1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

I. Have a successful professional career in industry, government, academia, military and start-ups as innovative engineers.

II. Effectively solve engineering problems associated with Cyber Physical Systems, Real Time mobility Applications, Smart systems, and Networking Applications.

III. Have the ability to think analytically and logically to understand technical problems in ubiquitous systems and provide solutions through research and lifelong learning.

IV. Adopt ethical practices to collaborate with team members and team leaders to build cutting-edge technical solutions in a connected world.

V. Strongly focus on transformative ideas and critical analysis, to innovate and be active members ready to serve the society, locally and internationally.

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 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

3. Adapt new technologies such as 5G and beyond for developing solutions to real world problems.

4. Exhibit proficiency in pervasive computing areas for providing solutions to real world problems in industry and research establishments in the application areas of IoT, autonomous vehicles, and smart homes/Cities.

5. Excel in hybrid mobile application development with a focus on security to address business needs.

PEO/PO Mapping:

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NON - AUTONOMOUS COLLEGES AFFILIATED ANNA UNIVERSITY
M.E. MOBILE AND PERVERSIVE COMPUTING
REGULATIONS – 2021
CHOICE BASED CREDIT SYSTEM
I TO IV SEMESTERS CURRICULA AND 1st SEMESTER SYLLABI

#### SEMESTER I

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**THEORY**

1. MP4391  Smart Convergent Technologies  PCC  3  0  0  3  3
2.         Professional Elective III    PEC  3  0  0  3  3
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**PRACTICALS**

5. MP4311  Project Work I    EEC  0  0  12  12  6

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1. MP4411  Project Work II    EEC  0  0  24  24  12

**TOTAL**  0  0  24  24  12

**TOTAL NO. OF CREDITS: 74**

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**PROFESSIONAL ELECTIVES**

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2. BD4251  Big Data Mining and Analytics  PEC  3  0  0  3  3
3. MP4092  Human Computer Interaction  PEC  3  0  0  3  3
4. MP4001  Energy Aware Computing  PEC  3  0  0  3  3
5. IF4095  Social Network Analysis  PEC  3  0  0  3  3
6. MP4091  Cognitive Computing  PEC  3  0  0  3  3

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4
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### AUDIT COURSES (AC)

Registration for any of these courses is optional to students

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COURSE OBJECTIVES:
This course will hold the student to

- study the methods of solving a system of linear equations using matrix theory.
- learn the mathematical aspects of graph, colouring, various graph theoretic algorithms which are applicable to computer languages.
- study the linear programming models and Transportation models and various techniques to solve them.
- determination of probability and moments, distributions of discrete and continuous random variables and random processes.
- study the characteristics of queueing models and discrete Markov chains, applications of them.

UNIT I  MATRIX METHODS

UNIT II  GRAPH THEORY
Introduction to paths, trees, vector spaces - Matrix coloring and directed graphs - Some basic algorithms – Shortest path algorithms – Depth - First search on a graph – Isomorphism – Other Graph - Theoretic algorithms – Performance of graph theoretic algorithms – Graph theoretic computer languages.

UNIT III  OPTIMIZATION TECHNIQUES
Linear programming - Basic concepts – Graphical and simplex methods – Big M method - Two phase simplex method - Revised simplex method - Transportation problems – Assignment problems.

UNIT IV  PROBABILITY AND RANDOM VARIABLES
Probability – Axioms of probability – Conditional probability – Bayes theorem - Random variables - Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Exponential, Normal distributions – Two dimensional random variables - Poisson process.

UNIT V  QUEUEING THEORY
Single and multiple servers - Markovian queueing models - Finite and infinite capacity queues – Finite source model – Queuing applications.

TOTAL: 60 PERIODS

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

- apply various methods in matrix theory to solve system of linear equations.
- mathematical concepts on graph theory and various graph related algorithms.
- could develop a fundamental understanding of linear programming models, able to develop a linear programming model from problem description, apply the simplex method for solving linear programming problems.
- computation of probability and moments, standard distributions of discrete and continuous random variables and functions of a random variable.
- exposing the basic characteristic features of a queuing system and acquire skills in analyzing queuing models, using discrete time Markov chains to model computer systems.

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

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

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

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

UNIT IV INTELLECTUAL PROPERTY RIGHTS
UNIT V  PATENTS


TOTAL: 30 PERIODS

REFERENCES:

CP4151 ADVANCED DATA STRUCTURES AND ALGORITHMS

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

UNIT I  ROLE OF ALGORITHMS IN COMPUTING & COMPLEXITY ANALYSIS


UNIT II  HIERARCHICAL DATA STRUCTURES


UNIT III  GRAPHS

UNIT IV ALGORITHM DESIGN TECHNIQUES


UNIT V NP COMPLETE AND NP HARD


TOTAL: 45 PERIODS

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

COURSE OUTCOMES:

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

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MP4151 EMBEDDED SYSTEMS AND IIOT

COURSE OBJECTIVES:

- To learn the internal architecture of an embedded processor including timers and interrupts.
- To learn and use embedded C programming.
- To provide exposure on architecture and components of IIOT.
- To introduce the communication protocols of IIOT.
- To study about visualization and data processing of IIOT.

UNIT I EMBEDDED PROCESSOR

UNIT II EMBEDDED C PROGRAMMING
Programming Embedded Systems in C - Memory And I/O Devices Interfacing - Implementing Timers, Interrupts and Serial communication in embedded C- Need For RTOS - Multiple Tasks and Processes – Context Switching - Priority Based Scheduling Policies.

UNIT III INTRODUCTION & ARCHITECTURE OF IIOT

UNIT IV COMMUNICATION TECHNOLOGIES OF IIOT
Hardwire the sensors with different protocols such as HART, MODBUS-Serial & Parallel, Ethernet, BACNet, Current, M2M etc. Need of protocols; Communication Protocols: Wi-Fi, Wi-Fi direct, IEEE 802.15.4, Zigbee, Z wave, BLE, SPI, RFID, Industry standards communication technology (COAP, LoRAWAN, OPC UA, MQTT AMQP IIOT), connecting into existing Modbus and Profibus technology, wireless network communication.

UNIT V VISUALIZATION OF IIOT
Cloud platforms: Overview of cots cloud platforms, predix, thingworx, azure etc. Front-end EDGE devices, Enterprise data for IIOT, Emerging descriptive data standards for IIOT, Cloud database, Cloud computing, Fog or Edge computing. Connecting an Arduino/Raspberry pi to the Web: Introduction, setting up the Arduino/Raspberry pi development environment, Options for Internet connectivity with Arduino, Configuring your Arduino/Raspberry pi board for the IoT.
SUGGESTED ACTIVITIES:
1. A Study on the various embedded processors like virtual watches, PDAS, digital cameras, mp3 players
2. Develop an application using embedded C programming in arduino
3. Build a project using IIOT components
4. Study of communication protocols and technology in IIOT
5. Presentation on most prominent IIOT visualization tools

PRACTICAL EXERCISES:
1. Experiments on Arduino, ESp8266, raspberry Pi
5. Demonstration of MQTT communication
6. Demonstration of LoRa communication.

TOTAL: 30 PERIODS

HARDWARE/SOFTWARE REQUIREMENTS
1. Arduino
2. ESp8266
3. Raspberry Pi

COURSE OUTCOMES:
CO1: Describe the internal architecture of an embedded processor including timers and interrupts.
CO2: Write the embedded C programming.
CO3: Use the components of IIOT for building applications.
CO4: Demonstrate and perform the communication by using the protocols.
CO5: Explain about visualization and data processing of IIOT.

REFERENCES:

TOTAL: 75 PERIODS

**CO-PO Mapping**

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**CP4153 NETWORK TECHNOLOGIES**

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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**


**UNIT II WIRELESS NETWORKS**

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

**UNIT III MOBILE DATA NETWORKS**

UNIT IV  SOFTWARE DEFINED NETWORKS

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, HossamAffifi, “Wi-Fi, Bluetooth, Zigbee and WiMax”, Springer 2007 (UNIT 2)

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

UNIT I  CELLULAR CONCEPTS

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

UNIT III  PERFORMANCE OF DIGITAL MODULATION OVER WIRELESS CHANNELS

UNIT IV  DIVERSITY TECHNIQUES

UNIT V  MULTICARRIER MODULATION
Data Transmission using Multiple Carriers – Multicarrier Modulation with Overlapping Sub channels – Mitigation of Subcarrier Fading – Discrete Implementation of Multicarrier Modulation – Peak to average Power Ratio- Frequency and Timing offset.
SUGGESTED ACTIVITIES:
1: Survey on various features of cellular networks
2: Study the nature of cellular networks
3: A comparative study on the performance of different digital modulation techniques
4: Perform a review of various diversity techniques in wireless communication
5: Presentation on design of multicarrier systems for 5G

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

TOTAL: 45 PERIODS

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CP4161 ADVANCED DATA STRUCTURES AND ALGORITHMS LABORATORY L T P C 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:
- To gain expertise in Virtualization, Virtual Machines and deploy practical virtualization solution
- To understand the architecture, infrastructure and delivery models of cloud computing.
- To explore the roster of AWS services and illustrate the way to make applications in AWS
- To gain knowledge in the working of Windows Azure and Storage services offered by Windows Azure
- To develop the cloud application using various programming model of Hadoop and Aneka

UNIT I VIRTUALIZATION AND VIRTUALIZATION INFRASTRUCTURE
6

UNIT II CLOUD PLATFORM ARCHITECTURE
12

UNIT III AWS CLOUD PLATFORM - IAAS
9

UNIT IV PAAS CLOUD PLATFORM
9

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

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

TOTAL: 45 PERIODS

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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:
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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MP4291  
CYBER PHYSICAL SYSTEMS  
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COURSE OBJECTIVES:
- To learn about the principles of cyber-physical systems
- To familiarize with the basic requirements of CPS.
- To know about CPS models
- To facilitate the students to understand the CPS foundations
- To make the students explore the applications and platforms.
- To provide introduction to practical aspects of cyber physical systems.
- To equip students with essential tools to implement CPS.

UNIT I  
INTRODUCTION TO CYBER-PHYSICAL SYSTEMS  
6
UNIT II  CPS - REQUIREMENTS
Safety Specifications: Specifications, Verifying Invariants, Enumerative Search, Symbolic Search-
Liveness Requirements: Temporal Logic, Model Checking, Proving Liveness

UNIT III  CPS MODELS
Dynamical Systems: Continuous, Linear Systems-Time Models, Linear Systems, Designing
Controllers, Analysis Techniques- Timed Model: Processes, Protocols, Automata- Hybrid
Dynamical Models

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

UNIT V  APPLICATIONS AND PLATFORMS
Medical CPS- CPS Built on Wireless Sensor Networks- CyberSim User Interface- iClebo Kobuki -
IRobot Create- myRIO- Cybersim- Matlab toolboxes - Simulink.

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

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

REFERENCES
1. Raj Rajkumar, Dionisio De Niz, and Mark Klein, Cyber-Physical Systems, Addison-Wesley
   Professional, 2016
3. Lee, Edward Ashford, and Sanjit Arunkumar Seshia. Introduction to embedded systems: A
cyber physical systems approach. 2nd Edition, 2017
4. André Platzer, Logical Analysis of Hybrid Systems: Proving Theorems for Complex
5. Jean J. Labrosse, Embedded Systems Building Blocks: Complete and Ready-To-Use
6. Jensen, Jeff, Lee, Edward, A Seshia, Sanjit, An Introductory Lab in Embedded and Cyber-
7. documentation | KOBUKI (yujinrobot.com)
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NE4251  NETWORK SECURITY  L T P C  3 0 0 3

COURSE OBJECTIVES:
- To learn the fundamentals of cryptography and its application to network security.
- To understand the mathematics behind cryptography.
- To learn about the security issues in internet protocol.
- To understand the security issues in other layers
- To study about intrusion detection and prevention system and wireless hacking.

UNIT I  INTRODUCTION TO NETWORK SECURITY  9

UNIT II  SYMMETRIC AND ASYMMETRIC CIPHERS  9

UNIT III  SECURITY ISSUES IN INTERNET PROTOCOL  9

UNIT IV  SECURITY IN OTHER LAYERS  9

UNIT V  INTRUSION DETECTION AND PREVENTION SYSTEM(IDPS) AND WIRELESS HACKING  9
IDPS introduction - Uses of IDPS Technologies - Key functions of IDPS Technologies, Signature Based Detection, Anomaly Based Detection - Wireless networks - WPA
Handshaking - Wireless hacking tools.

**COURSE OUTCOMES:**

**CO1:** To design cryptographic algorithms and carry out their implementation.

**CO2:** To carry out cryptanalysis on cipher.

**CO3:** To be able to design and implement security based internet protocols.

**CO4:** To carry out system security for other layers.

**CO5:** To understand the importance of intrusion detection and prevention system and wireless hacking.

**TOTAL: 45 PERIODS**

**REFERENCES**


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**MP4211** TERM PAPER WRITING AND SEMINAR L T P C 0 0 2 1

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

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

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

Activities to be carried out

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<th>Instructions</th>
<th>Submission week</th>
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<td>Selection of area of interest and Topic</td>
<td>You are requested to select an area of interest, topic and state an objective</td>
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<td>3 % Based on clarity of thought, current relevance and clarity in writing</td>
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<td>Collecting Information about your area &amp; topic</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.-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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<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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- Favour more recent papers,
- Pick a recent survey of the field so you can quickly gain an overview,
- Find relationships with respect to each other and to your topic area (classification scheme/categorization)
- Mark in the hard copy of papers whether complete work or section/sections of the paper are being considered

Reading and notes for first 5 papers

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<tr>
<th>Reading Paper Process</th>
<th>5th week</th>
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<td>For each paper form a Table answering the following questions:</td>
<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>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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<tr>
<td>What did the author say were the important directions for future research?</td>
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Conclude with limitations/issues not addressed by the paper (from the perspective of your survey)

Reading and notes for next 5 papers

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<th>Repeat Reading Paper Process</th>
<th>6th week</th>
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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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<td>Reading and notes for final 5 papers</td>
<td>Repeat Reading Paper Process</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>Draft outline 1 and Linking papers</td>
<td>Prepare a draft Outline, your survey goals, along with a classification / categorization diagram</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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<tr>
<td>Abstract</td>
<td>Prepare a draft abstract and give a presentation</td>
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<td>(Clarity, purpose and conclusion)</td>
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<td>Introduction Background</td>
<td>Write an introduction and background sections</td>
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<td>(clarity)</td>
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<tr>
<td>Sections of the paper</td>
<td>Write the sections of your paper based on the classification / categorization diagram in keeping with the goals of your survey</td>
<td>11th</td>
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<td>(this component will be evaluated based on the linking and classification among the papers)</td>
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<td>Your conclusions</td>
<td>Write your conclusions and future work</td>
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<td>Final Draft</td>
<td>Complete the final draft of your paper</td>
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<td>Seminar</td>
<td>A brief 15 slides on your paper</td>
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<td>(based on presentation and Viva-voce)</td>
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**TOTAL: 30 PERIODS**
COURSE OBJECTIVES:

- To explore the digital signature standard.
- Learn to implement security algorithms using Wireshark
- To analyze the effectiveness of intrusion detection system
- To learn the security issues in Virtual Private Network
- To identify mechanism for secured Email communication

SUGGESTED ACTIVITIES:

1. Implement the SIGNATURE SCHEME - Digital Signature Standard
2. Implement how to capture and analyze packets using Wireshark
3. To Analysis Network using Wireshark for
   (a) Traffic Monitoring (TCP slow down and HTTP slow down)
   (b) Packet Sniffing
4. To perform man in middle attack using DNS spoofing
5. To Perform HTTP Session Hijacking through Cookie stealing
6. To Configure AAA (TACACS+) on Packet Tracer for User Authentication
7. Demonstrate intrusion detection system (ids) using any tool(snort or any other software)
8. Create a Virtual Private Network and evaluate application response time in the presence and absence of a firewall.
9. Implementation of Email incoming and outgoing authenticity controls and malware filtration and attachment security

COURSE OUTCOMES:

CO1: Implement the digital signature scheme
CO2: Develop the various security algorithms using wireshark
CO3: Use different open source tools for network security and analysis
CO4: Develop an Virtual Private Network with security.
CO5: Addressing the Email secured communication

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TOTAL: 30 PERIODS
COURSE OBJECTIVES:
- To learn about Fundamentals of IoT and Security
- To know about IoT applications in Industry
- To learn about RFID Pervasive networks
- To gain fundamental concepts in 5G and Next Gen networks
- To know about IoT implementation

UNIT I TOWARDS THE IOT UNIVERSE

UNIT II IOT APPLICATIONS — VALUE CREATION FOR INDUSTRY

UNIT III RFID PERVASIVE NETWORKS

UNIT IV INTRODUCTION TO INDUSTRIAL INTERNET OF THINGS
Industrial Internet- Key IIoT Technologies- Innovation and the IIoT - Key Opportunities and Benefits - The Digital and Human Workforce - Logistics and the Industrial Internet- IOT Innovations in Retail - Cyber Physical Systems (CPS) – IP Mobility – Network Virtualization - SDN (Software Defined Networks)- The Cloud and Fog

UNIT V IIOT ARCHITECTURE AND DESIGNING INDUSTRIAL INTERNET SYSTEMS

COURSE OUTCOMES:
After completion of the course, the student will be able to:
CO1: Describe the core principles of IoT Network Management
CO2: Identify the applications of IoT in Industry
CO3: Explain the basic concepts in RFID and Pervasive Networks
CO4: Discuss the fundamental concepts in IIoT, CPS and Network Virtualization.

CO5: Design Industrial Internet Systems

TOTAL: 45 PERIODS

REFERENCES:
4. Gilchrist, Alasdair, “Industry 4.0 The Industrial Internet of Things”, Apress, 2017. (Unit IV and Unit V)

CO-PO Mapping

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MP4094 WEB SERVICES AND API DESIGN L T P C
3 0 0 3

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

UNIT I INTRODUCTION TO WEB SERVICE

UNIT II WEB SERVICE BUILDING BLOCKS
Introduction to SOAP: SOAP Syntax- Sending SOAP Messages - SOAP Implementations - Introduction to WSDL: WSDL Syntax - SOAP Binding - WSDL Implementations - Introduction to
UNIT III RESTFUL WEB SERVICES

UNIT IV IMPLEMENTATION OF RESTFUL WEB SERVICES

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

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

TOTAL: 45 PERIODS

REFERENCES
1. Leonard Richardson and Sam Ruby, RESTful Web Services, O’Reilly Media, 2007
3. Lindsay Bassett, Introduction to JavaScript Object Notation, O'Reilly Media, 2015
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BD4251 BIG DATA MINING AND ANALYTICS L T P C 3 0 0 3

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
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/


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**CO-PO Mapping**
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 EVALUATION 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


COURSE OUTCOMES:

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

TOTAL: 45 PERIODS
REFERENCES

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MP 4001 ENERGY AWARE COMPUTING L T P C 3 0 0 3

COURSE OBJECTIVES:
- To understand the fundamentals of Energy Efficient Computing.
- To become familiar with the concept of Energy Efficient Storage Systems.
- To introduce the various types of scheduling algorithms in energy efficient computing.
- To introduce the concept of Green Networking.
- To study Energy Aware Computing Applications.

UNIT I INTRODUCTION 9
Subthreshold Computing – Energy Efficient Network-on-Chip Architectures for Multi-Core Systems
Energy-Efficient MIPS CPU Core with Fine-Grained Run-Time Power Gating – Case Study: Geyser

UNIT II ENERGY EFFICIENT STORAGE 9
Power-Efficient Strategies for Storage Systems-Energy-Saving Techniques for Disk Storage Systems
- Thermal and Power-Aware Task Scheduling and Data Placement for Storage Centric Data centres - Energy-Saving Techniques for Disk Storage Systems
UNIT III  ENERGY EFFICIENT SCHEDULING ALGORITHMS  9

UNIT IV  INTRODUCTION TO GREEN NETWORKING  9
Power-Aware Middleware for Mobile Applications -Energy Efficiency of Voice-over-IP Systems - Intelligent Energy-Aware Networks - Green TCAM-Based Internet Routers

UNIT V  ENERGY AWARE COMPUTING APPLICATIONS  9

COURSE OUTCOMES:
CO1: Explain the power efficient storage architecture.
CO2: Analyze the different types of Energy Efficient Storage systems.
CO3: Design the schedule algorithms for Energy Efficient Systems
CO4: Identify the different types of Green Networking schemes in the energy efficient computing
CO5: Explore the applications of Energy Aware Computing

TOTAL: 45 PERIODS

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38
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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MP4091 COGNITIVE COMPUTING L T P C 3 0 0 3

COURSE OBJECTIVES:
- To familiarize Use the Innovation Canvas to justify potentially successful products.
- To learn various ways in which to develop a product idea.
- To understand about how Big Data can play vital role in Cognitive Computing
- To know about the business applications of Cognitive Computing
- To get into all applications of Cognitive Computing
UNIT I  FOUNDATION OF COGNITIVE COMPUTING  9
Foundation of Cognitive Computing: cognitive computing as a new generation, the uses of cognitive systems, system cognitive, gaining insights from data, Artificial Intelligence as the foundation of cognitive computing, understanding cognition Design Principles for Cognitive Systems: Components of a cognitive system, building the corpus, bringing data into cognitive system, machine learning, hypotheses generation and scoring, presentation, and visualization services

UNIT II  NATURAL LANGUAGE PROCESSING IN COGNITIVE SYSTEMS  9
Natural Language Processing in support of a Cognitive System: Role of NLP in a cognitive system, semantic web, Applying Natural language technologies to Business problems Representing knowledge in Taxonomies and Ontologies: Representing knowledge, Defining Taxonomies and Ontologies, knowledge representation, models for knowledge representation, implementation considerations

UNIT III  BIG DATA AND COGNITIVE COMPUTING  9
Relationship between Big Data and Cognitive Computing: Dealing with human-generated data, defining big data, architectural foundation, analytical data warehouses, Hadoop, data in motion and streaming data, integration of big data with traditional data Applying Advanced Analytics to cognitive computing: Advanced analytics is on a path to cognitive computing, Key capabilities in advanced analytics, using advanced analytics to create value, Impact of open source tools on advanced analytics

UNIT IV  BUSINESS IMPLICATIONS OF COGNITIVE COMPUTING  9
Preparing for change ,advantages of new disruptive models , knowledge meaning to business, difference with a cognitive systems approach , meshing data together differently, using business knowledge to plan for the future , answering business questions in new ways , building business specific solutions , making cognitive computing a reality , cognitive application changing the market The process of building a cognitive application: Emerging cognitive platform, defining the objective, defining the domain, understanding the intended users and their attributes, questions and exploring insights, training and testing

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

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

TOTAL:45 PERIODS
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MP4002 RFID AND SENSOR TECHNOLOGY

COURSE OBJECTIVES:
- Know the fundamentals of identification systems and RFID
- Understand the principles of RFID
- Learn sensor technologies and design RFID enabled sensors

UNIT I FUNDAMENTALS OF RFID

UNIT II PRINCIPLES OF RFID

UNIT III DESIGN OF RFID
Architecture of Electronic Data Carriers – Transponder with Memory Function - Microprocessors - Dual Interface Card - Memory Technology - Measuring Physical Variables - Readers - The
Manufacture of Transponders and Contactless Smart Cards – Standardization – Animal Identification - Contactless Smart Cards - Container Identification – Anti-theft Systems for Goods - Item Management

UNIT IV  SENSOR TECHNOLOGIES  9

UNIT V  DESIGN OF RFID ENABLED SENSORS  9

COURSE OUTCOMES:
Upon completion of the course, students will be able to:
CO1: Demonstrate the fundamentals of identification systems.
CO2: Illustrate the basic principles of RFID.
CO3: Design and customize RFID based applications.
CO4: Understand the basic sensor technologies.
CO5: Develop interactive applications using RFID enabled sensors.

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TOTAL: 45 PERIODS

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COURSE OBJECTIVES:
- To give the knowledge of Body area Networks.
- To know the hardware requirement of BAN.
- To understand the communication and security aspects in the BAN.
- To introduce the coexistence issues with BAN.
- To know the applications of BAN in the field of medicine.

UNIT I INTRODUCTION
Definition, BAN and Healthcare, Technical Challenges- Sensor design, biocompatibility, Energy Supply, optimal node placement, number of nodes, System security and reliability, BAN Architecture – Introduction

UNIT II HARDWARE FOR BAN

UNIT III COMMUNICATIONS AND NETWORKS
Wireless Communication and Network RF communication in Body, Antenna design and testing, Propagation, Base Station-Network topology-Stand Alone BAN, Wireless personal Area Network Technologies-IEEE 802.15.1, IEEE P802.15.13, IEEE 802.15.14, Zigbee.

UNIT IV COEXISTENCE ISSUES WITH BAN
Coexistence Issues with Ban Interferences - Intrinsic - Extrinsic, Effect on transmission, Counter measures-on physical layer and data link layer, Regulatory issues Medical Device regulation in USA and Asia, Security and Self-protection-Bacterial attacks, Virus infection, Secured protocols, Self-protection

UNIT V APPLICATIONS OF BAN
Monitoring patients with chronic disease, Hospital patients, Elderly patients, Cardiac arrhythmias monitoring, Multi patient monitoring systems, Multichannel Neural recording, Gait analysis, Sports Medicine, Electronic pill.

COURSE OUTCOMES:
After completion of the course, the student will be able to:
- CO1: Apply various soft computing concepts for practical applications.
- CO2: Explain about the working of Body Area Network and discuss about the hardware required for implementation.
- CO3: Assess the efficiency of communication and the security parameters.
- CO4: Describe the issues associated with BAN.
- CO5: Design a BAN for appropriate application in medicine.
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CP4091 AUTONOMOUS SYSTEMS

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

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

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

UNIT III ROBOTICS INTRODUCTION, END EFFECTORS AND CONTROL
Vacuum grippers-Air operated grippers-Gripper force analysis-Gripper design-Simple problems- Robot controls-Point to point control, Continuous path control, Intelligent robot control system for robot joint-Control actions-Feedback devices-Encoder, Resolver, LVDT-Motion Interpolations-Adaptive control.

UNIT IV  ROBOT TRANSFORMATIONS, SENSORS AND ROBOT CELL DESIGN

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

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

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TOTAL: 45 PERIODS

46
COURSE OBJECTIVES:

- To give the knowledge of soft computing theories fundamentals
- To provide the mathematical background for carrying out the optimization associated with neural network learning
- To familiarize the ideas of fuzzy sets, fuzzy logic, use of heuristics and Fuzzy Logic Control Systems
- To introduce the mathematical background for genetic algorithms
- To expose the hybrid soft computing systems and its applications

UNIT I 
SOFT COMPUTING FUNDAMENTALS 

UNIT II 
NEURAL NETWORKS
Fundamental Models of ANN: McCulloch- Pitts Model –Hebb Network – Linear Separability

UNIT III 
FUZZY COMPUTING AND MODELING

UNIT IV 
GENETIC ALGORITHM AND APPLICATIONS

UNIT V 
HYBRID SOFT COMPUTING AND APPLICATIONS
Case Studies: Neuro-fuzzy Hybrid system- genetic neuro hybrid systems - genetic fuzzy hybrid and

COURSE OUTCOMES:
After completion of the course, the student will be able to:
CO1: Apply various soft computing concepts for practical applications
CO2: Choose and design suitable neural network for real time problems
CO3: Use fuzzy logic rules and reasoning to handle uncertainty and develop decision making and expert system
CO4: Describe the importance of genetic algorithms for solving combinatorial optimization problems
CO5: Analysis the various hybrid soft computing techniques and apply in real time problems

TOTAL: 45 PERIODS

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COURSE OBJECTIVES:
- To learn the basics of unity for Game development.
- To become familiar with the Unity & C# and popular tools & plugins.
- To learn to work with 2D Game development.
- To understand 3D Graphics and principles for development.
- To implement a larger, demo-able game project.

UNIT I  BASICS OF UNITY  9
Introduction, Modes of unity, Scene view, Project View, Game View, Scripting Game Dev Basics, Scenes, Game Objects, Components.

UNIT II  WORKING 2D GRAPHICS AND USER INTERFACE CONCEPTS  9
Unity & C# - Camera - Sprites and Texture Atlases - Animation – Scrolling, – Mobile Game Input; Designing for Mobile - Basic Touch and Multi-Touch Gestures - Accelerometer - Virtual joypads - Usability and Game case studies - Designing for the impatient gamer.

UNIT III  GAME DESIGN PRINCIPLES AND BUILDING 2D GAME  9
Game Genres, Game Worlds, Character Development, Story Telling, User Experience, Core MEchanics, Game Balancing, Level Design, Gnome on a Rope, Getting Started Building the Game, Preparing for Gameplay, building Gameplay with Traps and Objectives, Polishing the Game, Final Touches on Gnome’s Well.

UNIT IV  3D GRAPHICS AND AND GAME ENGINE  9
Math and Physics; - Quick overview of vector math - Physics principles - 3D math primer - Basics of the 3D world - 3D rendering essentials - Collision and Rigid body dynamics animation systems- Using Unity for 3D development, Creating GUIs in Unity, Particle Effects - Cross-platform game engines - Platform specific game creation tools.

UNIT V  BUILDING A 3D GAME  9
Building a Space Shooter, Input and Flight Control, Adding Weapons and Targeting, Asteroids and Damage, Audio, Menus, Death, and Explosions!, Lighting and Shaders, Making a Custom Wizard- Custom Editor Window- Custom Property Drawer- Custom Inspector, The Unity Services Ecosystem, Deployment.

COURSE OUTCOMES:
CO1: Work with the Unity environment for building a game from scratch.
CO2: Can work with 2D Graphics and build the UI.
CO3: Use the Game Design Principles for Designing Games.
CO4: Use 3D Graphics and the Game engine properties to build 3D Games.
CO5: Designing and Building 3D game with Unity/ equivalent open source tool.

TOTAL PERIODS: 45

REFERENCES
2. Jonathon Manning and Paris Buttfield-Addison, “Mobile Game Development”, O'Reilly Media,
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MP4005 FULL STACK MOBILE APPLICATION DEVELOPMENT L T P C 3 0 0 3

COURSE OBJECTIVES:
- Know the fundamentals of Android programming using the Android SDK
- Understand KOTLIN programming
- Learn Android programming concepts like activities and intents, designing user interface using views, data persistence, content providers, messaging and networking, location-based services, and developing android services etc.
- Understanding android databases
- Learn to develop Android Apps

UNIT I INTRODUCTION


UNIT II KOTLIN PROGRAMMING

Introduction to KOTLIN programming - Basics of Kotlin, Operations and Priorities, Decision Making. Loop Control, Data Structures(Collections), Functions, Object Oriented Programming: Inheritance, abstract, interface, super and this, visibility modifiers.
UNIT III INTRODUCTION TO ANDROID
Basics of an ANDROID application, introduction to manifest, externalizing resources, application lifecycle, ANDROID activities, Widgets: Button, TextView, ImageView, Progressbar, ListView, EditText, Calendar, DateTime etc, Working with Intent and Files.

UNIT IV PREFERENCES, DATABASE AND CONTENT PROVIDER
Creating, saving and retrieving shares preferences, Including static files as resources, Introducing ANDROID databases, Content values and cursors, Working with SQLite databases, Creating content providers, Using content providers, Native ANDROID Content providers. Introduction and addition of action bar, Menus and dialogs, drawable and gradients, Using location-based services, Selecting a location provider, Finding your current location, and Creating map-based activities.

UNIT V ADVANCED ANDROID APP DEVELOPMENT
Introduction of recycle view and card view. Playing audio and video, manipulating raw audio, using camera to take pictures, recording video, adding media to media store, Hardware support for telephony, using telephony, introducing SMS and MMS, Signing and publishing applications, introduction to monetizing applications

COURSE OUTCOMES:
Upon completion of the course, students will be able to:
CO1: Demonstrate the fundamentals of Full Stack mobile application development.
CO2: Illustrate the basic concepts of KOTLIN programming.
CO3: Develop and customize application user interfaces
CO4: Develop interactive applications using Maps, Location based services, UI-UX.
CO5: Create and deploy interactive applications in android using databases with multiple activities including audio, video and notifications

TOTAL: 45 PERIODS

REFERENCES
3. https://kotlinlang.org/
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MP4071 HEALTHCARE ANALYTICS

COURSE OBJECTIVES:
- To impart the fundamental concepts of Healthcare data analytics
- To give the knowledge about the Health care Data Sources.
- To familiarize Advanced Data Analytics for Healthcare
- To learn the Health IoT data analytics
- To implement the Applications and Practical Systems for Healthcare.

UNIT I INTRODUCTION
Introduction- Healthcare Data Sources and Basic Analytics - Healthcare Data Sources : Electronic Health Records: Components of HER- Coding system- Biomedical Image Analysis: Biomedical Imaging Modalities- Object Detection- Image Segmentation- Image Registration- Feature Extraction- Mining of Sensor Data in Healthcare: Mining Sensor Data in Medical Informatics: Scope and Challenges- Sensor Data Mining Applications

UNIT II HEALTHCARE DATA SOURCES
Biomedical Signal Analysis: Types of Biomedical Signals- ECG Signal Analysis- Denoising of Signals- Multivariate Biomedical Signal Analysis- Cross-Correlation Analysis- Methods to Study Connectivity- Genomic Data Analysis for Personalized Medicine: Genomic Data Generation-Methods and Standards for Genomic Data Analysis- Types of Computational Genomics Studies towards Personalized Medicine
UNIT III  ADVANCED DATA ANALYTICS FOR HEALTHCARE  
Basic Statistical Prediction Models- Alternative Clinical Prediction Models- Survival Models- 
Evaluation and Validation- Temporal Data Mining for Healthcare Data: Association Analysis- 
Temporal Pattern Mining- Sensor Data Analysis- Other Temporal Modeling Methods- Visual 
Analytics for Healthcare: Visual Analytics and Medical Data Visualization- Visual Analytics in 
Healthcare.

UNIT IV  HEALTH IOT DATA ANALYTICS  
Internet of things in the healthcare industry- IoT healthcare architecture- Characteristics of IoT 
health data- Health data analytics using Internet of things- Computational intelligence in Internet of 
things for future healthcare applications.

UNIT V  APPLICATIONS AND PRACTICAL SYSTEMS FOR HEALTHCARE  
Data Analytics for Pervasive Health: Supporting Infrastructure and Technology - Basic Analytic 
Techniques- Advanced Analytic Techniques- Applications - Fraud Detection in Healthcare- Data 
Analytics for Pharmaceutical Discoveries- Clinical Decision Support Systems.

COURSE OUTCOMES: 
CO1: Describe the basics of healthcare data analytics. 
CO2: Explain the Healthcare Data Sources. 
CO3: Discuss the Advanced Data Analytics for Healthcare. 
CO4: Express the Health IoT data analytics. 
CO5: Apply the practical Systems for Healthcare.

TOTAL: 45 PERIODS

REFERENCES
2. Sanjay Kumar Singh Ravi Shankar Singh Anil Kumar Pandey Udmale S.S. Ankit 
   Chaudhary, IoT-Based Data Analytics for the Healthcare Industry Techniques and 
3. Prasant Kumar Pattnaik, Suneeta Mohanty (Editor), Satarupa 
   Mohanty (Editor) Format: Kindle Edition, Smart Healthcare Analytics in IoT Enabled 
4. Nilanjan Dey, Amira Ashour, Simon James Fong, Chintan Bhatt, Healthcare Data 

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COURSE OBJECTIVES:
- To provide an overview of Haptic technology
- To learn the concepts of Haptic rendering system.
- To analyze the effectiveness of multimedia haptic in real time applications.
- To enable the student to create applications in a collaborative environment.

UNIT I  INTRODUCTION

UNIT II  HUMAN HAPTIC PERCEPTION AND MACHINE HAPTICS

UNIT III  COMPUTER HAPTICS
Haptic Rendering Subsystem-Polygon based Representation and Scene Graph-Collision Detection Techniques and Bounding Volumes-Penetration Depth and Collision Response-Haptic Rendering of Surface Properties-Haptic Rendering of other Representation methods- Haptic Rendering of more than 3-DOF-Control Methods for Haptic systems-Benchmarking Haptic Rendering systems-Haptic Software Frameworks

UNIT IV  MULTIMEDIA HAPTICS

UNIT V  TOUCHING THE FUTURE: CHALLENGES AND TRENDS

COURSE OUTCOMES:
CO1: Demonstrate knowledge in human perception, Machine and Multimedia Haptics.
CO2: Create integrated and collaborative haptic systems
CO3: Identify and representation of Haptic Rendering subsystem
CO4: Analyze and characterize Multimedia Haptics
CO5: Learn the challenges, recent trends and applications of Haptic Technology
REFERENCES
2. http://haptic.mech.nwu.edu

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CP4252 MACHINE LEARNING L T P C 3 0 2 4

COURSE OBJECTIVES:
- To understand the concepts and mathematical foundations of machine learning and types of problems tackled by machine learning
- To explore the different supervised learning techniques including ensemble methods
- To learn different aspects of unsupervised learning and reinforcement learning
- To learn the role of probabilistic methods for machine learning
- To understand the basic concepts of neural networks and deep learning

UNIT I INTRODUCTION AND MATHEMATICAL FOUNDATIONS 9

UNIT II SUPERVISED LEARNING 9
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:
- 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.
- 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.

45 PERIODS

30 PERIODS
1. 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.
2. You can either pick a project of your own design, or you can choose from the set of pre-defined projects.
3. You are free to use any third-party ideas or code that you wish as long as it is publicly available.
4. You must properly provide references to any work that is not your own in the write-up.
5. 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.

REFERENCES
9. Trevor Hastie, Robert Tibshirani, Jerome Friedman, “The Elements of Statistical Learning”,

TOTAL:75 PERIODS
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BC4151 BIOMETRIC SYSTEMS

COURSE OBJECTIVES:
- To learn and understand biometric technologies and their functionalities.
- To learn the role of biometric in the organization.
- To learn the computational methods involved in the biometric systems.
- To expose the context of Biometric Applications.
- To learn to develop applications with biometric security.

UNIT I INTRODUCTION 9+3

UNIT II FINGERPRINT, FACE AND IRIS AS BIOMETRICS 9+3
Background of face recognition – Design of face recognition system – Neural network for face recognition – Face detection in video sequences – Challenges in face biometrics – Face recognition methods – Advantages and disadvantages.

UNIT III PRIVACY ENHANCEMENT AND MULTIMODAL BIOMETRICS 9+3
Privacy concerns associated with biometric developments – Identity and privacy – Privacy concerns – biometrics with privacy enhancement – Comparison of various biometrics in terms of

UNIT IV WATERMARKING TECHNIQUES & BIOMETRICS: SCOPE AND FUTURE 9+3

UNIT V IMAGE ENHANCEMENT TECHNIQUES & BIOMETRICS STANDARDS 9+3

LIST OF EXPERIMENTS (Experiments can be designed with similar use cases as below):
1. Student school smart card
2. Secure lab access using card scanner plus face recognition
3. Student bus pass with barcode card scan
4. Student bus pass with webcam scan
5. Employee attendance system by Qr scan
6. Student examination datacard
7. School student attendance system by barcode scan
8. School student attendance system by Qr scan
9. School student attendance with fingerprint reader
10. Fingerprint voting system project
11. Employee hourly attendance by barcode scan
12. Visual product identification for blind

COURSE OUTCOMES:
CO1: Identify the various biometric technologies.
CO2: Design of biometric recognition for the organization.
CO3: Develop simple applications for privacy.
CO4: Understand the need of biometric in the society
CO5: Understand the research in biometric techniques.

TOTAL : 75 PERIODS

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**IF4071 DEEP LEARNING**

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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**


**UNIT II NEURAL NETWORKS**


**UNIT III CONVOLUTIONAL NEURAL NETWORK**


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

TOTAL: 45+30 PERIODS

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

### UNIT I INTRODUCTION
Need for Bioinformatics technologies – Overview of Bioinformatics technologies Structural bioinformatics – Data format and processing – Secondary resources and applications – Role of Structural bioinformatics – Biological Data Integration System.

### UNIT II DATAWAREHOUSING AND DATAMINING IN BIOINFORMATICS
Bioinformatics data – Data warehousing architecture – data quality – Biomedical data analysis – DNA data analysis – Protein data analysis – Machine learning – Neural network architecture and applications in bioinformatics.

### UNIT III MODELING FOR BIOINFORMATICS

### UNIT IV PATTERN MATCHING AND VISUALIZATION

### UNIT V MICROARRAY ANALYSIS

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

**COURSE OUTCOMES:**

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

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

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**CP4072 BLOCKCHAIN TECHNOLOGIES**

**COURSE OBJECTIVES:**

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

UNIT I INTRODUCTION OF CRYPTOGRAPHY AND BLOCKCHAIN
What is Blockchain, Blockchain Technology Mechanisms & Networks, Blockchain Origins, Objective of Blockchain, Blockchain Challenges, Transactions and Blocks, P2P Systems, Keys as Identity, Digital Signatures, Hashing, and public key cryptosystems, private vs. public Blockchain.

UNIT II BITCOIN AND CRYPTOCURRENCY

UNIT III INTRODUCTION TO ETHEREUM

UNIT IV INTRODUCTION TO HYPERLEDGER AND SOLIDITY PROGRAMMING

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

TOTAL: 45 PERIODS

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

TOTAL: 30 PERIODS

SUPPLEMENTARY RESOURCES:
- NPTEL online course: https://nptel.ac.in/courses/106/104/106104220/#
- Udemy: https://www.udemy.com/course/build-your-blockchain-az/
- EDUXLABS Online training: https://eduxlabs.com/courses/blockchain-technology-training/?tab=tab-curriculum

TOTAL: 75 PERIODS

COURSE OUTCOMES:
After the completion of this course, student will be able to
CO1: Understand and explore the working of Blockchain technology (Understanding)
CO2: Analyze the working of Smart Contracts (Analyze)
CO3: Understand and analyze the working of Hyperledger (Analyze).
CO4: Apply the learning of solidity to build de-centralized apps on Ethereum (Apply)
CO5: Develop applications on Blockchain

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MU4291 MIXED REALITY

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

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

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

UNIT II  INTERACTIVE TECHNIQUES IN VIRTUAL REALITY


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

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

UNIT III  VISUAL COMPUTATION IN VIRTUAL REALITY


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

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

UNIT IV  AUGMENTED AND MIXED REALITY

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

Suggested Activities:
- External learning - AR Systems
Suggested Evaluation Methods:
- Brainstorming session different AR systems and environments.

UNIT V I/O INTERFACE IN VR & APPLICATION OF VR

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

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

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

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

TOTAL: 45 PERIODS

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

TOTAL: 30 PERIODS

TOTAL: 75+30=75 PERIODS

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### AUDIT COURSES

**AX4091 ENGLISH FOR RESEARCH PAPER WRITING**

L T P C 2 0 0 0

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

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

**UNIT II PRESENTATION SKILLS**

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

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

TOTAL: 30 PERIODS

REFERENCES:

AX4092  DISASTER MANAGEMENT  L T P C
2 0 0 0

COURSE OBJECTIVES:
- Summarize basics of disaster
- Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Develop the strengths and weaknesses of disaster management approaches

UNIT I  INTRODUCTION  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

Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics

UNIT IV

DISASTER PREPAREDNESS AND MANAGEMENT

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

UNIT V

RISK ASSESSMENT

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

TOTAL : 30 PERIODS

COURSE OUTCOMES:

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

REFERENCES:


AX4093

CONSTITUTION OF INDIA

L T P C
2 0 0 0

COURSE OBJECTIVES:

Students will be able to:

• Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
• To address the growth of Indian opinion regarding modern Indian intellectuals’ constitutional
• Role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
• To address the role of socialism in India after the commencement of the Bolshevik Revolution 1917 And its impact on the initial drafting of the Indian Constitution.

UNIT I

HISTORY OF MAKING OF THE INDIAN CONSTITUTION

History, Drafting Committee, (Composition & Working)
UNIT II PHILOSOPHY OF THE INDIAN CONSTITUTION
Preamble, Salient Features

UNIT III CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES

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

UNIT V LOCAL ADMINISTRATION

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.
UNIT I  சங்கமுறைமை
1. தமிழ்சுக்கோல் நூல் வேறுபாட்டுப்படிப்பு: -சுருக்கம், ராஜவர், காலத்தின்
2. அகலகாண்ட (82)
   - திமுக முக்தங்கள் அரங்கம்
3. குறிக்குமி பாட்டுகள் பாணாக்கற்கள்
4. பொதுகாலம் (95,195)
   - பசுநகர் முன்னிலை குறாம்பார்

UNIT II  அறநநறியதமிழ்
1. அரந்துவகுத்த திருவள்ளுவர்
   - பொருள் வாக்குத்த விபராலம், புர் பாடல், புத்த தெகவை
2. பிற அறநூல்கள் - திருக்கண்டத்துத்த
   - தலைத் துறைக்குரிய திருக்காவால், இன்று பாலகாலம் (கவாலம் விளைப்பெட்ட நூல்)

UNIT III  கட்டடத்கார்பியங்கள்
1. குறிக்குமி பாதிகள்
   -சிங்கப்பிரமணமும், குன்றுகள் காலக
2. குறிக்குமில் திருக்கட்டுப் பாதுகாப்பாலம்
   - திருக்கட்டுப் பாதுகாப்பாலம் அறிக்கைநூல்கள் காலக

UNIT IV  அருள்நநறியதமிழ்
1. குறிக்குமில் பாதிகள்
   - பாரி வைத்துகழத்து விடு தொத்துக்கள், வைத்துகழத்து பாரைகள் காலக
2. பாக்தரியதமிழ்
   - சிறுத்தாக்கும் பொருள் சிற்பம்
3. குறிக்குமில் (617, 618)
   - தில்லித் தில்லித் சிற்பம்
4. குறிக்குமில் நிறுவிய துறைத்தில் பாதுகாப்பாலம்
5. பாக்காயம்
   - பூக்கல் வார்த்தை பாரைகள்
6. அகலகாண்ட (4)
   - சுருக்கம்
   குறிக்குமில் (11)
   - தில்லித்
   குறிக்குமில் (11)
   - பாரைகள், புத்த
   குறிக்குமில் 50 (27)
   - பாரை
   சிற்பம் பாரைமும் நூல்கள்
UNIT V

1. உகரநகடத் தமிழ்
- தமிழின் முதல் புதினம்
- தமிழின் முதல் சிறுககத
- கட்டுகர இலக்கியம்
- பயண இலக்கியம்
- நொடகம்
2. நொட்டு விடுதகல் பபொரொட்டமும் தமிழ் இலக்கியமும்
3. முதொய விடுதகலயும் தமிழ் இலக்கியமும்
4. தபண் விடுதகலயும் விளிம்பு நிகலயினரின் பமம்பொட்டில் தமிழ் இலக்கியமும்
5. அறிவியல் தமிழ்
6. இகணயத்தில் தமிழ்
7. சுற்றுசூழல் பமம்பொட்டில் தமிழ் இலக்கியம்

TOTAL: 30 PERIODS

தமிழ் இலக்கிய சுயிரியல் புத்தகங்கள் / பொத்தகங்கள்

1. தமிழ் விக்கிப்பீடியொ (Tamil Wikipedia)
   - https://ta.wikipedia.org
2. தமிழ் விக்கிப்பீடியொ (Tamil Virtual University)
   - www.tamilvu.org
3. தமிழ் விக்கிப்பீடியொ (Tamil Wikipedia)
   - https://ta.wikipedia.org
4. தமிழ் விக்கிப்பீடியொ (Tamil Virtual University)
   - www.tamilvu.org
5. தமிழ் விக்கிப்பீடியொ (Tamil Virtual University)
   - www.tamilvu.org
6. தமிழ் விக்கிப்பீடியொ (Tamil Virtual University)
   - www.tamilvu.org

OCE431 INTEGRATED WATER RESOURCES MANAGEMENT L T P C 3 0 0 3

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 foot print - Virtual water trade for achieving global water and food security — Irrigation efficiencies, irrigation methods - current water pricing policy– scope to relook pricing.

TOTAL: 45 PERIODS

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:
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
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

UNIT III  CHALLENGES IN MANAGEMENT AND DEVELOPMENT

UNIT IV  GOVERNANCE
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
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 in to the aspects of sustainable resource management in the absence of a clear level playing field in the developmental aspects. |

REFERENCES


OCE433 PRINCIPLES OF SUSTAINABLE DEVELOPMENT L T P C

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
UNIT V ASSESSING PROGRESS AND WAY FORWARD 8

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 L T P C
3 0 0 3

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
5. Lee N. and George C. 2000. Environmental Assessment in Developing and Transitional
OMET431 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
Barriers – Noise control at the receiver -- Sound transmission through barriers – Noise reduction Vs Transmission loss - Enclosures

TOTAL: 45 PERIODS

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, VENTILLATION & AIR CONDITIONING
UNIT III  LIGHTING, COMPUTER, TV  9

UNIT IV  ENERGY EFFICIENT BUILDINGS  9

UNIT V  ENERGY STORAGE TECHNOLOGIES  9
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:
1. Understand technical aspects of energy conservation scenario.
2. Energy audit in any type for domestic buildings and suggest the conservation measures.
3. Perform building load estimates and design the energy efficient landscape system.
4. Gain knowledge to utilize an appliance/device sustainably.
5. Understand the status and current technological advancement in energy storage field.

REFERENCES:
6. (Could be downloaded from www.energymanagertraining.com)
UNIT II DESIGN FOR ADDITIVE MANUFACTURING

UNIT III VAT POLYMERIZATION

UNIT IV MATERIAL EXTRUSION AND SHEET LAMINATION

POWDER BASED PROCESS

UNIT V CASE STUDIES AND OPPORTUNITIES ADDITIVE MANUFACTURING PROCESSES

REFERENCES:
UNIT I  NEED FOR ELECTRIC VEHICLES  9
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  9
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  9
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  9
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  9

REFERENCES:

TOTAL: 45 PERIODS
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  9

UNIT II  OPPORTUNITY IDENTIFICATION & PRODUCT PLANNING  9

UNIT III  IDENTIFYING CUSTOMER NEEDS & PRODUCT SPECIFICATIONS  9

UNIT IV  CONCEPT GENERATION, SELECTION & TESTING  9

UNIT V  INDUSTRIAL DESIGN & PROTOTYPING  9

TOTAL: 45 PERIODS

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

REFERENCES:

OBA431 SUSTAINABLE MANAGEMENT L T P C
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
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
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  

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

OBA432 MICRO AND SMALL BUSINESS MANAGEMENT L T P C 3 0 0 3

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

UNIT II SCREENING THE BUSINESS OPPORTUNITY AND FORMULATING THE BUSINESS PLAN
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
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.

**OBA433  INTELLECTUAL PROPERTY RIGHTS**
L T P C
3 0 0 3

**COURSE OBJECTIVE**
➢ To understand intellectual property rights and its valuation.

**UNIT I  INTRODUCTION**
9
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
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
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
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
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
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

ET4251 IoT FOR SMART SYSTEMS LT P C 3 0 0 3

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-PCle, 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 RASPPERRY 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  9
Various paradigms of learning problems, Supervised, Semi-supervised and Unsupervised algorithms

UNIT II     NEURAL NETWORKS  9

UNIT III    MACHINE LEARNING – FUNDAMENTALS & FEATURE SELECTIONS & CLASSIFICATIONS  9
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
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:

OBJECTIVES:
To impart knowledge on

- Different types of renewable energy technologies
- Standalone operation, grid connected operation of renewable energy systems

UNIT I INTRODUCTION
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
UNIT III PHOTOVOLTAIC SYSTEM DESIGN
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

UNIT V OTHER RENEWABLE ENERGY SOURCES
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:

PS4093 SMART GRID

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
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
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
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

Unit V HIGH PERFORMANCE COMPUTING FOR SMART GRID APPLICATIONS
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 L T P C 3 0 0 3

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

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

REFERENCE:

NC4201 INTERNET OF THINGS AND CLOUD L T P C
3 0 0 3

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

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
UNIT V  IoT AND CLOUD


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

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
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
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

97
UNIT III   SURGICAL ROBOTS
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
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
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

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
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  9
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  9
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  9
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  9

UNIT – V  HOME AUTOMATION  9
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

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

TOTAL: 45 PERIODS
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

TOTAL : 45 PERIODS

REFERENCES
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 thermoset 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, prepgres 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 thermoset and thermoplastic composites.

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

TOTAL: 45 PERIODS

REFERENCES
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

TOTAL : 45 PERIODS

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

BY4016 IPR, BIOSAFETY AND ENTREPRENEURSHIP

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

REFERENCES

TOTAL : 45 PERIODS