Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

B.E. Sem-Vth Examination December 2010

Subject code: 152503

Subject Name: Design of Machine Elements-I

Date: 16 /12 /2010 **Time: 03.00 pm - 05.30 pm**

Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** What do you mean by stress concentration? Explain the methods of reducing stress concentration with sketch. **07**

(b) Write in detail Application of Soderberg's Equation. **07**

Q.2 **(a)** Explain Design procedure of Disc or Plate clutch. **07**

(b) A multiple disc clutch, steel on bronze, is to transmit 4.5 kW at 750 r.p.m. The inner radius of the contact is 40 mm and outer radius of the contact is 70 mm. The clutch operates in oil with an expected coefficient of 0.1. The average allowable pressure is 0.35 N/mm^2. **07**

Find: 1.) the total number of steel and bronze discs; 2.) the actual axial force required; 3.) the actual average pressure; and 4.) the actual maximum pressure.

OR

(b) Write a design procedure of Internal Expanding Brake. **07**

Q.3 **(a)** Explain design procedure of Flywheel. **07**

(b) The following data is given for an open-type V-belt drive: **07**

Diameter of driving pulley= 150 mm,
Diameter of driven pulley = 300 mm,
Centre distance = 1m,
Groove angle = 40^o,
mass of belt = 0.25 kg/m,
Maximum Permissible tension = 750 N,
Coefficient of friction = 0.2,
Calculate the maximum power transmitted by the belt and the corresponding belt velocity. Neglect power losses.

OR

Q.3 **(a)** Prove that the ratio of the driving tensions on the two sides of a pulley is **07**

$T_1/T_2=e^{\mu\theta}$

where, T_1 = Tension in the tight side of the belt,
T_2 = Tension in the slack side of the belt,
Θ = Angle of contact in radians,
μ= Coefficient of friction between the belt and the pully.

(b) A bronze spur pinion rotating at 600 r.p.m. drives a cast iron spur gear at a transmission ratio of 4:1 . The allowable static stresses for the bronze pinion and cast iron gear are 84 MPa and 105 MPa respectively. The pinion has 16 standard 20^o full depth involute teeth of module 8 mm. The face width of both the gears is 90 mm. Find the power that can be transmitted from the standpoint of strength. **07**

Q.4 **(a)** "Forces Acting on a Connecting Rod" Explain with neat sketch. **07**

(b) A connecting rod of length I may be considered as a strut with the ends free to turn on the crank pin and the gudgeon pin. In the directions of the axes of these pins, however, it may be considered as having fixed ends. Assuming that Euler's formula is applicable, determine the ratios of the sides of the rectangular cross-section so that the connecting rod is equally strong in both planes of buckling. **07**

OR

Q.4 **(a)** Explain terms used in Bevel gear with neat sketch. **07**

(b) Design and Draw a valve spring of a petrol engine for the following operating conditions: **07**

Spring load when the valve is open = 400 N
Spring load when the valve is closed = 250 N
Maximum inside diameter of spring = 25 mm
Length of the spring when the valve is open = 40 mm
Length of the spring when the valve is closed =50 mm
Maximum permissible shear stress = 400 MPa

Q.5 **(a)** Explain the terms used in Gears with sketch. **07**

(b) A Cast iron cylinder of internal diameter 200 mm and thickness 50 mm is subjected to a pressure of 5 N/mm^2. Calculate the tangential and radial stresses at the inner, middle (radius = 125 mm) and outer surfaces. **07**

OR

Q.5 **(a)** Classify the Pressure vessels. **07**

Explain (1) Circumferential or Hoop Stress.
(2) Longitudinal Stress.

(b) A lever loaded safety valve has a diameter of 100 mm and the blow off pressure is 1.6 N/mm^2. The fulcrum of the lever is screwed into the cast iron body of the cover. Find the diameter of the threaded part of the fulcrum if the permissible tensile stress is limited to 50 MPa and the leverage ratio is 8. **07**

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