

**National Exams May 2013**  
**98-Ind-B10 - Industrial Safety and Health**  
**3 hours duration**

**Notes:**

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.
2. This is a Closed Book exam. No calculators are allowed for this exam.
3. Any five questions constitute a complete paper. Only the first five questions as they appear in your answer book will be marked.
4. All questions are of equal value.
5. Write your answers in point-form whenever possible, but fully.

**Marking Scheme (marks)**

- |    |        |         |         |
|----|--------|---------|---------|
| 1. | (i) 7, | (ii) 7, | (iii) 6 |
| 2. | (i) 6, | (ii) 7, | (iii) 7 |
| 3. | (i) 7, | (ii) 6, | (iii) 7 |
| 4. | (i) 6, | (ii) 7, | (iii) 7 |
| 5. | (i) 7, | (ii) 6, | (iii) 7 |
| 6. | (i) 7, | (ii) 6, | (iii) 7 |
| 7. | (i) 6, | (ii) 6, | (iii) 8 |

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1.
  - (i) State the areas other than operator error that can cause failure of equipment and accident. Name and explain the new engineering discipline or concept that grew out of the idea of other areas responsible for accident causation or avoidance.
  - (ii) State the costs associated with the Occupational Health and Safety Act (OHSA) and OHSA standards that companies, especially the smaller (20 to 250 employees) ones, generally object to because they feel that such costs are not economically justifiable.
  - (iii) Explain the manner by which unsafe conditions contributing to an unsafe act resulting in an accident, can be uncovered.
  
2.
  - (i) State the manner by which fault-free analysis can be used in accident investigation. What are the limitations of the fault-free analysis?
  - (ii) What is the purpose of job safety analysis (JSA)? State the steps followed in conducting a job safety analysis.
  - (iii) Explain the concept of failure modes and effects analysis (FMEA) in the context of reliability engineering.
  
3.
  - (i) Define physical hazards. Name some of the physical hazards.
  - (ii) What are some of the common chemical hazards?
  - (iii) What is your understanding of the criterion for permit-required confined space?
  
4.
  - (a) What are the general methods of controlling harmful environmental stresses (dust, exhaust, etc.)?
  - (b) State the basic principles and approaches for engineering control measures used to deal with physical hazards (noise, temperature, radiation, pressure, etc.).
  - (c) What are the responsibilities of facilities and equipment designers in providing safety measures for toxic hazards?
  
5.
  - (i) Explain the role of process information, process analysis and operating procedures in providing process safety.
  - (ii) What are the basic ingredients of an effective training plan to ensure that the operators follow the operating procedure?
  - (iii) Explain the important hazardous chemical information needed for process safety analysis.
  
6.
  - (i) State the means by which damage resulting from a hazard can be minimized and controlled.
  - (ii) What are the order of preferences that should be followed as general principles for eliminating and controlling hazards in industry?
  - (iii) State the common precautionary measures that must be followed in the operation of all mechanical equipment.

7. A shipping department packager in a small manufacturing plant placed a gear on a layout table and sprayed it with a rust preventative before packing it for shipment. After the employee had sprayed several gears, the spray gun became clogged and failed to operate. The employee tried to clean the clogged spray gun tip. At that instant, the gun discharged, and the employee's left thumb was severely lacerated and subsequently had to be amputated.
- (a) Determine the cause of the accident.
  - (b) State the corrective actions required.
  - (c) Suggest the follow-up action required.