C14–M–402

4478

BOARD DIPLOMA EXAMINATION, (C–14)

SEPTEMBER/OCTOBER - 2020

DME—FOURTH SEMESTER EXAMINATION

DESIGN OF MACHINE ELEMENTS—I

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 the factors to be considered for the design of a machine element.

2. Define design stress and working stress.

3. Find the safe load that M12 bolt will carry, if the permissible tensile stress in the bolt material is 45 MPa.

4. How is a screw thread designated? Give an example.

5. List the advantages of riveted joint over welded joint.

6. A solid shaft is transmitting 1 kW power at a speed of 200 r.p.m. Find the torque transmitted by a shaft.

7. Sketch gib-head key with proportions.

8. State any three reasons for joining the shaft with couplings.

9. State the applications of rolling contact bearings.

10. List the functions of bearing.

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PART—B   10×5=50
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Instructions : (1) Answer *any* **five** questions.

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

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

11. A point in a body is strained by subjecting a tensile stress of 80 MPa in *X*-direction and compressive stress of 100 MPa in *Y*-direction and a shear stress of 50 MPa. Determine *(a)* magnitude of principal stresses and *(b)* magnitude of maximum shear stresses.

12. *(a)* State the maximum principal strain theory of failure. Write mathematical expression for it.

(b) Draw and mention the proportionate dimensions of a hexagonal nut and a square nut.

13. Design and draw a proportionate sketch of an eyebolt to lift a load of 80 kN, if the tensile stress is not to exceed 460 MPa. Take factor of safety = 5.

14. Compute the minimum pull per pitch length which will rupture the joint and efficiency of double riveted double covered butt joint of plates thickness 90 mm and 100 mm pitch. The rivets are made with 24 mm diameter rivets. Permissible stresses are $_t$ 120 N/mm^2, $_c$ 150 N/mm^2 and 100 N/mm^2.

15. A tie bar 120 mm×10 mm is to be welded to another tie bar 120 mm×15 mm subjected to a load of 20 kN as shown in the figure below :
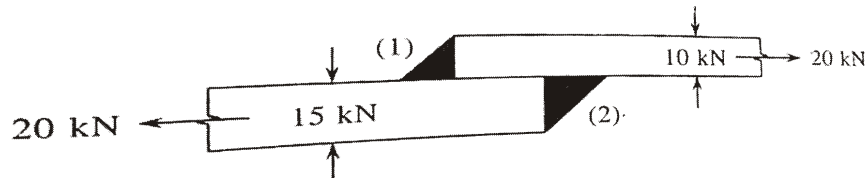
Calculate the sizes of the end fillet so that the stresses in both the fillets are the same. The allowable stress in the weld is 105 N/mm^2.

16. A steel shaft transmits 4 kW at 800 r.p.m. The angle of twist is not to exceed 0·25° per meter length of shaft. The modulus of rigidity for the material of the shaft is 84×10^3 N/mm^2. Find the diameter of the shaft and shear stress induced in the shaft.

17. Design a CI flange coupling to connect two shafts in order to transmit 75 kW at 720 r.p.m. The following permissible stresses may be assumed :

    Permissible shear stress for shaft, bolt,

                    key material = 33 N/mm^2

    Permissible crushing stress for bolt,

                    key material = 60 N/mm^2

    Permissible shear stress for cast iron flange = 15 N/mm^2

18. A journal bearing, whose diameter is 60 mm, is subjected to a load of 4500 N while rotating at 180 r.p.m. Take 0·02 and l/d ratio is 3. Find *(a)* bearing pressure, *(b)* power lost in friction and *(c)* heat generated.

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