M. Tech Odd Semester Examination, February, 2023

Agricultural Engineering

(3rd Semester)

Course No.: MAE3E01

(Energy Engineering in the Design of Tractor and Machinery)

Full Marks: 50
Pass Marks: 25

Time: 2 hours

Note:
1. Attempt any five questions.
2. Begin each answer in a new page.
3. Answer parts of a question at a place.
4. Assume reasonable data wherever required.
5. The figures in the right margin indicate full marks for the question.
6. All the mathematical symbols and abbreviations have their usual meanings.

1. (a) Briefly describe octave-band and third-octave-band analyses with respect to noise produced by a machine in a work environment 4

   (b) State the factors affecting (i) work posture, (ii) $V0_2$ max, and (iii) fitness o f a person. 2x3=6

2. (a) Heat stress is always a risk. How is it measured? State any four measures that you may take for reducing heat stress in a working environment. 5

   (b) State any five main problems associated with machine safety. Name any four safety devices that you may suggest in this context. 5

3. (a) Define 'aerobic' and 'anaerobic' work with suitable examples. How is 'physical work capacity' of a

person objectively measured? 'Work capacity may depend on physical conditioning'- why? 6

(b) "A hand tooI should be selected so that it is possible to operate with a straight wrist". Why? Cite three exampleswhere this condition is' achieved. 4

4. (a) In ergonomic design of a worksystem, 'anthropometric mismatch' is to be avoided. What is it? What are the possible reasons ofthis mismatch? Cite three examples of such mismatch from industrial situations. 8

(b) State any two measures to control noise at its source and structure-borne transmissions. 2

5. State any three measures that you may suggest for shift work performance. Explain any two shift systems with their rationale in this respect. 10

6. A worker lifts cartons of grapes from a conveyor onto a pallet. The cartons weigh 20 kg each and are 30 cm^2. The worker grasps the middle of each carton, as there are no handles. The centre of gravity of the load is 50 cm from his lumbar spine. The height of the pallet adjusts automatically to 80 cm and the height of the conveyor is 70 cm above the floor. The worker turns by 45°each time a carton is transferred. The workerperform5 lifts/min for 1 h per day. Calculate RWL and the lifting index. (Assume suitable values for frequency and coupling factors). Comment on the safety ofthis task and identify the main risk factors. Suggest how the safety ofthe task can be improved in the short term. 10

7. Noise is unacceptable in a working environment. Why? How do you measure 'sound pressure level' and 'noise dose'? A machine subjects its operator to 90 dBA when it is idle and 95 dBA when it is used at full power. Assume 7 hours of use per day with 2.5 hours at 90 dBA and 4.5 hours at 95 dBA. Calculate and interpret he total noise dose in Indian environment. 10

8. Several human factors principles are applicable to design for human assembly. Name and briefly describe them. How are these principles consistent with the basic ergonomic design of work systems? 10

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