ANNA UNIVERSITY, CHENNAI
NON - AUTONOMOUS COLLEGES AFFILIATED ANNA UNIVERSITY
M.TECH. INFORMATION TECHNOLOGY
REGULATIONS – 2021
CHOICE BASED CREDIT SYSTEM

1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

To produce graduates who will be able to:

I. Provide suitable IT solutions to challenging problems in their profession by applying the best practices.

II. Apply their knowledge and skills to analyse, design, test and implement various IT support systems and be engaged in life-long learning.

III. Respond to the technological changes in Information Technologies and to foster related research to meet the needs of the society.

IV. To work collaboratively on multidisciplinary projects and exhibit high levels of professional and ethical values within the organization and society at large.

V. Become entrepreneurs and show their leadership and technical skills to develop innovative IT solutions to address the challenges of a sustainable ecosystem.

2. PROGRAM OUTCOMES (POs)

1. An ability to independently carry out research/investigation and development work to solve practical problems

2. An ability to write and present a substantial technical report/document

3. Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program

4. Identify, formulate and solve engineering problems by applying mathematical foundations, algorithmic principles and design techniques in IT environment to meet industrial challenges.

5. Analyse and recommend the suitable IT solutions required for the implementation of a software systems

6. Apply the known facts and use modern tools to provide innovative solutions in the domain of Information technology
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**TOTAL NO. OF CREDITS: 75**

### PROFESSIONAL ELECTIVES

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## SUMMARY

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<tr>
<th>Sl. No.</th>
<th>NAME OF THE PROGRAMME: M.TECH. INFORMATION TECHNOLOGY</th>
<th>SUBJECT AREA</th>
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MA4108       APPLIED PROBABILITY AND STATISTICAL ANALYSIS       L    T    P    C
3    1    0    4

COURSE OBJECTIVES:

- To provide students with basic concepts of probability theory.
- To gain knowledge about two dimensional random variable and its regression, correlations.
- To decide whether to accept or reject a specific value of the parameters.
- To provide the most appropriate interval estimator of the parameters in statistical inferences.
- To avoid or at least minimize, the problems of estimating the effects of the independent variables by experimental designs.

UNIT I       PROBABILITY AND RANDOM VARIABLES
12

UNIT II       TWO DIMENSIONAL RANDOM VARIABLES
12
Joint distributions – Marginal and conditional distributions – Functions of two dimensional random variables – Regression curve – Correlation.

UNIT III      TESTING OF HYPOTHESIS
12
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 IV       ESTIMATION THEORY
12
Interval estimation for population mean - Standard deviation - Difference in means, proportion ratio of standard deviations and variances.

UNIT V       DESIGN OF EXPERIMENTS
12
Completely randomized design – Randomized block design – Latin square design – $2^2$ Factorial design.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

After completing this course, students should demonstrate competency in the following topics:
- Basic probability axioms and rules and the moments of discrete and continuous random variables and various standard distributions and their properties.
- Distributions of two dimensional variables, correlation and regression.
- Use statistical tests in testing hypotheses on data.
- Interval estimation for population parameters such as mean and standard deviation.
- List the guidelines for designing experiments and recognize the key historical figures in Design of Experiments.

REFERENCES:
RM4151 RESEARCH METHODOLOGY AND IPR

UNIT I RESEARCH DESIGN
Overview of research process and design, Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys.

UNIT II DATA COLLECTION AND SOURCES
Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data - Preparing, Exploring, examining and displaying.

UNIT III DATA ANALYSIS AND REPORTING
Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation.

UNIT IV INTELLECTUAL PROPERTY RIGHTS

UNIT V PATENTS

TOTAL: 30 PERIODS

REFERENCES:
COURSE OBJECTIVES:
- To understand the usage of algorithms in computing
- To learn and use hierarchical data structures and its operations
- To learn the usage of graphs and its applications
- To select and design data structures and algorithms that is appropriate for problems
- To study about NP Completeness of problems.

UNIT I  ROLE OF ALGORITHMS IN COMPUTING & COMPLEXITY  9
ANALYSIS

UNIT II  HIERARCHICAL DATA STRUCTURES  9

UNIT III  GRAPHS  9

UNIT IV  ALGORITHM DESIGN TECHNIQUES  9

UNIT V  NP COMPLETE AND NP HARD  9

TOTAL: 45 PERIODS

SUGGESTED ACTIVITIES:
1. Write an algorithm for Towers of Hanoi problem using recursion and analyze the complexity (No of disc-4)
2. Write any one real time application of hierarchical data structure
3. Write a program to implement Make_Set, Find_Set and Union functions for Disjoint Set Data Structure for a given undirected graph G(V,E) using the linked list representation with simple implementation of Union operation
4. Find the minimum cost to reach last cell of the matrix from its first cell
5. Discuss about any NP completeness problem
COURSE OUTCOMES:

CO1: Design data structures and algorithms to solve computing problems.
CO2: Choose and implement efficient data structures and apply them to solve problems.
CO3: Design algorithms using graph structure and various string-matching algorithms to solve real-life problems.
CO4: Design one's own algorithm for an unknown problem.
CO5: Apply suitable design strategy for problem solving.

REFERENCES:

CP4152 DATABASE PRACTICES

COURSE OBJECTIVES:
• Describe the fundamental elements of relational database management systems
• Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.
• Understand query processing in a distributed database system
• Understand the basics of XML and create well-formed and valid XML documents.
• Distinguish the different types of NoSQL databases
• To understand the different models involved in database security and their applications in real time world to protect the database and information associated with them.

UNIT I RELATIONAL DATA MODEL


Suggested Activities:
Data Definition Language
• Create, Alter and Drop
• Enforce Primary Key, Foreign Key, Check, Unique and Not Null Constraints
• Creating Views
Data Manipulation Language
• Insert, Delete, Update
• Cartesian Product, Equi Join, Left Outer Join, Right Outer Join and Full Outer Join
• Aggregate Functions
• Set Operations
UNIT II DISTRIBUTED DATABASES, ACTIVE DATABASES AND OPEN DATABASE CONNECTIVITY 15

Suggested Activities:
- Distributed Database Design and Implementation
- Row Level and Statement Level Triggers
- Accessing a Relational Database using PHP, Python and R

UNIT III XML DATABASES 15

Suggested Activities:
- Creating XML Documents, Document Type Definition and XML Schema
- Using a Relational Database to store the XML documents as text
- Using a Relational Database to store the XML documents as data elements
- Creating or publishing customized XML documents from pre-existing relational databases
- Extracting XML Documents from Relational Databases
- XML Querying

UNIT IV NOSQL DATABASES AND BIG DATA STORAGE SYSTEMS 15

Suggested Activities:
- Creating Databases using MongoDB, DynamoDB, Voldemort Key-Value Distributed Data Store Hbase and Neo4j.
- Writing simple queries to access databases created using MongoDB, DynamoDB, Voldemort Key-Value Distributed Data Store Hbase and Neo4j.

UNIT V DATABASE SECURITY 15
Suggested Activities:
Implementing Access Control in Relational Databases

COURSE OUTCOMES:
At the end of the course, the students will be able to

CO1: Convert the ER-model to relational tables, populate relational database and formulate SQL queries on data.
CO2: Understand and write well-formed XML documents
CO3: Be able to apply methods and techniques for distributed query processing.
CO4: Design and Implement secure database systems.
CO5: Use the data control, definition, and manipulation languages of the NoSQL databases

REFERENCES:

CP4153 NETWORK TECHNOLOGIES L T P C
3 0 0 3

COURSE OBJECTIVES:
• To understand the basic concepts of networks
• To explore various technologies in the wireless domain
• To study about 4G and 5G cellular networks
• To learn about Network Function Virtualization
• To understand the paradigm of Software defined networks

UNIT I NETWORKING CONCEPTS

UNIT II WIRELESS NETWORKS
Wireless access techniques- IEEE 802.11a, 802.11g, 802.11e, 802.11n/ac/ax/ay/ba/be, QoS – Bluetooth – Protocol Stack – Security – Profiles – zigbee

UNIT III MOBILE DATA NETWORKS

UNIT IV SOFTWARE DEFINED NETWORKS
9

UNIT V NETWORK FUNCTIONS VIRTUALIZATION
9
Motivation-Virtual Machines –NFV benefits-requirements – architecture- NFV Infrastructure -Virtualized Network Functions - NFV Management and Orchestration- NFV Use Cases- NFV and SDN –Network virtualization – VLAN and VPN

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: Explain basic networking concepts
CO2: Compare different wireless networking protocols
CO3: Describe the developments in each generation of mobile data networks
CO4: Explain and develop SDN based applications
CO5: Explain the concepts of network function virtualization

SUGGESTED ACTIVITIES:
1: Execute various network utilities such as tracert, pathping, ipconfig
2: Implement the Software Defined Networking using Mininet
3: Implement routing in Mininet
4: Install a virtual machine and study network virtualization
5: Simulate various network topologies in Network Simulator

REFERENCES:
2. HoudaLabiod, Costantino de Santis, HossamAffifi –“Wi-Fi, Bluetooth, Zigbee and WiMax”, Springer 2007 (UNIT 2)
COURSE OBJECTIVES:
- To understand the concepts and mathematical foundations of machine learning and types of problems tackled by machine learning
- To explore the different supervised learning techniques including ensemble methods
- To learn different aspects of unsupervised learning and reinforcement learning
- To learn the role of probabilistic methods for machine learning
- To understand the basic concepts of neural networks and deep learning

UNIT I  INTRODUCTION AND MATHEMATICAL FOUNDATIONS 9

UNIT II  SUPERVISED LEARNING 9

UNIT III  UNSUPERVISED LEARNING AND REINFORCEMENT LEARNING 9

UNIT IV  PROBABILISTIC METHODS FOR LEARNING 9

UNIT V  NEURAL NETWORKS AND DEEP LEARNING 9
Neural Networks – Biological Motivation - Perceptron – Multi-layer Perceptron – Feed Forward Network – Back Propagation-Activation and Loss Functions - Limitations of Machine Learning – Deep Learning – Convolution Neural Networks – Recurrent Neural Networks – Use cases

45 PERIODS

SUGGESTED ACTIVITIES:
1. Give an example from our daily life for each type of machine learning problem
2. Study at least 3 Tools available for Machine Learning and discuss pros & cons of each
3. Take an example of a classification problem. Draw different decision trees for the example and explain the pros and cons of each decision variable at each level of the tree
4. Outline 10 machine learning applications in healthcare
5. Give 5 examples where sequential models are suitable.
6. Give at least 5 recent applications of CNN
PRACTICAL EXERCISES:

1. Implement a Linear Regression with a Real Dataset
   (https://www.kaggle.com/harrywang/housing). Experiment with different features in building a model. Tune the model's hyperparameters.

2. Implement a binary classification model. That is, answers a binary question such as "Are houses in this neighborhood above a certain price?" (use data from exercise 1). Modify the classification threshold and determine how that modification influences the model. Experiment with different classification metrics to determine your model's effectiveness.

3. Classification with Nearest Neighbors. In this question, you will use the scikit-learn’s KNN classifier to classify real vs. fake news headlines. The aim of this question is for you to read the scikit-learn API and get comfortable with training/validation splits. Use California Housing Dataset

4. In this exercise, you'll experiment with validation sets and test sets using the dataset. Split a training set into a smaller training set and a validation set. Analyze deltas between training set and validation set results. Test the trained model with a test set to determine whether your trained model is overfitting. Detect and fix a common training problem.

5. Implement the k-means algorithm using https://archive.ics.uci.edu/ml/datasets/Codon+usage dataset

6. Implement the Naïve Bayes Classifier using https://archive.ics.uci.edu/ml/datasets/Gait+Classification dataset

7. Project - (in Pairs) Your project must implement one or more machine learning algorithms and apply them to some data.
   a. Your project may be a comparison of several existing algorithms, or it may propose a new algorithm in which case you still must compare it to at least one other approach.
   b. You can either pick a project of your own design, or you can choose from the set of pre-defined projects.
   c. You are free to use any third-party ideas or code that you wish as long as it is publicly available.
   d. You must properly provide references to any work that is not your own in the write-up.
   e. Project proposal You must turn in a brief project proposal. Your project proposal should describe the idea behind your project. You should also briefly describe software you will need to write, and papers (2-3) you plan to read.

List of Projects (datasets available)
1. Sentiment Analysis of Product Reviews
2. Stock Prediction
3. Sales Forecasting
4. Music Recommendation
5. Handwriting Digit Classification
6. Fake News Detection
7. Sports Prediction
8. Object Detection
9. Disease Prediction

COURSE OUTCOMES:
Upon the completion of course, students will be able to
CO1: Understand and outline problems for each type of machine learning
CO2: Design a Decision tree and Random forest for an application
CO3: Implement Probabilistic Discriminative and Generative algorithms for an application and analyze the results.

CO4: Use a tool to implement typical Clustering algorithms for different types of applications.

CO5: Design and implement an HMM for a Sequence Model type of application and identify applications suitable for different types of Machine Learning with suitable justification.

TOTAL: 75 PERIODS

REFERENCES

CP4161 ADVANCED DATA STRUCTURES AND ALGORITHMS LABORATORY

COURSE OBJECTIVES:
- To acquire the knowledge of using advanced tree structures
- To learn the usage of heap structures
- To understand the usage of graph structures and spanning trees
- To understand the problems such as matrix chain multiplication, activity selection and Huffman coding
- To understand the necessary mathematical abstraction to solve problems.

LIST OF EXPERIMENTS:
1: Implementation of recursive function for tree traversal and Fibonacci
2: Implementation of iteration function for tree traversal and Fibonacci
3: Implementation of Merge Sort and Quick Sort
4: Implementation of a Binary Search Tree
5: Red-Black Tree Implementation
6: Heap Implementation
7: Fibonacci Heap Implementation
8: Graph Traversals
9: Spanning Tree Implementation
10: Shortest Path Algorithms (Dijkstra’s algorithm, Bellman Ford Algorithm)
11: Implementation of Matrix Chain Multiplication
Hardware/Software Requirements
1: 64-bit Open source Linux or its derivative
2: Open Source C++ Programming tool like G++/GCC

COURSE OUTCOMES:
CO1: Design and implement basic and advanced data structures extensively
CO2: Design algorithms using graph structures
CO3: Design and develop efficient algorithms with minimum complexity using design techniques
CO4: Develop programs using various algorithms.
CO5: Choose appropriate data structures and algorithms, understand the ADT/libraries, and use it to design algorithms for a specific problem.

TOTAL: 60 PERIODS

REFERENCES:

IF4111 APPLIED PROBABILITY AND STATISTICAL ANALYSIS LABORATORY  L T P C
0 0 2 1

COURSE OBJECTIVES:
- Apply key concepts of probability, including discrete and continuous random variables, probability distributions, conditioning, independence, expectations, and variances.
- Analyze statistical data graphically using frequency distributions and cumulative frequency distributions.
- Analyze statistical data using measures of central tendency, dispersion and location.
- Identify the type of statistical situation to which different distributions can be applied.
- Apply the concepts of interval estimation and confidence intervals.

ACTIVITIES:
1: Scrape the LivingSocial/Groupon sites for the daily deals and develop a prediction of how successful the deal will be based on location/price/type of deal. You could use either the RCurl R package or the XML R package to scrape the data.
2: Does social media presence or influence affect the performance of an employee?
3: Determine the best number of clusters from Crime Dataset.
4: Download data on state of the union speeches from here (http://stateoftheunion.onetowthree.net/texts/index.html) and use the tm package in R to analyze the patterns of word use over time
5: Analysis of all the factors that contribute to low productivity in employees.

TOTAL: 30 PERIODS
COURSE OUTCOMES:
CO1: Translate real-world problems into probability models.
CO2: Derive the probability density function of transformation of random variables.
CO3: Use Poisson, exponential distributions to solve statistical problems.
CO4: How to derive the probability density function of transformations of random variables and use these techniques to generate data from various distributions.
CO5: How to translate real-world problems into probability models.

IF 4201
SOFTWARE INDUSTRIALIZATION

COURSE OBJECTIVES:
• To provide students with a theoretical understanding of current best practices in software engineering and its Lifecycle Models
• To provide students with practical experience to produce high-quality software with an emphasis on design quality and technical evaluation
• To do project management and cost estimation
• To gain knowledge of the System Analysis and Design concepts
• To understand software testing approaches
• To gain knowledge about agile modelling and DSDM with DevOps practices
• To have hands on experience in developing a software project by using various software engineering principles and methods in each of the phases of software development

UNIT I SOFTWARE ENGINEERING
9

UNIT II REQUIREMENT ANALYSIS
9
Requirement analysis and specification – Requirements gathering - Software Requirements: Functional and non-functional requirements - user requirements - system requirements - interface specification - the software requirements document - Requirements engineering process: Feasibility studies - requirements elicitation and analysis - requirements validation - requirements management - System models: Context models - behavioural models - data models - object models - structured methods and analysis.

UNIT III SOFTWARE ARCHITECTURE
9

UNIT IV SOFTWARE TESTING
9
Testing Strategies: A strategic approach to software testing - test strategies for conventional
software - black-box and white-box testing - validation testing - system testing - the art of debugging - Product metrics: Software quality - metrics for analysis model - metrics for design model - metrics for source code - metrics for testing - metrics for maintenance.

UNIT V  SOFTWARE METHODOLOGIES  9

SUGGESTED ACTIVITIES:
1: Development of problem statement
3: Preparation of Software Configuration Management and Risk Management related documents
4: Study and usage of any Design phase CASE tool
5: Performing the Design by using any Design phase CASE tools
6: Develop test cases for unit testing and integration testing
7: Develop test cases for various white box and black box testing techniques

SAMPLE PROJECTS:
1. Passport automation System
2. Book Bank
3. Online Exam Registration
4. Stock Maintenance System
5. Online course reservation system
6. E-ticketing
7. Software Personnel Management System
8. Credit Card Processing
10. Recruitment system.

COURSE OUTCOMES:
CO1: Understand the advantages of various Software Development Lifecycle Models
CO2: Compare project management approaches as well as cost and schedule estimation strategies
CO3: Translate end-user requirements into system and software requirements and generate a high-level design of the system from the software requirements
CO4: Use UML diagrams for analysis and design
CO5: Understand the advantages Agile methodologies and of DevOps practices
CO6: Develop a simple testing report.

TOTAL :45 PERIODS

REFERENCES

IF4291 FULL STACK WEB APPLICATION DEVELOPMENT

COURSE OBJECTIVES:
- Develop TypeScript Application
- Develop Single Page Application (SPA)
- Able to communicate with a server over the HTTP protocol
- Learning all the tools need to start building applications with Node.js
- Implement the Full Stack Development using MEAN Stack

UNIT I FUNDAMENTALS & TYPESCRIPT LANGUAGE

UNIT II ANGULAR

UNIT III NODE.js
Target and Event API. Buffers. Buffers and TypedArrays. Buffers and iteration. Using buffers for binary data. Flowing vs. non-flowing streams. JSON.

UNIT IV EXPRESS.Js

UNIT V MONGODB

LIST OF EXPERIMENTS:
1: Accessing the Weather API from Angular
2: Accessing the Stock Market API from Angular
3: Call the Web Services of Express.js From Angular
4: Read the data in Node.js from MongoDB
5: CRUD operation in MongoDB using Angular

COURSE OUTCOMES:
CO1: Develop basic programming skills using Javascript
CO2: Implement a front-end web application using Angular.
CO3: Will be able to create modules to organise the server
CO4: Build RESTful APIs with Node, Express and MongoDB with confidence.
CO5: Will learn to Store complex, relational data in MongoDB using Mongoose

TOTAL : 45 + 30 = 75 PERIODS

REFERENCES
1. Adam Freeman, Essential TypeScript, Apress, 2019
2. Mark Clow, Angular Projects, Apress, 2018
3. Alex R. Young, Marc Harter, Node.js in Practice, Manning Publication, 2014

BD4251 BIG DATA MINING AND ANALYTICS

COURSE OBJECTIVES:
- To understand the computational approaches to Modeling, Feature Extraction
- To understand the need and application of Map Reduce
- To understand the various search algorithms applicable to Big Data
- To analyse and interpret streaming data
To learn how to handle large data sets in main memory and learn the various clustering techniques applicable to Big Data

UNIT I  DATA MINING AND LARGE SCALE FILES  9

UNIT II  SIMILAR ITEMS  9

UNIT III  MINING DATA STREAMS  9

UNIT IV  LINK ANALYSIS AND FREQUENT ITEMSETS  9

UNIT V  CLUSTERING  9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to

CO1: Design algorithms by employing Map Reduce technique for solving Big Data problems.
CO2: Design algorithms for Big Data by deciding on the apt Features set.
CO3: Design algorithms for handling petabytes of datasets
CO4: Design algorithms and propose solutions for Big Data by optimizing main memory consumption
CO5: Design solutions for problems in Big Data by suggesting appropriate clustering techniques.

REFERENCES:

WEB REFERENCES:
1. https://swayam.gov.in/nd2_arp19_ap60/preview
ONLINE RESOURCES:
1. https://examupdates.in/big-data-analytics/

CP4291  INTERNET OF THINGS  L T P C 3 0 2 4

COURSE OBJECTIVES:
- To Understand the Architectural Overview of IoT
- To Understand the IoT Reference Architecture and Real World Design Constraints
- To Understand the various IoT levels
- To understand the basics of cloud architecture
- To gain experience in Raspberry PI and experiment simple IoT application on it

UNIT I  INTRODUCTION  9+6
Internet of Things- Domain Specific IoTs - IoT and M2M-Sensors for IoT Applications–Structure of IoT– IoT Map Device- IoT System Management with NETCONF-YANG

UNIT II  IoT ARCHITECTURE, GENERATIONS AND PROTOCOLS  9+6

UNIT III  IoT PROTOCOLS AND TECHNOLOGY  9+6

UNIT IV  CLOUD ARCHITECTURE BASICS  9+6
The Cloud types; IaaS, PaaS, SaaS.- Development environments for service development; Amazon, Azure, Google Appcloud platform in industry

UNIT V  IOT PROJECTS ON RASPBERRY PI  9+6
Building IOT with RASPBERRY PI- Creating the sensor project - Preparing Raspberry Pi - Clayster libraries – Hardware Interacting with the hardware - Interfacing the hardware- Internal representation of sensor values - Persisting data - External representation of sensor values - Exporting sensor data

SUGGESTED ACTIVITIES:
1. Develop an application for LED Blink and Pattern using arduino or Raspberry Pi
2. Develop an application for LED Pattern with Push Button Control using arduino or Raspberry Pi
3. Develop an application for LM35 Temperature Sensor to display temperature values using arduino or Raspberry Pi
4. Develop an application for Forest fire detection end node using Raspberry Pi device and sensor
5. Develop an application for home intrusion detection web application
6. Develop an application for Smart parking application using python and Django for web
COURSE OUTCOMES:

CO1: Understand the various concept of the IoT and their technologies
CO2: Develop the IoT application using different hardware platforms
CO3: Implement the various IoT Protocols
CO4: Understand the basic principles of cloud computing
CO5: Develop and deploy the IoT application into cloud environment

TOTAL: 75 PERIODS

REFERENCES:


IF4211
TERM PAPER WRITING AND SEMINAR

In this course, students will develop their scientific and technical reading and writing skills that they need to understand and construct research articles. A term paper requires a student to obtain information from a variety of sources (i.e., Journals, dictionaries, reference books) and then place it in logically developed ideas. The work involves the following steps:

1. Selecting a subject, narrowing the subject into a topic
2. Stating an objective.
3. Collecting the relevant bibliography (at least 15 journal papers)
4. Preparing a working outline.
5. Studying the papers and understanding the authors contributions and critically analysing each paper.
6. Preparing a working outline
7. Linking the papers and preparing a draft of the paper.
8. Preparing conclusions based on the reading of all the papers.
9. Writing the Final Paper and giving final Presentation

Please keep a file where the work carried out by you is maintained.
Activities to be carried out

24
<table>
<thead>
<tr>
<th>Activity</th>
<th>Instructions</th>
<th>Submission week</th>
<th>Evaluation</th>
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<tbody>
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<td>Selection of area of interest and</td>
<td>You are requested to select an area of interest, topic and state an objective</td>
<td>2nd week</td>
<td>3 % Based on clarity of thought, current relevance and clarity in writing</td>
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<td>Topic</td>
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<tr>
<td>Stating an Objective</td>
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<td>Collecting Information about your</td>
<td>1. List 1 Special Interest Groups or professional society</td>
<td>3rd week</td>
<td>3% (the selected information must be area specific and of international</td>
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<td>area &amp; topic</td>
<td>2. List 2 journals</td>
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<td>and national standard)</td>
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<td>3. List 2 conferences, symposia or workshops</td>
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<td>4. List 1 thesis title</td>
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<td>5. List 3 web presences (mailing lists, forums, news sites)</td>
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<td>6. List 3 authors who publish regularly in your area</td>
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<td>Collection of Journal papers in</td>
<td>7. Attach a call for papers (CFP) from your area.</td>
<td>3rd week</td>
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<td>the topic in the context of the</td>
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<td>objective – collect 20 &amp; then filter</td>
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<td>• You have to provide a complete list of references you will be using -</td>
<td>4th week</td>
<td>6% (the list of standard papers and reason for selection)</td>
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<td>Based on your objective - Search various digital libraries and Google Scholar</td>
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<td>• When picking papers to read - try to:</td>
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<td>• Pick papers that are related to each other in some ways and/or that are</td>
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<td>• Favoured journals and conferences,</td>
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<td>• Favoured “first” or “foundational” papers in the field (as indicated in</td>
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<td>• Favoured more recent papers,</td>
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<td>• Pick a recent survey of the field so you can quickly gain an overview,</td>
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<td>• Find relationships with respect to each other and to your topic area</td>
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<td>(classification scheme/categorization)</td>
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<td>• Mark in the hard copy of papers whether complete work or section/sections</td>
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<td>of the paper are being considered</td>
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<td>Reading and notes for first 5</td>
<td>• Reading Paper Process</td>
<td>5th week</td>
<td>8% (the table given)</td>
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<td>• For each paper form a Table</td>
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papers | answering the following questions:  
| What is the main topic of the article?  
| What was/were the main issue(s) the author said they want to discuss?  
| Why did the author claim it was important?  
| How does the work build on other’s work, in the author’s opinion?  
| What simplifying assumptions does the author claim to be making?  
| What did the author do?  
| How did the author claim they were going to evaluate their work and compare it to others?  
| What did the author say were the limitations of their research?  
| What did the author say were the important directions for future research?  
| Conclude with limitations/issues not addressed by the paper (from the perspective of your survey) | should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)

| Reading and notes for next 5 papers | Repeat Reading Paper Process | 6th week | 8%  
| (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper) |

| Reading and notes for final 5 papers | Repeat Reading Paper Process | 7th week | 8%  
| (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper) |

| Draft outline 1 and Linking papers | Prepare a draft Outline, your survey goals, along with a classification / categorization diagram | 8th week | 8%  
| (this component will be evaluated based on the |
### Table of Course Timelines and Assessments

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
<th>Week(s)</th>
<th>Weighting</th>
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<tbody>
<tr>
<td>Abstract</td>
<td>Prepare a draft abstract and give a presentation</td>
<td>9th week</td>
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<td>(Clarity, purpose and conclusion)</td>
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<td>Introduction Background</td>
<td>Write an introduction and background sections</td>
<td>10th week</td>
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<td>Sections of the paper</td>
<td>Write the sections of your paper based on the classification / categorization diagram in keeping with the goals of your survey</td>
<td>11th week</td>
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<td>(this component will be evaluated based on the linking and classification among the papers)</td>
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<td>Your conclusions</td>
<td>Write your conclusions and future work</td>
<td>12th week</td>
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<td>Final Draft</td>
<td>Complete the final draft of your paper</td>
<td>13th week</td>
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<td>Seminar</td>
<td>A brief 15 slides on your paper</td>
<td>14th &amp; 15th week</td>
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<td>(based on presentation and Viva-voce)</td>
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TOTAL: 30 PERIODS

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### IF4301 INFORMATION AND NETWORK SECURITY

L T P C 3 0 0 3

**COURSE OBJECTIVES:**
- To introduce the concepts and models of security.
- To understand the risk assessment and security standard.
- To plan for business continuity and incident response plan.
- To estimate the level of security risk faced by an organisation and the countermeasures to handle the risk.
- To understand potential vulnerabilities and to develop a security blueprint.

**UNIT I INFORMATION SECURITY**

Introduction to Information Security - Security Issues - CIA Triad - Parkerian Hexad - Introduction

UNIT II FUNDAMENTALS OF CRYPTOGRAPHY

UNIT III INTRUSION DETECTION

UNIT IV NETWORK SECURITY

UNIT V APPLICATION SECURITY

SUGGESTED ACTIVITIES:
1: In-class activity to learn about various security services and attacks.
2: Analyse risk for any real time applications and prepare a blueprint for security to control the risk.
3: Develop an attack success scenario and assess the potential damage.
4: Prepare the contingency planning documents for business continuity.
5: Discussion on scanning and analysis tools for identifying the vulnerabilities.

COURSE OUTCOMES:
After completing the course students will be able to
CO1: Apply the basic security models and policies required by the computing system.
CO2: Apply a cryptographic algorithm to build a secure application.
CO3: Monitor, detect and prevent intrusions in a network.
CO4: Predict the vulnerabilities in any computing system and propose a security solution.
CO5: Understand the importance of network security and risk management of an organization.

TOTAL :45 PERIODS

REFERENCES
7. Software-Defined Networking and Security, Dijiang Huang, Ankur Chowdhary, and Sandeep Pisharody. CRC Press, 2018

MU4251 DIGITAL IMAGE PROCESSING L T P C
3 0 0 3

COURSE OBJECTIVES:
- To study fundamental concepts of digital image processing.
- To understand and learn image processing operations and restoration.
- To use the concepts of Feature Extraction
- To study the concepts of Image Compression.
- To expose students to current trends in the field of image segmentation.

UNIT I INTRODUCTION
Examples of fields that use digital image processing, fundamental steps in digital image processing, components of image processing system. Digital Image Fundamentals: A simple image formation model, image sampling and quantization, basic relationships between pixels. Image enhancement in the spatial domain: Basic gray-level transformation, histogram processing, enhancement using arithmetic and logic operators, basic spatial filtering, smoothing, and sharpening spatial filters, combining the spatial enhancement methods.

Suggested Activities:
- Discussion of Mathematical Transforms.
- Numerical problem solving using Fourier Transform.
- 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 II IMAGE RESTORATION
A model of the image degradation/restoration process, noise models, restoration in the presence of noise—only spatial filtering, Weiner filtering, constrained least squares filtering, geometric transforms; Introduction to the Fourier transform and the frequency domain, estimating the degradation function. Color Image Processing: Color fundamentals, color models, pseudo color image processing, basics of full–color image processing, color transforms, smoothing and sharpening, color segmentation

Suggested Activities:
- Discussion on Image Artifacts 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 III FEATURE EXTRACTION
9

Suggested Activities:
- External learning – Feature selection and reduction.
- External learning – Image salient features.
- Assignment on numerical problems in texture computation.

Suggested Evaluation Methods:
- Assignment problems on feature extraction and reduction.
- Quizzes on feature selection and extraction.

UNIT IV IMAGE COMPRESSION
9
Fundamentals, image compression models, error-free compression, lossy predictive coding, image compression standards Morphological Image Processing: Preliminaries, dilation, erosion, open and closing, hit or miss transformation, basic morphological algorithms

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

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

UNIT V IMAGE SEGMENTATION
9

Suggested Activities:
- Flipped classroom on importance of segmentation.

Suggested Evaluation Methods:
- Tutorial – Image segmentation and edge detection.

COURSE OUTCOMES:
CO1: Apply knowledge of Mathematics for image processing operations
CO2: Apply techniques for image restoration.
CO3: Identify and extract salient features of images.
CO4: Apply the appropriate tools (Contemporary) for image compression and analysis.
CO5: Apply segmentation techniques and do object recognition.

TOTAL: 45 PERIODS
REFERENCES

IF4001 GAME DEVELOPMENT L T P C
3 0 0 3

COURSE OBJECTIVES:
● To know the basics of 2D and 3D graphics for game development.
● To know the stages of game development.
● To understand the basics of a game engine.
● To survey the gaming development environment and toolkits.
● To learn and develop simple games using the Pygame environment.

UNIT I 3D GRAPHICS FOR GAME PROGRAMMING 9

UNIT II GAME DESIGN PRINCIPLES 8

UNIT III GAME ENGINE DESIGN 8

UNIT IV OVERVIEW OF GAMING PLATFORMS AND FRAMEWORKS 10
Pygame Game development – Unity – Unity Scripts – Mobile Gaming, Game Studio, Unity – Single player and Multiplayer games.

UNIT V GAME DEVELOPMENT USING PYGAME 10

SUGGESTED ACTIVITIES:
1: External learning - Writing Unity scripts and assets.
2: Practical - Implementation of simple games.
3: External learning on Unity Game Engine.
4: Practical - Installation of Unity and scripts.
5: Practical - Pygame routines for character rendering, transformations and sound processing.

COURSE OUTCOMES:
CO1: To have a fundamental understanding of the concepts of 2D and 3D graphics.
CO2: Apply design and development principles in the construction of games.
CO3: Understand the implementation of gaming engines.
CO4: Understand foundational language and platforms of game development technology.
CO5: Will gain experience with various game developments like Pygame and Unity.

TOTAL : 45 PERIODS

REFERENCES

MP4152 WIRELESS COMMUNICATIONS L T P C 3 0 0 3

COURSE OBJECTIVES:
- To understand the basic concepts in cellular communication.
- To learn the characteristics of wireless channels.
- To understand the impact of digital modulation techniques in fading.
- To get exposed to diversity techniques in wireless communication.
- To acquire knowledge in multicarrier systems.

UNIT I CELLULAR CONCEPTS 9

UNIT II THE WIRELESS CHANNEL 9
Overview of wireless systems – Physical modeling for wireless channels – Time and Frequency coherence – Statistical channel models – Capacity of wireless Channel- Capacity of Flat Fading Channel – Channel Side Information at Receiver – Channel Side Information at Transmitter and
Receiver – Capacity comparisons – Capacity of Frequency Selective Fading channels.

UNIT III PERFORMANCE OF DIGITAL MODULATION OVER WIRELESS CHANNELS

UNIT IV DIVERSITY TECHNIQUES

UNIT V MULTICARRIER MODULATION
Data Transmission using Multiple Carriers – Multicarrier Modulation with Overlapping Sub channels – Mitigation of Subcarrier Fading – Discrete Implementation of Multicarrier Modulation – Peak to average Power Ratio- Frequency and Timing offset.

SUGGESTED ACTIVITIES:
1: Survey on various features of cellular networks
2: Study the nature of cellular networks
3: A comparative study on the performance of different digital modulation techniques
4: Perform a review of various diversity techniques in wireless communication
5: Presentation on design of multicarrier systems for 5G

COURSE OUTCOMES:
CO1: Design solutions for cellular communication
CO2: Determine the capacity of wireless channels
CO3: Analyze the performance of the digital modulation techniques in fading channels
CO4: Apply various diversity techniques in wireless communication
CO5: Design multicarrier systems in wireless communication

TOTAL: 45 PERIODS

REFERENCES:
COURSE OBJECTIVES:

- To understand the optimization techniques used in compiler design.
- To be aware of the various computer architectures that support parallelism.
- To become familiar with the theoretical background needed for code optimization.
- To understand the techniques used for identifying parallelism in a sequential program.
- To learn the various optimization algorithms.

UNIT I INTRODUCTION
Language Processors - The Structure of a Compiler – The Evolution of Programming Languages-

UNIT II INSTRUCTION-LEVEL PARALLELISM

UNIT III OPTIMISING FOR PARALLELISM AND LOCALITY-THEORY

UNIT IV OPTIMISING FOR PARALLELISM AND LOCALITY – APPLICATION

UNIT V INTERPROCEDURAL ANALYSIS

COURSE OUTCOMES:
CO1: Design and implement techniques used for optimization by a compiler.
CO2: Modify the existing architecture that supports parallelism.
CO3: Modify the existing data structures of an open source optimising compiler.
CO4: Design and implement new data structures and algorithms for code optimization.
CO5: Critically analyse different data structures and algorithms used in the building of an optimising compiler.

TOTAL : 45 PERIODS

REFERENCES
2. Randy Allen, Ken Kennedy, “Optimizing Compilers for Modern Architectures: A

UNIT I INTRODUCTION TO MULTIMEDIA ELEMENTS

UNIT II MULTIMEDIA COMPRESSION

UNIT III MULTIMEDIA ARCHITECTURES

UNIT IV MULTIMEDIA OPERATING SYSTEM AND DATABASES

UNIT V MULTIMEDIA COMMUNICATION & APPLICATIONS
SUGGESTED ACTIVITIES:
1: Assignments on creativity and visual appearance.
2: Practical - Creating and editing visual elements using tools like Audacity, Fontographer, Blender, Photoshop and flash.
3: Flipped classroom on different compression techniques.
4: Flipped classroom on concepts of Multimedia hardware architectures.
5: Flipped classroom on multimedia database and indexing structures.

COURSE OUTCOMES:
CO1: Use the multimedia elements effectively.
CO2: Encode and decode the multimedia elements.
CO3: Understand the underlying multimedia computing architectures used for media development.
CO4: Develop effective strategies to deliver quality-of-experience in multimedia applications.
CO5: Design and implement algorithms and techniques related to multimedia objects.

TOTAL :45 PERIODS

REFERENCES

COURSE OBJECTIVES:
- Articulate & apply standard computer vision concepts
- Implement standard image processing tasks
- Applying Clustering concept for Image Classification
- Identify practical constraints in computer vision application
- Architecture of an existing computer vision pipeline based on deep learning models

UNIT I COMPUTER VISION

UNIT II PIXEL-BASED MANIPULATIONS & TRANSFORMATION
Perspective transform. Linear vs. polar coordinates. Three-dimensional space. General pixel mapping.

UNIT III STRUCTURE IDENTIFICATION 11

UNIT IV CLUSTERING IMAGES & IMAGE RETRIEVAL 9

UNIT V IMAGE CLASSIFICATION USING DEEP LEARNING 9

SUGGESTED ACTIVITIES:
1: Identify and List various noises in the Image.
2: Identify Image Manipulation
3: Add colour descriptors and improve the search results.
4: Hierarchical k-means is a clustering method that applies k-means recursively to the clusters to create a tree of incrementally refined clusters
5: Image Classification using CNN

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: Understand the basic knowledge, theories and methods of computer vision.
CO2: to understand the essentials of image processing concepts through mathematical interpretation.
CO3: Demonstrate a knowledge of a broad range of fundamental image processing and image analysis techniques
CO4: Apply Clustering algorithms for clustering.
CO5: Analyse cognitive tasks including image classification, recognition and detection through deep learning.

REFERENCES
1. Pro Processing for Images and Computer Vision with OpenCV, Bryan WC Chung, Apress, 2017
2. Programming Computer Vision with Python, Jan Erik Solem, O'Reilly Media, 2012
3. A PRACTICAL INTRODUCTION TO COMPUTER VISION WITH OPENCV, Kenneth Dawson-Howe, Wiley, 2014
COURSE OBJECTIVES:

- To learn the foundations of Human Computer Interaction.
- Understanding Interaction Styles and to become familiar with the design technologies for individuals and persons with disabilities.
- To understand the process of Evaluation of Interaction Design.
- To clarify the significance of task analysis for ubiquitous computing
- To get insight on web and mobile interaction.

UNIT I  FOUNDATIONS OF HCI


UNIT II  INTERACTION STYLES


UNIT III  VALUATION OF INTERACTION

Evaluation Techniques- assessing user experience- usability testing – Heuristic evaluation and walkthroughs, analytics predictive models. Cognitive models, Socio-organizational issues and stakeholder requirements, Communication and collaboration models

UNIT IV  MODELS AND THEORIES

Task analysis, dialog notations and design, Models of the system, Modeling rich interaction, Ubiquitous computing

UNIT V  WEB AND MOBILE INTERACTION

Hypertext, Multimedia and WWW, Designing for the web Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Use Transitions-Lookup patterns-Feedback patterns Mobile apps, Mobile navigation, content and control idioms, Multi-touch gestures, Inter-app integration, Mobile web
COURSE OUTCOMES:
CO1: Understand the basics of human computer interactions via usability engineering and cognitive modeling.
CO2: Understand the basic design paradigms, complex interaction styles.
CO3: Understand the models and theories for user interaction
CO4: Examine the evaluation of interaction designs and implementations.
CO5: Elaborate the above issues for web and mobile applications.

TOTAL: 45 PERIODS

REFERENCES

IF4003 CYBER FORENSICS L T P C 3 0 0 3

COURSE OBJECTIVES:
- Emphasise the importance of digital forensics
- Can conduct a digital investigation in an organised and systematic way
- Understand the in-depth concept of Network Forensics
- Understand the in-depth concept of Mobile and Cloud Forensics
- Understand and perform basic static and dynamic malware analysis

UNIT I FORENSIC FUNDAMENTALS

UNIT II NETWORK FORENSICS
Network Evidence – Types of Network Monitoring – Setting Up a Network Monitoring System –

UNIT III  MOBILE FORENSICS 9

UNIT IV  CLOUD FORENSICS 9

UNIT V  MALWARE FORENSICS 9

SUGGESTED ACTIVITIES:
1: Analysis Network Forensics
2: Implement forensics trace from mobile phone
3: Implement Forensics on Android and iPhone Mobiles
4: Implement Cloud Forensics on AWS and Azure
5: Implement Static and Dynamic Malware Forensics

COURSE OUTCOMES:
CO1: Can explain and properly document the process of digital forensics analysis.
CO2: Understand the network attacks and forensic tools used for network forensics.
CO3: Understand and analyse the different methods used for data recovery, evidence collection and data seizure from the mobile devices.
CO4: Analyses the principles, theories, and practice of cloud forensics.
CO5: Understand and analyse malware behaviour, including launching, encoding, and network signatures.

TOTAL: 45 PERIODS

REFERENCES

40
COURSE OBJECTIVES:

- To understand basic problem solving strategies.
- To outline game theory based search and constraint satisfaction
- To study knowledge representation techniques
- To explore reasoning and planning associated with AI.
- To study the techniques of knowledge representation.
- To understand probabilistic and other types of reasoning
- To discuss ethical and safety issues associated with AI

UNIT I  INTRODUCTION AND PROBLEM SOLVING  9
Artificial Intelligence - Introduction - Problem-solving - Solving Problems by Searching –
Uninformed Search Strategies - Informed (Heuristic) Search Strategies - Local Search - Search
in Partially Observable Environments

UNIT II  ADVERSARIAL SEARCH AND CONSTRAINT SATISFACTION  9
Game Theory - Optimal Decisions in Games - Heuristic Alpha–Beta Tree Search - Monte Carlo
Tree Search - Stochastic Games - Partially Observable Games - Limitations of Game Search
Algorithms Constraint Satisfaction Problems (CSP) – Examples - Constraint Propagation-
Backtracking Search for CSPs - Local Search for CSPs

UNIT III  KNOWLEDGE, REASONING AND PLANNING  9
First Order Logic – Inference in First Order Logic - Using Predicate Logic - Knowledge
Representation - Issues - Ontological Engineering - Categories and Objects – Reasoning
Systems for Categories - Planning - Definition - Algorithms - Heuristics for Planning - Hierarchical
Planning

UNIT IV  UNCERTAIN KNOWLEDGE AND REASONING  9
Quantifying Uncertainty - Probabilistic Reasoning - Probabilistic Reasoning over Time
Based Reasoning – Explanation-Based Learning – Evolutionary Computation

UNIT V  PHILOSOPHY, ETHICS AND SAFETY OF AI  9
The Limits of AI – Knowledge in Learning – Statistical Learning Methods – Reinforcement
Learning - Introduction to Machine Learning and Deep Learning - Can Machines Really Think? -
Distributed AI Artificial Life-The Ethics of AI - Interpretable AI - Future of AI - AI Components - AI
Architectures

TOTAL : 45 PERIODS

SUGGESTED ACTIVITIES:

1. Solve puzzles with uninformed and informed searches.
2. Reasoning methods through puzzles and real life scenarios
3. Ontology creation using Protégé
4. Give example scenarios where probabilistic reasoning and case based reasoning can be applied
5. Discuss some case studies and their ethical issues
COURSE OUTCOMES:

CO1: Implement any three problem solving methods for a puzzle of your choice
CO2: Understand Game playing and implement a two player game using AI techniques
CO3: Design and Implement an example using predicate Logic
CO4: Implement a case based reasoning system
CO5: Discuss some methodologies to design ethical and explainable AI systems

REFERENCES:


MU4153 PRINCIPLES OF MULTIMEDIA

COURSE OBJECTIVES:

- To get familiarity with gamut of multimedia and its significance
- To acquire knowledge in multimedia components.
- To acquire knowledge about multimedia tools and authoring.
- To acquire knowledge in the development of multimedia applications.
- To explore the latest trends and technologies in multimedia

UNIT I INTRODUCTION


Suggested Activities:

1. Flipped classroom on media Components.
2. External learning – Interactive presentation.

Suggested Evaluation Methods:

1. Tutorial – Handling media components
2. Quizzes on different types of data presentation.
UNIT II ELEMENTS OF MULTIMEDIA

Text-Types, Font, Unicode Standard, File Formats, Graphics and Image data representations – data types, file formats, color models; video – color models in video, analog video, digital video, file formats, video display interfaces, 3D video and TV: Audio – Digitization, SNR, SQNR, quantization, audio quality, file formats, MIDI; Animation- Key Frames and Tweening, other Techniques, 2D and 3D Animation.

Suggested Activities:
1. Flipped classroom on different file formats of various media elements.

Suggested Evaluation Methods:
1. Demonstration on after effects animations.
2. Quizzes on file formats and color models.

UNIT III MULTIMEDIA TOOLS


Suggested Activities:
1. Flipped classroom on multimedia tools.
2. External learning – Comparison of various authoring tools.

Suggested Evaluation Methods:
1. Tutorial – Audio editing tool.
2. Quizzes on animation tools.

UNIT IV MULTIMEDIA SYSTEMS


Suggested Activities:
1. Flipped classroom on concepts of multimedia hardware architectures.
2. External learning – Digital repositories and hypermedia design.

Suggested Evaluation Methods:
1. Quizzes on multimedia hardware and compression techniques.
2. Tutorial – Hypermedia design.

UNIT V MULTIMEDIA APPLICATIONS FOR THE WEB AND MOBILE PLATFORMS

Reality, Internet multimedia content distribution, Multimedia Information sharing – social media sharing, cloud computing for multimedia services, interactive cloud gaming. Multimedia information retrieval.

**Suggested Activities:**
1. External learning – Game consoles.
2. External learning – VRML scripting languages.

**Suggested Evaluation Methods:**
1. Demonstration of simple interactive games.
2. Tutorial – Simple VRML program.

**COURSE OUTCOMES:**
CO1: Handle the multimedia elements effectively.
CO2: Articulate the concepts and techniques used in multimedia applications.
CO3: Develop effective strategies to deliver Quality of Experience in multimedia applications.
CO4: Design and implement algorithms and techniques applied to multimedia objects.
CO5: Design and develop multimedia applications following software engineering models.

**REFERENCES:**

**NE407 WIRELESS SENSOR NETWORKS AND PROTOCOLS**

**COURSE OBJECTIVES:**
- To learn about the issues in the design of wireless ad hoc networks
- To understand the working of protocols in different layers of mobile ad hoc and sensor networks
- To expose the students to different aspects in sensor networks
- To understand various security issues in ad hoc and sensor networks and solutions to the issues

**UNIT I WIRELESS SENSOR NETWORK ARCHITECTURE**
Introduction to wireless sensor networks- Challenges, Comparison with ad hoc network, Node architecture and Network architecture, design principles, Service interfaces, Gateway, Short range radio communication standards - Physical layer and transceiver design considerations.

**UNIT II MAC & ROUTING IN WIRELESS SENSOR NETWORKS**
Protocols

UNIT III TRANSPORT & QOS IN WIRELESS SENSOR NETWORKS 9

UNIT IV SECURITY IN AD HOC AND SENSOR NETWORKS 9

UNIT V TOOLS FOR WSN 9

COURSE OUTCOMES:
CO1: Identify different issues in wireless ad hoc and sensor networks
CO2: To analyze protocols developed for ad hoc and sensor networks
CO3: To identify and understand security issues in ad hoc and sensor networks
CO4: To learn the significance of Transport layer and QoS in wireless sensor networks.
CO5: To analyze the tools used for Wireless Sensor Networks

TOTAL: 45 PERIODS

REFERENCES

CP4093 INFORMATION RETRIEVAL TECHNIQUES L T P C
3 0 0 3

COURSE OBJECTIVES:
- To understand the basics of information retrieval with pertinence to modeling, 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, web search
- To get an understanding of machine learning techniques for text classification and clustering.
- To understand the concepts of digital libraries

UNIT I  INTRODUCTION: MOTIVATION

UNIT II  MODELING

UNIT III  INDEXING
Static and Dynamic Inverted Indices – Index Construction and Index Compression. Searching - Sequential Searching and Pattern Matching. Query Operations -Query Languages – Query Processing - Relevance Feedback and Query Expansion - Automatic Local and Global Analysis – Measuring Effectiveness and Efficiency

UNIT IV  EVALUATION AND PARALLEL INFORMATION RETRIEVAL

UNIT V  SEARCHING THE WEB

COURSE OUTCOMES:
CO1: Build an Information Retrieval system using the available tools.
CO2: Identify and design the various components of an Information Retrieval system.
CO3: Categorize the different types of IR Models.
CO4: Apply machine learning techniques to text classification and clustering which is used for efficient Information Retrieval.
CO5: Design an efficient search engine and analyze the Web content structure.

TOTAL: 45 PERIODS

REFERENCES
COURSE OBJECTIVES:
- Formalise different types of entities and relationships as nodes and edges and represent this information as relational data.
- Understand the fundamental concepts in analyzing the large-scale data that are derived from social networks.
- Understand the basic concepts and principles of different theoretical models of social networks analysis.
- Transform data for analysis using graph-based and statistics-based social network measures.
- Choose among social network designs based on research goals.

UNIT I GRAPH THEORY AND STRUCTURE

UNIT II SOCIAL NETWORK GRAPH ANALYSIS
Social network exploration/processing and properties: Finding overlapping communities, similarity between graph nodes, counting triangles in graphs, neighborhood properties of graphs. Pregel paradigm and Apache Giraph graph processing system.

UNIT III INFORMATION DIFFUSION IN SOCIAL NETWORKS

UNIT IV CASCADING IN SOCIAL NETWORKS

UNIT V LINK ANALYSIS & COMMUNITY DETECTION

**SUGGESTED ACTIVITIES:**
1: Twitter Intelligence project performs tracking and analysis of the Twitter
2: Large-Scale Network Embedding as Sparse Matrix Factorization
3: Implement how Information Propagation on Twitter
4: Social Network Analysis and Visualization software application.
5: Implement the Structure of Links in Networks

**COURSE OUTCOMES:**
CO1: Plan and execute network analytical computations.
CO2: Implement mining algorithms for social networks
CO3: Analyze and evaluate social communities.
CO4: Use social network analysis in behavior analytics
CO5: Perform mining on large social networks and illustrate the results.

**TOTAL : 45 PERIODS**

**REFERENCES**
1. Practical Social Network Analysis with Python, Krishna Raj P. M. Ankith Mohan and K. G. Srinivasa. Springer, 2018
2. SOCIAL NETWORK ANALYSIS: METHODS AND APPLICATIONS, STANLEY WASSERMAN, and KATHERINE F' AUST. CAMBRIDGE UNIVERSITY PRESS, 2012

**IF4093**

**GPU COMPUTING**

**UNIT I**

**GPU ARCHITECTURE**
Evolution of GPU architectures - Understanding Parallelism with GPU –Typical GPU Architecture - CUDA Hardware Overview - Threads, Blocks, Grids, Warps, Scheduling - Memory Handling with CUDA: Shared Memory, Global Memory, Constant Memory and Texture Memory.

**UNIT II**

**CUDA PROGRAMMING**
Using CUDA - Multi GPU - Multi GPU Solutions - Optimizing CUDA Applications: Problem Decomposition, Memory Considerations, Transfers, Thread Usage, Resource Contentions.
UNIT III PROGRAMMING ISSUES


UNIT IV OPENCL BASICS


UNIT V ALGORITHMS ON GPU

Parallel Patterns: Convolution, Prefix Sum, Sparse Matrix - Matrix Multiplication - Programming Heterogeneous Cluster.

SUGGESTED ACTIVITIES:

1. Debugging Lab
2. Performance Lab
3. Launching Nsight
4. Running Performance Analysis
5. Understanding Metrics
6. NVIDIA Visual Profiler
7. Matrix Transpose Optimization
8. Reduction Optimization

COURSE OUTCOMES:

CO1: Describe GPU Architecture
CO2: Write programs using CUDA, identify issues and debug them
CO3: Implement efficient algorithms in GPUs for common application kernels, such as matrix multiplication
CO4: Write simple programs using OpenCL
CO5: Identify efficient parallel programming patterns to solve problems

TOTAL: 45 PERIODS

REFERENCES

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

Suggested Evaluation Methods:
• Demonstration of the mini project.
• Tutorial - Virtual reality application.

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

IF4072 DESIGN THINKING L T P C 3 0 0 3

COURSE OBJECTIVES:
• To provide a sound knowledge in UI & UX
• To understand the need for UI and UX
• Research Methods used in Design
• Tools used in UI & UX
• Creating a wireframe and prototype

UNIT I UX LIFECYCLE TEMPLATE

UNIT II CONTEXTUAL INQUIRY

UNIT III DESIGN THINKING, IDEATION, AND SKETCHING

UNIT IV UX GOALS, METRICS, AND TARGETS
Practical tips and cautions for creating UX targets. How UX targets help manage the user experience engineering process.

UNIT V  ANALYSING USER EXPERIENCE

SUGGESTED ACTIVITIES:
1: Hands on Design Thinking process for a product
2: Defining the Look and Feel of any new Project
3: Create a Sample Pattern Library for that product (Mood board, Fonts, Colors based on UI principles)
4: Identify a customer problem to solve.
5: Conduct end-to-end user research - User research, creating personas, Ideation process (User stories, Scenarios), Flow diagrams, Flow Mapping

COURSE OUTCOMES:
CO1: Build UI for user Applications
CO2: Use the UI Interaction behaviors and principles
CO3: Evaluate UX design of any product or application
CO4: Demonstrate UX Skills in product development
CO5: Implement Sketching principles

TOTAL : 45 PERIODS

REFERENCES
4. Lean UX: Designing Great Products with Agile Teams, Gothelf, Jeff, Seiden, and Josh. O'Reilly Media, 2016
5. Designing UX: Prototyping: Because Modern Design is Never Static, Ben Coleman, and Dan Goodwin. SitePoint, 2017

IF4094  PATTERN RECOGNITION

COURSE OBJECTIVES:
- Understand the in-depth concept of Pattern Recognition
- Implement Bayes Decision Theory
- Understand the in-depth concept of Perception and related Concepts
- Understand the concept of ML Pattern Classification
- Understand the concept of DL Pattern Recognition

UNIT I  PATTERN RECOGNITION

UNIT II  STATISTICAL PATTERN RECOGNITION

UNIT III  BAYES DECISION THEORY CLASSIFIERS

UNIT IV  LINEAR DISCRIMINANT FUNCTIONS

UNIT V  NONLINEAR CLASSIFIERS

SUGGESTED ACTIVITIES:
1: Car Sales Pattern Classification using Support Vector Classifier
2: Avocado Sales Pattern Recognition using Linear regression
3: Tracking Movements by implementing Pattern Recognition
4: Detecting Lanes by implementing Pattern Recognition
5: Pattern Detection in SAR Images
COURSE OUTCOMES:
CO1: Discover imaging, and interpretation of temporal patterns
CO2: Identify Structural Data Patterns
CO3: Implement Pattern Classification using Machine Learning Classifiers
CO4: Implement Pattern Recognition using Deep Learning Models
CO5: Implement Image Pattern Recognition

TOTAL: 45 PERIODS

REFERENCES
2. Pattern Recognition, Jürgen Beyerer, Matthias Richter, and Matthias Nagel. 2018

IF4005 BLOCKCHAIN AND CRYPTOCURRENCY L T P C
3 0 2 4

COURSE OBJECTIVES:
- How assets can be transferred in a blockchain network
- Detailed Study of Blockchain
- Deploying transactions on the Blockchain node
- Learn, develop, and advance their skills in Ethereum development
- In depth knowledge on Smart Contract Deployment

UNIT I BLOCKCHAIN CONCEPTS

UNIT II ETHEREUM BLOCKCHAIN

UNIT III SMART CONTRACT WITH SOLIDITY
UNIT IV
SMART CONTRACT SECURITY

UNIT V
CRYPTOCURRENCY
About Crypto Currency Bitcoin, Bitcoin public addresses, Bitcoin Transaction output, Bitcoin Transaction input, Bitcoin Transaction verification, Mining and consensus, Mining a block, Verification of transactions, Key management, Wallet balance, Altcoins, Proof of Storage, Proof of Stake (PoS), Proof of coinage, Proof of Deposit, Stellar (XLM), Binance Coin (BNB), Cardano (ADA), Dogecoin (DOGE), XRP (XRP), Litecoin (LTC).

LIST EXPERIMENTS
1: Voting with Ethereum Blockchain
2: Building a Betting App
3: Implement a new Crypto Currency
4: Developing a Sales Order DApp
5: Develop a Supply Chain DApp

COURSE OUTCOMES:
CO1: Record transactions between parties
CO2: Implement advanced concepts such as privacy, security and decentralized file management.
CO3: Analyse how cryptocurrencies are created, transacted, and stored
CO4: Design decentralized applications for countless applications
CO5: Instantiate an Ethereum application on the network.

TOTAL : 45+30=75 PERIODS

REFERENCES
2. Mastering Ethereum, Andreas M. Antonopoulos and Dr. Gavin Wood. O’Reilly Media, 2018
4. The Blockchain Developer, Elad Elrom. Apress, 2019
COURSE OBJECTIVES:

- Learn Depth Concept of GO Programming
- How to develop Smart Contracts
- How to Deploy Smart Contracts
- Front end Development using Angular
- Implementing Bitcoin Network

UNIT I  GETTING STARTED WITH GO PROGRAMMING  8

UNIT II  BUILDING DISTRIBUTED APPLICATIONS IN GIN  8

UNIT III  SMART CONTRACTS USING SOLIDITY & GO  10

UNIT IV  DEVELOPING DAPPS  9

UNIT V  BITCOIN NETWORK  10

LIST OF EXPERIMENTS:  30
1: Developing Purchase Order DApp
COURSE OUTCOMES:
CO1: Learn How to Compile and Deploy Solidity
CO2: Use Golang to Connect to Ethereum
CO3: Deploy Ethereum Smart Contracts Using Golang
CO4: Develop DApp using Angular
CO5: Develop Bitcoin Application

REFERENCES

IF4006 FORECASTING AND OPTIMIZATION L T P C
3 0 2 4

COURSE OBJECTIVES:
- Knowledge to build and apply time series forecasting models
- Learn what attributes make data a time series.
- Learn about seasonality, trends, and cyclical patterns.
- Load and Summarize Dataset
- Load and Plot Dataset

UNIT I \ TIME SERIES FORECASTING 8

UNIT II \ TIME SERIES DATA PREPARATION 8
UNIT III LINEAR STATIONARY MODELS


UNIT IV REGRESSION EXTENSION TECHNIQUES FOR TIME-SERIES DATA


UNIT V DEEP LEARNING FOR TIME SERIES FORECASTING


LIST OF EXPERIMENTS:

1: Time Series Prediction of stock prices using ARIMA Model
2: Time Series Prediction of rainfall data using SARIMA Model
3: Forecasting of agricultural commodity pricing using pro
4: Time Series Prediction of Car Sales using ARIMA and SARIMA Model
5: Predicting Air Traffic Flow using Deep Learning

COURSE OUTCOMES:

CO1: Compile and fit time series forecasting model to training data
CO2: Evaluate Forecast Model
CO3: Analysis and compare ARIMA vs SARIMA vs Deep Learning Vs Prophet
CO4: How to evaluate a Prophet model on a hold-out dataset.
CO5: Assess trained model performance

TOTAL : 45+30 = 75 PERIODS

REFERENCES

1. Machine Learning for Time Series Forecasting with Python, Francesca Lazzeri, PhD. Wiley 2020
2. Practical Time Series Analysis, Dr. Avishek Pal and Dr. PKS Prakash. Packt Publishing, 2017
4. DEEP TIME SERIES FORECASTING With PYTHON, Dr. N.D Lewis, 2016
5. Practical Time Series Analysis, Aileen Nielsen. O'Reilly Media, 2019
COURSE OBJECTIVES:

- Develop and Train Deep Neural Networks.
- Develop a CNN, R-CNN, Fast R-CNN, Faster-R-CNN, Mask-RCNN for detection and recognition
- Build and train RNNs, work with NLP and Word Embeddings
- The internal structure of LSTM and GRU and the differences between them
- The Auto Encoders for Image Processing

UNIT I
DEEP LEARNING CONCEPTS

UNIT II
NEURAL NETWORKS

UNIT III
CONVOLUTIONAL NEURAL NETWORK

UNIT VI
NATURAL LANGUAGE PROCESSING USING RNN

UNIT V
DEEP REINFORCEMENT & UNSUPERVISED LEARNING

LIST OF EXPERIMENTS:
1: Feature Selection from Video and Image Data
2: Image and video recognition
COURSE OUTCOMES:
CO1: Feature Extraction from Image and Video Data
CO2: Implement Image Segmentation and Instance Segmentation in Images
CO3: Implement image recognition and image classification using a pretrained network (Transfer Learning)
CO4: Traffic Information analysis using Twitter Data
CO5: Autoencoder for Classification & Feature Extraction

TOTAL: 45+30=75 PERIODS

REFERENCES
1. Deep Learning A Practitioner's Approach Josh Patterson and Adam Gibson O'Reilly Media, Inc.2017
2. Learn Keras for Deep Neural Networks, Jojo Moolayil, Apress,2018
4. Deep Learning with Python, FRANÇOIS CHOLLET, MANNING SHELTER ISLAND,2017

IF4073  DEVOPS AND MICROSERVICES  L T P C
                    3 0 2 4

COURSE OBJECTIVES:
• To learn the basic concepts and terminology of DevOps
• To gain knowledge on Devops platform
• To understand building and deployment of code
• To be familiar with DevOps automation tools
• To learn basics of MLOps

UNIT I  INTRODUCTION  9+6
Software Engineering - traditional and Agile process models - DevOps -Definition - Practices - DevOps life cycle process - need for DevOps –Barriers

UNIT II  DEVS Platform AND SERVICES  9+6

UNIT III  BUILDING , TESTING AND DEPLOYMENT  9+6
Microservices architecture - coordination model - building and testing - Deployment pipeline - Development and Pre-commit Testing -Build and Integration Testing - continuous integration - monitoring - security - Resources to Be Protected - Identity Management

UNIT IV DEVOPS AUTOMATION TOOLS  9+6
Infrastructure Automation- Configuration Management - Deployment Automation - Performance
UNIT V  MLOps  9+6
MLOps - Definition - Challenges - Developing Models - Deploying to production - Model Governance - Real world examples

SUGGESTED ACTIVITIES:
1: Creating a new Git repository, cloning existing repository, Checking changes into a Git repository, Pushing changes to a Git remote, Creating a Git branch
2: Installing Docker container on windows/Linux, issuing docker commands
3: Building Docker images for Python Application
4: Setting up Docker and Maven in Jenkins and First Pipeline Run
5: Running Unit Tests and Integration Tests in Jenkins Pipelines

COURSE OUTCOMES:
CO1: Implement modern software Engineering process
CO2: work with DevOps platform
CO3: build, test and deploy code
CO4: Explore DevOps tools
CO5: Correlate MLOps concepts with real time examples

TOTAL : 75 PERIODS

REFERENCES
4. Mark Treveil, and the Dataiku Team - "Introducing MLOps" - O’Reilly Media, 2020

MP4292 MOBILE APPLICATION DEVELOPMENT  L T P C
  3 0 2 4

COURSE OBJECTIVES:
• To facilitate students to understand android SDK
• To help students to gain basic understanding of Android application development
• To understand how to work with various mobile application development frameworks
• To inculcate working knowledge of Android Studio development tool
• To learn the basic and important design concepts and issues of development of mobile applications

UNIT I  MOBILE PLATFORM AND APPLICATIONS  9

UNIT II  INTRODUCTION TO ANDROID  9
Introduction to Android: The Android Platform, Android SDK, Eclipse Installation, Android

UNIT III ANDROID APPLICATION DESIGN ESSENTIALS  9

UNIT IV ANDROID USER INTERFACE DESIGN & MULTIMEDIA  9
User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation. Playing Audio and Video, Recording Audio and Video, Using the Camera to Take and Process Pictures

UNIT V ANDROID APIs  9
Using Android Data and Storage APIs, Managing data using Sqlite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.

TOTAL:45 PERIODS

LIST OF EXPERIMENTS: (30)
1. Develop an application that uses GUI components, Font, Layout Managers and event listeners.
2. Develop an application that makes use of databases
3. Develop a native application that uses GPS location information
4. Implement an application that creates an alert upon receiving a message
5. Develop an application that makes use of RSS Feed.
6. Create an application using Sensor Manager
7. Create an android application that converts the user input text to voice.
8. Develop a Mobile application for simple and day to day needs (Mini Project)

COURSE OUTCOMES:
CO1: Identify various concepts of mobile programming that make it unique from programming for other platforms
CO2: Create, test and debug Android application by setting up Android development
CO3: Demonstrate methods in storing, sharing and retrieving data in Android applications
CO4: Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces
CO5: Create interactive applications in android using databases with multiple activities including audio, video and notifications and deploy them in marketplace

TOTAL: 45+30=75 PERIODS

REFERENCES
4. Reto Meier, “Professional Android 2 Application Development”, Wiley India Pvt Ltd, 2010
5. Mark L Murphy, “Beginning Android”, Wiley India Pvt Ltd, 2009
CP4292 MULTICORE ARCHITECTURE AND PROGRAMMING

COURSE OBJECTIVES:
- To understand the need for multi-core processors, and their architecture.
- To understand the challenges in parallel and multithreaded programming.
- To learn about the various parallel programming paradigms.
- To develop multicore programs and design parallel solutions.

UNIT I MULTI-CORE PROCESSORS

UNIT II PARALLEL PROGRAM CHALLENGES
Performance – Scalability – Synchronization and data sharing – Data races – Synchronization primitives (mutexes, locks, semaphores, barriers) – deadlocks and livelocks – communication between threads (condition variables, signals, message queues and pipes).

UNIT III SHARED MEMORY PROGRAMMING WITH OPENMP

UNIT IV DISTRIBUTED MEMORY PROGRAMMING WITH MPI
MPI program execution – MPI constructs – libraries – MPI send and receive – Point-to-point and Collective communication – MPI derived datatypes – Performance evaluation

UNIT V PARALLEL PROGRAM DEVELOPMENT
Case studies – n-Body solvers – Tree Search – OpenMP and MPI implementations and comparison.

TOTAL: 45 PERIODS

PRACTICALS:
1. Write a simple Program to demonstrate an OpenMP Fork-Join Parallelism.
2. Create a program that computes a simple matrix-vector multiplication b=Ax, either in C/C++. Use OpenMP directives to make it run in parallel.
3. Create a program that computes the sum of all the elements in an array A (C/C++) or a program that finds the largest number in an array A. Use OpenMP directives to make it run in parallel.
4. Write a simple Program demonstrating Message-Passing logic using OpenMP.

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5. Implement the All-Pairs Shortest-Path Problem (Floyd's Algorithm) Using OpenMP.
6. Implement a program Parallel Random Number Generators using Monte Carlo Methods in OpenMP.
7. Write a Program to demonstrate MPI-broadcast-and-collective-communication in C.
8. Write a Program to demonstrate MPI-scatter-gather-and-all gather in C.
9. Write a Program to demonstrate MPI-send-and-receive in C.
10. Write a Program to demonstrate by performing-parallel-rank-with-MPI in C.

TOTAL: 30 PERIODS

TOTAL: 45+30 = 75 PERIODS

COURSE OUTCOMES:
At the end of the course, the students should be able to:
CO1: Describe multicore architectures and identify their characteristics and challenges.
CO2: Identify the issues in programming Parallel Processors.
CO3: Write programs using OpenMP and MPI.
CO4: Design parallel programming solutions to common problems.
CO5: Compare and contrast programming for serial processors and programming for parallel processors.

REFERENCES:

BC4291 ETHICAL HACKING L T P C
3 0 2 4

COURSE OBJECTIVES:
- To understand and analyze security threats & countermeasures related to ethical hacking.
- To learn the different levels of vulnerabilities at a system level.
- To gain knowledge on the different hacking methods for web services and session hijacking.
- To understand the hacking mechanisms on how a wireless network is hacked.

UNIT I ETHICAL HACKING OVERVIEW & VULNERABILITIES
Understanding the importance of security, Concept of ethical hacking and essential Terminologies-Threat, Attack, Vulnerabilities, Target of Evaluation, Exploit. Phases involved in hacking
UNIT II
FOOTPRINTING & PORT SCANNING  9
Footprinting - Introduction to foot printing, Understanding the information gathering methodology of the hackers, Tools used for the reconnaissance phase, Port Scanning - Introduction, using port scanning tools, ping sweeps, Scripting Enumeration-Introduction, Enumerating windows OS & Linux OS

UNIT III
SYSTEM HACKING  9
Aspect of remote password guessing, Role of eavesdropping ,Various methods of password cracking, Keystroke Loggers, Understanding Sniffers ,Comprehending Active and Passive Sniffing, ARP Spoofing and Redirection, DNS and IP Sniffing, HTTPS Sniffing.

UNIT IV
HACKING WEB SERVICES & SESSION HIJACKING  9
Web application vulnerabilities, application coding errors, SQL injection into Back-end Databases, cross-site scripting, cross-site request forging, authentication bypass, web services and related flaws, protective http headers. Understanding Session Hijacking, Phases involved in Session Hijacking, Types of Session Hijacking, Session Hijacking Tools

UNIT V
HACKING WIRELESS NETWORKS  9
Introduction to 802.11, Role of WEP, Cracking WEP Keys, Sniffing Traffic, Wireless DOS attacks, WLANScanners, WLANSniffers,HackingTools,Securing Wireless Network

LIST OF EXPERIMENTS:
1: Study of Guessing username and passwords using Hydra
2: Experiment on Recovering password Hashes
3: Implementation to crack Linux passwords
4: Experiments on SQL injections
5: Analysis of WEP flaws
6: Experiments on Wireless DoS Attacks
7: Implementation of Buffer Overflow Prevention
8: Prevention against Cross Site Scripting Attacks
9: Experiments on Metasploit Framework
10: Implementation to identify web vulnerabilities
11. Wireshark: Experiment to monitor live network capturing packets and analyzing over the live network
12. LOIC: DoS attack using LOIC
13. FTK: Bit level forensic analysis of evidential image and reporting the same.
14. Darkcomet : Develop a malware using Remote Access Tool Darkcomet to take a remote access over network
15. HTTrack: Website mirroring using Httrack and hosting on a local network.
16. XSS: Inject a client side script to a web application
17. Emailtrackerpro: Email analysis involving header check, tracing the route. Also perform a check on a spam mail and non-spam mail

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: Understand vulnerabilities, mechanisms to identify vulnerabilities/threats/attacks
CO2: Use tools to identify vulnerable entry points
MU4151 ADVANCED GRAPHICS AND ANIMATION  L T P C  3 0 2 4

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

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

UNIT II  TRANSFORMATIONS  9
Suggested Activities:
1. Flipped classroom on rasterization.
2. Practical - Execute any shader application and set viewports, windows, draw polylines and explore the keyboard and mouse interaction routines.
3. Familiarize with transformations and hierarchical in OpenGL using a matrix stack

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

UNIT III FRACTALS

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

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

UNIT IV ADVANCED GRAPHICS

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

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

UNIT V ANIMATION
Overview of Animation Techniques – Keyframing, 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:**
1. Exploration of various animation techniques and tools (Self Study).
2. Carry out small projects like Design of small animation movies using any tools with good aesthetic sense.

**Suggested Evaluation Methods**
1. Discussion on various animation techniques and tools.
2. Projects may be evaluated based on the theme, design, creativity, tools and aesthetic sense.

**PRACTICAL EXERCISES:**
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.

**TOTAL : 45+30=75 PERIODS**

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

CO1: Understand and apply 3d graphics algorithms related to transformations, illumination, texturing, etc. With the aid of software libraries.

CO2: Develop interactive applications using 3d graphics

CO3: Investigate and apply software libraries for 3d graphics and related software needs.

CO4: Understand the issues relevant to computer animation.

CO5: Describe and synthesize character animation techniques, including motion, changing their facial expressions and crowd behavior.

**REFERENCES:**

### AUDIT COURSES

<table>
<thead>
<tr>
<th>Code</th>
<th>Course Title</th>
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<td>AX4091</td>
<td>ENGLISH FOR RESEARCH PAPER WRITING</td>
<td>2</td>
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**COURSE 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 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**

**COURSE 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
REFERENCES:

AX4092 DISASTER MANAGEMENT

COURSE 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
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
Economic Damage, Loss of Human and Animal Life, Destruction Of Ecosystem, Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Faminies, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

UNIT III DISASTER PRONE AREAS IN INDIA
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
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
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

COURSE 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

REFERENCES:


AX4093 CONSTITUTION OF INDIA

COURSE 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 Revolutionin1917and 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
Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

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

COURSE 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.

AX4094 தமிழ் தொடரியம் L T P C
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UNIT Iசங்க தொடரியம் 6
1. துவக்குச் செல்லும் ஊடுருவியம்
   - தற்கொலை, தேவதேம், வேலூர்
2. அதிகாரம் (82)
   - தேவதேம் தொல்கொலை அரங்கம்
3. குறிஞ்சிப் பொட்டின் மலர்க்கொட்சி
4. புறநூறு (95, 195)
   - பொடிய திகனியப் பதவியார்

UNIT IIஅறநநறித் தமிழ் 6
1. அறநநறித் திருவள்ளுவர் வகுத்த திருவள்ளுவர்
   - அங்கு மூலிகை, அன்னருவர், அகரங்கை, சோர், பசம்
2. பிற அறநூல்கள் - தொகுதிய மற்றும்
   - தொகுதிய சிதைப்புக் குடிக்கும், அகரங்கை (சோர், பசம், மூலிகை மற்றும் பசம்)
UNIT III

இரட்டடக் காப்பியங்கள்

1. கணக்கியிலிருந்து புரட்சி
   - நிறுவனங்கள் அமைக்கும் கட்டுமான
2. மூக்கும் ஒட்டியிழங்கள் பதிவிற்கும்
   - விளைந்துருவம் அவசர்ச்சிப் பாதுகாப்பு

UNIT IV

அதிசெல்வியுறு

1. கிணுனாய்ச்சிக் முன்பருட்பாந்த
   - பதிவு மாற்றங்கள் செய்ய வேண்டும் செயற்கைகள், வேதியியல் வல்லுனர்
   - பார்வை வல்லுனர், அமினுகள் வல்லுனர் போன்றிகள் வல்லுனர்
   - ஆப்பர் போர்கள்
2. செயல்நிலை
   - அரசியல் செயல்நிலைப் போர்கள்
3. சிறந்தபடி (617, 618)
   - தமிழ் வல்லுனர் விளக்கங்கள்
4. காண்ட்பாத்திரத் தேசியில் வேலாணார்
5. புதுநோய்
   - விளக்குமை வல்லுனர்கள்
6. அகரக்குறிக்குறிக்கு (4) - ஏணை
   குறிப்பிட்டத்தக்கு (11) - ஏணை
   குறிப்பிட்டத்தக்கு (11) - பார்வை போர்
   குறிப்பிட்டத்தக்கு 50 (27) - போர்

UNIT V

நவீன தமிழ் இலக்கியம்

1. உகரநகடத் தமிழ்
   - கட்டுகரடி பரிமாற்றம்
   - மரபு மாற்றம்
   - கைலாச வல்லுனர்
   - பார்வை வல்லுனர்
   - மசைசு வல்லுனர்
2. நொட்டு விடுத்தகாண்கள்
3. பயண விடுத்தகாண்கள்
4. தபணு விடுத்தகாண்கள்
5. அறிவியல் தமிழ்
6. இகணயத்தில்
7. சுற்றுசூழல்

TOTAL: 30 PERIODS

தமிழ் இலக்கிய சென்றுபிடிக்கார் / போர்க்கார்

1. தமிழ் விளக்கம் தமிழியகம் (Tamil Virtual University)
   - www.tamilvu.org
2. தமிழ் விக்கிப்பீடியொ (Tamil Wikipedia)  
   -https://ta.wikipedia.org
3. தர்மபுர ஆதரவு தமிழிடம்
4. வொழ்வியல் கல்லற்றியம்  
   - தமிழ் பல்கலைக்கழகம். கார்ப்
5. தமிழ்கல்லற்றியம்  
   - தமிழ் பல்கலைக்கழகம். தஞூர்
6. அறிவியல் கல்லற்றியம்  
   - தமிழ் பல்கலைக்கழகம். கார்ப்