ANNA UNIVERSITY, CHENNAI
UNIVERSITY DEPARTMENTS
M.E. COMPUTER SCIENCE AND ENGINEERING
REGULATIONS – 2019
CHOICE BASED CREDIT SYSTEM

VISION AND MISSION

VISION OF THE DEPARTMENT
The Department of Computer Science and Engineering strives to create computing professionals, researchers, and entrepreneurs, with high technical knowledge, communication skills, values and ethics. It collaborates with academia, industry and community to set high standards in academic excellence and in fulfilling societal responsibilities.

MISSION OF THE DEPARTMENT
The mission of the Department of Computer Science and Engineering is to

• Provide motivated faculty and state of the art facilities for education and research, both in foundational aspects and of relevance to emerging computing trends.
• Develop knowledgeable, industry-ready students with pertinent competencies.
• Inculcate responsibility through sharing of knowledge and innovative computing solutions that benefit the society-at-large.
• Engage in collaborative research with academia and industry for seamless transfer of knowledge resulting in patentable solutions.
• Generate adequate resources for research activities from sponsored projects and consultancy.
PROGRAM EDUCATIONAL OBJECTIVES:

1. Prepare students to understand the foundational concepts in Computer Science and Engineering
2. Enable students to integrate theory and practice for problem solving.
3. Empower students to critically analyze current trends and future issues from a system perspective at multiple levels of detail and abstraction.
4. Prepare students to critically analyze existing literature, identify the gaps and propose innovative and research oriented solutions
5. Enable students to pursue lifelong multidisciplinary learning as professional engineers and scientists
6. Enable students to effectively communicate technical information, function effectively on teams, and apply computer engineering solutions within a global, societal, and environmental context by following ethical practices

PROGRAM OUTCOMES (POs):

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<th>PO #</th>
<th>Graduate Attribute</th>
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<tr>
<td>1</td>
<td>Research Aptitude</td>
<td>An ability to independently carry out research / Investigations, identify problems and develop solutions to solve practical problems.</td>
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<td>Technical documentation</td>
<td>An ability to write and present a substantial technical report/document.</td>
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<td>Technical competence</td>
<td>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</td>
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<td>Handle complex problems</td>
<td>Use research based knowledge, methods, appropriate techniques, resources and tools to solve complex engineering issues with an understanding of the limitations.</td>
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<td>Environmental Sustainability and societal Ethics</td>
<td>Ensure development of socially relevant and eco-friendly indigenous products by applying technical knowledge, ethical principles and, sound engineering practices</td>
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<td>Life-long learning</td>
<td>Recognize the need for independent, life-long learning and engage in the broadest context of technological change.</td>
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PROGRAM SPECIFIC OUTCOMES:

1. To use mathematical, algorithmic and theoretical foundations in the study of computing systems.
2. To acquire in-depth knowledge and skills in core and emerging technologies of Computer Science and Engineering.
3. To develop and apply innovative solutions to real world problems using appropriate research techniques.

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the programme educational objective and the outcomes is given in the following table

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<th>PROGRAMME EDUCATIONAL OBJECTIVES</th>
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## ANNA UNIVERSITY, CHENNAI
### UNIVERSITY DEPARTMENTS
M.E. COMPUTER SCIENCE AND ENGINEERING
REGULATIONS – 2019
CHOICE BASED CREDIT SYSTEM
I - IV SEMESTER CURRICULA AND SYLLABI

### SEMESTER I

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**TOTAL** 16 1 8 25 19

*Audit course is optional

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*Audit course is optional
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M.E. COMPUTER SCIENCE AND ENGINEERING (PART TIME)  
REGULATIONS – 2019  
CHOICE BASED CREDIT SYSTEM  
I - VI SEMESTERS CURRICULA AND SYLLABI

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**TOTAL NO. OF CREDITS: 70**

### FOUNDATION COURSES (FC)

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|---------|-------------|------------------------------------------------------|----------|---|---|-----------------------|---------|
| 1.      | MA5153      | Advanced Mathematics for Scientific Computing       | FC       | 3 | 1 | 0 | 4                     | 4       |

### PROGRAM CORE COURSES (PCC)

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| 1.      | CP5151      | Data Structures and Algorithms                       | PCC      | 3 | 0 | 0 | 3                     | 3       |
| 2.      | CP5152      | Multi Core Architectures                             | PCC      | 3 | 0 | 0 | 3                     | 3       |
| 3.      | CP5252      | Compiler Optimization Techniques                     | PCC      | 3 | 0 | 2 | 5                     | 4       |
| 4.      | CP5161      | Data Structures and Algorithms Laboratory            | PCC      | 0 | 0 | 4 | 4                     | 2       |
| 5.      | CP5251      | Advanced Operating Systems                           | PCC      | 3 | 0 | 0 | 3                     | 3       |
| 6.      | CP5153      | Networking Technologies                              | PCC      | 3 | 0 | 0 | 3                     | 3       |
| 7.      | CP5253      | Machine Learning                                     | PCC      | 3 | 0 | 0 | 3                     | 3       |
| 8.      | CP5111      | Networking Laboratory                                | PCC      | 0 | 0 | 4 | 4                     | 2       |
| 9.      | CP5261      | Machine Learning Techniques Laboratory               | PCC      | 0 | 0 | 4 | 4                     | 2       |

### RESEARCH METHODOLOGY AND IPR COURSE (RMC)

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*(out of 6 courses one course must be selected)*

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**AUDIT COURSES (AC)**
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**EMPLOYABILITY ENHANCEMENT COURSES (EEC)**

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MA5153 ADVANCED MATHEMATICS FOR SCIENTIFIC COMPUTING

OBJECTIVES:
- To apply mathematical linear programming techniques to solve constrained problems.
- To appreciate the use of simulation techniques.
- To enable them to estimate the value of the parameters involved in the specific distribution from a possible continuum of alternatives.
- To give an idea of testing the statistical hypothesis claimed based on a set of data points using standard sampling distributions.
- To impart knowledge of handling random vectors which represent random variables in multidimensional space.

UNIT I LINEAR PROGRAMMING 12

UNIT II SIMULATION 12
Discrete Event Simulation – Monte Carlo Simulation – Stochastic Simulation – Applications to real time problems.

UNIT III ESTIMATION THEORY 12

UNIT IV TESTING OF HYPOTHESIS 12

UNIT V MULTIVARIATE ANALYSIS 12

TOTAL: 60 PERIODS

OUTCOMES:
At the end of the course, students will be able to
- Formulate and find optimal solution in the real life optimizing/allocation/assignment problems involving conditions and resource constraints.
- Simulate appropriate application/distribution problems.
- Obtain the value of the point estimators using the method of moments and method of maximum likelihood.
- Apply the concept of various test statistics used in hypothesis testing for mean and variances of large and small samples.
- Get exposure to the principal component analysis of random vectors and matrices.

REFERENCES:
OBJECTIVES:

- To extend the students’ knowledge of algorithms and data structures.
- To enhance their expertise in algorithmic analysis and algorithm design techniques.
- To understand various types of search and heap structures.
- To study various types of geometric, randomized and approximation algorithms.
- To extrapolate from them in order to apply those algorithms and techniques to solve problems.

UNIT I  FUNDAMENTALS

UNIT II  SEARCH STRUCTURES

UNIT III  HEAP STRUCTURES
Min/Max heaps – Deaps – Leftist Heaps – Binomial Heaps – Fibonacci Heaps – Skew Heaps – Lazy Binomial Heaps

UNIT IV  GEOMETRIC ALGORITHMS
Segment Trees – 1-Dimensional Range Searching – k-d Trees – Line Segment Intersection – Computing the Overlay of Two Subdivisions – Range Trees – Voronoi Diagram

UNIT V  ADDITIONAL TOPICS

TOTAL: 45 PERIODS

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

- Analyze algorithms.
- Determine algorithm correctness.
- Choose appropriate data structures for the problems to be solved.
- Design algorithms for problems from different domains.
- Identify various research strategies on algorithmic design.

REFERENCES:

OBJECTIVES:

- To introduce the students to the recent trends in the field of Computer Architecture and identify performance related parameters.
- To understand the different multiprocessor issues.
- To expose the different types of multicore architectures.
- To understand the design of the memory hierarchy.
- To understand how the various forms of parallelism are exploited by the architecture.

UNIT I  FUNDAMENTALS OF COMPUTER DESIGN AND ILP

UNIT II  MEMORY HIERARCHY DESIGN

UNIT III  MULTIPROCESSOR ISSUES

UNIT IV  MULTICORE ARCHITECTURES

UNIT V  VECTOR, SIMD AND GPU ARCHITECTURES

TOTAL : 45 PERIODS
OUTCOMES:
Upon completion of the course, the student will be able to
- Identify the limitations of ILP and the need for multicore architectures.
- Discuss the issues related to multiprocessing and suggest solutions.
- Point out the salient features of different multicore architectures and how they exploit parallelism.
- Point out the various optimizations that can be performed to improve the memory hierarchy design.
- Point out the salient features of vector, GPU and domain specific architectures.

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CP5153 NETWORKING TECHNOLOGIES

OBJECTIVES:
- To learn about integrated and differentiated services architectures.
- To understand the working of wireless network protocols.
- To study the developments in cellular networks.
- To get familiarized with next generation networks.
- To know the concepts behind software defined networks.

UNIT I NETWORK ARCHITECTURE AND QoS
UNIT II  WIRELESS NETWORKS

UNIT III  CELLULAR NETWORKS

UNIT IV  4G NETWORKS

UNIT V  SOFTWARE DEFINED NETWORKS

TOTAL : 45 PERIODS

OUTCOMES:
Upon completion of the course, the student will be able to
- Identify the different features of integrated and differentiated services.
- Demonstrate various protocols of wireless networks.
- Analyze the use of next generation networks.
- Provide solutions using SDN.
- Design protocols for cellular networks.

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RM5151  RESEARCH METHODOLOGY AND IPR  LT P C  2002

OBJECTIVES:
To impart knowledge and skills required for research and IPR:
- Problem formulation, analysis and solutions.
- Technical paper writing / presentation without violating professional ethics
- Patent drafting and filing patents.

UNIT I  RESEARCH PROBLEM FORMULATION  6
Meaning of research problem- Sources of research problem, criteria characteristics of a good research problem, errors in selecting a research problem, scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, necessary instrumentations

UNIT II  LITERATURE REVIEW  6
Effective literature studies approaches, analysis, plagiarism, and research ethics.

UNIT III  TECHNICAL WRITING / PRESENTATION  6
Effective technical writing, how to write report, paper, developing a research proposal, format of research proposal, a presentation and assessment by a review committee.

UNIT IV  INTRODUCTION TO INTELLECTUAL PROPERTY RIGHTS (IPR)  6

UNIT V  INTELLECTUAL PROPERTY RIGHTS (IPR)  6
Traditional knowledge Case Studies, IPR and IITs.

TOTAL: 30 HOURS
OUTCOMES:
1. Ability to formulate research problem
2. Ability to carry out research analysis
3. Ability to follow research ethics
4. Ability to understand that today’s world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity
5. Ability to understand about IPR and filing patents in R & D.

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CP5161 DATA STRUCTURES AND ALGORITHMS LABORATORY L T P C 0 0 4 2

OBJECTIVES:
- To familiarize various data structure implementations.
- To implement heap and various tree structures like AVL, Red-black, B-Tree and segment trees.
- To understand efficient implementation of line segment intersection.
- To understand various search structures.
- To get understanding of problem to program mapping.

LIST OF EXPERIMENTS:
1. Binary Search Trees
2. Min/Max Heaps
3. Leftist Heaps
4. AVL Trees
5. Red-Black Trees
6. B-Trees
7. Segment Trees
8. Line segment intersection

TOTAL : 60 PERIODS

OUTCOMES:
Upon completion of the course, the student will be able to
- Achieve programming skill to convert a problem to a programming logic.
- Apply suitable data structure for the problem in hand.
- Implement heap and various tree structures like AVL, Red-black, B-Tree and segment trees.
- Understand the usage of data structures for geometric problems.
- Understand the importance of height balancing in search structures.
OBJECTIVES:
- Demonstrate the operation of wireless networks.
- Simulate and analyze the performance of GSM, CDMA, LTE and SDN.
- To gain knowledge and work on various protocol layers.
- To explore network simulators.
- Identify the different features of integrated and differentiated services.

LIST OF EXPERIMENTS:
1) Configure networks using:
   a) Distance Vector Routing protocol
   b) Link State Vector Routing protocol
2) Implement the congestion control using Leaky bucket algorithm.
3) Installation of NS3 and execution of TCL commands / scripts.
4) Implementation Point to Point network using duplex links between the nodes. Analyze the packet transfer by varying the queue size and bandwidth. (using simulator)
5) Implement the dynamic routing protocol by varying the CBR traffic for each node and use a flow monitor( ) to monitor losses at nodes. (using simulator)
6) Create a wireless mobile ad-hoc network environment and implement the OLSR routing protocol. (using simulator)
7) Implement CDMA by assigning orthogonal code sequence for 5 stations, generate the CDMA code sequence and communicate between the stations using the generated code.
8) Create a GSM environment and implement inter and intra handover mechanisms. (using simulator)
9) In LTE environment implement Round Robin and Token Bank Fair Queue scheduler in MAC layer.
10) Write python script to create topology in Mininet and configure OpenFlow switches with POX controller to communicate between nodes.

TOTAL: 60 PERIODS
OUTCOMES:
Upon completion of the course, the student will be able to
- Judge the emerging wireless technology standards.
- Configure functionalities of router and switches.
- Assess the importance of wireless adhoc networks.
- Compare and contrast various wireless technologies.
- Explain and design the considerations for deploying wireless network infrastructure.

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CP5251  ADVANCED OPERATING SYSTEMS   L T P C
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OBJECTIVES:
- To understand the concepts of distributed systems.
- To get an insight into the various issues and solutions in distributed operating systems.
- To learn about real-time operating systems.
- To gain knowledge on the design concepts of mobile operating systems.
- To understand cloud operating systems.

UNIT I   INTRODUCTION

UNIT II  DISTRIBUTED OPERATING SYSTEMS
UNIT III DISTRIBUTED RESOURCE MANAGEMENT

UNIT IV REAL TIME OPERATING SYSTEMS

UNIT V MOBILE AND CLOUD OPERATING SYSTEMS

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, the students will be able to
- Identify the features of distributed operating systems.
- Demonstrate the various protocols of distributed operating systems.
- Identify the different features of real-time operating systems.
- Discuss the features of mobile operating systems.
- Discuss the features of cloud operating systems.

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OBJECTIVES:
- To understand different forms of intermediate languages and analyzing programs.
- To understand optimizations techniques for single program blocks.
- To apply optimizations on procedures and low level code.
- To explore and enhance inter procedural optimizations.
- To enhance resource utilization.

UNIT I INTERMEDIATE REPRESENTATION OF PROGRAMS AND ANALYSIS 9+6

UNIT II LOCAL AND LOOP OPTIMIZATIONS 9+6

UNIT III PROCEDURE OPTIMIZATION AND SCHEDULING 9+6

UNIT IV INTER PROCEDURAL OPTIMIZATION 9+6

UNIT V OPTIMIZING FOR MEMORY 9+6

TOTAL: 45 +30 = 75 PERIODS

OUTCOMES:
Upon completion of the course, the student will be able to
- Identify the different optimization techniques that are possible for a sequence of code.
- Design performance enhancing optimization techniques.
- Manage procedures with optimal overheads.
- Understand modern programming language features and constructs.
- Learn to work on a larger software project.
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CP5253 MACHINE LEARNING L T P C
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OBJECTIVES:
- To understand the concepts of Machine Learning.
- To appreciate supervised learning and their applications.
- To appreciate the concepts and algorithms of unsupervised learning.
- To understand the theoretical and practical aspects of Probabilistic Graphical Models.
- To appreciate the concepts and algorithms of advanced learning.

UNIT I INTRODUCTION

UNIT II SUPERVISED LEARNING
UNIT III  UNSUPERVISED LEARNING  9

UNIT IV  PROBABILISTIC GRAPHICAL MODELS  9

UNIT V  ADVANCED LEARNING  9

TOTAL : 45 PERIODS

OUTCOMES:
Upon completion of the course, the student will be able to
- Design a learning model appropriate to the application.
- Design a Neural Network for an application of your choice.
- Implement Probabilistic Discriminative and Generative algorithms for an application of your choice and analyze the results.
- Use a tool to implement typical Clustering algorithms for different types of applications.
- Design and implement an HMM for a Sequence Model type of application.
- Identify applications suitable for different types of Machine Learning with suitable justification.

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OBJECTIVES:
- To apply the concepts of Machine Learning to solve real-world problems
- To implement basic algorithms in clustering & classification applied to text & numeric data
- To implement algorithms emphasizing the importance of bagging & boosting in classification & regression
- To implement algorithms related to dimensionality reduction
- To apply machine learning algorithms for Natural Language Processing applications

EXERCISES RECOMMENDED
1. Solving Regression & Classification using Decision Trees
2. Root Node Attribute Selection for Decision Trees using Information Gain
3. Bayesian Inference in Gene Expression Analysis
4. Pattern Recognition Application using Bayesian Inference
5. Bagging in Classification
6. Bagging, Boosting applications using Regression Trees
7. Data & Text Classification using Neural Networks
8. Using Weka tool for SVM classification for chosen domain application
9. Data & Text Clustering using K-means algorithm
10. Data & Text Clustering using Gaussian Mixture Models
11. Dimensionality Reduction Algorithms in Image Processing applications
12. Application of CRFs in Natural Language Processing

TOTAL: 60 PERIODS

OUTCOMES:
Upon completion of the course, the student will be able to
- To learn to use Weka tool for implementing machine learning algorithms related to numeric data
- To learn the application of machine learning algorithms for text data
- To use dimensionality reduction algorithms for image processing applications
- To apply CRFs in text processing applications
- To use fundamental and advanced neural network algorithms for solving real-world data

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OBJECTIVES:
- To facilitate analysis, design and problem solving skills.
- To have a thorough domain knowledge.
- To understand the best Industry practices by reading case studies.
- To kindle innovative and professional thinking.
- To explore possible alternative solutions.
- To estimate feasibility, cost, risk and ROI.

SESSIONS BASED ON:
Identify an Application/Projects (may be of social relevance) – Understand Customer Requirements – Analyze and Understand Customers and Stakeholders – Value Additions – Innovations and Research Component – Preparing Plan / SRS Document Indicating Feasibility, Cost, Risk, ROI and Related Design – Suggest Implementation Methodology – Perform Risk Assessment and Management

TOTAL: 30 PERIODS

OUTCOMES:
Upon completion of the course, the student will be able to
- Identify and formulate the problem.
- Describe the background of the problem.
- Assess the needs of stakeholders.
- Make estimates like cost, risk, ROI etc., to justify the business opportunity.
- Describe the industry standards and procedures.
- Predict the business opportunity.
- Suggest system implications.

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OBJECTIVES:
- To comprehend the underlying principles of Relational Database Management System.
- To develop database models using parallel and distributed databases.
- To understand the concepts of XML and Web databases.
- To apprehend the design and implementation of active temporal and deductive databases.
- To develop applications based on NoSQL database.

UNIT I  RELATIONAL MODEL

UNIT II  PARALLEL AND DISTRIBUTED DATABASES

UNIT III  XML AND WEB DATABASES

UNIT IV  ACTIVE TEMPORAL AND DEDUCTIVE DATABASES

UNIT V  NoSQL DATABASES
NoSQL database vs traditional RDBMS database – Migrating from RDBMS to NoSQL– CRUD operations – Querying NoSQL stores – Indexing and Ordering Datasets – MongoDB-Database creation and Querying– Web Application development using MongoDB

TOTAL: 45 +30: 75 PERIODS

OUTCOMES:
Upon completion of the course, the student will be able to
- Design and implement relational databases.
- Design and implement parallel and distributed databases.
- Design and implement XML databases, Active, Temporal and Deductive databases.
- Implement the concept of database connectivity with the applications.
- Design and implement NoSQL database.

REFERENCES:
2. Han, Jiawei, Jian Pei, and MichelineKamber. Data mining: Concepts and Techniques. 2011.
8. David Lane, Hugh E. Williams, Web Database Applications with PHP and MySQL, O’Reilly Media; 2nd edition, 2004

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**OBJECTIVES:**
- To understand the concept of cloud and utility computing.
- To understand the various issues in cloud computing.
- To familiarize themselves with the lead players in cloud.
- To appreciate the emergence of cloud as the next generation computing paradigm.
- To be able to set up a private cloud.

**UNIT I  INTRODUCTION**

**UNIT II  VIRTUALIZATION**

**UNIT III  CLOUD COMPUTING MECHANISM**
UNIT IV HADOOP AND MAP REDUCE
Apache Hadoop – Hadoop Map Reduce –Hadoop Distributed File System- Hadoop I/O-
Developing a Map Reduce Application – Map Reduce Types and Formats – Map Reduce
Features– Hadoop Cluster Setup –Administering Hadoop.

UNIT V SECURITY IN THE CLOUD
Basic Terms and Concepts – Threat Agents – Cloud Security Threats –Cloud Security
Mechanism: Encryption, Hashing, Digital Signature, Public Key Infrastructure, Identity and Access

TOTAL: 45 +30 = 75 PERIODS

OUTCOMES:
Upon completion of the course, the student will be able to
• Articulate the main concepts, key technologies, strengths and limitations of cloud
computing.
• Identify the architecture, infrastructure and delivery models of cloud computing.
• Explain the core issues of cloud computing such as security, privacy and interoperability.
• Choose the appropriate technologies, algorithms and approaches for the related issues.
• Facilitate Service Level Agreements (SLA).

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OBJECTIVES:
- To learn about the importance of information security.
- To learn different scanning and enumeration methodologies and tools.
- To understand various hacking techniques and attacks.
- To be exposed to programming languages for security professionals.
- To understand the different phases in penetration testing.

UNIT I  INTRODUCTION TO HACKING  9+6

UNIT II  SCANNING AND ENUMERATION  9+6

UNIT III  SYSTEM HACKING  9+6

UNIT IV  PROGRAMMING FOR SECURITY PROFESSIONALS  9+6

UNIT V  PENETRATION TESTING  9+6

TOTAL: 45+30=75 PERIODS

OUTCOMES:
Upon completion of the course, the student will be able to
- Identify threats to computers.
- Defend hacking attacks.
- Protect data assets.
- Defend a computer against a variety of security attacks using various tools.
- Practice and use safe techniques on the World Wide Web.

REFERENCES:
OBJECTIVES:
- To understand broad range of image processing techniques and their applications.
- To learn about video processing techniques and understand the video content.
- To appreciate various techniques used for acquisition, preprocessing, enhancement and analysis of image and video data.
- To appreciate the use of image & video processing in current technologies.
- To expose the students to real-world applications and case studies of the image & video processing.

UNIT I  FUNDAMENTALS OF IMAGE PROCESSING  9+6

UNIT II  IMAGE ENHANCEMENT AND RESTORATION  9+6

UNIT III  IMAGE SEGMENTATION AND MORPHOLOGY  9+6

UNIT IV  BASICS OF VIDEO PROCESSING  9+6
Introduction – Video Sampling and Interpolation- Motion Detection and Estimation – Video Enhancement and Restoration

UNIT V  VIDEO SEGMENTATION, TRACKING &APPLICATIONS  9+6

TOTAL: 45+30 :75PERIODS
OUTCOMES:
Upon completion of the course, the student will be able to

- Have a clear impression of the breadth and practical scope of digital image processing and have arrived at a level of understanding that is the foundation for most of the work currently underway in this field.
- Critically analyze the role of video in modern technologies.
- Implement basic image and video processing algorithms.
- Design and develop various applications that incorporates different techniques of Image and Video processing.
- Apply and explore new techniques in the areas of image and video Processing.

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CP5085 PRINCIPLES OF CRYPTOGRAPHY L T P C 3 0 2 4

OBJECTIVES:
- To understand the mathematical foundations of security principles.
- To appreciate the different aspects of encryption techniques.
- To understand various attacks present over encryption and authentications techniques.
- To understand the role played by authentication in security.
- To appreciate the current trends of security practices.

UNIT I CLASSICAL ENCRYPTION AND BLOCKCIPHERS 9+6
UNIT II   PSEUDO RANDOM FUNCTIONS AND SYMMETRIC ENCRYPTION  9+6
Random Functions – Permutations – Pseudo Functions – Pseudo-random Permutations –
Modelling Blockciphers – Security Against Key Recovery – The Birthday Attack – Symmetric
Encryption Schemes – Chosen Plaintext Attacks – Semantic Security – Security of CTR and CBC
– Chosen Ciphertext Attack.

UNIT III   HASH FUNCTIONS AND MESSAGE AUTHENTICATION  9+6
Hash Function SHA1 – Collision resistant Hash Functions – Collision Finding Attacks –
Onewayness of Collision resistant Hash Functions – MD Transform – Syntax for message
Authentication – PRF as a MAC Paradigm – CBC MAC – Universal-hashing Approach –
Authenticated Encryption.

UNIT IV   NUMBER THEORY AND ASYMMETRIC ENCRYPTION  9+6
Computational Number Theory – Number Theoretic Primitives – Diffie Hellman Problem –
Asymmetric Encryption Schemes – Hybrid Encryption – ElGamal Scheme and its Variants –
Homomorphic Encryption – Digital Signatures

UNIT V   SECURITY PRACTICES AND ADVANCED TOPICS  9+6
Signature – Blind Signature – Distributed Ledger and Bitcoin — Secret Sharing – Shamir
Threshold Scheme – Security in Routing – Mixnet

TOTAL : 45 +30 = 75 PERIODS

OUTCOMES:
Upon completion of the course, the student will be able to
- Demonstrate the various classical encryption techniques and the adversary capabilities.
- Apply computational secrecy and semantic security to find out the probability of how strong
  are the security schemes.
- Illustrate the various MAC and HASH functions and apply the Birthday attack over Hash.
- Apply number theory in public key encryption techniques.
- Analyze the application of cryptography for secure E-Commerce and other secret
  transactions.

REFERENCES:
2. Jonathan Katz and Yehuda Lindell, “Introduction to Modern Cryptography ”, Chapman and
3. Hans Delfts and Helmut Knebl, “Introduction to Cryptography – Principles and

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OBJECTIVES:
- To understand the different architectures for IoT.
- To learn various protocols at the different layers for IoT.
- To develop prototype systems using Arduino / Raspberry Pi.
- To apply the use of data analytics in IoT.
- To develop applications of IoT in Industrial contexts.

UNIT I  ARCHITECTURES AND MODELS  9+6

UNIT II  CONNECTIVITY  9+6

UNIT III  SYSTEM DEVELOPMENT  9+6
Design Methodology – Case study – Basic blocks of IoT device – Raspberry Pi – Board, Interfaces, Linux, Setting up, Programming – Arduino – Other IoT Devices.

UNIT IV  DATA ANALYTICS AND IoT SECURITY  9+6

UNIT V  IoT IN INDUSTRY  9+6

TOTAL: 45+30 =75 PERIODS

OUTCOMES:
Upon completion of the course, the student will be able to
- Explain the underlying architectures and models in IoT.
- Analyze different connectivity technologies for IoT.
- Develop simple applications using Arduino / Raspberry Pi.
- Apply data analytics techniques to IoT.
- Study the needs and suggest appropriate solutions for Industrial applications.

REFERENCES:
CP5072 ADVANCED SOFTWARE ENGINEERING L T P C

OBJECTIVES :
- Comprehend the different stages of Software Development Lifecycle.
- Comprehend the Process of developing Analysis models and map the Analysis models to Design Models.
- Comprehend the Design Issues related to Web applications and Mobile Apps.
- Comprehend the Quality Factors associated with Software Development.
- Comprehend the use of different Testing Strategies in Software Development.

UNIT I PROCESS MODELS 9+6

UNIT II REQUIREMENTS MODELING AND DESIGN CONCEPTS 9+6
Understanding Requirements – Scenario based methods – Class based methods – Behavior, Patterns and Web/Mobile Apps – Design Process – Design concepts – Design Model

UNIT III SOFTWARE DESIGN 9+6
Architectural design – Component level Design – User Interface Design – Pattern based design – Web App design – Mobile App design

UNIT IV SOFTWARE QUALITY 9+6
UNIT V SOFTWARE TESTING AND SOFTWARE CONFIGURATION MANAGEMENT


TOTAL: 45+30: 75 PERIODS

OUTCOMES:
Upon completion of the course, the student will be able to
- Select Appropriate Process Model for Software Development.
- Develop Analysis Models and Map the Analysis Models to Design Models.
- Address the Design Issues related To Web Applications and Mobile Apps.
- Incorporate Appropriate Quality Factors and Standards during Software Development.

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OBJECTIVES:

- To understand the basic ideas and principles of Neural Networks
- To understand the basic concepts of Big Data and Statistical Data Analysis
- To familiarize the student with The Image Processing facilities like Tensorflow and Keras
- To appreciate the use of Deep Learning Applications
- To understand and implement Deep Learning Architectures

UNIT I  BASICS OF NEURAL NETWORKS  9
Basic concept of Neurons – Perceptron Algorithm – Feed Forward and Back Propagation Networks.

Suggested Activities:
- Discussion of role of Neural Networks.
- Practical – Installation of TensorFlow and Keras.

Suggested Evaluation Methods:
- Tutorial – Perceptron.
- Assignment problems on backpropagation networks.
- Quizzes on Neural Networks.

UNIT II  INTRODUCTION TO DEEP LEARNING  9

Suggested Activities:
- Discussion of role of Gradient Descent in Deep Learning.
- External learning – Feature extraction and feature learning.
- Discussion of Gradient Descent Problem.

Suggested Evaluation Methods
- Tutorial – Gradient descent in deep learning.
- Assignment problems in optimization.
- Quizzes on deep learning regularization and optimization.

UNIT III  CONVOLUTIONAL NEURAL NETWORKS  9
CNN Architectures – Convolution – Pooling Layers – Transfer Learning – Image Classification using Transfer Learning

Suggested Activities:
- Discussion of role of Convolutional Networks in Machine Learning.
- External learning – Concept of convolution and need for Pooling.

Suggested Evaluation Methods:
- Tutorial – Image classification and recurrent nets.
- Assignment problems in image classification performances.
- Quizzes on Convolutional Neural Networks.
UNIT IV  MORE DEEP LEARNING ARCHITECTURES  


Suggested Activities:
- Discussion of role of Deep Learning architectures.
- External learning – Compression of features using Autoencoders.

Suggested Evaluation Methods:
- Tutorial – LSTM and Autoencoders.
- Assignment problems in deep generative models, Deep Belief Networks.
- Quizzes on deep learning architectures.

UNIT V  APPLICATIONS OF DEEP LEARNING  


Suggested Activities:
- Discussion of role of Deep Learning in Image and NLP applications.
- External learning – NLP concepts.

Suggested Evaluation Methods:
- Tutorial – Image segmentation.
- Assignment problems in parsing and sentiment analysis.
- Quizzes on deep learning architectures.

PRACTICAL EXERCISES:
1. Implement Simple Programs like vector addition in TensorFlow.
2. Implement a simple problem like regression model in Keras.
4. Implement a Feed-Forward Network in TensorFlow/Keras.
5. Implement an Image Classifier using CNN in TensorFlow/Keras.
6. Implement a Transfer Learning concept in Image Classification.
8. Implement a SimpleLSTM using TensorFlow/Keras.
9. Implement an Opinion Mining in Recurrent Neural network.
10. Implement an Object Detection using CNN.
11. Mini Project

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Understand the role of Deep learning in Machine Learning Applications.
2. To get familiar with the use of TensorFlow/Keras in Deep Learning Applications.
3. To design and implement Deep Learning Applications.
5. To design and implement Convolutional Neural Networks.
6. To know about applications of Deep Learning in NLP and Image Processing.
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UNIT V  WEB ANALYTICS  9+6

TOTAL : 45+30 : 75 PERIODS

OUTCOMES:
Upon completion of the course, the student will be able to
- Design web pages that follow standards and are usable.
- Design web sites that are appealing.
- To be able to use Content management System for designing web Content.
- To take advantage of Content Management System tools for managing content for large web sites.
- To be able to use analytics tools for better management.

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IF5090  SEMANTIC WEB  L T P C
OBJECTIVES:
- To learn the fundamentals of semantic web and to conceptualize and depict Ontology for semantic web.
- To understand the languages for semantic web.
- To learn about the ontology learning algorithms and to utilize in the development of an application.
- To know the fundamental concepts of ontology management.
- To learn the applications related to semantic web.
UNIT I  THE QUEST FOR SEMANTICS

Suggested Activities:
- Flipped classroom on semantic web background and tutorial activity in class.
- Brainstorming session on various knowledge representation formats in class.

Suggested Evaluation Methods:
- Tutorial – Semantic web basics.
- Quizzes on knowledge representation formats.

UNIT II  LANGUAGES FOR SEMANTIC WEB AND ONTOLOGIES

Suggested Activities:
- Flipped classroom on comparison of various semantic web related languages and tutorial activity in class.

Suggested Evaluation Methods:
- Quizzes on various ontology related languages.

UNIT III  ONTOLOGY LEARNING FOR SEMANTIC WEB

Suggested Activities:
- Flipped classroom on natural language processing techniques like statistical text analysis, term extraction, Word sense disambiguation, concept extraction and tutorial activity in class.
- External reading – https://nlp.stanford.edu/fsnlp/

Suggested Evaluation Methods
- Tutorials – Language processing techniques.

UNIT IV  ONTOLOGY MANAGEMENT AND TOOLS

Suggested Activities:
- Flipped classroom on study of various ontology related tools.

Suggested Evaluation Methods
- Tutorials – Ontology related tools like Protege, Ontolingua, Webonto.
UNIT V APPLICATIONS


Suggested Activities:
- Flipped classroom on other applications of semantic web.

Suggested Evaluation Methods
- Quizzes on semantic web applications.

PRACTICAL EXERCISES:

1. Design of simple ontology on their domain of interest using Protege like tool.
2. Create RDF document using PHP library EasyRdf.
3. Use OWL language to represent relationships, properties and to provide inferences from created ontology.
4. Term extraction and Term disambiguation from corpus using Alchemy like API.
5. Use of any tool to apply SAPRQL queries and implement reasoning for avoiding inconsistencies.
7. Development of Simple application like chat bot, semantic search engine creation using Topic map data models extracted from Ontopia/Mappa.

TOTAL: 75 PERIODS

OUTCOMES:
On completion of the course, the students will be able to:
1. Create ontology for a given domain.
2. Develop an application using ontology languages and tools.
3. Understand the concepts of semantic Web.
4. Use ontology related tools and technologies for application creation.
5. Design and develop applications using semantic web.
6. Understand the standards related to semantic web.

REFERENCES:
OBJECTIVES:

- To understand the need and characteristics of mobile applications.
- To design the right user interface for mobile application.
- To understand the design issues in the development of mobile applications.
- To understand the development procedures for mobile application.
- To develop mobile applications using various tools and platforms.

UNIT I  INTRODUCTION

Suggested Activities:
- Flipped classroom on survey on mobile application models.
- External learning – mobile application design using frameworks and tools.

Suggested Evaluation Methods:
- Quiz – questionnaire related to mobile application models.
- Assignment – evaluate using learning content management system like Moodle.

UNIT II  USER INTERFACE
Generic UI development – Designing the right UI – Multimodal and Multichannel UI – Gesture based UI – Screen Elements and Layouts – Voice XML.

Suggested Activities:
- Flipped classroom on discussion on UI for mobile application like voice and gestures.
- External learning – survey on different view elements for mobile application.

Suggested Evaluation Methods:
- Quiz – questionnaire related to user interface design for mobile applications.
- Assignment – evaluate using learning content management system like Moodle.
UNIT III APPLICATION DESIGN 9

Suggested Activities:
- Flipped classroom on discussion on memory constraints for mobile application design.
- External learning – survey on resource management and concurrent operations.

Suggested Evaluation Methods:
- Quiz – questionnaire related to memory constraints in design for mobile applications.
- Assignment – evaluate using learning content management system like Moodle.

UNIT IV APPLICATION DEVELOPMENT I 9

Suggested Activities:
- Simple Android application development like user account creation.
- Android application accessing the mobile database to view user data.

Suggested Evaluation Methods:
- Evaluation based on the demonstrated application functionality using emulators.

UNIT V APPLICATION DEVELOPMENT II 9

Suggested Activities:
- Application accessing Internet for communication like web application.
- Android application accessing GPS for location based service.

Suggested Evaluation Methods:
- Evaluation based on the demonstrated application functionality using emulators.

PRACTICAL EXERCISES: 30
1. Develop an application that uses GUI components, Font and Colours.
2. Develop an application that uses Layout Managers and event listeners.
3. Develop a native calculator application.
4. Write an application that draws basic graphical primitives on the screen.
5. Develop an application that makes use of database.
6. Write an application that makes use of internet for communication (mobile web app).
7. Develop a native application that uses GPS location information.
8. Implement an application that writes data to the SD card.
9. Implement an application that creates an alert upon receiving a message.
10. Write a mobile application that creates alarm clock.

TOTAL: 75 PERIODS
OUTCOMES:
On completion of the course, the students will be able to:
1. Design the right user interface for mobile application.
2. Implement mobile application using UI toolkits and frameworks.
3. Design a mobile application that is aware of the resource constraints of mobile devices.
4. Develop web based mobile application that accesses internet and location data.
5. Implement android application to use telephony for SMS communication.
6. Implement android application with multimedia support.

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CP5075 CRYPTOCURRENCY AND BLOCKCHAIN TECHNOLOGIES L T P C
3 0 0 3

OBJECTIVES:
- To study the basic concepts of cryptocurrencies and blockchains.
- To explain the details of Bitcoin and its different components.
- To study the basics Hyperledger and Web3.
- To analyse the position of Web 3 and Hyperledger with different aspects of blockchain technologies.
- To differentiate between alternate blockchains and their advantages in application areas.
- To understand the Ethereum development environment and the application development process.

UNIT I INTRODUCTION
UNIT II  BITCOIN

UNIT III  WEB3 AND HYPERLEDGER

UNIT IV  ALTERNATIVE BLOCKCHAINS AND APPLICATIONS

UNIT V  ETHEREUM
Setting up Ethereum development tools – Solidity language. – Ethereum accounts, key pairs, working with Externally Owned Accounts (EOA), contract accounts – Smart contracts, structure, setting up and interaction, examples – Decentralised applications, implementation, case studies – Whisper protocol – Swarm architecture and concepts.

TOTAL : 45 PERIODS

OUTCOMES:
On Completion of the course, the students should be able to:
• Explain cryptocurrencies and their relationship with the blockchain technology.
• Explain the different steps in the use of Bitcoins.
• Relate Web 3 and Hyperledger to concepts in blockchain technologies.
• Apply blockchains to different real-life problems
• Implement a simple application using Ethereum.

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TOTAL : 45 PERIODS
OBJECTIVES:
- To enrich student learning in Multimedia systems basics
- To train the students to acquire knowledge in multimedia Tools and authoring
- To acquire knowledge about multimedia data compression techniques
- To acquire knowledge in the area of multimedia communication systems
- To know about popular multimedia application areas

UNIT I   MULTIMEDIA ELEMENTS

UNIT II   MULTIMEDIA TOOLS and AUTHORING

UNIT III   MULTIMEDIA COMPRESSION

UNIT IV   MULTIMEDIA COMMUNICATION SYSTEMS

UNIT V   MULTIMEDIA APPLICATIONS
Applications for WWW. Multimedia databases – Indexing and Retrieval, Visualization, Virtual, Augmented and Mixed Reality, Interactive E-learning, HCI and UX design, Games and Animation, Real-Time video conferencing.

PRACTICAL EXERCISES:
1. Editing various images (Image restoration, Changing colour image to Grey scale and vice versa) and adding special effects to images using tools like Photoshop, Gimp and flash
2. Creating and Editing various video clippings and adding special effects using tools like Adobe Premier Pro
3. Creating and Editing various audio files and adding special effects using tools like SoundForge and Audacity
4. Creating three dimensional models and animations using tools like Blender, 3DS Max, Unity
5. Working on Text compression algorithms like Run length and Huffman
6. Implementation of transformations like DCT and FFT
7. Designing User Interfaces and developing simple games using multimedia tools
8. Creating simple multimedia applications using any popular Authoring tools
9. Mini Project(4 Periods)
OUTCOMES:
On Completion of the course, the students should be able to:

- Handle the multimedia elements effectively
- Use Multimedia Hardware and Software for Editing and Authoring multimedia applications
- Implement Compression algorithms for various multimedia applications
- Develop effective strategies to deliver Quality-of-Experience in networked Multimedia applications
- Design and develop multimedia applications in various domains

TOTAL: 75 PERIODS

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OBJECTIVES:
- To understand the basics of information retrieval with pertinence to modeling, query operations and indexing.
- To understand the various applications of information retrieval giving emphasis to multimedia IR, web search.
- To learn measuring effectiveness and efficiency of information retrieval techniques.
- To get used to performing Parallel Information Retrieval.
- To understand the concepts of digital libraries.

UNIT I INTRODUCTION 9

UNIT II RETRIEVAL MODELING 9

UNIT III INDEXING 9

UNIT IV EVALUATION AND PARALLEL INFORMATION RETRIEVAL 9

UNIT V SEARCHING THE WEB 9

OUTCOMES:
Upon completion of the course, the student will be able to
- Build an Information Retrieval system using the available tools.
- Identify and design the various components of an Information Retrieval system.
- Measure effectiveness and efficiency of information retrieval techniques.
- Use parallel Information Retrieval approaches in real world problems.
- Design an efficient search engine and analyze the Web content structure.

REFERENCES:
## OBJECTIVES:
- To understand the computational approaches to Modeling, Feature Extraction.
- To understand the need and application of Map Reduce.
- To understand the various search algorithms applicable to Big Data.
- To analyze and interpret streaming data.
- To learn how to handle large data sets in main memory.
- To 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**
**OUTCOMES:**
Upon completion of the course, the student will be able to
- Design algorithms by employing Map Reduce technique for solving Big Data problems.
- Identify similarities using appropriate measures.
- Point out problems associated with streaming data and handle them.
- Discuss algorithms for link analysis and frequent itemset mining.
- Design solutions for problems in Big Data by suggesting appropriate clustering techniques.

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**CP5084 PARALLEL ALGORITHMS**

**OBJECTIVES:**
- To learn parallel algorithms development techniques for shared memory and DCM models.
- To study the main classes of fundamental parallel algorithms.
- Learn to design efficient parallel algorithms.
- To study the complexity and correctness models for parallel algorithms.
- To understand parallel solutions for bitwise computation.

**UNIT I INTRODUCTION**

**UNIT II SORTING & SEARCHING**
Sorting Networks – Sorting on a Linear Array – Sorting on CRCW, CREW, EREW – Searching a sorted sequence – Searching a random sequence – Bitonic Sort
UNIT III ALGEBRAIC PROBLEMS 9

UNIT IV GRAPH & GEOMETRY 9
Connectivity Matrix – Connected Components – All Pair Shortest Paths – Minimum Spanning Trees – Point Inclusion – Intersection, Proximity and Construction Problems

UNIT V OPTIMIZATION & BIT COMPUTATIONS 9
Prefix Sums – Job Sequencing – Knapsack – Adding Two Integers – Adding n Integers – Multiplying Two Integers – Selection

OUTCOMES:
Upon completion of the course, the student will be able to
• Understand the difference between sequential and parallel algorithms.
• Design parallel algorithms in various models of parallel computation.
• Apply a suitable model for developing a parallel algorithm.
• Know the basic issues associated with implementing parallel algorithms.
• Understand the differences among several algorithms used for solving the same problem and recognize which one is better under different conditions.

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OBJECTIVES:
- To understand the nature of threats and cyber security management goals and technology
- To understand the landscape of hacking and perimeter defense mechanisms
- To develop strategies for cyber security and protecting critical infrastructure
- To understand policies to mitigate cyber risks
- To understand the IT Act, scheme, amendments and emerging cyber law and desired cyber ecosystem capabilities

UNIT I OVERVIEW OF CYBER SECURITY

UNIT II ATTACKS AND COUNTERMEASURES

UNIT III STRATEGIES FOR CYBER SECURITY

UNIT IV POLICIES TO MITIGATE CYBER RISK

UNIT V CRITICAL INFORMATION INFRASTRUCTURE PROTECTION

TOTAL: 45 PERIODS

OUTCOMES:
- Gain knowledge on the nature of threats and cyber security management goals and framework
- Knowledge on the landscape of hacking and perimeter defense mechanisms
- Ability to differentiate and integrate strategies for cyber security and protecting critical infrastructure
- Able to understand policies to mitigate cyber risks
- Knowledge on IT Act, and amendments, copy rights, IPR and cyber law to deal with offenses.
REFERENCES:
9. CGI, —Cyber security in Modern Critical Infrastructure Environments, 2014.

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CP5087 SOFT COMPUTING LT P C 3 0 0 3

OBJECTIVES:
- To learn the key aspects of Soft computing and Neural networks.
- To study the fuzzy logic components.
- To gain insight onto neuro fuzzy modeling and control.
- To know about the components and building block hypothesis of genetic algorithm.
- To gain knowledge in machine learning through neural networks.

UNIT I INTRODUCTION TO SOFT COMPUTING
UNIT II  GENETIC ALGORITHMS  9
Introduction to Genetic Algorithms (GA) – Applications of GA – Building Block Hypothesis-
Representation– Fitness Measures – Genetic Operators-. GA based Machine Learning.

UNIT III  NEURAL NETWORKS  9
Machine Learning using Neural Network, Adaptive Networks – Feed Forward Networks –
Supervised Learning Neural Networks – Radial Basis Function Networks – Reinforcement
Learning – Unsupervised Learning Neural Networks – Adaptive Resonance Architectures –
Advances in Neural Networks.

UNIT IV  FUZZY LOGIC  9
Fuzzy Sets – Operations on Fuzzy Sets – Fuzzy Relations – Membership Functions-Fuzzy Rules
Making.

UNIT V  NEURO-FUZZY MODELING  9
Adaptive Neuro-Fuzzy Inference Systems – Coactive Neuro-Fuzzy Modeling – Classification and
Regression Trees – Data Clustering Algorithms – Rule based Structure Identification – Neuro-
Fuzzy Control – Case Studies.

TOTAL : 45 PERIODS

OUTCOMES:
Upon completion of the course, the student will be able to
• Differentiate Conventional AI and Computational Intelligence.
• Discuss on machine learning through neural networks.
• Apply knowledge in developing a Fuzzy expert system.
• Model Neuro Fuzzy system for clustering and classification.
• Discover knowledge to develop Genetic Algorithm and Support vector machine based
machine learning system.

REFERENCES:
3. George J. Klir and Bo Yuan, “Fuzzy Sets and Fuzzy Logic-Theor and Applications”,
Prentice Hall, 1996.
4. James A. Freeman and David M. Skapura, “Neural Networks Algorithms,
Addison Wesley, 1989.

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OBJECTIVES:
- To introduce the student to the notion of a game, its solutions concepts, and other basic notions and tools of game theory, and the main applications for which they are appropriate, including electronic trading markets.
- To formalize the notion of strategic thinking and rational choice by using the tools of game theory, and to provide insights into using game theory in modeling applications.
- To draw the connections between game theory, computer science, and economics, especially emphasizing the computational issues.
- To introduce contemporary topics in the intersection of game theory, computer science, and economics.
- To apply game theory in searching, auctioning and trading.

UNIT I INTRODUCTION

UNIT II GAMES WITH PERFECT INFORMATION
Games with Perfect Information – Strategic games – prisoner’s dilemma, matching pennies- Nash equilibria- theory and illustrations – Cournot’s and Bertrand’s models of oligopoly- auctions- mixed strategy equilibrium- zero-sum games- Extensive Games with Perfect Information-repeated games (prisoner’s dilemma)- subgame perfect Nash equilibrium; computational issues.

UNIT III GAMES WITH IMPERFECT INFORMATION

UNIT IV NON-COOPERATIVE GAME THEORY

UNIT V MECHANISM DESIGN

OUTCOMES:
Upon Completion of the course, the students will be able to
- Discuss the notion of a strategic game and equilibria and identify the characteristics of main applications of these concepts.
- Discuss the use of Nash Equilibrium for other problems.
- Identify key strategic aspects and based on these be able to connect them to appropriate game theoretic concepts given a real world situation.
- Identify some applications that need aspects of Bayesian Games.
- Implement a typical Virtual Business scenario using Game theory.
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OBJECTIVES:
- To learn about the issues in the design of wireless ad hoc networks.
- To understand the working of protocols in different layers of mobile ad hoc and sensor networks.
- To expose the students to different aspects in sensor networks.
- To understand various traffic generators and models for sensor networks.
- To understand various security issues in ad hoc and sensor networks and solutions to the issues.

UNIT I  FUNDAMENTALS AND ROUTING PROTOCOLS OF WIRELESS AD HOC NETWORKS
UNIT II  MOBILITY MODELS AND OVERHEAD CONTROL MECHANISMS IN MANETS

Description of Various Mobility Models – Simulation and Analysis of Various Mobility Models – Overhead Analysis in Hierarchical Routing Scheme – Overhead Minimization Techniques – Energy Models

UNIT III  WIRELESS SENSOR NETWORKS (WSN)


UNIT IV  PERFORMANCE ANALYSIS AND EVALUATION


UNIT V  SECURITY IN ADHOC AND SENSOR NETWORKS


TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, the student will be able to
- Identifying suitable routing protocols for various scenarios of ad hoc networks.
- To explore various mobility models for MANETs.
- Identify different issues in wireless sensor networks.
- Analyse the performance of IEEE 802.15.4.
- Identify and critique security issues in ad hoc and sensor networks.

REFERENCES:
OBJECTIVES:

- Know the importance and need of software security.
- Know about various attacks.
- Learn about secure software design.
- Understand risk management in secure software development.
- Know the working of tools related to software security.

UNIT I     LOW LEVEL ATTACKS

UNIT II    SECURE DESIGN

UNIT III   SECURITY RISK MANAGEMENT

UNIT IV    SECURITY TESTING
UNIT V  PENETRATION TESTING


OUTCOMES:
Upon completion of the course, the student will be able to
- Identify various vulnerabilities related to memory attack.
- Apply security principles in software development.
- Evaluate the extent of risks.
- Involve selection of testing techniques related to software security in testing phase of software development.
- Use tools for securing software.

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OBJECTIVES:
- To learn the basics of Cognitive Science with focus on acquisition, representation and use of knowledge by individual minds, brains, and machines.
- To study the mind and intelligence, embracing psychology, artificial intelligence, neuroscience and linguistics.
- To understand the role of neuro-science in the cognitive field.
- To learn about computational models for semantic processing.
- To appreciate the role of reasoning in cognitive processing.

UNIT I  INTRODUCTION TO COGNITIVE SCIENCE  9

UNIT II  COGNITIVE PSYCHOLOGY  9

UNIT III  COGNITIVE NEUROSCIENCE  9
Brain and Cognition Introduction to the Study of the Nervous System – Neural Representation – Neuropsychology- Computational Neuroscience - The Organization of the mind - Organization of Cognitive systems - Strategies for Brain mapping – A Case study: Exploring mindreading

UNIT IV  LANGUAGE ACQUISITION, SEMANTICS AND PROCESSING MODELS  9

UNIT V  HIGHER-LEVEL COGNITION  9

TOTAL : 45 PERIODS

OUTCOMES:
Upon completion of the course, the student will be able to
- Analyze the methods of knowledge representation in cognitive processing.
- Design cognitive architectures.
- Understand the connection between brain and cognition.
- Apply neural network models to cognition.
- Apply reasoning & decision making to design dynamic systems.

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CP5001 VIRTUALIZATION TECHNIQUES

OBJECTIVES:
- To understand the concepts of virtualization and virtual machines.
- To understand the implementation of process and system virtual machines.
- To explore the aspects of high level language virtual machines.
- To gain expertise in server, network and storage virtualization.
- To understand and deploy practical virtualization solutions and enterprise solutions.

UNIT I OVERVIEW OF VIRTUALIZATION

UNIT II PROCESS VIRTUAL MACHINES

UNIT III HIGH LEVEL LANGUAGE VIRTUAL MACHINES AND SERVER VIRTUALIZATION
UNIT IV  NETWORK AND STORAGE VIRTUALIZATION  9

UNIT V  APPLYING VIRTUALIZATION  9

TOTAL: 45 PERIODS

OUTCOMES:
Upon completion of the course, the student will be able to
- Classify Virtual Machines.
- Deploy legacy OS on virtual machines.
- Analyze the intricacies of server, storage and network virtualizations.
- Design and develop applications on virtual machine platforms.
- Suggest appropriate high level language virtual machine for the problem in hand.

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OBJECTIVES:

- To understand the tasks in database administration.
- To learn the methods to secure the database and to recover from failures.
- To understand the fundamentals of database tuning.
- To apply indexing techniques and query optimization for database tuning.
- To understand and measure performance monitors to troubleshoot the database system.

UNIT I INTRODUCTION TO DATABASE ADMINISTRATION

- Database Administration - DBA Tasks - Database Design - Performance Monitoring and Tuning - Availability - Database Security and Authorization - Backup and Recovery - Data Integrity - DBMS Release Migration - Types of DBAs - Creating the Database Environment - Choosing a DBMS - DBMS Architectures - DBMS Clustering - DBMS Proliferation - Hardware Issues - Installing the DBMS - DBMS Installation Basics Hardware Requirements - Storage Requirements Memory Requirements Configuring the DBMS - Connecting the DBMS to Supporting Infrastructure Software - Installation Verification - DBMS Environments - Upgrading DBMS Versions and Releases - Fallback Planning - Migration Verification

UNIT II DATABASE SECURITY, BACKUP AND RECOVERY


UNIT III FUNDAMENTALS OF TUNING


UNIT IV INDEX TUNING AND QUERY OPTIMIZATION


UNIT V TROUBLESHOOTING


TOTAL: 45 PERIODS
OUTCOMES:
Upon completion of the course, the students will be able to:
- Describe the principle functions in database administration and security
- Discuss the need for performance tuning in databases
- Write optimized code for accessing multiple databases
- Reconstruct indexes and optimize queries for better database performance.
- Carry out troubleshooting in database systems

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CP5077     DATA WAREHOUSING AND DATA MINING TECHNIQUES   L T PC
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OBJECTIVES:
- To understand data mining principles and techniques and Introduce DM as a cutting edge business intelligence.
- To expose the students to the concepts of data warehousing architecture and implementation.
- To learn various Data Mining techniques such as classification, clustering & Association rule mining
- To study the overview of developing areas – web mining, text mining and ethical aspects of data mining.
- To identify business applications and trends of data mining.
UNIT I - INTRODUCTION TO DATA WAREHOUSING
Evolution of Decision Support Systems - Data warehousing Components – Building a Data warehouse, Data Warehouse and DBMS, Data marts, Metadata, Multidimensional data model, OLAP vs OLTP, OLAP operations, Data cubes, Schemas for Multidimensional Database: Stars, Snowflakes and Fact constellations

UNIT II - DATA WAREHOUSE PROCESS AND ARCHITECTURE
Types of OLAP servers, 3-Tier data warehouse architecture, distributed and virtual data warehouses. Data warehouse implementation, tuning and testing of data warehouse. Data Staging (ETL) Design and Development, data warehouse visualization, Data Warehouse Deployment, Maintenance, Growth, Business Intelligence Overview- Data Warehousing and Business Intelligence Trends - Business Applications- tools-SAS

UNIT III - INTRODUCTION TO DATA MINING
Data mining-KDD versus data mining, Stages of the Data Mining Process-task primitives, Data Mining Techniques -Data mining knowledge representation – Data mining query languages, Integration of a Data Mining System with a Data Warehouse – Issues, Data preprocessing – Data cleaning, Data transformation, Feature selection, Dimensionality reduction, Discretization and generating concept hierarchies-Mining frequent patterns- association-correlation

UNIT IV - CLASSIFICATION AND CLUSTERING
Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Clustering techniques – Partitioning methods- k-means- Hierarchical Methods – distance based agglomerative and divisive clustering, Density-Based Methods – expectation maximization -Grid Based Methods – Model-Based Clustering Methods – Constraint – Based Cluster Analysis – Outlier Analysis

UNIT V - PREDICTIVE MODELING OF BIG DATA AND TRENDS IN DATA MINING

OUTCOMES:
Upon completion of the course, the student will be able to
- Evolve multidimensional intelligent model from typical system.
- Discover the knowledge imbibed in the high dimensional system and gain knowledge on datawarehouse process.
- Acquire knowledge of data processing and data quality.
- Design and deploy classification and clustering techniques.
- Evaluate various mining techniques on complex data objects.

REFERENCES:
1. Jiawei Han, Micheline Kamber, “Data Mining: Concepts and Techniques”, Morgan Kaufmann, Third edition, 2011.


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**CP5086 SOCIAL NETWORK ANALYSIS**

**OBJECTIVES:**
- To gain knowledge about the current web development and emergence of social web.
- To study about the modeling, aggregating and knowledge representation of semantic web.
- To appreciate the use of machine learning approaches for web content mining.
- To learn about the extraction and mining tools for social networks.
- To gain knowledge on web personalization and web visualization of social networks.

**UNIT I CLUSTERING AND CLASSIFICATION 9+6**

**UNIT II SOCIAL MEDIA MINING 9+6**

**UNIT III EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS 9+6**
UNIT IV   HUMAN BEHAVIOR ANALYSIS AND PRIVACY ISSUES   9+6

UNIT V   VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS   9+6

TOTAL : 45+30:75 PERIODS

OUTCOMES:
Upon completion of the course, the student will be able to
- Apply knowledge of current web development in the era of social web.
- Model, aggregate and represent knowledge for semantic web.
- Use machine learning approaches for web content mining.
- Design extraction and mining tools for social networks.
- Develop personalized web sites and visualization for social networks.

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OBJECTIVES:
The student should be able to
- Know what is software and the usage of different types of softwares.
- Know the Quality Metrics of various Softwares.
- Know the methodologies used in developing software.
- Test the product finally to check the product Quality.

UNIT I INTRODUCTION 9+6

UNIT II TESTING METHODOLOGIES 9+6

UNIT III TEST STRATEGIES 9+6

UNIT IV TEST AUTOMATION AND MANAGEMENT 9+6

UNIT V SQA IN PROJECT MANAGEMENT 9+6

OUTCOMES
Upon completion of the course, the student will be able to
- Develop Quality plans and use SQA components in project life cycle.
- Analyze the product Quality.
- Judge the use of infrastructure components and use configuration items for Quality control.
- Use various testing methods and verify.
- Assess Quality standards of various software products.

REFERENCES
OBJECTIVES:

- To determine the necessity of user interaction by understanding usability engineering and user modeling.
- To learn the methodologies for designing interactive systems.
- To investigate the core and complex design issues for interaction.
- To examine the evaluation methodologies of design.
- To understand design issues for web and mobile platforms.

UNIT I  INTRODUCTION
Context of Interaction –Ergonomics - Designing Interactive systems – Understanding User-cognition and cognitive frame works, User Centred approaches - Usability, Universal Usability, Understanding and conceptualizing interaction, Guidelines, Principles and Theories

UNIT II  INTERACTION DESIGN

UNIT III  DESIGN AND EVALUATION

UNIT IV  MODELS AND THEORIES

UNIT V  DESIGNING INTERACTIONS FOR WEB AND MOBILE PLATFORMS

TOTAL : 45 PERIODS
OUTCOMES:
Upon completion of the course, the student will be able to

- Understand the basics of human computer interactions via usability engineering and cognitive modeling.
- Understand the basic design paradigms, complex interaction styles.
- Understand the fundamental design issues.
- Evaluate of interaction designs and implementations.
- Use models and theories for user interaction.
- Use above concepts for web and mobile applications.

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SE5074 SOFTWARE RELIABILITY METRICS AND MODELS

OBJECTIVES:

- Learn different definitions of software quality.
- Know different notions of defects and classify them.
- Understand the basic techniques of data collection and how to apply them.
- Learn software metrics that define relevant metrics in a rigorous way.
- Gain confidence in ultra-high reliability.
UNIT I INTRODUCTION
Automated Testing – Background on software testing – Automated test life cycle methodology (ATLM) – Test Maturity Model – Test Automation Development – Overcoming false expectations of automated testing – benefits – Test tool proposal

UNIT II TEST FRAMEWORK AND AUTOMATION

UNIT III TEST PLANNING AND DESIGN
Test planning – Test program scope – Test requirements management – Test Program Events, Activities and Documentation – Test Environment – Test plan – Test requirements analysis – Test program design – Test procedure design – Test development architecture – Test Development Guidelines – Automation Infrastructure – Test execution and review – Executing and Evaluating Test Phases - Test metrics - Test bench design and evaluation

UNIT IV TESTING THE APPLICATIONS

UNIT V CASE STUDIES
Test automation and agile project management – database automation – test automation in cloud – Mainframe and Framework automation – Model based test case generation – Model based testing of Android applications

TOTAL : 45 PERIODS

OUTCOMES:
Upon completion of the course, the student will be able to
- Perform some simple statistical analysis relevant to software measurement data.
- Classify defects on identification and work on them.
- Use data collection techniques aptly.
- Use software metrics for relevant measures in a rigorous way.
- Use from practical examples both the benefits and limitations of software metrics for quality control and assurance.

REFERENCES:
OE5091 BUSINESS DATA ANALYTICS

OBJECTIVES:
- To understand the basics of business analytics and its life cycle.
- To gain knowledge about fundamental business analytics.
- To learn modeling for uncertainty and statistical inference.
- To understand analytics using Hadoop and Map Reduce frameworks.
- To acquire insight on other analytical frameworks.

UNIT I OVERVIEW OF BUSINESS ANALYTICS


Suggested Activities:
- Case studies on applications involving business analytics.
- Converting real time decision making problems into hypothesis.
- Group discussion on entrepreneurial opportunities in Business Analytics.

Suggested Evaluation Methods:
- Assignment on business scenario and business analytical life cycle process.
- Group presentation on big data applications with societal need.
- Quiz on case studies.

UNIT II ESSENTIALS OF BUSINESS ANALYTICS


Suggested Activities:
- Solve numerical problems on basic statistics.
- Explore chart wizard in MS Excel Case using sample real time data for data visualization.
- Use R tool for data visualization.
Suggested Evaluation Methods:
- Assignment on descriptive analytics using benchmark data.
- Quiz on data visualization for univariate, bivariate data.

UNIT III MODELING UNCERTAINTY AND STATISTICAL INFERENCE

Suggested Activities:
- Solving numerical problems in sampling, probability, probability distributions and hypothesis testing.
- Converting real time decision making problems into hypothesis.

Suggested Evaluation Methods:
- Assignments on hypothesis testing.
- Group presentation on real time applications involving data sampling and hypothesis testing.
- Quizzes on topics like sampling and probability.

UNIT IV ANALYTICS USING HADOOP AND MAPREDUCE FRAMEWORK

Suggested Activities:
- Practical – Install and configure Hadoop.
- Practical – Use web based tools to monitor Hadoop setup.
- Practical – Design and develop MapReduce tasks for word count, searching involving text corpus etc.

Suggested Evaluation Methods:
- Evaluation of the practical implementations.
- Quizzes on topics like HDFS and extensions to MapReduce.

UNIT V OTHER DATA ANALYTICAL FRAMEWORKS
Overview of Application development Languages for Hadoop – PigLatin – Hive – Hive Query Language (HQL) – Introduction to Pentaho, JAQL – Introduction to Apache: Sqoop, Drill and Spark, Cloudera Impala – Introduction to NoSQL Databases – Hbase and MongoDB.

Suggested Activities:
- Practical – Installation of NoSQL database like MongoDB.
- Practical – Demonstration on Sharding in MongoDB.
- Practical – Install and run Pig
- Practical – Write PigLatin scripts to sort, group, join, project, and filter data.
- Design and develop algorithms to be executed in MapReduce involving numerical methods for analytics.
Suggested Evaluation Methods:
- Mini Project (Group) – Real time data collection, saving in NoSQL, implement analytical techniques using Map-Reduce Tasks and Result Projection.

TOTAL: 45 PERIODS

OUTCOMES:
On completion of the course, the student will be able to:
- Identify the real world business problems and model with analytical solutions.
- Solve analytical problem with relevant mathematics background knowledge.
- Convert any real world decision making problem to hypothesis and apply suitable statistical testing.
- Write and Demonstrate simple applications involving analytics using Hadoop and MapReduce
- Use open source frameworks for modeling and storing data.
- Apply suitable visualization technique using R for visualizing voluminous data.

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OE5092 INDUSTRIAL SAFETY LT P C 3 0 0 3

OBJECTIVES:
- Summarize basics of industrial safety
- Describe fundamentals of maintenance engineering
- Explain wear and corrosion
- Illustrate fault tracing
- Identify preventive and periodic maintenance
UNIT I  INTRODUCTION  9
Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes, Fire prevention and firefighting, equipment and methods.

UNIT II  FUNDAMENTALS OF MAINTENANCE ENGINEERING  9
Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT III  WEAR AND CORROSION AND THEIR PREVENTION  9

UNIT IV  FAULT TRACING  9
Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, i. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

UNIT V  PERIODIC AND PREVENTIVE MAINTENANCE  9
Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: i. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

TOTAL: 45 PERIODS

OUTCOMES:
Students will be able to:
CO1: Ability to summarize basics of industrial safety
CO2: Ability to describe fundamentals of maintenance engineering
CO3: Ability to explain wear and corrosion
CO4: Ability to illustrate fault tracing
CO5: Ability to identify preventive and periodic maintenance

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REFERENCES:
OBJECTIVES:
- Solve linear programming problem and solve using graphical method.
- Solve LPP using simplex method
- Solve transportation, assignment problems
- Solve project management problems
- Solve scheduling problems

UNIT I  LINEAR PROGRAMMING  9
Introduction to Operations Research – assumptions of linear programming problems - Formulations of linear programming problem – Graphical method

UNIT II  ADVANCES IN LINEAR PROGRAMMING  9
Solutions to LPP using simplex algorithm- Revised simplex method - primal dual relationships – Dual simplex algorithm - Sensitivity analysis

UNIT III  NETWORK ANALYSIS – I  9
Transportation problems -Northwest corner rule, least cost method, Voges’s approximation method - Assignment problem -Hungarian algorithm

UNIT IV  NETWORK ANALYSIS – II  9
Shortest path problem: Dijkstra’s algorithms, Floyds algorithm, systematic method -CPM/PERT

UNIT V  NETWORK ANALYSIS – III  9
Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models

TOTAL: 45 PERIODS

OUTCOMES:
Students will be able to:
CO1: To formulate linear programming problem and solve using graphical method.
CO2: To solve LPP using simplex method
CO3: To formulate and solve transportation, assignment problems
CO4: To solve project management problems
CO5: To solve scheduling problems

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REFERENCES:
OBJECTIVES:
- Summarize the costing concepts and their role in decision making
- Infer the project management concepts and their various aspects in selection
- Interpret costing concepts with project execution
- Develop knowledge of costing techniques in service sector and various budgetary control techniques
- Illustrate with quantitative techniques in cost management

UNIT I  INTRODUCTION TO COSTING CONCEPTS  9
Objectives of a Costing System; Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost; Creation of a Database for operational control.

UNIT II  INTRODUCTION TO PROJECT MANAGEMENT  9
Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities, Detailed Engineering activities, Pre project execution main clearances and documents, Project team: Role of each member, Importance Project site: Data required with significance, Project contracts.

UNIT III  PROJECT EXECUTION AND COSTING CONCEPTS  9
Project execution Project cost control, Bar charts and Network diagram, Project commissioning: mechanical and process, Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis, Various decision-making problems, Pricing strategies: Pareto Analysis, Target costing, Life Cycle Costing.

UNIT IV  COSTING OF SERVICE SECTOR AND BUDGETERY CONTROL  9
Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis, Budgetary Control: Flexible Budgets; Performance budgets; Zero-based budgets.

UNIT V  QUANTITATIVE TECHNIQUES FOR COST MANAGEMENT  9
Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Learning Curve Theory.

TOTAL: 45 PERIODS

OUTCOMES:
Students will be able to:
CO1 – Understand the costing concepts and their role in decision making
CO2–Understand the project management concepts and their various aspects in selection
CO3–Interpret costing concepts with project execution
CO4–Gain knowledge of costing techniques in service sector and various budgetary control techniques
CO5 - Become familiar with quantitative techniques in cost management
OBJECTIVES:

- Summarize the characteristics of composite materials and effect of reinforcement in composite materials.
- Identify the various reinforcements used in composite materials.
- Compare the manufacturing process of metal matrix composites.
- Understand the manufacturing processes of polymer matrix composites.
- Analyze the strength of composite materials.

UNIT I  INTRODUCTION
Definition – Classification and characteristics of Composite materials - Advantages and application of composites - Functional requirements of reinforcement and matrix - Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT II  REINFORCEMENTS
Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers - Properties and applications of whiskers, particle reinforcements - Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures - Isostrain and Isostress conditions.

UNIT III  MANUFACTURING OF METAL MATRIX COMPOSITES

UNIT IV  MANUFACTURING OF POLYMER MATRIX COMPOSITES

UNIT V  STRENGTH
Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

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

- CO1 - Know the characteristics of composite materials and effect of reinforcement in composite materials.
- CO2 – Know the various reinforcements used in composite materials.
- CO3 – Understand the manufacturing processes of metal matrix composites.
- CO4 – Understand the manufacturing processes of polymer matrix composites.
- CO5 – Analyze the strength of composite materials.

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REFERENCES:

OBJECTIVES:

- Interpret the various types of wastes from which energy can be generated
- Develop knowledge on biomass pyrolysis process and its applications
- Develop knowledge on various types of biomass gasifiers and their operations
- Invent knowledge on biomass combustors and its applications on generating energy
- Summarize the principles of bio-energy systems and their features

UNIT I INTRODUCTION TO EXTRACTION OF ENERGY FROM WASTE
Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

UNIT II BIOMASS PYROLYSIS
Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT III BIOMASS GASIFICATION

UNIT IV BIOMASS COMBUSTION
Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.
UNIT V  BIO ENERGY

Properties of biogas (Calorific value and composition), Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

TOTAL: 45 PERIODS

OUTCOMES:

Students will be able to:

CO1 – Understand the various types of wastes from which energy can be generated
CO2 – Gain knowledge on biomass pyrolysis process and its applications
CO3 – Develop knowledge on various types of biomass gasifiers and their operations
CO4 – Gain knowledge on biomass combustors and its applications on generating energy
CO5 – Understand the principles of bio-energy systems and their features

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AUDIT COURSES (AC)

AX5091  ENGLISH FOR RESEARCH PAPER WRITING  L T P C  2 0 0 0

OBJECTIVES

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

UNIT I  INTRODUCTION TO RESEARCH PAPER WRITING  6
Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

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

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

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

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

REFERENCES

AX5092            DISASTER MANAGEMENT
L T P C
2 0 0 0

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

UNIT I            INTRODUCTION
Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.
UNIT II    REPERCUSSIONS OF DISASTERS AND HAZARDS  

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

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

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

TOTAL : 30 PERIODS

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

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OBJECTIVES

- Illustrate the basic sanskrit language.
- Recognize sanskrit, the scientific language in the world.
- Appraise learning of sanskrit to improve brain functioning.
- Relate sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power.
- Extract huge knowledge from ancient literature.

UNIT I ALPHABETS 6
Alphabets in Sanskrit

UNIT II TENSES AND SENTENCES 6
Past/Present/Future Tense - Simple Sentences

UNIT III ORDER AND ROOTS 6
Order - Introduction of roots

UNIT IV SANSKRIT LITERATURE 6
Technical information about Sanskrit Literature

UNIT V TECHNICAL CONCEPTS OF ENGINEERING 6
Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

TOTAL: 30 PERIODS

OUTCOMES

- CO1 - Understanding basic Sanskrit language.
- CO2 - Write sentences.
- CO3 - Know the order and roots of Sanskrit.
- CO4 - Know about technical information about Sanskrit literature.
- CO5 - Understand the technical concepts of Engineering.

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1. “Abhyaspustakam” – Dr. Vishwas, Samskrita-Bharti Publication, New Delhi
2. “Teach Yourself Sanskrit” Prathama Deeksha-Vempati Kutumbshastr, Rashtriya Sanskrit Sansthanam, New Delhi Publication

OBJECTIVES

Students will be able to

- Understand value of education and self-development
- Imbibe good values in students
- Let the should know about the importance of character
UNIT I

UNIT II

UNIT III

UNIT IV

TOTAL: 30 PERIODS

OUTCOMES
Students will be able to
- Knowledge of self-development.
- Learn the importance of Human values.
- Developing the overall personality.

Suggested reading

AX5095  CONSTITUTION OF INDIA  L T P C
2 0 0 0

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.
- Role and entitlement to civil and economic rights as well as the emergence nation hood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik 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 ORGANES 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.

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.

AX5096 PEDAGOGY STUDIES

OBJECTIVES
Students will be able to:
- Review existing evidence on there view topic to inform programme design and policy
- Making under taken by the DfID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.

UNIT I INTRODUCTION AND METHODOLOGY:
Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions - Overview of methodology and Searching.

UNIT II THEMATIC OVERVIEW
Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education.
UNIT III EVIDENCE ON THE EFFECTIVENESS OF PEDAGOGICAL PRACTICES
Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches - Teachers' attitudes and beliefs and Pedagogic strategies.

UNIT IV PROFESSIONAL DEVELOPMENT
Professional development: alignment with classroom practices and follow up support - Peer support - Support from the head teacher and the community - Curriculum and assessment - Barriers to learning: limited resources and large class sizes

UNIT V RESEARCH GAPS AND FUTURE DIRECTIONS
Research design – Contexts – Pedagogy - Teacher education - Curriculum and assessment - Dissemination and research impact.

TOTAL: 30 PERIODS

OUTCOMES
Students will be able to understand:
- What pedagogical practices are being used by teachers informal and informal classrooms in developing countries?
- What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
- How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

SUGGESTED READING

AX5097 STRESS MANAGEMENT BY YOGA

OBJECTIVES
- To achieve overall health of body and mind
- To overcome stress

UNIT I
Definitions of Eight parts of yoga.(Ashtanga)

UNIT II
Yam and Niyam - Do’s and Don’ts in life - i) Ahinsa, satya, astheya, Bramhacharya and aparigraha, ii) Ahinsa, satya, astheya, Bramhacharya and aparigraha.
UNIT III
Asan and Pranayam - Various yog poses and their benefits for mind & body - Regularization of breathing techniques and its effects - Types of pranayam

TOTAL: 30 PERIODS

OUTCOMES
Students will be able to:
- Develop healthy mind in a healthy body thus improving social health also
- Improve efficiency

SUGGESTED READING
1. “Yogic Asanas for Group Tarining-Part-I” : Janardan Swami Yoga bhyasi Mandal, Nagpur
2. “Rajayoga or conquering the Internal Nature” by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

AX5098
PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

OBJECTIVES
- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students

UNIT I
Neetisatakam-holistic development of personality - Verses- 19,20,21,22 (wisdom) - Verses-29,31,32 (pride & heroism) – Verses- 26,28,63,65 (virtue) - Verses- 52,53,59 (don't’s) - Verses-71,73,75,78 (do’s)

UNIT II
Approach to day to day work and duties - Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48 - Chapter 3-Verses 13, 21, 27, 35 Chapter 6-Verses 5,13,17,23, 35 - Chapter 18-Verses 45, 46, 48.

UNIT III
Statements of basic knowledge - Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68 Chapter 12 -Verses 13, 14, 15, 16,17, 18 - Personality of role model - shrimad bhagwad geeta - Chapter2-Verses 17, Chapter 3-Verses 36,37,42 - Chapter 4-Verses 18, 38,39 Chapter18 – Verses 37,38,63

TOTAL: 30 PERIODS

OUTCOMES
Students will be able to
- Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
- The person who has studied Geeta will lead the nation and mankind to peace and prosperity
- Study of Neet is hatakam will help in developing versatile personality of students.

SUGGESTED READING
1. Gopinath, Rashtriya Sanskrit Sansthanam P, Bhartrihari’s Three Satakam, Niti-sringar-vairagya, New Delhi, 2010