

**Model Question**

Reg. No:.....

Name:.....

Fourth Semester B.Tech Degree Examination, 2015

(2013 Scheme)

**13.403: MACHINE DESIGN (N)**

Time: 3 Hours

Max Marks: 100

Approved Design Data hand book permitted

Assume missing data, if any suitably

Answer **all** questions from Part A and **one** full question from each module from Part B

**PART A**

1. Explain different methods of reducing stress concentration in Machine parts.
2. Explain about true stress and true strain curve.
3. Define factor of safety and Endurance limit
4. Explain any two failures of a riveted joint.
5. Explain different types of welded joints.
6. Differentiate between thin shell and thick shell.
7. Enumerate the advantages of Rolling contact Bearing
8. What is Surge in springs?
9. What is interference in Gears?
10. Define Equivalent Twisting moment.

(10 × 2 = 20 marks)

## PART B

### Module I

11. A bolt is subjected to a direct tensile load of 22 kN and a shear load of 16 kN. Suggest the suitable size of the bolt according to various theories of elastic failure, if the yield stress in simple tension is 360 MPa. A factor of safety 3 should be used. Take Poisson's ratio as 0.25  
(20 Marks)

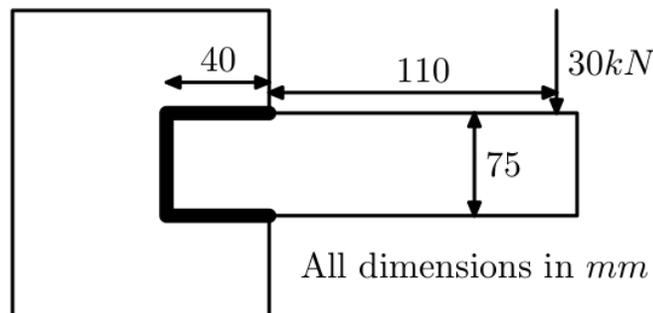
12. A pulley is keyed to a shaft midway between two anti-friction bearings. The bending moment at the pulley varies from -170 Nm to 510 Nm as the torsional moment in the shaft varies from 55 Nm to 165 Nm. The frequency of the variation of the loads is the same as the shaft speed. The shaft is made of cold drawn steel having an ultimate strength of 538 MPa and yield strength of 400 MPa. Determine the required diameter for an indefinite life. The stress concentration factor for the keyway in bending and torsion may be taken as 1.6 and 1.3 respectively. Use design factor  $N=1.5$

(20 Marks)

### Module II

13. Design a triple riveted butt joint with unequal cover plates for the longitudinal seam of a boiler shell, 1.2 m diameter, to carry a maximum steam pressure of  $2.05 \text{ N/mm}^2$ . The allowable stresses are  $75 \text{ N/mm}^2$  in tension,  $60 \text{ N/mm}^2$  in shear and  $130 \text{ N/mm}^2$  in crushing.  
(20 Marks)

14. Calculate the size of the weld required for an eccentrically loaded weld as shown in figure, the allowable stress in the weld is  $90 \text{ N/mm}^2$



(20 Marks)

### Module III

15. A spring loaded safety valve for a boiler is required to blow off at a pressure of  $2 \text{ N/mm}^2$ . The diameter of the valve is 70 mm. Design a suitable compression spring for the safety valve, assuming spring index to be 6 and 30 mm initial compression. The maximum lift of the valve is 15 mm. The shear stress of the material is 450 MPa.  $G = 0.84 \times 10^5 \text{ MPa}$

(20 Marks)

16. Design a journal and Bearing to support a load of 5500 N at 800 rpm using hardened steel journal and bronze-backed bearing. An abundance of oil is provided which has a specific gravity of 0.9 at  $15.5^\circ\text{C}$  and a viscosity of 10.2 centistokes at  $82^\circ\text{C}$  that may be taken to the limiting temperature for oil. Assume a clearance of 0.0025 cm per cm of diameter. Also calculate the mass of lubricating oil and rise in temperature

(20 Marks)

### Module IV

17. A mild steel shaft transmits 16 KW at 220 rpm. It is supported on two bearings 750 mm apart and has two gears keyed to it. The pinion having 24 teeth of 6mm module is located 100 mm to the left of the right hand bearing and delivers the power horizontally to the right. The gear having 80 teeth of 6mm module is located 15mm to the right of the left hand bearing and receives power in a vertical direction from below. Assuming an allowable working shear stress as 55MPa and a combined shock and fatigue factor of 1.5 in bending as well as torsion, determine the diameter of the shaft.

(20 Marks)

18. A pair of  $20^\circ$  stub involute tooth spur gear is to transmit 25 KW at a speed of 400 rpm of the pinion. Speed ratio is 1:3.25, the pinion is made of steel, C30(Heat treated) and the gear is made of cast iron grade 35(Heat treated). Design the pair and check the design for safety.

(20 Marks)

(4 × 20 = 80 marks)