C20-M–402

7455

BOARD DIPLOMA EXAMINATION, (C-20)

MAY—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 out the steps involved in design process of a machine element. 3

2. State the Rankine theory of failure and its mathematical statement. 2+1

3. How is a screw thread designated? Give an example. 1+2

4. What is the meaning of bolt of uniform strength? 3

5. Write the advantages and disadvantages of riveted joints. 1½+1½

6. Define the terms related to weld joints *(a)* throat and *(b)* leg. 1½+1½

7. Write the function of shafts and materials used for shafts. 3

8. Classify the keys in detail. 3

9. Write the differences between sliding and rolling contact bearings. 3

10. List three functions of springs. 3×1

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)* Design and draw an eye bolt to be used for lifting an electric machine load of 5 kN. Ultimate stress of the material is 600 MPa and the factor of safety is 6. Give the proportions of the eyebolt designed. 5+3

(OR)

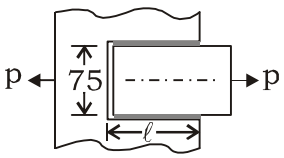
(b) The cylinder head of a steam engine is subjected to a steam pressure of 0.7 N/mm^2. It is held in position by means of 12 bolts. A soft copper gasket is used to make the joint leak proof. The effective diameter of cylinder is 300 mm. Considering the initial tension due to tightening of the bolt and assuming K = 0.5, find the size of the bolts so that the ultimate stress in the bolts is 800 MPa and factor of safety 8. 8

12. *(a)* Two plates of 10 mm thick are joined by a double riveted lap joint. The diameter of the rivets is 15 mm and pitch = 75 mm.

If tensile stress = 110 N/mm^2; shear stress = 85 N/mm^2; bearing stress = 140 N/mm^2, determine strength of the joint and efficiency of the riveted joint. 6+2

(OR)

(b) A plate, 75 mm wide and 10 mm thick, is joined with another steel plate by means of single transverse and double parallel fillet welds as shown in Fig. The joint is subjected to a maximum tensile force of 55 kN. The permissible tensile and shear stresses in the weld material are 70 and 50 N/mm^2 respectively. Determine the required length of each parallel fillet weld. 8



13. *(a)* A solid circular shaft is subjected to a bending moment of 3000 Nm and a torque of 10000 Nm. The shaft is made of steel having ultimate tensile stress of 700 MPa and ultimate shear stress of 500 MPa. Assuming a factor of safety of 6, determine the diameter of the shaft. 8

(OR)

(b) A solid shaft is transmitting 1 MW at 300 rpm. Determine the diameter of the shaft if the maximum torque transmitting exceeds the mean torque by 25%. Take the allowable shear stress as 60 N/mm^2. Also compute the outside and inside diameters of the hollow shaft if it is used for the same purpose. What will be the percentage of material saving if the solid shaft is replaced by hollow shaft? Take diameters ratio, k = 0.5. 8

14. *(a)* A flat foot step bearing 250 mm diameter supports a load of 30 kN at 120 rpm. Coefficient of friction is 0.05. Calculate the power lost at the bearing under the following conditions

(i) Uniform pressure theory

(ii) Uniform wear theory 4+4

(OR)

(b) A journal bearing whose diameter is 60 mm is subjected to a load of 4.5 kN while rotating at 180 rpm. If coefficient of friction is 0.02 and l/d ratio is 3, find *(i)* bearing pressure, *(ii)* power lost in friction and *(iii)* heat generated. 3+3+2

15. *(a)* A close coiled helical spring of 150 mm mean diameter is made of 8 mm diameter wire subjected to a load of 250 N. Determine the shear stress induced in the wire and energy stored, if the spring is wound for 20 turns. Assume modulus of rigidity as 0.8×10^5 N/mm^2.

(OR)

(b) A laminated spring 1 m long is made up of plates each 50 mm wide and 10 mm thick. If the bending stress in the plates is limited to 100 N/mm^2, how many plates will be required to enable the spring to carry a central point load of 2000 N? If $E = 2.1 \times 10^5$ N/mm^2, what is the deflection under given load? 5+3

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. Design a cast iron flange coupling to connect two shafts in order to transmit 7.5 kW power at 720 rpm. The following permissible stresses may be assumed. Permissible shear stress for shaft, bolts and key material = 33 N/mm^2. Permissible crushing stress for bolt and key material = 60 N/mm^2. Permissible shear stress for cast iron is 15 N/mm^2.

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