1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

To produce graduates who will be able to:

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

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

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

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

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

2. PROGRAM OUTCOMES (POs)

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

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

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

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

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

6. Apply the known facts and use modern tools to provide innovative solutions in the domain of Information technology
## MAPPING OF COURSE OUTCOMES AND PROGRAMME OUTCOMES

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# ANNA UNIVERSITY, CHENNAI
NON - AUTONOMOUS COLLEGES AFFILIATED ANNA UNIVERSITY
M.TECH. INFORMATION TECHNOLOGY
REGULATIONS – 2021
CHOICE BASED CREDIT SYSTEM
I TO IV SEMESTERS CURRICULA AND SYLLABI

## SEMESTER I

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### PROFESSIONAL ELECTIVES

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AUDIT COURSES (AC)
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COURSE OBJECTIVES :

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

UNIT I PROBABILITY AND RANDOM VARIABLES 12

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

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

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

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

TOTAL: 60 PERIODS

COURSE OUTCOMES :

After completing this course, students should demonstrate competency in the following topics:

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

REFERENCES :
5. Ross, S. M., "Introduction to Probability and Statistics for Engineers and Scientists", 5th Edition,

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RM4151 RESEARCH METHODOLOGY AND IPR L T P C 2 0 0 2

UNIT I RESEARCH DESIGN 6
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 6
Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods.
Data - Preparing, Exploring, examining and displaying.

UNIT III DATA ANALYSIS AND REPORTING 6
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 6

UNIT V PATENTS 6

TOTAL: 30 PERIODS
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
NP-Completeness: Polynomial Time – Polynomial-Time Verification – NP- Completeness and

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.

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COURSE OBJECTIVES:

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

UNIT I  RELATIONAL DATA MODEL


Suggested Activities:

Data Definition Language

- Create, Alter and Drop
- Enforce Primary Key, Foreign Key, Check, Unique and Not Null Constraints
- Creating Views

Data Manipulation Language

- Insert, Delete, Update
- Cartesian Product, Equi Join, Left Outer Join, Right Outer Join and Full Outer Join
- Aggregate Functions
- Set Operations
- 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  15

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

UNIT V  DATABASE SECURITY  15

Suggested Activities:
Implementing Access Control in Relational Databases

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

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**CP4153 NETWORK TECHNOLOGIES**

**L T P C**

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**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
- Peer To Peer Vs Client-Server Networks
- Network Devices
- Network Terminology
- Network Speeds
- Network throughput, delay
- Osi Model
- Packets, Frames, And Headers
- Collision And Broadcast Domains
- LAN Vs WAN
- Network Adapter
- Hub
- Switch
- Router
- Firewall
- IP addressing

**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
- 4G Networks and Composite Radio Environment
- Protocol Boosters
- Hybrid 4G Wireless Networks Protocols
- Green Wireless Networks
- Physical Layer and Multiple Access
- Channel Modelling for 4G
- Concepts of 5G
- channel access –air interface
- Cognitive Radio
- spectrum management
- C-RAN architecture
- Vehicular communications-protocol
- Network slicing
- MIMO, mmWave
- Introduction to 6G

**UNIT IV SOFTWARE DEFINED NETWORKS**
9
- SDN Architecture
- Characteristics of Software-Defined Networking
- SDN- and NFV-Related Standards
- SDN Data Plane
- Data Plane Functions
- Data Plane Protocols
- OpenFlow Logical Network Device
- Flow Table Structure
- Flow Table Pipeline
- The Use of Multiple Tables
- Group Table
- OpenFlow Protocol
- SDN Control Plane Architecture
- Control Plane Functions
- Southbound Interface
- Northbound Interface
- Routing
- ITU-T Model
- OpenDaylight
- OpenDaylight Architecture

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

TOTAL: 45 PERIODS

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

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

REFERENCES:
2. HoudaLabiod, Costantino de Santis, HossamAfifi – “Wi-Fi, Bluetooth, Zigbee and WiMax”, Springer 2007 (UNIT 2)

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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

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

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CP4161 ADVANCED DATA STRUCTURES AND ALGORITHMS L T P C
LABORATORY 0 0 4 2

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.

TOTAL: 60 PERIODS

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

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

TOTAL: 30 PERIODS

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

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COURSE OBJECTIVES:

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

UNIT I SOFTWARE ENGINEERING 9

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

UNIT III SOFTWARE ARCHITECTURE 9

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

UNIT V SOFTWARE METHODOLOGIES 9
Agile Modelling with XP- Introduction, Agile Modelling – Principles, Comparing XP and Agile Modelling, Scrum Methodology- The roles of Scrum, Advantages of Scrum. Dynamic Systems Development Methodology- Introduction, Overview of DSDM, the Principles of DSDM, Phases of DSDM, Core Techniques Used in DSDM. XP Tools- Introduction, JAVA and XP, Tools and...
Philosophies, Open-source Toolkit. DevOps : Motivation-Cloud as a platform-Operations-Deployment

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

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

**COURSE OUTCOMES:**

**CO1:** Understand the advantages of various Software Development Lifecycle Models

**CO2:** Compare project management approaches as well as cost and schedule estimation strategies

**CO3:** Translate end-user requirements into system and software requirements and generate a high-level design of the system from the software requirements

**CO4:** Use UML diagrams for analysis and design

**CO5:** Understand the advantages Agile methodologies and of DevOps practices

**CO6:** Develop a simple testing report.

**REFERENCES**


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IF4291 FULL STACK WEB APPLICATION DEVELOPMENT L T P C 3 0 2 4

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


UNIT IV  EXPRESS.Js


UNIT V  MONGODB


LIST OF EXPERIMENTS:

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

COURSE OUTCOMES:

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

TOTAL : 45 + 30 = 75 PERIODS

REFERENCES

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

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BD4251 BIG DATA MINING AND ANALYTICS

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

UNIT I DATA MINING AND LARGE SCALE FILES

UNIT II SIMILAR ITEMS

UNIT III MINING DATA STREAMS

UNIT IV LINK ANALYSIS AND FREQUENT ITEMSETS

UNIT V CLUSTERING

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/

CO-PO Mapping

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CP4291  INTERNET OF THINGS  L  T  P  C
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COURSE OBJECTIVES:
- To Understand the Architectural Overview of IoT
- To Understand the IoT Reference Architecture and Real World Design Constraints
- To Understand the various IoT levels
- To understand the basics of cloud architecture
- To gain experience in Raspberry PI and experiment simple IoT application on it

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

UNIT II IoT ARCHITECTURE, GENERATIONS AND PROTOCOLS 9+6

UNIT III IoT PROTOCOLS AND TECHNOLOGY 9+6

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

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

SUGGESTED ACTIVITIES:
1. Develop an application for LED Blink and Pattern using arduino or Raspberry Pi
2. Develop an application for LED Pattern with Push Button Control using arduino or Raspberry Pi
3. Develop an application for LM35 Temperature Sensor to display temperature values using arduino or Raspberry Pi
4. Develop an application for Forest fire detection end node using Raspberry Pi device and sensor
5. Develop an application for home intrusion detection web application
6. Develop an application for Smart parking application using python and Django for web 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
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IF4211                        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

<table>
<thead>
<tr>
<th>Activity</th>
<th>Instructions</th>
<th>Submission week</th>
<th>Evaluation</th>
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<tbody>
<tr>
<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>
<td>2nd week</td>
<td>3% Based on clarity of thought, current relevance and clarity in writing</td>
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<tr>
<td>Stating an Objective</td>
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<td>Collecting Information about your area &amp; topic</td>
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<tr>
<td>1. List 1 Special Interest Groups or professional society</td>
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<td>3rd week</td>
<td>3% (the selected information must be area specific and of international and national standard)</td>
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<td>2. List 2 journals</td>
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<td>3. List 2 conferences, symposia or workshops</td>
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<td>4. List 1 thesis title</td>
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<td>5. List 3 web presences (mailing lists, forums, news sites)</td>
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<td>6. List 3 authors who publish regularly in your area</td>
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<td>7. Attach a call for papers (CFP) from your area.</td>
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<tr>
<td>Collection of Journal papers in the topic in the context of the objective – collect 20 &amp; then filter</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>4th week</td>
<td>6% (the list of standard papers and reason for selection)</td>
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<td>• When picking papers to read - try to:</td>
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<tr>
<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>
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<td>• Favour papers from well-known journals and conferences,</td>
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<td>• Favour “first” or “foundational” papers in the field (as indicated in other people’s survey paper),</td>
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<td>• Favour more recent papers,</td>
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<td>• Pick a recent survey of the field so you can quickly gain an overview,</td>
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<td>• Find relationships with respect to each other and to your topic area (classification scheme/categorization)</td>
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<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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Reading and notes for first 5 papers

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<th>Reading Paper Process</th>
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<tr>
<td>For each paper form a Table answering the following questions:</td>
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<tr>
<td>- What is the main topic of the article?</td>
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<td>- What was/were the main issue(s) the author said they want to discuss?</td>
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<td>- Why did the author claim it was important?</td>
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<td>- How does the work build on other’s work, in the author’s opinion?</td>
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<td>- What simplifying assumptions does the author claim to be making?</td>
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<td>- What did the author do?</td>
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<td>- How did the author claim they were going to evaluate their work and compare it to others?</td>
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<td>- What did the author say were the limitations of their research?</td>
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<td>- What did the author say were the important directions for future research?</td>
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<td>Conclude with limitations/issues not addressed by the paper (from the perspective of your survey)</td>
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5th week 8% (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)

Reading and notes for next 5 papers

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<th>Repeat Reading Paper Process</th>
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6th week 8% (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)
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<th>Task</th>
<th>Description</th>
<th>Week</th>
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<tr>
<td><strong>Reading and notes for final 5 papers</strong></td>
<td>Repeat Reading Paper Process</td>
<td>7th week</td>
<td>8%</td>
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<td>(the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)</td>
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<tr>
<td><strong>Draft outline 1 and Linking papers</strong></td>
<td>Prepare a draft Outline, your survey goals, along with a classification / categorization diagram</td>
<td>8th week</td>
<td>8%</td>
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<td>(this component will be evaluated based on the linking and classification among the papers)</td>
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<td><strong>Abstract</strong></td>
<td>Prepare a draft abstract and give a presentation</td>
<td>9th week</td>
<td>6%</td>
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<td>(Clarity, purpose and conclusion)</td>
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<td><strong>Introduction Background</strong></td>
<td>Write an introduction and background sections</td>
<td>10th week</td>
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<td><strong>Sections of the paper</strong></td>
<td>Write the sections of your paper based on the classification / categorization diagram in keeping with the goals of your survey</td>
<td>11th week</td>
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<td><strong>Your conclusions</strong></td>
<td>Write your conclusions and future work</td>
<td>12th week</td>
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<td>(conclusions – clarity and your ideas)</td>
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<td><strong>Final Draft</strong></td>
<td>Complete the final draft of your paper</td>
<td>13th week</td>
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<td>4% Plagiarism Check Report</td>
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<td><strong>Seminar</strong></td>
<td>A brief 15 slides on your paper</td>
<td>14th &amp; 15th week</td>
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**TOTAL: 30 PERIODS**
COURSE OBJECTIVES:
- To introduce the concepts and models of security.
- To understand the risk assessment and security standard.
- To plan for business continuity and incident response plan.
- To estimate the level of security risk faced by an organisation and the countermeasures to handle the risk.
- To understand potential vulnerabilities and to develop a security blueprint.

UNIT I INFORMATION SECURITY

UNIT II FUNDAMENTALS OF CRYPTOGRAPHY

UNIT III INTRUSION DETECTION

UNIT IV NETWORK SECURITY

UNIT V APPLICATION SECURITY

SUGGESTED ACTIVITIES:
1: In-class activity to learn about various security services and attacks.
2: Analyse risk for any real time applications and prepare a blueprint for security to control the risk.
3: Develop an attack success scenario and assess the potential damage.
4: Prepare the contingency planning documents for business continuity.
5: Discussion on scanning and analysis tools for identifying the vulnerabilities.
COURSE OUTCOMES:
After completing the course students will be able to
CO1: Apply the basic security models and policies required by the computing system.
CO2: Apply a cryptographic algorithm to build a secure application.
CO3: Monitor, detect and prevent intrusions in a network.
CO4: Predict the vulnerabilities in any computing system and propose a security solution.
CO5: Understand the importance of network security and risk management of an organization.

TOTAL : 45 PERIODS

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

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MU4251 DIGITAL IMAGE PROCESSING

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

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

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

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

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

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

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

**UNIT III FEATURE EXTRACTION**

**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.

**REFERENCES**


**CO-PO Mapping**

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

UNIT I 3D GRAPHICS FOR GAME PROGRAMMING

UNIT II GAME DESIGN PRINCIPLES

UNIT III GAME ENGINE DESIGN

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

UNIT V GAME DEVELOPMENT USING PYGAME

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

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

TOTAL : 45 PERIODS

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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 9
Frequency Reuse – Channel Assignment Strategies – Handoff Strategies – Interference and system capacity- Co-Channel Interference- Adjacent Channel Interference – Trunking and Grade of service – Improving coverage & capacity in cellular systems-Cell Splitting- Sectoring-
Repeaters for Range Extension-Microcell Zone Concept.

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:
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
Basic Concepts – Need for Interprocedural Analysis – A Logical Representation of Data Flow – A

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

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IF4002 MULTIMEDIA TECHNOLOGIES L T P C 3 0 0 3

COURSE OBJECTIVES:
- To enrich student learning in multimedia systems.
- To train the students to acquire knowledge in multimedia related technologies.
- To acquire knowledge about multimedia techniques to enhance quality of service.
- To acquire knowledge in the development of multimedia systems.
- To learn about multimedia elements in a comprehensive way.
UNIT I  INTRODUCTION TO MULTIMEDIA ELEMENTS  9

UNIT II  MULTIMEDIA COMPRESSION  9

UNIT III  MULTIMEDIA ARCHITECTURES  8

UNIT IV  MULTIMEDIA OPERATING SYSTEM AND DATABASES  10

UNIT V  MULTIMEDIA COMMUNICATION & APPLICATIONS  9

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

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

TOTAL :45 PERIODS

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

**UNIT I** COMPUTER VISION

**UNIT II** PIXEL-BASED MANIPULATIONS & TRANSFORMATION

**UNIT III** STRUCTURE IDENTIFICATION

UNIT IV CLUSTERING IMAGES & IMAGE RETRIEVAL 9

UNIT V IMAGE CLASSIFICATION USING DEEP LEARNING 9

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

TOTAL: 45 PERIODS

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

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

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### MP4092 HUMAN COMPUTER INTERACTION

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

### UNIT I  FOUNDATIONS OF HCI


### UNIT II  INTERACTION STYLES


### UNIT III  VALUATION OF INTERACTION

UNIT IV MODELS AND THEORIES
Task analysis, dialog notations and design, Models of the system, Modeling rich interaction, Ubiquitous computing

UNIT V WEB AND MOBILE INTERACTION
Hypertext, Multimedia and WWW, Designing for the web Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Use Transitions-Lookup patterns-Feedback patterns Mobile apps, Mobile navigation, content and control idioms, Multi-touch gestures, Inter-app integration, Mobile web

COURSE OUTCOMES:
CO1: Understand the basics of human computer interactions via usability engineering and cognitive modeling.
CO2: Understand the basic design paradigms, complex interaction styles.
CO3: Understand the models and theories for user interaction
CO4: Examine the evaluation of interaction designs and implementations.
CO5: Elaborate the above issues for web and mobile applications.

TOTAL: 45 PERIODS

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COURSE OBJECTIVES:

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

UNIT I FORENSIC FUNDAMENTALS


UNIT II NETWORK FORENSICS


UNIT III MOBILE FORENSICS


UNIT IV CLOUD FORENSICS


UNIT V MALWARE FORENSICS


SUGGESTED ACTIVITIES:
1: Analysis Network Forensics
2: Implement forensics trace from mobile phone
3: Implement Forensics on Android and iPhone Mobiles
4: Implement Cloud Forensics on AWS and Azure
5: Implement Static and Dynamic Malware Forensics
COURSE OUTCOMES:
CO1: Can explain and properly document the process of digital forensics analysis.
CO2: Understand the network attacks and forensic tools used for network forensics.
CO3: Understand and analyze the different methods used for data recovery, evidence collection and data seizure from the mobile devices.
CO4: Analyzes the principles, theories, and practice of cloud forensics.
CO5: Understand and analyze malware behavior, including launching, encoding, and network signatures.

TOTAL: 45 PERIODS

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ML4151    ARTIFICIAL INTELLIGENCE    L T P C
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COURSE OBJECTIVES:
- To understand basic problem solving strategies.
- To outline game theory based search and constraint satisfaction.
- To study knowledge representation techniques.
- To explore reasoning and planning associated with AI.
- To study the techniques of knowledge representation.
- To understand probabilistic and other types of reasoning.
- To discuss ethical and safety issues associated with AI.

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

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

UNIT III KNOWLEDGE, REASONING AND PLANNING 9

UNIT IV UNCERTAIN KNOWLEDGE AND REASONING 9

UNIT V PHILOSOPHY, ETHICS AND SAFETY OF AI 9

TOTAL: 45 PERIODS

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

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

REFERENCES:
MU4153 PRINCIPLES OF MULTIMEDIA  

COURSE OBJECTIVES:

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

UNIT I INTRODUCTION


Suggested Activities:

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

Suggested Evaluation Methods:

1. Tutorial – Handling media components
2. Quizzes on different types of data presentation.

UNIT II ELEMENTS OF MULTIMEDIA

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

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

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

**UNIT III MULTIMEDIA TOOLS**


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

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

**UNIT IV MULTIMEDIA SYSTEMS**


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

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

**UNIT V MULTIMEDIA APPLICATIONS FOR THE WEB AND MOBILE PLATFORMS**

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

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

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

REFERENCES:
5. CO-PO Mapping

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NE4071 WIRELESS SENSOR NETWORKS AND PROTOCOLS L T P C
3 0 0 3

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

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

UNIT II  MAC & ROUTING IN WIRELESS SENSOR NETWORKS


UNIT III  TRANSPORT & QOS IN WIRELESS SENSOR NETWORKS


UNIT IV  SECURITY IN AD HOC AND SENSOR NETWORKS


UNIT V  TOOLS FOR WSN


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

TOTAL: 45 PERIODS

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

**COURSE OBJECTIVES:**
- To understand the basics of information retrieval with pertinence to modeling, query operations and indexing.
- To get an understanding of machine learning techniques for text classification and clustering.
- To understand the various applications of information retrieval giving emphasis to multimedia IR, web search.
- To get an understanding of machine learning techniques for text classification and clustering.
- To understand the concepts of digital libraries.

**UNIT I  INTRODUCTION: MOTIVATION**  

**UNIT II  MODELING**  

**UNIT III  INDEXING**  

**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


IF4095 SOCIAL NETWORK ANALYSIS

COURSE OBJECTIVES:

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

UNIT I  GRAPH THEORY AND STRUCTURE 10

UNIT II  SOCIAL NETWORK GRAPH ANALYSIS 9
Social network exploration/processing and properties: Finding overlapping communities, similarity between graph nodes, counting triangles in graphs, neighborhood properties of graphs. Pregel paradigm and Apache Giraph graph processing system.

UNIT III  INFORMATION DIFFUSION IN SOCIAL NETWORKS 9

UNIT IV  CASCADING IN SOCIAL NETWORKS 8

UNIT V  LINK ANALYSIS & COMMUNITY DETECTION 9

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

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

TOTAL: 45 PERIODS

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

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IF4093 GPU COMPUTING L T P C 3 0 0 3

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

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

UNIT IV OPENCL BASICS

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

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

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

REFERENCES

TOTAL : 45 PERIODS
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IF4004 VISUALIZATION TECHNIQUES

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

UNIT I INTRODUCTION

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

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

UNIT II DATA REPRESENTATION

Suggested Activities:
- Flipped classroom on color formats.
- External learning - Survey on different human computer interaction and types of user
interface.

Suggested Evaluation Methods:
- Assignment on human visual and auditory system.
- Quizzes on various color format.
- Assignment on human computer interaction user interface.

UNIT III  DATA PRESENTATION
9

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

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

UNIT IV  INTERACTION AND DESIGN
9

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

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

UNIT V  CURRENT TRENDS
9

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

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

TOTAL: 45 PERIODS

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

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

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COURSE OBJECTIVES:

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

UNIT I  UX LIFECYCLE TEMPLATE  8

UNIT II  CONTEXTUAL INQUIRY  10

UNIT III  DESIGN THINKING, IDEATION, AND SKETCHING  9

UNIT IV  UX GOALS, METRICS, AND TARGETS  8

UNIT V  ANALYSING USER EXPERIENCE  10

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

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

TOTAL: 45 PERIODS

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

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IF4094 PATTERN RECOGNITION L T P C 3 0 0 3

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

UNIT II  
**STATISTICAL PATTERN RECOGNITION**

UNIT III  
**BAYES DECISION THEORY CLASSIFIERS**

UNIT IV  
**LINEAR DISCRIMINANT FUNCTIONS**

UNIT V  
**NONLINEAR CLASSIFIERS**

**SUGGESTED ACTIVITIES:**
1: Car Sales Pattern Classification using Support Vector Classifier
2: Avocado Sales Pattern Recognition using Linear regression
3: Tracking Movements by implementing Pattern Recognition
4: Detecting Lanes by implementing Pattern Recognition
5: Pattern Detection in SAR Images

**COURSE OUTCOMES:**
CO1: Discover imaging, and interpretation of temporal patterns
CO2: Identify Structural Data Patterns
CO3: Implement Pattern Classification using Machine Learning Classifiers
CO4: Implement Pattern Recognition using Deep Learning Models
CO5: Implement Image Pattern Recognition

TOTAL: 45 PERIODS

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

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IF4005 BLOCKCHAIN AND CRYPTOCURRENCY

L T P C 3 0 2 4

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

UNIT I BLOCKCHAIN CONCEPTS

UNIT II ETHEREUM BLOCKCHAIN
Overview of Ethereum. Ethereum accounts Transactions Consensus Timestamp Nonce Block time
UNIT III       SMART CONTRACT WITH SOLIDITY

UNIT IV       SMART CONTRACT SECURITY

UNIT V       CRYPTOCURRENCY

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

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

TOTAL : 45+30=75 PERIODS

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

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IF4074 DISTRIBUTED APPLICATION DEVELOPMENT

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

UNIT I GETTING STARTED WITH GO PROGRAMMING

UNIT II BUILDING DISTRIBUTED APPLICATIONS IN GIN

UNIT III SMART CONTRACTS USING SOLIDITY & GO

UNIT IV DEVELOPING DAPPS

UNIT V BITCOIN NETWORK

LIST OF EXPERIMENTS: 30
1: Developing Purchase Order DApp
2: Designing a Voting DApp
3: Designing and Deploying Vaccine Production using DApp
4: Developing Auction DApp
5: Developing Property Registration DApp

COURSE OUTCOMES:
CO1: Learn How to Compile and Deploy Solidity
CO2: Use Golang to Connect to Ethereum
CO3: Deploy Ethereum Smart Contracts Using Golang
CO4: Develop DApp using Angular
CO5: Develop Bitcoin Application

TOTAL: 45+30=75 PERIODS

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

UNIT I  TIME SERIES FORECASTING  8

UNIT II  TIME SERIES DATA PREPARATION  8

UNIT III  LINEAR STATIONARY MODELS  9

UNIT IV  REGRESSION EXTENSION TECHNIQUES FOR TIME-SERIES DATA  10

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

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

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

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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  10

UNIT VI  NATURAL LANGUAGE PROCESSING USING RNN  10

UNIT V  DEEP REINFORCEMENT & UNSUPERVISED LEARNING  10

LIST OF EXPERIMENTS:  30
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

**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

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**CO 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  DEVPOL PLATFORM AND SERVICES  9+6
Cloud as a platform - IaaS, PaaS, SaaS - Virtualization - Containers -Supporting Multiple Data Centers - Operation Services - Hardware provisioning- software Provisioning - IT services - SLA - capacity planning - security - Service Transition - Service Operation Concepts.

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

UNIT IV  DEVPOL AUTOMATION TOOLS  9+6

UNIT V  MLOps  9+6
MLOps - Definition - Challenges -Developing Models - Deploying to production - Model Governance - Real world examples

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

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

TOTAL :75 PERIODS

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

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

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

UNIT I MOBILE PLATFORM AND APPLICATIONS

UNIT II INTRODUCTION TO ANDROID

UNIT III ANDROID APPLICATION DESIGN ESSENTIALS

UNIT IV ANDROID USER INTERFACE DESIGN & MULTIMEDIA
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
Using Android Data and Storage APIs, Managing data using Sqlite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.

TOTAL:45 PERIODS

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

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

TOTAL: 45+30=75 PERIODS

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

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Avg
COURSE OBJECTIVES:

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

UNIT I MULTI-CORE PROCESSORS


UNIT II PARALLEL PROGRAM CHALLENGES

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

UNIT III SHARED MEMORY PROGRAMMING WITH OPENMP


UNIT IV DISTRIBUTED MEMORY PROGRAMMING WITH MPI

MPI program execution – MPI constructs – libraries – MPI send and receive – Point-to-point and Collective communication – MPI derived datatypes – Performance evaluation.

UNIT V PARALLEL PROGRAM DEVELOPMENT

Case studies – n-Body solvers – Tree Search – OpenMP and MPI implementations and comparison.

TOTAL:45 PERIODS

PRACTICALS:

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

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BC4291 ETHICAL HACKING  L T P C
3 0 2 4

COURSE OBJECTIVES:
- To understand and analyze security threats & countermeasures related to ethical hacking.
- To learn the different levels of vulnerabilities at a system level.
- To gain knowledge on the different hacking methods for web services and session hijacking.
- To understand the hacking mechanisms on how a wireless network is hacked.
UNIT I  ETHICAL HACKING OVERVIEW & VULNERABILITIES  9
Understanding the importance of security, Concept of ethical hacking and essential Terminologies-
Threat, Attack, Vulnerabilities, Target of Evaluation, Exploit. Phases involved in hacking

UNIT II  FOOTPRINTING & PORT SCANNING  9
Footprinting - Introduction to foot printing, Understanding the information gathering methodology of
the hackers, Tools used for the reconnaissance phase, Port Scanning - Introduction, using port
scanning tools, ping sweeps, Scripting Enumeration-Introduction, Enumerating windows OS &
Linux OS

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

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

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

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

TOTAL:45 PERIODS
COURSE OUTCOMES:
CO1: Understand vulnerabilities, mechanisms to identify vulnerabilities/threats/attacks
CO2: Use tools to identify vulnerable entry points
CO3: Identify vulnerabilities using sniffers at different layers
CO4: Handle web application vulnerabilities
CO5: Identify attacks in wireless networks

TOTAL: 30 PERIODS

REFERENCES
1. Kimberly Graves, "Certified Ethical Hacker", Wiley India Pvt Ltd, 2010
5. Thomas Mathew, "Ethical Hacking", OSB publishers, 2003

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MU4151 ADVANCED GRAPHICS AND ANIMATION L T P C
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COURSE OBJECTIVES:
- To understand the basics of geometry processing.
- To understand the fundamentals of pipelined rasterization rendering of meshed objects and curved surfaces.
- To understand and work with advanced rendering methods such as radiosity.
- To design programs for advanced animation methods.
- To become proficient in graphics programming using OpenGL
UNIT I  
FUNDAMENTALS


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

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

UNIT II  
TRANSFORMATIONS


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

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

UNIT III  
FRACTALS


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

Suggested Evaluation Methods:
1. Quiz on Fractals.
2. Demonstration the generation of fractals using Python and Numpy.
3. Assessing the understanding of generation of fractals by changing the various parameters in the OpenGL environment through the programming structs.
UNIT IV ADVANCED GRAPHICS
Monte Carlo Algorithm – Texture Synthesis – Bump Mapping – Environmental Mapping –Advanced
Lighting and Shading – Shadows –Volumetric Rendering.

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

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

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

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

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

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

TOTAL : 45+30=75 PERIODS

COURSE OUTCOMES:
On completion of the course, the students will be able to:
CO1: Understand and apply 3d graphics algorithms related to transformations, illumination, texturing, etc. With the aid of software libraries.
CO2: Develop interactive applications using 3d graphics
CO3: Investigate and apply software libraries for 3d graphics and related software needs.
CO4: Understand the issues relevant to computer animation.
CO5: Describe and synthesize character animation techniques, including motion, changing their facial expressions and crowd behavior.

REFERENCES:

CO-PO Mapping

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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 6
Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT II PRESENTATION SKILLS 6

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

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

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

TOTAL: 30 PERIODS

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

REFERENCES:

AX4092 DISASTER MANAGEMENT
COURSE OBJECTIVES:
- Summarize basics of disaster
- Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Illustrate disaster risk reduction and humanitarian response policy and practice from
multiple perspectives.

- Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Develop the strengths and weaknesses of disaster management approaches

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

UNIT II REPERCUSSIONS OF DISASTERS AND HAZARDS 6

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

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

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

TOTAL : 30 PERIODS

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:
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 nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 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

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.

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.
3. திருமந்திரம் (617, 618)
   - தமிழ் தினம் விசாகத்
4. குருக்ககதாடனத் திருமை மலபாரம்
5. புராணங்கள்
   - சிறுபொற்கம் மலபாரம்
6. நாடகங்கள் (4) - தமிழ்
   கொயில்கள் (11) - தமிழ்
   பல்வெளி விதிகள் (11) - பார்வை, புராண
   புத்தகங்கள் 50 (27) - பார்வை
   ஆசிரியர் புரோஸ் பார்வை

UNIT V  தமிழ் இலக்கியம் 6

1. தமிழ் திகளம்
   - தமிழியல் பொருள் நிலை
   - தமிழ் பொருள் நிலை
   - சமையல் திகளம்
   - பார்வை திகளம்
   - குருக்ககதாடன
2. குருக்ககதாடனத் திருமை
3. தமிழ் விதிகள்
4. புத்தகங்கள்
5. இயற்கைப் பொருள்
6. தமிழ் பதிப்பங்கள்
7. சுற்றுச் சூழல்

TOTAL: 30 PERIODS

தமிழ் இலக்கியம் தர்க்ககல்விகள் / புத்தகங்கள்

1. தமிழ் திகளம் கல்விக்கழகம் (Tamil Virtual University)
   - www.tamilvu.org
2. தமிழ் விக்கிப்பீடியோ (Tamil Wikipedia)
   - https://ta.wikipedia.org
3. குருக்ககதாடன ஐன்ஸ்பீச்
4. பார்வை திகளம்
   - தமிழ் பொருள் நிலை
   - தமிழ் பார்வை
   - தமிழ் பொருள்
5. தமிழ் விதிகள்
   - தமிழ் திகளம்
   - தமிழ் பார்வை
6. இயற்கைப் பொருள்
   - தமிழ் பார்வை
OBJECTIVE

- Students will be introduced to the concepts and principles of IWRM, which is inclusive of the economics, public-private partnership, water & health, water & food security and legal & regulatory settings.

UNIT I  CONTEXT FOR IWRM

- Water as a global issue: key challenges
- Definition of IWRM within the broader context of development
- Key elements of IWRM: Principles
- Paradigm shift in water management
- Complexity of the IWRM process
- UN World Water Assessment
- SDGs

UNIT II  WATER ECONOMICS

- Economic view of water issues: economic characteristics of water good and services
- Non-market monetary valuation methods
- Water economic instruments
- Private sector involvement in water resources management: PPP objectives, PPP models, PPP processes, PPP experiences through case studies

UNIT III  LEGAL AND REGULATORY SETTINGS

- Basic notion of law and governance: principles of international and national law in the area of water management
- Understanding UN law on non-navigable uses of international water courses
- International law for groundwater management
- World Water Forums
- Global Water Partnerships
- Development of IWRM in line with legal and regulatory framework

UNIT IV  WATER AND HEALTH WITHIN THE IWRM CONTEXT

- Links between water and health: options to include water management interventions for health
- Health protection and promotion in the context of IWRM
- Global burden of Diseases
- Health impact assessment of water resources development projects
- Case studies

UNIT V  AGRICULTURE IN THE CONCEPT OF IWRM

- Water for food production: ‘blue’ versus ‘green’ water debate
- Water footprint - Virtual water trade
- For achieving global water and food security — Irrigation efficiencies, irrigation methods
- Current water pricing policy—scope to relook pricing

OUTCOMES

- On completion of the course, the student is expected to be able to

CO1 Describe the context and principles of IWRM; Compare the conventional and integrated ways of water management.

CO2 Select the best economic option among the alternatives; illustrate the pros and cons of PPP through case studies.

CO3 Apply law and governance in the context of IWRM.

CO4 Discuss the linkages between water-health; develop a HIA framework.

CO5 Analyse how the virtual water concept pave way to alternate policy options.

REFERENCES:


OCE432 WATER, SANITATION AND HEALTH L T P C 3 0 0 3

OBJECTIVES:
• Understand the accelerating health impacts due to the present managerial aspects and initiatives in water and sanitation and health sectors in the developing scenario

UNIT I FUNDAMENTALS WASH 9
Meanings and Definition: Safe Water- Health, Nexus: Water- Sanitation - Health and Hygiene – Equity issues-Water security - Food Security. Sanitation And Hygiene (WASH) and Integrated Water Resources Management (IWRM) - Need and Importance of WASH

UNIT II MANAGERIAL IMPLICATIONS AND IMPACT 9

UNIT III CHALLENGES IN MANAGEMENT AND DEVELOPMENT 9

UNIT IV GOVERNANCE 9
Public health -Community Health Assessment and Improvement Planning (CHA/CHIP)- Infrastructure and Investments on Water, (WASH) - Cost Benefit Analysis – Institutional Intervention-Public Private Partnership - Policy Directives - Social Insurance -Political Will vs Participatory Governance -

UNIT V INITIATIVES 9
Management vs Development -Accelerating Development- Development Indicators -Inclusive Development-Global and Local- Millennium Development Goal (MDG) and Targets - Five Year Plans - Implementation - Capacity Building - Case studies on WASH.

TOTAL: 45 PERIODS

OUTCOMES:
CO1 Capture to fundamental concepts and terms which are to be applied and understood
all through the study.

**CO2** Comprehend the various factors affecting water sanitation and health through the lens of third world scenario.

**CO3** Critically analyse and articulate the underlying common challenges in water, sanitation and health.

**CO4** Acquire knowledge on the attributes of governance and its say on water sanitation and health.

**CO5** Gain an overarching insight into the aspects of sustainable resource management in the absence of a clear level playing field in the developmental aspects.

REFERENCES

5. Intersectoral Water Allocation Planning and Management, 2000, World Bank Publishers

OCE433 PRINCIPLES OF SUSTAINABLE DEVELOPMENT

**OBJECTIVES:**

- To impart knowledge on environmental, social and economic dimensions of sustainability and the principles evolved through landmark events so as to develop an action mindset for sustainable development.

UNIT I SUSTAINABILITY AND DEVELOPMENT CHALLENGES


UNIT II PRINCIPLES AND FRAMEWORK

UNIT III SUSTAINABLE DEVELOPMENT AND WELLBEING


UNIT IV SUSTAINABLE SOCIO-ECONOMIC SYSTEMS

Sustainable Development Goals and Linkage to Sustainable Consumption and Production - Investing in Natural Capital - Agriculture, Forests, Fisheries - Food security and nutrition and sustainable agriculture - Water and sanitation - Biodiversity conservation and Ecosystem integrity - Ecotourism - Sustainable Cities - Sustainable Habitats - Green Buildings - Sustainable Transportation — Sustainable Mining - Sustainable Energy - Climate Change – Mitigation and Adaptation - Safeguarding Marine Resources - Financial Resources and Mechanisms

UNIT V ASSESSING PROGRESS AND WAY FORWARD


TOTAL: 45 PERIODS

OUTCOMES:

• On completion of the course, the student is expected to be able to

CO1 Explain and evaluate current challenges to sustainability, including modern world social, environmental, and economic structures and crises.

CO2 Identify and critically analyze the social environmental, and economic dimensions of sustainability in terms of UN Sustainable development goals

CO3 Develop a fair understanding of the social, economic and ecological linkage of Human well being, production and consumption

CO4 Evaluate sustainability issues and solutions using a holistic approach that focuses on connections between complex human and natural systems.

CO5 Integrate knowledge from multiple sources and perspectives to understand environmental limits governing human societies and economies and social justice dimensions of sustainability.

REFERENCES:


OCE434 ENVIRONMENTAL IMPACT ASSESSMENT

OBJECTIVES:
- To make the students to understand environmental clearance, its legal requirements and to provide knowledge on overall methodology of EIA, prediction tools and models, environmental management plan and case studies.

UNIT I INTRODUCTION

UNIT II IMPACT IDENTIFICATION AND PREDICTION

UNIT III SOCIO-ECONOMIC IMPACT ASSESSMENT
Socio-economic impact assessment - relationship between social impacts and change in community and institutional arrangements. factors and methodologies- individual and family level impacts. communities in transition-rehabilitation

UNIT IV EIA DOCUMENTATION AND ENVIRONMENTAL MANAGEMENT PLAN
Environmental management plan - preparation, implementation and review – mitigation and rehabilitation plans – policy and guidelines for planning and monitoring programmes – post project audit – documentation of EIA findings – ethical and quality aspects of environmental impact assessment

UNIT V CASE STUDIES
Mining, power plants, cement plants, highways, petroleum refining industry, storage & handling of hazardous chemicals, common hazardous waste facilities, CETPs, CMSWMF, building and construction projects

TOTAL: 45 PERIODS

OUTCOMES:
- On completion of the course, the student is expected to be able to
  CO1 Understand need for environmental clearance, its legal procedure, need of EIA, its types, stakeholders and their roles
  CO2 Understand various impact identification methodologies, prediction techniques and model of impacts on various environments
  CO3 Understand relationship between social impacts and change in community due to development activities and rehabilitation methods
CO4 Document the EIA findings and prepare environmental management and monitoring plan

CO5 Identify, predict and assess impacts of similar projects based on case studies

REFERENCES:
1. EIA Notification 2006 including recent amendments, by Ministry of Environment, Forest and Climate Change, Government of India
2. Sectoral Guidelines under EIA Notification by Ministry of Environment, Forest and Climate Change, Government of India

OME431 VIBRATION AND NOISE CONTROL STRATEGIES

OBJECTIVES
- To appreciate the basic concepts of vibration in damped and undamped systems
- To appreciate the basic concepts of noise, its effect on hearing and related terminology
- To use the instruments for measuring and analyzing the vibration levels in a body
- To use the instruments for measuring and analyzing the noise levels in a system
- To learn the standards of vibration and noise levels and their control techniques

UNIT- I BASICS OF VIBRATION

UNIT- II BASICS OF NOISE
Introduction - Anatomy of human ear - Mechanism of hearing - Amplitude, frequency, wavelength and sound pressure level - Relationship between sound power, sound intensity and sound pressure level - Addition, subtraction and averaging decibel levels - sound spectra -Types of sound fields - Octave band analysis - Loudness.

UNIT- III INSTRUMENTATION FOR VIBRATION MEASUREMENT
UNIT- IV INSTRUMENTATION FOR NOISE MEASUREMENT AND ANALYSIS

Microphones - Weighting networks - Sound Level meters, its classes and calibration - Noise measurements using sound level meters - Data Loggers - Sound exposure meters - Recording of noise - Spectrum analyser - Intensity meters - Energy density sensors - Sound source localization.

UNIT- V METHODS OF VIBRATION CONTROL, SOURCES OF NOISE AND ITS CONTROL


OUTCOMES:
On Completion of the course the student will be able to
1. apply the basic concepts of vibration in damped and undamped systems
2. apply the basic concepts of noise and to understand its effects on systems
3. select the instruments required for vibration measurement and its analysis
4. select the instruments required for noise measurement and its analysis.
5. recognize the noise sources and to control the vibration levels in a body and to control noise under different strategies.

REFERENCES:

OME432 ENERGY CONSERVATION AND MANAGEMENT IN DOMESTIC SECTORS

COURSE OBJECTIVES:
- To learn the present energy scenario and the need for energy conservation.
- To understand the different measures for energy conservation in utilities.
- Acquaint students with principle theories, materials, and construction techniques to create energy efficient buildings.
• To identify the energy demand and bridge the gap with suitable technology for sustainable habitat
• To get familiar with the energy technology, current status of research and find the ways to optimize a system as per the user requirement

UNIT I    ENERGY SCENARIO

UNIT II    HEATING, VENTILATION & AIR CONDITIONING

UNIT III    LIGHTING, COMPUTER, TV

UNIT IV    ENERGY EFFICIENT BUILDINGS

UNIT V    ENERGY STORAGE TECHNOLOGIES
Necessity & types of energy storage – Thermal energy storage – Battery energy storage, charging and discharging– Hydrogen energy storage & Super capacitors – energy density and safety issues – Applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to:
• Understand technical aspects of energy conservation scenario.
• Energy audit in any type for domestic buildings and suggest the conservation measures.
• Perform building load estimates and design the energy efficient landscape system.
• Gain knowledge to utilize an appliance/device sustainably.
• Understand the status and current technological advancement in energy storage field.

REFERENCES:
6. (Could be downloaded from www.energymanagertraining.com)

OME433 ADDITIVE MANUFACTURING

UNIT I INTRODUCTION 9

UNIT II DESIGN FOR ADDITIVE MANUFACTURING 9

UNIT III VAT POLYMERIZATION 9

UNIT IV MATERIAL EXTRUSION AND SHEET LAMINATION 9

POWDER BASED PROCESS

UNIT V CASE STUDIES AND OPPORTUNITIES ADDITIVE MANUFACTURING PROCESSES 9

TOTAL: 45 PERIODS

REFERENCES:

OME434 ELECTRIC VEHICLE TECHNOLOGY L T P C

UNIT I NEED FOR ELECTRIC VEHICLES
History and need for electric and hybrid vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies, comparison of diesel, petrol, electric and hybrid vehicles, limitations, technical challenges

UNIT II ELECTRIC VEHICLE ARCHITECHTURE
Electric vehicle types, layout and power delivery, performance – traction motor characteristics, tractive effort, transmission requirements, vehicle performance, energy consumption, Concepts of hybrid electric drive train, architecture of series and parallel hybrid electric drive train, merits and demerits, mild and full hybrids, plug-in hybrid electric vehicles and range extended hybrid electric vehicles, Fuel cell vehicles.

UNIT III ENERGY STORAGE
Batteries – types – lead acid batteries, nickel based batteries, and lithium based batteries, electrochemical reactions, thermodynamic voltage, specific energy, specific power, energy efficiency, Battery modeling and equivalent circuit, battery charging and types, battery cooling, Ultra-capacitors, Flywheel technology, Hydrogen fuel cell, Thermal Management of the PEM fuel cell

UNIT IV ELECTRIC DRIVES AND CONTROL
Types of electric motors – working principle of AC and DC motors, advantages and limitations, DC motor drives and control, Induction motor drives and control, PMSM and brushless DC motor -drives and control, AC and Switch reluctance motor drives and control – Drive system efficiency – Inverters – DC and AC motor speed controllers

UNIT V DESIGN OF ELECTRIC VEHICLES

TOTAL: 45 PERIODS
REFERENCES:

OME435 NEW PRODUCT DEVELOPMENT

COURSE OBJECTIVES:
The main learning objective of this course is to prepare the students for:
- Applying the principles of generic development process; and understanding the organization structure for new product design and development.
- Identifying opportunity and planning for new product design and development.
- Conducting customer need analysis; and setting product specification for new product design and development.
- Generating, selecting, and testing the concepts for new product design and development.
- Applying the principles of Industrial design and prototype for new product design and development.

UNIT I INTRODUCTION TO PRODUCT DESIGN & DEVELOPMENT

UNIT II OPPORTUNITY IDENTIFICATION & PRODUCT PLANNING

UNIT III IDENTIFYING CUSTOMER NEEDS & PRODUCT SPECIFICATIONS

UNIT IV CONCEPT GENERATION, SELECTION & TESTING

UNIT V INDUSTRIAL DESIGN & PROTOTYPING
Industrial Design: Need and Impact–Industrial Design Process. Prototyping – Principles of
Prototyping – Prototyping Technologies – Planning for Prototypes.

**COURSE OUTCOMES:**
Upon completion of this course, the students will be able to:
- Apply the principles of generic development process; and understand the organization structure for new product design and development.
- Identify opportunity and plan for new product design and development.
- Conduct customer need analysis; and set product specification for new product design and development.
- Generate, select, and test the concepts for new product design and development.
- Apply the principles of Industrial design and prototype for design and develop new products.

**TEXT BOOK:**

**REFERENCES:**

**OBA431 SUSTAINABLE MANAGEMENT 3 0 0 3**

**COURSE OBJECTIVES:**
- To provide students with fundamental knowledge of the notion of corporate sustainability.
- To determine how organizations impacts on the environment and socio-technical systems, the relationship between social and environmental performance and competitiveness, the approaches and methods.

**UNIT I MANAGEMENT OF SUSTAINABILITY**
Management of sustainability - rationale and political trends: An introduction to sustainability management, International and European policies on sustainable development, theoretical pillars in sustainability management studies.

**UNIT II CORPORATE SUSTAINABILITY AND RESPONSIBILITY**
Corporate sustainability parameter, corporate sustainability institutional framework, integration of sustainability into strategic planning and regular business practices, fundamentals of stakeholder engagement.
UNIT III SUSTAINABILITY MANAGEMENT: STRATEGIES AND APPROACHES  9
Corporate sustainability management and competitiveness: Sustainability-oriented corporate strategies, markets and competitiveness, Green Management between theory and practice, Sustainable Consumption and Green Marketing strategies, Environmental regulation and strategic postures; Green Management approaches and tools; Green engineering: clean technologies and innovation processes; Sustainable Supply Chain Management and Procurement.

UNIT IV SUSTAINABILITY AND INNOVATION  9
Socio-technical transitions and sustainability, Sustainable entrepreneurship, Sustainable pioneers in green market niches, Smart communities and smart specializations.

UNIT V SUSTAINABLE MANAGEMENT OF RESOURCES, COMMODITIES AND COMMONS  9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
CO1: An understanding of sustainability management as an approach to aid in evaluating and minimizing environmental impacts while achieving the expected social impact.
CO2: An understanding of corporate sustainability and responsible Business Practices
CO3: Knowledge and skills to understand, to measure and interpret sustainability performances.
CO4: Knowledge of innovative practices in sustainable business and community management
CO5: Deep understanding of sustainable management of resources and commodities

REFERENCES:
4. Margaret Robertson, Sustainability Principles and Practice, 2014
5. Peter Rogers, An Introduction to Sustainable Development, 2006

COURSE OBJECTIVES
- To familiarize students with the theory and practice of small business management.
- To learn the legal issues faced by small business and how they impact operations.

UNIT I INTRODUCTION TO SMALL BUSINESS  9
UNIT II SCREENING THE BUSINESS OPPORTUNITY AND FORMULATING THE BUSINESS PLAN

9

Concepts of opportunity recognition; Key factors leading to new venture failure; New venture screening process; Applying new venture screening process to the early stage small firm Role planning in small business – importance of strategy formulation – management skills for small business creation and development.

UNIT III BUILDING THE RIGHT TEAM AND MARKETING STRATEGY

9

Management and Leadership – employee assessments – Tuckman's stages of group development - The entrepreneurial process model - Delegation and team building - Comparison of HR management in small and large firms - Importance of coaching and how to apply a coaching model.

Marketing within the small business - success strategies for small business marketing - customer delight and business generating systems, - market research, - assessing market performance-sales management and strategy - the marketing mix and marketing strategy.

UNIT IV FINANCING SMALL BUSINESS

9

Main sources of entrepreneurial capital; Nature of ‘bootstrap’ financing - Difference between cash and profit - Nature of bank financing and equity financing - Funding-equity gap for small firms. Importance of working capital cycle - Calculation of break-even point - Power of gross profit margin- Pricing for profit - Credit policy issues and relating these to cash flow management and profitability.

UNIT V VALUING SMALL BUSINESS AND CRISIS MANAGEMENT

9

Causes of small business failure - Danger signals of impending trouble - Characteristics of poorly performing firms - Turnaround strategies - Concept of business valuation - Different valuation measurements - Nature of goodwill and how to measure it - Advantages and disadvantages of buying an established small firm - Process of preparing a business for sale.

TOTAL: 45 PERIODS

COURSE OUTCOMES

CO1. Familiarise the students with the concept of small business
CO2. In depth knowledge on small business opportunities and challenges
CO3. Ability to devise plans for small business by building the right skills and marketing strategies
CO4. Identify the funding source for small start ups
CO5. Business evaluation for buying and selling of small firms

REFERENCES

3. Journal articles on SME’s.
COURSE OBJECTIVE
- To understand intellectual property rights and its valuation.

UNIT I  INTRODUCTION
Intellectual property rights - Introduction, Basic concepts, Patents, Copyrights, Trademarks, Trade Secrets, Geographic Indicators; Nature of Intellectual Property, Technological Research, Inventions and Innovations, History - the way from WTO to WIPO, TRIPS.

UNIT II  PROCESS
New Developments in IPR, Procedure for grant of Patents, TM, GIs, Patenting under Patent Cooperation Treaty, Administration of Patent system in India, Patenting in foreign countries.

UNIT III  STATUTES

UNIT IV  STRATEGIES IN INTELLECTUAL PROPERTY
Strategies for investing in R&D, Patent Information and databases, IPR strength in India, Traditional Knowledge, Case studies.

UNIT V  MODELS
The technologies Know-how, concept of ownership, Significance of IP in Value Creation, IP Valuation and IP Valuation Models, Application of Real Option Model in Strategic Decision Making, Transfer and Licensing.

TOTAL: 45 PERIODS

COURSE OUTCOMES
- CO1: Understanding of intellectual property and appreciation of the need to protect it
- CO2: Awareness about the process of patenting
- CO3: Understanding of the statutes related to IPR
- CO4: Ability to apply strategies to protect intellectual property
- CO5: Ability to apply models for making strategic decisions related to IPR

REFERENCES
2. Intellectual Property rights and copyrights, EssEss Publications.
COURSE OBJECTIVE

- To help students develop knowledge and competence in ethical management and decision making in organizational contexts.

UNIT I  ETHICS AND SOCIETY  9
Ethical Management- Definition, Motivation, Advantages-Practical implications of ethical management. Managerial ethics, professional ethics, and social Responsibility-Role of culture and society’s expectations- Individual and organizational responsibility to society and the community.

UNIT II  ETHICAL DECISION MAKING AND MANAGEMENT IN A CRISIS  9
Managing in an ethical crisis, the nature of a crisis, ethics in crisis management, discuss case studies, analyze real-world scenarios, develop ethical management skills, knowledge, and competencies. Proactive crisis management.

UNIT III  STAKEHOLDERS IN ETHICAL MANAGEMENT  9
Stakeholders in ethical management, identifying internal and external stakeholders, nature of stakeholders, ethical management of various kinds of stakeholders: customers (product and service issues), employees (leadership, fairness, justice, diversity) suppliers, collaborators, business, community, the natural environment (the sustainability imperative, green management, Contemporary issues).

UNIT IV  INDIVIDUAL VARIABLES IN ETHICAL MANAGEMENT  9
Understanding individual variables in ethics, managerial ethics, concepts in ethical psychology-ethical awareness, ethical courage, ethical judgment, ethical foundations, ethical emotions/intuitions/intensity. Utilization of these concepts and competencies for ethical decision-making and management.

UNIT V  PRACTICAL FIELD-GUIDE, TECHNIQUES AND SKILLS  9
Ethical management in practice, development of techniques and skills, navigating challenges and dilemmas, resolving issues and preventing unethical management proactively. Role modelling and creating a culture of ethical management and human flourishing.

TOTAL: 45 PERIODS

COURSE OUTCOMES

CO1: Role modelling and influencing the ethical and cultural context.
CO2: Respond to ethical crises and proactively address potential crises situations.
CO3: Understand and implement stakeholder management decisions.
CO4: Develop the ability, knowledge, and skills for ethical management.
CO5: Develop practical skills to navigate, resolve and thrive in management situations

REFERENCES

COURSE OBJECTIVES:
- To study about Internet of Things technologies and its role in real time applications.
- To introduce the infrastructure required for IoT
- To familiarize the accessories and communication techniques for IoT.
- To provide insight about the embedded processor and sensors required for IoT
- To familiarize the different platforms and Attributes for IoT

UNIT I         INTRODUCTION TO INTERNET OF THINGS
Overview, Hardware and software requirements for IOT, Sensor and actuators, Technology drivers, Business drivers, Typical IoT applications, Trends and implications.

UNIT II         IOT ARCHITECTURE

UNIT III       PROTOCOLS AND WIRELESS TECHNOLOGIES FOR IOT
PROTOCOLS:
NFC, SCADA and RFID, Zigbee MIPI, M-PHY, UniPro, SPMI, SPI, M-PCIe GSM, CDMA, LTE, GPRS, small cell.

Wireless technologies for IoT: WiFi (IEEE 802.11), Bluetooth/Bluetooth Smart, ZigBee/ZigBee Smart, UWB (IEEE 802.15.4), 6LoWPAN, Proprietary systems-Recent trends.

UNIT IV       IOT PROCESSORS
Services/Attributes: Big-Data Analytics for IOT, Dependability, Interoperability, Security, Maintainability.
Embedded processors for IOT : Introduction to Python programming - Building IOT with RASPERRY PI and Arduino.

UNIT V      CASE STUDIES
Industrial IoT, Home Automation, smart cities, Smart Grid, connected vehicles, electric vehicle charging, Environment, Agriculture, Productivity Applications, IOT Defense

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of this course, the students will have the ability to
CO1: Analyze the concepts of IoT and its present developments.
CO2: Compare and contrast different platforms and infrastructures available for IoT
CO3: Explain different protocols and communication technologies used in IoT
CO4: Analyze the big data analytic and programming of IoT
CO5: Implement IoT solutions for smart applications

REFERENCES:

ET4072 MACHINE LEARNING AND DEEP LEARNING

COURSE OBJECTIVES:
The course is aimed at
- Understanding about the learning problem and algorithms
- Providing insight about neural networks
- Introducing the machine learning fundamentals and significance
- Enabling the students to acquire knowledge about pattern recognition.
- Motivating the students to apply deep learning algorithms for solving real life problems.

UNIT I LEARNING PROBLEMS AND ALGORITHMS
Various paradigms of learning problems, Supervised, Semi-supervised and Unsupervised algorithms

UNIT II NEURAL NETWORKS

UNIT III MACHINE LEARNING – FUNDAMENTALS & FEATURE SELECTIONS & CLASSIFICATIONS
Classifying Samples: The confusion matrix, Accuracy, Precision, Recall, F1- Score, the curse of dimensionality, training, testing, validation, cross validation, overfitting, under-fitting the data, early stopping, regularization, bias and variance. Feature Selection, normalization, dimensionality reduction, Classifiers: KNN, SVM, Decision trees, Naïve Bayes, Binary classification, multi class classification, clustering.
UNIT IV  DEEP LEARNING: CONVOLUTIONAL NEURAL NETWORKS  9
Feed forward networks, Activation functions, back propagation in CNN, optimizers, batch normalization, convolution layers, pooling layers, fully connected layers, dropout, Examples of CNNs.

UNIT V  DEEP LEARNING: RNNS, AUTOENCODERS AND GANS  9
State, Structure of RNN Cell, LSTM and GRU, Time distributed layers, Generating Text, Autoencoders: Convolutional Autoencoders, Denoising autoencoders, Variational autoencoders, GANs: The discriminator, generator, DCGANs

COURSE OUTCOMES (CO):
At the end of the course the student will be able to
CO1 : Illustrate the categorization of machine learning algorithms.
CO2: Compare and contrast the types of neural network architectures, activation functions
CO3: Acquaint with the pattern association using neural networks
CO4: Elaborate various terminologies related with pattern recognition and architectures of convolutional neural networks
CO5: Construct different feature selection and classification techniques and advanced neural network architectures such as RNN, Autoencoders, and GANs.

REFERENCES:

PX4012  RENEWABLE ENERGY TECHNOLOGY  L T P C  3 0 0 3

OBJECTIVES:
To impart knowledge on
• Different types of renewable energy technologies
• Standalone operation, grid connected operation of renewable energy systems

UNIT I  INTRODUCTION  9
Classification of energy sources – Co2 Emission - Features of Renewable energy - Renewable energy scenario in India -Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment Per Capital Consumption - CO₂ Emission - importance of renewable energy sources, Potentials – Achievements– Applications.
UNIT II  SOLAR PHOTOVOLTAICS  9

UNIT III  PHOTOVOLTAIC SYSTEM DESIGN  9
Block diagram of solar photo voltaic system : Line commutated converters (inversion mode) - Boost and buck-boost converters - selection of inverter, battery sizing, array sizing - PV systems classification- standalone PV systems - Grid tied and grid interactive inverters- grid connection issues.

UNIT IV  WIND ENERGY CONVERSION SYSTEMS  9
Origin of Winds: Global and Local Winds- Aerodynamics of Wind turbine-Derivation of Betz’s limit-Power available in wind-Classification of wind turbine: Horizontal Axis wind turbine and Vertical axis wind turbine- Aerodynamic Efficiency-Tip Speed Tip Speed Ratio-Solidity-Blade Count-Power curve of wind turbine - Configurations of wind energy conversion systems: Type A, Type B, Type C and Type D Configurations- Grid connection Issues - Grid integrated SCIG and PMSG based WECS.

UNIT V  OTHER RENEWABLE ENERGY SOURCES  9
Qualitative study of different renewable energy resources: ocean, Biomass, Hydrogen energy systems, Fuel cells, Ocean Thermal Energy Conversion (OTEC), Tidal and wave energy, Geothermal Energy Resources.

TOTAL : 45 PERIODS

OUTCOMES:
After completion of this course, the student will be able to:

CO1: Demonstrate the need for renewable energy sources.
CO2: Develop a stand-alone photo voltaic system and implement a maximum power point tracking in the PV system.
CO3: Design a stand-alone and Grid connected PV system.
CO4: Analyze the different configurations of the wind energy conversion systems.
CO5: Realize the basic of various available renewable energy sources

REFERENCES:
COURSE OBJECTIVES

- To Study about Smart Grid technologies, different smart meters and advanced metering infrastructure.
- To know about the function of smart grid.
- To familiarize the power quality management issues in Smart Grid.
- To familiarize the high performance computing for Smart Grid applications
- To get familiarized with the communication networks for Smart Grid applications

UNIT I  INTRODUCTION TO SMART GRID  9
Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits. Difference between conventional & Smart Grid, Comparison of Micro grid and Smart grid, Present development & International policies in Smart Grid, Smart Grid Initiative for Power Distribution Utility in India – Case Study.

UNIT II  SMART GRID TECHNOLOGIES  9
Technology Drivers, Smart Integration of energy resources, Smart substations, Substation Automation, Feeder Automation, Transmission systems: EMS, FACTS and HVDC, Wide area monitoring, Protection and control, Distribution systems: DMS, Volt/Var control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, Plug in Hybrid Electric Vehicles (PHEV) – Grid to Vehicle and Vehicle to Grid charging concepts.

UNIT III  SMART METERS AND ADVANCED METERING INFRASTRUCTURE  9
Introduction to Smart Meters, Advanced Metering infrastructure (AMI) drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit (PMU) & their application for monitoring & protection. Demand side management and demand response programs, Demand pricing and Time of Use, Real Time Pricing, Peak Time Pricing.

UNIT IV  POWER QUALITY MANAGEMENT IN SMART GRID  9

UNIT V  HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS  9
Architecture and Standards - Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN), Broadband over Power line (BPL), PLC, Zigbee, GSM, IP based Protocols, Basics of Web Service and CLOUD Computing, Cyber Security for Smart Grid.

TOTAL : 45 PERIODS

COURSE OUTCOME:
Students able to
CO1: Relate with the smart resources, smart meters and other smart devices.
CO2: Explain the function of Smart Grid.
CO3: Experiment the issues of Power Quality in Smart Grid.
CO4: Analyze the performance of Smart Grid.
CO5: Recommend suitable communication networks for smart grid applications
REFERENCES

DS4015 BIG DATA ANALYTICS

COURSE OBJECTIVES:
- To understand the basics of big data analytics
- To understand the search methods and visualization
- To learn mining data streams
- To learn frameworks
- To gain knowledge on R language

UNIT I INTRODUCTION TO BIG DATA
Introduction to Big Data Platform – Challenges of Conventional Systems - Intelligent data analysis

UNIT II SEARCH METHODS AND VISUALIZATION

UNIT III MINING DATA STREAMS

UNIT IV FRAMEWORKS
MapReduce – Hadoop, Hive, MapR – Sharding – NoSQL Databases - S3 - Hadoop Distributed File Systems – Case Study- Preventing Private Information Inference Attacks on Social Networks-
Grand Challenge: Applying Regulatory Science and Big Data to Improve Medical Device Innovation
UNIT V  R LANGUAGE

COURSE OUTCOMES:
CO1: understand the basics of big data analytics
CO2: Ability to use Hadoop, Map Reduce Framework.
CO3: Ability to identify the areas for applying big data analytics for increasing the business outcome.
CO4: gain knowledge on R language
CO5: Contextually integrate and correlate large amounts of information to gain faster insights.

TOTAL: 45 PERIODS

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NC4201  INTERNET OF THINGS AND CLOUD

COURSE OBJECTIVES:
- To understand Smart Objects and IoT Architectures
- To learn about various IOT-related protocols
- To build simple IoT Systems using Arduino and Raspberry Pi.
- To understand data analytics and cloud in the context of IoT
- To develop IoT infrastructure for popular applications

UNIT I  FUNDAMENTALS OF IoT
UNIT II PROTOCOLS FOR IoT
Infrastructure protocol (IPV4/V6/RPL), Identification (URIs), Transport (Wifi, Lifi, BLE), Discovery,
Data Protocols, Device Management Protocols. – A Case Study with MQTT/CoAP usage-IoT
privacy, security and vulnerability solutions.

UNIT III CASE STUDIES/INDUSTRIAL APPLICATIONS
Case studies with architectural analysis: IoT applications – Smart City – Smart Water – Smart
Agriculture – Smart Energy – Smart Healthcare – Smart Transportation – Smart Retail – Smart
waste management.

UNIT IV CLOUD COMPUTING INTRODUCTION
Introduction to Cloud Computing - Service Model – Deployment Model- Virtualization Concepts –
Cloud Platforms – Amazon AWS – Microsoft Azure – Google APIs.

UNIT V IoT AND CLOUD
IoT and the Cloud - Role of Cloud Computing in IoT - AWS Components - S3 – Lambda - AWS IoT
Core -Connecting a web application to AWS IoT using MQTT- AWS IoT Examples. Security
Concerns, Risk Issues, and Legal Aspects of Cloud Computing- Cloud Data Security

TOTAL:45 PERIODS

COURSE OUTCOMES:
At the end of the course, the student will be able to:
CO1: Understand the various concept of the IoT and their technologies..
CO2: Develop 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

REFERENCES
and Anupama C. Raman ,CRC Press, 2017
3. EMC Education Services, “Data Science and Big Data Analytics: Discovering, Analyzing,

MX4073 MEDICAL ROBOTICS

COURSE OBJECTIVES:
• To explain the basic concepts of robots and types of robots
• To discuss the designing procedure of manipulators, actuators and grippers
• To impart knowledge on various types of sensors and power sources
• To explore various applications of Robots in Medicine
• To impart knowledge on wearable robots
UNIT I  INTRODUCTION TO ROBOTICS 9
Introduction to Robotics, Overview of robot subsystems, Degrees of freedom, configurations and concept of workspace, Dynamic Stabilization

Sensors and Actuators
Sensors and controllers, Internal and external sensors, position, velocity and acceleration sensors, Proximity sensors, force sensors Pneumatic and hydraulic actuators, Stepper motor control circuits, End effectors, Various types of Grippers, PD and PID feedback actuator models

UNIT II  MANIPULATORS & BASIC KINEMATICS 9
Construction of Manipulators, Manipulator Dynamic and Force Control, Electronic and pneumatic manipulator, Forward Kinematic Problems, Inverse Kinematic Problems, Solutions of Inverse Kinematic problems

Navigation and Treatment Planning
Variable speed arrangements, Path determination – Machinery vision, Ranging – Laser – Acoustic, Magnetic, fiber optic and Tactile sensor

UNIT III  SURGICAL ROBOTS 9
Da Vinci Surgical System, Image guided robotic systems for focal ultrasound based surgical applications, System concept for robotic Tele-surgical system for off-pump, CABG surgery, Urologic applications, Cardiac surgery, Neuro-surgery, Pediatric and General Surgery, Gynecologic Surgery, General Surgery and Nanorobotics. Case Study

UNIT IV  REHABILITATION AND ASSISTIVE ROBOTS 9
Pediatric Rehabilitation, Robotic Therapy for the Upper Extremity and Walking, Clinical-Based Gait Rehabilitation Robots, Motion Correlation and Tracking, Motion Prediction, Motion Replication. Portable Robot for Tele rehabilitation, Robotic Exoskeletons – Design considerations, Hybrid assistive limb. Case Study

UNIT V  WEARABLE ROBOTS 9
Augmented Reality, Kinematics and Dynamics for Wearable Robots, Wearable Robot technology, Sensors, Actuators, Portable Energy Storage, Human–robot cognitive interaction (cHRI), Human–robot physical interaction (pHRI), Wearable Robotic Communication - case study

TOTAL:45 PERIODS

COURSE OUTCOMES:
CO1: Describe the configuration, applications of robots and the concept of grippers and actuators
CO2: Explain the functions of manipulators and basic kinematics
CO3: Describe the application of robots in various surgeries
CO4: Design and analyze the robotic systems for rehabilitation
CO5: Design the wearable robots

REFERENCES
VE4202 EMBEDDED AUTOMATION L T P C
3 0 0 3

COURSE OBJECTIVES:

- To learn about the process involved in the design and development of real-time embedded system
- To develop the embedded C programming skills on 8-bit microcontroller
- To study about the interfacing mechanism of peripheral devices with 8-bit microcontrollers
- To learn about the tools, firmware related to microcontroller programming
- To build a home automation system

UNIT - I INTRODUCTION TO EMBEDDED C PROGRAMMING
C Overview and Program Structure - C Types, Operators and Expressions - C Control Flow - C Functions and Program Structures - C Pointers And Arrays - FIFO and LIFO - C Structures - Development Tools

UNIT - II AVR MICROCONTROLLER
ATMEGA 16 Architecture - Nonvolatile and Data Memories - Port System - Peripheral Features: Time Base, Timing Subsystem, Pulse Width Modulation, USART, SPI, Two Wire Serial Interface, ADC, Interrupts - Physical and Operating Parameters

UNIT – III HARDWARE AND SOFTWARE INTERFACING WITH 8-BIT SERIES CONTROLLERS
Lights and Switches - Stack Operation - Implementing Combinational Logic - Expanding I/O - Interfacing Analog To Digital Convertors - Interfacing Digital To Analog Convertors - LED Displays: Seven Segment Displays, Dot Matrix Displays - LCD Displays - Driving Relays - Stepper Motor Interface - Serial EEPROM - Real Time Clock - Accessing Constants Table - Arbitrary Waveform Generation - Communication Links - System Development Tools

UNIT – IV VISION SYSTEM
UNIT – V HOME AUTOMATION

Home Automation - Requirements - Water Level Notifier - Electric Guard Dog - Tweeting Bird Feeder - Package Delivery Detector - Web Enabled Light Switch - Curtain Automation - Android Door Lock - Voice Controlled Home Automation - Smart Lighting - Smart Mailbox - Electricity Usage Monitor - Proximity Garage Door Opener - Vision Based Authentic Entry System

TOTAL: 45 PERIODS

COURSE OUTCOMES:
On successful completion of this course, students will be able to
CO1: analyze the 8-bit series microcontroller architecture, features and pin details
CO2: write embedded C programs for embedded system application
CO3: design and develop real time systems using AVR microcontrollers
CO4: design and develop the systems based on vision mechanism
CO5: design and develop a real time home automation system

REFERENCES:

CX4016 ENVIRONMENTAL SUSTAINABILITY

UNIT I INTRODUCTION
Valuing the Environment: Concepts, Valuing the Environment: Methods, Property Rights, Externalities, and Environmental Problems

UNIT II CONCEPT OF SUSTAINABILITY
Sustainable Development: Defining the Concept, the Population Problem, Natural Resource Economics: An Overview, Energy, Water, Agriculture

UNIT III SIGNIFICANCE OF BIODIVERSITY
Biodiversity, Forest Habitat, Commercially Valuable Species, Stationary - Source Local Air Pollution, Acid Rain and Atmospheric Modification, Transportation

UNIT IV POLLUTION IMPACTS
Water Pollution, Solid Waste and Recycling, Toxic Substances and Hazardous Wastes, Global Warming

UNIT V ENVIRONMENTAL ECONOMICS
Development, Poverty, and the Environment, Visions of the Future, Environmental economics and policy by Tom Tietenberg, Environmental Economics
REFERENCES

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UNIT I REINFORCEMENTS
Introduction – composites –classification and application; reinforcements- fibres and its properties; preparation of reinforced materials and quality evaluation; preforms for various composites

UNIT II MATRICES
Preparation, chemistry, properties and applications of thermoplastic and thermostet resins; mechanism of interaction of matrices and reinforcements; optimization of matrices

UNIT III COMPOSITE MANUFACTURING
Classification; methods of composites manufacturing for both thermoplastics and thermosets-Hand layup, Filament Winding, Resin transfer moulding, prepregs and autoclave moulding, pultrusion, vacuum impregnation methods, compression moulding; post processing of composites and composite design requirements

UNIT IV TESTING
Fibre volume and weight fraction, specific gravity of composites, tensile, flexural, impact, compression, inter laminar shear stress and fatigue properties of thermostet and thermoplastic composites.

UNIT V MECHANICS
Micro mechanics, macro mechanics of single layer, macro mechanics of laminate, classical lamination theory, failure theories and prediction of inter laminar stresses using at ware

REFERENCES
UNIT I  BASICS OF NANOCOMPOSITES

UNIT II  METAL BASED NANOCOMPOSITES
Metal-metal nanocomposites, some simple preparation techniques and their properties. Metal-Oxide or Metal-Ceramic composites, Different aspects of their preparation techniques and their final properties and functionality. Fractal based glass-metal nanocomposites, its designing and fractal dimension analysis. Core-Shell structured nanocomposites

UNIT III  POLYMER BASED NANOCOMPOSITES
Preparation and characterization of diblock Copolymer based nanocomposites; Polymer Carbon nanotubes based composites, their mechanical properties, and industrial possibilities.

UNIT IV  NANOCOMPOSITE FROM BIOMATERIALS
Natural nanocomposite systems - spider silk, bones, shells; organic-inorganic nanocomposite formation through self-assembly. Biomimetic synthesis of nanocomposites material; Use of synthetic nanocomposites for bone, teeth replacement.

UNIT V  NANOCOMPOSITE TECHNOLOGY

REFERENCES:
5. The search for novel, superhard materials- Stan Vepřek (Review Article) JVST A, 1999

TOTAL : 45 PERIODS
UNIT I    IPR


UNIT II AGREEMENTS, TREATIES AND PATENT FILING PROCEDURES


UNIT III BIOSAFETY


UNIT IV GENETICALLY MODIFIED ORGANISMS

- Definition of GMOs & LMOs – Roles of Institutional Biosafety Committee – RCGM – GEAC etc. for GMO applications in food and agriculture – Environmental release of GMOs – Risk Analysis – Risk Assessment – Risk management and communication – Overview of National Regulations and relevant International Agreements including Cartegana Protocol.

UNIT V ENTREPRENEURSHIP DEVELOPMENT


TOTAL : 45 PERIODS

REFERENCES