B.TECH IN MECHANICAL AND SMART MANUFACTURING			
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)			
SEMESTER - VIII			
Advanced Smart Manufacturing Techniques			
Course Code	**18SM81**	CIE Marks	40
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	60
Credits	03	Exam Hours	03

Course objectives:

Students will be able

- To know various techniques in smart manufacturing.
- To understand big data analytics in manufacturing.
- To understand AI techniques in manufacturing
- To understand the fundamentals of additive manufacturing
- To expose the students to concepts of digital twins and applications

Module-1

Introduction to Smart Manufacturing: Overview of smart manufacturing concepts and principles, Historical context and evolution of manufacturing techniques, Importance of smart manufacturing in modern industry.

Internet of Things(IoT) in Manufacturing: Fundamentals of IoT and its application in manufacturing, Sensors, actuators and communication protocols, Data acquisition, processing and transmission, IoT platforms and architectures for manufacturing environment.

Module-2

Big Data analytics for Manufacturing: Introduction to big data analytics and its significance in manufacturing, Data preprocessing and cleaning techniques, Descriptive, diagnostic, predictive and prescriptive analytics, Case studies on using big data analytics to improve manufacturing processes.

Artificial Intelligence in Manufacturing: Overview of AI technologies and their role in manufacturing, Machine learning algorithms for predictive maintenance, quality control and process optimization, Deep learning for image recognition and defect detection.

Module-3

Additive Manufacturing: Fundamentals of additive manufacturing process and materials, Design considerations for additive manufacturing, Applications for 3D printing in prototyping, customization and production. Advanced topics such as multi-material printing, topology optimization and in-situ monitoring.

Module-4

Digital Twin Technology: Concept of digital twins and their role in smart manufacturing, Creation and development of digital twin models, Integration of digital twins with IoT data and simulation tools, Case studies on using digital twins for predictive maintenance, process optimization and product life cycle management.

Module-5

Emerging Technologies and Trends: Overview of emerging technologies shaping the future of smart manufacturing, Augmented Reality (AR) and virtual reality applications (VR) applications in manufacturing, Blockchain for supply chain transparency and product traceability, Quantum computing and its potential impact on manufacturing optimization

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Understand IoT techniques in manufacturing
2. Understand blockchain and techniques
3. Understand 3D printing technologies and AI techniques

Question paper pattern:
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of four sub- questions) from each module.
- Each full question will have sub- question covering all the topics under a module.
- The students will have to answer five full questions, selecting one full question from each module.

Suggested Learning Resources:
Books
1. Smart Manufacturing: Technologies and Applications" by Mojtaba Khorram Niaki and Amir Mosavi
2. Big Data Analytics in Smart Manufacturing Principles and Practices P Suresh, T. Poongodi, B Balamurugan, Meenakshi Sharma Chapman & Hall 2022
3. Artificial Intelligence in Manufacturing by Diego Galar, Uday Kumar
4. Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing" by Ian Gibson, David W. Rosenl
5. Digital Twin Technologies and Smart Cities" by Leandro A. F. Fernandes and Victor Chang
6. Emerging Technologies in Supply Chain Management" by Thorsten Blecker, Wolfgang Kersten