Code No: 125DV **R15**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, November/December - 2017
DESIGN OF MACHINE MEMBERS - I
(Common to AME, ME)

Time: 3 hours **Max. Marks: 75**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

Assume Suitable Data if Necessary:

PART - A

(25 Marks)

1.a) Illustrate how the stress concentration in a component can be reduced. [2]
b) What is meant by stress concentration? How do you take it into consideration in case of a component subjected to dynamic loading? [3]
c) Classify the rivet heads according to Indian standard specification. [2]
d) Sketch and discuss the various types of welded joints used in pressure vessels. [3]
e) How are the keys classified? [2]
f) Distinguish between cotter joint and knuckle joint. [3]
g) What type of stresses are induced in shafts? [2]
h) Why a hollow shaft has greater strength and stiffness than solid shaft of equal weight? [3]
i) Classify springs according to their shapes. [2]
j) What is the function of a spring? In which type of spring the behavior is non-linear? [3]

PART - B

(50 Marks)

2. A mild steel shaft of 50 mm diameter is subjected to a bending moment of 2000 Nm and a torque T. If the yield point of the steel in tension is 200 MPa, find the maximum value of this torque without causing yielding of the shaft according to [10]
a) The maximum principal stress
b) The maximum shear stress and
c) The maximum distortion strain energy theory of yielding.

OR

3. A cantilever beam made of cold drawn carbon steel of circular cross-section as shown in Figure 1, is subjected to a load which varies from – F to 3 F. Determine the maximum load that this member can withstand for an infinite life using a factor of safety as 2. The theoretical stress concentration factor is 1.42 and the notch sensitivity is 0.9. Assume the following values: [10]
Ultimate stress = 550 MPa
Yield stress = 470 MPa
Endurance limit = 275 MPa

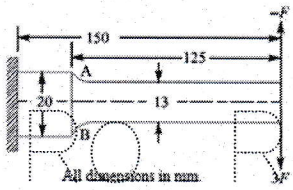

Figure 1

4. Two lengths of mild steel tie rod having width 200 mm and thickness 12.5 mm are to be connected by means of a butt joint with double cover plates. Design the joint if the permissible stresses are 80 MPa in tension, 65 MPa in shear and 160 MPa in crushing. Make a sketch of the joint. [10]

OR

5. Determine the size of the bolts and the thickness of the arm for the bracket as shown in Figure 2, if it carries a load of 40 kN at an angle of 60^0 to the vertical. The material of the bracket and the bolts is same for which the safe stresses can be assumed as 70, 50 and 105 MPa in tension, shear and compression respectively. [10]

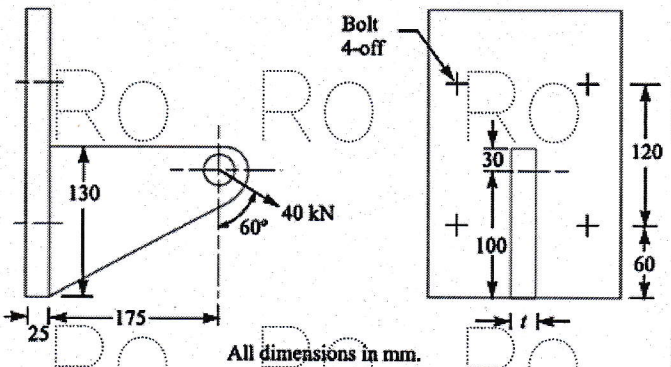

Figure 2

6. Design and draw a sleeve and cotter joint to resist a tensile load of 60 kN. All parts of the joint are made of the same material with the following allowable stresses: [10] $\sigma t = 60$ MPa ; $\tau = 70$ MPa ; and $\sigma c = 125$ MPa.

OR

7. Design and draw a knuckle joint to connect two mild steel bars under a tensile load of 25 kN. The allowable stresses are 65 MPa in tension, 50 MPa in shear and 83 MPa in crushing. [10]

8. A horizontal nickel steel shaft rests on two bearings, A at the left and B at the right end and carries two gears C and D located at distances of 250 mm and 400 mm respectively from the centre line of the left and right bearings. The pitch diameter of the gear C is 600 mm and that of gear D is 200 mm. The distance between the centre line of the bearings is 2400 mm. The shaft transmits 20 kW at 120 RPM. The power is delivered to the shaft at gear C and is taken out at gear D in such a manner that the tooth pressure FtC of the gear C and FtD of the gear D act vertically downwards. Find the diameter of the shaft, if the working stress is 100 MPa in tension and 56 MPa in shear. The gear C and D weighs 950 N and 350 N respectively. The combined shock and fatigue factors for bending and torsion may be taken as 1.5 and 1.2 respectively. [10]

OR

9. Design and draw a cast iron flange coupling for a mild steel shaft transmitting 90 kW at 250 rpm. The allowable shear stress in the shaft is 40 MPa and the angle of twist is not to exceed 1^0 in a length of 20 diameters. The allowable shear stress in the coupling bolts is 30 MPa. [10]

10. Design a close coiled helical compression spring for a service load ranging from 2250 N to 2750 N. The axial deflection of the spring for the load range is 6 mm. Assume a spring index of 5. The permissible shear intensity is 420 MPa and modulus of rigidity G = 84 kN/mm^2. Neglect the effect of stress concentration. Draw a fully dimensioned sketch, showing details of the finish of the end coils. [10]

OR

11. Design and draw a valve spring of a petrol engine for the following operating conditions:
Spring load when the valve is open = 400 N
Spring load when the valve is closed = 250 N
Maximum inside diameter of spring = 25 mm
Length of the spring when the valve is open = 40 mm
Length of the spring when the valve is closed = 50 mm
Maximum permissible shear stress = 400 MPa [10]

---oo0oo---