7455

C20-M–402

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BOARD DIPLOMA EXAMINATION, (C-20)

OCTOBER/NOVEMBER—2023

DME – FOURTH SEMESTER EXAMINATION

DESIGN OF MACHINE MEMBERS

Time : 3 Hours] [*Total Marks* : 80

PART—A 3×10=30

Instructions : (1) Answer **all** questions.

(2) Each question carries **three** marks.

(3) Answers should be brief and straight to the point and shall not exceed five simple sentences.

1. List six factors to be considered while designing a machine element. 3

2. Write the statement and equation for maximum shear stress theory. 2+1

3. What size of an axial hole must be drilled in M-30 bolt to make it uniform strength? 3

4. List six types of locking devices. 3

5. Define efficiency of a riveted joint. 3

6. Write the classification of welded joints. 3

7. A solid shaft is to transmit 300 kW at 150 r.p.m. If the maximum shear stress induced in the shaft must not exceed 85 N/mm^2, find the diameter of the shaft. 3

8. Write two differences between rigid and flexible couplings. 3

9. Define bearing and classify bearings. 1+2

10. Define a spring. List four applications of springs. 1+2

PART—B

8×5=40

Instructions : (1) Answer **all** questions.

(2) Each question carries **eight** marks.

(3) Answers should be comprehensive and criterion for valuation is the content but not the length of the answer.

11. *(a)* An eye bolt is to be used for lifting a load of 90 kN. Design the bolt if the tensile stress is not to exceed 100 N/mm^2. Draw a neat proportionate sketch of the bolt. 4+4

(OR)

(b) A steam engine cylinder has an effective diameter of 350 mm and the maximum steam pressure acting on the cylinder is 1.25 N/mm^2. Calculate the number of bolts of size M-30 required to fix the cylinder cover, assuming the permissible stress in the bolts as 35 MPa. 8

12. *(a)* Design a riveted lap joint to carry a load of 450 kN to connect 15 mm thick plates. Rivets are placed in double row. Given tensile stress is 175 N/mm^2, shear stress is 110 N/mm^2, crushing stress is 250 N/mm^2. 8

(OR)

(b) Write the advantages and disadvantages of welded joints over riveted joints. 4+4

13. *(a)* A steel spindle transmits 10 kW at 600 r.p.m. The angular deflection should not exceed 0.5° per meter length of spindle. If the modulus of rigidity for the material of spindle is 85×10^3 N/mm^2. Find the diameter of the spindle and shear stress induced in the spindle. 6+2

(OR)

(b) Design a protective cast iron flange coupling for a steel shaft transmitting 20 kW at 250 rpm and having an allowable shear stress of 45 N/mm^2. The working stress in the bolts should not exceed 35 N/mm^2. Assume that the same material is used for shaft and key and that the crushing stress is twice the value of its shear stress. The maximum torque is 35% greater than the mean torque. The shear stress for cast iron is 15 N/mm^2. 8

14. *(a)* The thrust of shaft is taken by 4 collars. The shaft runs at 100 rpm and bears a pressure of 0.5 N/mm^2. The collar have outer diameter 350 mm and inner diameter 250 mm. Assume μ = 0.05. Calculate the power lost due to friction by using *(i)* uniform pressure distribution theory and *(ii)* uniform wear theory. 4+4

(OR)

(b) Find *(i)* rubbing velocity, *(ii)* coefficient of friction and *(iii)* heat generated in a journal bearing supporting 10 kN on a 125 mm diameter shaft rotating at 1300 rpm. The ratio of length to diameter is 1.5. The diametral clearance is 0.15 mm and the absolute viscosity of lubricating oil is 0.01 kp/m-s; and K = 0.002. 2+3+3

15. *(a)* A closed coiled helical spring is required to exert a force of 4 kN and to have stiffness of 75 kN/m. If the mean diameter of the coil is to be 100 mm and the working stress 200 N/mm^2, find the number of turns and diameter of spring wire with which it is made. Take $G = 0.8 \times 10^5$ N/mm^2. 8

(OR)

(b) A leaf spring 1 m long is required to carry a central load of 10 kN, of the central deflection is not to exceed 18 mm and the maximum stress is 150 N/mm^2. Determine the thickness, width and number of plates. Take width of plate is 10 times the thickness and $E = 2 \times 10^5$ N/mm^2. 8

PART—C

10×1=10

Instructions : (1) Answer the following question.

(2) The question carries **ten** marks.

(3) Answer should be comprehensive and the criterion for valuation is the content but not the length of the answer.

16. A solid shaft is transmitting 50 kW at 250 rpm. Determine the diameter of the shaft if the maximum allowable Shear stress is 350 MPa and factor of safety is 6.Also compute the outside and inside diameters of the hollow shaft if it is used for the same purpose. What will be percentage of material saving, if the solid shaft is replaced by hollow shaft? Take diameters ratio K = 0.5.

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