Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER– V • EXAMINATION – WINTER 2016

Subject Code: 152503 Date: 19/11/2016
Subject Name: Design of Machine Elements - I
Time: 10:30AM – 01:00PM Total Marks: 70

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Use of own design data book is permitted.**

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

(b) Write in detail Factors to be considered while designing machine parts to avoid fatigue failure. **07**

Q.2 **(a)** Write a design procedure of Disc Brake. **07**

(b) A simple band break operates on a drum of 65 cm in diameter that is running at 250 rpm. The coefficient of friction is 0.25. The brake band has a contact of 270^0, one end is fastened to a fixed pin and the other end to the brake arm 125 mm from the fixed pin. The straight brake arm is 750 mm long and placed perpendicular to the diameter that bisects the angle of contact. What is the pull necessary on the end of the brake arm to stop the wheel if 35 KW is being absorbed? **07**

OR

(b) Explain the following terms **07**
(I) Notch sensitivity, (II) Surface finish factor, (III) Endurance limit

Q.3 **(a)** Explain with the help of neat sketch the working principal of centrifugal clutch. **07**

(b) An engine developing 50KW at 1000 r.p.m. is fitted with a cone clutch built inside the fly wheel. The cone has a face angel of 12^0 and a maximum mean diameter of 500mm. The co-efficient of friction is 0.2. The normal pressure on the clutch face is not to exceed 0.1 N/mm^2. **07**
Determine:(a) The face width required (b) The axial spring force necessary to engage the clutch.

OR

Q.3 **(a)** Explain. Design procedure of spring. **07**

(b) Derive an expression for Beam strength of the Spur gear. **07**

Q.4 **(a)** Explain the different causes of gear tooth failures and suggest possible remedies to avoid such failures. **07**

(b) Design a pair of spur pinion and gear made of cast steel and cast iron respectively. The diameter of pinion is 140 mm and it transmits 30 Kw power at 1200 rpm. The gear ratio is 3:1 and teeth are 20^0full depth involute. Permissible static bending stress for pinion is 110 MPa and for gear is 55 MPa. **07**

OR

Q.4 **(a)** What is the difference between column and strut? What are the different types of end conditions based on Eulers' column theory? Define "slenderness ratio". **07**

(b) A closed vessel is to be designed to withstand an internal pressure of 55 MPa having inside diameter of 50 cm. The properties of the vessel material are yield strength is 300 MPa, ultimate tensile strength is 500 MPa, Poisson's ratio = 0.3. Determine the required wall thickness of the vessel using a factor of safety of 1.5 based on yield strength on the basis of i) maximum principal stress theory, ii) maximum shear stress theory. **07**

Q.5 **(a)** Explain different types of Pressure vessel supports with neat sketch. **07**

(b) A Cast iron cylinder of internal diameter 200 mm and thickness 55 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)** 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**

(b) Classify the Pressure vessels. **07**
Explain (1) Circumferential or Hoop Stress.
(2) Longitudinal Stress.

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