PVP 19

Code: 19ME3602

III B.Tech - II Semester – Regular Examinations – JUNE 2022

DESIGN OF MACHINE ELEMENTS
(MECHANICAL ENGINEERING)

Duration: 3 hours Max. Marks: 70

Note: 1. This question paper contains two Parts A and B.
2. Part-A contains 5 short answer questions. Each Question carries 2 Marks.
3. Part-B contains 5 essay questions with an internal choice from each unit. Each question carries 12 marks.
4. All parts of Question paper must be answered in one place.

PART – A

1. a) What are the factors to be considered for the selection of materials for the design of machine elements?
   b) List out various theories of failures applicable to brittle materials.
   c) Enumerate different types of riveted joints.
   d) What is meant by formative or equivalent number of teeth for helical gears.
   e) Define spring rate and spring index.

PART – B

UNIT – I

2. a) Explain general considerations in machine design. 6 M
   b) Explain the use of standards in machine design. 6 M

OR

3. a) Explain any five mechanical properties of metals. 6 M
   b) What do you understand by preferred numbers? Explain fully? 6 M

UNIT – II

4. a) The diameter of a piston of the steam engine is 300 mm and the maximum steam pressure is 0.7 N/mm^2. If the maximum permissible compressive stress for the piston rod material is 40 N/mm^2, find the size of the piston rod. 6 M

   b) Find the minimum size of a hole that can be punched in a 20 mm thick mild steel plate having an ultimate shear strength of 300 N/mm^2. The maximum permissible compressive stress in the punch material is 1200 N/mm^2. 6 M

OR

5. A bar of circular cross-section is subjected to alternating tensile forces varying from a minimum of 200 kN to a maximum of 500 kN. It is to be manufactured of a material with an ultimate tensile strength of 900 MPa and an endurance limit of 700 MPa. Determine the diameter of bar using safety factors of 3.5 related to ultimate tensile strength and 4 related to endurance limit and a stress concentration factor of 1.65 for fatigue load. Use Goodman straight line as basis for design. 12 M

UNIT-III

6. A cast iron bracket to carry a shaft and a belt pulley is shown in Fig. 1. The bracket is fixed to the main body by means of four standard bolts. The tensions in the slack and tight sides of the belt are 2.2 kN and 4.25 kN respectively. Find the size of the bolts, if the safe tensile stress for bolts is 50 MPa. 12 M

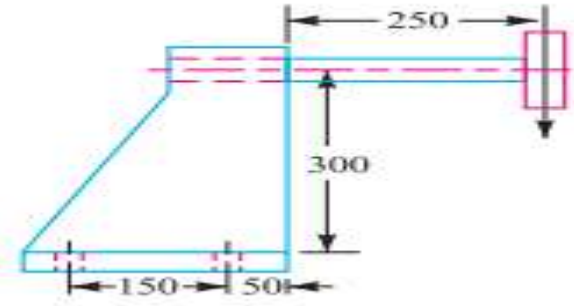

Fig. 1

OR

7. Two plates of 10 mm thickness each are to be joined by means of a single riveted double strap butt joint. Determine the rivet diameter, rivet pitch, strap thickness and efficiency of the joint. Take the working stresses in tension and shearing as 80 MPa and 60 MPa respectively. 12 M

UNIT – IV

8. Design a knuckle joint to transmit 150 kN. The design stresses may be taken as 5MPa in tension, 60 MPa in shear and 150 MPa in compression. 12 M

OR

9. A gear drive is required to transmit a maximum power of 22.5 kW. The velocity ratio is 1:2 and r.p.m. of the pinion is 200. The approximate centre distance between the shafts may be taken as 600 mm. The teeth have 20° stub involute profiles. The static stress for the gear material (which is cast iron) may be taken as 60 MPa and face width as 10 times the module. Find the module, face width and number of teeth on each gear. Check the design for dynamic and wear loads. The deformation or dynamic factor in the Buckingham equation may be taken as 80 and the material combination factor for the wear as 1.4. 12 M

UNIT – V

10. Design a close coiled helical compression spring for a service load ranging from 2000 N to 2500 N. The axial deflection of the spring for the load range is 5 mm. Assume a spring index of 6. The permissible shear stress intensity is 410 MPa and modulus of rigidity, G = 84 kN/mm^2. 12 M

OR

11. A locomotive semi-elliptical laminated spring has an overall length of 1 m and sustains a load of 70 kN at its centre. The spring has 3 full length leaves and 15 graduated leaves with a central band of 100 mm width. All the leaves are to be stressed to 400 MPa, when fully loaded. The ratio of the total spring depth to that of width is 2. Take E = 210 kN/mm^2. Determine : i) The thickness and width of the leaves. ii). The initial gap that should be provided between the full length and graduated leaves before the band load is applied. iii). The load exerted on the band after the spring is assembled. 12 M