Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Branch: B Tech Honours (Artificial Intelligence) **Semester - VII**

Subject: Intelligent System and Robotics **Subject Code: ……**

Total Theory Periods: 40 **Total Tutorial Periods: 10**

No. of Class tests to: 2 (Minimum) **No. of Assignments to be submitted: One per Unit**

ESE Duration: Three Hours, **Maximum Marks in ESE: 100**

Minimum Marks in ESE: 35

Course Objectives

1. Gain comprehensive understanding of intelligent systems and robotics, encompassing their principles, algorithms, and technologies.
2. Explore the diverse applications of intelligent systems and robotics across various domains.
3. Develop proficiency in designing, developing, and deploying intelligent robotic systems for real-world tasks.
4. Familiarize with advanced concepts and techniques essential for effective utilization of intelligent systems in practical scenarios.
5. Acquire practical skills and theoretical knowledge necessary to address challenges and opportunities in the field of intelligent systems and robotics.

Course Outcomes

Upon successful completion of the course, students should be able to:

1. Understand the fundamental concepts of intelligent systems and robotics, including perception, cognition, and action.
2. Analyze the components and architecture of intelligent robotic systems, including sensors, actuators, and control systems.
3. Apply machine learning and artificial intelligence techniques to enable autonomous decision-making and adaptive behavior in robotic systems.
4. Design and implement algorithms for robot perception, navigation, manipulation, and interaction with the environment.
5. Develop practical robotic applications for tasks such as autonomous exploration, object recognition, manipulation, and human-robot interaction.
6. Evaluate the performance, reliability, and safety of intelligent robotic systems in real-world scenarios.

Unit 1: INTRODUCTION TO INTELLIGENT SYSTEMS AND ROBOTICS

Overview of intelligent systems and robotics: history, applications, and challenges, Principles of robotic perception, cognition, and action, Introduction to robotic hardware and software platforms, Ethical considerations and societal impacts of intelligent robotics

Unit 2: ROBOT PERCEPTION AND SENSING

Sensory modalities in robotics: vision, touch, proprioception, and environmental sensing, Sensor fusion techniques for multimodal perception, Feature extraction and object recognition in robotic vision, Localization and mapping algorithms for robot navigation.

Unit 3: ROBOT CONTROL AND DECISION MAKING

Control architectures for autonomous robots: reactive, deliberative, and hybrid approaches, Path planning and motion control techniques for robot navigation, Reinforcement learning and planning algorithms for decision-making in robotics, Human-robot interaction and collaborative robotics

Unit 4: ROBOT MANIPULATION AND INTERACTION

Robotic manipulation: kinematics, dynamics, and control of robot arms and grippers, Grasping and manipulation techniques for object manipulation, Human-robot interaction: gesture recognition, speech processing, and natural language understanding, Assistive robotics and applications in healthcare, manufacturing, and service industries

Unit 5: ADVANCED TOPICS IN ROBOTICS

Robot learning and adaptation: learning from demonstration, imitation learning, and transfer learning, Autonomous exploration and mapping in unknown environments, Swarm robotics and collective intelligence, Emerging trends and future directions in intelligent systems and robotics

TEXTBOOKS

1. "Introduction to Autonomous Robots: Mechanics, Sensors, Actuators, and Algorithms", Nikolaus Correll, Bradley Hayes, Adam Hoover, Derek Kingston, Publisher: MIT Press, 2019.
2. "Robotics: Modelling, Planning and Control", Authors: Bruno Siciliano, Lorenzo Sciavicco, Luigi Villani, Giuseppe Oriolo, Springer, 2009.

REFERENCE BOOKS

1. "Probabilistic Robotics", Authors: Sebastian Thrun, Wolfram Burgard, Dieter Fox, MIT Press , 2005
2. Robotics: Everything You Need to Know About Robotics from Beginner to Expert", Peter Mckinnon, CreateSpace Independent Publishing Platform, 2018
3. Modern Robotics: Mechanics, Planning, and Control", Kevin M. Lynch, Frank C. Park, Cambridge University Press, 2017

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Branch: B Tech Honours (Artificial Intelligence) **Semester - VII**

Subject: Business Intelligence and Analytics **Subject Code: ……**

Total Theory Periods: 40 **Total Tutorial Periods: 10**

No. of Class tests to: 2 (Minimum) **No. of Assignments to be submitted: One per Unit**

ESE Duration: Three Hours, **Maximum Marks in ESE: 100**

Minimum Marks in ESE: 35

Course Objectives

1. Gain a comprehensive understanding of principles, techniques, and technologies for analyzing and extracting insights from business data.
2. Acquire knowledge and skills in applying artificial intelligence (AI) and data analytics techniques to address real-world business challenges.
3. Develop the ability to optimize decision-making processes through data-driven insights.
4. Learn to leverage data analytics to drive strategic initiatives within organizations.
5. Equip students with practical skills to solve business problems effectively using business intelligence and analytics tools and methodologies.

Course Outcomes

Upon successful completion of the course, students should be able to:

1. Understand the fundamental concepts of business intelligence (BI) and analytics, including data warehousing, data mining, and predictive modeling.
2. Analyze business data using various AI and analytics techniques to identify patterns, trends, and correlations.
3. Apply data visualization and reporting tools to communicate insights and facilitate decision-making processes in organizations.
4. Design and implement AI-driven analytics solutions for tasks such as customer segmentation, market basket analysis, and predictive modeling.
5. Evaluate the performance and effectiveness of BI and analytics systems in improving business outcomes and driving competitive advantage.
6. Develop strategies to address ethical and privacy considerations in the collection, analysis, and use of business data.

Unit 1: INTRODUCTION TO BUSINESS INTELLIGENCE AND ANALYTICS

Overview of business intelligence (BI) and analytics: concepts, principles, and applications, Data-driven decision-making in organizations, Data warehousing and ETL (Extract, Transform, Load) processes, Ethical and legal considerations in business data analytics

Unit 2: DATA EXPLORATION AND VISUALIZATION

Exploratory data analysis (EDA) techniques: summary statistics, data visualization, and outlier detection, Visualization tools and techniques for communicating insights: charts, graphs, dashboards, Interactive data exploration and drill-down capabilities, Best practices for designing effective data visualizations

Unit 3: PREDICTIVE MODELING AND MACHINE LEARNING

Introduction to predictive modeling: regression, classification, and clustering algorithms, Feature engineering and selection techniques for predictive analytics, Model evaluation and validation: cross-validation, ROC curves, precision-recall curves, Applications of machine learning in business: churn prediction, customer lifetime value estimation, fraud detection

Unit 4: BUSINESS ANALYTICS APPLICATIONS

Customer segmentation and profiling using clustering techniques, Market basket analysis and recommendation systems, Time series forecasting and demand prediction, Text analytics and sentiment analysis for customer feedback and social media data

Unit 5: ADVANCED TOPICS IN BUSINESS INTELLIGENCE

Real-time analytics and stream processing, Big data analytics: Hadoop, Spark, and NoSQL databases, Prescriptive analytics and optimization techniques, Emerging trends and future directions in business intelligence and analytics

TEXTBOOKS

1. Business Intelligence Guidebook: From Data Integration to Analytics", Rick Sherman, Morgan Kaufmann, 2015.
2. Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking", Foster Provost, Tom Fawcett, O'Reilly Media, 2013.

REFERENCE BOOKS

1. "The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling", Ralph Kimball, Margy Ross, Wiley, 2013.
2. "Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die", Eric Siegel Wiley, 2013.
3. “Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", David Loshin, Morgan Kaufmann, 2013.

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Branch: B Tech Honours (Artificial Intelligence) **Semester - VII**

Subject: Software Engineering **Subject Code: ……**

Total Theory Periods: 40 **Total Tutorial Periods: 10**

No. of Class tests to: 2 (Minimum) **No. of Assignments to be submitted: One per Unit**

ESE Duration: Three Hours, **Maximum Marks in ESE: 100**

Minimum Marks in ESE: 35

Course Objectives

1. Develop a comprehensive understanding of software development principles, methodologies, and practices.
2. Acquire knowledge and skills essential for designing, developing, and maintaining high-quality software systems.
3. Emphasize the application of software engineering best practices within the realm of artificial intelligence (AI) applications.
4. Gain proficiency in implementing software engineering techniques tailored for AI-centric projects.
5. Prepare students to effectively design, develop, and manage software solutions by integrating software engineering principles with AI technologies.

Course Outcomes

Upon successful completion of the course, students should be able to:

1. Understand the fundamental concepts and principles of software engineering, including requirements engineering, software design, and testing.
2. Apply software development methodologies, such as agile, iterative, and incremental approaches, to plan and manage software projects effectively.
3. Design and implement software systems using appropriate programming languages, frameworks, and tools, with a focus on AI applications.
4. Apply software engineering best practices for ensuring software quality, reliability, and maintainability in AI systems.
5. Collaborate effectively in software development teams, practicing communication, teamwork, and project management skills.
6. Demonstrate ethical and professional responsibility in software development, adhering to legal and ethical standards and considering societal impacts.

Unit 1: INTRODUCTION TO SOFTWARE ENGINEERING

Overview of software engineering: concepts, principles, and software development life cycle, Software processes and methodologies: waterfall, agile, scrum, and kanban, Requirements engineering: elicitation, analysis, specification, and validation, Ethical and professional considerations in software engineering.

Unit 2: SOFTWARE DESIGN AND ARCHITECTURE

Principles of software design: abstraction, modularity, cohesion, and coupling, Architectural styles and patterns: client-server, layered architecture, and micro services, Design principles for AI systems: modifiability, scalability, and adaptability, Software modelling techniques: UML diagrams, entity-relationship diagrams, and data flow diagrams.

Unit 3: IMPLEMENTATION AND TESTING

Programming paradigms and languages for software development, Coding standards, conventions, and best practices, Unit testing, integration testing, and system testing techniques, Test-driven development (TDD) and behaviour-driven development (BDD) practices.

Unit 4: SOFTWARE MAINTENANCE AND EVOLUTION

Software maintenance activities: corrective, adaptive, and perfective maintenance, Version control systems and configuration management, Software refactoring and code quality improvement techniques, Legacy system modernization and migration strategies.

Unit 5: SOFTWARE PROJECT MANAGEMENT

Project planning and estimation techniques: work breakdown structure (WBS), effort estimation models, Agile project management frameworks: scrum, kanban, and extreme programming (XP), Risk management and mitigation strategies in software projects, Software documentation and knowledge management practices.

TEXTBOOKS

1. Title: "Software Engineering: A Practitioner's Approach", Author: Roger S. Pressman, Publisher: McGraw-Hill Education, Year: 2020.
2. Title: "Clean Code: A Handbook of Agile Software Craftsmanship", Author: Robert C. Martin, Publisher: Prentice Hall, Year: 2008.

REFERENCE BOOKS

1. Title: "Agile Software Development: Principles, Patterns, and Practices", Author: Robert C. Martin, Publisher: Prentice Hall, Year: 2002.
2. Title: "Introduction to the Art of Programming Using Scala", Author: Mark C. Lewis, Publisher: CRC Press, Year: 2012.
3. Title: "Continuous Delivery: Reliable Software Releases through Build, Test, and Deployment Automation", Authors: Jez Humble, David Farley, Publisher: Addison-Wesley Professional, Year: 2010.

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Branch: B Tech Honours (Artificial Intelligence) **Semester - VII**

Subject: Intelligent System and Robotics Lab **Subject Code: ……**

Maximum Marks in ESE: 40

List of Experiments (Any 10)

1. Path Planning Algorithms: Implement algorithms such as A*, Dijkstra, or RRT to find the optimal path for a robot to navigate in a known environment.
2. PID Control: Design a PID controller to regulate the position or velocity of a robot arm or mobile robot.
3. SLAM (Simultaneous Localization and Mapping): Implement SLAM algorithms like EKF SLAM or FastSLAM for mapping and localization in robotics.
4. Reinforcement Learning for Robot Navigation: Train a robot to navigate through a maze or reach a target using reinforcement learning algorithms like Q-learning or Deep Q-Networks.
5. Object Detection and Recognition: Use deep learning frameworks like Tensor Flow or PyTorch to detect and recognize objects in images or video streams captured by a robot's camera.
6. Voice Command Recognition: Develop a system to recognize and respond to voice commands using speech recognition libraries such as Speech Recognition in Python.
7. Gesture Recognition: Implement a gesture recognition system using computer vision techniques like Open CV to interpret hand gestures and control a robot's movements.
8. Swarm Robotics Simulation: Simulate a swarm of robots using tools like ROS (Robot Operating System) or V-REP to study collective behaviours and coordination strategies.
9. Neural Network-based Robot Control: Train neural networks to control the movement or manipulation of a robotic arm or gripper using frameworks like Keras or Tensor Flow.
10. Evolutionary Robotics: Use evolutionary algorithms like Genetic Algorithms or Genetic Programming to evolve robot controllers for specific tasks.
11. Robot Localization with Kalman Filters: Implement Extended Kalman Filters (EKF) or Unscented Kalman Filters (UKF) for robot localization using noisy sensor data.
12. Mobile Robot Simulation: Simulate the movement and interaction of mobile robots in different environments using tools like Gazebo or Webots.
13. Behavior-Based Robotics: Design and implement behaviors for a robot using a behavior-based approach, combining simple reactive behaviors to achieve complex tasks.
14. Human-Robot Interaction: Develop interfaces for humans to interact with robots, such as speech interfaces, gesture interfaces, or haptic feedback using Python libraries or Matlab GUI tools.
15. Robot Soccer Simulation: Create a simulated robot soccer environment using platforms like Robo Cup Soccer Simulation or Pygame to implement robot strategies and compete against other simulated teams.

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Branch: B Tech Honours (Artificial Intelligence) **Semester - VII**

Subject: Business Intelligence and Analytics Lab **Subject Code: ……**

Maximum Marks in ESE: 40

LIST OF EXPERIMENTS

1. Data Visualization with Tableau: Use Tableau or a similar data visualization tool to create nteractive dashboards and visualizations for analyzing business data, such as sales trends, customer demographics, or product performance.
2. Exploratory Data Analysis (EDA) with Pandas: Perform exploratory data analysis on a business dataset using the Pandas library in Python, including data cleaning, summarization, and visualization of key insights.
3. Sentiment Analysis on Social Media Data: Analyze sentiment on social media platforms (e.g., Twitter, Facebook) related to a specific business or product using natural language processing (NLP) techniques to classify tweets or posts as positive, negative, or neutral.
4. Customer Segmentation Analysis: Segment customers based on demographic or behavioral attributes using clustering algorithms such as k-means clustering or hierarchical clustering, and analyze the characteristics of each segment.
5. Market Basket Analysis: Perform market basket analysis on transaction data to identify associations between products frequently purchased together, using techniques such as Apriori algorithm or FP-Growth algorithm.
6. Predictive Analytics with Regression Models: Build and evaluate regression models to predict business metrics such as sales revenue, customer churn, or product demand based on historical data, using libraries like scikit-learn in Python.
7. Time Series Forecasting: Apply time series forecasting techniques to predict future trends or patterns in business metrics, such as sales, stock prices, or website traffic, using methods like ARIMA or exponential smoothing.
8. Anomaly Detection in Business Data: Detect anomalies or outliers in business data that may indicate fraud, errors, or unusual behavior using statistical methods or machine learning algorithms such as isolation forest or one-class SVM.
9. Customer Lifetime Value (CLV) Analysis: Calculate and analyze customer lifetime value (CLV) metrics to understand the long-term profitability of different customer segments and inform marketing or retention strategies.
10. A/B Testing for Marketing Campaigns: Design and analyze A/B tests to compare the effectiveness of different marketing strategies or campaigns, measuring key performance indicators (KPIs) such as click-through rates, conversion rates, or revenue.

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Branch: B Tech Honours (Artificial Intelligence) **Semester - VII**

Subject: Software Engineering Lab **Subject Code: ……**

Maximum Marks in ESE: 40

LIST OF EXPERIMENTS

1. Version Control with Git: Practice basic Git operations such as repository creation, file addition, committing changes, and pushing to a remote repository.
2. Code Review Simulation: Conduct a simulated code review session where students provide feedback on each other's code, focusing on readability, maintainability, and adherence to coding standards.
3. Unit Testing with pytest: Write and execute unit tests for Python functions using the pytest framework, covering different test cases and assertions.
4. Continuous Integration Setup: Set up a basic continuous integration (CI) pipeline using tools like GitHub Actions or Travis CI to automatically build and test code changes on every commit.
5. Code Refactoring Exercise: Identify and refactor code snippets to improve code quality, readability, and performance, focusing on techniques such as extracting methods, removing duplication, and improving naming conventions.
6. Agile Sprint Planning: Conduct a simulated sprint planning session following agile principles, where students break down user stories into tasks, estimate their effort, and allocate them for a sprint.
7. Pair Programming Activity: Pair up students to work on a programming task collaboratively, taking turns as the driver and navigator, and switch roles periodically to promote teamwork and knowledge sharing.
8. Code Documentation Practice: Write and document Python functions and classes using docstrings and generate HTML documentation using tools like Sphinx or MkDocs.
9. Mocking and Dependency Injection: Practice mocking and dependency injection techniques in Python using libraries like unittest.mock or dependency-injector to isolate and test individual components of a software system.
10. Code Review Automation: Integrate a code quality analysis tool like CodeFactor or Codacy with GitHub to automatically analyze code changes and provide feedback on code style, complexity, and potential issues.

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Branch: B Tech Honours (Artificial Intelligence) **Semester - VII**

Subject: Technical Communication and Soft Skill **Subject Code: ……**

Maximum Marks (TA): 20

1. **Effective Communication in AI**
   Principles of effective technical communication. Written and verbal communication skills. Presentation techniques for conveying AI concepts.

2. **Teamwork and Collaboration**
   Importance of teamwork in AI projects. Collaboration tools and techniques.

3. **Problem-Solving Skills**
   Critical thinking and problem-solving strategies. Analytical skills for AI applications.

4. **Time Management and Productivity**
   Time management techniques for project completion. Prioritization and task management skills.

5. **Professional Ethics and Integrity**
   Ethical considerations in AI research and development. Maintaining integrity and professionalism in the workplace.

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Branch: B Tech Honours (Artificial Intelligence) **Semester - VII**

Subject: Professional Training **Subject Code: ……**

Maximum Marks (TA): 100

1. **Project Management in AI**
   Introduction to project management methodologies.Project planning, scheduling, and risk management. Case Study: Implementation of AI project management techniques in a real-world scenario.

2. **Ethical and Legal Considerations in AI**
   Ethical issues in AI development and deployment.Legal frameworks and regulations.Case Study: Ethical implications of AI algorithms in decision-making processes.

3. **3.2AI Tools and Technologies**
   Hands-on training with popular AI frameworks and tools. Introduction to machine learning pipelines. Case Study: Implementation of AI models using Tensor Flow or PyTorch.

4. **Industry Case Studies**
   Analysis of AI applications across industries. Guest lectures from industry professionals. Case Study: Successful AI implementations in healthcare, finance, or retail sectors.

5. **Minor project work**

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Branch: B Tech Honours (Artificial Intelligence) **Semester - VII**

Subject: Computer Vision (Professional Elective II) **Subject Code: ……**

Total Theory Periods: 40 **Total Tutorial Periods: 10**

No. of Class tests to: 2 (Minimum) **No. of Assignments to be submitted: One per Unit**

ESE Duration: Three Hours, **Maximum Marks in ESE: 100**

Minimum Marks in ESE: 35

Course Objectives

1. To provide students with a comprehensive understanding of computer vision fundamentals and techniques.
2. To enable students to apply computer vision algorithms to solve real-world problems in various domains.
3. To familiarize students with state-of-the-art methodologies and advancements in computer vision research.
4. To develop practical skills in image processing, feature extraction, object detection, and recognition.
5. To encourage students to critically evaluate and analyze the ethical and societal implications of computer vision applications.

Course Outcomes

1. Understand the principles and theoretical foundations of computer vision.
2. Apply various computer vision algorithms for tasks such as image classification, object detection, and image segmentation.
3. Implement computer vision techniques using programming languages and frameworks such as Python and OpenCV.
4. Analyze and evaluate the performance of computer vision models using appropriate metrics.
5. Demonstrate an understanding of ethical considerations and potential biases in computer vision applications.

Unit 1: INTRODUCTION TO COMPUTER VISION

Overview of computer vision concepts and applications.Image formation and representation. Color spaces and image enhancement techniques. Image filtering and convolution operations.

Unit 2: IMAGE PROCESSING AND FEATURE EXTRACTION

Image transformation and geometric operations. Image segmentation techniques (e.g., thresholding, edge detection). Feature extraction methods (e.g., corner detection, scale-invariant feature transform).

Unit 3: OBJECT DETECTION AND RECOGNITION

Introduction to object detection and localization.Popular object detection algorithms (e.g., Haar cascades, YOLO, SSD). Object recognition techniques using deep learning approaches (e.g., Convolutional Neural Networks).

Unit 4: DEEP LEARNING FOR COMPUTER VISION

Fundamentals of deep learning and neural networks. Convolutional Neural Networks (CNNs) architecture and applications in computer vision.

Transfer learning and fine-tuning pre-trained CNN models for specific tasks.

Unit 5: ADVANCED TOPICS AND APPLICATIONS

Advanced topics in computer vision (e.g., image registration, motion analysis). Applications of computer vision in fields such as healthcare, autonomous vehicles, and surveillance. Ethical considerations and societal implications of computer vision technologies.

TEXTBOOKS:

1. Title: "Computer Vision: Algorithms and Applications" Author: Richard Szeliski, Publication Details: Springer, 2010

2. Title: "Learning OpenCV 4 Computer Vision with Python 3: Get to grips with tools, techniques, and algorithms for computer vision and machine learning", Author: Joseph Howse, Joe Minichino, Prateek Joshi, Publication Details: Packt Publishing, 2018

REFERENCE BOOKS:

1. Title: "Computer Vision: A Modern Approach", Author: David A. Forsyth, Jean Ponce, Publication Details: Prentice Hall, 2002.

2. Title: "Deep Learning for Computer Vision", Author: Rajalingappaa Shanmugamani, Publication Details: Packt Publishing, 2018.

3. Title: "Python Deep Learning: Exploring deep learning techniques, neural network architectures and GANs with PyTorch, Keras and TensorFlow", Author: Ivan Vasilev, Daniel Slater, Gianmario Spacagna, Peter Roelants, Valentino Zocca, Publication Details: Packt Publishing, 2019.

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Branch: B Tech Honours (Artificial Intelligence) **Semester - VII**

Subject: Multimedia System and Application **Subject Code: ……**

(Professional Elective II)

Total Theory Periods: 40 **Total Tutorial Periods: 10**

No. of Class tests to: 2 (Minimum) **No. of Assignments to be submitted: One per Unit**

ESE Duration: Three Hours, **Maximum Marks in ESE: 100**
Minimum Marks in ESE: 35

Course Objectives

1. To introduce students to the fundamental concepts and principles of multimedia systems.
2. To provide an understanding of multimedia data representation, compression, and transmission techniques.
3. To familiarize students with multimedia applications and their real-world implementations.
4. To develop practical skills in designing and developing multimedia systems and applications.
5. To encourage students to analyze and evaluate the performance of multimedia systems in various contexts.

Course Outcomes

1. Understand the components and architecture of multimedia systems.
2. Apply multimedia data compression techniques to optimize storage and transmission.
3. Design and develop multimedia applications using appropriate tools and technologies.
4. Analyze and evaluate the performance of multimedia systems based on quality metrics and user experience.
5. Demonstrate an understanding of ethical and legal considerations in multimedia content creation and distribution.

Unit 1: INTRODUCTION TO MULTIMEDIA SYSTEMS

Overview of multimedia concepts, components, and applications. Multimedia data types and formats. Multimedia system architecture and components.

Unit 2: Multimedia Data Representation and Compression

Digital audio and video representation. Image and video compression techniques (e.g., JPEG, MPEG). Lossy and lossless compression algorithms.

Unit 3: MULTIMEDIA COMMUNICATION AND STREAMING

Multimedia data transmission over networks. Streaming media protocols and technologies. Quality of Service (QoS) considerations in multimedia communication.

Unit 4: MULTIMEDIA APPLICATIONS AND DEVELOPMENT

Multimedia authoring tools and platforms. Design principles for interactive multimedia applications. Case studies of multimedia applications in various domains.

Unit 5: ETHICAL AND LEGAL ASPECTS OF MULTIMEDIA

Ethical considerations in multimedia content creation and distribution. Intellectual property rights and copyright issues in multimedia. Regulatory frameworks and standards for multimedia systems and applications.

TEXTBOOKS

1. Title: "Multimedia Systems and Applications", Author: Ralf Steinmetz, Klara Nahrstedt, Publication Details: Springer, 2004

2. Title: "Multimedia: Computing, Communications & Applications", Author: Ralf Steinmetz, Klara Nahrstedt, Publication Details: Prentice Hall, 2010

REFERENCE BOOKS

1. Title: "Multimedia Systems", Author: John F. Koegel Buford, J. Lennox, Publication Details: Springer, 2014

2. Title: "Introduction to Multimedia Systems", Author: Sugata Mitra, Publication Details: Chapman and Hall/CRC, 2017

3. Title: "Multimedia Systems: Algorithms, Standards, and Industry Practices", Author: Parag Havaldar, Gerard Medioni. Publication Details: Springer, 2014

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Branch: B Tech Honours (Artificial Intelligence) **Semester - VII**

Subject: Image Processing (Professional Elective II) **Subject Code: ……**

Total Theory Periods: 40 **Total Tutorial Periods: 10**

No. of Class tests to: 2 (Minimum) **No. of Assignments to be submitted: One per Unit**

ESE Duration: Three Hours, **Maximum Marks in ESE: 100**

Minimum Marks in ESE: 35

Course Objectives

1. To introduce students to the fundamental principles and techniques of digital image processing.
2. To provide an understanding of various image enhancement and restoration methods.
3. To familiarize students with image segmentation and feature extraction techniques.
4. To develop practical skills in implementing image processing algorithms using appropriate tools and programming languages.
5. To encourage students to analyze and evaluate the performance of image processing algorithms in real-world applications.

Course Outcomes

1. Understand the theoretical foundations of digital image processing.
2. Apply various image enhancement techniques to improve image quality and visual appearance.
3. Implement image restoration algorithms to remove noise and other artifacts from images.
4. Design and implement image segmentation algorithms for object detection and recognition.
5. Analyze and evaluate the performance of image processing algorithms based on quantitative metrics and visual inspection.

Unit 1: INTRODUCTION TO DIGITAL IMAGE PROCESSING

Overview of digital image processing concepts and applications. Digital image representation and characteristics.Image acquisition and preprocessing techniques.

Unit 2: IMAGE ENHANCEMENT AND RESTORATION

Spatial domain enhancement techniques (e.g., histogram equalization, spatial filtering). Frequency domain enhancement techniques (e.g., Fourier transform, filtering in frequency domain). Image restoration techniques (e.g., image denoising, image deblurring).

Unit 3: IMAGE SEGMENTATION AND FEATURE EXTRACTION

Thresholding and region-based segmentation methods. Edge detection algorithms (e.g., Sobel, Canny). Feature extraction techniques (e.g., corner detection, texture analysis).

Unit 4: MORPHOLOGICAL IMAGE PROCESSING

Mathematical morphology operations (e.g., erosion, dilation, opening, closing). Morphological image processing for noise removal and feature extraction. Applications of morphological operations in image analysis.

Unit 5: ADVANCED TOPICS IN IMAGE PROCESSING

Image compression techniques (e.g., JPEG, wavelet-based compression).Image registration and fusion methods. Case studies and applications of image processing in various domains (e.g., medical imaging, remote sensing).

TEXTBOOKS

1. Title: "Digital Image Processing", Author: Rafael C. Gonzalez, Richard E. Woods, Publication Details: Pearson, 2017

2. Title: "Digital Image Processing Using MATLAB", Author: Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, Publication Details: Gatesmark Publishing, 2019

REFERENCE BOOKS

1. Title: "Image Processing, Analysis, and Machine Vision", Author: Milan Sonka, Vaclav Hlavac, Roger Boyle, Publication Details: Cengage Learning, 2014

2. Title: "Principles of Digital Image Processing: Core Algorithms", Author: Wilhelm Burger, Mark J. Burge, Publication Details: Springer, 2009

3. Title: "Computer Vision: Algorithms and Applications", Author: Richard Szeliski, Publication Details: Springer, 2010

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Branch: B Tech Honours (Data Science) **Semester - VII**

Subject: High Performance Computing **Subject Code: ……**

(Professional Elective II)

Total Theory Periods: 40 **Total Tutorial Periods: 10**

No. of Class tests to: 2 (Minimum) **No. of Assignments to be submitted: One per Unit**

ESE Duration: Three Hours, **Maximum Marks in ESE: 100**

Minimum Marks in ESE: 35

Course Objectives

1. To introduce students to the principles and techniques of high-performance computing (HPC)
2. To provide an understanding of parallel computing architectures and programming models.
3. To familiarize students with performance optimization techniques for HPC applications.
4. To develop practical skills in designing and implementing parallel algorithms for various computational tasks.
5. To encourage students to analyze and evaluate the performance of HPC systems and applications.

Course Outcomes

1. Understand the principles of parallel computing and its relevance to high-performance computing.
2. Apply parallel programming models and techniques to solve computationally intensive problems.
3. Design and implement parallel algorithms for tasks such as matrix multiplication, sorting, and numerical simulations.
4. Optimize the performance of parallel applications using profiling, tuning, and scaling techniques.
5. Evaluate the performance and scalability of HPC systems based on metrics such as speedup, efficiency, and scalability.

Unit 1: INTRODUCTION TO HIGH-PERFORMANCE COMPUTING

Overview of high-performance computing concepts, applications, and challenges. Evolution of computing architectures and the need for parallelism. Introduction to parallel computing models (e.g., SIMD, MIMD).

Unit 2: PARALLEL COMPUTING ARCHITECTURES

Classification of parallel computing architectures (e.g., shared-memory, distributed-memory). Multi-core processors, GPUs, and accelerators for parallel computing. Interconnection networks and communication overhead in parallel systems.

Unit 3: PARALLEL PROGRAMMING MODELS

Introduction to parallel programming languages and libraries (e.g., MPI, OpenMP, CUDA). Parallelization techniques for different computational tasks (e.g., data parallelism, task parallelism). Hands-on exercises with parallel programming frameworks.

Unit 4: PERFORMANCE OPTIMIZATION IN HPC

Profiling and performance analysis of parallel applications. Optimization techniques for memory access, communication, and computation.
Scalability analysis and load balancing in parallel computing environments.

Unit 5: ADVANCED TOPICS IN HIGH-PERFORMANCE COMPUTING

Parallel algorithms for specific computational tasks (e.g., numerical simulations, machine learning). High-performance computing in big data analytics and artificial intelligence. Case studies of HPC applications in scientific computing, engineering, and industry.

TEXTBOOKS

1. Title: "Introduction to High Performance Computing for Scientists and Engineers", Author: Georg Hager, Gerhard Wellein, Publication Details: CRC Press, 2010

2. Title: "Parallel Programming: Concepts and Practice", Author: Thomas Rauber, Gudula Rünger, Publication Details: CRC Press, 2010

REFERENCE BOOKS

1. Title: "High Performance Computing", Author: Charles Severance, Kevin Dowd, Publication Details: O'Reilly Media, 2018

2. Title: "Parallel and Distributed Computing: A Survey of Models, Paradigms and Approaches", Author: Claudia Leopold, Wolfgang Karl, Publication Details: Springer, 2012

3. Title: "Programming Massively Parallel Processors: A Hands-on Approach", Author: David B. Kirk, Wen-mei W. Hwu, Publication Details: Morgan Kaufmann, 2012

Chhattisgarh Swami Vivekananda Technical University, Bhilai (C.G.)

Branch: B Tech Honours (Data Science) **Semester - VII**

Subject: Crypto-currency and Block Chain Technology (Professional Elective II)

Subject Code: ……

Total Theory Periods: 40 **Total Tutorial Periods: 10**

No. of Class tests to: 2 (Minimum) **No. of Assignments to be submitted: One per Unit**

ESE Duration: Three Hours, **Maximum Marks in ESE: 100**

Minimum Marks in ESE: 35

Course Objectives

1. To introduce students to the fundamental concepts and principles of cryptocurrencies and blockchain technology.
2. To provide an understanding of the underlying cryptographic techniques used in cryptocurrencies and blockchain.
3. To familiarize students with the architecture and components of blockchain systems.
4. To explore the applications and use cases of blockchain technology beyond cryptocurrencies.
5. To develop practical skills in designing and implementing blockchain-based solutions.

Course Outcomes

1. Understand the fundamentals of cryptocurrencies, including their history, characteristics, and mechanics.
2. Analyze the cryptographic techniques used in blockchain technology, such as hashing, digital signatures, and consensus mechanisms.
3. Explain the architecture and components of blockchain systems, including blocks, transactions, and distributed ledgers.
4. Identify and evaluate various applications of blockchain technology in industries such as finance, supply chain, and healthcare.
5. Design and implement basic blockchain solutions, including smart contracts and decentralized applications (DApps).

Unit 1: INTRODUCTION TO CRYPTOCURRENCIES

Overview of cryptocurrencies: history, characteristics, and benefits. Cryptographic techniques used in cryptocurrencies: hashing, digital signatures, and cryptographic hash functions. Introduction to blockchain technology and its role in cryptocurrencies.

Unit 2: BLOCKCHAIN ARCHITECTURE AND COMPONENTS

Basic principles of blockchain: decentralized consensus, immutability, and transparency. Blockchain architecture: blocks, transactions, and the structure of a blockchain. Types of blockchain networks: public, private, and consortium.

Unit 3: CRYPTOCURRENCY MECHANICS AND ECONOMICS

Mechanics of cryptocurrency transactions: wallets, addresses, and keys. Cryptocurrency mining: proof-of-work, proof-of-stake, and other consensus mechanisms. Economic aspects of cryptocurrencies: valuation, volatility, and market dynamics.

Unit 4: APPLICATIONS OF BLOCKCHAIN TECHNOLOGY

Beyond cryptocurrencies: use cases of blockchain in finance, supply chain management, healthcare, and more. Smart contracts: definition, execution, and applications. Decentralized applications (DApps) and their potential impact on various industries.

Unit 5: BLOCKCHAIN DEVELOPMENT AND IMPLEMENTATION

Blockchain development platforms and tools: Ethereum, Hyperledger, and others. Hands-on exercises with blockchain development: creating smart contracts, deploying DApps, and interacting with blockchain networks. Challenges and future directions in blockchain technology.

TEXTBOOKS

1. Title: "Mastering Bitcoin: Unlocking Digital Crypto currencies", Author: Andreas M. Antonopoulos, Publication Details: O'Reilly Media, 2017

2. Title: "Blockchain Basics: A Non-Technical Introduction in 25 Steps", Author: Daniel Drescher, Publication Details: Apress, 2017

REFERENCE BOOKS

1. Title: "Blockchain Revolution: How the Technology Behind Bitcoin and Other Crypto currencies is Changing the World", Author: Don Tapscott, Alex Tapscott, Publication Details: Portfolio, 2016

2. Title: "Ethereum: Block chains, Digital Assets, Smart Contracts, Decentralized Autonomous Organizations", Author: Henning Diedrich Publication Details: Create Space Independent Publishing Platform, 2017

3. Title: "Mastering Blockchain: Unlocking the Power of Crypto currencies, Smart Contracts, and Decentralized Applications", Author: Imran Bashir, Publication Details: Packt Publishing, 2018