IV B.Tech I Semester

23A39702	**SMART SYSTEMS** **(Professional Elective-V)**	**L**	**T**	**P**	**C**
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Course Objectives:

- To introduce the fundamental principles and applications of AI in building intelligent and interconnected smart systems.
- To enable learners to understand the role of AI in smart environments such as smart homes, smart cities, smart healthcare, and smart industries.
- To explore the integration of IoT, edge computing, and AI for real-time decision-making in smart systems.
- To examine various machine learning, deep learning, and reinforcement learning models used in smart automation.
- To design and evaluate AI-based smart solutions considering scalability, security, and efficiency.

Course Outcomes:

1. Understand the architecture, components, and challenges of smart systems and analyze real-world applications in smart homes, grids, and cities.

2. Apply machine learning and deep learning techniques for smart applications such as surveillance, activity recognition, predictive maintenance, and virtual assistants.

3. Evaluate the deployment of AI in urban infrastructure, including smart transportation, public safety, energy management, and real-time urban analytics.

4. Demonstrate the use of AI in healthcare and agriculture, focusing on health monitoring, precision farming, and ethical considerations.

5. Design and deploy smart system prototypes using AI models on edge devices, considering energy efficiency, real-time processing, and performance evaluation.

Unit I: Introduction to Smart Systems and AI Foundations
Definition and Components of Smart Systems, Overview of AI in Smart Environments, Role of Sensors, Actuators, and Connectivity, IoT and AI: A Synergistic Integration, Key Challenges in Smart Systems: Scalability, Interoperability, Data Acquisition and Edge Intelligence, Use Cases: Smart Cities, Smart Homes, Smart Grid, Case Study: AI-based Home Automation System

Unit II: Machine Learning and Deep Learning for Smart Systems
Supervised, Unsupervised, and Reinforcement Learning, Deep Learning Architectures (CNN, RNN, LSTM), Smart Surveillance using Image Recognition, Activity and Gesture Recognition Models, Predictive Maintenance in Smart Industry, Anomaly Detection in Smart Systems, NLP in Smart Assistants and Chatbots, ML Model Evaluation and Optimization for Edge Devices

Unit III: AI for Smart Cities and Urban Infrastructure
Traffic Monitoring and Smart Transportation Systems, AI in Waste Management and Water Monitoring, Public Safety with AI-driven Surveillance, Intelligent Street Lighting and Smart Parking

Systems, Air Quality Prediction and Control, Smart Energy Management with AI, Smart Governance using AI-Driven Decision Support, Real-time Analytics and Cloud-Edge Integration

Unit IV: AI in Smart Healthcare and Agriculture

Remote Health Monitoring Systems, AI for Early Disease Detection and Prediction, Smart Wearables and Bio-sensors, Precision Farming using AI and Drones, Crop Health Monitoring and Yield Prediction, Livestock Monitoring and Automated Irrigation Systems, Data Privacy in Smart Healthcare Systems, Ethical Implications in AI-based Smart Health Solutions

Unit V: Design and Deployment of Smart Systems

Architecture Design of Smart Applications, Edge vs Cloud Intelligence: Trade-offs, Real-time Processing and Inference Optimization, Energy-efficient AI Model Design, AI Model Deployment on Edge Devices (Raspberry Pi, Jetson Nano), Interfacing with MQTT, HTTP, and REST APIs, Testing and Evaluation of Smart System Performance, Capstone Project: Build a Prototype Smart System

Text Books:

1. F. Flórez-Revuelta and P. Remagnino, Ambient Intelligence: A Novel Paradigm, Springer, 2017.
2. A. P. Chandrakasan, Smart Systems and Internet of Things, Wiley India, 2020.
3. Russell, Stuart, and Norvig, Peter. Artificial Intelligence: A Modern Approach, 4th Edition, Pearson, 2020.

Reference Books:

1. John Krumm, Ubiquitous Computing Fundamentals, CRC Press, 2018.
2. Andreas Symeonidis and Pericles Loucopoulos, The Engineering of Intelligent Systems: Models, Methods, and Tools, Springer, 2021.
3. Rajkumar Buyya et al., Fog and Edge Computing: Principles and Paradigms, Wiley, 2019.

Online Courses:

1. AI for Smart Cities – edX (IIT Kanpur)
2. IoT and AI for Smart Cities – Coursera (University of London)
3. AI for Everyone – Coursera by Andrew Ng