III-I ME

R16

Code No: 135AG

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, December - 2019

DESIGN OF MACHINE MEMBERS - I

(Mechanical Engineering)

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 as sub questions.

PART – A

(25 Marks)

1.a) Draw the graph between true stress and true strain. [2]
b) What design factors must be considered while designing a casting? [3]
c) What is the effect of surface finish on endurance limit? [2]
d) Discuss the stress time diagram of fluctuating stress. [3]
e) What is throat thickness in welding joints. [2]
f) Which is stronger among parallel and transverse fillet joint and why? [3]
g) What is the function of connecting rod in knuckle joint? [2]
h) What is the effect of keyways? [3]
i) What is protected type flange coupling? [2]
j) What properties are required for a shaft? [3]

PART – B

(50 Marks)

2. A bracket made up of steel having σ_{yt} -200 MPa and subjected to a force of 5kN acting at an angle of 30^0 to the vertical, as shown in the figure 1. The factor of safety is 4. Determine the dimensions of the cross section of the bracket. [10]

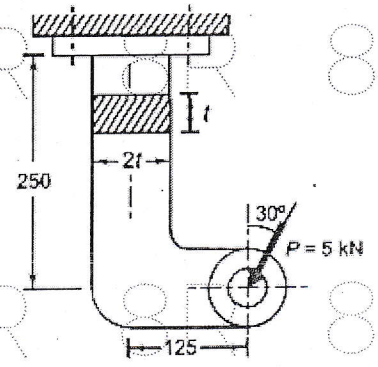

Figure 1

OR

3.a) Derive an expression for an impact stress.
b) What is the importance of the preferred numbers? [5+5]

4. A bar of steel has an ultimate tensile strength of 700 MPa, a yield point stress of 400 MPa and fully corrected endurance limit of 220 MPa. The bar is subjected to a mean bending stress of 60 MPa and stress amplitude of 80 MPa. The bar is also subjected to a mean torsional stress and torsional stress amplitude of 70 and 35 MPa respectively. Determine the factor of safety. [10]

OR

5. A shaft is subjected to a bending moment of -170 to +510 Nm, also subjected to torsional moment of 55 Nm to 165 Nm. The shaft has an ultimate strength of 540 MPa and yield strength of 400 MPa. Determine the required diameter of the shaft for an indefinite life. The stress concentration factor for the keyway attached to the shaft in bending and torsion may be taken as 1.6 and 1.3 respectively. Factor of safety may be taken as 1.5. Take size factor=0.85, and surface finish factor =0.88. (Assume $\sigma_e=0.5\sigma_u$, $\tau_e=0.55\sigma_e$). [10]

6. A welded connection of a steel plate is as shown in Figure 2. It is subjected to an eccentric force of 10 kN. Determine the throat dimension of the welds, if the permissible shear stress is limited to 95 N/mm^2. Assume static conditions. [10]

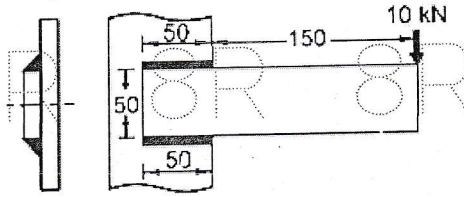

Figure 2

OR

7. A cylindrical pressure vessel with 1.5 m inside diameter is subjected to internal steam pressure of 1,5 MPa. It is made from steel plate by triple riveted double strap longitudinal butt joint with equal straps. The pitch of the rivets in outer row is twice of the pitch of rivets in inner rows. The rivets are arranged in zigzag pattern, the efficiency of the riveted joint should be at least 80 %. The permissible stresses for plate and rivets in tension, shear and compression are 80, 60 and 120 MPa respectively. Assume that the rivet in double shear is 1.875 times stronger than in single shear. Design the riveted joint. [10]

8. The rod is subjected to a maximum pull of 100 kN. The rod, strap, gib and cotter are all made of plain carbon steel having σ_y-250 N/mm^2 and the factor of safety is 10. Assume thickness of cotter as 0.2 times the width of the strap. Design a gib and cotter joint used for strap type big end if the connecting rod. [10]

OR

9.a) What are the functions of flat saddle, tapered and sunk keys?
b) Write the design procedure for the failure of keys. [5+5]

10. A transmission shaft with the bearings 0.8 m apart receives 20 kW power at 500 rpm through a pulley 300 mm in diameter and mounted at an overhung of 200 mm. A 360 mm diameter pulley mounted midway between the bearings transmits the torque to a shaft located below it. Both the pulleys have vertical belt tensions and coefficient of friction between the belt and pulley is 0.3. If the required safety margin is 3, design the shaft using maximum shear stress theory. Given ultimate and yield strength of shaft is 700 MPa and 460 MPa respectively. [10]

OR

11. Design a bushed pin type coupling for connecting a motor shaft to a pump shaft for the following service conditions:
Power to be transmitted is 40 kW, speed of the motor shaft – 1000 rpm, diameter of the motor shaft is 50 mm, diameter of the pump shaft is 45 mm. the bearing pressure in the rubber bush and allowable stress in the pins are to be limited to 0.45 N/mm^2 and 25 MPa respectively. [10]

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