

GUJARAT TECHNOLOGICAL UNIVERSITY

BE-6 SEMESTER – OLD PAPER – S22 TO W25 – QUESTION BANK

Subject Name & Code: **INDUSTRY 4.0 - 3161926**

Unit 1: Introduction to Industry 4.0

Repeated Questions:

1. **What is Industry 4.0?** (S22 - Q1a, 03 marks) (W22 - Q1a, 03 marks) (S23 - Q1a, 03 marks) (W24 - Q1a, 03 marks) (S25 - Q1a, 03 marks) (W25 - Q1a, 03 marks)
2. **How is India preparing for Industry 4.0?** (S22 - Q1c, 07 marks) (W22 - Q2 OR(c), 07 marks) (S23 - Q1c, 07 marks) (W23 - Q1c, 07 marks) (W24 - Q2 OR(c), 07 marks) (S25 - Q1c, 07 marks) (W25 - Q1c, 07 marks)
3. **What are the benefits of Industry 4.0?** (S22 - Q2a, 03 marks) (W22 - Q1b, 04 marks) (S23 - Q1b, 04 marks) (S25 - Q1b, 04 marks)

Other Important Questions:

1. How does Industry 4.0 differ from previous industrial revolutions? (S25 - Q1a, 03 marks)
 2. Explain the history of industrial revolution. (W25 - Q1b, 04 marks)
 3. List down all industrial revolutions and discuss in brief. (S22 - Q3a, 03 marks)
 4. List down all industrial revolutions. Define Industry 4.0 and give reasons for its implementation. (S22 - Q3b, 04 marks)
 5. What is the difference between Industries 4.0 and 3.0? (S22 - Q1b, 04 marks)
 6. Differentiate Industry 3.0 and Industry 4.0. (W24 - Q1a, 03 marks)
 7. Explain the origin of Industry 4.0? Also write advantages of industry 4.0 in manufacturing and Production system? (W23 - Q2 OR(c), 07 marks)
 8. What are the three core and nine supportive technologies help to implementation of Industry 4.0? (W23 - Q1c, Not specified)
 9. Write three sectors and brief how they adopt Industry 4.0? (W23 - Q2a, Not specified)
 10. Which industry branches are suitable for industry 4.0 development? (S22 - Q1b, 04 marks)
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Unit 2: A Conceptual Framework for Industry 4.0

Repeated Questions:

1. **Explain Proposed Framework for Industry 4.0.** (S22 - Q2c, 07 marks) (W22 - Q2c, 07 marks) (S23 - Q2c, 07 marks) (W24 - Q1c, 07 marks)
2. **Main Concepts and Components of Industry 4.0.** (W22 - Q1c, 07 marks) (S25 - Q2a, 03 marks)
3. **What are the key components that constitute the core structure of Industry 4.0?** (S25 - Q2a, 03 marks) (W25 - Q2a, 03 marks)

Other Important Questions:

1. What is the proposed Framework for Technology Roadmap about Industry 4.0? (W22 - Q2c, 07 marks)
 2. Write briefly about Proposed Framework for Industry 4.0. (S22 - Q2c, 07 marks)
 3. Enlist the key components of Industry 4.0. (W25 - Q2a, 03 marks)
 4. Elaborate Technologies behind Industrial revolution 4.0. (S22 - Q2 OR(c), 07 marks) (S25 - Q2 OR(c), 07 marks)
 5. Design principal of Industry 4.0. (S22 - Q2b, 04 marks)
 6. Design principal for Industry 4.0. (W22 - Q2b, 04 marks)
 7. Explain six design principles for Industry 4.0. (S22 - Q3c, 07 marks) (W24 - Q3 OR(c), 07 marks)
 8. Enlist seven design principles considered for modern manufacturing industries and explain any two. (W25 - Q2c, 07 marks)
 9. Explain the proposed framework for Industry 4.0? (W23 - Q1b, Not specified)
 10. How state of art used for successful system adaptation to Industry 4.0? (W23 - Q4 OR(a), Not specified)
 11. What do you mean by Industry 4.0 and how it is associated with IoT? (S22 - Q2b, 04 marks)
 12. What is end to end engineering? explain in short. (S23 - Q2a, 03 marks)
 13. Draw and explain a hypothetical model for revolution in Industry 4.0? (W23 - Q2b, Not specified)
 14. What is IoT? How is it associated with Industry 4.0? (W24 - Q3 OR(b), 04 marks)
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Unit 3: Technology Roadmap for Industry 4.0

Repeated Questions:

1. **What is technology road mapping?** (S23 - Q3a, 03 marks) (W25 - Q3 OR(a), 03 marks)
2. **Explain the phases of technology roadmap for Industry 4.0.** (W25 - Q3 OR(c), 07 marks)
(From Syllabus: Strategy Phase, New Product and Process Development Phase)

Other Important Questions:

1. Enlist the key benefits of technology road mapping for industry 4.0. (S22 - Q2a, 03 marks)
 2. Briefly explain the key benefits of technology road mapping of Industry 4.0. (W25 - Q3c, 07 marks)
 3. What are the benefits of technology Roadmap? (S23 - Q3 OR(a), 03 marks)
 4. What metrics and indicators are employed to monitor the progress and effectiveness of the technology roadmap in advancing Industry 4.0? (S25 - Q2b, 04 marks)
 5. What are the fundamental components and elements included in the proposed framework for the technology roadmap of Industry 4.0? (S25 - Q2c, 07 marks)
 6. What is a Road map? How does this roadmap benefit for implementation of Industry 4.0? (W23 - Q3c, Not specified)
 7. Describe the new products and process development phase of technology roadmap. (S23 - Q4 OR(c), 07 marks)
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Unit 4: Advances in Robotics in the Era of Industry 4.0

Repeated Questions:

1. **Discuss Autonomous Robots.** (S22 - Q3 OR(b), 04 marks) (W22 - Q3b, 04 marks)
2. **List Industrial robotics applications.** (S22 - Q4a, 03 marks) (W24 - Q3a, 03 marks)
3. **Explain the industrial robotic applications in context of (1) Manufacturing (2) Maintenance (3) Assembly.** (S22 - Q4 OR(c), 07 marks) (W22 - Q3c, 07 marks) (W24 - Q4 OR(c), 07 marks)
4. **What are advanced sensor technologies in robotics? Enlist and explain.** (S22 - Q3 OR(c), 07 marks) (W24 - Q3c, 07 marks)
5. **What is IoRT? Enlist various components of IoRT.** (S22 - Q4 OR(a), 03 marks) (W24 - Q4a, 03 marks)

Other Important Questions:

1. Brief on Internet of Robotic things. (W22 - Q3 OR(a), 03 marks)
2. Write a short note on Internet of robotic things. (S25 - Q3a, 03 marks)
3. Write short note on Internet of Robotics things & cloud robotics. (W25 - Q4 OR(c), 07 marks)
4. What are co-operative robots? Explain with two examples. (S23 - Q2 OR(c), 07 marks)
5. What is a COBOT? Explain working of a COBOT with a neat sketch. (W25 - Q4c, 07 marks)
6. Explain Human- Robot Collaborative Manufacturing. (S22 - Q4c, 07 marks)
7. Discuss Human Robots collaborative manufacturing. (W22 - Q3 OR(c), 07 marks)
8. List any three advantages of adaptive Robotics? (S23 - Q1b, 04 marks)
9. What is adaptive robotics? (W25 - Q3a, 03 marks)
10. What is the function of actuator used for robots? (W25 - Q4a, 03 marks)
11. Explain the working of magnetic positioning sensors used for adaptive robotics. (W25 - Q4b, 04 marks)
12. Write a short note on Cloud Robotics and Cognitive Architecture for cyber - Physical Robotics. (W23 - Q3b, Not specified)
13. Illustrate cognitive architecture for cyber physical robotics with required block diagram. (W24 - Q4c, 07 marks)
14. What is robotics? What are three main categories of parts of robots? (S23 - Q4 OR(a), 03 marks)
15. What is a robot? draw a neat sketch with proper name and explain the function of each component? (W23 - Q3 OR(c), Not specified) [Figure required - refer Question paper of W23]
16. What is the difference between traditional robot and advanced robots? Explain with examples. (S23 - Q5 OR(b), 04 marks)
17. How are robots utilized in manufacturing within the Industry 4.0 paradigm? Discuss specific applications and the impact on production efficiency and quality. (S25 - Q5 OR(b), 07 marks)
18. Provide examples of industries where robotic applications in maintenance and assembly have demonstrated significant improvements. (S25 - Q5 OR(c), 07 marks)
19. How can you justify Industry 4.0 and robotic technology help to prevent the spread of COVID 19 in India? (W23 - Q4 OR(c), Not specified)
20. Explain in short virtualization and decentralization with respect to Industry 4.0. (S23 - Q3b, 04 marks)
21. Draw the Block Diagram of vertical integration. (S23 - Q3 OR(b), 04 marks) [Figure required - refer Question paper of S23]
22. Define: (1) Additive manufacturing (2) Transducer. (W24 - Q2b, 04 marks)
23. Write short note on: Additive manufacturing for Industry 4.0. (W25 - Q3b, 04 marks)
24. Role of 3 D printing in Industry 4.0. (S22 - Q4 OR(b), 04 marks) (W22 - Q4a, 03 marks)

Unit 5: The Role of Augmented Reality in the Age of Industry 4.0

Repeated Questions:

1. **Write difference between AR & VR.** (S22 - Q5a, 03 marks) (W22 - Q5b, 04 marks) (S25 - Q4 OR(b), 04 marks)
2. **What are the various AR Hardware and software technology?** (S22 - Q5 OR(b), 04 marks) (W24 - Q5 OR(b), 04 marks)
3. **Explain the Industrial Applications of AR.** (S22 - Q3 OR(c), 07 marks) (S25 - Q3c, 07 marks)
4. **Enlist industrial application of AR.** (W22 - Q5a, 03 marks) (W25 - Q5 OR(b), 04 marks)

Other Important Questions:

1. Explain AR Hardware and software Technology. (S23 - Q3 OR(c), 07 marks)
2. Describe the essential hardware technologies that constitute an Augmented Reality system in an industrial setting. (S25 - Q3 OR(c), 07 marks)
3. Write a brief note on Augmented Reality Hardware and Augmented Reality Software Technology. (W23 - Q4 OR(b), Not specified)
4. Discuss the basic features of Augmented Reality. (W25 - Q4 OR(b), 04 marks)
5. What is the meaning of Augmented Reality? Explain the main parts of the AR. (W23 - Q4b, Not specified)
6. Explain the concept of Augmented Reality. (S22 - Q4b, 04 marks)
7. How does the integration of AR contribute to the overall goals and principles of Industry 4.0 in manufacturing and beyond? (S25 - Q3 OR(b), 04 marks)
8. Provide examples of industries or companies successfully using AR for training purposes, and what outcomes have they observed. (S25 - Q4c, 07 marks)
9. Explain how Augmented Reality is employed in quality control processes and maintenance activities in Industry 4.0. (S25 - Q4 OR(c), 07 marks)
10. Explain the role of AR in product design and development. (W25 - Q5b, 04 marks)
11. What is Photogrammetry? (S23 - Q5a, 03 marks)
12. Distinguish between AR, VR and MR. (W24 - Q5c, 07 marks)

Unit 6: Obstacles and Framework Conditions for Industry 4.0

Repeated Questions:

1. **Enlist the various challenges for Industry 4.0 transformation.** (S22 - Q3b, 04 marks) (S22 - Q3 OR(b), 04 marks) (W25 - Q3 OR(b), 04 marks)
2. **What are the obstacles in the industry 4.0 transformation?** (S23 - Q5 OR(c), 07 marks) (W23 - Q5a, 03 marks)
3. **Write short note on: Obstacles in implementation of industry 4.0.** (W25 - Q5c, 07 marks) (From Syllabus: Lack of standards, data security, skilled workers, etc.)
4. **Explain financing condition for Industry 4.0 in India.** (S22 - Q5 OR(b), 04 marks) (W22 - Q4b, 04 marks) (W24 - Q3b, 04 marks)
5. **State methods for protection of corporate data in Industry 4.0.** (S22 - Q5c, 07 marks) (W22 - Q5a, 03 marks)

Other Important Questions:

1. What is the availability of skilled workers for Industry 4.0? (S22 - Q5b, 04 marks)
 2. How is India handling the need for skill development to meet the demands of Industry 4.0 technologies? (S25 - Q1c, 07 marks)
 3. What are the reasons for lack of digital strategy? (S23 - Q4a, 03 marks)
 4. What are the legal challenges in the Industry 4.0 transformation? (S23 - Q4c, 07 marks)
 5. Explain the legal framework conditions for the industry 4.0. (S22 - Q5c, 07 marks)
 6. Why legal framework required and how this will help for implementing Industry 4.0? (W23 - Q5c, 07 marks)
 7. What are the risks of an industry 4.0 solution? (S22 - Q4a, 03 marks)
 8. What are the risks of an Industry 4.0 resolution? (W24 - Q3 OR(a), 03 marks)
 9. How much does it cost to implement an industry 4.0 solution? (S22 - Q3 OR(a), 03 marks)
 10. How much does it cost to implement Industry 4.0 solutions? (W24 - Q4 OR(a), 03 marks)
 11. How does Industry 4.0 affect workers? (S22 - Q5 OR(a), 03 marks) (S25 - Q5a, 03 marks) (W24 - Q5 OR(a), 03 marks)
 12. What is Industry 4.0 Cyber Security? (S22 - Q5 OR(b), 04 marks)
 13. Explain the importance of Cyber security in tackling the obstacles in Industry 4.0 with suitable examples. (W25 - Q5 OR(c), 07 marks)
 14. Describe the challenges faced by smart factories with regard to cyber security? (S23 - Q5c, 07 marks)
 15. How does digital strategy and data connectivity affect Industry 4.0? (W23 - Q5 OR(b), 04 marks)
 16. Explain the importance of data security in digital framework. (W25 - Q5a, 03 marks)
 17. What is poor data in digital framework? (W25 - Q5 OR(a), 03 marks)
 18. What are the steps that make India, a leading manufacturing hub? (W23 - Q5b, 04 marks)
 19. Enlist where India have adopted Industry 4.0. (S22 - Q5 OR(a), 03 marks)
 20. Sectors in India which have adopted Industry 4.0. (W22 - Q4a, 03 marks)
 21. Which sectors in India have adopted Industry 4.0? (S25 - Q4a, 03 marks)
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Unit X: Cross-Unit & Miscellaneous Concepts

(This section contains questions that span multiple core units or cover general syllabus concepts not exclusively in one chapter.)

Repeated Questions:

1. **Explain Industry 4.0 Services.** (S22 - Q5c, 07 marks) (S23 - Q3c, 07 marks)
2. **What do you understand by smart factories?** (S22 - Q4 OR(a), 03 marks) (S25 - Q3b, 04 marks) (W24 - Q4b, 04 marks)
3. **What is big data? Write applications of Big data.** (S22 - Q4b, 04 marks) (W22 - Q5c, 07 marks) (W24 - Q5b, 04 marks)
4. **What are Cyber-Physical Systems explain in detail.** (S22 - Q3c, 07 marks) (W22 - Q4c, 07 marks)

Other Important Questions:

1. What is cyber physical system? (S22 - Q1a, 03 marks) (W24 - Q1b, 04 marks)
2. Write a case study of any Industry implemented Industry 4.0. (S22 - Q4 OR(c), 07 marks) (W22 - Q5 OR(c), 07 marks)
3. Write a short note on smart factories. (S23 - Q5b, 04 marks)
4. Explain the Characteristics of smart factory. (S23 - Q2b, 04 marks)
5. How do you propose the application of Artificial Intelligence and robotics will be beneficial in its [smart factory] implementation? (S22 - Q5 OR(c), 07 marks) (S25 - Q3b, 04 marks)
6. Explain the role of AI and Robotics in the implementation of Industry 4.0. (W24 - Q5 OR(c), 07 marks)
7. Define AI. (S23 - Q1a, 03 marks)
8. Write a Scope of AI. (S23 - Q5 OR(a), 03 marks)
9. Write a short note on Artificial intelligence with reference to Industry 4.0. (S22 - Q2 OR(c), 07 marks) (W22 - Q4c, 07 marks) (W22 - Q5b, 04 marks) (S25 - Q5b, 04 marks)
10. Explain a role of AI in Industry 4.0. (S23 - Q2c, 07 marks)
11. How AI fulfil the requirement of Real- time analysis? (W23 - Q4a, Not specified)
12. What is 5G and how will it accelerate industry 4.0? (S22 - Q5a, 03 marks) (W24 - Q5a, 03 marks)
13. Explain cloud robotics with suitable example. (W24 - Q2a, 03 marks)
14. Explore the concept of cloud robotics and its role in the Industry 4.0 landscape. (S25 - Q5 OR(a), 07 marks)
15. Write short note on: Cloud technologies for Industry 4.0. (W25 - Q2 OR(c), 07 marks)
16. Write a short note on five layers of Internet of robotic things. (W23 - Q5 OR(a), 03 marks)
17. Explain IoRT classification according to application areas. (S22 - Q4 OR(c), 07 marks)
18. How does the Internet of Robotic Things (IoRT) transform the way robots operate in Industry 4.0 environments? (S25 - Q4b, 04 marks)
19. Write a short note on Seven Types of Robotics Software that are used for Robot Programming. (W23 - Q5 OR(c), 07 marks)
20. Write properties of Embedded systems. (W25 - Q2b, 04 marks)
21. What is IoT? Enlist various components of IoT. (S25 - Q4 OR(a), 03 marks)
22. Write a difference between IOT and IIOT. (W23 - Q3a, Not specified)
23. Define sensor? and explain in details about temperature sensor and contact sensor? (W23 - Q3 OR(b), Not specified)
24. Explain the principle of working of light sensor. (W23 - Q3 OR(a), Not specified)
25. Draw a diagram showing role of digitization in industry 4.0 adaptation. (S23 - Q4 OR(b), 04 marks) [Figure required - refer Question paper of S23]
26. Write a lifecycle of Industry 4.0 and explain each topic in brief? (W23 - Q2c, Not specified)
27. Why should you implement industry 4.0 solutions? (S22 - Q3a, 03 marks)
28. Explain synthesis by vapour condensation methods. (W24 - Q2c, 07 marks)
