Subject Code:- AME0712

Roll. No:

Time: 3 Hours

Max. Marks: 100

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

1. This Question paper comprises of three Sections -A, B, & C. It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.

2. Maximum marks for each question are indicated on right -hand side of each question.

3. Illustrate your answers with neat sketches wherever necessary.

4. Assume suitable data if necessary.

5. Preferably, write the answers in sequential order.

6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.

SECTION-A

20

1. Attempt all parts:-

1-a.   In the context of digital twins, what does "OT" stand for? (CO1, K1)   1

   (a)   Over Time

   (b)   Operational Technology

   (c)   Online Trading

   (d)   Organizational Tactics

1-b.   How can digital twins be used in manufacturing? (CO1, K1)   1

   (a)   To create virtual reality games

   (b)   To optimize supply chains

   (c)   To develop new smartphone apps

   (d)   To predict weather patterns

1-c.   What layer of the smart factory architecture handles real-time data processing and   1
control near the devices? (CO2, K1)

   (a)   Device Layer

   (b)   Communication Layer

   (c)   Edge Layer

   (d)   Control Layer

1-d.   What is the primary advantage of edge computing in smart factories? (CO2, K1)   1

   (a)   Centralized data storage

   (b)   Reduced latency

(c) Scalability

(d) Cost efficiency

1-e. Which technology plays a crucial role in enabling communication between cyber and physical components in CPS? (CO3, K1) 1

(a) Blockchain

(b) Artificial intelligence

(c) Wireless communication

(d) Virtual reality

1-f. Which of the following is NOT a domain where CPS is commonly applied? (CO3, K1) 1

(a) Healthcare

(b) Transportation

(c) Entertainment

(d) Agriculture

1-g. Connected manufacturing relies heavily on which technology for communication and data exchange? (CO4, K1) 1

(a) Blockchain

(b) Artificial intelligence

(c) Internet of Things (IoT)

(d) Virtual reality

1-h. What is the primary goal of real-time monitoring in connected manufacturing? (CO4, K1) 1

(a) To increase production costs

(b) To optimize resource allocation

(c) To delay production processes

(d) To reduce data accuracy

1-i. Which of the following is a key component of cognitive systems? (CO5, K1) 1

(a) Memory

(b) Processor speed

(c) Keyboard

(d) Monitor resolution

1-j. What role does perception play in cognitive systems? (CO5, K1) 1

(a) It refers to the ability to understand emotions

(b) It involves the interpretation of sensory data

(c) It is the core processing unit of a computer

(d) It is responsible for decision-making

2. Attempt all parts:-

2.a. How can digital twins be used in manufacturing? (CO1, K1) 2

2.b.	What is the role of automation in a smart factory? (CO2, K1)	2
2.c.	Define the term "sensors" in the context of CPS. (CO3, K1)	2
2.d.	Name one key technology enabling connected manufacturing. (CO4, K1)	2
2.e.	Give an example of a cognitive system application in autonomous vehicles. (CO5, K1)	2

SECTION-B   30

3. Answer any <u>five</u> of the following:-

3-a.	Describe a situation where digital twins are used in the energy sector to monitor and control power plants. (CO1, K2)	6
3-b.	What are the key differences between a static digital twin and a dynamic digital twin? (CO1, K2)	6
3-c.	Explain the role of Industrial Internet of Things (IIoT) sensors in quality control within smart factories. (CO2, K2)	6
3-d.	What role does artificial intelligence play in optimizing processes within a smart factory? (CO2, K2)	6
3.e.	Describe the concept of "predictive maintenance" in CPS. How can it reduce downtime in industrial settings? (CO3, K2)	6
3.f.	Discuss the benefits of blockchain technology in ensuring transparency and traceability within a connected manufacturing supply chain. (CO4, K2)	6
3.g.	Describe the concept of "cognitive augmentation" and its applications. (CO5, K2)	6

SECTION-C   50

4. Answer any <u>one</u> of the following:-

4-a.	Discuss the advantages of using digital twins in the construction industry and their impact on project efficiency. (CO1, K2)	10
4-b.	In the context of healthcare, provide a specific example of how a digital twin could be applied to monitor a patient's health condition and support medical decision-making. (CO1, K2)	10

5. Answer any <u>one</u> of the following:-

5-a.	Describe the principles of green manufacturing and how they align with the objectives of a smart factory. What are the potential economic and environmental benefits? (CO2, K2)	10
5-b.	Explain the concept of "Industry 4.0" and its significance in the context of smart factories. (CO2, K2)	10

6. Answer any <u>one</u> of the following:-

6-a.	Discuss the use of CPS in smart grid systems and its impact on energy distribution and management. (CO3, K2)	10
6-b.	You are tasked with implementing a digital twin for a complex piece of manufacturing equipment. Explain the steps you would take to create and utilize this digital twin to improve maintenance and optimize performance. (CO3, K2)	10

7. Answer any <u>one</u> of the following:-

7-a.	Discuss the potential consequences of a cybersecurity breach in a connected manufacturing facility. (CO4, K2)	10
7-b.	Provide an example of a smart home security system that utilizes CPS. Discuss how it integrates sensors, IoT devices, and real-time data analysis to enhance security and convenience for homeowners. (CO4, K2)	10

8. Answer any <u>one</u> of the following:-

8-a.	Explain the concept of "unsupervised learning" in cognitive systems, and provide an application scenario. (CO5, K2)	10
8-b.	In the education sector, how do cognitive systems personalize learning experiences for students? Provide an example of how cognitive systems can adapt to individual student needs. (CO5, K2)	10