C 6147 (Pages : 2) Name.....

Reg. No.....

SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION JUNE 2010

ME 04 602—MACHINE DESIGN

(2004 Admissions)

Time : Three Hours Maximum : 100 Marks

I. (a) Explain stress concentration.

(b) What is meant by bilateral tolerance ?

(c) What is Woodruff key ? Give its applications.

(d) Describe the purpose of gib in cotter joint. What are the applications of cotter joints ?

(e) Explain the different types of welded joints with neat sketch.

(f) Under what circumstances, concentric springs are preferred ?

(g) Explain power shafting.

(h) What are the different stresses acting in the couplings ?

(8 × 5 = 40 marks)

II. (a) Briefly explain shear stress and shear strain.

(b) Calculate the diameter of the solid to transmit 50 kW at 180 rpm, if the angle of twist in a length of 4 metres is not to exceed 0.4°,the allowable stress in the material is 70 MPa and modulus of rigidity is 84 GPa.

(11 + 4 = 15 marks)

Or

(b) A machine part of 16mm diameter is made of Alloy Steel. It is subjected to a bending moment of 100Nm, a torque of 50Nm and an axial pull of 5 kN. Estimate the factor of safety based on Maximum Normal Stress, Maximum shear stress and Maximum Distortion energy theories. Assume yield tensile strength for the material as 500Mpa.

(15 marks)

III. (a) A shaft and a key are made of the same material and the key width is 1/4 of the shaft diameter. Consider shear only, determine the minimum length of the key in terms of the shaft diameter. The shearing strength of the key material is 60% of its crushing strength. Determine the thickness of the key to make the key equally strong in shear and crushing.

(15 marks)

Or

(b) (i) What do you mean by efficiency of riveted joint ?

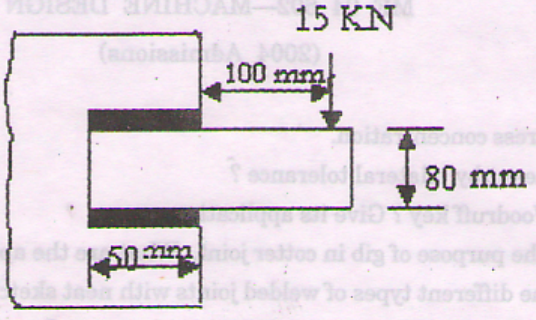
(ii) A locomotive boiler of 1.8 m internal diameter is required to generate steam at 1.4 MPa gauge. Calculate the thickness of the shell plate and design the triple riveted longitudinal double butt strap joint with unequal straps. Use the following data: σ_t =77 MPa, τ = 60 MPa and σ_c = 135 MPa. Efficiency of triple-riveted longitudinal butt joint is 84%.

(4 + 11= 15 marks)

Turn over

IV. (a) Sketch and discuss the various types of welded joints used in pressure vessels.

(b) A bracket carrying a load of 15 kN is to be welded as shown in Figure. Find the size of weld required if the allowable shear stress is not to exceed 80 MPa.



(5 + 10 = 15 marks)

Or

(c) A rail carriage weighing 200kN and running at 5 km/hour is brought to rest by four buffer springs of close coiled helical type during connection with another carriage which is already at rest. The mean coil diameter is 5 times the wire diameter. The deflection of each spring is 220 mm, to bring the carriage to rest. Safe shear stress for the spring material is 400 N/mm^2. Calculate the maximum load on the spring, diameter of wire and coil, number of turns and free length of spring. Assume the ends of spring are squared and ground. Take G = 0.8 × 10^4 N/mm^2.

(15 marks)

V. (a) A shaft running at 400 rpm transmits 10kW. Assuming allowable shear stress in shaft is 40 MPa. find the diameter of the shaft.

Or

(b) Determine the diameter of the hollow shaft with inside dia = 0.6 outside dia. The shaft is driven by an overhung pulley of 90cm dia. Take weight of pulley = 60kg, the belt tensions as 290 and 100kg, overhang = 25cm, angle of lap = 180°.

(6 + 9 = 15 marks)

Or

(b) The shaft and the flange of a marine engine are to be designed for flange coupling, in which the flange is forged on the end of the shaft. The following particulars are considered in the design.

Power of the engine = 3MW

Speed of the engine = 100 rpm.

Permissible shear stress in bolts and shaft = 60MPa

Number of bolts used = 8

Pitch circle diameter of bolts = 1.6 × diameter of shaft. Find (i) Diameter of shaft. (ii) Diameter of bolts. (iii) Thickness of flange. (iv) Diameter of flange.

(15 marks)

[4 × 15 = 60 marks)