



M.E DEGREE EXAMINATIONS: NOV/ DEC 2024

(Regulation 2024)

First Semester

CONSTRUCTION MANAGEMENT

24CNT502: Construction Equipment and Automation

COURSE OUTCOMES

- CO1:** Apply knowledge of construction equipment management to plan efficient equipment utilization in construction projects.
- CO2:** Analyze earthwork equipment to select the most suitable machinery for various tasks.
- CO3:** Apply tunneling and demolition techniques to ensure safe and effective equipment use
- CO4:** Analyze automation technologies to enhance efficiency and reduce costs in construction.
- CO5:** Apply robotic technologies to improve accuracy and safety in construction tasks.

Time: Three Hours

Maximum Marks: 100

PART A (4*20 = 80 Marks)

1. Scenario: The Mumbai–Ahmedabad High-Speed Rail Corridor is India’s flagship bullet train project. It includes challenging engineering feats, such as the construction of a 7 km undersea tunnel, 194 km of viaducts, and multiple stations in densely populated areas. As of 2024, the project has faced delays due to environmental concerns, land acquisition, and equipment availability.
 - a) Discuss the equipment management strategies needed to ensure smooth operation for constructing the 7 km undersea tunnel. 4 CO1 [K₃]
 - b) Examine the suitability of different earthwork equipment for viaduct construction in this project. 4 CO2 [K₄]
 - c) Evaluate the safety challenges involved in tunneling undersea and propose measures to mitigate them. 4 CO3 [K₅]
 - d) Propose an automation plan using drones and AI for monitoring progress across the construction sites. 4 CO4 [K₆]
 - e) Assess the effectiveness of robotics in reducing delays and increasing precision in this high-speed rail project. 4 CO5 [K₅]

2. Scenario: The Dalian Jinzhouwan International Airport is set to become the world’s largest artificial island airport. Located in China, it requires constructing a 21 km² artificial island, featuring runways, terminals, and supporting infrastructure. The construction must balance environmental

- preservation with the challenges of operating in a marine ecosystem.
- a) Explain the considerations for selecting and managing equipment for dredging and land reclamation. 4 CO1 [K₃]
 - b) Analyze the role of earth movers in handling material logistics during the artificial island's construction. 4 CO2 [K₄]
 - c) Evaluate the effectiveness of equipment used for compaction and dewatering in ensuring long-term stability. 4 CO3 [K₅]
 - d) Design an automated process for integrating underwater sensors to monitor the island's structural integrity. 4 CO4 [K₆]
 - e) Assess the role of robotics in the construction of terminals and runway structures to enhance efficiency and sustainability. 4 CO5 [K₅]
3. Scenario: The Paradise Dam, crucial for Bundaberg's water supply, is being rebuilt after safety concerns. The dam's capacity will be increased with innovative engineering solutions. However, challenges such as cost escalation, environmental regulations, and equipment reliability have affected progress.
- a) Describe the steps involved in planning and managing heavy equipment for dam reconstruction. 4 CO1 [K₃]
 - b) Analyze the role of earthwork equipment in stabilizing the foundation during reconstruction. 4 CO2 [K₄]
 - c) Evaluate the safety measures adopted for dewatering operations and their impact on project success. 4 CO3 [K₅]
 - d) Propose an automation-driven system for monitoring sediment removal and concrete placement. 4 CO4 [K₆]
 - e) Assess the role of robotics in constructing the dam's spillway and reinforcing its structure. 4 CO5 [K₅]
4. Scenario: The 240 MW Jammerland Bugt offshore wind farm will provide clean energy to 240,000 households. Situated in Denmark, the project faces challenges such as extreme weather, offshore logistics, and ensuring sustainable practices during turbine installation.
- a) Identify the equipment required for safe and efficient turbine installation. 4 CO1 [K₃]
 - b) Examine the challenges in using earth-moving equipment for the seabed's preparation. 4 CO2 [K₄]
 - c) Evaluate the safety and operational measures for handling offshore cranes during adverse weather. 4 CO3 [K₅]
 - d) Develop an automation plan for underwater inspection of turbine foundations. 4 CO4 [K₆]
 - e) Assess the impact of robotics in assembling and maintaining offshore wind turbines. 4 CO5 [K₅]

Answer any ONE Question
PART B (1*20 = 20 Marks)

5. Scenario: The Delhi Metro's expansion includes two new corridors to reduce traffic congestion in the National Capital Region. The project involves constructing tunnels, elevated tracks, and modernized stations. Challenges include land acquisition, minimizing disruption in urban areas, and integrating new systems into the existing network.
- a) Explain the planning and equipment management required for tunneling in densely populated urban areas. 4 CO1 [K₃]
 - b) Analyze the use of earthwork equipment for creating stable foundations for elevated tracks. 4 CO2 [K₄]
 - c) Evaluate the measures taken to ensure safety in tunneling under existing infrastructure. 4 CO3 [K₅]
 - d) Propose an automated monitoring system to track construction progress and address delays. 4 CO4 [K₆]
 - e) Assess the role of robotics in modernizing metro station construction for enhanced passenger experience. 4 CO5 [K₅]

OR

6. Scenario: The United States is piloting a Smart Highway project in California. This innovative highway will feature solar-powered roadways, embedded sensors for real-time traffic monitoring, automated toll systems, and dedicated lanes for autonomous vehicles. The project aims to improve traffic flow, reduce emissions, and enhance road safety. Challenges include integrating advanced technologies with existing infrastructure and managing large-scale equipment during construction.
- a) Discuss the equipment management strategies required for laying solar-powered roadways across a busy interstate highway. 4 CO1 [K₃]
 - b) Analyze the challenges of preparing the foundation and subgrade for embedding smart sensors and automated systems. 4 CO2 [K₄]
 - c) Evaluate the safety considerations for deploying equipment and workers while maintaining traffic flow on existing lanes. 4 CO3 [K₅]
 - d) Design an automation plan for integrating real-time data from sensors into the traffic monitoring and control system. 4 CO4 [K₆]
 - e) Assess the potential impact of robotics on the construction of specialized lanes for autonomous vehicles, focusing on efficiency and precision. 4 CO5 [K₅]
