

JK Lakshmipat University Jaipur
INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination, December 2022

B. Tech. (All), Semester VII, 2022-23

Roll No.....

ME2101: Industrial Safety Management

Time: 3 hours

Max. Marks: 60

Instructions to students:

1. Do not write anything other than your roll number on the question paper.
2. Mention all the assumptions for your answers clearly.
3. Choice for attempt Question-3 or Question-4.

NIOSH defines a confined space as one which, by design, has limited openings for entry and exit or unfavorable natural ventilation which contains or produces dangerous air contaminants and is not intended for continuous occupancy.

Confined spaces include but are not limited to storage tanks, compartments of ships, process vessels, pits, silos, vats, wells, sewers, digesters, degreasers, reaction vessels, boilers, ventilation and exhaust ducts, tunnels, underground utility vaults, and pipelines. Confined spaces can be found in many industrial settings, from steel mills to paper mills, from shipyards to farms, and from public utilities to the construction industry. The hazards associated with confined spaces can cause serious injury and death to workers.

Q. 1.1	Identify the Two major factors that lead to fatal injuries in confined spaces. In addition to writing the confined-space-hazards with suitable examples.	5.0 (LO1,2)
Q. 1.2	Develop the prevention and rescue methods for all types of confined space hazards.	5.0 (LO1,2)
Q. 1.3	Discuss the significant criteria, amongst several, which may be considered as the construction of the development of safety performance measures progress.	5.0 (LO3)
Q. 1.4	Prepare the safety procedure as per legislation to protect life, society, and property from the above toxic chemical accident.	5.0 (CO4)

The Incident:

- Shiva, aged eighteen years, had no formal education and got a job with a contractor on a daily basis.
- A contract to replace the damaged pieces of an A.C. sheet roof on a large shed of a factory, located in the vicinity of his village was entrusted to the contractor, who accepted the contract merely on the strength of Shiva's painstaking nature. Neither the contractor nor Shiva had any experience and knowledge of carrying out maintenance work on a fragile roof. Being

equally ignorant, the company management did not bother about any rules and regulations regarding the safety of the man and assigned the task to the contractor.

- On the very first day of this assignment, Shiva, along with an engineer of the company, climbed up onto the A.C. sheet roof of a godown, adjoining the main workplace shed. A bamboo ladder was put in place to gain access to the main shed roof. The engineer was standing on the top of the parapet skirt wall on the godown and was supervising Shiva's work.
- While Shiva was trying to place the ladder properly on the fragile roof of the godown, he slipped and fell straight down onto an A.C. sheet, which broke open causing him to fall through to the concrete floor below. Unfortunately, the gunny bags stuffed with cotton waste that used to be always stored on the floor were cleared away to make space for the idol of Lord Ganesh for a festival that was to commence within a few days.
- Shiva fell head onto the concrete floor from a height of about 15 ft. He sustained severe injuries on his scalp, head, and other parts of his body. The engineer shouted for help. The contractor and others rushed to the site and managed to take Shiva to a nearby hospital, where he was declared dead.

The Management System

- None of the senior executives, namely the Works Manager, Production Manager, and Personnel Manager, were available at the factory or in town. Information reached them very late.
- Neither the management executives nor the contractor had any knowledge of carrying out work on a fragile roof. They were completely ignorant of the legal provisions. In addition, they did not notify the mishap to the authorities within the stipulated period.

Data That Should Have Been Collected

- Were they, or anyone else, aware of the fact that walking or working on an A.C. sheet of a roof was unsafe and dangerous? Did they or did they not know that it was a fragile material and could give way to body weight?
- None of the officers nor the supervisors had knowledge of the statutory provisions regarding 'working on a fragile roof', enacted under the Maharashtra Factories' Rule 73-F which requires the assigning and ensuring of the responsibilities with the job-assigners and the job-assignees by issuing and signing a safe-work-permit.
- The provision of a 'safe walk ladder' or 'crawling board', telescopic ladder or safety belt with adequate length of lifeline and proper training to use them was not made.
- Prompt first aid, medical help, and hospitalization were not made available.
- Provisions of M.F. Rule 115 were not observed and followed. Notification was delayed for no reason. The occupier was served with different show-cause notices.

Q. 2.1	Investigate the above accidents to find the root causes/ factors that contributed to the severity of this accident as per OSHA investigation.	5.0 (LO1,2)
Q. 2.2	Laid down the safety procedure for prevention of the recurrence of this type of accident.	5.0 (LO5)
Q. 2.3	Develop the Fall-Protection Programme for Trips, Slips, and Falls.	5.0 (LO4)

Q. 2.4	Suggest and explain the most suitable techniques for identifying the hazards and calculating the risk for the above accident.	5.0 (LO2,3)
Q. 3.1	An angle-iron framed trolley (178 cm in height, 115 cm in length, and 65 cm in width) weighing approximately 150 kg was designed and fabricated for transferring propeller shafts in a medium vehicle manufacturing plant. The propeller shaft, about 100 cm in length, weighed 20 kg. The trolley was designed to carry 25 shafts, vertically hung on 5 top crossed members—each holding 5 shafts. The trolley was provided with two fixed unidirectional wheels in the front and two swivel wheels at the rear. A handle, a horizontal crossbar welded across the vertical members of the trolley was provided at the height of about 110 cm for the purpose of pushing the trolley from the swivel wheel side. Two operators were assigned to transfer 20 propeller shafts, loaded in the trolley, from their section to another section. The total weight, including that of the trolley, was approximately 470 kg. They did not follow the usual safe operating procedure laid down. Both the operators had never been on the job earlier and as such, the supervisor in charge did not bother to instruct them on safe handling. They were only asked to transfer the material to the designated section. One of them held the handle with his right hand and started dragging the trolley from the swivel wheel side while the other operator pushed it from behind, i.e., from the fixed wheel side. They pulled the trolley through their section, then entered the adjoining section on the same floor. A floor joint in the marked passageway was damaged and had widened, creating a broken floor cavity. The trolley got stuck in this cavity and the swivel wheels turned at right angles and refused to move. The front operator went to the side, held the trolley firmly with both hands and both of them tried to push it hard to get it moving again. The front operator lost his balance and fell down on the side of the track. The trolley toppled over him. His back and lower limbs suffered acute contused injuries and he experienced numbness in the whole of his lower body. He was immediately taken to a hospital. Analyze observations for this accident and develop technical recommendations to prevent a similar accident in the future.	5.0 (LO3,4)

Q. 3.2	Two operators were operating a Goliath crane in an engineering shop that manufactured mini-boilers. When the crane approached the location of a Jib crane at the end of the huge shed, they heard a loud bang. The Jib crane had dislodged from its foundation and fallen down on its side with the base plate uprooted. It was reported by the operators that the boom of the Jib crane, which was moved by them earlier, was found in its steady position in the gap between the structural members of the Goliath crane and the shed. An unusual clear distance between the vertical structural member of the Goliath crane and the tilted boom of the Jib crane was observed. The plant manager and these skilled and experienced operators decided to lift the Jib crane to make it stand erect. They first unloaded the element from the Goliath crane without moving the crane further to prevent it striking the Jib crane. They then fixed the lifting hooks onto the span of the Jib crane. When they lifted the Jib crane, it gave way completely from its foundation plate and collapsed on its own. The free end of the boom struck against the floor in the gap between two structural members. This time the boom brushed heavily against the vertical structural members of the Goliath crane and ultimately got jammed in between. <i>Investigating the accident and finding the exact cause of the mishap could not be ascertained.</i>	5.0 (LO1,2)
Q. 3.3	The main unit of a refrigeration plant had tripped the previous night because of the defective low oil pressure trip cut-out device located in the relay compartment of the control panel unit in the refrigeration department. The electrical maintenance service department was requisitioned to disconnect the power supply and replace the defective cutout. The electrician who was entrusted with the job of replacing the defective cutout was standing on an M.S. stand in front of the panel. He removed all the screws of the cutout, except one which was jammed. He was then trying to remove the jammed screw when his left wrist touched the live terminals of one of the auxiliary relays located just above the cutout. He received an intense electrical shock. His left hand was virtually dragged in. He managed to pull his hand out and get down onto the floor on his own. All his co-workers rushed to rescue him. They laid him flat on the floor and massaged his left hand and arm. He was then taken to a hospital for further	5.0 (LO1,4)

	medical treatment. He was unable to lift and stretch his left arm and his left shoulder pained at the slightest movement of his left hand. Medical authorities reported that he experienced 'shearing of spinouts muscle with haematoma'. <i>As a safety officer your write your observations during the investigation to find the causes of the above accident. In addition, develop the guidelines for preventing this accident.</i>	
Q. 3.4	Design a questionnaire to help us think of the less obvious ways of preventing an accident from happening again.	5.0 (LO4)

OR

Q. 4.1	Write the Safety and Loss Prevention and Control Responsibilities for the Implementation of a Safety Policy in hazardous premises for the following designations: 1. Occupier/Manager under the Factories Act 2. Dept. Head/Section Head 3. The Manager 4. The First Line Supervisors 5. Safety Manager and/or Safety Officers 6. Personnel or Human Resource Managers and Officers 7. Maintenance Manager, Deputies, and Assistants 8. Purchase/Materials Manager 9. Quality Assurance Manager 10. Manager Assigning Any Job To a Contractor 11. Security Manage 12. Office Employees 13. Workmen	10.0 (LO4, 5)
Q. 4.2	Write the principles of fire extinguishing and Classification Of Fires (IS: 2190-1971)	5.0 (LO1,2)
Q. 4.3	Prepare a list of personal protective equipment non-respiratory for employees those are working zone-2 area.	5.0 (LO1, 4)

All the best!

