Code No: 115DV **R13**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, March - 2017

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.

PART - A

(25 Marks)

1.a)	Define factor of safety.	[2]
b)	Explain the methods to reduce stress concentration in machine members.	[3]
c)	What is row pitch and margin of a riveted joint?	[2]
d)	What do you understand by bolt of uniform strength?	[3]
e)	Explain the purpose of a gib.	[2]
f)	How is a sunk key designed?	[3]
g)	When do you consider column factor in design of shafts.	[2]
h)	How is a flange coupling modified to make it flexible coupling.	[3]
i)	What is a torsion spring?	[2]
j)	Explain surging in springs.	[3]

PART - B

(50 Marks)

2.a) What are theories of failure. Explain any two theories of elastic failure for bi-axial loading system with the help of equations.

b) A solid circular shaft, 20 mm in diameter, is subjected to torsional shear stress, which varies from 0 to 35 N/mm^2 and at the same time, is subjected to an axial stress that varies from -15 to +30 N/mm^2. The frequency of variation of these stresses is equal to the shaft speed. The shaft is made of steel FeE 400(S_{ut}=540 N/mm^2 and S_{yt}=400 N/mm^2 and the corrected endurance limit of the shaft is 200 N/mm^2. Determine the factor of safety. [5+5]

OR

3.a) What are the general considerations in designing machine members. Discuss in detail.

b) Explain about preferred numbers.

c) A simply supported shaft of 50 mm diameter and 0.5 m long is subjected to, at its mid-section, a load that varies cyclically from 2P to 4P. Determine the value of P. Yield strength=450 MPa, Endurance limit=350 Mpa, Factor of safety=2, size correction factor=0.85 and surface correction factor =0.9. [3+3+4]

4.a) Describe the procedure to design an eccentrically loaded welded joint.

b) A double riveted, chain lap joint is to be made for joining two plates of 10 mm thick. The allowable stresses are 60 MPa in tension, 80 MPa in crushing and 50 MPa in shear. Determine the rivet diameter, pitch of the rivets and row pitch. Also find the efficiency of the joint. [5+5]

OR

5.a) Explain how to design a bolt considering both initial tightening load and external force.

b) A flanged bearing for a horizontal shaft is fastened to a frame by means of 4 bolts, equally spaced on 160 mm pitch circle diameter. A 100 kN force acts at a distance of 50 mm from the frame. The diameter of the flange is 220 mm. Determine the size of the bolts, if the tensile stress for the bolt material is 80 MPa. [5+5]

6. Design a knuckle joint to connect two circular rods subjected to an axial tensile force of 50 kN. The rods are co-axial and a small amount of angular movement between their axes is permissible. Assume permissible stresses as: f_t = 80 N/mm^2; f_s = 40 N/mm^2; f_c = 80 N/mm^2. [10]

OR

7.a) Mention different types of cotter joints. Where are they used?

b) Design a socket and spigot type cotter joint to resist a load of 25 kN. Assume safe stresses as: σ_t=50 MPa; τ_{all} =40 MPa; σ_c=65 MPa. [5+5]

8.a) Write how a shaft is designed on the basis of rigidity.

b) A steel shaft 1.25 m long between bearings carries 1250 N pulley at its mid point. The pulley is keyed to the shaft and receives 20 kW at 200 rpm. The belt drive is horizontal and the ratio of the belt tensions is 3:1. The diameter of the pulley is 600 mm. Compute the shaft diameter. [5+5]

OR

9. Two 40 mm diameter shafts running at 500 rpm and transmitting a torque of 1200 Nm are connected by a rigid unprotected type of flange coupling. The flanges are fitted with six bolts. Permissible stresses are 35 MPa in shear and 45 MPa in crushing. Design the coupling with a neat sketch. [10]

10.a) Why Wahl's factor is to be considered in the design of helical compression or tension springs.

b) A spring loaded safety valve for a boiler is required to blow-off at a pressure of 1.2 N/mm^2. The diameter of the valve is 55 mm. Design a suitable compression spring for the safety valve, assuming spring index to be 6 and an initial compression 25 mm. The maximum lift of the valve is 15 mm. The shear stress in the material is to be limited to 450 MPa. Take G= 0.84×10^5 MPa. [5+5]

OR

11.a) Write the design procedure of helical compression springs under fatigue loading.

b) A bumper, consisting of two helical springs of circular section, brings to rest, a railway wagon of mass 1500 kg moving at 1.2 m/s. While doing so, the springs are compressed by 150 mm. The mean diameter of the coils is 6 times the wire diameter and permissible shear stress is 400 MPa. Design the springs. Take G= 0.84×10^5 MPa. [5+5]

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