104502

TME-502 Printed Pages : 8

Paper ID & Roll No. to be filled in your Answer Book

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B.Tech.

UTU (Vth SEMESTER) EXAMINATION, 2013-14

MACHINE DESIGN

Time : Three Hours] [Max. Marks : 100

Note: (1) Answer the following questions.

(2) Assume suitable data, if missing in the problem.

1. Attempt any four questions. Each question carries five marks:

(i) Discuss the influence of standardisation on the design of a component.

(ii) Why are metals in their pure form unsuitable for industrial use?

(iii) How are grey cast iron and plain carbon steels designated according to Indian Standards?

(iv) Select suitable materials for the following parts stating the special property which makes it most suitable for use in manufacturing:

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(a) Turbine blade.

(b) Bush bearing.

(c) Carburetor body.

(d) Automobile cylinder block.

(e) Spring used in a spring loaded safety valve.

(v) Define mechanical property of an engineering material. Define the following proprties if a material:

(a) Ductility

(b) Toughness

(c) Hardness

(d) Creep

(vi) Discuss the important non-metallic materials of construction used in engineering practise.

2. Attempt any four questions. Each question carries five marks:

(i) What is factor of safety? Explain the factors influencing the choice of factor of safety.

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(ii) Explain how the maximum shear stress theory is used for biaxial and triaxial stress cases?

(iii) Define stress intensity factor, notch sensitivity and fatigue stress concentration factor.

(iv) State the significance of S-N curve. A rotating beam specimen made of steel 45C8 (S_{ut} = 630 N/mm^2) is subjected to a completely reversed bending stress. Calculate the endurance strength of the specimen for a life of 1,20,000 cycles.

(v) The load on a bolt consists of an axial pull of 10kN together with a transverse shear force of 5kN. Find the diameter of bolt required according to: Maximum shear stress theory and maximum distortion energy theory.

(vi) A spherical pressure vessel, with a 500 mm inner diameter, is welded from steel plates. The welded joints are sufficiently strong and do not weaker the vessel. The plates are made from cold drawn steel 20C8 (S_{ut} = 440 N/mm^2 and S_{yt} = 242 N/mm^2). The vessel is subjected to internal pressure which varies from zero 6h 10 N/mm^2. The expected reliability is 90% and the factor of safety is 4. The vessel is expected to withstand infinite number of stress cycles. Calculate the thickness of the plates.

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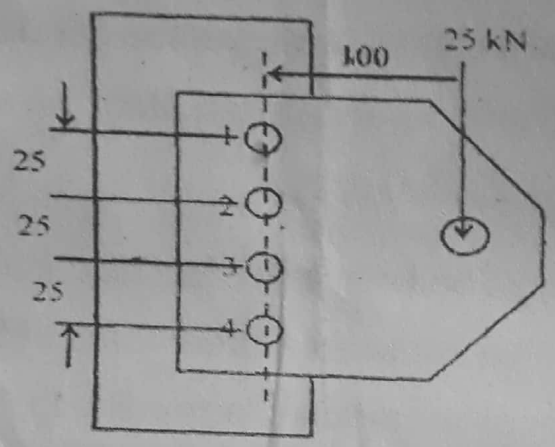
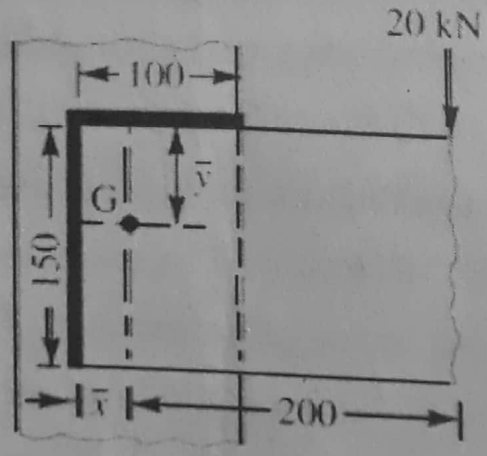
3. Attempt any two questions. Each question carries ten marks:

(i) A bracket is supported by means of 4 bolts of same size, as shown in figure. Determine the diameter of the rivet if the maximum allowable shear stress is 100MN/mm².



(ii) A bracket, as shown in figure carries a load of 20kN. Find the size of the weld of the allowable shear stress is not to exceed 80Mpa.



All dimensions in mm.

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(iii) A shaft is supported by two bearings placed 1 m apart. A 600mm diameter pulley is mounted at a distance of 300mm to the right of left hand bearing and this drives a pulley directly below it with the help of belt having maximum tension of 2.25kN. another pulley 400mm diameter is placed 200mm 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 ì= 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.

4. Attempt any two questions. Each question carries ten marks:

(i) What is nipping in a leaf spring? Discuss its role. Also derive the equation for nip.

$$C = \frac{2PL^3}{Enbt^3}$$

Where C= intial nip, P = maximum force, L = length of the cantiliver or half the length of semi elliptic spring, E = modulus of eleasticity, n = totla number of leaves, b = width of each leaf and t = thickness of each leaf.

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(ii) A direct reading helical tension spring is attached to a rigid support at one end and carries masses at the other free end. The ponter attached to the free end moves on a scale and indicates the mass. The length of the scale is 100mm, which is divided into 50 equal divisions. Each division on the scale indicates 0.5 kg. the maximum capacity of the spring balance is 25 kg. the spring index is 6. The spring is made of oil hardened and tempered steel wire of SW-grade (G = 81370 N/mm^2). The permissible shear stress in the spring wire should be 50% of the ultimate tensile strength. Desing the spring and give its specifications.

(iii) Design and draw a screw jack for lifting a safe laod of 150 kN through a maximum lift of 350 mm. The elastic strength of the material of the screw may be taken as 240 MPa in compression and 160 MPa in shear. The nut may be made of phosphorus bronze for which the elastic strengths in tension, compression and shear are respectively 130, 115, and 100 MPa. bearing pressure between the threads of the screw and the nut may be taken as 18 N/mm^2. Safe crushing stress for the material of the body is 100Mpa. coefficient of friction for the screw as well as collar may be taken as 0.15.

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5. Attempt any two questions. Each question carries 10 marks:

(i) Disuss the various factors to be considered in machine design.

(ii) Write a short note on the following:

(a) Design by evolution

(b) Brain stroming.

(iii) For the devises described below write a set of functions and design requirements (must be detailed and specific, giving quantitative data wherever possible):

(a) A hydraulic jack used for a car repair.

(b) A garage door opener.

(c) A paper feed device for a copier.

(d) A machine to insert toothpaste tubes into cartons.

(e) A table for positioning a weldement in relation to a robotic welder.

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