

**National Exams December 2002**

**98-CS-2-Engineering 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.

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**98-CS-2, Engineering in Society – Health, Safety and the Environment**

- (i) What are the four types of citations issued by the Compliance Officer for the violation of OSHA standards?
  - (ii) State the factors or aspects that must be considered in performing economic analyses for the prevention of safety and of actual or potential accident losses.
  - (iii) State the priorities that are observed in making OSHA inspections.
2. (i) Explain the manner by which the existence of hazards can be determined.  
(ii) State the means of hazard elimination and accident avoidance. Give examples.  
(iii) Explain the concept of “fail-safe designs”. What are the categories of fail-safe designs?
  3. (i) State the features of equipment and procedures or operations of an old or new plant that should be reviewed to ensure plant safety.  
(ii) What are the high-hazard, moderate-hazard and low-hazard areas in a plant? How should they be identified in a plant?  
(iii) Explain the manner in which accident and injury frequency rates and severity rates are used by the safety engineers.
  4. (i) Explain the various means by which fire can be suppressed.  
(ii) What are the possible effects of fire?  
(iii) What are the advantages of sprinkler systems? Explain wet, dry and deluge systems. What is the main reason the sprinkler systems sometimes fail to operate?
  5. (i) Define hypoxia. What are the causes of hypoxia?  
(ii) State the harmful effects of chemical agents to specific organs of the body.  
(iii) How are the toxic agents detected? Name the typical operations that require the use of respiratory protective equipment and protective clothing.
  6. (i) State the characteristics and purpose of: (a) audiometric test program, (b) sound-level meter (A), and (c) octave-band analyzer.  
(ii) State the potential problems due to vibration and noise that should be periodically reviewed by the safety engineer.  
(iii) Explain the manner by which vibration can be eliminated through isolation of sources and personnel.
  7. An axle packager in a metals plant placed an axle on a layout table and sprayed it with a rust preventative before packing it for shipment. The spraying was done with a gun operated at a pressure of 40 pounds per square inch (psi). The gun clogged while the packager was spraying, and he wiped the spray tip with his left thumb. At that instant the gun discharged and the employee received an injection of rust preventative in his left thumb. Subsequently, the left thumb had to be amputated.
    - (i) Determine the cause of the accident.
    - (ii) State the corrective actions required.
    - (iii) Suggest the follow-up action required.