UPES
End Semester Examination, DEC 2024
Course: Digital Transformation and Innovation in Manufacturing Ecosystem   Semester: V

Program: INT BBA+MBA   **Time   : 03 hrs.**
Course Code: STGM3015   **Max. Marks: 100**

Instructions:

SECTION A
10Qx2M=20Marks

S. No.		Marks	CO
Q	Statement of question		**CO1**
Q 1	How does data analytics support digital transformation in the manufacturing sector? a) It automates production processes without human intervention b) It provides insights for improving operational efficiency and reducing downtime c) It primarily assists in customer relationship management d) It simplifies the transition to digital tools by analyzing historical trends	**2**	
Q 2	What is the main objective of digital transformation in manufacturing? a) To eliminate all traditional manufacturing processes b) To reduce reliance on digital technologies c) To optimize production efficiency and enhance product quality d) To achieve mass customization without increasing operational costs	**2**	
Q 3	In what way does the Internet of Things (IoT) assist in digital transformation within manufacturing? a) It allows for automation of manual tasks and reduces the need for human oversight b) It enables real-time monitoring and predictive maintenance of equipment c) It centralizes data processing to reduce network complexity d) It increases energy consumption by constantly transmitting data	**2**	
Q 4	How does augmented reality (AR) benefit the manufacturing industry? a) It hinders productivity by requiring additional worker training b) It provides immersive experiences for customer engagement only c) It allows for real-time visualization of data and remote technical support d) It reduces the speed of production by overcomplicating processes	**2**	
Q 5	What is a major driver for sustainability within digital transformation in manufacturing?	**2**	

	a) The need for reduced transportation costs b) Decreasing environmental regulations and compliance requirements c) Growing environmental concerns and the need to reduce waste d) Expanding market demand for high-performance materials		
Q 6	Which of the following is a significant trend in the digital transformation of manufacturing? a) Dependence on legacy systems for operational management b) Increased use of manual inspection in production c) Integration of IoT sensors for monitoring and optimization of production systems d) Reliance on third-party vendors for end-to-end manufacturing solutions	**2**	
Q 7	Which factor is a key driver of change in supply chain management for manufacturing? a) The increasing scarcity of natural resources b) Shrinking global markets and regionalization of supply chains c) The globalization of markets and the need for faster, more flexible supply chains d) Simplification of product offerings to reduce complexity	**2**	
Q 8	What role does cybersecurity play in the digital transformation of manufacturing? a) It mainly involves securing intellectual property in R&D processes b) It is essential for safeguarding data integrity and protecting against cyber threats c) It only affects the financial transactions in supply chain operations d) It is a lower priority as digital transformation progresses	**2**	
Q 9	How is big data used in manufacturing? a) Big data is primarily used for customer behavior prediction and marketing optimization b) It is mainly used to track employee performance and workplace safety c) It enables predictive maintenance and helps improve product quality through data analysis d) It restricts decision-making by focusing too much on historical data trends	**2**	
Q 10	What impact does digital transformation have on the role of human workers in manufacturing? a) It eliminates the need for human intervention in most tasks b) It increases reliance on manual labour for basic tasks c) It enhances collaboration between human workers and intelligent automation systems d) It reduces the need for highly skilled labour as machines take over most functions	**2**	
	SECTION B **4Qx5M= 20 Marks**		
Q	Statement of question		**CO4**

Q1	Explain what it means for a factory to adopt digital transformation by sharing examples. What are its benefits to manufacturing companies?	**5**	
Q 2	What are the potential benefits of implementing a smart factory concept in the manufacturing ecosystem?	**5**	
Q 3	Explain how factories can collect information from their machines to improve efficiency and reduce mistakes.	**5**	
Q 4	Explain the main technologies involved in Industry 4.0. and how they help factories work more efficiently.	**5**	

SECTION-C
3Qx10M=30 Marks

Q	Statement of question		**CO5**
Q1	What are the characteristics that define a Smart Factory? What are the key components that you will include when implementing a Smart Factory?	**10**	
Q 2	Describe what is a digital twin and its characteristics? Analyse how it can be used to make better decisions in manufacturing using examples	**10**	
Q 3	How does the adoption of IOT contribute to improvement in business operations? Explain using business case examples OR What are the ethical considerations in deploying automation and artificial intelligence in manufacturing processes?	**10**	

SECTION-D
2Qx15M= 30 Marks

Q	Statement of question		**CO2**
Q1	What is the process to follow to when 3D printing an object? What are the various methods a manufacturer can use while 3D printing an object? Also showcase a few interesting applications of the technology	**15**	
Q 2	What are the potential socio-economic and environmental implications of digital transformation in the manufacturing ecosystem, and how can sustainability be integrated into these innovations? OR Case Study: Digital Transformation and Innovation in the Manufacturing Industry In recent years, the manufacturing industry has been significantly reshaped by digital technologies, driven by the need for greater efficiency, flexibility, and competitiveness. A case study of a leading industrial manufacturer, GS&Co. Manufacturing Ltd., illustrates how digital transformation and innovation have helped the company streamline its operations and enhance its market position. Company Background:	**15**	

GS&Co. Manufacturing Ltd. is a large-scale manufacturer of industrial machinery components, including gears, motors, and valves. Established in 1975, the company has a strong reputation for producing high-quality parts for industries such as automotive, aerospace, and energy. However, GS&Co. Manufacturing Ltd. faced challenges due to rising production costs, slower production times, and the increasing demand for customized solutions. As competition from both domestic and international players intensified, the company recognized the need to adopt digital technologies to remain competitive and meet changing customer demands.

Digital Transformation Initiatives:
1.   Adoption of Smart Factory Solutions (IoT and Industry 4.0): GS&Co. Manufacturing Ltd. implemented an IoT-based system across its production facilities. This connected machinery, sensors, and devices across the factory floor, collecting real-time data on machine performance, production output, and energy consumption. This data was analyzed to optimize equipment usage, predict maintenance needs, and improve overall operational efficiency.
2.   Cloud-Based Manufacturing Resource Planning (MRP): The company adopted a cloud-based Manufacturing Resource Planning (MRP) system to integrate production scheduling, inventory management, and procurement processes. This system allowed for real-time visibility across the supply chain, enabling GS&Co. Manufacturing to quickly adapt to supply chain disruptions, improve order fulfillment, and reduce waste.
3.   Advanced Robotics and Automation: To improve production efficiency and reduce labor costs, GS&Co. Manufacturing invested in advanced robotics and automation solutions. Robotic arms were introduced to handle repetitive tasks, such as assembly and quality checks, allowing human workers to focus on more complex tasks that required decision-making or problem-solving.
4.   Additive Manufacturing (3D Printing): GS&Co. Manufacturing explored additive manufacturing (3D printing) technologies for prototyping and producing customized parts. This enabled the company to reduce lead times for product design, improve product flexibility, and cater to customers needing specialized parts on short notice.
5.   Data-Driven Predictive Maintenance: The company used data analytics and machine learning to implement a predictive maintenance system. Sensors on machinery collected data on vibration, temperature, and pressure, which was then analyzed to predict failures before they occurred. This reduced downtime and minimized maintenance costs, ensuring a more consistent production flow.

Innovation Initiatives:

1.   Collaborative Product Development: GS&Co. Manufacturing established a cross-functional innovation team, bringing together engineers, IT specialists, and marketing professionals. This team was responsible for collaborating on new product development, creating solutions that aligned with emerging customer needs and industry trends. The team also worked with customers to co-develop customized products based on specific operational requirements.

2.   Sustainability and Eco-Friendly Production Practices: As part of its innovation strategy, GS&Co. Manufacturing implemented digital tools to optimize energy usage and minimize waste in the production process. The company introduced smart energy management systems and enhanced recycling practices, helping them reduce their environmental footprint and appeal to sustainability-conscious customers.

3.   Digital Twin Technology for Simulation and Optimization: GS&Co. Manufacturing implemented digital twin technology, creating virtual models of its manufacturing processes. These models enabled the company to simulate various production scenarios, optimize workflows, and identify bottlenecks before they occurred. This capability allowed the company to test new ideas and improve its production efficiency without disrupting operations.

Questions:
1.   Using the Smart Factory structure, analyse the key digital transformation initiatives that GS&Co. Manufacturing Ltd. implemented, and how did these initiatives impact the company's operational efficiency, product quality, and competitiveness in the manufacturing sector?

2.   How do you did GS&Co. Manufacturing's innovation initiatives contribute to the company's success in adapting to the digital manufacturing environment?

3.   How should GS&Co. Manufacturing Ltd. manage the organizational change required for the successful adoption of digital transformation technologies? Discuss the role of leadership, employee training, and change management strategies in overcoming resistance and ensuring the effective implementation of new technologies.