Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER–VIII • EXAMINATION – SUMMER • 2014

Subject Code: 182004 Date: 29-05-2014

Subject Name: Design of Mechanisms - II

Time: 10.30 am - 01.00 pm Total Marks: 70

Instructions:

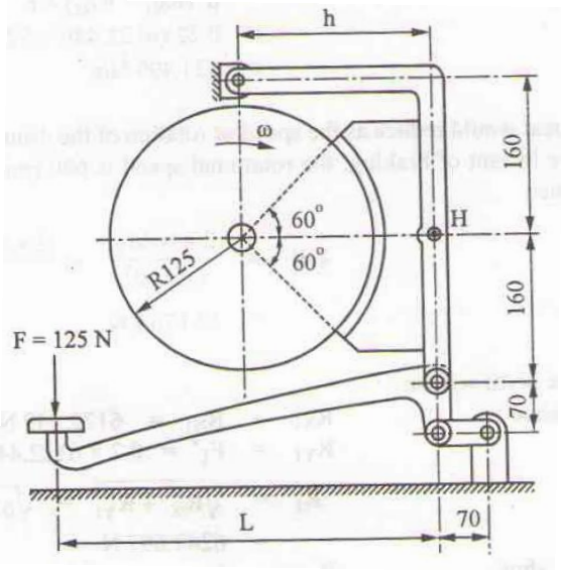
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**a**	Explain ergonomics with consideration of Man machine system.	**04**
	b	Design a crane hook for 30 kN crane. The hook is to be swiveling type of triangular section.	**10**
Q.2	**a**	Explain the stress concentration and methods to reduce the stress concentration.	**07**
	b	Select the suitable size of 6 X 7 steel wire rope to lift a cage of vertical mine hoist 500 m deep. The cage has a mass of 400 kg and it has to lift 1200 kg mass of iron ore at a speed of 120 m/min. the full speed is to be attained in 2 meters. Assume the factor of safety as 7. Take sheave diameter = 60 d mm, E = 8 X 10^4 MPa, mass of rope = 0.35 d^2 kg/100 meter, diameter of wire 0.1d mm, Area of wires in rope = 0.38d^2 mm^2, ultimate strength = 560d^2 N, where, d is the diameter of rope in mm.	**07**
		OR	
Q.2	**b**	1. What is Muff coupling? Give its applicatiobns. What are the advantages and disadvantages of Muff coupling?	**04**
		2. What are the mis alignment between two connecting shaft? What are the advantages and disadvantages of rigid coupling and flexible coupling?	**03**
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_{50} life of bearing?	**03**
	b	A cantilever beam of circular cross section (diameter 25 mm and length 200 mm), has an ultimate tensile strength of 450 MPa and a yield strength of 300 MPa. A load perpendicular to the cross section having a variation of 2F and –F is applied at the free end. Assumed the corrected endurance limit of 140 MPa. If the life of the cantilever beam is to be 10000 cycles at a factor of safety of 2, determine the values of maximum and minimum force.	**07**
		OR	
Q;3	**a**	The following data is given for the full journal bearing: Radial load = 3.2 kN Journal speed = 1490 rpm Journal diameter = 50 mm Bearing length = 50 mm Radial clearance =0.05 mm Viscosity of the lubricant = 25cP Assumed that the total heat generated in the bearing is carried by total oil flow in the bearing, calculate: Coefficient of friction Power lost in friction Minimum oil film thickness Temperature rise	**07**

$\left(\frac{l}{d}\right)$	ε	$\left(\frac{h_o}{c}\right)$	S	ϕ	$\left(\frac{r}{c}\right)f$	$\left(\frac{Q}{rcn_s l}\right)$	$\left(\frac{Q_s}{Q}\right)$	$\left(\frac{p}{p_{max.}}\right)$
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.3 **b** What are the objective of the lubrication? explain the hydrodynamic and hydrostatic lubrication. **07**

Q.4 A single block shoe brake is operated through linkages as shown in the following figure. the shoe is pivoted to the arm at h. the dimension 'h' is so selected to get moment of frictional force about the pivot as zero. assume μ = 0.33. determine the lever length l, if the braking torque of 120 nm is to be obtained. **14**



OR

Q.4 **a** A cast iron pulley of 900 mm diameter is to be used for transmitting 7.5 kw power at 200 rpm to shaft of 35 mm diameter. The ratio of the belt tension is 2:1, while the permissible tension in belt is 20 n per mm width. If the permissible tensile stress for pulley is 15 n/mm^2, design the pulley. **07**

b Calculate the dynamic load carrying capacity of a single deep groove ball bearing with operating cycle listed below, which will have a life of 15 000 hours. **07**

fraction of cycle	type of load	radial (n)	thrust (n)	speed (rpm)	service factor
1/10	heavy shock	2000	1200	400	3.0
1/10	light shock	1500	1000	500	1.5
1/5	moderate shocks	1000	1500	600	2.0
3/5	no shock	1200	2000	800	1.0

Assume radial and axial load factors to be 1.0 and 1.5 respectively and inner race rotates.

Q.5 Following data is given for a steel spur gear transmitting 7.5kw power running at 1440 rpm to a machine running at 480 rpm. Approximate centre distance 0f 240 mm. Allowable bending stress for pinion and gear are 200 mpa and 160 mpa respectively. Surface hardness is 450 bhn. Tooth system is 20° full depths involutes. Design a spur gear drive for above application. **14**

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

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

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

$$C = 11860 \times e$$

$$e = 0.025$$

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

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

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

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

OR

Q.5 A pair of carefully cut mating spur gears has 20° full depth of 4 mm module. The number of teeth on pinion and gears are 38 and 115, respectively. The face width is 40 mm. If the pinion and gear are made of steel with fb static = 233 mpa and surface hardness of 300 bhn. Calculate the safe power that can be transmitted when the pinion is run at 1200 rpm. **14**

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