Code No: 125DV **R15**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year I Semester Examinations, November/December - 2018
DESIGN OF MACHINE MEMBERS - I
(Common to ME, AME)

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)	Enumerate the most commonly used engineering materials.	[2]
b)	What are the factors to be considered for the selection of materials for the design of machine elements?	[3]
c)	What is an economical joint and where does it find applications?	[2]
d)	What are the assumptions made in the design of welded joints?	[3]
e)	What is the effect of keyway into the shaft?	[2]
f)	Why gibs are used in a cotter joint? Draw the sketches of single and double gib.	[3]
g)	What do you understand by torsional rigidity and lateral rigidity?	[2]
h)	What are flexible couplings and what are their applications?	[3]
i)	Explain one method for avoiding the tendency of a compression spring to buckle.	[2]
j)	What is the importance of spring index in springs.	[3]

PART - B

(50 Marks)

2. The load on a bolt consists of an axial pull of 10 kN together with a transverse shear force of 5 kN. Find the diameter of bolt required according to
a) Maximum principal stress theory
b) Maximum shear stress theory
c) Maximum principal strain theory
d) Maximum strain energy theory
e) Maximum distortion energy theory
Take permissible tensile stress at elastic limit = 100 MPa and poisson's ratio = 0.3 [10]

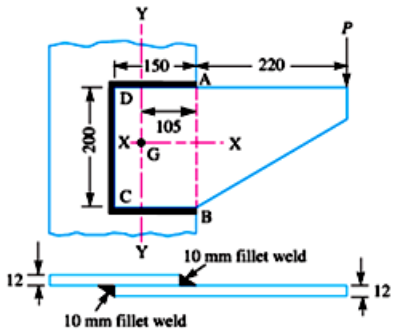
OR

3. A machine component is subjected to a flexural stress which fluctuates between + 300 MN/m^2 and – 150 MN/m^2. Determine the value of minimum ultimate strength according to
a) Gerber relation
b) Modified Goodman relation
c) Soderberg relation.
Take yield strength = 0.55 Ultimate strength, endurance strength = 0.5 Ultimate strength and factor of safety = 2. [10]

4. Design a lap joint for a mild steel flat tie-bar 200 mm × 10 mm thick, using 24 mm diameter rivets. Assume allowable stresses in tension and compression of the plate material as 112 MPa and 200 MPa respectively and shear stress of the rivets as 84 MPa. Show the disposition of the rivets for maximum joint efficiency and determine the joint efficiency. Take diameter of rivet hole as 25.5 mm for a 24 mm diameter rivet. [10]

OR

5. A braket is welded to the side of a column and carries a vertical load P, as shown in the Figure. Evaluate P so that the maximum shear stress in the 10 mm fillet welds is 80 MPa. [10]



6. Draw a cotter joint to connect two mild steel rods for a pull of 30 kN. The maximum permissible stresses are 55 MPa in tension; 40 MPa in shear and 70 MPa in crushing. Draw a neat sketch of the joint designed. [10]

OR

7. Design and draw 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. Draw a neat sketch of the joint designed. [10]

8. A shaft is supported by two bearings placed 1 m apart. A 600 mm diameter pulley is mounted at a distance of 300 mm to the right of left hand bearing and this drives a pulley directly below it with the help of belt having maximum tension of 2.25 kN. Another pulley 400 mm diameter is placed 200 mm to the left of right hand bearing and is driven with the help of electric motor and belt, which is placed horizontally to the right. The angle of contact for both the pulleys is 180^0 and $\mu = 0.24$. Determine the suitable diameter for a solid shaft, allowing working stress of 63 MPa in tension and 42 MPa in shear for the material of shaft. Assume that the torque on one pulley is equal to that on the other pulley. [10]

OR

9. Design a bushed-pin type of flexible coupling to connect a pump shaft to a motor shaft transmitting 32 kW at 960 r.p.m. The overall torque is 20 percent more than mean torque. The material properties are as follows:
a) The allowable shear and crushing stress for shaft and key material is 40 MPa and 80 MPa respectively.
b) The allowable shear stress for cast iron is 15 MPa.
c) The allowable bearing pressure for rubber bush is 0.8 N/mm^2.
d) The material of the pin is same as that of shaft and key.
Draw neat sketch of the coupling. [10]

10. Design a helical spring for a spring loaded safety valve (Ramsbottom safety valve) for the following conditions :
Diameter of valve seat = 65 mm
Operating pressure = 0.7 N/mm^2
Maximum pressure when the valve blows off freely = 0.75 N/mm^2
Maximum lift of the valve when the pressure rises from 0.7 to 0.75 N/mm2 = 3.5 mm
Maximum allowable stress = 550 MPa
Modulus of rigidity = 84 kN/mm^2
Spring index = 6
Draw a neat sketch of the free spring showing the main dimensions. [10]

OR

11. A concentric spring for an aircraft engine valve is to exert a maximum force of 5000 N under an axial deflection of 40 mm. Both the springs have free length, same solid length and are subjected to equal maximum shear stress of 850 MPa. If the spring index for both the springs is 6, find (a) the load shared by each spring (b) the main dimensions of both the springs, and (c) the number of active coils in each spring. Assume G = 80 kN/mm^2 and diametral clearance to be equal to the difference between the wire diameter. [10]

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