ANNAMALAI UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
M.E. COMPUTER SCIENCE & ENGINEERING
(FULL–TIME)
REGULATIONS AND SYLLABUS
REGULATIONS

VISION

To provide congenial academic environment for individuals to develop and blossom as academically superior, nationally responsible and socially conscious citizens.

MISSION

- To impart high quality computer knowledge to the students by conducting education programmes
- To provide exposure to the students about the emerging technological advancements for meeting the demands of the industry
- To advance discipline of computing through internationally recognized research and development
- To foster an environment that promotes extension activities and continuing education

PROGRAMME EDUCATIONAL OBJECTIVES

M. E. (Computer Science and Engineering) graduates will have a sufficient understanding in the field of Computer Science and Engineering including scientific principles, analysis, techniques and design methodologies to

1. Demonstrate ability to adapt to hastily rising advanced areas of computer science to achieve greater height in their profession through lifelong learning
2. Develop creative computer systems for solving social, technical, environmental real time problems that exhibit ethical responsibility
3. Apply their skills in clear communication, teamwork and time management for administering a team/project, working on multidisciplinary team with other stakeholders
4. Exhibit professional attitudes by assisting in proficient development, participating in professional societies and contributing an employer’s efforts to comply with software licensing, protecting privacy, assure quality and safety
After the successful completion of the M.E. (Computer Science and Engineering) degree programme, the students will be able to:

**PO 1: ANALYTICAL SKILLS:**
Narrate familiarity in the knowledge of computing, mathematical concepts, algorithmic principles in computer science and engineering theory to fabricate computer based systems of varying complexity.

**PO 2: PROBLEM SOLVING SKILLS:**
Analyze, generate, and interpret data to choose relevant procedures, resources and contemporary tools in computer science and engineering considering current and future trends.

**PO 3: CREATIVE SKILLS:**
Investigate and devise a computer based system to meet the necessary requirements within the realistic constraints such as economic, environmental, societal, ethical, safety and sustainability in the field of computer science and engineering.

**PO 4: TEAM WORK AND PROFESSIONAL INTEGRITY:**
Effectively function as a leader in multi-disciplinary teams and entrust on professional responsibilities to achieve a common objective.

**PO 5: SPEAKING / WRITING SKILLS:**
Correspond efficiently on intricate computing problems with all type of audiences and engrave valuable reports, documentation and oral presentations.

**PO 6: ASSESSMENT SKILLS:**
Broad analyzing capability on local and global impact of computing on individuals, organizations and society.

**PO 7: SOCIAL AND CONTINUING EDUCATION PERCEPTION:**
Express capability for sustainable professional development and life-long learning with a knowledge of contemporary issues for the growth of computer science and engineering field.

**PO 8: CAREER AND IMMEDIATE EMPLOYMENT:**
Recognize the significance of proficient perfection by pursuing studies to face competitive examinations and the ability to propose innovative methods in research for real-life problems that offer demanding and gratifying careers in computing.

**PO 9: SELF MOTIVATED LEARNING:**
Develop the ability of self-determined life-long learning in the scientific/technical perspective.

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CRSME OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Programme : M.E. Specialization: Computer Science and Engineering

Courses of Study and Scheme of Examination (REGULATION-2019)

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L- Lecture; P- Practical; T- Thesis; CA- Continuous Assessment; FE- Final Examination

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L- Lecture ; P- Practical; T- Thesis; CA- Continuous Assessment; FE- Final Examination

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LIST OF OPEN ELECTIVES

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LIST OF AUDIT COURSES

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LIST OF VALUE ADDED COURSES

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<td>Introduction to Data Science</td>
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<td>Advanced Data Science</td>
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COURSE OBJECTIVES:
- To enable the student to choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.
- To understand the necessary mathematical abstraction to solve problems.
- To familiarize students with advanced paradigms and data structure used to solve algorithmic problems.
- To come up with analysis of efficiency and proofs of correctness.

Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries.
Hashing: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, open addressing, linear probing, Quadratic probing, Double hashing, rehashing, extendible hashing.

Skip Lists: Need for randomizing data structures and algorithms, search and update operations on skip lists, probabilistic analysis of skip lists, deterministic skip lists.
Trees: Binary search trees, AVL trees, red black trees, 2-3 trees, B-Trees, Splay trees.


REFERENCES:

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Understand the implementation of symbol table using hashing techniques.
2. Develop and analyze algorithms for red-black trees, B-trees and Splay trees.
3. Build algorithms for text processing applications.
4. Identify suitable data structures and develop algorithms for computational geometry problems.
5. Implement algorithms related to computational geometry problems.
### Mapping of CoS with POs

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### COURSE OBJECTIVES:
- To introduce the fundamental concepts of machine learning and its applications.
- To learn the classification, clustering and regression based machine learning algorithms.
- To understand the deep learning architectures.
- To understand the methods of solving real life problems using the machine learning techniques.


Combining Multiple Learners: Generating diverse learners - model combination schemes - voting - error-correcting output codes - bagging - boosting - mixture of experts revisited -
stacked generalization - fine-tuning an ensemble – cascading. Recent trends in various learning techniques of machine learning and classification methods for solving real world problems.

REFERENCES:

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Understand the basic concepts of machine learning.
2. Employ the classification, clustering and regression algorithms.
3. Apply the deep learning architectures.
5. Apply recent in various learning techniques of machine learning and classification methods for solving real world problems.

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COURSE OBJECTIVES:
- To understand the scope, characteristics and objectives of the research problem.
- To analyse and investigate the research problem.
- To write the research proposal and to present before a committee.
- To understand the nature of grants and patents.

Effective literature studies approaches, analysis, Plagiarism, Research ethics, Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.


New Developments in IPR: Administration of Patent System. IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

REFERENCES:

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Understand research problem formulation. Analyze research related information.
2. Follow research ethics.
3. Understand IPR and to promote among students.
4. Create investment in R & D, which leads to creation of new and better products, and in turn to bring economic growth and social benefits.
5. Generate novel developments in IPR systems.
COURSE OBJECTIVES:

- To implement the advanced data structure techniques using C++.
- The student should be able to choose appropriate data structures, understand the ADT/libraries and use it to design algorithms for a specific problem.
- Students should be able to understand the necessary mathematical abstraction to solve problems.
- To familiarize students with advanced paradigms and data structure used to solve algorithmic problems.
- To Gain knowledge in practical applications of data structures.

LIST OF EXERCISES

CYCLE – I

Write a C++ program to implement the following:
1. Hashing with chaining.
2. Skip Lists.
4. AVL Trees.
5. B-Trees.

CYCLE – II

7. Trie structure.
8. Huffman coding algorithm.
9. One dimensional range searching.
10. Two dimensional range searching.

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Understand to design and analyze the time and space efficiency of the data structure.
2. Understand and capable to identify the appropriate data structure for given problem.
3. Understand the practical knowledge on the application of data structures.
4. Understand the need of developing graphics applications.
5. Learned algorithmic development of graphics primitives like: line, circle, ellipse, polygon etc. and the representation and three dimensional transformations.

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COURSE OBJECTIVES:
- To implement the basic machine learning techniques using Python.
- To implement the convolution neural network architecture using Python.
- To solve the challenging research problems in the area of Speech and Image processing.

LIST OF EXERCISES

CYCLE – I

Write a PYTHON program to implement the following:
1. Linear and logistic regression with error estimation.
2. Univariate and multivariate Gaussian densities.
3. Dimensionality reduction using Principal Component Analysis (PCA).
4. Clustering using
   a) k-means.
   b) Gaussian mixture modeling (GMM).
5. Classification using
   a) Back propagation neural network (BPNN).
   b) Support vector machine (SVM).
6. Construction of decision tree and random forest.

CYCLE – II

8. Sequence prediction using recurrent neural network (RNN).
10. Face detection and tracking.
COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Understand the basic concepts of machine learning.
2. Devise and implement the classification, clustering and regression algorithms.
3. Implement the deep learning architectures.
5. Apply the machine learning algorithms in real life problems.

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COURSE OBJECTIVES:
- To introduce students the advanced methods of designing and analyzing algorithms.
- To enable the students to choose appropriate algorithms and use it for a specific problem.
- To familiarize students with basic paradigms and data structures used to solve advanced algorithmic problems.
- To understand different classes of problems concerning their computation difficulties.
- To introduce the students to get familiarity in recent developments in the area of algorithmic design.

Sorting: Review of various sorting algorithms, topological sorting. Graph: Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case (Dijkstra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis.

Matroids: Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST. Graph Matching: Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path.

Flow-Networks: Maxflow-mincut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm. Matrix Computations: Strassen's algorithm and
introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the
time complexities of basic matrix operations, LUP-decomposition.

Shortest Path in Graphs: Floyd-Warshall algorithm and introduction to dynamic programming
paradigm. More examples of dynamic programming. Modulo Representation of
integers/polynomials: Chinese Remainder theorem, Conversion between base-representation and
Schonhage-Strassen Integer Multiplication algorithm.

Linear Programming: Geometry of the feasibility region and Simplex algorithm. NP-completeness:
Examples, proof of NP-hardness and NP-completeness. One or more of the following topics based
on time and interest: Approximation algorithms, Randomized Algorithms, Interior Point Method,
Advanced Number Theoretic Algorithm. Recent Trends in problem solving paradigms using recent
searching and sorting techniques by applying recently proposed data structures.

REFERENCES:
2. Alfred V. Aho, John E. Hopcroft, Jeffrey d. Ullman, “The Design and Analysis of

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Analyze the complexity/performance of different algorithms.
2. Determine the appropriate data structure for solving a particular set of problems.
3. Categorize the different problems in various classes according to their complexity.
4. Have an insight of recent activities in the field of the advanced data structure.
5. Analyze the feasibility of the linear programming techniques by applying recently proposed data structures.

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Mapping of Cos with POs
COURSE OBJECTIVES:

- To expose the students about the fundamentals of Embedded System.
- To educate about Firmware design and development.
- To discuss on aspects required in Embedded system design techniques.
- To understand the fundamentals of Internet of Things.
- To build a small low cost embedded system using Arduino / Raspberry Pi or equivalent boards and to apply the concept of Internet of Things in the real world scenario.


REFERENCES:


**COURSE OUTCOMES:**
After the completion of the course, the students will be able to
1. Recognize the key features of embedded systems in terms of computer hardware and be able to discuss their functions.
2. Aware of the key factors in embedded system design and development.
3. Explain the special extra-functional that are imposed on embedded systems.
4. Design a portable IoT using Arduino/ equivalent boards and relevant protocols.
5. Develop web services to access/control IoT devices.

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**COURSE OBJECTIVES:**
- To introduce IoT concepts and techniques and support their ability in designing suitable procedure for a specified scenario in Python.
- To employ IoT based solutions for real-world problems.
- To give students knowledge on humanoid PC software, humanoid android App, Arduino, BISOFT PC software GUI programming toolkit for Python.
- To provide the student hand-on experience on Python to implement various IoT techniques.

**LIST OF EXERCISES**

**CYCLE I**

1. Programming and Simulation of 8051 in Keil IDE [Finding average of numbers].
2. Alphanumeric LCD interface using 8051.
3. Study of ARM evaluation system.
4. Flashing of LEDs using ARM (LPC2148).
5. Interfacing keyboard and LCD using ARM (LPC2148).
6. Temperature sensor interface using ARM (LPC2148).
7. Study of FPGA evaluation system.
8. Design of logic gates using FPGA.
9. Design of UP/Down counter using FPGA.

**CYCLE II**

10. Automatic street light control.
11. Control raspberry Pi using local server.
12. Connect with RTC.
14. Transfer data using serial communication.
15. Smart Jacket with interactive display.
16. Accident alert with location information over Internet.
17. Personalized toy for kids – voice based.
18. Live air pollution monitor over Internet.
19. Interactive humanoid.
20. Smart gloves for gaming.
21. Interactive learning kit with touch sensor.
22. Google voice recognition assisted remote control robot.
23. Learn electronics the smart way – TROPS and Beak kit.

**COURSE OUTCOMES:**
After the completion of the course, the students will be able to
1. Understand the basic concepts of IoT.
2. Design and implement IoT techniques to solve the real world problems.
3. Implement solution methods on humanoid PC software, humanoid android App, Arduino, BISOFT PC software.
4. Develop applications in 8051 in Keil IDE.
5. Design and implement embedded solution using ARM (LPC2148).

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| Mapping of Cos with POs |
**COURSE OBJECTIVES:**

- To train the students in the field work related to Computer Science and Engineering and to have a practical knowledge in carrying out the Computer Science and Engineering related problems.
- To train and develop skills in solving problems during execution of the problems related to Computer Science and Engineering.
- To work on a technical topic related to Computer Science and Engineering and acquire the ability of written and oral presentation.
- To acquire the ability of writing technical papers for Conferences and Journals.

The students will individually undertake a training program in reputed concerns in the field of Computer Science and Engineering during summer vacation (at the end of second semester for Full Time / Fifth semester for Part – Time) for a minimum stipulated period of four weeks. At the end of training the student has to submit the detailed report on the training undertaken within ten days from the commencement of the third semester for Full Time / Fifth semester for Part – Time. The student will be evaluated by a team of staff members nominated by the Head of the Department through a viva-voce examination.

For seminar/mini project, the students will work for two periods per week guided by a faculty. They will be asked to give a presentation of not less than 15 minutes and not more than 30 minutes (on any technical topic for seminar and on the project title for mini project). They will defend their presentation. A brief copy of their presentation also should be submitted. Evaluation will be done by the examiners based on the technical presentation, the report and also on the interaction shown during the seminar/viva for seminar and mini project respectively.

**COURSE OUTCOMES:**

After the completion of the course, the students will be able to

1. Analyze a given Computer Science and Engineering problem and to identify and implement appropriate problem solving methodology to propose a meaningful solution.
2. Face the audience and to interact with them confidently.
3. Tackle any problem during group discussion in the corporate interviews.
4. Acquire the ability to work in the actual environment and to use the technical resources.
5. Analyse any short coming while implementing a technical problem and to handle the same.
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**COURSE OBJECTIVES:**
- To train the students in the current thrust area in Computer Science and Engineering and to have practical knowledge in handling the technical scenario.
- To develop skills on the research topic and to implement the appropriate methods to handle the issue.

The students will individually undertake a research problem in the field of Computer Science and Engineering in the third semester for Full-Time / Fifth semester for Part-Time. The student will be guided by a staff member. The progress of the research will be evaluated every month by a team of staff members. The student has to submit the detailed report on the research problem at the end of Third semester for Full-Time / Fifth semester for Part-Time. The student will be evaluated by a team of examiners nominated by the Head of the Department through a viva-voce examination.

**COURSE OUTCOMES:**
After the completion of the course, the students will be able to
1. Conduct independent empirical research to evaluate and present their results responsibly and critically.
2. Present the conclusions with understandability using appropriate tables and graphs in the form of report.
3. Maintain the ethical standards of scientific research and to follow the basic principles in an academic community that requires constant learning and knowledge updation.
4. Analyse any short coming while implementing a technical problem and to handle the same.
5. Implement any research problem in the current thrust area using the gained practical knowledge.
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COURSE OBJECTIVES:
- To train the students in the current thrust area in Computer Science and Engineering and to have practical knowledge in handling the technical scenario.
- To develop skills on the research topic and to implement the appropriate methods to handle the issue.

The students will continue the research problem undertaken during third semester for Full-Time / Fifth semester for Part-Time in the field of Computer Science and Engineering. The student will be guided by a staff member. The progress of the research will be evaluated every month by a team of staff members. The student has to submit the detailed report on the research problem at the end of Fourth semester for Full-Time / Sixth semester for Part-Time. The student will be evaluated by a team of examiners nominated by the Head of the Department through a viva-voce examination.

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Conduct independent empirical research to evaluate and present their results responsibly and critically.
2. Present the conclusions with understandability using appropriate tables and graphs in the form of report.
3. Maintain the ethical standards of scientific research and to follow the basic principles in an academic community that requires constant learning and knowledge updation.
4. Analyse any short coming while implementing a technical problem and to handle the same.
5. Implement any research problem in the current thrust area using the gained practical knowledge.
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PROGRAM ELECTIVES
COURSE OBJECTIVES:

- To get familiarity with the wireless/mobile market and the future needs and challenges.
- To know the key concepts of wireless networks, standards, technologies and their basic operations.
- To study the design and analyse various security techniques.
- To evaluate MAC and network protocols using network simulation software tools.
- To get familiar with the wireless/mobile market and the future needs and challenges.


WiMAX (Physical layer, Media access control, Mobility and Networking), IEEE 802.22 Wireless Regional Area Networks, Overview on IEEE 802.21 Media Independent Handover. Wireless sensor networks: Introduction, Application, Physical, MAC layer and Network Layer, Power Management, Overview on Tiny OS.


REFERENCES:

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Demonstrate advanced knowledge of networking and wireless networking and understand various types of wireless networks, standards, operations and use cases.
2. Be able to design WLAN, WPAN, WWAN, Cellular based upon underlying propagation and performance analysis.
3. Demonstrate knowledge of protocols used in wireless networks and learn simulating wireless networks.
4. Design wireless networks exploring trade-offs between wire line and wireless links. Develop mobile applications to solve some of the real world problems.
5. Devise network and security applications by applying recent techniques.

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COURSE OBJECTIVES:
- To make the students familiar with both the theoretical and practical aspects of computing with images.
- To describe the foundation of image formation, measurement and analysis.
- To understand the geometric relationships between 2D images and the 3D world.
- To grasp the principles of state-of-the-art deep neural networks.


Pattern matching techniques: Graph-theoretic approach to object location, possibilities for saving computation, Using generalized Hough transform for feature collation, generalizing the maximal Clique and other approaches, relational descriptors, Search.
3D - Vision and variety of methods – Shape and shading – Photometric stereo – Shape and texture. Motion: Introduction, Optical Flow, Interpretation of optical flow fields, using focus of expansion to avoid collision, time-to-adjacency analysis, difficulties with optical flow method, stereo from motion, Kalman filter.

Real-time pattern recognition systems: Case study on location of cereals and insects, Surveillance, In-Vehicle vision systems.

REFERENCES:

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Implement computer graphics techniques required for computer vision.
2. Apply the concepts of visible and illumination methods.
3. Implement 3D vision techniques.
4. Develop computer vision algorithms.
5. Design and implement pattern matching techniques.

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COURSE OBJECTIVES:

- To understand representation of digital images in the spatial and frequency domains.
- To understand Image Compression, Segmentation and image compression standards.
- To provide an in-depth understanding of various concepts related to image Representation and Description.
- To get familiar with image enhancement concepts and image degradation/restoration process.

Digital image representation


Image enhancement:

- Frequency Domain - Filtering in Frequency Domain — Smoothing and Sharpening filters – Homomorphic Filtering.


Image compression:

- Redundancies, image compression models, elements of information theory, error-free compression variable length coding, bit plane coding, lossless predictive coding, lossy compression, predictive coding, transform coding, image compression standards- JPEG, MPEG.

Image Analysis:

- Segmentation, detection of discontinuities, edge linking and boundary detection.
- Edge Operators, thresholding, region-oriented segmentation.

REFERENCES:

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Acquire knowledge of principles of digital image processing.
2. Solve problems pertaining to the field of image acquisition, preprocessing, Fourier domain processing.
3. Perform basic image restoration, image segmentation and image compression.
4. Provide the foundations for life-long learning and continual professional development in the areas of image applications.
5. Interpret various image compression standards.

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COURSE OBJECTIVES:
- To understand sensor networks for various application setups.
- To devise appropriate data dissemination protocols and model links cost.
- To study the fundamental concepts of wireless sensor networks and to have a basic knowledge of the various protocols at various layers.
- To evaluate the performance of sensor networks and identify bottlenecks.


Hardware Platforms: Motes, Hardware parameters. Introduction to NS-3: Introduction to Network Simulator 3 (NS-3), Description of the NS-3 core module and simulation example.


REFERENCES:

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Describe and explain radio standards and communication protocols for wireless sensor networks.
2. Explain the function of the node architecture and use of sensors for various applications.
3. Obtain familiarity with architectures, functions and performance of wireless sensor networks systems and platforms.
4. Demonstrate various security related issues in routing protocols.
5. Utilise the knowledge gained in relevant advanced topics in wireless sensor networks.

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COURSE OBJECTIVES:

- To introduce to the field of Artificial Intelligence (AI) with emphasis on its use to solve real world problems for which solutions are difficult to express using the traditional algorithmic approach.
- To explore the essential theory behind methodologies for developing systems that demonstrates intelligent behaviour including dealing with uncertainty.
- To learn from experience by following problem solving strategies found in real life.


Biological foundations to intelligent systems II: Fuzzy logic, knowledge Representation and inference mechanism, genetic algorithm, and fuzzy neural networks.


Knowledge representation and logical inference Issues in knowledge representation. Structured representation, such as frames, and scripts, semantic networks and conceptual graphs. Formal logic and logical inference. Knowledge-based systems structures, its basic components. Ideas of Blackboard architectures.

Reasoning under uncertainty and Learning Techniques on uncertainty reasoning such as Bayesian reasoning, Certainty factors and Dempster-Shafer Theory of Evidential reasoning. A study of different learning and evolutionary algorithms, such as statistical learning and induction learning. Recent trends in Fuzzy logic, Knowledge Representation.

REFERENCES:


COURSE OUTCOMES:

After the completion of the course, the students will be able to

1. Demonstrate knowledge of the fundamental principles of intelligent systems.
2. Analyze and compare the relative merits of a variety of AI problem solving techniques.
3. Understand the reasoning and learning techniques under uncertainty.
4. Be aware of general competence in implementing knowledge based engineering.
5. Understand the effect of knowledge based engineering and the overall understanding of
   the whole process.

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**COURSE OBJECTIVES:**
- To introduce the fundamental concepts and issues of managing large volume of shared data
  in a parallel and distributed environment.
- To provide insight into related research problems.
- To introduce advanced concepts in mobile and multi databases.

Introduction: Distributed data processing; What is a DDBS; Advantages and disadvantages of
DDBS; Problem areas; Overview of database and computer network concepts. Distributed database
management system Architecture: Transparencies in a distributed DBMS; Distributed DBMS
architecture; Global directory issues.

Distributed database design: Alternative design strategies; Distributed design issues; Fragmentation;
Data allocation. Semantics data control: View management; Data security; Semantic Integrity
Control. Query processing issues: Objectives of query processing; Characterization of query
processors; Layers of query processing; Query decomposition; Localization of distributed data

Distributed query optimization: Factors governing query optimization; Centralized query
optimization; Ordering of fragment queries; Distributed query optimization algorithms. Transaction
management: The transaction concept; Goals of transaction management; Characteristics of
transactions; Taxonomy of transaction models. Concurrency control: Concurrency control in
centralized database systems; Concurrency control in DDBSs; Distributed concurrency control
algorithms; Deadlock management.

Reliability: Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit
protocols; Recovery protocols.
Parallel database systems: Parallel architectures; parallel query processing and optimization; load balancing. Advanced topics: Mobile Databases, Distributed Object Management, Multi-databases.

REFERENCES:

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Design trends in distributed systems.
2. Apply network virtualization.
3. Employ remote method invocation and objects.
4. Describe the reliability techniques and concurrency control in DDBs.
5. Apply distributed computing environment and parallel architecture techniques.

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COURSE OBJECTIVES:
- To understand web engineering principles for web application development.
- To learn to architect and model web applications.
- To design web application using design methods.
- To apply various testing methods and understand web project management.


Promoting Web Applications and web project management: Operation and maintenance of web applications: Introduction; Challenges in launching the web application. Promoting web application; Content Management. Usage Analysis –Web project management – Usability of web application – Performance of web application.

REFERENCES:


COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Understand web engineering concepts.
2. Compare different web application architectures and models.
3. Apply design technique to develop web applications.
4. Compare various testing approaches.
5. Apply guidelines to manage web applications.
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|          | E OBJECTIVES:                  | 3 | 0 | 0 |
|          | • To prepare the data for analysis and develop meaningful Data Visualizations. |
|          | • To work with a variety of real world data sets. |
|          | • To learn how to prepare data sets for analysis by cleaning and reformatting. |
|          | • To apply a variety of different data exploration techniques including summary statistics and visualization methods. |
| Introduction: Sources of data, process for making sense of data. Describing Data: Observations and variables, types of variables, central tendency, distribution of the data, confidence intervals, hypothesis tests. |
| Preparing data tables: Cleaning the data, removing observations and variables, Removing Observations and Variables, Generating Consistent Scales Across Variables, New Frequency Distribution, Converting Text to Numbers, Converting Continuous Data to Categories, Combining Variables, Generating Groups, Preparing Unstructured Data. |
| Exploratory Analysis, Descriptive and comparative statistics, clustering and association, hypothesis generation. Identifying and understanding groups: Learning Decision Trees from Data. |
| Building models from data: Overview, Linear Regression, Logistic Regression, k-Nearest Neighbors, Classification and Regression Trees, Ethics in the profession: Cases in computing, statistics and communication. |
REFERENCES:

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Work in a business environment in which data preparation occurs.
2. Prepare data marts for statistical analysis.
3. Read data from databases and clean the data for statistical analysis.
4. Develop strategies for dealing with imperfect real world data.
5. Understand ethics in the profession.

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Mapping of Cos with POs

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COURSE OBJECTIVES:
- To fix software flaws and bugs in various software.
- To make students aware of various issues like weak random number generation, information leakage, poor usability, and weak or no encryption on data traffic.
- To learn techniques for successfully implementing and supporting network services on an enterprise scale and heterogeneous systems environment.
- To design methodologies and tools to develop secure software containing minimum vulnerabilities and flaws.
Secure Software Design: Identify software vulnerabilities and perform software security analysis, Master security programming practices, Master fundamental software security design concepts, Perform security testing and quality assurance.

Enterprise Application Development: Describe the nature and scope of enterprise software applications, Design distributed N-tier software application, Research technologies available for the presentation, business and data tiers of an enterprise software application. Design and build a database using an enterprise database system, Develop components at the different tiers in an enterprise system, Design and develop a multi-tier solution to a problem using technologies used in enterprise system, Present software solution.

Enterprise Systems Administration: Design, implement and maintain a directory-based server infrastructure in a 8 heterogeneous systems environment, Monitor server resource utilization for system reliability and availability, Install and administer network services (DNS/DHCP/Terminal Services/Clustering/Web/Email).

Obtain the ability to manage and troubleshoot a network running multiple services, Understand the requirements of an enterprise network and how to go about managing them.

Handle insecure exceptions and command/SQL injection, Defend web and mobile applications against attackers, software containing minimum vulnerabilities and flaws. Case study of DNS server, DHCP configuration and SQL injection attack.

REFERENCES:

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Differentiate various software vulnerabilities.
2. Understand software process vulnerabilities for an organization.
3. Monitor resources consumption in a software.
4. Interrelate security and software development process.
5. Manage and troubleshoot a enterprise network and to manage them.
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**COURSE OBJECTIVES:**
- To learn parallel programming with Graphics Processing Units (GPUs).
- To understand GPU computer architecture.
- To learn GPU programming environments.
- To program and debug GPU programs.

Introduction: History, Graphics Processors, Graphics Processing Units, GPGPUs. Clock speeds, CPU / GPU comparisons, Heterogeneity, Accelerators, Parallel programming, CUDA OpenCL / OpenACC, Hello World Computation Kernels, Launch parameters, Thread hierarchy, Warps / Wavefronts, Thread blocks / Workgroups, Streaming multiprocessors, 1D / 2D / 3D thread mapping, Device properties, Simple Programs.

Memory: Memory hierarchy, DRAM / global, local / shared, private / local, textures, Constant Memory, Pointers, Parameter Passing, Arrays and dynamic Memory, Multi-dimensional Arrays, Memory Allocation, Memory copying across devices, Programs with matrices, Performance evaluation with different memories.

Synchronization: Memory Consistency, Barriers (local versus global), Atomics, Memory fence. Prefix sum, Reduction. Programs for concurrent Data Structures such as Worklists, Linked-lists. Synchronization across CPU and GPU Functions: Device functions, Host functions, Kernels functions, Using libraries (such as Thrust), and developing libraries.


REFERENCES:

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Implement concepts in parallel programming.
2. Synchronize CPU and GPU Functions.
3. Debug and profile parallel programs.
4. Apply multi GPU concepts.
5. Design programs for concurrent Data Structures such as Worklists

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COURSE OBJECTIVES:
- To provide an in-depth study of the rapidly changing and fascinating field of computer forensics.
- To combine both the technical expertise and the knowledge required to investigate, detect and prevent digital crimes.
- To obtain knowledge on digital forensics legislations, digital crime, forensics processes and procedures, data acquisition and validation, e-discovery tools.
- To collect and preserve E-evidence, investigate operating systems and file systems, network forensics, art of steganography and mobile device forensics.

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Cyber Crime Scene Analysis: Discuss the various court orders etc., methods to search and seizure electronic evidence, retrieved and un-retrieved communications, Discuss the importance of understanding what court documents would be required for a criminal investigation.

Evidence Management & Presentation: Create and manage shared folders using operating system, importance of the forensic mindset, define the workload of law enforcement, Explain what the normal case would look like, Define who should be notified of a crime, parts of gathering evidence, Define and apply probable cause.

Computer Forensics: Prepare a case, Begin an investigation, Understand computer forensics workstations and software, Conduct an investigation, Complete a case, Critique a case, Network Forensics: open-source security tools for network forensic analysis, requirements for preservation of network data.


REFERENCES:

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Understand relevant legislation and codes of ethics.
3. Apply policies and procedures in E-discovery, guidelines and standards, E-evidence, tools and environment.
4. Design web forensics and network forensics.
5. Understand the legal aspects of digital forensics.
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**COURSE OBJECTIVES:**
- To present the three main mobile platforms and their ecosystems, namely Android, iOS, and Phone Gap/WebOS.
- To explore the emerging technologies and tools used to design and implement feature-rich mobile applications for smart phones and tablets.
- To take into account both the technical constraints relative to storage capacity, processing capacity, display screen, communication interfaces, and the user interface, context and profile.


More on UIs: VUIs and Mobile Apps, Text-to-Speech Techniques, Designing the Right UI, Multichannel and Multimodal UIs. Storing and Retrieving Data, Synchronization and Replication of Mobile Data, Getting the Model Right, Android Storing and Retrieving Data, Working with a Content Provider.


More on Security, Hacking Android Recent trends in Communication protocols for IOT nodes, mobile computing techniques in IOT, agents based communications in IOT.

REFERENCES:

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Identify the target platform and users and be able to define and sketch a mobile application.
2. Understand the fundamentals, frameworks, and development lifecycle of mobile application platforms including iOS, Android, and PhoneGap.
3. Design and develop a mobile application prototype in one of the platform (challenge project).
4. Select appropriate data transmission standards in terms of social competence.
5. Understand the need for continuous improvement of his/her skills due to the rapidly changing environment of mobile devices.

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COURSE OBJECTIVES:
- To provide insight to the mathematical formulation of real world problems.
- To understand the need and origin of the optimization methods.
- To optimize these mathematical problems using nature based algorithms especially for NP-Hard problems.
To get a broad picture of the various applications of optimization methods used in engineering.

Engineering application of Optimization, Formulation of design problems as mathematical programming problems.

General Structure of Optimization Algorithms, Constraints, The Feasible Region.


Optimization Algorithms like Genetic Optimization, Particle Swarm Optimization, Ant Colony Optimization etc.

Real life Problems and their mathematical formulation as standard programming problems. Recent trends: Applications of ant colony optimization, genetics, linear and quadratic programming in real world applications.

REFERENCES:

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Formulate optimization problems.
2. Understand and apply the concept of optimality criteria for various types of optimization problems.
3. Solve various constrained and unconstrained problems in Single variable as well as multivariable.
4. Evaluate and measure the performance of an algorithm.
5. Investigate, study, develop and organise innovative solutions for various applications.
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### COURSE OBJECTIVES:

- To Understand Data mining principles and techniques.
- To study the overview of Visualization and Statistical Perspectives and clustering techniques in details for better organization and retrieval of data.
- To understand the concept of Predictive Modelling for the retrieval purposes.
- To expose the students to the concepts of Data warehousing Architecture and Implementation.
- To identify Business applications and Tools of Data mining.


REFERENCES:

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Learn about the fundamentals of data mining.
2. Discover the knowledge imbibed in the high dimensional system.
3. Cluster the high dimensional data for better organization of the data.
4. Apply the Predictive Modelling techniques for mining the data.
5. Study the various mining applications and tools.

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COURSE OBJECTIVES:
- To understand the basic mechanism of speech production and auditory perception.
- To learn the basic concepts of time and frequency domain analysis of speech signal.
- To explain the various parametric representation of speech.
- To acquire knowledge on several applications of speech and audio processing.


REFERENCES:

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Acquired knowledge of speech production and auditory perception
2. Understand the time and frequency domain analysis of speech.
3. Acquired knowledge on various parameters of speech.
4. Ability to develop systems for various applications of speech processing.
5. Study and interpret the parametric representation of speech.
### COURSE OBJECTIVES:

- To understand the fundamentals of information security
- To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
- To understand how to deploy encryption techniques to secure data in transit across data networks
- To analyze key terms and critical concepts of information security
- To understand the fundamentals of Cryptography


Classical Cryptography: Substitution Ciphers, permutation Ciphers, Block Ciphers, DES Modes of Operation, AES, Linear Cryptanalysis, Differential Cryptanalysis, Hash Function - SHA 512, Message Authentication Codes, HMAC - Authentication Protocols

Introduction to Public Key Cryptography: Number theory, The RSA Cryptosystem and Factoring Integer, Attacks on RSA, The ELGamal Cryptosystem, Digital Signature Algorithm, Finite Fields, Elliptic Curves Cryptography, Key management - Session and Interchange keys, Key exchange and generation - PKI.


Intruders, Intrusion detection, password management, Virus and related threats, Countermeasures, Firewall design principles, Types of firewalls.
REFERENCES:

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Realize basic security algorithms for a computing system.
2. Analyze the vulnerabilities in any computing system and consequently be capable to design a security justification.
3. Recognize the security issues in the network and resolve it.
4. Evaluate security means using exact approaches, together with theoretical root, modeling, and simulations.
5. Understand authentication requirements of various security protocols.

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COURSE OBJECTIVES:
- To provide the students with a basic understanding of the theory behind various video processing tasks.
- To learn the most popular and successful algorithms to solve video processing problems.
- To understand and implement video segmentation and compression techniques.


Image Segmentation: Thresholding - Clustering - Bayesian Methods - Graph-Based Methods - Active-Contour Models. Change Detection: Shot-Boundary Detection - Background Subtraction. Motion Segmentation: Dominant-Motion Segmentation - Multiple-Motion Segmentation. Motion Tracking: Graph-Based Spatio-Temporal Segmentation and Tracking - Kanade Lucas Tomasi Tracking - Mean-Shift Tracking - Active-Contour Tracking - 2D mesh Tracking.


REFERENCES:
COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Exhibit sufficient understanding of video processing including video representation, video filtering and video compression.
2. Demonstrate the program basic video processing operations using the MATLAB.
3. Develop a complete video processing system to achieve a specific task and analyze and interpret the system.
5. Evaluate more advanced or future video compression technologies and multimedia application systems that exploit compressed video.

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COURSE OBJECTIVES:
- To study about medical image fundamentals.
- To acquire knowledge in medical image storage and enhancement techniques.
- To provide an up-to-date background in current state-of-the-art in medical imaging and applications of computational tools for medicine.
- To understand ultrasound image methods.

Introduction to medical imaging technology, systems, and modalities. Brief history, importance, applications, trends, challenges. Medical Image Formation Principles: X-Ray physics, X-Ray generation, attenuation, scattering, dose Basic principles of CT, reconstruction methods, artifacts, CT hardware.

Medical Image Storage, Archiving and Communication Systems and Formats Picture archiving and communication system (PACS), Formats: DICOM Radiology Information Systems (RIS) and Hospital Information Systems (HIS). Medical Image Processing, Enhancement, Filtering Basic image processing algorithms Thresholding, contrast enhancement, SNR characteristics, filtering, histogram modeling.


PET and SPECT Ultrasound Imaging methods, mathematical principles, resolution, noise effect, 3D imaging, positron emission tomography, single photon emission tomography, ultrasound imaging, applications. Medical Image Search and Retrieval Current technology in medical image search, content-based image retrieval, new trends: ontologies. Applications. Other Applications of Medical Imaging Validation, Image Guided Surgery, Image Guided Therapy; Computer Aided Diagnosis/Diagnostic Support Systems.

REFERENCES:

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Acquire depth knowledge about the various medical image processing techniques
2. Attain practical knowledge in medical Imaging.
3. Perform research works in the area of medical imaging
4. Gain knowledge about how to extract, model, and analyze information from medical data and applications in order to help diagnosis, treatment and monitoring of diseases through computer science.
### COURSE OBJECTIVES:

- To understand the fundamentals of adhoc Network architecture, Protocols, Issues.
- To introduce the various types of adhoc routing protocols.
- To provide in-depth knowledge about Sensor Network Architecture, its Applications and MAC Protocols for sensor networks.
- To elucidate issues in WSN routing, Indoor and outdoor Localization and Quality of Service in WSN.
- To emphasize on Necessity for Mesh Networks, IEEE 802.11s Architecture and different types of Mesh Networks.


REFERENCES:

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Understand the knowledge of Ad Hoc networking basics and Architecture.
2. Implement Ad hoc routing protocols and analyzing the performances of Protocols.
3. Recognize wireless sensor networks basics and routing methods.
4. Design and implement the Mesh networks with MAC enhancements.
5. Understand implement the principles of mobile ad hoc networks and to understand the implications on data transmission delay and bandwidth consumption.

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COURSE OBJECTIVES:
- To know the fundamentals of network architectures
- To explicate various protocols and its functionalities
- To study about different network management standards

Switching and Bridging, Datagrams, Virtual Circuit Switching, Source Routing, Bridges and LAN Switches, Basic Internetworking (IP), What is an Internetwork ?, Service Model, Global Addresses, Datagram Forwarding in IP, subnetting and classless addressing, Address Translation(ARP), Host Configuration(DHCP), Error Reporting(ICMP), Virtual Networks and Tunnels.

Network as a Graph, Distance Vector(RIP), Link State(OSPF), Metrics, The Global Internet, Routing Areas, Routing among Autonomous systems(BGP), IP Version 6(IPv6), Mobility and Mobile IP.

Simple Demultiplexer (UDP), Reliable Byte Stream(TCP), End-to-End Issues, Segment Format, Connecting Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries, TCP Extensions, Queuing Disciplines, FIFO, Fair Queuing, TCP Congestion Control, Additive Increase/ Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery.

Congestion-Avoidance Mechanisms, DEC bit, Random Early Detection (RED), Source-Based Congestion Avoidance. The Domain Name System(DNS),Electronic Mail(SMTP,POP,IMAP,MIME),World Wide Web(HTTP),Network Management(SNMP).

REFERENCES:

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Classify network services, protocols and architectures.
2. Knowledge on key Internet applications and their protocols.
3. Ability to develop their own applications using the sockets API.
4. Practical knowledge gained by hands-on sessions.
5. Gain the knowledge of application layer protocol.
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COURSE OBJECTIVES:
- To provide the knowledge and expertise to become a proficient data scientist.
- To demonstrate an understanding of statistics and machine learning concepts that are vital for data science.
- To produce Python code to statistically analyse a dataset.
- To critically evaluate data visualisations based on their design and use for communicating stories from data.

Introduction to core concepts and technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications.

Data collection and management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, Using multiple data sources.

Data analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes.

Data visualisation: Introduction, Types of data visualisation, Data for visualisation: Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual encodings.

Applications of Data Science, Technologies for visualisation, Bokeh (Python). Recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science.

REFERENCES:

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Explain how data is collected, managed and stored for data science.
2. Understand the key concepts in data science, including their real-world applications and the toolkit used by data scientists.
3. Implement data collection and management scripts using MongoDB.
4. Apply data visualization techniques and data encodings.
5. Implement recent trends in various data collection and analysis techniques.
### Mapping of Cos with POs

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### COURSE OBJECTIVES:

- To understand the fundamentals of Internet of Things.
- To build a small low cost embedded system using Arduino / Raspberry Pi or equivalent boards.
- To apply the concept of Internet of Things in the real world scenario

#### Introduction
- Characteristics
- Physical design
- Protocols
- Logical design
- Enabling technologies
- IoT Levels
- Domain Specific IoTs
- IoT vs M2M

#### IoT systems management
- IoT Design Methodology
- Specifications Integration and Application Development

#### Physical device
- Raspberry Pi Interfaces
- Programming
- APIs / Packages
- Web services

#### Intel Galileo Gen2
- With Arduino
- Interfaces
- Arduino IDE
- Programming
- APIs and Hacks

#### Various Real time applications of IoT
- Connecting IoT to cloud
- Cloud Storage for IoT
- Data Analytics for IoT
- Software & Management Tools for IoT
- IoE
- Overview
- Architecture
- Smart objects and LLNs
- Secure mobility

### REFERENCES:

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Design a portable IoT using Arduino/ equivalent boards and relevant protocols.
2. Develop web services to access/control IoT devices.
3. Deploy an IoT application and connect to the cloud.
4. Analyze applications of IoT in real time scenario.
5. Design IoT based prototypes.

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COURSE OBJECTIVES:
- To understand several key big data technologies used for storage, analysis and manipulation of data.
- To recognize the key concepts of Hadoop framework, MapReduce, Pig, Hive, Hadoop Ecosystem, R, and NoSQL.
- To prepare a sample big data project.

Introduction to Big Data: Big Data and its importance – Characteristics – Big data analytics – Basic requirements – Big data applications – Map Reduce framework – Algorithms using map reduce. NoSQL Databases: Key-value databases – Column-family databases – Document databases – Graph databases.


REFERENCES:

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Categorize and summarize big data and its importance.
2. Differentiate various big data technologies like Hadoop, MapReduce, Hadoop Ecosystem, R, and No-SQL.
3. Apply tools and techniques to analyze big data.
4. Earn tips and tricks for big data use cases and solutions.
5. Apply and analyse statistical models in R using data visualization techniques.

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COURSE OBJECTIVES:
- To understand the concepts 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.


Map Reduce Hadoop Distributed File Systems – Hadoop I/O – Developing Map Reduce Applications – Working of Map Reduce – Types and Formats – Setting up Hadoop Cluster.


REFERENCES:
COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Articulate the main concepts, key technologies, strengths and limitations of cloud computing.
2. Identify the architecture, infrastructure and delivery models of cloud computing.
3. Explain the core issues of cloud computing such as security, privacy and interoperability.
4. Choose the appropriate technologies, algorithms and approaches for the related issues.
5. Develop map reduce applications.

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COURSE OBJECTIVES:
- To understand the issues in the design of web application development
- To learn the concepts of client side and server side technologies, three tier application using MVC and software components using EJB
- To understand and learn the importance of java based security solutions
- To learn the concept of frameworks


Web Application Development: Three tier architecture - Working with model - View - Controller - JCP - J2EE - XML based APIs - Application servers - Presentation tier and EIS tier - Java Mail - JMS - Java transactions - JNDI - Java authentication and authorization services - Java cryptography.

Component Based Development: Service Tier and Data tier - EJB architecture - Session beans - Entity beans - Message driven beans - J2EE connector architecture - Web Services - J2EE Web Services - Patterns – Presentation, service tier and Data tier patterns - J2ME - J2ME application development.


REFERENCES:

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Design and develop web applications using various models.
2. Develop Web applications using HTML and scripting technologies with advanced features.
3. Acquire knowledge of security features supported in Java.
4. Develop web services using J2EE and related technologies.
5. Implement advanced frameworks, MVC frameworks and spring frameworks.

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COURSE OBJECTIVES:
- To learn the design techniques and fundamentals of Human Computer Interaction (HCI)
- To know the various types of existing interfaces and evaluation techniques
- To understand the applications of HCI in emerging trends


REFERENCES:

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Understand the requirements and specifications for the interaction design.
2. Analyze the evaluation techniques of human interaction.
3. Able to design an efficient and user friendly human computer interface.
4. Determine the most appropriate HCI methods to meet the needs of a practical software development project.
5. Analyse and implement cognitive models and Ubiquitous computing applications.

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**COURSE OBJECTIVES:**

- To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.
- To implement soft computing based solutions for real-world problems
- To give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms.
- To provide the student hand-on experience on MATLAB to implement various strategies.


Matlab/Python Lib: Introduction to Matlab/Python, Arrays and array operations, functions and files, study of neural network toolbox and fuzzy logic toolbox. Other Soft Computing techniques: Simulated Annealing, Tabu search, Ant colony optimization (ACO), Particle Swarm Optimization (PSO).

REFERENCES:
5. MATLAB Toolkit.

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Identify and describe soft computing techniques and their roles in building intelligent machines.
2. Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.
3. Apply genetic algorithms to combinatorial optimization problems.
4. Evaluate and compare solutions by various soft computing approaches for a given problem.
5. Implement various applications of GA in Machine Learning.

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Mapping of Cos with POs
AUDIT COURSES
COURSE OBJECTIVES:
- To understand how to improve your writing skills and level of readability
- To learn about what to write in each section
- To understand the skills needed when writing a Title
- To ensure the good quality of paper at very first-time submission

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


Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

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.

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. Useful phrases, how to ensure paper is as good as it could possibly be the first-time submission.

REFERENCES:

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Plan and prepare paragraphs without ambiguity and vagueness.
2. Check plagiarism and paraphrasing.
3. Review the literatures and write a good discussion on any topic.
4. Utilize the knowledge obtained to write a good research paper.
COURSE OBJECTIVES:

- To understand the key concepts in disaster risk reduction and humanitarian response.
- To evaluate disaster risk reduction, humanitarian response policy and practice from multiple perspectives.
- To develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- To understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.


Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

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.

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.

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. Disaster Mitigation: Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

REFERENCES:

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Demonstrate the significance of natural and man-made disasters.
2. Gain knowledge about disaster prone areas in India.
3. Understand post-disaster diseases/epidemics and their remedies.
4. Assess disaster risk and mitigation.

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COURSE OBJECTIVES:
- To get a working knowledge in illustrious Sanskrit, the scientific language in the world.
- To learn Sanskrit for improving brain function.
- To learn Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power.
- To explore the huge knowledge from ancient literature.

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences

Order Introduction of roots, Technical information about Sanskrit literature.

Technical concepts of engineering-electrical, Mechanical, Architecture, Mathematics.

REFERENCES:

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Understand basic Sanskrit language.
2. Study ancient Sanskrit literature about science & technology.
3. Use as a logical language to develop logic in students.

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COURSE OBJECTIVES:
- To understand value of education and self-development.
- To imbibe good values in students.
- To let the students know about the importance of character.


REFERENCES:

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Demonstrate knowledge of self-development.
2. Learn the importance of Human values.
3. Develop the overall personality.

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


REFERENCES:

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Understand the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Know the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Learn 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.

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COURSE OBJECTIVES:
- To review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
- To identify critical evidence gaps to guide the development.

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

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.

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.

Research gaps and future directions: Research design Contexts Pedagogy Teacher education Curriculum and assessment Dissemination and research impact.

REFERENCES:

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Understand pedagogical practices that are being used by teachers in formal and informal classrooms in developing countries.
2. Appreciate the evidence on the effectiveness of these pedagogical practices, conditions, and the population of learners.
3. Realise the teacher education (curriculum and practicum), the school curriculum and guidance materials that best support effective pedagogy.

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COURSE OBJECTIVES:
• To achieve overall health of body and mind.
• To overcome stress.
Definitions of Eight parts of yoga. (Ashtanga)

Yam and Niyam.
Do’s and Don’t’s in life.
   i) Ahinsa, satya, astheya, bramhacharya and aparigraha
   ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan
Asan and Pranayam
   i) Various yog poses and their benefits for mind & body
   ii) Regularization of breathing techniques and its effects-Types of pranayam.

REFERENCES:
1. ‘Yogic Asanas for Group Tarining-Part-I’ : Janardan Swami Yogabhyasi Mandal, Nagpur
2. “Rajayoga or conquering the Internal Nature” by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata
3. Develop healthy mind in a healthy body thus improving social health also
4. Improve efficiency.

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Know the definitions of eight pats of yoga.
2. Understand the Do’s and don’ts in life.
3. Practice various yog poses and realize their benefits.

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COURSE 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

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

73
REFERENCES:

COURSE OUTCOMES:
After the completion of the course, the students will be able to
1. Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life.
2. Understand person who has studied Geeta, who will lead the nation and mankind to peace and prosperity.
3. Study of Neetishatakam will help in developing versatile personality of students.
VALUE ADDED COURSES
COURSE OBJECTIVES:

- To understand the basic concepts of computers and operating systems.
- To familiarize the fundamentals of Internet, web utilities, computer networks.
- To learn the network security and protocols.
- To gain knowledge in the basics of data science.

Introduction to computers and operating systems: Computer system – hardware: input devices, output devices – Software : system software - application Software - utility Software - Virus: types of virus – virus preventive and corrective measures - operating system: Building blocks of a generic operating system – Types of operating system – Functions of operating systems.


REFERENCES:


COURSE OUTCOMES:

After the completion of the course, the students will be able to

1. Identify and describe basic concepts in computers and operating system.
2. Understand and handle Internet facilities.
3. Describe the network protocols and network security systems.
4. Apply various basic data science concepts for a given problem.
COURSE OBJECTIVES:

- To equip the students with some of the basic concepts and principles of data science.
- To make the students learn techniques and tools to deal with data collection and integration, exploratory data analysis, modeling, evaluation, and effective communication.
- To develop skill sets needed to be a data scientist.
- To work effectively on data science projects.

Introduction: Big Data and Data Science hype, Datafication, Data Scientist, Current landscape of perspectives, Statistical Inference - Populations and Samples, Statistical modeling, Probability distributions, Modeling - Exploratory Data Analysis - Philosophy - Data Science Process - Case Study: RealDirect.

Algorithms: Linear Regression, k-NN, k-means, Spam Filters, Naive Bayes, Wrangling - Logistic Regression: Classifiers, Case Study: M6D Logistic Regression.


Recommendation Engines: Nearest Neighbors - Dimensionality Problem - Singular Value Decomposition, Principal Component Analysis - Social Network Analysis.

Data Visualization: Basic principles, ideas and tools for data visualization, Sample projects – Data Engineering algorithms - Data Scientists and Ethics.

REFERENCES:


COURSE OUTCOMES:

After the completion of the course, the students will be able to

1. Describe the basic concepts of Data Science.
2. Apply basic machine learning algorithms for predictive modeling.
3. Apply Exploratory Data Analysis and Data Science process in a case study.
4. Identify approaches used for Feature Generation and Feature Selection and use in applications.
5. Create effective visualization of given data.