ANNA UNIVERSITY, CHENNAI
NON - AUTONOMOUS COLLEGES AFFILIATED ANNA UNIVERSITY
M.E. COMPUTER SCIENCE AND ENGINEERING
REGULATIONS – 2021
CHOICE BASED CREDIT SYSTEM

1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):
   I. Develop proficiency as a computer science engineer with an ability to solve a wide range of computational problems and have sustainable development in industry or any other work environment.
   II. Analyze and adapt quickly to new environments and technologies, gather new information, and work on emerging technologies to solve multidisciplinary engineering problems.
   III. Possess the ability to think analytically and logically to understand technical problems with computational systems for a lifelong learning which leads to pursuing research.
   IV. Adopt ethical practices to collaborate with team members and team leaders to build technology with cutting-edge technical solutions for computing systems.
   V. Strongly focus on design thinking and critical analysis to create innovative products and become entrepreneurs.

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 of Computer Science and Engineering.
   4. Efficiently design, build and develop system application software for distributed and centralized computing environments in varying domains and platforms.
   5. Understand the working of current Industry trends, the new hardware architectures, the software components and design solutions for real world problems by Communicating and effectively working with professionals in various engineering fields and pursue research orientation for a lifelong professional development in computer and automation arenas.
   6. Model a computer based automation system and design algorithms that explore the understanding of the tradeoffs involved in digital transformation.
**ANNA UNIVERSITY, CHENNAI**

**NON - AUTONOMOUS COLLEGES AFFILIATED ANNA UNIVERSITY**

**M.E. COMPUTER SCIENCE AND ENGINEERING**

**REGULATIONS – 2021**

**CHOICE BASED CREDIT SYSTEM**

**I TO IV SEMESTERS CURRICULA AND SYLLABI**

**SEMESTER I**

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**TOTAL NO. OF CREDITS: 75**

### PROFESSIONAL ELECTIVES

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### RESEARCH METHODOLOGY AND IPR COURSES (RMC)

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MA4151  APPLIED PROBABILITY AND STATISTICS FOR COMPUTER SCIENCE ENGINEERS

COURSE OBJECTIVES:

- To encourage students to develop a working knowledge of the central ideas of Linear Algebra.
- To enable students to understand the concepts of Probability and Random Variables.
- To understand the basic probability concepts with respect to two dimensional random variables along with the relationship between the random variables and the significance of the central limit theorem.
- To apply the small / large sample tests through Tests of hypothesis.
- To enable the students to use the concepts of multivariate normal distribution and principal components analysis.

UNIT I  LINEAR ALGEBRA  12

UNIT II  PROBABILITY AND RANDOM VARIABLES  12

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

UNIT IV  TESTING OF HYPOTHESIS  12
Sampling distributions – Type I and Type II errors – Small and Large samples – Tests based on Normal, t, Chi square and F distributions for testing of mean, variance and proportions – Tests for independence of attributes and goodness of fit.

UNIT V  MULTIVARIATE ANALYSIS  12
Random vectors and matrices – Mean vectors and covariance matrices – Multivariate normal density and its properties – Principal components – Population principal components – Principal components from standardized variables.

TOTAL : 60 PERIODS

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

CO1: apply the concepts of Linear Algebra to solve practical problems.
CO2: use the ideas of probability and random variables in solving engineering problems.
CO3: be familiar with some of the commonly encountered two dimensional random variables and be equipped for a possible extension to multivariate analysis.
CO4: use statistical tests in testing hypotheses on data.
**REFERENCES:**


**RM4151**

RESEARCH METHODOLOGY AND IPR  
L T P C  
2 0 0 2

**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  

**REFERENCES**


**CP4151 ADVANCED DATA STRUCTURES AND ALGORITHMS**  
**L T P C**  
3 0 0 3

**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**  
**ANALYSIS**


**UNIT II HIERARCHICAL DATA STRUCTURES**  


**UNIT III GRAPHS**  


**UNIT IV ALGORITHM DESIGN TECHNIQUES**  


**UNIT V NP COMPLETE AND NP HARD**  


**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 L T P C
3 0 2 4

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 15
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
- Nested Queries

Transaction Control Language
- Commit, Rollback and Save Points

UNIT II DISTRIBUTED DATABASES, ACTIVE DATABASES AND OPEN DATABASE CONNECTIVITY


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


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


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

TOTAL : 75 PERIODS

COURSE OUTCOMES
At the end of the course, the students will be able to
CO1: Convert the ER-model to relational tables, populate relational databases 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

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 9

UNIT II WIRELESS NETWORKS 9
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 9

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. Houda Labiod, Costantino de Santis, Hossam Affifi “Wi-Fi, Bluetooth, Zigbee and WiMax”, Springer 2007 (UNIT 2)

CP4154 PRINCIPLES OF PROGRAMMING LANGUAGES

COURSE OBJECTIVES:
- To understand and describe syntax and semantics of programming languages
- To understand data, data types, and basic statements
- To understand call-return architecture and ways of implementing them
- To understand object-orientation, concurrency, and event handling in programming languages
- To develop programs in non-procedural programming paradigms

UNIT I SYNTAX AND SEMANTICS

UNIT II DATA, DATA TYPES, AND BASIC STATEMENTS

UNIT III SUBPROGRAMS AND IMPLEMENTATIONS

UNIT IV OBJECT-ORIENTATION, CONCURRENCY, AND EVENT HANDLING

UNIT V FUNCTIONAL AND LOGIC PROGRAMMING LANGUAGES
Introduction to lambda calculus – fundamentals of functional programming languages – Programming with Scheme – Programming with ML – Introduction to logic and logic programming – Programming with Prolog – multi-paradigm languages

TOTAL : 45 PERIODS
COURSE OUTCOMES:

CO1: Describe syntax and semantics of programming languages
CO2: Explain data, data types, and basic statements of programming languages
CO3: Design and implement subprogram constructs
CO4: Apply object-oriented, concurrency, and event handling programming constructs
CO5: Develop programs in Scheme, ML, and Prolog and Understand and adopt new programming language

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
12: Activity Selection and Huffman Coding Implementation

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.

REFERENCES:


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
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

UNIT III IoT PROTOCOLS AND TECHNOLOGY

UNIT IV CLOUD ARCHITECTURE BASICS
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

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 application

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:

CP4292  MULTICORE ARCHITECTURE AND PROGRAMMING  L  T  P  C
3  0  2  4

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  9

UNIT II  PARALLEL PROGRAM CHALLENGES  9
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  9

UNIT IV  DISTRIBUTED MEMORY PROGRAMMING WITH MPI  9
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  9
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.
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:

CP4252 MACHINE LEARNING L T P C
3 0 2 4

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

UNIT II SUPERVISED LEARNING

UNIT III UNSUPERVISED LEARNING AND REINFORCEMENT LEARNING

UNIT IV PROBABILISTIC METHODS FOR LEARNING
UNIT V  NEURAL NETWORKS AND DEEP LEARNING

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: 30 PERIODS

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

SE4151 ADVANCED SOFTWARE ENGINEERING

COURSE OBJECTIVES:
- To understand the rationale for software development process models
- To understand why the architectural design of software is important;
- To understand the five important dimensions of dependability, namely, availability, reliability, safety, security, and resilience.
To understand the basic notions of a web service, web service standards, and service-oriented architecture;
To understand the different stages of testing from testing during development of a software system

UNIT I SOFTWARE PROCESS & MODELING

UNIT II SOFTWARE DESIGN

UNIT III SYSTEM DEPENDABILITY AND SECURITY

UNIT IV SERVICE-ORIENTED SOFTWARE ENGINEERING, SYSTEMS ENGINEERING AND REAL-TIME SOFTWARE ENGINEERING

UNIT V SOFTWARE TESTING AND SOFTWARE CONFIGURATION MANAGEMENT

SUGGESTED ACTIVITIES
1. Comparatively analysing different Agile methodologies.
2. Describing the scenarios where ‘Scrum’ and ‘Kanban’ are used.
3. Mapping the data flow into suitable software architecture.
4. Developing behavioural representations for a class or component.
5. Implementing simple applications as RESTful service.

TOTAL: 45 PERIODS
COURSE OUTCOMES:
The Students will be able to

CO1: Identify appropriate process models based on the Project requirements
CO2: Understand the importance of having a good Software Architecture.
CO3: Understand the five important dimensions of dependability, namely, availability, reliability, safety, security, and resilience.
CO4: Understand the basic notions of a web service, web service standards, and service-oriented architecture;
CO5: Be familiar with various levels of Software testing

REFERENCES:

CP4211 TERM PAPER WRITING AND SEMINAR L T P C 0 0 2 1

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 (atleast 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

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<th>Instructions</th>
<th>Submission week</th>
<th>Evaluation</th>
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<td>Selection of area of interest and Topic</td>
<td>You are requested to select an area of interest, topic and state an objective</td>
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<td>3 % Based on clarity of thought, current</td>
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<th>Objective</th>
<th>collecting Information about your area &amp; topic</th>
<th>Collection of Journal papers in the topic in the context of the objective – collect 20 &amp; then filter</th>
<th>Reading and notes for first 5 papers</th>
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<tbody>
<tr>
<td>1. List 1 Special Interest Groups or professional society</td>
<td>You have to provide a complete list of references you will be using. Based on your objective - Search various digital libraries and Google Scholar</td>
<td>Reading Paper Process</td>
<td></td>
</tr>
<tr>
<td>2. List 2 journals</td>
<td>When picking papers to read - try to:</td>
<td>For each paper form a Table answering the following questions:</td>
<td></td>
</tr>
<tr>
<td>3. List 2 conferences, symposia or workshops</td>
<td>- Pick papers that are related to each other in some ways and/or that are in the same field so that you can write a meaningful survey out of them,</td>
<td>- What is the main topic of the article?</td>
<td></td>
</tr>
<tr>
<td>4. List 1 thesis title</td>
<td>- Favour papers from well-known journals and conferences,</td>
<td>- What was/were the main issue(s) the author said they want to discuss?</td>
<td></td>
</tr>
<tr>
<td>5. List 3 web presences (mailing lists, forums, news sites)</td>
<td>- Favour “first” or “foundational” papers in the field (as indicated in other people’s survey paper),</td>
<td>- Why did the author claim it was important?</td>
<td></td>
</tr>
<tr>
<td>6. List 3 authors who publish regularly in your area</td>
<td>- Favour more recent papers,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Attach a call for papers (CFP) from your area.</td>
<td>- Pick a recent survey of the field so you can quickly gain an overview,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Find relationships with respect to each other and to your topic area (classification scheme/categorization)</td>
<td></td>
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<tr>
<td></td>
<td>- Mark in the hard copy of papers whether complete work or section/sections of the paper are being considered</td>
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<tr>
<td>3rd week</td>
<td>3% (the selected information must be area specific and of international and national standard)</td>
<td>4th week</td>
<td>6% (the list of standard papers and reason for selection)</td>
</tr>
<tr>
<td>5th week</td>
<td>8% (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| relevance and clarity in writing | | | |

25
- 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)

<table>
<thead>
<tr>
<th>Reading and notes for next 5 papers</th>
<th>Repeat Reading Paper Process</th>
<th>6th week</th>
<th>8% (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading and notes for final 5 papers</td>
<td>Repeat Reading Paper Process</td>
<td>7th week</td>
<td>8% (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)</td>
</tr>
<tr>
<td>Draft outline 1 and Linking papers</td>
<td>Prepare a draft Outline, your survey goals, along with a classification / categorization diagram</td>
<td>8th week</td>
<td>8% (this component will be evaluated based on the linking and classification among the papers)</td>
</tr>
<tr>
<td>Abstract</td>
<td>Prepare a draft abstract and give a presentation</td>
<td>9th week</td>
<td>6% (Clarity, purpose and conclusion) 6% Presentation &amp; Viva Voce</td>
</tr>
<tr>
<td>Introduction Background</td>
<td>Write an introduction and background sections</td>
<td>10th week</td>
<td>5% (clarity)</td>
</tr>
<tr>
<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>
<td>10% (this component will be evaluated based on the linking and classification among the papers)</td>
</tr>
</tbody>
</table>
Your conclusions | Write your conclusions and future work | 12\textsuperscript{th} week | 5\% (conclusions – clarity and your ideas) \hline
Final Draft | Complete the final draft of your paper | 13\textsuperscript{th} week | 10\% (formatting, English, Clarity and linking) \\
| | & 4\% Plagiarism Check Report \hline
Seminar | A brief 15 slides on your paper | 14\textsuperscript{th} & 15\textsuperscript{th} week | 10\% (based on presentation and Viva-voce) \hline
\hline

TOTAL: 30 PERIODS

CP4212 SOFTWARE ENGINEERING LABORATORY L T P C 0 0 2 1

LAB OBJECTIVE:
The Software Engineering Lab has been developed by keeping in mind the following objectives:
- To impart state-of-the-art knowledge on Software Engineering and UML in an interactive manner through the Web.
- Present case studies to demonstrate practical applications of different concepts.
- Provide a scope to students where they can solve small, real-life problems.

LIST OF EXPERIMENTS:
1. Write a Problem Statement to define a title of the project with bounded scope of project
2. Select relevant process model to define activities and related task set for assigned project
3. Prepare broad SRS (Software Requirement Specification) for the above selected projects
4. Prepare USE Cases and Draw Use Case Diagram using modelling Tool
5. Develop the activity diagram to represent flow from one activity to another for software development
6. Develop data Designs using DFD Decision Table & ER Diagram.
7. Draw class diagram, sequence diagram, Collaboration Diagram, State Transition Diagram for the assigned project
8. Write Test Cases to Validate requirements of assigned project from SRS Document
9. Evaluate Size of the project using function point metric for the assigned project
10. Estimate cost of the project using COCOMO and COCOCMOLI for the assigned project
11. Use CPM/PERT for scheduling the assigned project
12. Use timeline Charts or Gantt Charts to track progress of the assigned project

TOTAL:30 PERIODS

LAB OUTCOME:
CO1: Can produce the requirements and use cases the client wants for the software being Produced.
CO2: Participate in drawing up the project plan. The plan will include at least extent and work assessments of the project, the schedule, available resources, and risk management can model and specify the requirements of mid-range software and their architecture.
CO3: create and specify such a software design based on the requirement specification that the software can be implemented based on the design.

CO4: Can assess the extent and costs of a project with the help of several different assessment methods.

CP4391 SECURITY PRACTICES

COURSE OBJECTIVES:
- To learn the core fundamentals of system and web security concepts
- To have thorough understanding in the security concepts related to networks
- To deploy the security essentials in IT Sector
- To be exposed to the concepts of Cyber Security and cloud security
- To perform a detailed study of Privacy and Storage security and related Issues

UNIT I SYSTEM SECURITY

UNIT II NETWORK SECURITY

UNIT III SECURITY MANAGEMENT

UNIT IV CYBER SECURITY AND CLOUD SECURITY

UNIT V PRIVACY AND STORAGE SECURITY

COURSE OUTCOMES:
CO1: Understand the core fundamentals of system security
CO2: Apply the security concepts to wired and wireless networks
CO3: Implement and Manage the security essentials in IT Sector
CO4: Explain the concepts of Cyber Security and Cyber forensics
CO5: Be aware of Privacy and Storage security Issues.

REFERENCES

MP4092 HUMAN COMPUTER INTERACTION L T P C 3 0 0 3

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 9

UNIT II INTERACTION STYLES 9
UNIT III  EVALUATION OF INTERACTION  9  
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  9  
Task analysis, dialog notations and design, Models of the system, Modeling rich interaction, Ubiquitous computing

UNIT V  WEB AND MOBILE INTERACTION  9  
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

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MP4251  CLOUD COMPUTING TECHNOLOGIES  
L T P C  3 0 0 3

COURSE OBJECTIVES:
- To gain expertise in Virtualization, Virtual Machines and deploy practical virtualization solution
- To understand the architecture, infrastructure and delivery models of cloud computing.
- To explore the roster of AWS services and illustrate the way to make applications in AWS
To gain knowledge in the working of Windows Azure and Storage services offered by Windows Azure
To develop the cloud application using various programming model of Hadoop and Aneka

UNIT I  VIRTUALIZATION AND VIRTUALIZATION INFRASTRUCTURE  6

UNIT II  CLOUD PLATFORM ARCHITECTURE  12

UNIT III  AWS CLOUD PLATFORM - IAAS  9

UNIT IV  PAAS CLOUD PLATFORM  9

UNIT V  PROGRAMMING MODEL  9
Introduction to Hadoop Framework - Mapreduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job –Developing Map Reduce Applications - Design of Hadoop file system –Setting up Hadoop Cluster- Aneka: Cloud Application Platform, Thread Programming, Task Programming and Map-Reduce Programming in Aneka

COURSE OUTCOMES:
CO1: Employ the concepts of virtualization in the cloud computing
CO2: Identify the architecture, infrastructure and delivery models of cloud computing
CO3: Develop the Cloud Application in AWS platform
CO4: Apply the concepts of Windows Azure to design Cloud Application
CO5: Develop services using various Cloud computing programming models.

TOTAL: 45 PERIODS

REFERENCES

BD4151 FOUNDATIONS OF DATA SCIENCE

COURSE OBJECTIVES:
- To apply fundamental algorithms to process data.
- Learn to apply hypotheses and data into actionable predictions.
- Document and transfer the results and effectively communicate the findings using visualization techniques.
- To learn statistical methods and machine learning algorithms required for Data Science.
- To develop the fundamental knowledge and understand concepts to become a data science professional.

UNIT I INTRODUCTION TO DATA SCIENCE
Data science process – roles, stages in data science project – working with data from files – working with relational databases – exploring data – managing data – cleaning and sampling for modeling and validation – introduction to NoSQL.

UNIT II MODELING METHODS

UNIT III INTRODUCTION TO R

UNIT IV MAP REDUCE
Introduction – distributed file system – algorithms using map reduce, Matrix-Vector Multiplication by Map Reduce – Hadoop - Understanding the Map Reduce architecture - Writing Hadoop MapReduce Programs - Loading data into HDFS - Executing the Map phase - Shuffling and sorting - Reducing phase execution.

UNIT V DATA VISUALIZATION
Documentation and deployment – producing effective presentations – Introduction to graphical analysis – plot() function – displaying multivariate data – matrix plots – multiple plots in one
window - exporting graph using graphics parameters - Case studies.

**COURSE OUTCOMES:**

- **CO1:** Obtain, clean/process and transform data.
- **CO2:** Analyze and interpret data using an ethically responsible approach.
- **CO3:** Use appropriate models of analysis, assess the quality of input, derive insight from results, and investigate potential issues.
- **CO4:** Apply computing theory, languages and algorithms, as well as mathematical and statistical models, and the principles of optimization to appropriately formulate and use data analyses.
- **CO5:** Formulate and use appropriate models of data analysis to solve business-related challenges.

**REFERENCES:**


**MP4152 WIRELESS COMMUNICATIONS**

**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**


**UNIT II THE WIRELESS CHANNEL**

- 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 learn the fundamental principles and practices associated with each of the agile development methods
- To apply the principles and practices of agile software development on a project of interest and relevance to the student.
- To provide a good understanding of software design and a set of software technologies and APIs.
- To do a detailed examination and demonstration of Agile development and testing techniques.
- To understand Agile development and testing.

UNIT I AGILE SOFTWARE DEVELOPMENT
Basics and Fundamentals of Agile Process Methods, Values of Agile, Principles of Agile, stakeholders, Challenges. Lean Approach: Waste Management, Kaizen and Kanban, add process and products add value. Roles related to the lifecycle, differences between Agile and traditional plans, differences between Agile plans at different lifecycle phases. Testing plan links between testing, roles and key techniques, principles, understand as a means of assessing the initial status of a project. How Agile helps to build quality

UNIT II AGILE AND SCRUM PRINCIPLES

UNIT III AGILE PRODUCT MANAGEMENT
Communication, Planning, Estimation Managing the Agile approach Monitoring progress, Targeting and motivating the team, Managing business involvement, Escalating issue. Quality, Risk, Metrics and Measurements, Managing the Agile approach Monitoring progress, Targeting and motivating the team, Managing business involvement and Escalating issue

UNIT IV AGILE REQUIREMENTS AND AGILE TESTING

UNIT V AGILE REVIEW AND SCALING AGILE FOR LARGE PROJECTS
COURSE OUTCOMES:
CO1: Analyze existing problems with the team, development process and wider organization
CO2: Apply a thorough understanding of Agile principles and specific practices
CO3: Select the most appropriate way to improve results for a specific circumstance or need
CO4: Judge and craft appropriate adaptations to existing practices or processes depending upon analysis of typical problems
CO5: Evaluate likely successes and formulate plans to manage likely risks or problems

TOTAL: 45 PERIODS

REFERENCES

CP4095 PERFORMANCE ANALYSIS OF COMPUTER SYSTEMS

COURSE OBJECTIVES:
- To understand the mathematical foundations needed for performance evaluation of computer systems
- To understand the metrics used for performance evaluation
- To understand the analytical modeling of computer systems
- To enable the students to develop new queuing analysis for both simple and complex systems
- To appreciate the use of smart scheduling and introduce the students to analytical techniques for evaluating scheduling policies

UNIT I OVERVIEW OF PERFORMANCE EVALUATION

UNIT II MARKOV CHAINS AND SIMPLE QUEUES
UNIT III  MULTI-SERVER AND MULTI-QUEUE SYSTEMS
Server Farms: M/M/k and M/M/k/k – Capacity Provisioning for Server Farms – Time Reversibility and Burke’s Theorem – Networks of Queues and Jackson Product Form – Classed and Closed Networks of Queues.

UNIT IV  REAL-WORLD WORKLOADS

UNIT V  SMART SCHEDULING IN THE M/G/1

COURSE OUTCOMES:
Upon completion of this course, the students should be able to
CO1: Identify the need for performance evaluation and the metrics used for it
CO2: Distinguish between open and closed queuing networks
CO3: Apply Little’s law and other operational laws to open and closed systems
CO4: Use discrete-time and continuous-time Markov chains to model real world systems
CO5: Develop analytical techniques for evaluating scheduling policies

TOTAL : 45 PERIODS

REFERENCES:
COURSE OBJECTIVES

- To get a comprehensive knowledge of the architecture of distributed systems.
- To understand the deadlock and shared memory issues and their solutions in distributed environments.
- To know the security issues and protection mechanisms for distributed environments.
- To get a knowledge of multiprocessor operating systems and database operating systems.

UNIT I  INTRODUCTION  9

UNIT II  DISTRIBUTED DEADLOCK DETECTION AND RESOURCE MANAGEMENT  9

UNIT III  DISTRIBUTED SHARED MEMORY AND SCHEDULING  9

UNIT IV  DATA SECURITY  9

UNIT-V  MULTIPROCESSOR AND DATABASE OPERATING SYSTEM  9
Multiprocessor operating systems - basic multiprocessor system architectures – interconnection networks for multiprocessor systems – caching – hypercube architecture. Multiprocessor Operating System - structures of multiprocessor operating system, operating system design issues- threads-process synchronization and scheduling. Database Operating systems :Introduction- requirements

TOTAL: 45 PERIODS

COURSE OUTCOMES:
After the completion of this course, student will be able to
CO1: Understand and explore the working of Theoretical Foundations of OS.
CO2: Analyze the working principles of Distributed Deadlock Detection and resource management
CO3: Understand the concepts of distributed shared memory and scheduling mechanisms
CO4: Understand and analyze the working of Data security
CO5: Apply the learning into multiprocessor system architectures.

REFERENCES:
1. Mukesh Singhal, Niranjan G.Shivaratri, "Advanced concepts in operating systems: Distributed, Database and multiprocessor operating systems", TMH, 2001

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  9
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.
• Numerical problem solving in Image Enhancement.
• External learning – Image Noise and its types.
Suggested Evaluation Methods:
- Tutorial – Image transforms.
- Assignments on histogram specification, histogram equalization and spatial filters.
- Quizzes on noise modeling.

UNIT 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

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
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

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

BD4071 HIGH PERFORMANCE COMPUTING FOR BIG DATA

COURSE OBJECTIVES:
• To learn the fundamental concepts of High Performance Computing.
• To learn the network & software infrastructure for high performance computing.
• To understand real time analytics using high performance computing.
• To learn the different ways of security perspectives and technologies used in HPC.
• To understand the emerging big data applications.
UNIT I  INTRODUCTION

UNIT II  NETWORK & SOFTWARE INFRASTRUCTURE FOR HIGH PERFORMANCE BDA

UNIT III  REAL TIME ANALYTICS USING HIGH PERFORMANCE COMPUTING

UNIT IV  SECURITY AND TECHNOLOGIES

UNIT V  EMERGING BIG DATA APPLICATIONS
Deep learning Accelerators – Accelerators for clustering applications in machine learning - Accelerators for classification algorithms in machine learning – Accelerators for Big data Genome Sequencing.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of the course, the student should be able to:
CO1: Understand the basics concepts of High Performance computing systems.
CO2: Apply the concepts of network and software infrastructure for high performance computing
CO3: Use real time analytics using high performance computing.
CO4: Apply the security models and big data applications in high performance computing
CO5: Understand the emerging big data applications.

REFERENCES:
WEB REFERENCES:
1. https://www.hpcwire.com/

ONLINE RESOURCES:
2. https://www.nics.tennessee.edu/computing-resources/what-is-hpc

CP4093 INFORMATION RETRIEVAL TECHNIQUES

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**


**CP4096 SOFTWARE QUALITY ASSURANCE**

**COURSE OBJECTIVES:**

- Be exposed to the software quality factors, Quality Assurance (SQA) architecture and SQA components.
- Understand the integration of SQA components into the project life cycle.
- Be familiar with the software quality infrastructure.
- Be exposed to the management components of software quality.
- Be familiar with the Quality standards, certifications and assessments

**UNIT I INTRODUCTION TO SOFTWARE QUALITY & ARCHITECTURE**

Need for Software quality – Software quality assurance (SQA) – Software quality factors- McCall’s quality model – SQA system components – Pre project quality components – Development and quality plans.

**UNIT II SQA COMPONENTS AND PROJECT LIFE CYCLE**

Integrating quality activities in the project life cycle – Reviews – Software Testing – Quality of software maintenance components – Quality assurance for external participants contribution – CASE tools for software quality Management.

**UNIT III SOFTWARE QUALITY INFRASTRUCTURE**

Procedures and work instructions – Supporting quality devices - Staff training and certification - Corrective and preventive actions – Configuration management – Software change control – Configuration management audit -Documentation control.

**UNIT IV SOFTWARE QUALITY MANAGEMENT & METRICS**

Project process control – Software quality metrics – Cost of software quality – Classical quality cost
UNIT V  STANDARDS, CERTIFICATIONS & ASSESSMENTS  9

COURSE OUTCOMES:
CO1: Utilize the concepts of SQA in software development life cycle
CO2: Demonstrate their capability to adopt quality standards.
CO3: Assess the quality of software products.
CO4: Apply the concepts in preparing the quality plan & documents.
CO5: Ensure whether the product meets company's quality standards and client's expectations and demands

TOTAL: 45 PERIODS

REFERENCES

CP4091  AUTONOMOUS SYSTEMS  L T P C  3 0 0 3

COURSE OBJECTIVES:
- To impart knowledge on the functional architecture of autonomous vehicles
- To impart knowledge on Localization and mapping fundamentals
- To impart knowledge on process end effectors and robotic controls
- To learn Robot cell design, Robot Transformation and Sensors
- To learn Micro/Nano Robotic Systems

UNIT I  INTRODUCTION AND FUNCTIONAL ARCHITECTURE  9
Functional architecture - Major functions in an autonomous vehicle system, Motion Modeling - Coordinate frames and transforms, point mass model, Vehicle modeling (kinematic and dynamic bicycle model - two-track models), Sensor Modeling - encoders, inertial sensors, GPS.

UNIT II  PERCEPTION FOR AUTONOMOUS SYSTEMS  9
SLAM - Localization and mapping fundamentals, LIDAR and visual SLAM, Navigation – Global path planning, Local path planning, Vehicle control - Control structures, PID control, Linear quadratic regulator, Sample controllers.
UNIT III  ROBOTICS INTRODUCTION, END EFFECTORS AND CONTROL

UNIT IV  ROBOT TRANSFORMATIONS, SENSORS AND ROBOT CELL DESIGN

UNIT V  MICRO/NANO ROBOTICS SYSTEM
Micro/Nano robotics system overview-Scaling effect-Top down and bottom up approach Actuators of Micro/Nano robotics system-Nano robot communication techniques-Fabrication of micro/nano grippers-Wall climbing micro robot working principles-Biomimetic robot-Swarm robot-Nano robot in targeted drug delivery system.

COURSE OUTCOMES:
CO1: Understand architecture and modeling of autonomous systems.
CO2: Employ localization mapping techniques for autonomous systems
CO3: Design solutions for autonomous systems control.
CO4: Analyze Robot Transformations, Sensors and Cell Design
CO5: Explain the working principles of Micro/Nano Robotic system

TOTAL: 45 PERIODS

REFERENCES
COURSE OBJECTIVES:

- To understand the Web analytics platform, and their evolution.
- To learn about the various Data Streams Data.
- To learn about the benefits of surveys and capturing of data
- To understand Common metrics of web as well as KPI related concepts.
- To learn about the various Web analytics versions.

UNIT I  INTRODUCTION
Definition, Process, Key terms: Site references, Keywords and Key phrases; building block terms: Visit characterization terms, Content characterization terms, Conversion metrics; Categories: Offsite web, on site web; Web analytics platform, Web analytics evolution, Need for web analytics, Advantages, Limitations.

UNIT II  DATA COLLECTION
Click stream Data: Web logs, Web Beacons, JavaScript tags, Packet Sniffing; Outcomes Data: E-commerce, Lead generation, Brand/Advocacy and Support; Research data: Mindset, Organizational structure, Timing; Competitive Data: Panel-Based measurement, ISP-based measurement, Search Engine data.

UNIT III  QUALITATIVE ANALYSIS
Heuristic evaluations: Conducting a heuristic evaluation, Benefits of heuristic evaluations; Site Visits: Conducting a site visit, Benefits of site visits; Surveys: Website surveys, Post-visit surveys, creating and running a survey, Benefits of surveys. Capturing data: Web logs or JavaScript's tags, Separate data serving and data capture, Type and size of data, Innovation, Integration, Selecting optimal web analytic tool, Understanding click stream data quality, Identifying unique page definition, Using cookies, Link coding issues.

UNIT IV  WEB METRICS

UNIT V  WEB ANALYTICS 2.0
Web analytics 1.0, Limitations of web analytics 1.0, Introduction to analytic 2.0, Competitive intelligence analysis : CI data sources, Toolbar data, Panel data, ISP data, Search engine data, Hybrid data, Website traffic analysis: Comparing long term traffic trends, Analyzing competitive site overlap and opportunities. Google Analytics: Brief introduction and working, Adwords, Benchmarking, Categories of traffic: Organic traffic, Paid traffic; Google website optimizer, Implementation technology, Limitations, Performance concerns, Privacy issues.

TOTAL: 45 PERIODS
COURSE OUTCOMES
Upon completion of this course, the students should be able to:
CO1: Understand the Web analytics platform, and their evolution.
CO2: Use the various Data Streams Data.
CO3: Know how the survey of capturing of data will benefit.
CO4: Understand Common metrics of web as well as KPI related concepts.
CO5: Apply various Web analytics versions in existence.

REFERENCES:

MP4091
COURSE OBJECTIVES:
- To familiarize Use the Innovation Canvas to justify potentially successful products.
- To learn various ways in which to develop a product idea.
- To understand about how Big Data can play vital role in Cognitive Computing
- To know about the business applications of Cognitive Computing
- To get into all applications of Cognitive Computing

UNIT I FOUNDATION OF COGNITIVE COMPUTING
Foundation of Cognitive Computing: cognitive computing as a new generation, the uses of cognitive systems, system cognitive, gaining insights from data, Artificial Intelligence as the foundation of cognitive computing, understanding cognition Design Principles for Cognitive Systems: Components of a cognitive system, building the corpus, bringing data into cognitive system, machine learning, hypotheses generation and scoring, presentation, and visualization services

UNIT II NATURAL LANGUAGE PROCESSING IN COGNITIVE SYSTEMS
Natural Language Processing in support of a Cognitive System: Role of NLP in a cognitive system, semantic web, Applying Natural language technologies to Business problems Representing knowledge in Taxonomies and Ontologies: Representing knowledge, Defining Taxonomies and Ontologies, knowledge representation, models for knowledge representation, implementation considerations

UNIT III BIG DATA AND COGNITIVE COMPUTING
Relationship between Big Data and Cognitive Computing: Dealing with human-generated data, defining big data, architectural foundation, analytical data warehouses, Hadoop, data in motion and streaming data, integration of big data with traditional data Applying Advanced Analytics to cognitive computing: Advanced analytics is on a path to cognitive computing, Key capabilities in advanced analytics, using advanced analytics to create value, Impact of open source tools on advanced analytics
UNIT IV  BUSINESS IMPLICATIONS OF COGNITIVE COMPUTING  9
Preparing for change, advantages of new disruptive models, knowledge meaning to business, difference with a cognitive systems approach, meshing data together differently, using business knowledge to plan for the future, answering business questions in new ways, building business specific solutions, making cognitive computing a reality, cognitive application changing the market
The process of building a cognitive application: Emerging cognitive platform, defining the objective, defining the domain, understanding the intended users and their attributes, questions and exploring insights, training and testing

UNIT V  APPLICATION OF COGNITIVE COMPUTING  9
Building a cognitive health care application: Foundations of cognitive computing for healthcare, constituents in healthcare ecosystem, learning from patterns in healthcare Data, Building on a foundation of big data analytics, cognitive applications across the health care eco system, starting with a cognitive application for healthcare, using cognitive applications to improve health and wellness, using a cognitive application to enhance the electronic medical record Using cognitive application to improve clinical teaching

COURSE OUTCOMES:
CO1: Explain applications in Cognitive Computing.
CO2: Describe Natural language processor role in Cognitive computing.
CO3: Explain future directions of Cognitive Computing
CO4: Evaluate the process of taking a product to market
CO5: Comprehend the applications involved in this domain.

TOTAL:45 PERIODS

REFERENCES

AP4093 QUANTUM COMPUTING L T P C 3 0 0 3

COURSE OBJECTIVES:
• To introduce the building blocks of Quantum computers and highlight the paradigm change between conventional computing and quantum computing
• To understand the Quantum state transformations and the algorithms
• To understand entangled quantum subsystems and properties of entangled states
• To explore the applications of quantum computing

UNIT I  QUANTUM BUILDING BLOCKS  9
The Quantum Mechanics of Photon Polarization, Single-Qubit Quantum Systems, Quantum State Spaces, Entangled States, Multiple-Qubit Systems, Measurement of Multiple-Qubit States, EPR Paradox and Bell’s Theorem, Bloch sphere
UNIT II QUANTUM STATE TRANSFORMATIONS 9
Unitary Transformations, Quantum Gates, Unitary Transformations as Quantum Circuits, Reversible Classical Computations to Quantum Computations, Language for Quantum Implementations.

UNIT III QUANTUM ALGORITHMS 9
Computing with Superpositions, Quantum Subroutines, Quantum Fourier Transformations, Shor’s Algorithm and Generalizations, Grover’s Algorithm and Generalizations

UNIT IV ENTANGLED SUBSYSTEMS AND ROBUST QUANTUM COMPUTATION 9
Quantum Subsystems, Properties of Entangled States, Quantum Error Correction, Graph states and codes, CSS Codes, Stabilizer Codes, Fault Tolerance and Robust Quantum Computing

UNIT V QUANTUM INFORMATION PROCESSING 9

COURSE OUTCOMES:
At the end of the course, the student will be able to
CO1: Understand the basic principles of quantum computing.
CO2: Gain knowledge of the fundamental differences between conventional computing and quantum computing.
CO3: Understand several basic quantum computing algorithms.
CO4: Understand the classes of problems that can be expected to be solved well by quantum computers.
CO5: Simulate and analyze the characteristics of Quantum Computing Systems.

REFERENCES:
1. John Gribbin, Computing with Quantum Cats: From Colossus to Qubits, 2021
2. William (Chuck) Eastom, Quantum Computing Fundamentals, 2021
3. Parag Lala, Quantum Computing, 2019

TOTAL: 45 PERIODS

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 analyze 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/

CP4094 MOBILE AND PERVERSIVE COMPUTING L T P C 3 0 0 3

COURSE OBJECTIVES:
- To understand the basics of Mobile Computing and Personal Computing
- To learn the role of cellular networks in Mobile and Pervasive Computing
- To expose to the concept of sensor and mesh networks
- To expose to the context aware and wearable computing
- To learn to develop applications in mobile and pervasive computing environment

UNIT I INTRODUCTION 9

UNIT II 3G AND 4G CELLULAR NETWORKS 9

UNIT III SENSOR AND MESH NETWORKS 9

UNIT IV CONTEXT AWARE COMPUTING & WEARABLE COMPUTING 9

UNIT V APPLICATION DEVELOPMENT 9
Three tier architecture - Model View Controller Architecture - Memory Management – Information Access Devices – PDAs and Smart Phones – Smart Cards and Embedded Controls – J2ME – Programming for CLDC – GUI in MIDP – Application Development ON Android and iPhone
COURSE OUTCOMES:
CO1: Design a basic architecture for a pervasive computing environment
CO2: Design and allocate the resources on the 3G-4G wireless networks
CO3: Analyze the role of sensors in Wireless networks
CO4: Work out the routing in mesh network
CO5: Deploy the location and context information for application development
CO6: Develop mobile computing applications based on the paradigm of context aware computing and wearable computing

TOTAL: 45 PERIODS

REFERENCES

MP4094 WEB SERVICES AND API DESIGN

COURSE OBJECTIVES:
- To learn the basics of Web service.
- To become familiar with the Web Services building blocks
- To learn to work with RESTful web services.
- To implement the RESTful web services.
- To understand resource oriented Architecture.

UNIT I INTRODUCTION TO WEB SERVICE

UNIT II WEB SERVICE BUILDING BLOCKS
Introduction to SOAP: SOAP Syntax- Sending SOAP Messages - SOAP Implementations - Introduction to WSDL: WSDL Syntax - SOAP Binding - WSDL Implementations - Introduction to UDDI: The UDDI API - Implementations - The Future of UDDI
UNIT III  
RESTFUL WEB SERVICES
9

UNIT IV  
IMPLEMENTATION OF RESTFUL WEB SERVICES
9

UNIT V  
RESOURCE ORIENTED ARCHITECTURE
9
Resource- URIs - Addressability - Statelessness - Representations - Links and Connectedness - The Uniform Interface - Designing Read-Only Resource-Oriented Services : Resource Design - Turning Requirements Into Read-Only Resources - Figure Out the Data Set- Split the Data Set into Resources- Name the Resources - Design Representation- Link the Resources to Each Other- The HTTP Response

COURSE OUTCOMES:
CO1: Explain how to write XML documents.
CO2: Apply the web service building blocks such as SOAP, WSDL and UDDI
CO3: Describe the RESTful web services.
CO4: Implement the RESTful web service with Spring Boot MVC
CO5: Discuss Resource-oriented Architecture.

TOTAL: 45 PERIODS

REFERENCES
1. Leonard Richardson and Sam Ruby, RESTful Web Services, O’Reilly Media, 2007
3. Lindsay Bassett, Introduction to JavaScript Object Notation, O’Reilly Media, 2015

CP4092  
DATA VISUALIZATION TECHNIQUES
L T P C
3 0 0 3

COURSE OBJECTIVES:
- To develop skills to both design and critique visualizations.
- To introduce visual perception and core skills for visual analysis.

54
• To understand technological advancements of data visualization
• To understand various data visualization techniques
• To understand the methodologies used to visualize large data sets

UNIT I  INTRODUCTION AND DATA FOUNDATION  9
Basics - Relationship between Visualization and Other Fields - The Visualization Process - Pseudo
code Conventions - The Scatter plot. Data Foundation - Types of Data - Structure within and
between Records - Data Preprocessing - Data Sets

UNIT II  FOUNDATIONS FOR VISUALIZATION  9
Visualization stages - Semiology of Graphical Symbols - The Eight Visual Variables – Historical
Perspective - Taxonomies - Experimental Semiotics based on Perception Gibson's Affordance
theory – A Model of Perceptual Processing.

UNIT III  VISUALIZATION TECHNIQUES  9
Spatial Data: One-Dimensional Data - Two-Dimensional Data – Three Dimensional Data - Dynamic
Data - Combining Techniques. Geospatial Data: Visualizing Spatial Data - Visualization of Point
Data -Visualization of Line Data - Visualization of Area Data – Other Issues in Geospatial Data
Visualization Multivariate Data: Point-Based Techniques - Line-Based Techniques - Region-Based
Techniques - Combinations of Techniques – Trees Displaying Hierarchical Structures – Graphics
and Networks- Displaying Arbitrary Graphs/Networks.

UNIT IV  INTERACTION CONCEPTS AND TECHNIQUES  9
Text and Document Visualization: Introduction - Levels of Text Representations - The Vector
Space Model - Single Document Visualizations -Document Collection Visualizations – Extended
Text Visualizations Interaction Concepts: Interaction Operators - Interaction Operands and Spaces
- A Unified Framework. Interaction Techniques: Screen Space - Object-Space –Data Space -
Attribute Space- Data Structure Space - Visualization Structure – Animating Transformations -
Interaction Control.

UNIT V  RESEARCH DIRECTIONS IN VISUALIZATIONS  9
Steps in designing Visualizations – Problems in designing effective Visualizations- Issues of Data.
and Applications

COURSE OUTCOMES:
CO1: Visualize the objects in different dimensions.
CO2: Design and process the data for Visualization.
CO3: Apply the visualization techniques in physical sciences, computer science, applied
mathematics and medical sciences.
CO4: Apply the virtualization techniques for research projects.
CO5: Identify appropriate data visualization techniques given particular requirements imposed by
the data.

TOTAL: 45 PERIODS

REFERENCES
  1. Matthew Ward, Georges Grinstein and Daniel Keim, “Interactive Data Visualization

IF4091 COMPILER OPTIMIZATION TECHNIQUES

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

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**


**CP4002**

**FORMAL MODELS OF SOFTWARE SYSTEMS**

**COURSE OBJECTIVES:**

- To understand the goals, complexity of software systems, the role of Specification activities and qualities to control complexity.
- To understand the fundamentals of abstraction and formal systems
- To learn fundamentals of logic reasoning- Propositional Logic, temporal logic and apply to models systems
- To understand formal specification models based on set theory, calculus and algebra and apply to a case study
- To learn Z, Object Z and B Specification languages with case studies.

**UNIT I**

**SPECIFICATION FUNDAMENTALS**


**UNIT II**

**FORMAL METHODS**

UNIT III  LOGIC  9

UNIT IV  SPECIFICATION MODELS  9

UNIT V  FORMAL LANGUAGES  9

COURSE OUTCOMES:
CO1: Understand the complexity of software systems, the need for formal specifications activities and qualities to control complexity.
CO2: Gain knowledge on fundamentals of abstraction and formal systems
CO3: Learn the fundamentals of logic reasoning- Propositional Logic, temporal logic and apply to models systems
CO4: Develop formal specification models based on set theory, calculus and algebra and apply to a typical case study
CO5: Have working knowledge on Z, Object Z and B Specification languages with case studies.

TOTAL: 45 PERIODS

REFERENCES

AP4094  ROBOTICS  LTCP  3003

COURSE OBJECTIVES:
- To Introduce the concepts of Robotic systems
- To understand the concepts of Instrumentation and control related to Robotics
- To understand the kinematics and dynamics of robotics
- To explore robotics in Industrial applications

UNIT I  INTRODUCTION TO ROBOTICS  9
Robotics - History - Classification and Structure of Robotic Systems - Basic components - Degrees of freedom - Robot joints coordinates - Reference frames - workspace - Robot languages - Robotic sensors - proximity and range sensors, ultrasonic sensor, touch and slip sensor.

UNIT II  ROBOT KINEMATICS AND DYNAMICS  9

UNIT III  ROBOTICS CONTROL  9
Control of robot manipulator - state equations - constant solutions - linear feedback systems, single-axis PID control - PD gravity control - computed torque control, variable structure control and impedance control.

UNIT IV  ROBOT INTELLIGENCE AND TASK PLANNING  9
Artificial Intelligence - techniques - search problem reduction - predicate logic means and end analysis - problem solving - robot learning - task planning - basic problems in task planning - AI in robotics and Knowledge Based Expert System in robotics

UNIT V  INDUSTRIAL ROBOTICS  9
Robot cell design and control - cell layouts - multiple robots and machine interference - work cell design - work cell control - interlocks - error detection deduction and recovery - work cell controller - robot cycle time analysis. Safety in robotics, Applications of robot and future scope.

COURSE OUTCOMES:
At the end of the course the student will be able to
CO1: Describe the fundamentals of robotics
CO2: Understand the concept of kinematics and dynamics in robotics.
CO3: Discuss the robot control techniques
CO4: Explain the basis of intelligence in robotics and task planning
CO5: Discuss the industrial applications of robotics

TOTAL: 45 PERIODS
REFERENCE:

ML4291     NATURAL LANGUAGE PROCESSING     L T P C
                                 2 0 2 3

COURSE OBJECTIVES:
- To understand basics of linguistics, probability and statistics
- To study statistical approaches to NLP and understand sequence labeling
- To outline different parsing techniques associated with NLP
- To explore semantics of words and semantic role labeling of sentences
- To understand discourse analysis, question answering and chatbots

UNIT I  INTRODUCTION

UNIT II  STATISTICAL NLP AND SEQUENCE LABELING

UNIT III  CONTEXTUAL EMBEDDING
Constituency –Context Free Grammar –Lexicalized Grammars- CKY Parsing – Earley's algorithm-Evaluating Parsers -Partial Parsing – Dependency Relations- Dependency Parsing - Transition Based - Graph Based

UNIT IV  COMPUTATIONAL SEMANTICS

UNIT V  DISCOURSE ANALYSIS AND SPEECH PROCESSING

TOTAL : 30 PERIODS
SUGGESTED ACTIVITIES:
1. Probability and Statistics for NLP Problems
2. Carry out Morphological Tagging and Part-of-Speech Tagging for a sample text
3. Design a Finite State Automata for more Grammatical Categories
4. Problems associated with Vector Space Model
5. Hand Simulate the working of a HMM model
6. Examples for different types of work sense disambiguation
7. Give the design of a Chatbot

PRACTICAL EXERCISES:
1. Download nltk and packages. Use it to print the tokens in a document and the sentences from it.
2. Include custom stop words and remove them and all stop words from a given document using nltk or spaCY package
3. Implement a stemmer and a lemmatizer program.
4. Implement a simple Part-of-Speech Tagger
5. Write a program to calculate TFIDF of documents and find the cosine similarity between any two documents.
6. Use nltk to implement a dependency parser.
7. Implement a semantic language processor that uses WordNet for semantic tagging.
8. Project - (in Pairs) Your project must use NLP concepts and apply them to some data.
   a. Your project may be a comparison of several existing systems, or it may propose a new system in which case you still must compare it to at least one other approach.
   b. You are free to use any third-party ideas or code that you wish as long as it is publicly available.
   c. You must properly provide references to any work that is not your own in the write-up.
   d. 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 Possible Projects
1. Sentiment Analysis of Product Reviews
2. Information extraction from News articles
3. Customer support bot
4. Language identifier
5. Media Monitor
6. Paraphrase Detector
7. Identification of Toxic Comment
8. Spam Mail Identification

COURSE OUTCOMES:
CO1: Understand basics of linguistics, probability and statistics associated with NLP
CO2: Implement a Part-of-Speech Tagger
CO3: Design and implement a sequence labeling problem for a given domain
CO4: Implement semantic processing tasks and simple document indexing and searching system using the concepts of NLP
CO5: Implement a simple chatbot using dialogue system concepts

TOTAL: 60 PERIODS
REFERENCES
1. Daniel Jurafsky and James H. Martin, “Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition” (Prentice Hall Series in Artificial Intelligence), 2020
2. Jacob Eisenstein. “Natural Language Processing”, MIT Press, 2019
3. Samuel Burns “Natural Language Processing: A Quick Introduction to NLP with Python and NLTK, 2019

IF4093
GPU COMPUTING

COURSE OBJECTIVES:
- To understand the basics of GPU architectures
- To understand CPU GPU Program Partitioning
- To write programs for massively parallel processors
- To understand the issues in mapping algorithms for GPUs
- To introduce different GPU programming models

UNIT I
GPU ARCHITECTURE
9
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
9
Using CUDA - Multi GPU - Multi GPU Solutions - Optimizing CUDA Applications: Problem Decomposition, Memory Considerations, Transfers, Thread Usage, Resource Contentions.

UNIT III
PROGRAMMING ISSUES
9

UNIT IV
OPENCL BASICS
9
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

IF4073  DEVOPS AND MICROSERVICES

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
Software Engineering - traditional and Agile process models - DevOps - Definition - Practices - DevOps life cycle process - need for DevOps – Barriers

UNIT II DEVOPS PLATFORM AND SERVICES

UNIT III BUILDING, TESTING AND DEPLOYMENT
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

UNIT V MLOPS
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
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

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:
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: 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

IF4071 DEEP LEARNING L T P C 3 0 2 4

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 6

UNIT II NEURAL NETWORKS 9
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
3. Image Colorization
4. Aspect Oriented Topic Detection & Sentiment Analysis
5. Object Detection using Autoencoder

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
COURSE OBJECTIVES:

- This course is intended to study the basics of Blockchain technology.
- During this course the learner will explore various aspects of Blockchain technology like application in various domains.
- By implementing, learners will have idea about private and public Blockchain, and smart contract.

UNIT I INTRODUCTION OF CRYPTOGRAPHY AND BLOCKCHAIN

Introduction to Blockchain, Blockchain Technology Mechanisms & Networks, Blockchain Origins, Objective of Blockchain, Blockchain Challenges, Transactions and Blocks, P2P Systems, Keys as Identity, Digital Signatures, Hashing, and public key cryptosystems, private vs. public Blockchain.

UNIT II BITCOIN AND CRYPTOCURRENCY


UNIT III INTRODUCTION TO ETHEREUM

Introduction to Ethereum, Consensus Mechanisms, Metamask Setup, Ethereum Accounts, Transactions, Receiving Ethers, Smart Contracts.

UNIT-IV INTRODUCTION TO HYPERLEDGER AND SOLIDITY PROGRAMMING


UNIT V BLOCKCHAIN APPLICATIONS

Internet of Things, Medical Record Management System, Domain Name Service and Future of Blockchain, Alt Coins.

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS:

1. Create a Simple Blockchain in any suitable programming language.
2. Use Geth to Implement Private Ethereum Block Chain.
4. Build Hyperledger Fabric with Smart Contract.
5. Create Case study of Block Chain being used in illegal activities in real world.
6. Using Python Libraries to develop Block Chain Application.

TOTAL: 30 PERIODS

SUPPLEMENTARY RESOURCES:

- NPTEL online course: https://nptel.ac.in/courses/106/104/106104220/#
- Udemy: https://www.udemy.com/course/build-your-blockchain-az/
COURSE OUTCOMES:
After the completion of this course, student will be able to

CO1: Understand and explore the working of Blockchain technology

CO2: Analyze the working of Smart Contracts

CO3: Understand and analyze the working of Hyperledger

CO4: Apply the learning of solidity to build de-centralized apps on Ethereum

CO5: Develop applications on Blockchain

REFERENCES:

SE4073  EMBEDDED SOFTWARE DEVELOPMENT  LT PC
3 0 2 4

COURSE OBJECTIVES:

- To understand the architecture of embedded processor, microcontroller, and peripheral devices.
- To interface memory and peripherals with embedded systems.
- To study the embedded network environment.
- To understand challenges in Real time operating systems.
- To study, analyse and design applications on embedded systems.

UNIT I  EMBEDDED PROCESSORS  9+6

UNIT II  EMBEDDED COMPUTING PLATFORM  9+6

UNIT III  EMBEDDED NETWORK ENVIRONMENT  9+6

UNIT IV  REAL-TIME CHARACTERISTICS  9+6

UNIT V  SYSTEM DESIGN TECHNIQUES  9+6

SUGGESTED ACTIVITIES:
1. Study of ARM evaluation system
2. Interfacing ADC and DAC.
3. Interfacing LED and PWM.
4. Interfacing real time clock and serial port.
5. Interfacing keyboard and LCD.
6. Interfacing EPROM and interrupt.
8. Interrupt performance characteristics of ARM and FPGA.
9. Flashing of LEDS.
10. Interfacing stepper motor and temperature sensor.

COURSE OUTCOMES:
CO1: Understand different architectures of embedded processor, microcontroller and peripheral devices. Interface memory and peripherals with embedded systems.
CO2: Interface memory and peripherals with embedded systems.
CO3: Work with embedded network environment.
CO4: Understand challenges in Real time operating systems.
CO5: Design and 70analyse applications on embedded systems.

TOTAL:75 PERIODS

REFERENCES
IF4291  FULL STACK WEB APPLICATION DEVELOPMENT  LTPC  3024

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  10

UNIT II  ANGULAR  10

UNIT III  NODE.js  10

UNIT IV  EXPRESS.Js  7
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

CP4071  BIO INFORMATICS  

COURSE OBJECTIVES:
• Exposed to the need for Bioinformatics technologies
• Be familiar with the modeling techniques
• Learn microarray analysis
• Exposed to Pattern Matching and Visualization
• To know about Microarray Analysis

UNIT I  INTRODUCTION
Need for Bioinformatics technologies – Overview of Bioinformatics technologies Structural bioinformatics – Data format and processing – Secondary resources and applications – Role of Structural bioinformatics – Biological Data Integration System.
UNIT II  DATAWAREHOUSING AND DATAMINING IN BIOINFORMATICS  9
Bioinformatics data – Data warehousing architecture – data quality – Biomedical data analysis – DNA data analysis – Protein data analysis – Machine learning – Neural network architecture and applications in bioinformatics.

UNIT III  MODELING FOR BIOINFORMATICS  9

UNIT IV  PATTERN MATCHING AND VISUALIZATION  9

UNIT V  MICROARRAY ANALYSIS  9

TOTAL: 45 PERIODS

LIST OF EXPERIMENTS:
1. Manipulating DNA strings
2. Use Protein Data Bank to visualize and Analyze the Proteins from protein database
3. Explore the Human Genome with the SciPy Stack
4. Hidden Markov Model for Biological Sequence
5. Molecular Modeling using MMTK package
6. Sequence Alignment using Biopython, Pairwise and multiple sequence alignment using ClustalW and BLAST
7. Simple generation and manipulation of genome graphs
8. DNA data handling using Biopython
9. Chaos Game Representation of a genetic sequence
10. Visualize the microarray data using Heatmap

TOTAL: 30 PERIODS

COURSE OUTCOMES:
CO1: Understand the different Data formats
CO2: Develop machine learning algorithms.
CO3: Develop models for biological data.
CO4: Apply pattern matching techniques to bioinformatics data – protein data – genomic data.
CO5: Apply micro array technology for genomic expression study.

TOTAL: 45 +30=75 PERIODS
REFERENCES

MP4291  CYBER PHYSICAL SYSTEMS  L T P C
3 0 2 4

COURSE OBJECTIVES:
- To learn about the principles of cyber-physical systems
- To familiarize with the basic requirements of CPS.
- To know about CPS models
- To facilitate the students to understand the CPS foundations
- To make the students explore the applications and platforms.
- To provide introduction to practical aspects of cyber physical systems.
- To equip students with essential tools to implement CPS.

UNIT I  INTRODUCTION TO CYBER-PHYSICAL SYSTEMS  6

UNIT II  CPS - REQUIREMENTS  12

UNIT III  CPS MODELS  9

UNIT IV  CPS FOUNDATIONS  9
Symbolic Synthesis for CPS- Security in CPS-Synchronization of CPS-Real-Time Scheduling for CPS

UNIT V  APPLICATIONS AND PLATFORMS  9

LIST OF EXPERIMENTS  (30)
1. Installation of Xilinx SDK, LABVIEW, MatLab and Cybersim
2. Installation of, myRIO iRobot Create Wiring, Kobuki Wiring
3. CPS DEsign with the iRobot Create
4. CPS Design with the Kobuki.
5. Write a program in MATLAB to implement open loop system stability.
6. Write a program in MATLAB to implement timed automation.

COURSE OUTCOMES:
CO1: Explain the core principles behind CPS
CO2: Discuss the requirements of CPS.
CO3: Explain the various models of CPS.
CO4: Describe the foundations of CPS.
CO5: Use the various platforms to implement the CPS.

TOTAL: 45+30=75 PERIODS

REFERENCES
7. documentation | KOBUKI (yujirobot.com)

MU4291 MIXED REALITY L T P C
3 0 2 4

COURSE OBJECTIVES:
- To study about Fundamental Concept and Components of Virtual Reality
- To study about Interactive Techniques in Virtual Reality
- To study about Visual Computation in Virtual Reality
- To study about Augmented and Mixed Reality and Its Applications
- To know about I/O Interfaces and its functions.

UNIT I INTRODUCTION TO VIRTUAL REALITY 9

Suggested Activities:
- Flipped classroom on uses of MR applications.
- Videos – Experience the virtual reality effect.
- Assignment on comparison of VR with traditional multimedia applications.
UNIT II  INTERACTIVE TECHNIQUES IN VIRTUAL REALITY


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

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

UNIT III  VISUAL COMPUTATION IN VIRTUAL REALITY


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

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

UNIT IV  AUGMENTED AND MIXED REALITY

Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality, wireless displays in educational augmented reality applications, mobile projection interfaces, marker-less tracking for augmented reality, enhancing interactivity in AR environments, evaluating AR systems.

Suggested Activities:
- External learning - AR Systems

Suggested Evaluation Methods:
- Brainstorming session different AR systems and environments.
UNIT V  I/O INTERFACE IN VR & APPLICATION OF VR

Human factors: Introduction, the eye, the ear, the somatic senses. VR Hardware: Introduction, sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR systems. VR Software: Introduction, Modeling virtual world, Physical simulation, VR toolkits, Introduction to VRML, Input -- Tracker, Sensor, Digitalglobe, Movement Capture, Video-based Input, 3D Menus & 3DScanner etc. Output -- Visual /Auditory / Haptic Devices. VR Technology in Film & TV Production. VR Technology in Physical Exercises and Games. Demonstration of Digital Entertainment by VR.

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

Suggested Evaluation Methods:
- Tutorial – Mobile Interface Design.
- Brainstorming session on wearable computing devices and games design.
- Demonstration and evaluation of the developed MR application.

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: Understand the Fundamental Concept and Components of Virtual Reality
CO2: Able to know the Interactive Techniques in Virtual Reality
CO3: Can know about Visual Computation in Virtual Reality
CO4: Able to know the concepts of Augmented and Mixed Reality and Its Applications
CO5: Know about I/O Interfaces and its functions.

TOTAL:45+30=75 PERIODS

REFERENCES
3. Alan Craig, William Sherman and Jeffrey Will, Developing Virtual Reality Applications,

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AUDIT COURSES

AX4091 ENGLISH FOR RESEARCH PAPER WRITING L T P C
2 0 0 0

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
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

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

UNIT IV RESULT WRITING SKILLS
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
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 L T P C
2 0 0 0

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

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 of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution 1917 And 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
District’s Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of
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.
UNIT III மாணல் கருப்பிற்கள்
1. காலைப்பிள்ளைப் பருக்கி
   - மின்பூச்சியையும் காண்டது
2. சுத்ருத்ததய சுருக்கப்பிறகன
   - சுத்ருத்தாய முழுநுட்ப காண்ட

UNIT IV அச்சனாமத் திமி
1. சிறுபல்லு
   - பாரதி பல்லும்புத்து காண்டது போகும் பில்லியல்
     போகும் காண்டது, அகரமாங்க குசரும் இலக்கியனின் காண்டது, அரசு
     பல்லுப்ப்
2. சிறுபல்லு
   - அச்சனாமதி புலக்கா சிறும்
3. சிறுபல்லு (617, 618)
   - மின்பூச்சியையும் காண்ட
4. சிறுபல்லு
5. சிறுபல்லு
   - சிறுபல்லு
6. காலைப்பிள்ளை (4)
7. காலைப்பிள்ளை (11)
8. காலைப்பிள்ளை (11)
9. பாரதி, புரா
10. பாரதி, பயண

UNIT V நியாய தமிழ் இலக்கியம்
1. மாணல் தமிழ்
   - குறிப்பிடிக்கப்பிறகன
   - குறிப்பிடிக்கப்பிறகன
2. மாணல் தமிழ்
3. மாணல் தமிழ்
4. மாணல் தமிழ்
5. மாணல் தமிழ்
6. மாணல் தமிழ்
7. மாணல் தமிழ்
தமிழ் துறந்தை வலிமைகள் / புதுக்காலம்

1. தமிழ் நிறுவன கல்விக்கழகம் (Tamil Virtual University)
   - www.tamilvu.org
2. தமிழ் விக்கிப்பீட்டு வலிமை (Tamil Wikipedia)
   - https://ta.wikipedia.org
3. தமிழ் உலக புதுக்காலம்
4. மாணிக்கள் கல்லறிசை
   - தமிழ் பல்கலைக்கழகம், கத்தரவு
5. தமிழ் கல்லறிசை
   - தமிழ் நாட்டின் கத்தரவு (thamilvalarchithurai.com)
6. அறிவியல் கல்லறிசை
   - தமிழ் பல்கலைக்கழகம், கத்தரவு