B.Tech Even Semester Examination, May, 2025

Agricultural Engineering

(6th Semester)

Course No: AE-602

(Machine Design & Drawing)

Full Marks: 70
Pass Marks: 28
Time: 3 hours

Note:

1. Attempt any five questions taking one from each unit.
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 figure in the right margin indicates full marks for the question
6. All the mathematical symbols and abbreviations have their usual meanings.

UNIT-I

1. (i) What do you mean by ductility and malleability? [4]

   (ii) Briefly explain the principal theories of failure for a member subjected to bi-axial stress. [10]

2. (i) Define fatigue stress concentration factor. Briefly explain notch sensitivity. [5]

   (ii) A mild steel shaft of 50 mm diameter is subjected to a bending moment of 2000 N-m and a torque T. If the yield point of the steel in tension is 200 MPa, find the maximum value of this torque without causing yielding of the shaft according to 1. the maximum principal stress; 2. the maximum shear

stress; and 3. the maximum distortion strain energy theory of yielding. [9]

UNIT-II

3. (i) Define flywheel and governor. Briefly explain the design of connecting rod with necessary formula. [2+5]

   (ii) Enlist the classification of machine design with explanation. [7]

4. (i) Provide a concise explanation on maximum fluctuation of energy. [5]

   (ii) The turning moment diagram for a petrol engine is drawn to the following scales: Turning moment, 1 mm = 5 N-m; Crank angle, 1 mm = 1°. The turning moment diagram repeats itself at every half revolution of the engine and the areas above and below the mean turning moment line, taken in order are 295, 685, 40, 340, 960, 270 mm^2. Determine the mass of 300 mm diameter flywheel rim when the coefficient of fluctuation of speed is 0.3% and the engine runs at 1800 r.p.m. Also determine the cross-section of the rim when the width of the rim is twice of thickness. Assume density of rim material as 7250 kg / m^3. [9]

UNIT-III

5. (i) Explain in details about the stresses in flywheel arms. [7]

   (ii) Define brittleness. Write the general procedure in machine design with flowchart. [2+5]

6. A punching machine makes 25 working strokes per minute and is capable of punching 25 mm diameter holes in 18 mm thick steel plates having ultimate shear strength of 300 MPa. The punching operation takes place during $1/10^{th}$ of a revolution of the crank shaft. Estimate the power needed for the driving motor, assuming a mechanical efficiency of 95 per cent. Determine suitable dimensions for the rim cross-section of the flywheel, which is to revolve at 9 times the speed of the crank shaft. The permissible coefficient of fluctuation of speed is 0.1. [7+7]

UNIT-IV

7. (i) Enlist the properties of friction material surface of friction clutch. [2]

   (ii) Define clutch. Explain the design consideration of positive and friction clutch. [4+8]

8. (i) Define fatigue and creep. [2]

   (ii) Enlist the types of friction clutches. Explain the design consideration of a disc or plate clutch with necessary diagram. [12]

UNIT-V

9. (i) Define the important 7 terms used in hydrodynamic journal bearing. [7]

   (ii) Write in details about bearing characteristic number and bearing modulus for journal bearings. [7]

10. (i) Write the advantages and disadvantages of roller bearing over sliding bearing. [4]

    (ii) Briefly explain the 4 principal types of roller bearings. [10]

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