

**National Exams December 2014**  
**11-CS-2-Engineering in Society – Health and Safety**  
**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. Candidates may use one of two calculators, the Casio or Sharp approved models.
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. Show all calculations.

**Marking Scheme (marks)**

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

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1.
  - (i) State the elements of Domino Theory.
  - (ii) Explain by means of a diagram, the four system safety factors: the four Ms.
  - (iii) What is single factor theory? Explain its limitation.
  
2.
  - (i) What are the engineering activities that result in hazards in industry?
  - (ii) State the other (than engineering) factors causing hazards.
  - (iii) What are the components of communication essential in safety engineering? Show by means of a diagram.
  
3.
  - (i) State the safety practices and safeguards for controlling hand tools hazards?
  - (ii) State the factors that contribute to manual materials handling injuries, especially low back pain.
  - (iii) What are the frequently recommended lifting procedures?
  
4.
  - (i) Explain the characteristics of the following fire detectors: (a) heat detectors, and (b) smoke detectors.
  - (ii) State the characteristics of the following sprinkler systems: (a) wet-type, (b) dry-type and (c) deluge.
  - (iii) What is your understanding of the fire suppression systems that do not use water?
  
5.
  - (i) State the steps followed in the conduct of a safety audit process.
  - (ii) What is the purpose of accident investigation? State the criteria used to decide which accidents to investigate.
  - (iii) State the classic steps followed in accident investigation.
  
6.
  - (i) State the detrimental effects (other than hearing loss) from noise.
  - (ii) What is your understanding of audiology and audiogram?
  - (iii) An industrial worker is exposed to the following noise levels during an 8-hour work shift: 80 dBA for 4 hrs, 85 dBA for 2hrs, 90 dBA for 1 hr and 95 dBA for 1 hr. Calculate the combined effect or the daily noise dose, (OSHA permissible exposure levels for duration/day are: 80 dBA-16 hrs, 85 dBA-8 hrs, 90 dBA -4 hrs and 95 dBA – 2 hrs.). Is the daily noise acceptable? If this is not, then what should be done?
  
7. A millwright was reaching out to make an adjustment on a flywheel chain on a press while standing on a 20-foot ladder. In doing so, he lost his balance and fell onto the shaft and then struck a conveyor and fell to the floor, approximately 15 feet below. This caused a compound fracture of his right leg and property damage of \$5,000 for a broken shaft and belts on a large press and broken guard on the conveyor belt.
  - (i) Determine the cause of the accident.
  - (ii) State the corrective actions required.
  - (iii) Suggest the follow-up actions required