C20-M–402

7455

BOARD DIPLOMA EXAMINATION, (C-20)

NOVEMBER/DECEMBER—2022

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 any three theories of elastic failures for a part subjected to bi-axial stresses.

2. Briefly explain the general procedure involved while designing a new component.

3. Name any six locking devices which are used to prevent loosening of nut under vibrations.

4. Find the size of hole that must be drilled in M40 bolt to make it of uniform strength.

5. Define the efficiency of a riveted joint.

6. Define the following terms with respect to welding :

(a) Toe *(b)* Throat *(c)* Leg

7. State any three characteristics of good couplings.

8. Give the classification of shafts.

9. State any three functions of springs.

10. Distinguish between sliding contact bearings and rolling contact bearings.

PART—B

8×5=40

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

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

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

11. *(a)* A gear box weighing 7·5kN is provided with a steel eye bolt for lifting and transporting on the shop floor. The eye bolt is made of plain carbon steel having yield strength of 480 N/mm^2 and the factor of safety is 6. Design the eye bolt and draw a proportionate sketch.

(OR)

(b) Find the stress induced in a boiler stay supporting an area 300 mm X 200 mm of the flat end surface. The nominal diameter of the stay is 50 mm and the pressure inside the boiler is 1·1MPa gauge. Consider the effect of initial tightening and the stiffness factor as 0·6.

12. *(a)* Find out the maximum safe load and maximum efficiency among the following riveted joints having thickness of 10 mm plates with 20 mm diameter of the rivets having a pitch of 60 mm :

(i) Single riveted lap joint

(ii) Double riveted, single cover butt joint.

(iii) Double riveted, double cover butt joint.

(iv) Triple riveted, double cover butt joint

Assume

Permissible tensile stress in plate = 120 MPa

Permissible shear stress in rivets = 90 MPa

Permissible crushing stress in rivets = 180 MPa

(OR)

(b) Find the length of the weld required for joining a plate of 50 mm width and 10 mm thick by a transverse fillet weld to another plate and is subjected to a static tensile load of 50 kN. Take the permissible stress equal to 100 MPa.

Draw a legible sketch of double riveted single strap butt joint and indicate standard parameters on it. (4+4)

13. *(a)* What are the basic functions of keys? Discuss various modes of failure of keys.

(OR)

(b) A solid circular shaft is subjected to a bending moment of 3000 Nm and a torque of 10000 Nm. The shaft is having ultimate tensile stress of 700 MPa and ultimate shear stress of 500 MPa. Assume factor of safety as 6. Suggest suitable standard diameter of shaft for safe design.

14. *(a)* A journal bearing, 30 mm in radius, runs at 12·5 revolutions per sec. The bearing pressure is 1·2 MPa. The length of the bearing is 2 times the shaft diameter. The ratio of journal diameter to the diametral clearance is 1000. The absolute viscosity of the lubricating oil is 0·011 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) Heat generated due to friction.

(OR)

(b) A multi collar thrust bearing the axial load of 55 kN is taken up by a number of collars. The bearing pressure is 0·40 N/mm^2. The shaft diameter is 125 mm and runs of 200 r.p.m. The collar diameter is 1·8 times the diameter of the shaft. Take coefficient of friction as 0·022. Calculate *(i)* Number of collars required *(ii)* Frictional torque *(iii)* Power lost in friction *(iv)* Heat generated at the bearing by using uniform pressure theory.

15. *(a)* A railway wagon of 44 kN is moving at 7 kmph. How many springs each of 8 coils will the required in a buffer stop to absorb the energy of motion during a compression of 220 mm? The mean diameter of coils is 150 mm and the spring wire diameter is 25 mm. Take modulus of rigidity to the spring material as 84kN/mm^2.

(OR)

(b) A laminated spring 1m 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/mm2, how many plates will be required to enable the spring to carry a central point load of 2000 N? If Young's Modulus is 21×10^5 N/mm^2, what is the deflection under given load? Calculate radius of curvature of plates also.

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 and draw a muff coupling to connect two shafts transmitting 40 kW and 150 rev/min. The allowable shear and crushing stresses for the shaft and key which are made of 50C8 steel are 37·0 N/mm^2 and 96·23 N/mm^2 respectively. The material for the muff is FG150 cast iron with permissible shear strength of 17·3 N/mm^2. Assume that the maximum torque transmitted is 20% greater than the mean torque.

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