MapReduce
- Use open source frameworks for modeling and storing data.
- Apply suitable visualization technique using R for visualizing voluminous data.
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OE5092  INDUSTRIAL SAFETY  L T P C
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OBJECTIVES:
- Summarize basics of industrial safety
- Describe fundamentals of maintenance engineering
- Explain wear and corrosion
- Illustrate fault tracing
- Identify preventive and periodic maintenance

UNIT I  INTRODUCTION
Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.
UNIT II FUNDAMENTALS OF MAINTENANCE ENGINEERING
Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT III WEAR AND CORROSION AND THEIR PREVENTION

UNIT IV FAULT TRACING
Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment’s like, i. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

UNIT V PERIODIC AND PREVENTIVE MAINTENANCE
Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: i. Machine tools, ii. Pumps, iii. Air compressors. iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

TOTAL: 45 PERIODS

OUTCOMES:
Students will be able to:
CO1: Ability to summarize basics of industrial safety
CO2: Ability to describe fundamentals of maintenance engineering
CO3: Ability to explain wear and corrosion
CO4: Ability to illustrate fault tracing
CO5: Ability to identify preventive and periodic maintenance

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OE5093 OPERATIONS RESEARCH L T P C
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OBJECTIVES:
- Solve linear programming problem and solve using graphical method.
- Solve LPP using simplex method.
- Solve transportation, assignment problems.
- Solve project management problems.
- Solve scheduling problems.

UNIT I LINEAR PROGRAMMING 9

UNIT II ADVANCES IN LINEAR PROGRAMMING 9
Solutions to LPP using simplex algorithm - Revised simplex method - primal dual relationships – Dual simplex algorithm - Sensitivity analysis.

UNIT III NETWORK ANALYSIS – I 9

UNIT IV NETWORK ANALYSIS – II 9
Shortest path problem: Dijkstra's algorithms, Floyd's algorithm, systematic method - CPM/PERT.

UNIT V NETWORK ANALYSIS – III 9
Scheduling and sequencing - single server and multiple server models - Deterministic inventory models - Probabilistic inventory control models.

TOTAL: 45 PERIODS

OUTCOMES:
Students will be able to:
CO1: To formulate linear programming problem and solve using graphical method.
CO2: To solve LPP using simplex method.
CO3: To formulate and solve transportation, assignment problems.
CO4: To solve project management problems.
CO5: To solve scheduling problems.
OE5094 COST MANAGEMENT OF ENGINEERING PROJECTS

OBJECTIVES:
- Summarize the costing concepts and their role in decision making
- Infer the project management concepts and their various aspects in selection
- Interpret costing concepts with project execution
- Develop knowledge of costing techniques in service sector and various budgetary control techniques
- Illustrate with quantitative techniques in cost management

UNIT I INTRODUCTION TO COSTING CONCEPTS
Objectives of a Costing System; Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost; Creation of a Database for operational control.

UNIT II INTRODUCTION TO PROJECT MANAGEMENT
Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities, Detailed Engineering activities, Pre project execution main clearances and documents, Project team: Role of each member, Importance Project site: Data required with significance, Project contracts.

UNIT III PROJECT EXECUTION AND COSTING CONCEPTS
Project execution Project cost control, Bar charts and Network diagram, Project commissioning: mechanical and process, Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis, Various decision-making problems, Pricing strategies: Pareto Analysis, Target costing, Life Cycle Costing.

REFERENCES:
UNIT IV  COSTING OF SERVICE SECTOR AND BUDGETERY CONTROL  9
Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis, Budgetary Control: Flexible Budgets; Performance budgets; Zero-based budgets.

UNIT V  QUANTITATIVE TECHNIQUES FOR COST MANAGEMENT  9
Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Learning Curve Theory.
TOTAL: 45 PERIODS

OUTCOMES:
Students will be able to:
CO1 – Understand the costing concepts and their role in decision making
CO2–Understand the project management concepts and their various aspects in selection
CO3–Interpret costing concepts with project execution
CO4–Gain knowledge of costing techniques in service sector and various budgetary control techniques
CO5 - Become familiar with quantitative techniques in cost management

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2. Charles T. Horngren and George Foster, Advanced Management Accounting, 1988

OE5095  COMPOSITE MATERIALS  L T P C
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OBJECTIVES:
• Summarize the characteristics of composite materials and effect of reinforcement in composite materials.
• Identify the various reinforcements used in composite materials.
• Compare the manufacturing process of metal matrix composites.
• Understand the manufacturing processes of polymer matrix composites.
• Analyze the strength of composite materials.

UNIT–I  INTRODUCTION  9
Definition – Classification and characteristics of Composite materials - Advantages and application of composites - Functional requirements of reinforcement and matrix - Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.
UNIT – II REINFORCEMENTS
Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers - Properties and applications of whiskers, particle reinforcements - Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures - Isostrain and Isostress conditions.

UNIT – III MANUFACTURING OF METAL MATRIX COMPOSITES

UNIT–IV MANUFACTURING OF POLYMER MATRIX COMPOSITES

UNIT – V STRENGTH
Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

TOTAL: 45 PERIODS

OUTCOMES:
Students will be able to:
• CO1 - Know the characteristics of composite materials and effect of reinforcement in composite materials.
• CO2 – Know the various reinforcements used in composite materials.
• CO3 – Understand the manufacturing processes of metal matrix composites.
• CO4 – Understand the manufacturing processes of polymer matrix composites.
• CO5 – Analyze the strength of composite materials.

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REFERENCES:
OBJECTIVES:
- Interpret the various types of wastes from which energy can be generated
- Develop knowledge on biomass pyrolysis process and its applications
- Develop knowledge on various types of biomass gasifiers and their operations
- Invent knowledge on biomass combustors and its applications on generating energy
- Summarize the principles of bio-energy systems and their features

UNIT I  INTRODUCTION TO EXTRACTION OF ENERGY FROM WASTE  9
Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW –
Conversion devices – Incinerators, gasifiers, digestors

UNIT II  BIOMASS PYROLYSIS  9
Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application –
Manufacture of pyrolytic oils and gases, yields and applications.

UNIT III  BIOMASS GASIFICATION  9
Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers –
Design, construction and operation – Gasifier burner arrangement for thermal heating –
Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in
gasifier operation.

UNIT IV  BIOMASS COMBUSTION  9
Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors,
Types, inclined grate combustors, Fluidized bed combustors, Design, construction and
operation - Operation of all the above biomass combustors.

UNIT V  BIO ENERGY  9
Properties of biogas (Calorific value and composition), Biogas plant technology and status -
Bio energy system - Design and constructional features - Biomass resources and their
classification - Biomass conversion processes - Thermo chemical conversion - Direct
combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion -
aerobic digestion - Types of biogas Plants – Applications - Alcohol production from
biomass - Bio diesel production -Urban waste to energy conversion - Biomass energy
programme in India.

TOTAL: 45 PERIODS

OUTCOMES:
Students will be able to:
CO1 – Understand the various types of wastes from which energy can be generated
CO2 – Gain knowledge on biomass pyrolysis process and its applications
CO3 – Develop knowledge on various types of biomass gasifiers and their operations
CO4 – Gain knowledge on biomass combustors and its applications on generating energy
CO5 – Understand the principles of bio-energy systems and their features

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AUDIT COURSES (AC)

AX5091 ENGLISH FOR RESEARCH PAPER WRITING L T P C
2 0 0 0

OBJECTIVES
- Teach how to improve writing skills and level of readability
- Tell about what to write in each section
- Summarize the skills needed when writing a Title
- Infer the skills needed when writing the Conclusion
- Ensure the quality of paper at very first-time submission

UNIT I INTRODUCTION TO RESEARCH PAPER WRITING 6
Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT II PRESENTATION SKILLS 6

UNIT III TITLE WRITING SKILLS 6
Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check

UNIT IV RESULT WRITING SKILLS 6
Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNIT V VERIFICATION SKILLS 6
Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first-time submission

TOTAL: 30 PERIODS

OUTCOMES
CO1 – Understand that how to improve your writing skills and level of readability
CO2 – Learn about what to write in each section
CO3 – Understand the skills needed when writing a Title
CO4 – Understand the skills needed when writing the Conclusion
CO5 – Ensure the good quality of paper at very first-time submission

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AX5092 DISASTER MANAGEMENT L T P C
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OBJECTIVES
• Summarize basics of disaster
• Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
• Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
• Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
• Develop the strengths and weaknesses of disaster management approaches

UNIT I INTRODUCTION 6
Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT II REPERCUSSIONS OF DISASTERS AND HAZARDS 6

UNIT III DISASTER PRONE AREAS IN INDIA 6
Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics

UNIT IV DISASTER PREPAREDNESS AND MANAGEMENT 6
Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT V RISK ASSESSMENT 6
Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People’s Participation in Risk Assessment. Strategies for Survival

TOTAL : 30 PERIODS
OUTCOMES
CO1: Ability to summarize basics of disaster
CO2: Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
CO3: Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
CO4: Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
CO5: Ability to develop the strengths and weaknesses of disaster management approaches

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AX5093   SANSKRIT FOR TECHNICAL KNOWLEDGE   L T P C
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OBJECTIVES
- Illustrate the basic sanskrit language.
- Recognize sanskrit, the scientific language in the world.
- Appraise learning of sanskrit to improve brain functioning.
- Relate sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power.
- Extract huge knowledge from ancient literature.

UNIT I       ALPHABETS
Alphabets in Sanskrit

UNIT II      TENSES AND SENTENCES
Past/Present/Future Tense - Simple Sentences

UNIT III     ORDER AND ROOTS
Order - Introduction of roots

UNIT IV      SANSKRIT LITERATURE
Technical information about Sanskrit Literature
UNIT V  TECHNICAL CONCEPTS OF ENGINEERING

Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

TOTAL: 30 PERIODS

OUTCOMES

- CO1 - Understanding basic Sanskrit language.
- CO2 - Write sentences.
- CO3 - Know the order and roots of Sanskrit.
- CO4 - Know about technical information about Sanskrit literature.
- CO5 - Understand the technical concepts of Engineering.

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1. “Abhyaspustakam” – Dr. Vishwas, Samskrita-Bharti Publication, New Delhi
2. “Teach Yourself Sanskrit” Pratham Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Santhanam, New Delhi Publication

AX5094  VALUE EDUCATION

OBJECTIVES

Students will be able to

- Understand value of education and self-development
- Imbibe good values in students
- Let the should know about the importance of character

UNIT I


UNIT II


UNIT III


UNIT IV

TOTAL: 30 PERIODS

OUTCOMES
Students will be able to
- Knowledge of self-development.
- Learn the importance of Human values.
- Developing the overall personality.

SUGGESTED READING

AX5095 CONSTITUTION OF INDIA L T P C
2 0 0 0

OBJECTIVES
Students will be able to:
- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals’ constitutional
- Role and entitlement to civil and economic rights as well as the emergence nation hood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution1917and its impact on the initial drafting of the Indian Constitution.

UNIT I HISTORY OF MAKING OF THE INDIAN CONSTITUTION:
History, Drafting Committee, (Composition & Working)

UNIT II PHILOSOPHY OF THE INDIAN CONSTITUTION:
Preamble, Salient Features

UNIT III CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES:

UNIT IV ORGANS OF GOVERNANCE:
Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

UNIT V LOCAL ADMINISTRATION:
UNIT VI ELECTION COMMISSION:
Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.

TOTAL: 30 PERIODS

OUTCOMES
Students will be able to:
- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization
- of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party[CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

SUGGESTED READING
1. The Constitution of India, 1950(Bare Act), Government Publication.

AX5096 PEDAGOGY STUDIES

OBJECTIVES
Students will be able to:
- Review existing evidence on there view topic to inform programme design and policy
- Making under taken by the DfID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

UNIT I INTRODUCTION AND METHODOLOGY:
Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions - Overview of methodology and Searching.

UNIT II THEMATIC OVERVIEW
Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.

UNIT III EVIDENCE ON THE EFFECTIVENESS OF PEDAGOGICAL PRACTICES
Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers’ attitudes and beliefs and Pedagogic strategies.
UNIT IV  PROFESSIONAL DEVELOPMENT
Professional development: alignment with classroom practices and follow up support - Peer support - Support from the head teacher and the community - Curriculum and assessment - Barriers to learning: limited resources and large class sizes

UNIT V  RESEARCH GAPS AND FUTURE DIRECTIONS
Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.

TOTAL: 30 PERIODS

OUTCOMES
Students will be able to understand:
- What pedagogical practices are being used by teachers informal and informal classrooms in developing countries?
- What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
- How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

SUGGESTED READING

AX5097  STRESS MANAGEMENT BY YOGA

OBJECTIVES
- To achieve overall health of body and mind
- To overcome stress

UNIT I
Definitions of Eight parts of yoga.(Ashtanga)

UNIT II
Yam and Niyam - Do’s and Don’t’s in life - i) Ahinsa, satya, astheya, bramhacharya and aparigraha, ii) Ahinsa, satya, astheya, bramhacharya and aparigraha.

UNIT III
Asan and Pranayam - Various yog poses and their benefits for mind & body - Regularization of breathing techniques and its effects- Types of pranayam

TOTAL: 30 PERIODS
OUTCOMES
Students will be able to:
- Develop healthy mind in a healthy body thus improving social health also
- Improve efficiency

SUGGESTED READING
1. “Yogic Asanas for Group Tarining-Part-I”: Janardan Swami Yoga bhyasi Mandal, Nagpur
2. “Rajayoga or conquering the Internal Nature” by Swami Vivekananda, Advaita Ashrama
   (Publication Department), Kolkata

AX5098
PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS  L  T  P  C
OBJECTIVES
- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

UNIT I
Neetisatakam-holistic development of personality - Verses- 19,20,21,22 (wisdom) - Verses- 29,31,32 (pride & heroism) – Verses- 26,28,63,65 (virtue) - Verses- 52,53,59 (dont's) - Verses- 71,73,75,78 (do’s)

UNIT II
Approach to day to day work and duties - Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48 - Chapter 3-Verses 13, 21, 27, 35 Chapter 6-Verses 5,13,17,23, 35 - Chapter 18-Verses 45, 46, 48.

UNIT III
Statements of basic knowledge - Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 Chapter 12 -Verses 13, 14, 15, 16,17, 18 - Personality of role model - shrimad bhagwad geeta - Chapter2-Verses 17, Chapter 3-Verses 36,37,42 - Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63

TOTAL: 30 PERIODS

OUTCOMES
Students will be able to
- Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
- The person who has studied Geeta will lead the nation and mankind to peace and prosperity
- Study of Neet is hatakam will help in developing versatile personality of students.

SUGGESTED READING
1. Gopinath, Rashtriya Sanskrit Sansthanam P, Bhartrihari’s Three Satakam, Niti-sringar-vairagya, New Delhi,2010