

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V • EXAMINATION – SUMMER • 2015****Subject Code: 152503****Date: 11/05/2015****Subject Name: Design of Machine Elements - I****Time: 02.30pm-05.00pm****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) Explain stress concentration with neat 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) Explain the different causes of gear tooth failures and suggest. **07**
- OR**
- (b) Write a design procedure of Internal Expanding Brake. **07**
- Q.3** (a) 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/mm². Find: 1.) the total number of steel and bronze discs; 2.) the actual axial force required; 3.) the actual average pressure. **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°,
 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) 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 1250 rpm. The gear ratio is 3:1 and teeth are 20° full depth involute. Permissible static bending stress for pinion is 110 MPa and for gear is 55 MPa. **07**
 (b) For a hardened steel worm and gear the centre distance is 450 mm. Transmission ratio is 20. Find the axial module and the lead angle. **07**
- Q.4** (a) Explain terms used in Bevel gear with neat sketch. **07**
 (b) Classify the Pressure vessels. **07**
 Explain (1) Circumferential or Hoop Stress.
 (2) Longitudinal Stress.
- OR**
- Q.4** (a) Design and Draw a valve spring of a petrol engine for the following operating conditions: 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 **07**
 (b) A Cast iron cylinder of internal diameter 200 mm and thickness 50 mm is subjected to a pressure of 5 N/mm². Calculate the tangential and radial stresses at the inner, middle (radius = 125 mm) and outer surfaces. **07**

- Q.5 (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)** Derive the expression to determine wrench torque required for bolt tightening. **07**
- OR**
- Q.5 (a)** Explain different types of springs with neat sketch. **07**
- (b)** Explain energy stored in helical spring of circular wire. **07**
