C 28755 (Pages : 2) Name.....

Reg. No.....

SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION
JUNE 2012

ME 04 602—MACHINE DESIGN

Time : Three Hours Maximum : 100 Marks

Assume data whereever necessary.
Use of design data book is permitted.

Part A

I. (a) How will you account for stress concentration in design of machine parts ?

(b) What is impact ? Give examples of impact force.

(c) What are the factors to be considered while selecting the types of key ?

(d) What are the applications of Cottor joint ?

(e) Why reinforcement is normally required in welded joints ?

(f) What is the nip of leaf spring ?

(g) What types of stresses are induced in shafts ?

(h) What are the advantages and disadvantages of rigid flange coupling ?

(8 × 5 = 40 marks)

Part B

II. (a) Stresses induced at a critical point in a machine component made of steel $\left[\sigma_y\, t = 380 \text{N/mm}^2\right]$ are as follows. σ_x = 100 N/mm^2, σ_y = 40 N/mm^2 and $\tau_{xy} = 80 \text{ N/mm}^2$. Calculate the factor of safety by (i) maximum shear stress theory and ; (ii) maximum normal stress theory.

Or

(b) A steel rod is subjected to a reverse axial load of 180 kN. Find the diameter of tie rod for a factor of safety of 2. Neglect column action. The material has an ultimate tensile strength of 1070 MPa and yield strength of 910 MPa. The endurance limit in reversed bending may be assumed to be one-half of the ultimate tensile strength. The correction factors for axial loading = 0.7, for machined surface = 0.8, for size = 0.85, stress concentration = 1.

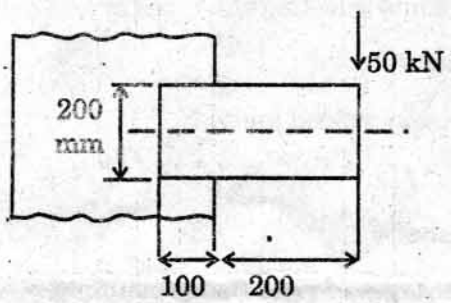
III. (a) A double rivetted lap joint with zig-zag rivetting is to be designed for 13mm thick plate. Assume σ_t = 80 MPa, τ = 60 MPa and σ_c = 120 MPa. State how the joint will fail and find the efficiency of the joint.

Or

(b) Design a Cotter joint to resist a load of 70 kN which acts along the axis of the rods connected by Cotter. The materials of the Cotter and rods will permit the following safe stress

$$\sigma_t = 55 N/mm^2, \sigma_c = 85 N/mm^2, \tau = 43 N/mm^2.$$

IV. (a) A welded connection of steel plates is shown below. It is subjected to an eccentric force of 50 kN. Determine the size of the weld , if the permissible shear stress in the weld is not to exceed 70N/mm^2.



Or

(b) Design a helical spring for a spring loaded safety valve in which diameter of valve seat = 65 mm, operating pressure = 0.7 N/mm^2, maximum pressure when the valve blows off freely = 0.75 N/mm^2. Lift of the valve when pressure rises from 0.7 to 0.75 N/mm^2 = 3.5 mm, Maximum allowable stress = 550 MPa, Modulus of rigidity = 84 kN/mm^2 spring index = 6.

V. (a) A cast gear wheel is driven by a pinion and transmits 100 kW at 375 r.p.m. The gear has 200 machine cut teeth having 20° pressure angle and is mounted at the centre of a 0.4 m long shaft. The gear weighs 2,000 N and its pitch circle diameter is 1.2m. Design the gear shaft. Assume that the axes of the gear and pinion lie in the same horizontal plane.

Or

(b) Design a flange coupling to transmit 135kW at 120 rev/min from one shaft to another. Allowable shearing stress of the bolt material is 45 N/mm^2 while that of shaft material is 55N/mm^2. The flanges are made of cast iron for which the stresses in compression and shear are 75N/mm^2 and 175 N/mm^2 respectively. The material of shaft and key is same.

(4 × 15 = 60 marks)