

[4]
 OR iii. How does augmented reality (AR) improve efficiency in manufacturing? Describe **6** 4 3 4 1

Total No. of Questions: 6

Total No. of Printed Pages: 4

Enrollment No.....

Q.6 Attempt any two:

- i. Discuss the impact of smart logistics on supply chain management in Industry 4.0. **5** 5 4 5 1
- ii. How does predictive maintenance reduce downtime and improve productivity in Industry 4.0? Explain **5** 5 3 5 1
- iii. Analyze the significance of smart energy management in achieving sustainable manufacturing. **5** 1 4 5 1



Knowledge is Power

Faculty of Engineering
End Sem Examination Dec 2024
ME3EL22 Industrial Revolution 4.0

Programme: B.Tech.

Branch/Specialisation: ME

Duration: 3 Hrs.

Maximum Marks: 60

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d. Assume suitable data if necessary. Notations and symbols have their usual meaning.

| | Marks | BL | PO | CO | PSO |
|---|----------|----|----|----|-----|
| Q.1 i. What is a defining feature of Industry 4.0? | 1 | 1 | 1 | 1 | 1 |
| (a) Use of assembly lines | | | | | |
| (b) Adoption of mass production | | | | | |
| (c) Integration of digital technologies and IoT | | | | | |
| (d) Transition from water power to electricity | | | | | |
| ii. Cyber-physical systems in Industry 4.0 are characterized by- | 1 | 3 | 2 | 1 | 1 |
| (a) Physical objects controlled by software and connected via a network | | | | | |
| (b) Machines that operate without human intervention | | | | | |
| (c) Use of only cloud computing technologies | | | | | |
| (d) Analog control systems for manufacturing | | | | | |
| iii. What is a key application of IoT in industrial settings? | 1 | 2 | 1 | 2 | 1 |
| (a) Manual assembly line monitoring | | | | | |
| (b) Real-time monitoring and predictive maintenance | | | | | |
| (c) Paper-based record keeping | | | | | |
| (d) Employee time tracking | | | | | |
| iv. Which technology allows storage and processing of large data sets remotely in Industry 4.0? | 1 | 2 | 3 | 2 | 1 |
| (a) Big data analytics | | | | | |
| (b) Edge computing | | | | | |
| (c) Cloud computing | | | | | |
| (d) IoT | | | | | |

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|-------|--|----------|---|------|--|----------|---|---|---|---|---|
| | | [2] | | | | | | | | | |
| v. | What is the primary function of robotic process automation (RPA)? | 1 | 3 | 4 | 3 | 1 | | | | | |
| | (a) Manual task execution | | | | | | | | | | |
| | (b) Automating repetitive digital tasks | | | | | | | | | | |
| | (c) Designing industrial control systems | | | | | | | | | | |
| | (d) Building physical robots | | | | | | | | | | |
| vi. | How do industrial automation systems contribute to Industry 4.0? | 1 | 4 | 1 | 3 | 1 | | | | | |
| | (a) By replacing digital systems with analog systems | | | | | | | | | | |
| | (b) By automating and optimizing manufacturing processes | | | | | | | | | | |
| | (c) By limiting flexibility in production | | | | | | | | | | |
| | (d) By increasing manual labor requirements | | | | | | | | | | |
| vii. | What is the primary function of digital twin technology in Industry 4.0? | 1 | 2 | 2 | 4 | 1 | | | | | |
| | (a) Creating physical prototypes for testing | | | | | | | | | | |
| | (b) Simulating and analyzing real-world systems digitally | | | | | | | | | | |
| | (c) Enhancing manual inspection processes | | | | | | | | | | |
| | (d) Limiting the use of IoT and AI | | | | | | | | | | |
| viii. | What is the biggest cybersecurity concern in smart factories? | 1 | 2 | 2 | 4 | 1 | | | | | |
| | (a) Lack of automation | | | | | | | | | | |
| | (b) Unauthorized access to sensitive data and systems | | | | | | | | | | |
| | (c) Absence of IoT implementation | | | | | | | | | | |
| | (d) Overuse of manual monitoring systems | | | | | | | | | | |
| ix. | Which technology is most critical for predictive maintenance? | 1 | 1 | 1 | 5 | 1 | | | | | |
| | (a) Augmented reality | | | | | | | | | | |
| | (b) Data analytics and IoT sensors | | | | | | | | | | |
| | (c) Manual inspections | | | | | | | | | | |
| | (d) Cloud-based human resources software | | | | | | | | | | |
| x. | What is the role of condition monitoring in predictive maintenance? | 1 | 2 | 1 | 5 | 1 | | | | | |
| | (a) Replacing real-time monitoring with periodic checks | | | | | | | | | | |
| | | [3] | | | | | | | | | |
| | | | (b) Detecting equipment issues before they lead to failures | | | | | | | | |
| | | | (c) Disabling IoT connectivity in systems | | | | | | | | |
| | | | (d) Manually scheduling maintenance tasks | | | | | | | | |
| | | | Q.2 | i. | What role does data analytics play in the success of Industry 4.0? | 2 | 1 | 2 | 1 | 1 | |
| | | | | ii. | Briefly describe one challenge industries face when implementing Industry 4.0 technologies. | 3 | 1 | 3 | 1 | 1 | |
| | | | | iii. | Describe the fundamental principles of Industry 4.0 and how they drive modern manufacturing. | 5 | 1 | 5 | 1 | 1 | |
| | | | OR | iv. | Discuss the role of the Internet of Things (IoT) in creating smart factories. Provide examples of its applications. | 5 | 1 | 5 | 1 | 1 | |
| | | | Q.3 | i. | What are the advantages of using cloud computing in Industry 4.0? | 2 | 2 | 6 | 2 | 1 | |
| | | | | ii. | What are the applications of Artificial Intelligence and machine learning in Industry 4.0? Discuss their impact on production, maintenance, and quality control. | 8 | 2 | 6 | 2 | 1 | |
| | | | OR | iii. | Describe how IoT, cloud computing, and big data analytics work together to transform industrial operations in Industry 4.0. Provide examples. | 8 | 2 | 5 | 2 | 1 | |
| | | | Q.4 | i. | What are collaborative robots (Cobots)? How are they used in Industry 4.0? | 3 | 3 | 7 | 3 | 1 | |
| | | | | ii. | Analyse the impact of robotic process automation (RPA) and intelligent automation on industrial efficiency. | 7 | 3 | 7 | 3 | 1 | |
| | | | OR | iii. | How do sensing and perception technologies enable smarter factories in Industry 4.0? Explain it. | 7 | 3 | 6 | 3 | 1 | |
| | | | | | | | | | | | 3 |
| | | | Q.5 | i. | Explain the applications of digital twin technology in manufacturing. | 4 | 4 | 5 | 4 | 1 | |
| | | | | ii. | What are the cybersecurity challenges faced by smart factories in Industry 4.0? Explain it. | 6 | 4 | 3 | 4 | 1 | |

Marking Scheme

ME3EL22 (T) Industrial Revolution 4.0 (T)

| | | |
|-----|---|--|
| Q.1 | i) Answer: c) Integration of digital technologies and IoT ii) Answer: a) Physical objects controlled by software and connected via a network iii) Answer: b) Real-time monitoring and predictive maintenance iv) Answer: c) Cloud computing v) Answer: b) Automating repetitive digital tasks vi) Answer: b) By automating and optimizing manufacturing processes vii) Answer: b) Simulating and analyzing real-world systems digitally viii) Answer: b) Unauthorized access to sensitive data and systems ix) Answer: b) Data analytics and IoT sensors x) Answer: b) Detecting equipment issues before they lead to failures | 1 1 1 1 1 1 1 1 1 1 |
| Q.2 | i. What role does data analytics play in the success of Industry 4.0? ii. Briefly describe one challenge industries face when implementing Industry 4.0 technologies. Description-1M Challenge-2M iii. Describe the fundamental principles of Industry 4.0 and how they drive modern manufacturing. Fundamental principle -3M how-2M | 2 3 5 |
| OR | iv. Discuss the role of the Internet of Things (IoT) in creating smart factories. 3M Provide examples of its applications. 2M | 5 |
| Q.3 | i. What are the advantages of using cloud computing in Industry 4.0? ii. What are the applications of Artificial Intelligence and machine learning in Industry 4.0? Discuss their impact on production, maintenance, and quality control. | 2 8 |
| OR | iii. Describe how IoT, cloud computing, and big data analytics work together to transform industrial operations in Industry 4.0. | 3+3+2 |

| | | |
|-----|--|---------------------------------|
| | | Provide examples. (4*2M) |
| Q.4 | i. What are collaborative robots (Cobots), and how are they used in Industry 4.0? What are robots – 1M Uses – 2M | 3 |
| OR | ii. Analyse the impact of robotic process automation (RPA) 4M intelligent automation on industrial efficiency. 3M | 7 |
| OR | iii. How do sensing and 3M perception technologies enable smarter factories in Industry 4.0? Explain 4M | 7 |
| Q.5 | i. Explain the applications of digital twin technology in manufacturing. 4 applications 1 mark each | 4 |
| OR | ii. What are the cybersecurity challenges faced by smart factories in Industry 4.0? Explain 3M | 6 |
| OR | iii. How does augmented reality (AR) improve efficiency in manufacturing? Describe AR 2M AR-2M How improve efficiency-4M | 6 |
| Q.6 | i. Attempt any two: Discuss the impact of smart logistics on supply chain management in Industry 4.0. smart logistics-1M SCM-1M Impact-3M | 5 |
| OR | ii. How does predictive maintenance reduce downtime and improve productivity in Industry 4.0? Explain Predictive maintenance -2M How- 3M | 5 |
| OR | iii. Analyze the significance of smart energy management in achieving sustainable manufacturing. SEM-2M Analysis-3M | 5 |
| | | ***** |