VISION OF THE DEPARTMENT:
To educate students with conceptual knowledge and technical skills in the field of Information Technology with moral and ethical values to achieve excellence in academic, industry and research centric environments.

MISSION OF THE DEPARTMENT:
1. To inculcate in students a firm foundation in theory and practice of IT skills coupled with the thought process for disruptive innovation and research methodologies, to keep pace with emerging technologies.
2. To provide a conducive environment for all academic, administrative and interdisciplinary research activities using state-of-the-art technologies.
3. To stimulate the growth of graduates and doctorates, who will enter the workforce as productive IT engineers, researchers and entrepreneurs with necessary soft skills, and continue higher professional education with competence in the global market.
4. To enable seamless collaboration with the IT industry and Government for consultancy and sponsored research.
5. To cater to cross-cultural, multinational and demographic diversity of students.
6. To educate the students on the social, ethical, and moral values needed to make significant contributions to society.
1. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

I. To prepare students to excel in research or to succeed in Information Technology Profession by adapting to the rapid advances in new emerging technologies through rigorous graduate education.

II. To provide students with a solid foundation in mathematical, scientific and engineering fundamentals required to provide IT solutions to real-world problems of Industries, Businesses and Society.

III. To train students with good computer science and engineering knowledge so as to comprehend, analyze, design and create novel products and novel IT services.

IV. To inculcate students in solving real-time problems through IT knowledge and with attention to team work, effective communication skills and critical thinking.

V. To provide student with an academic environment aware of excellence, leadership, ethical codes and guidelines, learning and teamwork for a successful professional career.

2. PROGRAMME OUTCOMES (POs):

On successful completion of the programme, the students will acquire the following:

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<td>1</td>
<td>An ability to independently carry out research /investigation and development work to solve practical problems.</td>
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<td>An ability to write and present a substantial technical report/document.</td>
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<td>A degree of mastery over the field of Information Technology.</td>
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<td>An ability to comprehend, select and adopt appropriate and emerging computing and communication technologies to solve the challenging problems of this information era.</td>
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<td>An ability to recognize the need for applying efficient software and hardware based solutions to improve the quality of life.</td>
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<td>An ability to function effectively as an individual and a team member, in project and product development and to follow professional ethics in the career.</td>
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3. PEO / PO Mapping:

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**EMPLOYABILITY ENHANCEMENT COURSES (EEC)**

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**SUMMARY**

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</table>
UNIT I  ONE DIMENSIONAL RANDOM VARIABLES  12
Random variables - Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Functions of a Random Variable.

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

UNIT III  ESTIMATION THEORY  12

UNIT IV  TESTING OF HYPOTHESES  12
Sampling distributions - Type I and Type II errors - Tests based on Normal, t, Chi-Square and F distributions for testing of mean, variance and proportions – Tests for Independence of attributes and Goodness of fit.

UNIT V  MULTIVARIATE ANALYSIS  12

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1 Use the appropriate and relevant, fundamental and applied mathematical and statistics knowledge and methodologies in solving practical problem.

CO2 Bring together and flexibly apply knowledge to characterize, analyse and solve a wide range of problems.

CO3 Understand the balance between the complexity/accuracy of the mathematical/statistical models used and the timeliness of the delivery of the solution.

CO4 Steeped in research methods and rigor.

CO5 Develop critical thinking based on empirical evidence and the scientific approach to knowledge development.

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RM3151 RESEARCH METHODOLOGY AND IPR L T P C 2 1 0 3

UNIT I RESEARCH PROBLEM FORMULATION 9
Objectives of research, types of research, research process, approaches to research; conducting literature review- information sources, information retrieval, tools for identifying literature, Indexing and abstracting services, Citation indexes, summarizing the review, critical review, identifying research gap, conceptualizing and hypothesizing the research gap

UNIT II RESEARCH DESIGN AND DATA COLLECTION 9
Statistical design of experiments- types and principles; data types & classification; data collection - methods and tools

UNIT III DATA ANALYSIS, INTERPRETATION AND REPORTING 9
Sampling, sampling error, measures of central tendency and variation.; test of hypothesis-concepts; data presentation- types of tables and illustrations; guidelines for writing the abstract, introduction, methodology, results and discussion, conclusion sections of a manuscript; guidelines for writing thesis, research proposal; References – Styles and methods, Citation and listing system of documents; plagiarism, ethical considerations in research

UNIT IV INTELLECTUAL PROPERTY RIGHTS 9
Concept of IPR, types of IPR – Patent, Designs, Trademarks and Trade secrets, Geographical indications, Copy rights, applicability of these IPR; , IPR & biodiversity; IPR development process, role of WIPO and WTO in IPR establishments, common rules of IPR practices, types and features of IPR agreement, functions of UNESCO in IPR maintenance.
UNIT V  PATENTS  9
Patents – objectives and benefits of patent, concept, features of patent, inventive steps, specifications, types of patent application; patenting process - patent filing, examination of patent, grant of patent, revocation; equitable assignments; Licenses, licensing of patents; patent agents, registration of patent agents.

TOTAL: 45 PERIODS

COURSE OUTCOMES
Upon completion of the course, the student can
CO1: Describe different types of research; identify, review and define the research problem
CO2: Select suitable design of experiment s; describe types of data and the tools for collection of data
CO3: Explain the process of data analysis; interpret and present the result in suitable form
CO4: Explain about Intellectual property rights, types and procedures
CO5: Execute patent filing and licensing

REFERENCES:
2. Soumitro Banerjee, “Research methodology for natural sciences”, ISc Press, Kolkata, 2022,

IF3151  ADVANCED DATA STRUCTURES AND ALGORITHMS  L  T  P  C
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UNIT I  ALGORITHMS IN COMPUTING  9

UNIT II  ALGORITHM DESIGN TECHNIQUES  9

UNIT III  HIERARCHICAL DATA STRUCTURES  9
UNIT IV  GRAPH ALGORITHMS

UNIT V  NP-COMPLETE AND NP-HARD

PRACTICAL EXCERCISE:
1. Iterative and recursive algorithms and its complexity analysis.
3. Quick sort algorithm using randomized algorithmic approach.
5. Activity chain and Huffman coding using Greedy approach.
7. Implementation of basic heap operations.
8. Implementation of Top down Splay and Fibonacci Heap operations using Amortized analysis.
9. Representation of Graphs and Graph traversals.
10. Implementation of a Spanning tree for a given graph using Prim’s algorithm.
11. Implementation of a Shortest path of a given graph using Dijkstra’s algorithm

TOTAL: 90 PERIODS

COURSE OUTCOMES:
At the end of the course, students will be able to:
CO1: Analyze and implement suitable iterative or recursive algorithms for a given problem with minimum complexity.
CO2: Create suitable design strategies to solve a problem in an efficient manner.
CO3: Implement hierarchical data structures to approach a real time problem and also to solve it in amortized runs.
CO4: Understand and develop algorithms using graph structures for suitable applications.
CO5: Solve NP Complete problems efficiently.
CO6: Apply appropriate data structures and suitable algorithmic design to implement real time applications.

REFERENCES:

11
UNIT I  
SERVER SIDE ACTIONS  
Node and NPM - Installation - Commands - Packaging - filesystem - http/ https - OS - Path - Process - collaborative version control system git– MERN Stack  

UNIT II  
CLIENT SIDE ACTIONS  
React - Writing different components - Introduction to Typescript - Programming structures - Boolean - Arrays - Tuples - enum - function  

UNIT III  
ADVANCED TYPESCRIPT  
Classes - Inheritance - Interfaces - Namespaces - Modules - Decorators - Debugging Typescript apps - development of a simple web application with typescript  

UNIT IV  
WEBPACK  
Introduction to webpack - dependency graph - Plugins - Modules - Adding node modules - REST Endpoint - mailer - other examples  

UNIT V  
DEPLOYMENT THROUGH CONTAINERS  
Containerization - Installation of Docker - Pulling Images - Creating Images - Deploying to Dockerhub - Development and deployment of js applications in docker  

PRACTICAL EXCERCISE:  
1. Working with git commands  
2. Installation of Typescript  
3. Programming with different data structures and functions using Typescript  
4. Programming with classes and inheritance  
5. Packaging the code with added modules  
6. Development of a web application using React.js  
7. Development of a web application using Node.js  
8. Development of a full stack web application  
9. Deployment of web application using Docker  

COURSE OUTCOMES:  
At the end of the course, students will be able to  
CO1: Work with collaborative version control  
CO2: Develop web applications using Node  
CO3: Use Typescript for Client side actions
CO4: Develop web applications with Typescript  
CO5: Explore webpack for creating web applications  
CO6: Deploy applications through containers

REFERENCES:
1. Frank Zammett, Modern Full-Stack Development Using TypeScript, React, Node.js, Webpack, and Docker, Apress, 2020  
2. David Choi, Full-Stack React, TypeScript, and Node, Packt Publications, 2020  

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IF3152 ADVANCED DATABASE MANAGEMENT SYSTEMS  L T P C  
3 0 2 4

UNIT I DISTRIBUTED DATABASES  

UNIT II NOSQL DATABASES  

UNIT III ADVANCED DATABASE SYSTEMS  

UNIT IV DOCUMENT DATABASES  
UNIT V GRAPH DATABASES


PRACTICAL EXERCISES:
1. Create a distributed database using horizontal and vertical fragmentation in any DBMS.
2. Creation of distributed queries using the fragmented data created.
3. Create a document based database using MongoDB and manipulate the data.
4. Create a document database using Cassandra and manipulate the data.
5. Create a database to store multimedia elements and perform data retrieval operations.
6. Create a temporal database and explore the usage of temporal queries in it.
8. Given JSON and BSON document database and manipulate the data.
9. Create a simple Recommendation engine in E commerce use graph database.
10 Develop a social media application using Graph database.

TOTAL: 75 PERIODS

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

CO1: Design a distributed database system and execute distributed queries.
CO2: Implement NoSQL database systems and manipulate the data associated with it.
CO3: Disseminate knowledge on advanced database system concepts.
CO4: Create real time applications using Spatial, temporal and Mobile Databases.
CO5: Design and develop document databases using XML /JSON databases.
CO6: Build a simple real time application using graph databases and execute queries on it.

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UNIT I  MODERN PROCESSORS AND OPTIMIZATION TECHNIQUES  9
Stored Program Computer Architecture - General cache-based microprocessor architecture -
Memory hierarchies – Multicore processors - Multithreaded processors - Vector processors- Scalar
profiling - Simple measures, large impact - The role of compilers - Dynamic memory management -
Storage order- Case study: Jacobi algorithm and Dense matrix transpose.

UNIT II  PARALLEL COMPUTING  9
Taxonomy of parallel computing paradigms - Shared-memory computers - Cache coherence -
UMA – ccNUMA - Distributed-memory computers - Hierarchical (hybrid) systems - Networks-
Basic performance characteristics of networks - Buses, Switched and fat-tree networks - Mesh
networks, Hybrids - Parallelism- Data parallelism - Functional parallelism - Parallel scalability -
Factors that limit parallel execution - Scalability metrics, Simple scalability laws - Parallel
efficiency, Serial performance versus strong scalability - Refined performance models.

UNIT III  SHARED MEMORY PARALLEL PROGRAMMING  9
Introduction to OpenMP - Parallel execution - Data scoping - OpenMP work sharing for loops –
Synchronization – Reductions - Loop scheduling, Tasking - Case study: OpenMP- parallel Jacobi
algorithm - Advanced OpenMP: Wave front parallelization - Efficient OpenMP programming -
Performance pitfalls - Determining OpenMP overhead for short loops – Serialization - Case study: Parallel sparse matrix vector multiply.

UNIT IV  DISTRIBUTED MEMORY PARALLEL PROGRAMMING  9
Distributed-memory parallel programming with MPI- Message passing - Messages and point-to-
point Communication, Collective Communication - Nonblocking point-to-point Communication -
Virtual topologies - Example: MPI parallelization of a Jacobi solver - MPI implementation -
Performance properties, MPI performance tools - Communication parameters - Synchronization,
serialization, contention - Reducing Communication overhead.

UNIT V  PARALLELISM ON THE NODES  9
LESLIE3D – Parallel Ocean Programming – SWIM – S3D – Load Imbalance – Communication
GALGEL - APSI- EQUAKE – ART.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course, students will be able to
CO1:  Acquire the knowledge of Modern processors and concepts
CO2:  Acquire the ability to identify parallel computers
CO3:  Appreciate the concepts of parallelization in shared memory programming
CO4:  Apply the knowledge on parallel programming using Open MP in distributed memory
CO5: Acquire the knowledge on parallel programming using MPI

CO6: Analyse the performance of parallelism on nodes using multiprocessor programming concepts

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IF3201 SOFTWARE DESIGN METHODOLOGIES  L T P C
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UNIT I INTRODUCTION AND FORMAL METHODS 9

UNIT II REQUIREMENTS ENGINEERING AND MANAGEMENT 9
UNIT III SOFTWARE DESIGN AND SOFTWARE IMPLEMENTATION


UNIT IV SOFTWARE PRACTICES, PROCESSES AND ARCHITECTURE


UNIT V SOFTWARE PROJECT MANAGEMENT


PRACTICAL EXERCISES:

Design, develop, implement and test any one of the following projects:
1. Data Mining.
2. Embedded Projects, Smart Card/Biometrics.
3. Web Based Projects.
5. Artificial Intelligence.

The road map for the project will be the following:
• Identify and propose ways to build quality software for the chosen project.
• Identify, justify and develop an appropriate generic software process model for the chosen project.
• Using the FDD feature template, define a feature set for the chosen project.
• Perform requirements elicitation mechanisms on the selected project and justify the selection of an appropriate strategy.
• Categorize the requirements (considering contradicting, omission, commission of requirements) in a software project.
• Perform analysis.
• Develop a complete process framework.
• Design and model for the chosen project.
• Draw the activity network representation of the tasks for the chosen project.
• Determine ES, EF, and LS, LF for every task.
• Develop the Gantt chart representation for the project.
• Perform software project management tasks.

TOTAL: 75 PERIODS

COURSE OUTCOMES:

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

CO1: Analytically apply general principles of software development in the development of complex software and software-intensive systems.
CO2: Understand methods and techniques for advanced software development and also be able to use these in various development situations.
CO3: Apply testing techniques for object oriented software and web-based systems.
CO4: Familiarize with the basic concepts of Software design and implementation.
CO5: Apply various software metrics on software quality products.
CO6: Apply various skills on real-time projects.

REFERENCES:
3. Learning Agile, Andrew Stellman and Jennifer Greene, O'Reilly, 4th Indian Reprint, 2018

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IF3202 FUNDAMENTALS OF MACHINE LEARNING L T P C 3 0 2 4

UNIT I INTRODUCTION 9

UNIT II SUPERVISED LEARNING - I 9

UNIT III SUPERVISED LEARNING II 9

UNIT IV PROBABILISTIC GRAPHICAL MODELS 9
UNIT V  UNSUPERVISED LEARNING AND REINFORCEMENT LEARNING


PRACTICAL EXERCISES:
1. Develop an application that makes predictions from data using Linear Regression.
2. Develop an application that makes predictions from data using Logistic Regression.
3. Implement a classifier using ID3 and CART algorithms.
5. Develop a system to implement a classifier using SVM
7. Develop a system that can extract the word from the given sentences using the Hidden Markov model.
8. Develop a system that can automatically group articles by similarity using K–Means clustering.

TOTAL: 75 PERIODS

COURSE OUTCOMES:
At the end of the course, students will be able to
CO1: Disseminate the key elements of machine learning and the basics of learning theory.
CO2: Apply regression analysis and decision tree models for regression and classification problems.
CO3: Implement SVM or Neural Network model for an appropriate application and improve the performance using ensemble models.
CO4: Design and implement an BBN, HMM for a sequence model type of application and implement a PGM for any real time application using an open-source tool.
CO5: Use a tool to implement typical clustering algorithms for different types of applications.
CO6: Identify suitable learning tasks to which Reinforcement learning techniques can be applied.

REFERENCES:
IF3203  
INFORMATION SECURITY  

UNIT I  
INTRODUCTION TO SECURITY AND MATHEMATICAL FOUNDATIONS  
9

UNIT II  
SYMMETRIC CRYPTOGRAPHY  
9

UNIT III  
ASYMMETRIC KEY CRYPTOGRAPHY  
9

UNIT IV  
NETWORK SECURITY  
9

UNIT V  
SYSTEM SECURITY  
9

COURSE OUTCOMES:
At the end of the course, students will be able to
CO1: Understand the fundamentals of network security, security architecture, threats and vulnerabilities.
CO2: Apply the different cryptographic operations of symmetric cryptographic algorithms.

TOTAL: 45 PERIODS
CO3: Apply the different cryptographic operations of public key cryptography.
CO4: Apply the various Authentication schemes to simulate different applications.
CO5: Understand various Security practices and System security standards
CO6: Know the state of art technologies like Ethical Hacking, Block chain etc.

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IF3351 NEXT GENERATION WIRELESS NETWORKS  L T P C  3 0 2 4

UNIT I  5G INTERNET AND LEAP TO 6G VISION  9

UNIT II  SMALL CELLS FOR 5G MOBILE NETWORKS  9

UNIT III  COOPERATION FOR NEXT GENERATION WIRELESS NETWORKS  9
UNIT IV NETWORKING TECHNIQUES AND APPLICATIONS FOR 5G NETWORKS 9

UNIT V FUTURISTIC TECHNOLOGICAL ASPECTS OF 6G 9

PRACTICAL EXERCISES: 30
1. Model, Simulate and Test 5G NR PHY in Matlab
2. Evaluating 5G cloud based networks system using C-RAN Simulator.
3. Model a simulator software to generates realistic spatial and temporal wideband channel impulse response using NYUSIM
4. Model and simulate 6G-enabling technologies with MATLAB
5. Create and optimize your intellectual property (IP) for 6G using open MATLAB functions and compare your innovations to existing benchmarks.
7. Scale your simulations for massive MIMO, larger bandwidths, and higher sampling rates. Manage large and long-running simulations by distributing them on multiple cores, clusters, or the cloud and by leveraging GPUs.
8. Perform faster and more accurate RF component modeling for new mmWave and sub-THz frequencies.
9. Simulate propagation loss and channel models in mmWave and sub-THz frequency ranges.
10. Model non-terrestrial networks (NTN) by performing end-to-end link-level simulations, scenario modeling, orbit propagation, and visualization.
11. Explore RF sensing and detect the presence of events or persons in a scene by analyzing RF waveforms.
12. Examine the effect of reconfigurable intelligent surfaces (RIS) on overall system performance.
13. Apply artificial intelligence (AI) techniques, including machine learning, deep learning, or reinforcement learning workflows to solve 6G wireless communications problems.

TOTAL: 75 PERIODS

COURSE OUTCOMES:
At the end of the course, students will be able to
CO1: Compare the 5G network with older generations of networks.
CO2: Identify suitable small cells for different applications in 5G networks.
CO3: Simulate 5G network scenarios.
CO4: Connect applications of FOG Computing
CO5: Design applications with 5G network support.
CO6: Analyze the 6G Networks
REFERENCES:

4. 5G Mobile Communications: Concepts and Technologies 1st Edition

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IF3311 PROJECT WORK I

Individual student carry out project I, the goal of project I is to choose the final year project, Perform Literature Survey, refer IEEE papers, IEEE/ACM papers, study the implementation issues, familiarize with the tools needed for implementation, study necessary simulation software (if any) and implement the initial phase of the project. Three reviews needs to be conducted project report has to be submitted by the team. Final review will be conducted by external member.

COURSE OUTCOMES:

Upon completion of this course, the student should be able to:

CO1: Work as a team, identify a real-world problem that can be solved using IT tools and techniques.

CO2: Analyse existing artifacts and solutions and design novel effective approaches.

CO3: Explore, select, and deploy the appropriate tools for effective implementation of the design.

CO4: Prepare the documentation for the design and implementation, write reports and make presentations justifying the choices made.

CO5: Develop the required collaboration and communication skills to work in a professional team and multi-disciplinary context.

CO6: Quickly develop Proof-of-Concept of solutions to problems.

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Individual student carry out project II, which can be a continuation of project I work or a new problem can be formulated, with necessary Literature Survey by referring to IEEE/ACM transactions/standard peer reviewed journals/conference papers, identify the challenges to be addressed/gaps in the existing research works, propose a solution with necessary architecture with modular design including data required, relevant algorithms, study of necessary simulation software (if any), implement the project, evaluate the work with relevant metrics and finally present the project work with a detailed report.

COURSE OUTCOMES:
Upon completion of this course, the student should be able to:

CO1: Apply the acquired knowledge of basic science and engineering concepts to solve real-world problems.

CO2: Analyse, design and develop IT solutions following best practices.

CO3: Explore, select, and deploy the appropriate tools for effective implementation of projects.

CO4: Prepare the documentation for the design and implementation, write reports and make presentations justifying the choices made.

CO5: Develop the required collaboration and communication skills to work in a professional team and multi-disciplinary context.

CO6: Develop and showcase the complete solution for a given problem in industry/research.

IF3051  ARTIFICIAL LIFE AND ROBOTICS  L T P C  3 0 0 3

UNIT I  ARTIFICIAL LIFE
The Artificial Life - foundations, scope, problems, and approaches of AI, reactive, deliberative, goal-driven, utility-driven, and learning agents-Behavior systems – Emergent behavior- Approaches for Designing the Behavior Programs - Modeling Adaptive Autonomous Agents - Characteristics of Agent Architectures - Example Autonomous Agents.
UNIT II INTRODUCTION TO ROBOTICS 9

UNIT III ROBOTIC SENSORS AND TRAJECTORY PLANNING 9

UNIT IV COMPUTER VISION IN ROBOTICS AND ROBOT PROGRAMMING 9
Vision System Devices, Image acquisition, Masking, Sampling and quantization, Image representation - Picture coding - Object recognition and categorization - Depth measurement with vision systems- Robot guidance with vision systems. Robot control sequencing - Robot programming languages - Sample programs - Smart sensors, MEMS based sensors, Artificial Intelligence and robot programming

UNIT V ROBOTICS APPLICATIONS 9

TOTAL: 45 PERIODS

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

CO1: Design and implement an intelligent autonomous agent for problem solving.

CO2: Demonstrate and illustrate the fundamentals of Robotics.

CO3: Develop robotic design with proper navigation to solve real time problems.

CO4: Apply programmable automation in different subfields of robotics.

CO5: Develop vision-based systems for robot guidance.

CO6: Design and implement a robot for few real time applications.

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IF3057 INFORMATION RETRIEVAL L T P C

UNIT I INTRODUCTION TO INFORMATION RETRIEVAL 9

UNIT II TEXT REPRESENTATION AND QUERYING 9
Porter stemmer; Zipf’s law; morphology; index term selection; using thesauri; Metadata and markup languages (SGML, HTML, XML, DTD) and schema Web linking technologies - Query Operations and Languages – Relevance Feedback – Query Expansion – Query Languages.

UNIT III CATEGORIZATION AND CLUSTERING 9

UNIT IV INFORMATION EXTRACTION AND INTEGRATION 9
Search Engines, Spidering, Web Crawling, Meta-crawlers, Directed spidering, link analysis, Static ranking: Page Rank HITS, shopping agents, Query log analysis, Adversarial IR; Extracting data from text, XML, Ontologies, Thesauri, Semantic Web, collecting and integrating specialized information on the web.

UNIT V RECOMMENDER SYSTEMS AND IR EVALUATION 9
Experimental Evaluation of IR Performance Metrics - Recall, Precision and F Measure – Evaluations on Benchmark Text Collections.

TOTAL: 45 PERIODS

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

CO1: Build an Information Retrieval system using the available tools.
CO2: Identify and design the various components of an Information Retrieval system.
CO3: Apply machine learning techniques to text classification and clustering which is used for efficient Information Retrieval.
CO4: Analyze the Web content structure.
CO5: Analyze the approaches used for recommendation systems.
CO6: Design an efficient search engine

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IF3055 HUMAN COMPUTER INTERACTION

UNIT I INTRODUCTION TO HUMAN-COMPUTER INTERACTION

UNIT II DESIGNING INTERACTIVE SYSTEMS
Implementation support – Windowing systems – Programming in the application – Toolkits – User Interface Management Systems

UNIT III  EVALUATION AND UNIVERSAL DESIGN PRINCIPLES  9

UNIT IV  MODELS AND THEORIES  9

UNIT V  HCI IN COLLABORATIVE APPLICATIONS  9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course, students will be able to
CO1: Demonstrate a comprehensive understanding of the concepts and theories related to human-computer interaction and their application in designing interactive systems.
CO2: Apply user-centred design principles and guidelines to create intuitive and effective user interfaces for interactive systems.
CO3: Utilize appropriate evaluation methods and techniques to assess the usability and user experience of interactive systems, and report evaluation results effectively.
CO4: Analyze and apply various HCI models, such as task models and dialogue models, to design interactive systems.
CO5: Explore and discuss the challenges and implications of HCI in collaborative applications, such as groupware and computer-mediated communication.
CO6: Demonstrate a comprehensive understanding of the principles, theories, and methodologies of human-computer interaction and effectively apply them in the design of user-friendly and efficient interactive systems.

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IF3052 AUTONOMOUS GROUND VEHICLE SYSTEMS  
UNIT I INTRODUCTION TO AUTONOMOUS DRIVING  

UNIT II SENSORS FOR AUTONOMOUS GROUND VEHICLES  

UNIT III ENVIRONMENT PERCEPTION AND MODELING  
Road Recognition: Basic Mean Shift Algorithm, Mean Shift Clustering, Mean Shift Segmentation, Mean Shift Tracking, Road Recognition Algorithm – Vehicle Detection and Tracking: Generating ROIs, Multi Resolution Vehicle Hypothesis, Vehicle Validation using Gabor Features and SVM, Boosted Gabor Features – Multiple Sensor Based Multiple Object Tracking.

UNIT IV NAVIGATION FUNDAMENTALS  

UNIT V VEHICLE CONTROL AND CONNECTED VEHICLE  
COURSE OUTCOMES:
At the end of the course, students will be able to

CO1: Identify the requirements and design challenges of AGVs.
CO2: Select suitable sensors to sense the internal state and external world of AGVs.
CO3: Implement lane detection, road detection & vehicle detection algorithms.
CO4: Simulate/implement ground vehicle navigation algorithms.
CO5: Simulate/implement ground vehicle control systems.
CO6: Design communication protocols for connected vehicles.

REFERENCES:

IF3060 OPEN SOURCE TECHNOLOGIES L T P C
3 0 0 3

UNIT I INTRODUCTION

UNIT II PROCEDURAL PROGRAMMING
Object Oriented Programming in Python - Bank account simulations - Problems with procedural implementation - Building software with Classes, Objects and Instantiation
UNIT III WEB DEVELOPMENT WITH PYTHON 9

UNIT IV WORKING WITH DATABASES 9

UNIT V WORKING WITH CONTAINERS 9
Running software in containers - Installing Dockers - Working with databases such as Redis - Building Docker images - Deployment of applications with Docker

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course, students will be able to
CO1: Use shell commands for executing programs and applications.
CO2: Use Git for collaboration and maintaining different versions.
CO3: Develop a web application using the Flask framework.
CO4: Work with NoSQL structures.
CO5: Develop a server side web application using Python.
CO6: Deploy an application using containers

REFERENCES:
3. Irv Kalb, Object-Oriented Python, O’Reilly, 2022

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UNIT I  PROPOSITION LOGIC  9
Introduction to Logic - Foundation in mathematics - Natural Deduction - Formal language Syntax and Semantics - Normal Forms - Applications in AI.

UNIT II  PREDICATE LOGIC  9
Syntax and semantics - Natural Deduction rules - Expressiveness - Micromodels of software - Inference mechanisms in AI

UNIT III  MODAL LOGIC  9
Higher order logic – Modal logic syntax – Semantics – Accessibility relation – Types of modal logic – Natural deduction.

UNIT IV  TEMPORAL LOGIC  9
Linear Temporal Logic - Syntax - Semantics - Model Checking - Computational Tree Logic - Syntax - Semantics - Application in Operating Systems and Distributed systems

UNIT V  EPISTEMIC LOGIC  9
Logic of knowledge - Syntax - Semantics - Natural Deduction - Multi-agent reasoning - Applications in Distributed systems.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
Upon completion of this course, the student should be able to:

CO1: Understand the mathematical underpinnings of Logic
CO2: Apply Proposition Logic to Computer Science domains
CO3: Understand the reasoning process of Predicate Logic
CO4: Understand the advantages of Higher Order Logic over Lower Order Logic
CO5: Apply Temporal Logic to Distributed Systems
CO6: Design Multi agent systems using Epistemic Logic

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UNIT I  INTRODUCTION  9

UNIT II  SOCIAL NETWORK PROFILES  9
Introduction to Social Networks Profiles – Types of Commercial Social Network Profiles (CSNP) – Quantitative and Qualitative Analysis of CSNP – Analysis of Social Networks Extracted from Log Files – Data Mining Methods Related to SNA and Log Mining – Clustering Techniques – Case Study.

UNIT III  SEMANTICS OF SOCIAL NETWORK  9
Introduction to Ontology based Knowledge Representation – Ontology Languages for the Semantic Web – RDF and OWL – Modeling Social Network Data – Network Data Representation, Ontological Representation of Social Individuals and Relationships – Aggregating and Reasoning with Social Network Data – Advanced Representations.

UNIT IV  SOCIAL NETWORK MINING  9

UNIT V  VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS  9

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course, students will be able to
CO1: Understand basic principles behind network analysis algorithms and develop practical skills in network analysis.
CO2: Model and represent knowledge for social semantic Web.
CO3: Apply data mining techniques on social networks.
CO4: Use extraction and mining tools for analyzing Social networks.
CO5: Develop secure social network applications.
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IF3001 CONVERSATIONAL SYSTEMS L T P C 3 0 0 3

UNIT I FUNDAMENTALS OF CONVERSATIONAL SYSTEMS 9
Introduction: Overview, Case studies, Explanation about different modes of engagement for a human being, History and impact of AI. Underlying technologies: Natural Language Processing, Artificial Intelligence and Machine Learning, NLG, Speech-To-Text, Text-To-Speech, Computer Vision etc. Introduction to Top players in Market – Google, MS, Amazon & Market trends. Messaging Platforms (Facebook, WhatsApp) and Smart speakers – Alexa, Google Home and other new channels. Ethical and Legal Considerations in AI Overview.

UNIT II FOUNDATIONAL BLOCKS FOR PROGRAMMING AND NATURAL LANGUAGE PROCESSING 9

UNIT III BUILDING A CHAT BOT / CONVERSATIONAL AI SYSTEMS 9

UNIT IV ROLE OF ML/AI IN CONVERSATIONAL TECHNOLOGIES AND CONTACT CENTERS
Brief Understanding on how Conversational Systems uses ML technologies in ASR, NLP, Advanced Dialog management, Language Translation, Emotion/Sentiment Analysis, Information extraction, etc. to effectively converse, Introduction to Contact centers – Impact & Terminologies. Case studies & Trends.

UNIT V CONVERSATIONAL ANALYTICS AND FUTURE
Conversation Analytics: The need of it - Introduction to Conversational Metrics - Summary, Robots and Sensory Applications overview - XR Technologies in Conversational Systems, XR-Commerce - Future technologies and market innovations overview.

TOTAL: 45 PERIODS

COURSE OUTCOMES:
At the end of the course, students will be able to
CO1: Familiarize in the NLP tool kit and the pre-processing techniques of natural language processing.
CO2: Familiarize with the basic technologies required for building a conversational system.
CO3: Build a Chatbot for any application and fundamentals needed to deploy it.
CO4: Involve AI in building conversational system and build advanced systems that can be cognitively inclined towards human behaviour.
CO5: Build a real time working conversational system for social domain that can intelligently process inputs and generate relevant replies.
CO6: Ability to identity the role of chatbot in real time environments.

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UNIT I  
FUNDAMENTALS OF WSN  
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UNIT II  
MAC LAYER OF WSN AND ZIGBEE STANDARD  
9

UNIT III  
DATA CENTRIC COMPUTING IN WSN  
9

UNIT IV  
SYNCHRONIZATION, LOCALIZATION AND TRACKING IN WSNs  
9

UNIT V  
DESIGN REQUIREMENT OF BAN AND WBAN  
9

PRACTICAL EXERCISES:  
30
1. Simulate a WSN using MatLab with a 'n' number of nodes and implement data aggregation.
2. Create a WSN and compute the distance between the nodes deployed
3. Simulate an geographical routing protocol using Omnet++
4. Build a WBAN hardware prototype for an health monitoring application using Bluetooth connectivity
5. Deploy an WBAN in hub and spoke model extend the network using Zigbee modules
6. Create WSN model to deploy data centric routing protocols using ns-3
7. Explore Contiki OS and COOJA IDE to simulate a real world application

TOTAL: 75 PERIODS

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

CO1: Understand different types of sensors, their actuators and the architecture of motes.
CO2: Design a WBAN using different networking concepts and hardware interfaces.
CO3: Understand and apply data centric computing in wireless sensor networks.
CO4: Apply appropriate localization techniques for different scenarios.
CO5: Manage sensor networks by synchronizing the time, locating and tracking objects.
CO6: Carry out experiments in simulators and real sensors.

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IF3003 ADVANCED COMPUTER ARCHITECTURE

UNIT I INSTRUCTION LEVEL PARALLELISM 9

UNIT II THREAD-LEVEL PARALLELISM 9
Multi-threading – Multiprocessors - Centralized and Distributed Shared Memory Architectures – Cache Coherence Issues - Performance Issues – Synchronization Issues – Models of Memory Consistency

UNIT III SIMD AND GPU ARCHITECTURES 9
UNIT IV   MEMORY HIERARCHY DESIGN

UNIT V   INTERCONNECT AND STORAGE
Interconnection Networks – Buses, Crossbar and Multi-Stage Switches – Multi-Core Processor Architectures - Case Study. Warehouse- Scale Computers - Programming Models and Workloads – Storage Architectures – Physical Infrastructure – Case Study

PRACTICAL EXERCISES:
1. Write a MIPS program for a simple application in MARS simulator and analyse the possibility of parallel execution.
2. Write a MIPS code to explore string based operation
3. Explore the different system call in MARS simulator for the RISC code execution
4. Consider a RISC code and simulate a compiler based static scheduling of instruction
5. Consider a RISC code and simulate(PDIWeb) instruction dynamic scheduling
6. Explore CodeApeel to simulate Pipeline Dependencies
7. Consider a RISC code and simulate(PDIWeb) instruction dynamic scheduling
8. Write a CUDA program for simple SIMD application

TOTAL: 75 PERIODS

COURSE OUTCOMES:
At the end of the course, students will be able to
CO1: Compare and evaluate the performance of various architectures.
CO2: Design a coherent and consistent memory system for multiprocessor.
CO3: Analyze the requirements of large systems to select and build the right infrastructure
CO4: Design and analyze memory and interconnection system for processor.
CO5: Distinguish and model the multiprocessor architecture styles.
CO6: Point out the hazards present in a pipeline and suggest remedies

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IF3004 VIRTUALIZATION L T P C
3 0 2 4

UNIT I INTRODUCTION TO VIRTUALIZATION
Importance of virtualization- virtualization software operation: virtualizing servers, virtualizing Desktops, virtualizing applications- Understanding hypervisors: types of hypervisor, role of hypervisor- understanding virtual machines-working with virtual machines

UNIT II VIRTUAL MACHINES ON THE DESKTOP
VM types-Installing VM tools for windows and linux-building windows VM and linux VM-Managing VMs: backing up and modifying VM configurations, copying and moving VM workstation-VM CLI administration and keyboard shortcuts-monitoring and configuring VM performance.

UNIT III VIRTUALIZE STORAGE
SCSI-Fibre channel-iSCSI-SAN backup and recovery techniques-RAID:The root for storage virtualization-SNIA shared storage model-Applying SNIA shared storage model- Hierarchical storage management- virtual tape libraries.

UNIT IV NETWORKING VIRTUALIZATION

UNIT V APPLICATIONS
Understanding availability: Increasing availability, protecting a virtual machine, protecting multiple virtual machines, protecting data centers-Understanding applications in a virtual machine: virtual infrastructure performance capabilities, deploying applications in a virtual environment, understanding virtual appliances and vApps, Openstack and containers.

PRACTICAL EXERCISES:
1. installation of various hypervisors and instantiation of VMs with image file using open source hypervisors such as Virtual Box, VMWare Player, Xen and KVM.
2. Simple application for communications across VMs using VMware
3. Installation of OpenStack.
4. Creation of VMs and installing applications and executing simple programs in OpenStack.
5. Implementing windows and linux virtual file systems.
6. Creation of simple network topology using open source network virtualization tools (like mininet and others).
7. Building microsoft and Linux virtual machine clusters
8. Implementation of various scheduling mechanisms using an open source cloud simulator.

TOTAL: 75 PERIODS

COURSE OUTCOMES:
At the end of the course, students will be able to
CO1: Analyse the virtualization concepts and Hypervisor
CO2: Work with virtual machines on windows and linux.
CO3: Setup, Configure and manage virtual storage with RAID and Intelligent storage systems.
CO4: manage networks for VM and additional devices in virtual machine
CO5: gain knowledge on availability and deploy application VM environments.
CO6: Apply the Virtualization for real-world applications and Experiment with the VM with various software

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IF3005 ADVANCED OPERATING SYSTEM TECHNIQUES L T P C
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UNIT I OPERATING SYSTEM BASICS 6
Overview – Synchronization Mechanisms – Process and Threads– Critical Section Problem
Synchronization Problems: Dining Philosophers, Producer consumer – Language Mechanism for
Synchronization: Monitors, Serializers, Path Expressions, Communicating Sequential Processes –
Resources.

UNIT II DISTRIBUTED OPERATING SYSTEM 11
Issues in Distributed Operating System – Communication Primitives – Lamport’s Logical clocks –
Vector Clocks – Causal Ordering of Messages – Distributed Mutual Exclusion Algorithms:
Lamport’s Algorithm – The Ricart-Agarwala Algorithm – Maekawa’s Algorithm – Centralized and
Distributed Deadlock Detection Algorithms.-Agreement Protocols-A Classification of Agreement
Problems-A Classification of Agreement Problems.

UNIT III DISTRIBUTED RESOURCE MANAGEMENT 10
Distributed File System – Mechanisms for Building Distributed File Systems-Design Issues -
Distributed Shared Memory – Algorithms for Implementing Distributed Shared memory– Issues in
Load Distributing – Components of a Load Distributing Algorithm- Stability-Load Distributing
Algorithm.
UNIT IV  FAILURE RECOVERY AND REAL TIME OPERATING SYSTEMS  
Failure Recovery: Synchronous and Asynchronous Check Pointing and Recovery – Algorithm for 
Check pointing in a DDBS- Algorithm for Site Recovery- Fault Tolerance: Two-Phase Commit 
Systems – Characteristics– Applications of Real Time Systems – Real Time Task Scheduling – 
Handling Resource Sharing

UNIT V  CASE STUDIES  
The FreeBSD System: Design principle – Interface – Process Management– Memory 

PRACTICAL EXERCISES:  
1. Introduction to Linux and shell programming. (4 hours) 
2. Write a program to implement a distributed chat server using TCP socket. 
3. Write a program to implement client server RPC and client server based program using RMI. 
4. Write a multi threaded client server program. 
5. Write a program to simulate the functioning of lamports logical clock and lamports vector 
clock. 
6. Write a program to implement Christian’s algorithm and Berkeley algorithm. 
7. Write a program to check grep and pipe commands in FreeBSD. 
8. Write a program to do file permission and directory file permission in free BSD. 
9. Write a program to building multi-threaded and multi-process application. 

TOTAL: 75 PERIODS

COURSE OUTCOMES: 
At the end of the course, students will be able to 
CO1: Articulate the main concepts, key ideas, strengths and limitations of operating systems. 
CO2: Analyze the structure and basic architectural components of OS. 
CO3: Have an understanding of high-level OS kernel structure. 
CO4: Used gained insight into hardware-software interactions for compute and I/O. 
CO5: Acquire practical skills in system tracing and performance analysis. 
CO6: Explore research ideas in system structure and behaviour.

REFERENCES:
Media, 2011. 
IF3006 DEEP LEARNING L T P C 3 0 2 4

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

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

UNIT III ADVANCED DEEP LEARNING ARCHITECTURES 9

UNIT IV DEEP REINFORCEMENT LEARNING 9

UNIT V APPLICATIONS OF DEEP LEARNING 9

PRACTICAL EXERCISES: 30
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
COURSE OUTCOMES:
At the end of the course, students will be able to

CO1: Understand the role of Deep learning in Machine Learning Applications.
CO2: To get familiar with the use of TensorFlow/Keras in Deep Learning Applications.
CO3: To design and implement Deep Learning Applications.
CO4: Critically Analyse Different Deep Learning Models in Image Related Projects.
CO5: To design and implement Convolutional Neural Networks.
CO6: To know about applications of Deep Learning in NLP and Image Processing.

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IF3059 MOBILE APPLICATION DEVELOPMENT AND DEPLOYMENT

UNIT I INTRODUCTION

UNIT II USER INTERFACE
Generic UI development – UI Components – Event Handling – Designing the right UI – Multimodal and multichannel UI – Gesture based UI – Screen Elements and Layouts – Voice XML

UNIT III APPLICATION DESIGN
Memory Management – Design Patterns for Limited Memory - Work Flow for Application development – Java API - Dynamic Linking - Plugins and rule of thumb for using DLLs - Concurrency and resource management – File Management – Data Base Management: SQLite
UNIT IV APPLICATION DEVELOPMENT I

UNIT V APPLICATION DEVELOPMENT II

PRACTICAL EXERCISES:
1. Install and configure java development kit (JDK), android studio and android SDK.
2. Develop an application that uses GUI components, fonts and colors.
3. Design an application that uses Layout Managers, Event listeners, Event handling and push notification in Android.
4. Build a simple native calculator application to do simple arithmetic operations.
5. Create animations and graphical primitives in Android environment.
6. Develop an application that makes use of SQL Lite mobile database.
7. Develop an application that makes use of internet for communication using Firebase to send SMS and E-Mail services.
8. Implement an android application that writes data into the SD card and makes use of Notification Manager.
9. Develop a native application that uses Location based services such as GPS tracking, geofencing, and activity recognition using Google play services.
10. Implement simple gaming application using open source tools like flutter or Unity.

TOTAL: 75 PERIODS

COURSE OUTCOMES:
At the end of the course, students will be able to
CO1: Design the right user interface for mobile application
CO2: Implement mobile application using UI toolkits and frameworks
CO3: Design mobile applications that is aware of the resource constraints of mobile devices
CO4: Develop web based mobile application that accesses internet and location data
CO5: Implement android application to use telephony for SMS communication
CO6: Implement android application with multimedia support

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IF3053 BLOCKCHAIN TECHNOLOGIES L T P C 3 0 2 4

UNIT I INTRODUCTION TO BLOCKCHAIN History of Blockchain – Blockchain Architecture - Distributed Ledger Technology (DLT); Blocks and Chain Structure; Types of Blockchain – Consensus – Consensus algorithms- Decentralization using Blockchain – Blockchain and Full Ecosystem Decentralization – Platforms for Decentralization.

UNIT II BITCOIN AND CRYPTOCURRENCIES History and Origins of Bitcoin; Bitcoin Technology and Architecture - Transactions and Scripting Language- Bitcoin Wallets; Bitcoin Mining; Bitcoin Transactions and Network; Alternative Coins - Bitcoin Limitations; Name Coin – Prime Coin – Zcash –Bitcoin Smart Contracts – Ricardian Contracts.

UNIT III ETHEREUM Ethereum and its features ; Ethereum Architecture : Ethereum Virtual Machine (EVM) -The Ethereum Network –Runtime Byte Code, Blocks and Blockchain, Fee Schedule— Ethereum Programming Languages, Smart Contracts Development ; Ethereum Scaling Solutions, Ethereum DApps and Use Cases; Ethereum Community and Ecosystem


PRACTICAL EXERCISES:
1. Construct the simple blockchain based application to store and retrieve the cryptocurrencies.
2. Create the wallet to send the digital currencies from one account to another account.
3. Understand the technology components of Blockchain and how it works behind – the scenes.
4. Be aware of different approaches to developing decentralized applications.
5. Perform bitcoin transactions using Python - bitcoinlib.
6. Understand the Bitcoin and its limitations by comparing with other alternative coins.
7. Develop the environment for Ethereum by using Ganache.
8. Create the nodes on Ethereum blockchain and mine the blockchain.
9. Establish deep understanding of the Ethereum model, its consensus model and code execution.
10. Learn Solidity programming language and develop simple Ethereum based applications.
11. Build the decentralized app and deploy it to provide Ethereum environment.
12. Build a simple application using hyperledger in blockchain environment.
14. Design a smart contract and test it in a Ethereum environment.
15. Develop a block chain based applications which is suitable for your online shopping services.

TOTAL: 75 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the technology components of Blockchain and how it works behind-the-scenes.
CO2: Aware of different approaches to developing decentralized applications.
CO3: Understand the Bitcoin and its limitations by comparing with other alternative coins.
CO4: Establish deep understanding of the Ethereum model, its consensus model, code execution.
CO5: Understand the architectural components of a Hyperledger and its development framework.
CO6: Come to know the Alternative blockchains and emerging trends in blockchain.

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UNIT I  INTRODUCTION

UNIT II  DEVICE LAYER

UNIT III  DEVELOPING IOT SYSTEMS

UNIT IV  CLOUD OFFERINGS AND ANALYTICS

UNIT V  IoT MANAGEMENT & CASE STUDIES

PRACTICAL EXERCISES:
1. Develop a BLINK sketch in Arduino.
2. Develop an Arduino sketch that repeats an LED to glow brightly, decrease the brightness, switches off the LED, increases the brightness and LED glows with maximum intensity (a sketch for fading).
3. Develop an Arduino sketch that takes sensor readings for five seconds during the startup, and tracks the highest and lowest values it gets. These sensor readings during the first five seconds of the sketch execution define the minimum and maximum of expected values for the readings taken during the loop (a sketch for calibrating a sensor).
4. Develop an Arduino sketch that reads the value of a variable resistor as an analog input and changes blink rate of the LED.
5. Develop an Arduino sketch to use a piezo element to detect the vibration.
6. Develop a Python program to control an LED using Raspberry Pi.
7. Develop a Python program to interface an LED with a switch using Raspberry Pi.
8. Miniproject.

TOTAL: 75 Periods
COURSE OUTCOMES:
At the end of the course, students will be able to
CO1: Understand the evolution of the Internet and the impact of IoT in the society.
CO2: Design portable IoT devices using Arduino IDE/ Raspberry Pi with Python.
CO3: Apply appropriate protocols in various parts of IoT based systems.
CO4: Use cloud offerings and big data tools in IoT based systems.
CO5: Implement Map-Reduce based programs using Apache frameworks.
CO6: Design, deploy and manage complex IoT based systems.

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IF3063 VISUALIZATION METHODS AND TECHNIQUES L T P C 3 0 2 4

UNIT I INTRODUCTION 9

UNIT II VISUAL REPRESENTATION 9

UNIT III MULTIMODAL PRESENTATION 9
UNIT IV INTERACTION TYPES

Interaction Concepts and Techniques – Problem of Information overload – Interaction Types-
Human Computer Interaction-Norman’s Action Cycle-Interaction for: Information Visualization,
Navigation, Models, Involuntary, Interactive Medical Application- Tactile Maps for Visually
Challenged People.

UNIT V ADVANCE DESIGN TECHNIQUES

Designing Effective Visualization, Comparing and Evaluating- Research Directions –Systems-
Personal view –Attitude-Idea Generation- Convergence- Sketching- Evaluation Criteria – Analytic
and Empirical Method – Case Study – Interactive Calendars –Selecting one from many- Animation
Design for Simulation.

PRACTICAL EXERCISES:

1. Representing data in different visualization chart (bar, pie, etc) R language
2. Exploring various Visualization tools (Open Source)
3. Implementation of the interactive forms.
4. Implementing various types of data representation.
5. Creating Interoperable Web Visualization Components using Candela tool.
6. Implementing Line and Stacked charts with Labels and Notes using Data wrapper tool.
7. Creating Interactive Charts using Google Chart tool.
8. Working with animation using Chartist.js tool.

TOTAL: 75 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the concepts and techniques used in Visualization Techniques.
CO2: Implement different techniques of information representation.
CO3: Implement various presentations of information.
CO4: Apply different interaction types used to present information.
CO5: Design and implement effective Visualization.
CO6: Create and evaluate interactive data Visualization real-time problem.

REFERENCES:

1. O.Ward, Georges Grinstein and Daniel Keim,” Interactive Data Visualization Foundations,
IF3056  IMAGE PROCESSING AND COMPUTER VISION  L T P C  3 0 2 4

UNIT I  FUNDAMENTALS OF IMAGE PROCESSING  9
Introduction – Applications of Image Processing – Steps in Image Processing Applications –
Human vision and color perception- Digital Imaging System – Imaging sensors-Sampling and
Quantization – Pixel Connectivity – Distance Measures – Colour Fundamentals and Models – File
Formats – Image Operations.

UNIT II  IMAGE ENHANCEMENT AND TRANSFORMS  9
Image Transforms: Discrete Fourier Transform – Fast Fourier Transform –– Wavelet Transforms -
Image Enhancement in Spatial and Frequency Domain – Grey Level Transformations – Histogram
Processing –Spatial Filtering – Smoothing And Sharpening – Frequency Domain: Filtering in
Frequency Domain.

UNIT III  RESTORATION AND BOUNDARY DETECTION  9
Image Restoration – Image Degradation Model – Noise Modeling – Blur – Order Statistic Filters –
Image Restoration - Morphological operations- dilatation-eration-opening-closing- edge detection-
corner detection - detection of Discontinuities Edge Linking and Boundary Detection

UNIT IV  IMAGE SEGMENTATION AND FEATURE EXTRACTION  9
Image Segmentation — Thresholding – Region based Segmentation – Image Features and
Extraction – Image Features – Types of Features – Feature extraction – SIFT ,SURF– Feature
reduction algorithms- PCA.

UNIT V  IMAGE CLASSIFIER AND APPLICATIONS  9
Image Classifiers – Supervised Learning – maximum likely hood-minimum distance-parallopipded-
Support Vector Machines, Image Clustering – Unsupervised Learning – kMeans-Hierarchical and
Partition based Clustering Algorithms –ANN-Deep learning image classifier

PRACTICAL EXERCISES:

1. Implementation of Reading and Writing of Images in Matlab and OpenCV/Octave/SciLab.
2. Implementation of simple spatial filters like Low Pass Filters and High Pass Filters in
Matlab/OpenCV.
3. Implementation of Histogram Techniques in Matlab/Octave/OpenCV.
5. Implementation of Fourier and Wavelet Transforms in Matlab/Octave.
8. Implementation of Image Classifier using SVM in Matlab/Octave/ OpenCV.
10. Implementation of Feature extraction in images using Matlab/Octav/opencv

TOTAL: 75 PERIODS

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

CO1: Implement basic image processing operations.
CO2: Apply and develop new techniques in the areas of image enhancement and frequency transforms
CO3: To restore images from noise and to extract edges and boundaries.
CO4: Understand the image segmentation algorithms and Extract features from images.
CO5: Apply classifiers and clustering algorithms for image classification and clustering.
CO6: Design and develop an image processing application that uses different concepts of image processing.

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IF3058 MIXED REALITY TECHNIQUES

UNIT I INTRODUCTION TO MIXED REALITY

Introduction to virtual reality (VR), augmented reality (AR), and Mixed Reality (MR) – History – MR
Use cases & Designing for MR platforms – Mixing Virtual with Real - MR hardware and devices – The Input – The output – Optical see through displays – Eye Tracking- Computer vision for MR

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UNIT II INTERACTION DESIGN IN MR

UNIT III SOFTWARE DESIGN AND IMPLEMENTATION

UNIT IV MIXED REALITY AND HUMAN-ROBOT INTERACTION

UNIT V APPLICATIONS OF MIXED REALITY

PRACTICAL EXERCISES:
1. Design and implement an interactive MR application with gesture or motion controller input for interacting with virtual objects.
2. Create a virtual tour MR application for exploring historical sites or museum exhibits with informative content.
3. Develop an AR experience using marker-based tracking for scanning physical markers to reveal interactive virtual content.
4. Design and implement a collaborative MR application for multiple users to interact and collaborate in a shared virtual space.
5. Create an MR puzzle game where users solve virtual puzzles and challenges using interactions with virtual objects and the real-world environment.
7. Design an AR educational experience that reveals interactive 3D models and additional information when scanning textbook pages or learning materials.
8. Create an immersive MR storytelling experience where users interact with characters and objects to progress through a narrative.
9. Develop an MR training simulation for practicing specific tasks or skills in a safe and controlled environment.
10. Design and implement an AR wayfinding application for overlaying navigation instructions and points of interest onto the real-world environment.

TOTAL: 75 PERIODS

COURSE OUTCOMES:
At the end of the course, students will be able to
CO1: Demonstrate knowledge and understanding of VR, AR, and MR concepts, technologies, and applications.
CO2: Apply design principles and considerations specific to Mixed Reality platforms.
CO3: Understand interaction design principles in Mixed Reality.
CO4: Apply software design and implementation skills for Mixed Reality systems.
CO5: Demonstrate knowledge of the intersection of Mixed Reality and Human-Robot Interaction (HRI).
CO6: Analyze and evaluate the integration of Mixed Reality technologies and principles into real-world applications

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IF3007 GPU ARCHITECTURE AND PROGRAMMING

UNIT I GPU ARCHITECTURE

UNIT II CUDA PROGRAMMING

UNIT III OPENCL BASICS

UNIT IV GPU PROGRAMMING: PyCUDA
GPU programming using PyCUDA: kernels, threads, blocks, and grids – thread synchronization and intercommunication – Parallel prefix algorithm – Streams, events, contexts, and concurrency.

UNIT V ALGORITHMS ON GPU
Parallel Patterns: Convolution, Prefix Sum, Sparse Matrix – Matrix Multiplication – Programming Heterogeneous Cluster.
PRACTICAL EXERCISES:
1. Implement matrix multiplication using CUDA. Experiment with different matrix sizes and kernel launch options and compare the performance. (4 hours)
2. Implement vector reduction using CUDA, and check output with CUDA profiler.
3. Implement matrix multiplication with tiling and shared memory.
4. Implement various performance tuning techniques for matrix multiplication.
5. Implement matrix multiplication using OpenCL.
6. Implement vector reduction using OpenCL.
7. Implement graph traversal using CUDA
8. Implement image processing algorithms using CUDA
9. Experiment with advanced features such as dynamic parallelism
10. Mini project: Choose an application and implement using GPU and do performance analysis.

TOTAL: 75 PERIODS

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

CO1: Describe GPU Architecture
CO2: Write programs using CUDA, identify issues and debug them
CO3: Program GPU using OpenCL
CO4: Program GPU using CUDA and PyCUDA
CO5: Given a problem, identify efficient parallel programming patterns to solve it
CO6: Compare different GPU programming paradigms

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IF3008  SERVICE ORIENTED ARCHITECTURE AND MICROSERVICES  L T P C  3 0 2 4

UNIT I  SOFTWARE ENGINEERING PRACTICES  9

UNIT II  SOA AND MICROSERVICE ARCHITECTURE BASICS  9

UNIT III  CONTENTS SERVICE – ORIENTED ENTERPRISE APPLICATIONS  9

UNIT IV  SERVICE ORIENTED ANALYSIS AND DESIGN  9

UNIT V  MICROSERVICE ARCHITECTURE  9

PRACTICAL EXERCISES:  30
1. Implementing a Tier – 1, Tier – 2 and Tier – 3 programs
2. UML diagrams for a business application
3. Implementation of SOAD process
4. Implementation of Strawman architecture for loan application
5. Service Oriented Model using Java EE Enterprise Application
6. Design activity services for banking application
7. Design data services for banking application
8. Design client services for banking application
9. Virtual implementation of micro services in cloud environment

COURSE OUTCOMES:
At the end of the course, students will be able to
CO1: Analyze and design SOA based solutions.
CO2: Understand the basic principles of service orientation.
CO3: Implement and analyze Java EE Enterprise Application

TOTAL: 75 PERIODS
CO4: Understand the technology underlying service design.
CO5: Implement SOA with Micro Services applications.
CO6: Classify and make reasoned decision about the adoption of different SOA platforms.

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IF3009 CYBER FORENSICS

UNIT I INCIDENT AND INCIDENT RESPONSE
9

UNIT II OPERATING SYSTEM FORENSICS
9
UNIT III  FILE STORAGE AND DATA RECOVERY

UNIT IV  MOBILE FORENSICS
Introduction to Mobile technologies – Functions of Bluetooth and security issues – Phone Phreaking – Call Tampering – Types of evidences present in mobile forensics – Mobile phone evidence extraction process – Mobile forensic investigation tool kit – Tracking of mobile phone location.

UNIT V  IMAGE AND VIDEO FORENSICS

PRACTICAL EXERCISES:  
1. Demonstrate some of the mechanisms used by malicious attackers as well as forensic experts to disrupt computer networks and manipulate information access.
2. Demonstrate FTK Imager to access data’s evidence. It is used to quickly preview and create a forensically sound image of the disk if the preview warrants such action.
3. Demonstrate how data can be modified within a file or hidden on a disk without the data being saved as a file.
   b. MD5Hash (Freeware download from www.digitaldetective.co.uk/freetools/md5.asp).
   c. Text editor (Notepad is good enough).
4. Demonstrate how an attacker could exploit a machine and obtain access to a server with a filtered port by piping another unfiltered port.
   b. FPIPE (Freeware download from http://www.foundstone.com).
   c. FPORT (Freeware download from www.digitaldetective.co.uk/freetools/md5.asp).
5. Show how the encrypted Internet Explorer cache may be viewed using some freely available tools.
6. Demonstrate the typical use of steganography
7. Demonstrate mobile forensics with software:
   a. BitPim.
   b. Mobile Phone Examiner (MPE+).
   c. Trace an Email.
   d. eMailTrackerPro.

COURSE OUTCOMES:
At the end of the course, students will be able to
CO1: Recognize attacks on systems.

TOTAL: 75 PERIODS
CO2: Design a counter attack incident response and incident-response methodology.
CO3: Illustrate the methods for data recovery, evidence collection and data seizure.
CO4: Understand network and email attacks and forensic investigation with tools.
CO5: Use Forensic tools and collect evidences of a computer crime.
CO6: Analyze various image encryption/decryption, steganography and fraud in image.

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IF3010 BIOMETRICS L T P C
3 0 2 4

UNIT I BIOMETRICS FUNDAMENTALS 9

UNIT II FINGER AND FACIAL SCAN 9
Finger scan – Features – Components – Operation (Steps) – Competing finger Scan technologies Strength and weakness. Types of algorithms used for interpretation. Facial Scan - Features Components – Operation (Steps) – Competing facial Scan technologies–Strength-weakness.

UNIT III IRIS AND VOICE 9
Iris Scan - Features – Components – Operation (Steps) – Competing iris Scan technologies – Strength and weakness. Voice Scan - Features – Components – Operation (Steps) – Competing voice Scan (facial) technologies – Strength and weakness.

UNIT IV PHYSIOLOGICAL BIOMETRICS 9
Other physiological biometrics – Hand scan – Retina scan – AFIS (Automatic Finger

UNIT V BIOMETRICS APPLICATION DEVELOPMENT


PRACTICAL EXERCISES:

Installation of Matlab / Octave / Scilab Environments.
1. Explore the Octave / Scilab open-source software.
2. Implement a Matlab/Octave program to
3. Remove the noise present in an image.
4. Implement spatial filters to enhance the quality of the image.
5. Extraction of intensity features from an image
6. Extraction of features from the face, such as fiducial points.
7. Extraction of features from Iris images.
8. Read and playing of an audio file.
9. Extraction of audio features.
10. To extract keystroke features.
11. To match two images.
12. To match two signatures using template matching.

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

CO1: Implement basic biometrics related algorithms
CO2: Familiar with the use of MATLAB and its equivalent open source environments
CO3: Design and implement industrial applications that incorporates different concepts of biometrics
CO4: Critically analyze different approaches to implement mini projects in industrial environment and in security related projects
CO5: To know about Biometric standards
CO6: To know about Biometrics Application development

REFERENCES:
UNIT I  INTRODUCTION TO GRAPHIC TOOLS  9

UNIT II  RASTERIZATION  9
Lines-Filled Triangles-Shaded Triangles-Perspective Projection-Describing and Rendering a Scene-Clipping-Hidden Surface Removal-Shading-Textures-Extending the Rasterizer.

UNIT III  RAYTRACING  9
Introductory Concepts-Basic Raytracing- Light-Shadows and Reflections- Extending the Raytracer-shading and surface characteristics..

UNIT IV  PRINCIPLE OF ANIMATION  9
Introduction-Human Development-Developing Characters-Writing structure-Story Board-Gag Writing-Discourse-Script-Editing and rewriting-Types of Animation

UNIT V  ANIMATION TECHNIQUES  9
Introduction-Technical Background-Interpolation-Based Animation-Kinematic Linkage-Motion Capture-Physically Based Animation-Fluids: Liquids and Gases, Modelling and Animating Human Figures-Facial Animation - Behavioural Animation-Crowd Animation-interactive Animation-Visual Effects

PRACTICAL EXERCISES:  30
1. Implementation of OpenGL and Blender
2. Creating simple objects in OpenGL applying color and pattern
3. Creating object in OpenGL and applying transformation to it.
4. Creating interactive Scene using OpenGL.
5. Implementing the concept of Ray tracing in OpenGL.
8. Developing a Speaking Human Avatar and embedding voice to it.
9. Writing Script for a interactive Game of your choice.
10. Developing an interactive animated game.

TOTAL: 75 PERIODS
COURSE OUTCOMES:
At the end of the course, students will be able to
CO1: Demonstrate the concepts and techniques used in Animation Tool
CO2: Design and implement algorithms and techniques applied to Rendering.
CO3: Design and implement real world effect to scene.
CO4: Understand the basic concept of animation design.
CO5: Apply the mechanics concepts to design animation.
CO6: Create an interactive animation using animation techniques

REFERENCES:

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