

**National Exams May 2017**  
**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) 6, (iii) 7
3. (i) 8, (ii) 6, (iii) 6
4. (i) 7, (ii) 7, (iii) 6
5. (i) 7, (ii) 7, (iii) 6
6. (i) 6, (ii) 6, (iii) 8
7. (i) 6, (ii) 6, (iii) 8

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1. (i) State your understanding of the terms, safety engineering and safety practice.  
(ii) Show by means of a diagram your understanding of multiple factor theory in the context of incident and accident theories.  
(iii) Explain the concepts of (a) reactive approach for deriving preventive actions from accident and (b) proactive approach for developing preventive actions before accidents occur. Use diagrams to explain.
2. (i) State the various sources of hazards in industry.  
(ii) State the priorities in order of importance for selecting controls for hazards.  
(iii) State the steps that should be followed for the effective use of warning devices.
3. (i) Briefly explain the types of safeguards used in machines.  
(ii) State the purpose of point-of-operation devices used in a machine. Give examples.  
(iii) Explain the importance of handle design of hand tools from an ergonomics viewpoint.
4. (i) Explain the controls used for protecting people from exposure to hazardous materials in the workspace.  
(ii) State the characteristics of confined spaces. Name the confined spaces in industry.  
(iii) What are the main hazards of confined spaces? Explain.
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 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.
  - (i) Determine the cause of the accident.
  - (ii) State the corrective actions required.
  - (iii) Suggest the follow-up action required.