

7455

BOARD DIPLOMA EXAMINATION, (C-20)  
JUNE/JULY—2022

## DME – FOURTH SEMESTER EXAMINATION

## DESIGN OF MACHINE MEMBERS

Time : 3 hours ]

[ Total Marks : 80

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**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 factors to be considered in the selection of proper material for a machine element.
2. State the significance of design data handbooks.
3. Draw a proportionate sketch of an eye bolt.
4. A thread is designated by M24 × 3-7d. What does it mean?
5. Define the following terms related to riveted joint :
  - (a) Pitch
  - (b) Marginal distance
  - (c) Diagonal pitch
6. Briefly explain about the standard location of elements of a welding symbol.

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7. Write any three basic functions of keys.
  8. Define equivalent twisting moment equivalent bending moment for a shaft.
  9. List any three advantages of rolling contact bearings over sliding contact bearings.
  10. A closely coiled helical spring is to carry a load of 500 N with mean coil diameter as 50 mm. The wire diameter of the coil is 5 mm. Calculate the maximum shear stress induced in the spring material.

**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) The cylinder head of a steam engine is subjected to a steam pressure of  $0.7 \text{ N/mm}^2$  gauge. 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 the cylinder is 300 mm. Considering the initial tension due to tightening of the bolt and assuming gasket factor  $K$  as 0.5. Suggest the suitable standard size of the bolts so that the ultimate stress in the bolts is  $800 \text{ N/mm}^2$  and factor of safety is 8.

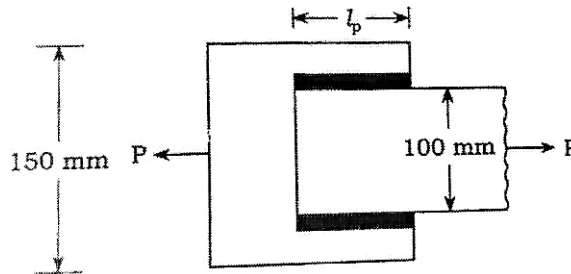
( OR )

- (b) (i) Briefly explain the design of bolts for boiler stays.  
(ii) Calculate the diameter of a stay bolt for a boiler to support an area of  $160 \text{ mm} \times 120 \text{ mm}$ , when the steam pressure is  $1.0 \text{ N/mm}^2$  gauge and design stress in tension in stay bolt is  $35 \text{ N/mm}^2$ .

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12. (a) (i) Discuss the methods of failure of riveted joints.
- (ii) A double – riveted double – strap butt joint is used to connect two plates, each of 12 mm thickness, by means of 16 mm diameter rivets having a pitch of 48 mm. The rivets and plates are made up of steel. The permissible stresses in tension, shear, and compression are  $80 \text{ N/mm}^2$ ,  $60 \text{ N/mm}^2$  and  $120 \text{ N/mm}^2$  respectively. Find the efficiency of the joint.

( OR )

- (b) (i) What is the relationship between the leg and throat of a fillet weld?
- (ii) Determine the length and size of weld required to develop full strength in the smaller plate as shown in figure. The thickness of both plates are 10 mm. Take tensile stress as  $120 \text{ N/mm}^2$  for smaller plate.



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13. (a) A motor shaft of 60 mm diameter transmits a torque of 150 N-m. It has an extension of 75 mm. The permissible shear and crushing stresses for mild steel key are  $55 \text{ N/mm}^2$  and  $110 \text{ N/mm}^2$  respectively. Justify whether the length of key way is sufficient or not.

( OR )

- (b) A mild steel shaft has to transmit 60 kW at 200 r.p.m. The allowable shear stress in the shaft is limited to  $42 \text{ N/mm}^2$  and the angle of twist is not to exceed  $1^\circ$  in a length of 20 times the diameter. Suggest the suitable standard diameter of the shaft for safe design. Assume modulus of rigidity as  $80 \text{ GN/m}^2$ .

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14. (a) A full journal bearing of 80 mm diameter with length to the diameter ratio as 2 has a bearing pressure of 1.6 MPa. The journal rotates at 750 r.p.m. and the ratio of journal diameter to the diametric clearance is 1000. The absolute viscosity is 0.012 kg/m-s. End leakage factor is 0.002. Find the (i) coefficient of friction, (ii) rubbing velocity, (iii) load on the bearing and (iv) power lost in friction.

( OR )

- (b) The thrust of a collar bearing is absorbed by 6 collars. The outer diameter is 140 mm and inner diameter is 100 mm. The shaft is carrying an axial load of 20 kN at 120 r.p.m. Calculate bearing pressure and also Calculate the heat generated at the bearing by using uniform pressure theory. Take coefficient of friction as 0.038.
15. (a) A closely coiled helical spring made up of 10 mm diameter steel wire has 15 coils of 100 mm mean diameter. The spring is subjected to an axial load of 100 N. Take modulus of rigidity of spring material as 81.6 kN/m<sup>2</sup>. Calculate the (i) maximum shear stress induced in the spring, (ii) Deflection and (iii) Stiffness of the spring.

( OR )

- (b) A carriage spring of 800 mm length is built-up of plates 80 mm wide and 8 mm thick. How many plates are necessary to support a central load of 12 kN without exceeding the stress of 180 N/mm<sup>2</sup>? Find out central deflection and Radius of curvature of plates. Take young's Modulus as  $2.0 \times 10^5$  N/mm<sup>2</sup>.

**PART—C**

10×1=10

**Instructions :** (1) Answer the following question.

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

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

16. Design and draw legible sketch of a cast iron protective type flange coupling to connect two shafts in order to transmit 18 kW power at 250 r.p.m. The following permissible stresses may be assumed :

Shear stress for shaft, bolt and key material = 40 N/mm<sup>2</sup>

Crushing stress for bolt and key material = 80 N/mm<sup>2</sup>

Shear stress for cast iron = 8 N/mm<sup>2</sup>

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