C 18252 (Pages : 3) Name.....

Reg. No.....

SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, JUNE 2011

ME 04 602—MACHINE DESIGN

(2004 Admissions)

Time : Three Hours Maximum : 100 Marks

Answer **all** *the questions*

I. (a) Explain the principles of standardisation.

(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) What are the various types of ends for helical compression spring ?

(g) What is factor of safety ? Explain the factors that influence the factor of safety.

(h) Explain critical speed of shaft.

(8 × 5 = 40 marks)

II. (a) What is meant by Brittleness, Hardness and Plasticity ? Why brittleness is undesirable property for materials to be used for Machine Parts ?

(b) Define the terms :

(i) Fit.

(ii) Basic Size.

(iii) Clearance.

(iv) Upper Deviation.

(7+ 8 = 15 marks)

(*Or*)

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

(15 marks)

Turn over

III. (a) A shaft and a key are made of the same material and the key width is ¼ 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.

(5 + 10 = 15 marks]

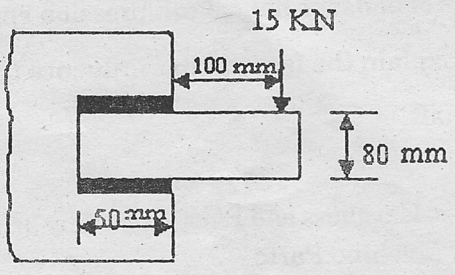
(Or)

(b) Design a cotter joint to withstand an axial load varying from 20 kN in tension to 60 kN in compression. The allowable for the steel used in the joint are 50 Mpa in tension; 70 Mpa in crushing; 40 Mpa in shear.

(15 marks)

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 below. Find the size of weld required if the allowable shear stress is not to exceed 80 MPa.



Figure

(15 marks)

(Or)

(c) A rail carriage weighing 200 kN 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 $G = 0.8 \times 10^4$ N/mm^2.

(15 marks)

V. (a) A belt pulley is transmitting 5 kW at 600 RPM to another pulley below it. The pulley is resting on two bearings 500 mm. apart. The load on the pulley due to belt tension and its own weight is 5 kN. Determine the minimum diameter of the shaft required for an allowable shear stress of 48 N/mm^2.

(1 5 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 = 3 MW

Speed of the engine = 100 rpm.

Permissible shear stress in bolts and shaft = 60 Mpa

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]