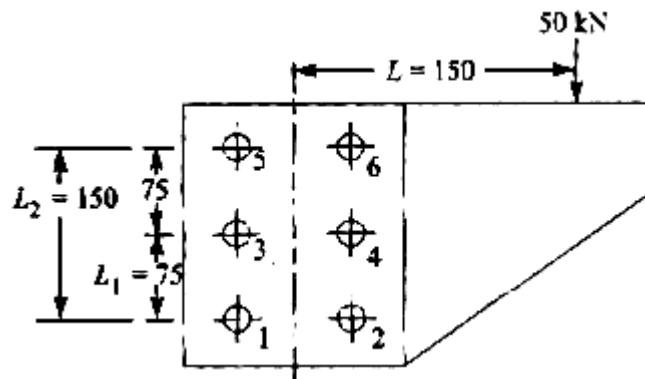


GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V • EXAMINATION – SUMMER • 2014****Subject Code: 152503****Date: 19-06-2014****Subject Name: Design of Machine Elements - I****Time: 10.30 am - 01.00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Use of PSG Design Data Book is permitted.

- Q.1** (a) A steel rod is to be subjected to reversed axial load of 150 kN. Find the diameter of the rod for the factor of safety of 2. Neglect column action. The material has an ultimate tensile strength as 1090 N/mm^2 , Yield stress as 920 N/mm^2 and Endurance limit as 540 N/mm^2 . Other correction factors are: Theoretical stress concentration factor: 2.5, Notch sensitivity: 0.8 **07**
- (b) What do you understand by Stress concentration? Illustrate how the stress concentration in a component can be reduced. **07**
- Q.2** (a) A semi-elliptical laminated spring is to carry a load of 6000 N and consists of 8 leaves 46 mm wide, two of the leaves being of full length. The spring is to be made 1000 mm between the eyes and is held at a centre by a 50 mm wide band. Assume that the spring is initially stressed so as to induce an equal stress of 550 N/mm^2 when fully loaded. Design the spring giving (i) thickness of leaves, (ii) eye diameter and (iii) length of leaves. **07**
- (b) A bracket is bolted to a column by 6 bolts of equal size as shown in figure-I. It carries a load of 50 kN at a distance of 150 mm from the centre of column. If the maximum stress in the bolt is to be limited to 150 MPa, determine the diameter of the bolt. **07**

**(Figure-I)****OR**

- (b) Generally how the springs are classified? Indicate the different types of springs by sketches and give at least two practical applications of each. **07**
- Q.3** (a) A cone clutch has a cone pitch angle 10° , mean diameter of 375 mm and face width of 150 mm. The co-efficient of friction is 0.15. The assumption of uniform wear exists. The average pressure on the lining is 0.075 N/mm^2 for a speed of 750 rpm. **07**
- Determine: (i) Force required engaging the clutch and (ii) Power that can be transmitted.

- (b) Design a cast iron flywheel for a four stroke cycle Diesel engine developing 100KW power at 250rpm. Considering hoop stress as 4 N/mm^2 calculate the mean diameter of the flywheel. The total fluctuation of speed is to be limited to 4% of the mean speed. The work done during the power stroke is $\frac{4}{3}$ times the average work done during the whole cycle. The maximum torque on the shaft is 1.4 times the mean torque. The arms are six in number and of elliptical section. The safe stress for the shaft and key may be taken as 40 N/mm^2 . Density of the C.I. is 7200 kg/m^3 . **07**
- OR**
- Q.3 (a) Describe with the help of a neat sketch the principal of operation of an internal expanding shoe brake. **07**
- (b) Following data refer to a single cylinder steam engine. **07**
 Boiler pressure: 1.5 N/mm^2 , Speed 250rpm, Mean effective pressure: 0.5 N/mm^2 , Ratio of stroke to diameter: 1.5:1, Power: 75 KW, Diagram factor: 0.8
 Gasket sealing pressure: 2 N/mm^2 , Gasket stiffness co-efficient: 0.3
 Calculate: (i) Thickness of the cylinder and flange, (ii) Thickness of the cylinder cover and (iii) Number and size of the bolts for tightening cover. Allowable stress for C.I. cylinder and cover in tension and shear 15 N/mm^2 and for M.S. bolts in tension 50 N/mm^2
- Q.4 (a) A pair of 20° full depth involute bevel gears is required to transmit 13.5 KW at 950rpm. The output shaft speed is 350 rpm and is at right angle to input shaft. Design the pair and check for possible failures. **10**
- (b) Give comparison between Involute and Cycloidal gear. **04**
- OR**
- Q.4 (a) Design a pair of Helical gear to transmit 32.5KW power at 1440 rpm. The speed Reduction is 2.5. Working life of the gear is 10,000 hours. **10**
- (b) Explain the different causes of gear tooth failure. **04**
- Q.5 (a) For a flat belt drive following data is given: **10**
 Motor power: 6 KW, Speed of motor: 1500 rpm, Speed of driven pulley: 500 rpm, Maximum peripheral speed of the belt: 16 m/sec., Load factor: 1.2, Density of the leather belt: 0.98 gm/cc , Diameter of the smaller pulley to thickness of the belt: 35, Endurance limit of the belt material: 4 N/mm^2 , Modulus of elasticity: 100 N/mm^2 , Factor of safety: 7, Ultimate strength of the belt: 25 N/mm^2 , Centre distance: 3000 mm.
 Determine belt size and design C.I. pulley.
- (b) What do you understand by a column and strut? Explain the various end conditions of a column or strut. **04**
- OR**
- Q.5 (a) Determine the dimensions of I-section connecting rod for an I C engine having the following specifications: **10**
 Diameter of the piston: 120 mm, Mass of the reciprocating parts: 2kg, Length of the connecting rod: 350mm, Engine revolutions per minute: 1800, Maximum explosion pressure: 3 N/mm^2 , Stroke length: 180mm
 The flange width and the depth of the I-section rod are in the ratio of 4t:6t where, 't' is the thickness of the flange and web. Assume yield stress in compression for the material as 330 MPa and factor of safety as 6.
- (b) Discuss design criterion for V-belt pulley. **04**
