

C 58390

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Name:

Reg. No.

**SIXTH SEMESTER B.TECH. (ENGINEERING) DEGREE
EXAMINATION, JUNE 2009**

ME 04 602—MACHINE DESIGN

(2004 admissions)

Time : Three Hours

Maximum : 100 Marks

Answer all questions.

1. (a) Explain the different steps in design process.
(b) What is meant by hole basis system ?
(c) Explain the different types of threaded fasteners.
(d) Explain the different types of keys with neat sketch and its applications.
(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)

2. (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)

3. (a) What is Woodruff key ? Give its applications.

- (b) A shaft and a key are made of the same material and the key width is $\frac{1}{4}$ 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.

(5 + 10 = 15 marks)

Or

Turn over

- (c) 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)
4. (a) Sketch and discuss the various types of welded joints used in pressure vessels.
 (b) A $200 \times 150 \times 10$ mm. angle is joined to a frame by two parallel fillet welds along the edge of 200 mm. length. If the angle is subjected to a static load of 200 kN, find the length of weld at the top and bottom. The allowable shear stress for static loading may be taken as 75 MPa. (15 marks)

Or

- (c) A truck spring has 12 leaves, two of which are full length leaves. The spring supports are 1.05 m. apart and the central band is 85 mm. wide. The central load is to be 5.4 kN with a permissible stress of 280 N/mm^2 . Determine the thickness and width of the steel spring leaves. The ratio of the total depth to the width of the spring is 3. Also determine the deflection of the spring. (15 marks)
5. (a) A machine shaft is subjected to an axial thrust of 60 kN and bending moment of 92000 N mm, while transmitting 70 kW at 900 R.P.M. The shaft is supported between two ends of span of 2.4 m. Determine the shaft diameter. (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 = 3 MW

Speed of the engine = 100 r.p.m.

Permissible shear stress in bolts and shaft = 60 MPa

Number of bolts used = 8.

Pitch circle diameter of bolts = $1.6 \times$ diameter of shaft. Find (i) Diameter of shaft ; (ii) Diameter of bolts ; (iii) Thickness of flange ; and (iv) Diameter of flange. (15 marks)

[4 × 15 = 60 marks]