

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-VIII EXAMINATION – SUMMER 2016

Subject Code:182004

Date:18/05/2016

Subject Name:Design of Mechanisms II

Time:10:30 AM to 01:00 PM

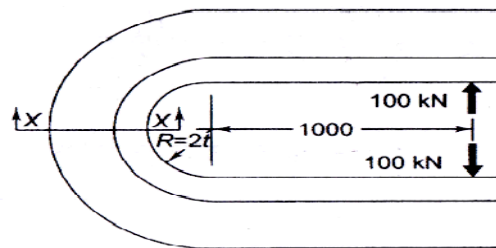
Total Marks: 70

Instructions:

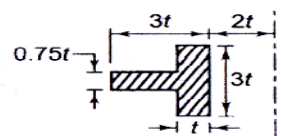
1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q : 1** **A** Explain ergonomics with consideration of Man machine system. **04**
 B Design a bush pin type flexible coupling to connect a pump shaft to a motor shaft transmitting 32 kW at 960 rpm considering 20% overload. The material properties are as follows: **10**
- (a) Allowable shear and crushing stress for shaft and key material is 40 MPa and 80 MPa respectively.
 (b) The allowable shear stress for cast iron is 15 MPa.
 (c) The allowable bearing pressure for rubber bush is 0.8 MPa.
 (d) The material for pin is same as that of the shaft.
- Q : 2** **A** The frame of a 100 kN punch press is shown in the following Fig. The material of the frame is Gray cast iron ($S_{ut} = 200$ MPa) and the factor of safety is 3. Determine the dimensions of the frame. **07**

$$R_n = \frac{A}{(b_i - t) \ln\left(\frac{R_i + t_i}{R_i}\right) + t \ln\left(\frac{R_o}{R_i}\right)}$$



(a)



(b) Section at XX

- B** Design the steel ropes required for an electric overhead travelling crane for the following data: **07**

Lifting capacity = 5000 kg, weight of lifting magnet = 2000 kg, weight of lifting tackle = 120 kg, Lifting height = 8 m, Number of ropes = 4, The efficiency of the pulley system = 93%. , factor of safety = 4

For the crane a special hoisting rope of 6 X 37 is recommended. Braking load = $480d^2$ N, Diameter of the wire = $0.045d$ mm, Area of wires in rope = $0.38 d^2$ mm², diameter of sheave = $27d$ mm, $E = 8 \times 10^4$ N/mm², where d is diameter of wire rope in mm.

OR

Q : 2 B Discuss the Soderberg and Goodman criterion for design of mechanical component under fluctuate loading. **07**

Q : 3 A 1. Define static load and dynamic load carrying capacity of rolling element bearings. **04**

2. Define the rating life of the bearing. What is L_{60} life of bearing? **03**

B A pulley of 0.9 m diameter revolving at 200 rpm is to transmit 7.5 kW. Find the width of a leather belt if the maximum tension is not to exceed 145 N in 10 mm width. The tension in the tight side is twice that in slack side. Determine the diameter of the shaft and the various parts of pulley, assuming it to have six arms. Maximum shear stress is not to exceed 63 MPa. **07**

OR

Q;3 A 1. Give merits and demerits of rolling contact bearing over the sliding contact bearing. **02**

2. Explain with the help of sketch how the coefficient of friction varies with the bearing characteristic number indifferent state of lubrication. **03**

3. What are the desirable properties of shoes friction material used for the lining of brake shoes? **02**

Q : 3 B A hot rolled steel shaft is subjected to a torsional moment that varies from 330 N-m clockwise to 110 N-m counter clockwise and an applied bending moment at a critical section varies from 440 N-m to -220 N-m. the shaft is uniform cross section and no keyway is present at the critical section. Determine the required shaft diameter. The material has an ultimate strength of 550 MN/m^2 and yield strength of 410 MN/m^2 . Take the endurance limit as half the ultimate strength, factor of safety of 2, size factor of 0.85 and surface finish factor of 0.62. **07**

Q : 4 Explain the procedure for selection of rolling element bearing for a shaft that is supported on two bearings. A spur gear is mounted between two bearings and power is supplied to the shaft from cantilever end through flat belt. Mention all necessary equations. **14**

OR

Q : 4 A Explain the energy absorbed by a brake in the following cases: **07**

1. When the motion of the body is pure translation

2. When the motion of the body is pure rotation
3. When the motion of the body is a combination of translation and rotation

B Explain the procedure followed in designing a journal bearing. **07**

Q : 5 Following data is given for a steel gear pair transmits 7.5 KW power from an electric motor running at 1440 RPM to a machine running at 480 RPM. Centre distance is 240 mm. Allowable bending stress for pinion and gear 160 MPa. Surface hardness is 300 BHN and 20⁰ stub tooth. $K_s = 1.25$. Design a gear pair for above application. **14**

OR

Q : 5 The P.C.D of spur pinion and gear are 100 mm and 300 mm respectively, The pinion is made up of plain carbon steel 40C8 ($f_{ut} = 600$ MPa) While gear is made up of grey cast iron FG300 Pinion receives 5 kW power at 500 rpm through its shaft. The service factor and F.O.S can be taken as 1.5 each. Design a gear pair. **14**

$$Y_p = 0.154 - \frac{0.912}{Z_p} \text{ (full depth)}$$

$$Y_p = 0.175 - \frac{0.841}{Z_p} \text{ (stub gear)}$$

$$F_s = f_b \times b \times Y_p \times \pi \times m$$

$$C = 11860 \times e$$

$$e = 0.025$$

$$F_d = F_t + \frac{21v(cb + F_t)}{21v + (cb + F_t)^{1/2}}$$

$$Q = \frac{2Z_g}{Z_g + Z_p}$$

$$k = \frac{f_{es}^2 \sin \phi}{1.4} \left[\frac{1}{E_p} + \frac{1}{E_g} \right]$$

$$F_w = D_p \times Q \times k \times b$$
