

GUJARAT TECHNOLOGICAL UNIVERSITY**B. E. Sem. - V - Examination – June- 2011****Subject code: 151905****Subject Name: Machine Design-I****Date: 29/06/2011****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 standard Design data book is permissible.

- Q.1**
- (a) What is endurance limit? Explain design criteria with solderberg's line. **04**
 - (b) Explain design of components for forging. **03**
 - (c) What do you mean by standardization? Explain role of preferred numbers in standardization? **04**
 - (d) Standardize six speeds between 250 to 1400 rpm and State the series of torque for 0.5kw drive. **03**

- Q.2**
- (a) Explain the following terms. **07**
 - 1) Spring index
 - 2) Spring rate
 - 3) Free length
 - 4) Wahl's factor
 - (b) Calculate the dimensions of the helical spring for a ramsbottom safety valve for the following data. **07**
 - valve diameter = 65 mm,
 - Maximum blows off pressure = 0.8 N/mm^2 ,
 - valve lift for pressure rise from 0.75 to $0.80 \text{ N/mm}^2 = 3.5 \text{ mm}$
 - Maximum allowable stress = 550 N/mm^2
 - Spring index = 6, Modulus of rigidity = $8.3 \times 10^4 \text{ N/mm}^2$.

OR

- (b) A hot rolled steel rod is to be subjected to a torsional load that will vary from a -100 Nm to +400 Nm. Determine the diameter of rod using a factor of safety 1.75 for the material of the rod take $\sigma_{ut} = 489 \text{ MN/m}^2$, $\sigma_{yp} = 315 \text{ MN/m}^2$. Take surface condition modifying factor = 0.68, Size factor = 0.85, Load factor = 0.58, Stress concentration factor = 1. **07**

- Q.3**
- (a) A hydraulic press for tiles is required to press tiles of $400 \times 400 \times 35 \text{ mm}$ thickness. Available fluid pressure is 22 N/mm^2 . The maximum force to be applied is 100 kN. Design the ram, cylinder, base plate & supporting column. Assume suitable materials for different parts of Hydraulic press & accordingly select design stresses. **07**
 - (b) Explain the design of pipes. **03**
 - (c) Explain the different types of cover plates in engineering practice. **04**

OR

- Q.3**
- (a) Design a V belt drive from the following data. **07**

Motor Power = 3.75 kw	Belt width = 17 mm
Speed of Motor = 1440 rpm	Belt thickness = 11 mm
Speed reduction = 4	Belt area = 140 mm^2

Density of belt = $1.5 \times 10^{-5} \text{ N/mm}^3$, Endurance limit for belt is 10 N/mm^2 .

- (b) Write step by step procedure for the design of chain drive giving all governing equation. **04**
- (c) Discuss the different types of belts and their material used for power transmission. **03**
- Q.4** (a) Explain Lubricant and properties of lubricants for sliding contact bearing. **04**
- (b) Explain hydrodynamic bearing & bearing modulus with neat sketch. **03**
- (c) A 75 mm diameter full journal bearing runs at 400 rpm. It is 75 mm long and is subjected to a radial load of 2500 N. The bearing is lubricated with SAE 30 oil with the viscosity 16.5×10^{-3} kg/m-s flows into the bearing at a temperature of 75°C. The radial clearance is 0.03 mm. Determine **07**
- 1) Sommerfeld number
 - 2) Minimum film thickness
 - 3) Attitude
 - 4) Power loss in friction
 - 5) Heat loss
 - 6) Side flow & Total flow of lubricants
 - 7) Temperature rise
- OR**
- Q.4** (a) Discuss bearing seals & lubrication of rolling contact bearings. **04**
- (b) Discuss causes of failure of antifriction bearing. **03**
- (c) For SKF 6207 bearing is to operate on the following work cycle. **07**
- Radial load of 6370N at 200 rpm for 25% of the time.
- Radial load of 9080N at 600 rpm for 20% of the time.
- Radial load of 3638N at 400 rpm for 55% of the time.
- The inner ring rotates. The loads are steady. Find the expected average life of this bearing in hours.
- Q.5** (a) Enlist the different factors on which the capacity of brake depends. Discuss self energizing and self locking brakes. **03**
- (b) Explain following term regarding wire rope used in hoisting machinery. **04**
- 1) Fatigue life of rope
 - 2) Stresses in hoisting rope
- (c) A Band brake as shown in figure-1 is required to balance a torque of 980 N-m at the drum shaft. The drum is to be made of 400 mm diameter & keyed to the shaft. **07**

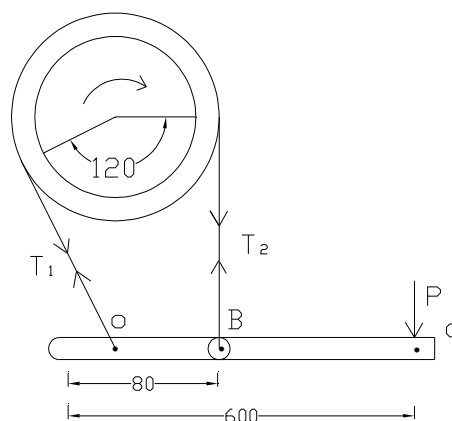


Figure-1.

The band is to be lined with ferodo lining having a coefficient of friction 0.25. The maximum pressure between the lining & drum is 0.5 N/mm^2 . Design the steel band, lever & pin. The permissible stresses for the band, lever and pin are 70 Mpa in tension and compression and 56 Mpa in shear.

OR

- Q.5 (a)** 1) Discuss briefly the considerations for selection of friction lining material. **03**
- 2) State design procedure of a Centrifugal clutch. **04**
- (b)** A multiplate clutch is used to transmit 5 kw power at 1440 rpm. The inner & outer diameters of contacting surfaces are 50 mm and 80 mm respectively. The coefficient of friction and the average allowable pressure intensity for the lining may be assumed as 0.1 and 350 kpa respectively. Determine **07**
- 1) Number of friction plates & pressure plates
 - 2) Axial force required to transmit power
 - 3) The actual average pressure
 - 4) Actual maximum pressure intensity after wear.
