[Total No. of Questions - 9] [Total No. of Printed Pages - 4]
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B. Tech 5th Semester Examination

Machine Design-I (O.S.)

ME-5002

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : (i) Assume any data if necessary
(ii) Attempt one question from each section A, B, C and D.
(iii) Section E is Compulsory.

SECTION - A

1. (a) Explain the following Properties

(i) Brittleness (ii) Machinability (iii) Stiffness (iv) Creep (v) Malleability **(10)**

(b) What are fits and tolerances? How they are designated? **(5)**

(c) What do you understand by the following designation of materials?

(i) FG350 (ii) 10C4 (iii) 40C15S12 (iv) 50Cr1V23 (v) 27Mn2 **(5)**

2. The structural connection shown in fig. 1 is subjected to an eccentric force P of 10kN with an eccentricity of 500mm. The centre-distance between bolts 1 and 2 is 200 mm, and the centre-distance between bolts 1 and 3 is 150 mm. All the bolts are identical. The bolts are made from plain carbon steel 30C8. (S_{yt}=400 N/mm^2) and the factor of safety is 2.5. Determine the size of the bolts. **(20)**

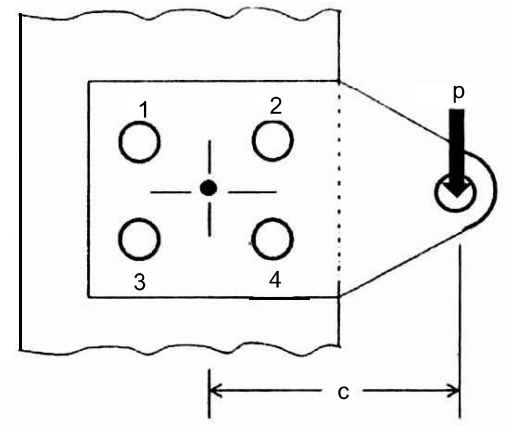

Figure 1

SECTION - B

3. Two mild steel rods are connected by a knuckle joint to transmit an axial load of 150 kN. Design the joint completely taking the material of joint as C-40 and factor of safety as 2. **(20)**

4. A shaft of rectangular cross-section is welded to a support by means of fillet welds as shown in fig. 2. Determine the size of the welds, if the permissible shear stress in the weld is limited to 75 N/mm^2. **(20)**

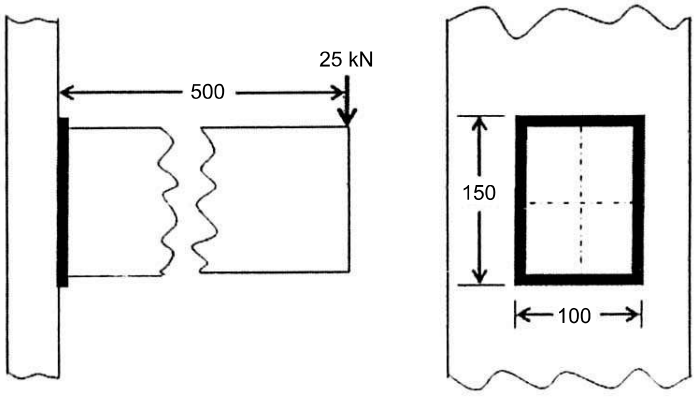

Figure 2

SECTION - C

5. The following data is given an open-type V-belt drive:

Diameter of driving pulley	= 150 mm
Diameter of driven pulley	= 300 mm
Centre distance	= 1 m
Groove angle	= 40°
Mass of belt	= 0.25 kg/m
Maximum permissible tension	= 750 N
Coefficient of friction	= 0.2

Plot a graph of the maximum tension and power transmitted against the belt velocity. Calculate the maximum power transmitted by the belt and the corresponding belt velocity. Neglect power losses. **(20)**

6. A machine is driven by a motor which exerts a constant torque. The resisting torque of the machine increases uniformly from 500 N-m to 1500 N-m through a 360° rotation of the driving shaft and drops suddenly to 500 N-m again at the beginning of the next revolution. The mean angular velocity of the machine is 30 rad/s and the coefficient of speed fluctuations is 0.2. A solid circular steel disk, 25 mm thick, is used as flywheel. The mass density of steel is 7800 kg/m^3 (μ=0.3). Calculate the outer diameter of the flywheel disk and the maximum stresses induced in it. **(20)**

SECTION - D

7. A cone clutch is used to connect an electric motor running at 1400 rpm with a machine which is stationary. The machine is equivalent to a rotor of mass 150 kg and radius of gyration as 250 mm. The machine has to be brought to the full speed of 1400 rpm from a stationary condition in 40 s. the semi-cone angle α is 12.5°. The mean radius of the clutch is twice the face width. The coefficient of friction is 0.2 and the normal intensity

of pressure between contacting surfaces should not exceed 0.1 N/mm^2. Assuming the uniform-wear criterion, calculate:

(i) The inner and outer diameters.

(ii) The face width of friction lining.

(iii) The force required to engage the clutch; and

(iv) The amount of heat generated during each engagement of clutch. **(20)**

8. (a) Discuss the various type of clutches giving atleast one practical application for each. **(5)**

(b) Why it is necessary to dissipate the heat generated when clutches operate? **(5)**

(c) How does the function of brake differ from the clutch? **(5)**

(d) What are the thermal considerations in break design? **(5)**

SECTION - E

9. Attempt the following questions.

(i) How do you classify materials for engineering use?

(ii) What are the various forms of screw threads?

(iii) Distinguish between cotter joint and knuckle joint.

(iv) What are the assumptions made in the design of welded joint?

(v) What is an eccentric riveted joint?

(vi) What are the types of keys?

(vii) What is splined shaft?

(viii) What are the requirements of a good shaft coupling?

(ix) Write the application of band brakes.

(x) What is uniform pressure theory for friction clutch?

(2×10=20)