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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY, HYDERABAD

B. Tech III Year I Semester Examinations, May/June – 2013

Design of Machine Members - I

(Mechanical Engineering)

Time: 3 hours

Max. Marks: 80

Answer any five questions  
All questions carry equal marks

- 1.a) Compare the theories of failure by drawing the boundaries of their application for biaxial stress condition and explain their field of application.
- b) A round steel rod is subjected to axial tension of 50 MPa with superimposed torsion of 100 MPa. What is your best prediction of the safety factor with respect to yielding if the material has a tensile strength of 500 MPa? [10+6]
- 2.a) Draw and explain S-N Curve? What is the difference between S-N Curve for ferrous and non-ferrous components?
- b) A rotating bar made of steel with ultimate strength of 600 MPa is subjected to a completely reversed bending stress. The corrected endurance limit of the bar is 300 MPa. Draw the S-N curve. Calculate the fatigue strength of the bar for a life of 90,000 cycles. [8+8]
3. A triple riveted butt joint with equal double cover plates (zig-zag riveting) is used for the longitudinal joint of a Lancashire boiler of 2.5 m internal diameter. The working steam pressure is  $1.12 \text{ N/mm}^2$  and the efficiency of the joint is 85 per cent. Calculate the plate thickness for mild steel of 460 MPa ultimate tensile strength. Assume ratio of tensile to shear stresses as 7/6 and factor of safety 4. The resistance of the rivets in double shear is to be taken as 1.875 times that of single shear. Design a suitable circumferential joint also. [16]
- 4.a) Determine the safe tensile load for bolts of M 20 and M 36. Assume that the bolts are not initially stressed and take the safe tensile stress as 200 MPa.
- b) The cylinder head of a steam engine is subjected to a pressure of  $1 \text{ N/mm}^2$ . It is held in position by means of 12 bolts. The effective diameter of the cylinder is 300 mm. A soft copper gasket is used to make the joint leak proof. Determine the size of the bolts so that the stress in the bolts does not exceed 100 MPa. [6+10]
5. Design a Knuckle joint to withstand a tensile load of 60 kN using steel with the permissible stresses in tension 65 MPa; in crushing 80 MPa; in shear 50 MPa. [16]
6. A shaft is supported by two bearings 400 mm apart and carries a bevel gear of 200 mm pitch diameter at one end that is overhanging beyond the nearer bearing by 150 mm. The gear produces a radial load of 9800 N and a thrust load of 2940 N when the speed is 600 rpm. Determine the shaft diameter if the shaft is made of steel with allowable shear stress of 40 MPa. Also determine the angle of twist and deflection at the bevel gear location if the modulus of rigidity is 80 GPa and the modulus of elasticity is 210 GPa. [16]

- 7.a) Sketch a muff coupling and identify its advantages and disadvantages.  
b) A shaft transmitting 150 kW is to be connected to a coaxial shaft through cast iron flange coupling. The shaft runs at 120 rpm. The key and shaft are to be made of same material for which permissible shearing stress is 60 MPa and compressive strength is 120 MPa. The steel bolts may be subjected to maximum shearing stress of 26 MPa. Design protected type flange coupling. [16]
- 8.a) Differentiate between active and inactive turns for various types of end conditions in case of the close coiled helical springs.  
b) From a toy gun, a bullet of 1 N is fired. The bullet travels a distance of 10 m. the compression of the spring when the gun is loaded is 100 mm and the bore of the barrel is 20 mm. Design a suitable spring. [16]

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