Seat No.:_____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–VIII • EXAMINATION – SUMMER 2013

Subject Code: 182004   **Date: 10/05/2013**
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   Discuss the various design steps for hook, wire rope, pins and side links of   **14**
             hoisting mechanism.

Q:2 **(a)**   The shaft and the flange of a marine engine are to be designed for flange   **07**
             coupling, in which flange is forged on the end of the shaft. The following
             particulars are to be considered in the design:
             Power of the engine = 3 MW
             Speed of the engine = 100 rpm
             Permissible shear stress in bolts and shaft = 60 MPa
             Number of bolts used = 8
             Pitch circle diameter of bolts = 1.6 X diameter of the shaft.

(b)   An overhung pulley transmits 35 kW at 240 rpm. The belt drive is vertical and   **07**
             the angle of wrap may be taken as 180°. The distance of the pulley centre line
             from the nearest bearing is 350 mm. Take μ = 0.25. Determine the dimensions
             of belt and pulley. The following permissible stresses may be taken for design
             purpose:
             For shaft and key the tension and shear stress is 80 MPa and 50 MPa
             respectively. Belt tension : 2.5 MPa, Pulley rim tension : 4.5 MPa, Pulley arms
             tension : 15 MPa.

OR

(b)   1. Explain the importance of the ergonomics in design of the mechanism.   **04**
             2. Differentiate self energizing and self locking block brake.   **03**

Q:3 **(a)**   A cantilever beam having an ultimate tensile strength of 500 N/mm^2 is   **07**
             subjected to a completely reversing load of 1.2 kN as shown in following fig.
             The notch sensitivity at the fillet is 0.6. Determine the diameter 'd' for a life of
             8000 cycles. Assume surface factor as 0.8, size factor as 0.9 and the
             calculations are expected at 90% reliability, for which the reliability factor is
             0.897. For $r_F/d = 0.15$,

| D/d	1.02	1.50	3
K_T	1.32	1.50	1.55
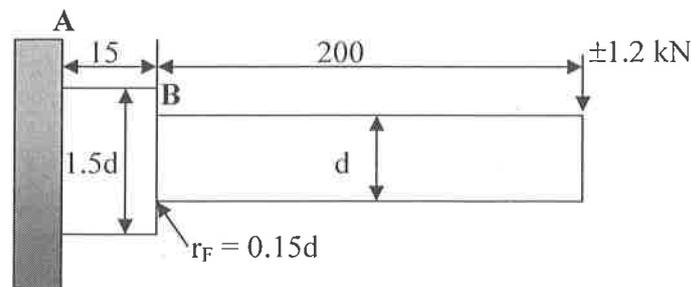
(b) 1. Define :   **03**
      1. Rating life of bearing
      2. Static load carrying capacity of bearing
      3. Dynamic load carrying capacity of bearing
    2. Explain the hydrodynamic lubrication in journal bearing with   **04**
      appropriate figures.

OR

Q:3   Explain (with appropriate graphs) the Soderberg Criterion, Goodman Criterion   **14** and Gerber Criterion to design the machine components under fluctuate loads and infinite life.

Q:4 **(a)** A curved link of the mechanism made from a round steel bar is shown in   **07** following figure. The material of the link is plain carbon steel 30C8 ($S_{yt} = 400$ N/mm^2) and the factor of safety is 3.5. Determine the dimensions of the link.
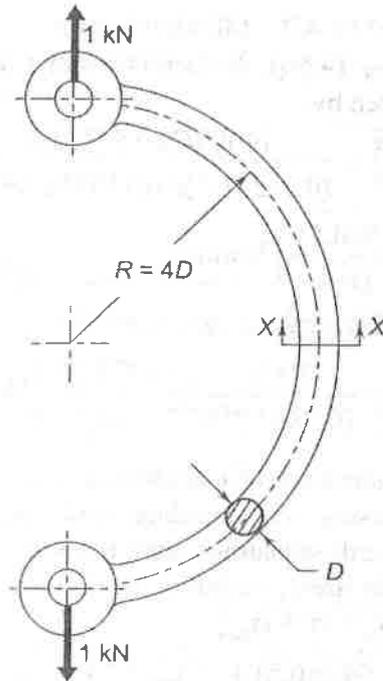
(b) A mine hoist employs 6 X 37 wire rope and has 6 falls of the rope. The   **07** maximum lifting capacity is 25 kN. The maximum velocity of 2 m/s is attained by the hoist trolley within 1.5 seconds. The dead weight accounts for 10 % of the service load. Overall efficiency of mine hoist is 95%. Design the rope for above application using following data:
Breaking load = 470 d^2 N, wire diameter = 0.045d mm, effective area of rope = 0.4 d^2 mm^2, minimum sheave diameter = 25d and factor of safety = 5, E =8 X10^4 MPa. Where, d is diameter of rope in mm.

OR

Q:4 **(a)** A pulley of 0.9 m diameter revolving at 200 rpm is to transmit 7.5 kW. Find   **07** 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 the slack side. Determine the diameter of the shaft and the dimensions of the various parts of the pulley, assuming it to have six arms. Maximum shear stress in shaft is not to exceed 63 MPa.

(b) A 65 mm diameter full journal bearing well lubricated support a load of 5.5 kN   **07** and having bearing length of 65 mm rotates at 800 rpm. Use minimum film

thickness of 0.015 mm and radial clearance of 0.03125 mm of bearing. Determine ; Viscosity of SAE 20 oil, the amount of flow rate, Maximum pressure intensity and power loss in friction.

$\left(\dfrac{l}{d}\right)$	ε	$\left(\dfrac{h_o}{c}\right)$	S	ϕ	$\left(\dfrac{r}{c}\right)f$	$\left(\dfrac{Q}{rcn_sl}\right)$	$\left(\dfrac{Q_s}{Q}\right)$	$\left(\dfrac{p}{p_{max}}\right)$
1	0	1.0	∞	(85)	∞	π	0	–
	0.1	0.9	1.33	79.5	26.4	3.37	0.150	0.540
	0.2	0.8	0.631	74.02	12.8	3.59	0.280	0.529
	0.4	0.6	0.264	63.10	5.79	3.99	0.497	0.484
	0.6	0.4	0.121	50.58	3.22	4.33	0.680	0.415
	0.8	0.2	0.0446	36.24	1.70	4.62	0.842	0.313
	0.9	0.1	0.0188	26.45	1.05	4.74	0.919	0.247
	0.97	0.03	0.00474	15.47	0.514	4.82	0.973	0.152
	1.0	0	0	0	0	0	1.0	0

Q:5 For double shoe brake shown in the following figure, find the maximum **14** intensity of pressure for each shoe and the torque exerted by the brake. Also find the absorbed power at the instant of braking. Assume coefficient of friction as 0.2 and the width of each shoe as 100 mm. the drum rotates in anticlockwise sense at 600 rpm. Determine the dimension 'a', if the frictional moment on the pivoted shoe is to be zero. Find the reactions at pivot.
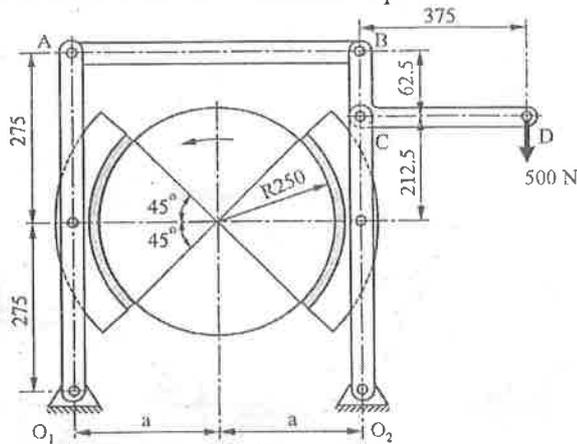
OR

Q:5 (a) A 6010 deep groove ball bearing having dynamic load carrying capacity 16.6 **07** kN, operates on following work cycle

Element No.	Radial load (N)	Spped (rpm)	Element time (%)
1	3000	720	30
2	7000	1440	50
3	5000	900	20

Determine: (a) the average speed of rotation (b) the equivalent radial load and (b) Life of the bearing.

(b) Discuss the design procedure of spur gears. **07**

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