

**National Exams May 2010**  
**98-CS-2-Engineering in Society - Health, Safety and the Environment**  
**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) 6, (ii) 7, (iii) 7
2. (i) 7, (ii) 7, (iii) 6
3. (i) 7, (ii) 7, (iii) 6
4. (i) 6, (ii) 8, (iii) 6
5. (i) 6, (ii) 7, (iii) 7
6. (i) 7, (ii) 7, (iii) 6
7. (i) 6, (ii) 7, (iii) 7

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1. (i) Explain the manner by which accident and injury rates can be minimized especially in smaller companies (between 20 and 250 employees).  
(ii) What are the costs associated with the OSHA Act and Standards that companies especially the smaller ones generally object to because they feel that such costs are not economically justifiable?  
(iii) State the factors or aspects that are considered in performing economic analyses of safety and actual or potential losses.
2. (i) Explain the manner by which engineering deficiencies can cause or contribute to accidents.  
(ii) What are the engineering design principles or approaches taken to reduce or eliminate hazards in industry?  
(iii) What precautionary measures are common to the operation of all mechanical equipment?
3. (i) What is the purpose of monitoring devices? State the manner by which monitors can be used for surveillance of equipment or processes.  
(ii) What are the means by which damage resulting from an accident can be minimized and controlled?  
(iii) State the procedure that should be followed for emergency actions in an industrial plant.
4. (i) What are the possible effects of fire hazards on personnel, materials and resources and the environment?  
(ii) What are the advantages of sprinkler systems? Explain the wet, dry and deluge sprinkler systems. What is the main reason the sprinkler systems sometimes fail to operate?  
(iii) Explain the means by which the spread of fire can be prevented, once fire is discovered.
5. (i) What are the major types of respiratory protective equipment?  
(ii) State the types and uses of air purifiers: mechanical, chemical and canister-type.  
(iii) State the responsibilities of the facilities and equipment designers in providing safety measures for toxic hazards.
6. (i) State the characteristics and purpose of: (a) audiometric test program, (b) sound-level meter, and (c) octave-band analyzer.  
(ii) State the engineering controls that can be used to reduce noise and vibration levels in industry.  
(iii) Explain the means by which noise reduction can be achieved in industry.

7. A drill-press operator was drilling holes while wearing gloves in metal fasteners to be used in aircraft wing gas tank assemblies. She then attempted to make a tool change while the machine was operating at a slow speed. While she was doing so, the glove on her right hand caught on the revolving drill and caused an amputation of the middle finger on her right hand.
  - (i) Determine the cause of the accident.
  - (ii) State the corrective actions required.
  - (iii) Suggest the follow-up action required.