

INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR

Date: 16-4-2013 EN/AN. Time: X/3 Hours. Full Marks: 100. No of students: 14

Autumn / Spring Semester, 2012-13 Deptt: Agri. & Food Engg. Sub. No: AG.60102
M.TECH (FMP)
I Yr B.Tech (H) / D.D. / B.Arch (H) / M.Sc. Sub. Name: Tractor Ergonomics

Instructions: 1) Answer any four Questions from Questions 1 to 5 and any eight Questions from Questions 6 to 15.

Questions 1 to 5: Answer ANY FOUR questions.

(13 × 4 = 52)

1. Explain the methods of noise control.
2. Sketch a diagram indicating major stages in the system design process and explain them briefly. Explain how human factors considerations are taken care in the design at various stages.
3. A leg operated pedal needed for applying brake has to be positioned in a tractor. The force that can be exerted by a seated person on the brake pedal and the range of its movement during braking have to be decided based on the measurements that would be carried out on a sample population of the tractor drivers of a given region. Explain step by step the methodology that has to be adopted for these measurements.
4. Explain how you can calibrate a person using heart rate in the laboratory for assessment of physiological work load experienced in the field conditions. List down the precautions to be observed during the laboratory test.
5. A human error classification system proposed by Rouse and Rouse is given in Table 1. Taking an example of pressure development in a boiler explain each step where human beings are likely to cause errors or encounter errors.

Questions 6 to 15: Answer ANY EIGHT questions. (6 × 8 = 48)

6. List down and explain the principles of arranging components in a work space.
7. Explain how exercise training helps a person to be able to perform physical work in a better way.
8. Explain the benefits of compatibility relationships in the human control of systems.
9. According to Rasmussen the likelihood and consequences of human errors can be reduced by personnel selection and training and by design of equipments, procedures and environment. Explain the generic approaches in the design for dealing with human errors.
10. Explain the fundamental elements contained in a warning signal. Give an example.
11. Discuss on the variability in the values of anthropometric variables and their ratios in people.
12. Sketch and explain CIE chromaticity diagram. Indicate different colours perceived by human eye.
13. Write down general recommendations on signal and warning lights.
14. Explain what is meant by acclimatization to heat stress. Explain how acclimatization to heat stress can be carried out on human beings.
15. Different parts of human body respond to different frequencies of vibration. Explain with examples.

Table 1: Human error classification scheme proposed by Rouse and Rouse (1983)

1. Observation of system state
 - a) Improper checking of correct readings
 - b) Erroneous interpretation of correct readings
 - c) Incorrect readings of appropriate state variables
 - d) Failure to observe sufficient number of variables
 - e) Observation of inappropriate state variables
 - f) Failure to observe any state variable
 2. Choice of system state
 - a) Hypothesis could not cause the values of the state variables observed
 - b) Much more likely causes should be considered first
 - c) Very costly place to start
 - d) Hypothesis does not functionally relate to the variables observed
 3. Testing of hypothesis
 - a) Stopped before reaching a conclusion
 - b) Reached wrong conclusion
 - c) Considered and discarded correct conclusion
 - d) Hypothesis not tested
 4. Choice of system state
 - a) Insufficient specification of goal
 - b) Choice of counterproductive or non-productive goal
 - c) Goal not chosen
 5. Choice of procedure
 - a) Choice of procedure that would not fully achieve goal
 - b) Choice of procedure that would achieve incorrect goal
 - c) Choice unnecessary for achieving goal
 - d) Procedure not chosen
 6. Execution of procedure
 - a) Required step omitted
 - b) Unnecessary repetition of required step
 - c) Unnecessary step added
 - d) Steps executed in wrong order
 - e) Step executed too early or too late
 - f) Control in wrong position or range
 - g) Stopped before procedure is complete
 - h) Unrelated inappropriate step executed
-