B.E. / B.Tech. (Mechanical Engineering) Model Curriculum Semester-V

PCCME302 - Design of Machine Elements

P. Pages : 2 **GUG/W/24/14069**

Time : Four Hours * 5 5 8 6 * Max. Marks : 80

Notes :
1. All questions carry equal marks.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Illustrate your answers wherever necessary with the help of neat sketches.
5. Non-programmable calculator is permitted.
6. Solve Q.1 Or Q.2, Q.3 Or Q.4, Q.5 Or Q.6, Q.7 Or Q.8.
7. Use of Design data book is permitted.

1. a) State and explain general considerations in designing machine element. **10**

b) Explain general design procedure with flow chart. **5**

c) Explain in short various theories of failure. **5**

OR

2. a) Design a knuckle joint to transmit 150 kN. The design stresses may be taken as 75 MPa in tension, 60 MPa in shear and 150 MPa in compression. **15**

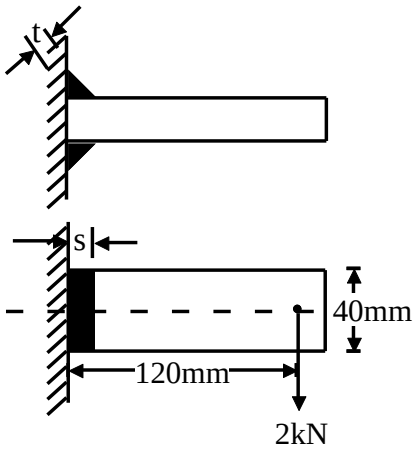
b) Why taper is provided on the cotter. State its values. **5**

3. a) Enumerate the different types of riveted joints. **5**

b) A double riveted double cover butt joint in plates 20 mm thick is made with 25 mm diameter rivets at 100 mm pitch. The permissible stresses are $\sigma_t = 120\,\text{MPa}$; $\tau = 100\,\text{MPa}$; $\sigma_c = 150\,\text{MPa}$. Find the efficiency of joint, taking the strength of the rivet in double shear as twice than that of single shear. **15**

OR

4. a) A welded joint shown is subjected to an eccentric load of 2 kN. Find the size of weld, if the maximum shear stress in the weld is 25 MPa. **10**



b) A plate 100 mm wide and 12.5 mm thick is to be welded to another plate by means of parallel fillet welds. The plates are subjected to a load of 50 kN. Find the length of the weld so that the maximum stress does not exceed 56 MPa. Consider the joint first under static loading and then under fatigue loading. **10**

5. a) What is self-locking and overhauling property of the threads and where it is necessary? **5**

b) The mean diameter of the square threaded screw having pitch of 10 mm is 50 mm. A load of 20 kN is lifted through a distance of 170 mm. Find the work done in lifting the load and the efficiency of the screw, when **15**

1) The load rotates with the screw, and
2) The load rests on the loose head which does not rotate with the screw.

The external and internal diameters of the bearing surface of the loose head are 60 mm and 10 mm respectively. The coefficient of friction for the screw and the bearing surface may be taken as 0.08.

OR

6. a) Explain the following terms of the spring: (1) Free length (2) Solid height (3) Spring rate (4) Spring index (5) Pitch of coil. **5**

b) Explain any five types of spring according to their shapes with neat sketch. **5**

c) A rail wagon of mass 20 tones is moving with a velocity of 2 m/s. It is brought to rest by two buffers with springs of 300 mm diameter. The maximum deflection of springs is 250 mm. The allowable shear stress in the spring material is 600 MPa. Design the spring for the buffers. **10**

7. a) A cast iron cylinder of inside diameter 160 mm is subjected to a pressure of $15\,N/mm^2$. The permissible working stress for the cast iron may be taken as 25 MPa. If the cylinder is closed by a flat head cast integral with the cylinder walls, find the thickness of the cylinder wall and the flat head. **5**

b) Explain any five keys with suitable dimensional sketch. **5**

c) The hydraulic cylinder 400 mm bore operates at a maximum pressure of $5\,N/mm^2$. The piston rod is connected to the load and the cylinder to the frame through hinged joints. The allowable tensile stress for cast steel cylinder and end cover is 80 MPa and for piston rod is 60 MPa. **10**

Design: 1. Cylinder, 2. Piston rod, 3. Hinge pin, and 4. Flat end cover.

OR

8. a) State the type of stresses developed during designing the shaft. Also, state the equations. **5**

b) A solid circular shaft is subjected to a bending moment of 3000 Nm and a torque of 10000 Nm. The shaft is made of 45C8 steel having ultimate tensile stress of 700 MPa and a ultimate shear stress of 500 MPa. Assuming a factor of safety as 6, Determine the diameter of the shaft. **5**

c) A steel spindle transmits 4 kW at 800 rpm. The angular deflection should not exceed 0.25^o per meter of the spindle. If the modulus of rigidity for the material of the spindle is 84 GPa, Find the diameter of the spindle and the shear stress induced in the spindle. **10**

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