PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

I. Use all the phases of the Software Development Life Cycle to build robust software systems

II. Analyze and evaluate problems critically using the theoretical and technical knowledge to develop sustainable solutions and systems

III. Identify the requirements and implement reliable, innovative and appropriate software solutions for the industrial need

IV. Enhance skills through lifelong learning as software professionals to progress in managerial and leadership roles.

V. Work efficiently in multidisciplinary teams with effective communication and follow ethical principles.

PROGRAMME OUTCOMES

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

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

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

4. Collect requirements from the stakeholders and design software engineering applications with deep understanding of best software principles and practices.

5. Apply software testing techniques to produce error free and reliable software and ensure quality.

6. Manage software project with state of the art approaches to ensure balance in all project areas like time, cost, quality, risk and human resource.

PEO/PO Mapping:

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(3-High, 2-Medium, 1-Low)
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### SEMESTER IV

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### PROFESSIONAL ELECTIVES

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**AUDIT COURSES (AC)**

Registration for any of these courses is optional to students.

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### Research Methodology and IPR Courses (RMC)

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## SUMMARY

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COURSE OBJECTIVES:
This course will help the students to
- acquire the knowledge of solving system of linear equations using an appropriate numerical methods.
- approximate the functions using polynomial interpolation numerical differentiation and integration using interpolating polynomials.
- acquire the knowledge of numerical solution of ordinary differential equation by single and multi step0 methods.
- obtain the solution of boundary value problems in partial differential equations using finite differences.
- study simulation and Monte-Carlo methods and their applications.

UNIT I  MATRICES AND LINEAR SYSTEMS OF EQUATIONS  12

UNIT II  INTERPOLATION, DIFFERENTIATION AND INTEGRATION  12

UNIT III  DIFFERENTIAL EQUATIONS  12

UNIT IV  PARTIAL DIFFERENTIAL EQUATIONS  12
Classification of second order PDE’s - Finite difference approximations to partial derivatives - Elliptic equations : Solution of Laplace and Poisson equations - One dimensional parabolic equation - Bender Schmidt method - Hyperbolic equation : One dimensional wave equation.

UNIT V  SIMULATION AND MONTE CARLO METHODS  12

COURSE OUTCOMES:
At the end of the course, students will be able to
- solve an algebraic or transcendental equation and linear system of equations using an appropriate numerical method.
- approximation of functions using polynomial interpolation, numerical differentiation and integration using interpolating polynomials.
- numerical solution of differential equations by single and multistep methods.

TOTAL: 60 PERIODS
• solution of boundary value problems and initial boundary value problems in partial differential equations using finite differences.

• simulation and Monte-Carlo methods and their applications.

REFERENCES:


CO-PO Mapping

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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 6

UNIT V PATENTS 6

TOTAL: 30 PERIODS

REFERENCES:

Course Outcomes:
At the end of this course, the students will have the ability to
1. Formulate and Design research problem
2. Understand and Comprehend the Data Collection Methods
3. Perform Data analysis and acquire Insights
4. Understand IPR and follow research ethics
5. Understand and Practice Drafting and filing a Patent in research and development

CO-PO Mapping:

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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

ALGORITHM 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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CO-PO Mapping

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CP4152 DATABASE PRACTICES
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COURSE OBJECTIVES:
- Describe the fundamental elements of relational database management systems
- Explain the basic concepts of relational data model, entity-relationship model, relational database design, relational algebra and SQL.
- Understand query processing in a distributed database system
- Understand the basics of XML and create well-formed and valid XML documents.
- Distinguish the different types of NoSQL databases
- To understand the different models involved in database security and their applications in real time world to protect the database and information associated with them.
UNIT I  RELATIONAL DATA MODEL

Suggested Activities:
Data Definition Language
- Create, Alter and Drop
- Enforce Primary Key, Foreign Key, Check, Unique and Not Null Constraints
- Creating Views
Data Manipulation Language
- Insert, Delete, Update
- Cartesian Product, Equi Join, Left Outer Join, Right Outer Join and Full Outer Join
- Aggregate Functions
- Set Operations
- Nested Queries
Transaction Control Language
- Commit, Rollback and Save Points

UNIT II  DISTRIBUTED DATABASES, ACTIVE DATABASES AND OPEN DATABASE CONNECTIVITY

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

UNIT III  XML DATABASES

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

UNIT IV  NOSQL DATABASES AND BIG DATA STORAGE SYSTEMS
Distributed System Concepts – NoSQL Graph Databases and Neo4j – Cypher Query Language of Neo4j – Big Data – MapReduce – Hadoop – YARN.

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

**UNIT V DATABASE SECURITY 15**

**Suggested Activities:**
Implementing Access Control in Relational Databases

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

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COURSE OBJECTIVES:

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

UNIT I SOFTWARE PROCESS & MODELING

UNIT II SOFTWARE DESIGN

UNIT III SYSTEM DEPENDABILITY AND SECURITY

UNIT IV SERVICE-ORIENTED SOFTWARE ENGINEERING, SYSTEMS ENGINEERING AND REAL-TIME SOFTWARE ENGINEERING
UNIT V SOFTWARE TESTING AND SOFTWARE CONFIGURATION MANAGEMENT


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

TOTAL: 45 PERIODS

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

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COURSE OBJECTIVES
- Understand the fundamentals of software architecture.
- Study the various software modeling techniques.
- Understand software implementation and deployment
- Learn the architecture of different applications.
- Relate software architecture and software quality.

UNIT I BASIC CONCEPTS, DESIGNING ARCHITECTURES

Suggested Activities
1. Identifying the pitfalls that are likely to occur for software architecture teams
2. Discussing about the role of Software architects as Cost estimators

UNIT II CONNECTORS, MODELING

1. Identifying a few commercial products which are infrastructure components that provide asynchronous messaging service.
2. Finding out the different possibilities of splitting the system into a number of computationally independent execution structures

UNIT III ANALYSIS, IMPLEMENTATION AND DEPLOYMENT
Concepts, Existing Frameworks, Software Architecture and Deployment, Software Architecture and Mobility, Pipes and Filters, Event-based, Implicit Invocation, Layered systems, Repositories Interpreters, Process control

Suggested Activities
1. Identifying the type of a given architectural pattern.
2. Representing software using pipe-filter architecture.

UNIT IV APPLIED ARCHITECTURES AND STYLES
Distributed and Networked Architectures, Architectures for Network-Based Applications, Decentralized Architectures, Service-Oriented Architectures and Web Services, Efficiency, Complexity, Scalability and Heterogeneity, Adaptability, Dependability

Suggested Activities
1. Identifying functional aspects of a service oriented architecture.
2. Discussing the pros and cons of implementing a middle ware to deal with architectural issues.
UNIT V IMPLEMENTATION

Understanding quality attributes- Availability- Deployability- Working with Other Quality Attributes-
Virtualization- the Cloud and Distributed Computing- Architecturally Significant Requirements-
Designing an Architecture

Suggested Activity
1. Identifying the cost of modifications in projects that measure deployment separately.
2. “Using the cloud assumes your application is service oriented.” Find some examples that
would support that statement and, if it is not universally true, find some that would falsify it.

TOTAL :45 PERIODS

Suggested Activity:
Students may be given problem domain that they may be encouraged to come out with multiple
solution domains by applying some pattern. The best solution would be selected and presented.

COURSE OUTCOMES:
Upon completion of the course, the student will be able to
- Develop Software applications starting from software architecture and design.
- Apply different types of systems analysis techniques and software design strategies.
- Learn to implement and deploy software applications.
- Evaluate and implement different types of design patterns based on the requirement and
  functionality
- Evaluate the quality attributes for software architecture

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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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SE4111  ADVANCED SOFTWARE TOOLS LABORATORY  L T P C  0 0 4 2  

COURSE OBJECTIVES

- To understand the software development process, methodologies and work flow
- To be familiar with all the UML notations and understand how it supports the entire software development process
- To understand how to map a design to code and code to a good design.
- To apply Black box and White box strategies to design test cases.
- To be familiar with the modern Computer aided Software Engineering tools

Identify ambiguities, inconsistencies and incompleteness from a requirements specification and state functional and non-functional requirement
Identify different actors and use cases from a given problem statement and draw use case diagram to associate use cases with different types of relationship
Draw a class diagram after identifying classes and association among them
Graphically represent various UML diagrams, and associations among them and identify the logical sequence of activities undergoing in a system, and represent them pictorially
Able to use modern engineering tools for specification, design, implementation and testing

3. Model Entity Relationship Diagram and Map the Entity Relationship Diagram to Relations.

Using an UML Tool Perform the Following:

1. Model a Class Diagram and Map the Class Diagram to Code.
2. Model Use Case Diagrams and Sequence Diagrams.
3. Model a State Transition Diagram.
4. Model an Activity diagram
5. Model a Collaboration Diagram
6. Model a Component diagram
7. Model a Deployment Diagram
8. Generating Code from UML Models (Forward Engineering)
9. Generating UML Models from Code (Reverse Engineering)
10. Version Control configuration and use.
11. Designing Test Suites.
12. Estimation of Test Coverage Metrics and Structural Complexity
13. Unit testing using JUnit.
14. Web Application testing using Selenium
15. Test management using any open source tool
16. Mini project strictly following a Software Development Life Cycle

TOTAL: 60 PERIODS

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

- Identify ambiguities, inconsistencies and incompleteness from a requirements specification and state functional and non-functional requirement
- Identify different actors and use cases from a given problem statement and draw use case diagram to associate use cases with different types of relationship
- Graphically represent various UML diagrams, and associations among them and identify the logical sequence of activities undergoing in a system, and represent them pictorially
- Design test cases using Black box and White box testing strategies.
- Use modern CASE tools for designing and testing Software applications.

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SE4201 SOFTWARE REQUIREMENTS ENGINEERING  L T P C  3 0 0 3

COURSE OBJECTIVES:
The student should be able to

- Understand the basics of requirements engineering
- Learn different techniques used for requirements elicitation
- Know the role played by requirements analysis in requirement integration
- Appreciate the use of various methodologies for requirements development
- Study the current trends in requirements prioritization and validation.

UNIT I INTRODUCTION
considerations, product construction, source-Levels of requirement-Evolution –Ambiguity in requirements specification

UNIT II REQUIREMENTS ELICITATION 9

UNIT III REQUIREMENTS ANALYSIS 9

UNIT IV REQUIREMENTS DEVELOPMENT 9

UNIT V REQUIREMENTS VALIDATION 9

TOTAL: 45 PERIODS

SUGGEST ACTIVITY:
- Students would be asked to identify a problem and frame the problem statement.
- Identify functional/non-functional requirements, domain requirements, and user and system requirements and analyze the feasibility.
- Give a presentation on the work done.

COURSE OUTCOMES
At the end of this course, the students should be able to:
CO1: Prepare SRS including the details of requirements engineering
CO2: Describe the stages of requirements elicitation.
CO3: Analyze software requirements gathering.
CO4: Use various methodologies for requirements development.
CO5: Perform requirements validation.

REFERENCES:
5. Aybüke Aurum · Claes Wohlin (Eds.-Engineering and managing software requirements), Springer-Verlag Berlin Heidelberg 2005

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### SE4202 SOFTWARE SYSTEM DESIGN

#### COURSE OBJECTIVES

The student should be able to:
- Understand the fundamentals of object modeling.
- Learn the unified process phases.
- Prepare the requirements for various case studies.
- Appreciate the idea behind Design Patterns in handling common problems faced during building an application.
- To practice object modeling using UML

#### UNIT I INTRODUCTION

Introduction to OOAD; typical activities / workflows / disciplines in OOAD, Introduction to iterative development and the Unified Process, Introduction to UML; mapping disciplines to UML artifacts, Introduction to Design Patterns – goals of a good design, Introducing a case study & MVC architecture.

#### UNIT II INCEPTION

Artifacts in inception, Understanding requirements – the FURPS model, Understanding Use case model – introduction, use case types and formats, Writing use cases – goals and scope of a use case, elements / sections of a use case, Use case diagrams, Use cases in the UP context and UP artifacts, Identifying additional requirements, Writing requirements for the case study in the use case model.
UNIT III  ELABORATION
System sequence diagrams for use case model, Domain model : identifying concepts, adding
associations, adding attributes, Interaction Diagrams, Introduction to GRASP design Patterns ,
Design Model: Use case realizations with GRASP patterns, Design Class diagrams in each MVC
layer Mapping Design to Code, Design class diagrams for case study and skeleton code

UNIT IV  DESIGN PATTERNS
Fabrication, Indirection, Singleton, Factory, Facade, Publish-Subscribe

UNIT V  UML DIAGRAMS
State-Chart diagrams, Activity diagrams, Component Diagrams, Deployment
diagrams, Object diagrams. Advanced concepts in OOAD : Use case relationships,
Generalizations Domain Model refinements, Architecture, Packaging model elements.

TOTAL : 45 PERIODS

COURSE OUTCOMES
Upon completion of the course, the students will be able to
CO1: Use UML notations Apply UML Use case Notations to applications.
CO2: Can apply unified process in software development
CO3: Understand the best use of Object-Oriented concepts for creating truly OOP programs
CO4: Use design patterns for better class and object composition.
CO5: Understand the concepts of Model refinement and diagrams.

REFERENCES
1. ‘Applying UML and patterns’ by Craig Larman, Pearson, 2005
2. “Object-Oriented Analysis & Design with the Unified Process”, Satzinger, Jackson & Burd
   Cengage Learning, Cengage Learning India Publisher, Year 2007
4. O’Reilly’s ‘Head-First Design Patterns’ by Eric Freeman et al. Year 2004
5. UML2 Toolkit by Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado: Wiley India
   Edition, Year 2003

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CO-PO Mapping
COURSE OBJECTIVES
The student should be able to

- Understand the basics of software testing
- Appreciate the different aspects of testing techniques
- Understand the testing process management
- Know the testing tools and test automation
- Learn the testing of various applications

UNIT I  INTRODUCTION

UNIT II  TESTING TECHNIQUES

UNIT III  MANAGING THE TESTING PROCESS

UNIT IV  BUILDING AGILITY & TOOL SUPPORT
Building Agility into the Testing Process– Using Agile Methods to Improve Software Testing — Tool Support For Testing

UNIT V  TEST AUTOMATION & TESTING THE APPLICATIONS

TOTAL : 45 PERIODS

Activity:
Develop small applications; create test scenarios and carry out different types of testing.

COURSE OUTCOMES:
At the end of this course, the students should be able to:
CO1: Comprehend a range of testing techniques
CO2: Select an appropriate testing strategy
CO3: Manage the testing process
CO4: Use different tools for testing
CO5: Understand automation testing and test various applications
REFERENCES:

7. CO-PO Mapping

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SE4204 INTEGRATED SOFTWARE PROJECT MANAGEMENT L T P C
3 0 0 3

COURSE OBJECTIVES
The student should be able to
- Understand the basic concept of project management.
- Learn the various costing and life cycle management.
- Understand the role played by risk in software project.
- Appreciate the use of metrics for software project management.
- Know the challenges in people management.

UNIT I PROJECT MANAGEMENT & COSTING

UNIT II PROCESS MODELS & LIFECYCLE MANAGEMENT
UNIT III   RISK MANAGEMENT  

UNIT IV   METRICS  

UNIT V   PEOPLE MANAGEMENT  

TOTAL : 45 PERIODS

Activity:
A mini-project can be given to the students and use it as a context for the tutorials

COURSE OUTCOMES
At the end of this course, the students should be able to:
CO1:Identify the various elements of software management process framework
CO2:Use available open source estimation tools for cost estimation
CO3:Identify existing risk and perform risk assessment
CO4:Design a software metric for software project management
CO5:Learn and assess the practices of people management

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

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

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

Activities to be carried out

<table>
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<tr>
<th>Activity</th>
<th>Instructions</th>
<th>Submission week</th>
<th>Evaluation</th>
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<tr>
<td>Selection of area of interest and Topic</td>
<td>You are requested to select an area of interest, topic and state an objective</td>
<td>2nd week</td>
<td>3 % Based on clarity of thought, current relevance and clarity in writing</td>
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<td>Stating an Objective</td>
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</table>
| Collecting Information about your area & topic | 1. List 1 Special Interest Groups or professional society  
2. List 2 journals  
3. List 2 conferences, symposia or workshops  
4. List 1 thesis title  
5. List 3 web presences (mailing lists, forums, news sites)  
6. List 3 authors who publish regularly in your area  
7. Attach a call for papers (CFP) from your area. | 3rd week        | 3% (the selected information must be area specific and of international and national standard) |
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<tr>
<th>Collection of Journal papers in the topic in the context of the objective – collect 20 &amp; then filter</th>
<th>4th week</th>
<th>6% (the list of standard papers and reason for selection)</th>
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<tr>
<td>• You have to provide a complete list of references you will be using - Based on your objective - Search various digital libraries and Google Scholar</td>
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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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<td>• Favour more recent papers,</td>
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<td>• Pick a recent survey of the field so you can quickly gain an overview,</td>
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<td>• Find relationships with respect to each other and to your topic area (classification scheme/categorization)</td>
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<td>• Mark in the hard copy of papers whether complete work or section/sections of the paper are being considered</td>
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<td>Reading and notes for first 5 papers</td>
<td>5th week</td>
<td>8% (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper)</td>
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<td>Reading Paper Process</td>
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<td>• For each paper form a Table answering the following questions:</td>
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<tr>
<td>• What is the main topic of the article?</td>
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<tr>
<td>• What was/were the main issue(s) the author said they want to discuss?</td>
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<td>• Why did the author claim it was important?</td>
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<td>• How does the work build on other’s work, in the author’s opinion?</td>
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<td>• What simplifying assumptions does the author claim to be making?</td>
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<td>• What did the author do?</td>
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<td>• How did the author claim they were going to evaluate their work and compare it to others?</td>
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<td>• What did the author say were the limitations of their research?</td>
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<td>the important directions for future research?</td>
<td>Conclude with limitations/issues not addressed by the paper (from the perspective of your survey)</td>
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<tr>
<td>Reading and notes for next 5 papers</td>
<td>Repeat Reading Paper Process</td>
<td>6th</td>
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<tr>
<td>Reading and notes for final 5 papers</td>
<td>Repeat Reading Paper Process</td>
<td>7th</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>
<td>8th</td>
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<tr>
<td>Abstract</td>
<td>Prepare a draft abstract and give a presentation</td>
<td>9th</td>
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<td>Introduction Background</td>
<td>Write an introduction and background sections</td>
<td>10th</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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<tr>
<td>Your conclusions</td>
<td>Write your conclusions and future work</td>
<td>12th</td>
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<tr>
<td>Final Draft</td>
<td>Complete the final draft of your paper</td>
<td>13th</td>
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<tr>
<td>Seminar</td>
<td>A brief 15 slides on your paper</td>
<td>14th &amp; 15th week</td>
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| Notes:                                                                 |                                                                                      |       |             |
|                                                                      | (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions about each paper) |       |             |
|                                                                      | (this component will be evaluated based on the linking and classification among the papers) |       |             |
|                                                                      | (Clarity, purpose and conclusion)                                                     |       |             |
|                                                                      | 6% Presentation & Viva Voce                                                          |       |             |
|                                                                      | (conclusions – clarity and your ideas)                                               |       |             |
|                                                                      | 4% Plagiarism Check Report                                                            |       |             |
|                                                                      | (based on presentation and Viva-voce)                                                |       |             |
**Course Outcomes:**

At the end of this course, the students will have the ability to

1. Select a topic and collect relevant literature for paper writing
2. Prepare a working outline of the Term paper
3. Summarize and link related papers for effective paper writing
4. Synthesize Conclusions on the topic under study
5. Effectively write and present a term paper

**CO-PO Mapping:**

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**SE4212 SOFTWARE DEVELOPMENT LABORATORY**

**COURSE OBJECTIVES:**

The student should be able to:

- learn the stages of software development
- know about preparing software project documentation
- learn various testing mechanisms
- gain practical experience in applying agile methodology
- understand the principles of DevOps

**LIST OF EXERCISES:**

Choose any application and apply the phases of Software Development Life Cycle

1. **Project Planning**
   Thorough study of the problem by reviewing the literature – Identify project scope, objectives, infrastructure. – PROJECT PLAN DOCUMENTATION

2. **Software requirement Analysis**
   Classify the functional and non-functional requirements - Describe the individual Phases / Modules of the project, Identify deliverables. – SRS DOCUMENTATION

3. **Software Design/Modeling**
   Prepare high-level and low-level designs
   Use work products – Data dictionary, Use case diagrams and activity diagrams, build and test class diagrams, Sequence diagrams, add interface to class diagrams. – DESIGN DOCUMENTATION

4. **Software Development and Debugging**
Use technology of your choice to develop and debug the application— CODE DOCUMENTATION

5. Software Testing

Perform validation testing, Coverage analysis, memory leaks, develop test case hierarchy and Site monitor. – TEST CASE DOCUMENTATION

6. Develop any software application using agile method.

7. Develop any software application using DevOps.

SUGGESTED LIST OF APPLICATIONS:
1. Student Marks Analyzing System.
2. Quiz System.
3. Online Ticket Reservation System
4. Payroll System
5. Course Registration System
8. Inventory system
9. Online Payment system
10. Hotel management system

TOTAL: 60 PERIODS

COURSE OUTCOMES:
At the end the student will be able to:
CO1: Formulate project plan and SRS
CO2: Prepare design and code documents at appropriate stages of software development
CO3: Test the software product
CO4: Develop a flexible software product using agile.
CO5: Implement DevOps principles to produce high-quality software

CO-PO Mapping

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SE4301 SOFTWARE RELIABILITY AND QUALITY L T P C
3 0 0 3

COURSE OBJECTIVES
The student should be able to
- Introduce the basics of software reliability
- Understand the various reliable modeling techniques
• Explore the different software reliable models
• Test the product for quality
• Monitor and comply against the defined standards

UNIT I INTRODUCTION TO SOFTWARE RELIABILITY
Defining failure – choosing a common measure – System and software failure intensity objectives – software reliability strategies - Failures, Faults and Errors – Availability – system and component reliabilities – basic failure intensity - Need for reliable software – concepts - The Dependability Concept - Failure Behavior of an X-ware System

UNIT II SOFTWARE RELIABILITY MODELING

UNIT III COMPARISON OF SOFTWARE RELIABILITY MODELS

UNIT IV SOFTWARE QUALITY ASSURANCE
Software Quality - Quality Principles - Quality Factors: Product operation, revision and transition; Components of SQA: System and architecture; Pre-Project Components; Contract Review; Development and Quality Plans; SQA Components in Project Life Cycle: SQA defect removal policies; Reviews: Project progress control; Costs; Quality Management Standards; Project Process Standards; Management and its Role in SQA; SQA Unit.

UNIT V SQA IN PROJECT MANAGEMENT
Project progress control – costs – quality management standards – project process standards – management and its role in SQA – SQA unit

TOTAL : 45 PERIODS

Activities:
Give a presentation about a software reliability tool of students’ choice.
Create an SQA Management Plan.

COURSE OUTCOMES:
At the end of this course, the students should be able to:
CO1:Perform some simple statistical analysis relevant to software measurement data
CO2:Compare and pick out the right reliability model
CO3:Evaluate the reliability of any given software product
CO4:Develop Quality plans and use SQA components in project life cycle
CO5:Assess Quality standards of various software products

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SE4071 AGILE METHODOLOGIES

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

UNIT I AGILE SOFTWARE DEVELOPMENT
UNIT II AGILE AND SCRUM PRINCIPLES

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

UNIT IV AGILE REQUIREMENTS AND AGILE TESTING

UNIT V AGILE REVIEW AND SCALING AGILE FOR LARGE PROJECTS

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

TOTAL: 45 PERIODS

REFERENCES
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**IF4095**  
**SOCIAL NETWORK ANALYSIS**  
**L T P C**  
**3 0 0 3**  
**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  

UNIT V  LINK ANALYSIS & COMMUNITY DETECTION  

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

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

TOTAL : 45 PERIODS

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

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BC4152  CYBER FORENSICS AND INVESTIGATION  L T P C
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COURSE OBJECTIVES:
- To gain a comprehensive understanding of cyber forensic principles and the collection, preservation, and analysis of digital evidence
- To combine both the technical expertise and the knowledge required to investigate, detect and prevent digital crimes.
- To understand the different applications and methods for conducting network and digital forensic acquisition and analysis
- To learn the E-evidence collection and preservation, investigating operating systems and file systems, network, cloud and mobile device forensics
- To gain knowledge on digital forensics legislations, digital crime, forensic processes and procedures.

UNIT I  CYBER FORENSICS SCIENCE
Cyber Forensics Science: Forensics Science, Forensics Fundamentals, Computer Forensics, and Digital Forensics.
Cyber Crime: Criminalistics as it relates to the Investigative Process, Analysis of Cyber Criminalistics Area, Holistic Approach to Cyber-forensics, Computer Forensics and Law Enforcement- Indian Cyber Forensic - Forensics Services, Professional Forensics Methodology- Types of Forensics Technology

UNIT II  NETWORK SECURITY FORENSICS SYSTEM AND SERVICES
Forensics system and Services : Forensics on - Internet Usage – Intrusion - Firewall and Storage Area Network; Occurrence of Cyber-crimes- Cyber Detectives- Fighting Cyber Crimes- Forensic Process
Open-source Security Tools for Network Forensic Analysis, Requirements for Preservation of Network Data
Computer Forensics - Data Backup and Recovery - Test Disk Suite.

UNIT III  DIGITAL FORENSICS PRESERVATION AND FORENSIC DATA ANALYSIS
Data-Recovery Solution, Hiding and Recovering Hidden Data, Evidence Collection and Data Seizure

UNIT IV  CLOUD, NETWORK AND MOBILE FORENSICS
Working with the cloud vendor, obtaining evidence, reviewing logs and APIs
Mobile Forensics techniques, Mobile Forensics Tools - Android Device – Analysis- Android Malware – iOS Forensic Analysis – SIM Forensic Analysis – Case study
Recent trends in Mobile Forensic Technique and methods to Search and Seize Electronic
UNIT V LEGAL ASPECTS OF DIGITAL FORENSICS


Current Cyber Forensic Tools: Overview of different software packages – Encase-Autopsy- Magnet – Wireshark - Mobile Forensic Tools – SQLite

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the responsibilities and liabilities of a computer forensic investigator

CO2: Identify potential sources of electronic evidence.

CO3: Understand the importance of maintaining the integrity of digital evidence.

CO4: Demonstrate the ability to perform basic forensic data acquisition and analysis using computer and network based applications and utilities.

CO5: Understand relevant legislation and codes of ethics.

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MP4251  CLOUD COMPUTING TECHNOLOGIES  L T P C
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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, 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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SE4072  IMAGE PROCESSING  L T P C  3 0 0 3

COURSE OBJECTIVES:
- To study fundamental concepts of digital image processing.
- To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- To become familiar with image compression
- To study the image segmentation and Morphological Processing.
- To expose student’s in recognition methods.
UNIT I  INTRODUCTION  9
Examples of fields that use digital image processing, fundamental steps in digital image processing, components of image processing system. Digital Image Fundamentals: A simple image formation model, image sampling and quantization, basic relationships between pixels. Color Image Processing: Color fundamentals, color models, pseudo color image processing, basics of full–color image processing, color transforms, smoothing and sharpening, color segmentation

UNIT II  IMAGE ENHANCEMENT  9
Image enhancement in the spatial domain: Basic gray-level transformation, histogram processing, enhancement using arithmetic and logic operators, basic spatial filtering, smoothing, and sharpening spatial filters, combining the spatial enhancement methods. Filtering in the Frequency Domain: Preliminary Concepts, Extension to functions of two variables, Image Smoothing, Image Sharpening, Homomorphic filtering. A model of the image degradation/restoration process, noise models, restoration in the presence of noise–only spatial filtering,

UNIT III  WAVELETS AND IMAGE COMPRESSION  9
Wavelets and Multiresolution Processing. Fundamentals, image compression models, error-free compression, lossy predictive coding, image compression standards

UNIT IV  IMAGE SEGMENTATION  9
Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation, Segmentation by Morphological Watersheds, The Use of Motion in Segmentation Morphological Image Processing: Preliminaries, dilation, erosion, open and closing, hit or miss transformation, basic morphologic algorithms.

UNIT V  REPRESENTATION AND OBJECT RECOGNITION  9
Representation, Boundary Descriptors, Regional Descriptors, Use of Principal Components for Description. Object Recognition: Patterns and patterns classes, recognition based on decision–theoretic methods, matching, optimum statistical classifiers, neural networks, structural methods – matching shape numbers, string matching.

COURSE OUTCOMES:
CO1: Apply knowledge of mathematics for image understanding and analysis.
CO2: Design and analysis of techniques / processes for image Enhancement.
CO3: Design and analysis of techniques / processes for image compression.
CO4: Able to expose to current trends in field of image segmentation.
CO5: Design, realize and troubleshoot various algorithms for image processing case studies.

REFERENCES
3. Introduction to Digital Image Processing with Matlab, Alasdair McAndrew, Thomson Course

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**CP4093 INFORMATION RETRIEVAL TECHNIQUES**

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

**UNIT I INTRODUCTION: MOTIVATION**

**UNIT II MODELING**

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

UNIT V SEARCHING THE WEB

TOTAL: 45 PERIODS

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

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COURSE OBJECTIVES:

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

UNIT I FOUNDATION OF COGNITIVE COMPUTING

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

UNIT II NATURAL LANGUAGE PROCESSING IN COGNITIVE SYSTEMS

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

UNIT III BIG DATA AND COGNITIVE COMPUTING

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

UNIT IV BUSINESS IMPLICATIONS OF COGNITIVE COMPUTING

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

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

**COURSE OUTCOMES:**

**CO1:** Explain applications in Cognitive Computing.

**CO2:** Describe Natural language processor role in Cognitive computing.

**CO3:** Explain future directions of Cognitive Computing

**CO4:** Evaluate the process of taking a product to market

**CO5:** Comprehend the applications involved in this domain.

**TOTAL :45 PERIODS**

**REFERENCES**


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**IF4094**

**PATTERN RECOGNITION**

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**COURSE OBJECTIVES:**

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

**UNIT I**

**PATTERN RECOGNITION**

UNIT II  
STATISTICAL PATTERN RECOGNITION  

UNIT III  
BAYES DECISION THEORY CLASSIFIERS  

UNIT IV  
LINEAR DISCRIMINANT FUNCTIONS  

UNIT V  
NONLINEAR CLASSIFIERS  

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

TOTAL:45 PERIODS

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

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

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**BD4251**

**BIG DATA MINING AND ANALYTICS**

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

**UNIT I**

**DATA MINING AND LARGE SCALE FILES**


**UNIT II**

**SIMILAR ITEMS**


**UNIT III**

**MINING DATA STREAMS**


**UNIT IV**

**LINK ANALYSIS AND FREQUENT ITEMSETS**

UNIT V  CLUSTERING


TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the students will be able to
CO1: Design algorithms by employing Map Reduce technique for solving Big Data problems.
CO2: Design algorithms for Big Data by deciding on the apt Features set .
CO3: Design algorithms for handling petabytes of datasets
CO4: Design algorithms and propose solutions for Big Data by optimizing main memory consumption
CO5: Design solutions for problems in Big Data by suggesting appropriate clustering techniques.

REFERENCES:

WEB REFERENCES:
1. https://swayam.gov.in/nd2_arp19_ap60/preview

ONLINE RESOURCES:
1. https://examupdates.in/big-data-analytics/

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COURSE OBJECTIVES:

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

UNIT I INTRODUCTION TO DATA SCIENCE

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

UNIT II MODELING METHODS


UNIT III INTRODUCTION TO R


UNIT IV MAP REDUCE

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

UNIT V DATA VISUALIZATION


TOTAL : 45 PERIODS

COURSE OUTCOMES:

**CO1:** Obtain, clean/process and transform data.

**CO2:** Analyze and interpret data using an ethically responsible approach.

**CO3:** Use appropriate models of analysis, assess the quality of input, derive insight from results, and investigate potential issues.

**CO4:** Apply computing theory, languages and algorithms, as well as mathematical and statistical models, and the principles of optimization to appropriately formulate and use data analyses.

**CO5:** Formulate and use appropriate models of data analysis to solve business-related challenges.
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IF4072 DESIGN THINKING L T P C 3 0 0 3

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

UNIT I UX LIFECYCLE TEMPLATE 8

UNIT II CONTEXTUAL INQUIRY 10
UNIT III DESIGN THINKING, IDEATION, AND SKETCHING


UNIT IV UX GOALS, METRICS, AND TARGETS


UNIT V ANALYSING USER EXPERIENCE


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

TOTAL : 45 PERIODS

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

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

### CO-PO Mapping

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**IF4093**  
**GPU COMPUTING**  
**L T P C**  
**3 0 0 3**

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

**UNIT I  
GPU ARCHITECTURE**  
9
Evolution of GPU architectures - Understanding Parallelism with GPU –Typical GPU Architecture - CUDA Hardware Overview - Threads, Blocks, Grids, Warps, Scheduling - Memory Handling with CUDA: Shared Memory, Global Memory, Constant Memory and Texture Memory.

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

**UNIT III  
PROGRAMMING ISSUES**  
9

**UNIT IV  
OPENCL BASICS**  
9

**UNIT V  
ALGORITHMS ON GPU**  
9
Parallel Patterns: Convolution, Prefix Sum, Sparse Matrix - Matrix Multiplication - Programming Heterogeneous Cluster.
SUGGESTED ACTIVITIES:
1. Debugging Lab
2. Performance Lab
3. Launching Nsight
4. Running Performance Analysis
5. Understanding Metrics
6. NVIDIA Visual Profiler
7. Matrix Transpose Optimization
8. Reduction Optimization

TOTAL: 45 PERIODS

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

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

UNIT I    INTRODUCTION TO WEB SERVICE

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

UNIT III    RESTFUL WEB SERVICES

UNIT IV    IMPLEMENTATION OF RESTFUL WEB SERVICES

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

COURSE OUTCOMES:
CO1: Explain how to write XML documents.
CO2: Apply the web service building blocks such as SOAP, WSDL and UDDI
CO3: Describe the RESTful web services.
CO4: Implement the RESTful web service web service with Spring Boot MVC
CO5: Discuss Resource-oriented Architecture.
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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IF4073 DEVOPS AND MICROSERVICES L T P C
3 0 2 4

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

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

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

UNIT IV  DEVOPS AUTOMATION TOOLS  9+6

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

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

TOTAL:75 PERIODS

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

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COURSE OBJECTIVES:
- Develop and Train Deep Neural Networks.
- Build and train RNNs, work with NLP and Word Embeddings.
- The internal structure of LSTM and GRU and the differences between them.
- The Auto Encoders for Image Processing.

UNIT I: DEEP LEARNING CONCEPTS 6

UNIT II: NEURAL NETWORKS 9

UNIT III: CONVOLUTIONAL NEURAL NETWORK 10

UNIT VI: NATURAL LANGUAGE PROCESSING USING RNN 10

UNIT V: DEEP REINFORCEMENT & UNSUPERVISED LEARNING 10

LIST OF EXPERIMENTS 30
1: Feature Selection from Video and Image Data
2: Image and video recognition
3: Image Colorization
4: Aspect Oriented Topic Detection & Sentiment Analysis
5: Object Detection using Autoencoder

**COURSE OUTCOMES:**

**CO1:** Feature Extraction from Image and Video Data  
**CO2:** Implement Image Segmentation and Instance Segmentation in Images  
**CO3:** Implement image recognition and image classification using a pretrained network (Transfer Learning)  
**CO4:** Traffic Information analysis using Twitter Data  
**CO5:** Autoencoder for Classification & Feature Extraction

TOTAL: 45+30=75 PERIODS

**REFERENCES**

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

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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**

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

UNIT III INTRODUCTION TO ETHEREUM
Introduction to Ethereum, Consensus Mechanisms, Metamask Setup, Ethereum Accounts, Transactions, Receiving Ethers, Smart Contracts.

UNIT-IV INTRODUCTION TO HYPERLEDGER AND SOLIDITY PROGRAMMING

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

TOTAL: 45 PERIODS

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

TOTAL: 30 PERIODS

SUPPLEMENTARY RESOURCES:
- NPTEL online course: https://nptel.ac.in/courses/106/104/106104220/
- Udemy: https://www.udemy.com/course/build-your-blockchain-az/
- 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
CO2: Analyze the working of Smart Contracts
CO3: Understand and analyze the working of Hyperledger
CO4: Apply the learning of solidity to build de-centralized apps on Ethereum
CO5: Develop applications on Blockchain

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IF 4291 FULL STACK WEB APPLICATION DEVELOPMENT L T P C 3 0 2 4

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

UNIT I FUNDAMENTALS & TYPESCRIPT LANGUAGE 10

UNIT II ANGULAR 10
UNIT III  NODE.Js

UNIT IV  EXPRESS.Js

UNIT V  MONGODB

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

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

TOTAL: 45 + 30=75 PERIODS

REFERENCES
1. Adam Freeman, Essential TypeScript, Apress, 2019
2. Mark Clow, Angular Projects, Apress, 2018
3. Alex R. Young, Marc Harter, Node.js in Practice, Manning Publication, 2014
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SE4073  EMBEDDED SOFTWARE DEVELOPMENT  L T P C
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COURSE OBJECTIVES:
- To understand the architecture of embedded processor, microcontroller, and peripheral devices.
- To interface memory and peripherals with embedded systems.
- To study the embedded network environment.
- To understand challenges in Real time operating systems.
- To study, analyze and design applications on embedded systems.

UNIT I  EMBEDDED PROCESSORS  9+6

UNIT II  EMBEDDED COMPUTING PLATFORM  9+6

UNIT III  EMBEDDED NETWORK ENVIRONMENT  9+6

UNIT IV  REAL-TIME CHARACTERISTICS  9+6
UNIT V SYSTEM DESIGN TECHNIQUES


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

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

REFERENCES

TOTAL:45+30=75 PERIODS
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### IF4074 DISTRIBUTED APPLICATION DEVELOPMENT

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

**UNIT I GETTING STARTED WITH GO PROGRAMMING**

Centralized vs Decentralized Systems
- Centralized Systems
- Decentralized Systems
- Decentralized Data
- Decentralized Wealth
- Decentralized Identity
- Decentralized Computing
- Decentralized Bandwidth
- Decentralized Markets for Decentralized Assets
- About Go Language
- The Terminal Environment
- Go. Your First Program
- Variables & Data Types
- Collection Frameworks
- Functions
- Structs and Interfaces
- Packages
- Hashes and Cryptography Packages
- Servers Packages
- Concurrency
- Goroutines
- Channels
- Channel Direction
- Select
- Buffered Channels
- The sync package
- Synchronizing with mutex locks
- Synchronizing access to composite values
- Concurrency barriers with sync
- WaitGroup
- Data IO

**UNIT II BUILDING DISTRIBUTED APPLICATIONS IN GIN**

- Installing and configuring Gin
- Dependency management in Golang
- Writing a custom HTTP handler
- Exploring API functionality
- Defining the data model
- HTTP endpoints
- Implementing HTTP routes & Methods
- Managing Data Persistence with MongoDB
- Authentication & Authorization
- Developing and Deploying Web Application using Gin

**UNIT III SMART CONTRACTS USING SOLIDITY & GO**

- The CAP theorem
- Consensus in distributed systems
- Understanding the hash function and the Merkle tree
- Operations using Solidity
- Control Structures
- Smart contract on a private blockchain
- Design of DAO
- Class properties of a contract
- Expression and control structures
- State variables
- Functions & its Modifiers
- Events
- Implementing funding limit with inheritance
- Making a contract abstract
UNIT IV DEVELOPING DAPPS

UNIT V BITCOIN NETWORK

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

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

TOTAL : 45+30=75 PERIODS

REFERENCES

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COURSE OBJECTIVES:

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

UNIT I INTRODUCTION

Internet of Things - Domain Specific IoTs - IoT and M2M-Sensors for IoT Applications – Structure of IoT - IoT Map Device - IoT System Management with NETCONF-YANG

UNIT II IoT ARCHITECTURE, GENERATIONS AND PROTOCOLS


UNIT III IoT PROTOCOLS AND TECHNOLOGY


UNIT IV CLOUD ARCHITECTURE BASICS

The Cloud types; IaaS, PaaS, SaaS – Development environments for service development; Amazon, Azure, Google Appcloud platform in industry

UNIT V IOT PROJECTS ON RASPBERRY PI

Building IOT with RASPBERRY Pi - Creating the sensor project - Preparing Raspberry Pi - Clayster libraries – Hardware Interacting with the hardware - Interfacing the hardware - Internal representation of sensor values - Persisting data - External representation of sensor values - Exporting sensor data

SUGGESTED ACTIVITIES:

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

COURSE OUTCOMES:

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

**TOTAL: 75 PERIODS**

**REFERENCES:**


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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**

algorithms, Radiosity, Hidden Surface Removal, Realism Stereographic image.

**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.

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: 45+30=75 PERIODS

COURSE OUTCOMES:

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

REFERENCES

2. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan


CO-PO Mapping

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AUDIT COURSES

AX4091 ENGLISH FOR RESEARCH PAPER WRITING

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

TOTAL: 30 PERIODS

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

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AX4092  DISASTER MANAGEMENT  L T P C 2 0 0 0

COURSE OBJECTIVES:
- Summarize basics of disaster
- Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Develop the strengths and weaknesses of disaster management approaches
UNIT I INTRODUCTION
Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT II REPERCUSSIONS OF DISASTERS AND HAZARDS

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

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

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

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

TOTAL : 30 PERIODS

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AX4093  CONSTITUTION OF INDIA  L  T  P  C
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COURSE OBJECTIVES:
Students will be able to:
- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals’ constitutional
- Role and entitlement to civil and economic rights as well as the emergence nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

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

UNIT II  PHILOSOPHY OF THE INDIAN CONSTITUTION
Preamble, Salient Features

UNIT III  CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES

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

UNIT V  LOCAL ADMINISTRATION

UNIT VI  ELECTION COMMISSION
Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.
COURSE OUTCOMES:
Students will be able to:

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

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

AX4094

UNIT I

1. Tamil Literature 6
   1. Thamizh Thamizh Thamizh  Thamizh Thamizh Thamizh
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UNIT II

1. Tamil Literature 6
   1. Thamizh Thamizh Thamizh Thamizh
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UNIT III

1. Tamil Literature 6
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   2. Thamizh Thamizh
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UNIT IV

அருள்நனற்றுதமிழ்

1. நீந்தவர்பார்ப்பால்
   - பரியுடன் தமிழ்கலை தோற்றப்படுத்தல், எவ்விக்கலாம் புராணங்கள் இராதுலாம். அருளநனற்றுதமிழ் தோற்றங்கள் எவ்விக்கலாம்.

2. தமிழ்நூறு
   - அருள்நனற்றுதமிழ் புராணங்கள்

3. சிறுபொணொற்றுப்பகட (617, 618)
   - பொரிப் பொரிப் விளக்கம்

4. காப்பொருள்தொண்டுதமிழ் மொழிபெயர் மொழிபெயர்

5. புறநூறு
   - சிறுபொணொற்றுப்பகட

6. நற்றிகண (11) - பொரி
   - சிறுபொணொற்றுப்பகட

UNIT V

நவீனதமிழ்

1. உகரநகடதமிழ்
   - தமிழின் முதல் புதினம்
   - தமிழின் முதல் சிறுககத
   - கட்டுகரிலக்கியம்
   - பயணிலக்கியம்
   - நொட்டு

2. முதோய்விடுத்தகலயும் தமிழ் இலக்கியமும்

3. தபணவிடுத்தகலயும் விளிம்பு நிகலயினரின் பமம்பொட்டில் தமிழ் இலக்கியமும்

4. அறிவியல் தமிழ்

5. இகணயத்தில் தமிழ்

6. சுற்றுசூழல் பமம்பொட்டில் தமிழ் இலக்கியம்

TOTAL : 30 PERIODS

தமிழ் விக்கிப்பீடியொ, தமிழ் இகணயகல்விக்கழகம் (Tamil Virtual University)
- www.tamilvu.org
2. தமிழ் விக்கிப்பீடியொ (Tamil Wikipedia)
- https://ta.wikipedia.org
3. தமிழ் பல்ககலக்கழகம்
4. தமிழ் பல்ககலக்கழகம்
   - www.tamilvu.org
5. தமிழ் பல்ககலக்கழகம்
   - thamilvalarchithurai.com
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.

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.

TOTAL: 45 PERIODS
CO5 Analyse how the virtual water concept pave way to alternate policy options.

REFERENCES:

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

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

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

UNIT II MANAGERIAL IMPLICATIONS AND IMPACT 9

UNIT III CHALLENGES IN MANAGEMENT AND DEVELOPMENT 9

UNIT IV GOVERNANCE 9
Public health -Community Health Assessment and Improvement Planning (CHA/CHIP)- Infrastructure and Investments on Water, (WASH) - Cost Benefit Analysis – Institutional Intervention-Public Private Partnership - Policy Directives - Social Insurance -Political Will vs Participatory Governance -
UNIT V  INITIATIVES
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 3 0 0 3

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 FRAME WORK

UNIT III  SUSTAINABLE DEVELOPMENT AND WELLBEING

UNIT IV  SUSTAINABLE SOCIO-ECONOMIC SYSTEMS

UNIT V  ASSESSING PROGRESS AND WAY FORWARD

TOTAL: 45 PERIODS

OUTCOMES:
• On completion of the course, the student is expected to be able to
  CO1 Explain and evaluate current challenges to sustainability, including modern world social, environmental, and economic structures and crises.
  CO2 Identify and critically analyze the social environmental, and economic dimensions of sustainability in terms of UN Sustainable development goals
  CO3 Develop a fair understanding of the social, economic and ecological linkage of Human well being, production and consumption
  CO4 Evaluate sustainability issues and solutions using a holistic approach that focuses on connections between complex human and natural systems.
  CO5 Integrate knowledge from multiple sources and perspectives to understand environmental limits governing human societies and economies and social justice dimensions of sustainability.

REFERENCES:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title: Environmental Impact Assessment</th>
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</thead>
<tbody>
<tr>
<td>OCE434</td>
<td>L T P C: 3 0 0 3</td>
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**OBJECTIVES:**
- To make the students understand environmental clearance, its legal requirements and to provide knowledge on overall methodology of EIA, prediction tools and models, environmental management plan and case studies.

**UNIT I INTRODUCTION**

**UNIT II IMPACT IDENTIFICATION AND PREDICTION**

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

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

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

**TOTAL: 45 PERIODS**

**OUTCOMES:**
- On completion of the course, the student is expected to be able to
CO1 Understand need for environmental clearance, its legal procedure, need of EIA, its types, stakeholders and their roles

CO2 Understand various impact identification methodologies, prediction techniques and model of impacts on various environments

CO3 Understand relationship between social impacts and change in community due to development activities and rehabilitation methods

CO4 Document the EIA findings and prepare environmental management and monitoring plan

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

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

OME431 VIBRATION AND NOISE CONTROL STRATEGIES

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

UNIT I BASICS OF VIBRATION

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

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

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

TOTAL: 45 PERIODS

OUTCOMES:
On Completion of the course the student will be able to
- apply the basic concepts of vibration in damped and undamped systems
- apply the basic concepts of noise and to understand its effects on systems
- select the instruments required for vibration measurement and its analysis
- select the instruments required for noise measurement and its analysis.
- 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 9

UNIT II  HEATING, VENTILLATION & AIR CONDITIONING 9

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:

- Understand technical aspects of energy conservation scenario.
- Energy audit in any type for domestic buildings and suggest the conservation measures.
- Perform building load estimates and design the energy efficient landscape system.
- Gain knowledge to utilize an appliance/device sustainably.
- Understand the status and current technological advancement in energy storage field.

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

OME433 ADDITIVE MANUFACTURING L T P C 3 0 0 3

UNIT I INTRODUCTION 9

UNIT II DESIGN FOR ADDITIVE MANUFACTURING 9

UNIT III VAT POLYMERIZATION 9

UNIT IV MATERIAL EXTRUSION AND SHEET LAMINATION 9

POWDER BASED PROCESS
UNIT V  CASE STUDIES AND OPPORTUNITIES ADDITIVE MANUFACTURING PROCESSES


TOTAL: 45 PERIODS

REFERENCES:
UNIT V DESIGN OF ELECTRIC VEHICLES

REFERENCES:

TOTAL: 45 PERIODS

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:

- Apply the principles of generic development process; and understand the organization structure for new product design and development.
- Identify opportunity and plan for new product design and development.
- Conduct customer need analysis; and set product specification for new product design and development.
- Generate, select, and test the concepts for new product design and development.
- Apply the principles of Industrial design and prototype for design and develop new products.

TEXT BOOK:

REFERENCES:

OBA431  SUSTAINABLE MANAGEMENT  LT 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  9
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  9
Corporate sustainability parameter, corporate sustainability institutional framework, integration of sustainability into strategic planning and regular business practices, fundamentals of stakeholder engagement.

UNIT III  SUSTAINABILITY MANAGEMENT: STRATEGIES AND APPROACHES  9
Corporate sustainability management and competitiveness: Sustainability-oriented corporate strategies, markets and competitiveness, Green Management between theory and practice, Sustainable Consumption and Green Marketing strategies, Environmental regulation and strategic postures; Green Management approaches and tools; Green engineering: clean technologies and innovation processes; Sustainable Supply Chain Management and Procurement.

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

UNIT V  SUSTAINABLE MANAGEMENT OF RESOURCES, COMMODITIES AND COMMONS  9

TOTAL: 45 PERIODS

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

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

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

UNIT I   INTRODUCTION TO SMALL BUSINESS  

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  
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  
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

COURSE OBJECTIVE
- To understand intellectual property rights and its valuation.

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

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

UNIT III STATUTES

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

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

TOTAL: 45 PERIODS

COURSE OUTCOMES
CO1: Understanding of intellectual property and appreciation of the need to protect it
CO2: Awareness about the process of patenting
CO3: Understanding of the statutes related to IPR
CO4: Ability to apply strategies to protect intellectual property
CO5: Ability to apply models for making strategic decisions related to IPR
REFERENCES
2. Intellectual Property rights and copyrights, EssEss Publications.

OBA434 ETHICAL MANAGEMENT

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.

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

TOTAL: 45 PERIODS
REFERENCES

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

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

UNIT II       IOT ARCHITECTURE

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

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

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

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

TOTAL: 45 PERIODS

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

REFERENCES:

ET4072 MACHINE LEARNING AND DEEP LEARNING L T P C 3 0 0 3

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
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
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

TOTAL : 45 PERIODS

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

REFERENCES:

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

OBJECTIVES:
To impart knowledge on
- Different types of renewable energy technologies
- Standalone operation, grid connected operation of renewable energy systems
UNIT I  INTRODUCTION  9
Classification of energy sources – Co2 Emission - Features of Renewable energy - Renewable energy scenario in India -Environmental aspects of electric energy conversion: impacts of renewable energy generation on environment Per Capital Consumption - CO₂ Emission - importance of renewable energy sources, Potentials – Achievements– Applications.

UNIT II  SOLAR PHOTOVOLTAICS  9

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

UNIT IV  WIND ENERGY CONVERSION SYSTEMS  9

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

TOTAL : 45 PERIODS

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

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

REFERENCES:

5. John Twideu and Tony Weir, “Renewal Energy Resources” BSP Publications,
PS4093 SMART GRID L T P C
3 0 0 3

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

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
L T P C
3  0  0  3

COURSE OBJECTIVES:
- To explain the basic concepts of robots and types of robots
- To discuss the designing procedure of manipulators, actuators and grippers
• To impart knowledge on various types of sensors and power sources
• To explore various applications of Robots in Medicine
• To impart knowledge on wearable robots

UNIT I INTRODUCTION TO ROBOTICS 9
Introduction to Robotics, Overview of robot subsystems, Degrees of freedom, configurations and concept of workspace, Dynamic Stabilization

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

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

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

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

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

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

TOTAL:45 PERIODS

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

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

COURSE OBJECTIVES:

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

UNIT - I  INTRODUCTION TO EMBEDDED C PROGRAMMING  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

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

TOTAL: 45 PERIODS

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

REFERENCES:

CX4016 ENVIRONMENTAL SUSTAINABILITY L T P C
UNIT I INTRODUCTION 9
Valuing the Environment: Concepts, Valuing the Environment: Methods, Property Rights, Externalities, and Environmental Problems

UNIT II CONCEPT OF SUSTAINABILITY 9
Sustainable Development: Defining the Concept, the Population Problem, Natural Resource Economics: An Overview, Energy, Water, Agriculture

UNIT III SIGNIFICANCE OF BIODIVERSITY 9
Biodiversity, Forest Habitat, Commercially Valuable Species, Stationary - Source Local Air Pollution, Acid Rain and Atmospheric Modification, Transportation

UNIT IV POLLUTION IMPACTS 9
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, prepregs and autoclave moulding, pultrusion, vacuum impregnation methods, compression moulding; post processing of composites and composite design requirements

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

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

REFERENCES

NT4002 NANOCOMPOSITE MATERIALS L T P C 3 0 0 3

UNIT I BASICS OF NANOCOMPOSITES 9

UNIT II METAL BASED NANOCOMPOSITES 9
Metal-metal nanocomposites, some simple preparation techniques and their properties. Metal-Oxide or Metal-Ceramic composites, Different aspects of their preparation techniques and their final properties and functionality. Fractal based glass-metal nanocomposites, its designing and fractal dimension analysis. Core-Shell structured nanocomposites

UNIT III POLYMER BASED NANOCOMPOSITES 9
Preparation and characterization of diblock Copolymer based nanocomposites; Polymer Carbon nanotubes based composites, their mechanical properties, and industrial possibilities.

UNIT IV NANOCOMPOSITE FROM BIOMATERIALS 9
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 9

TOTAL : 45 PERIODS

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

UNIT II AGREEMENTS, TREATIES AND PATENT FILING PROCEDURES  

UNIT III BIOSAFETY  

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

UNIT V ENTREPRENEURSHIP DEVELOPMENT  

TOTAL : 45 PERIODS

REFERENCES