Total No. of Questions : 10]

SEAT No. : ____

P3254

[Total No. of Pages : 5

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T.E. (Mechanical) (Semester - II)
DESIGN OF MACHINE ELEMENTS - II
(2012 Pattern)

Time :3 hours] ***[Max. Marks :70***

Instructions to the candidates:

1) ***Neat diagram must be drawn wherever necessary.***
2) ***Figures to the right indicate full marks.***
3) ***Use of logarithmic tables slide rule. Mollier charts, electronic pocket calculator and steam tables is allowed.***
4) ***Assume suitable data if necessary.***
5) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.***

Q1) a) What are the desirable properties of gear materials? State the suitable materials for various working conditions. **[4]**

b) A pair of spur gears with 20° pressure angle consists of 25 teeth pinion meshing with a 60 teeth gear. The module is 5 mm, while the facewidth is 45mm. The pinion rotates at 500 rpm. The gears are made of steel and neat treated to a surface hardness of 220 BHN. Assume that dynamic load is accounted by means of velocity factor. The service factor & factor of safety are 1.75 & 2 respectively. calculate:

i) Wear strength of gears.

ii) The static load the gears can transmit without pitting; and

iii) Rated power that can be trasmitted by gears.

$$y = 0.484 - \frac{2.87}{2}, k = 0.16\ [\text{BHN}/100]^2$$ **[6]**

OR

Q2) a) Explain the following. **[4]**

i) Herringbone helical gear

ii) Double helical gear

iii) Crossed helical gear

iv) Applications of crossed helical gear

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b) A pair of parallel helical gears consist of a 35 teeth pinion meshing with a 70 teeth gear. Power transmitted is 20kw at 720 rpm. Normal module is 5mm & facewidth is 50mm.The centre distance is 285mm. Normal pressure angle is 20°. The ultimate tensile strength of gear material is 600N/mm^2 & hardness is 300BHN. Service factor is 1.25. & the factor of safety is 2.

Calculate:

i) The helix angle;

ii) The beam strength;

iii) Wear strength

iv) Effective load, $\gamma = 0.484 - 2.87/2'$,& $CV = \frac{5.6}{5.6 + \sqrt{V}}$ **[6]**

Q3) a) A ball bearing subjected to a radial load of 3000N is expected to have a satisfactory life of 10000 hrs at 720 rpm with a reliability of 95%. Calculate the dynamic load carrying capacity of the bearing, so that it can be selected from a manufacturers catalog based on 90% reliability if there are four such bearings each with a reliability of 95% in a system, what is the reliability of complete system. **[6]**

b) Explain following types of bevel gears

i) Miter gear;

ii) Crown gear;

iii) Skew bevel gear

iv) Hypoid gear **[4]**

OR

Q4) a) Write a note on mounting of bearings with neat sketches. **[4]**

b) Derive the expression for beam strength of bevel gears. **[6]**

Q5) a) What are single - enveloping and double - enveloping worm gear drives? What are the applications of these gears. **[4]**

b) A pair of worm gears is designated as 2/54/10/5

Calculate:

i) The centre distance

ii) The speed reduction

iii) The dimensions of the worm and,

iv) The dimensions of the worm wheel **[8]**

c) How materials are selected for worm gearing? State the possible materials. **[4]**

OR

Q6) a) A pair of worm & worm wheel is designated as 1/30/10/10.The input speed of the worm is 1200 rpm. The worm wheel is made of centifugally cast phorsphor bronze and the worm is made of case - hardened carbon steel 14C6. Determine the power transmitting capacity based on the beam strength and also on wear strength. Use enpressions for beam & wear strength as per

1443 - 1974. Use following data.

Sb_1 = 28.2 for Case - hardened steel,

Sb_2 = 7.0 for phosphot - bronze

Xb_1 = 0.25 for 1200 rpm

Xb_2 = 0.48 for 40 rpm

Yz = 1.143

Sc_1 = 4.93 for case - hardened steel

Sc_2 = 1.55 for phosphor - bronze

Xc_1 = 0.112

Xc_2 = 0.26 **[12]**

b) Explain the force analysis in worm geaning. **[4]**

Q7) a) It is required to select a flat belt drive to connect two transmission shafts rotating at 800 and 400 rpm respectively. The centre distance between shafts is 3m and the helt drive is open - type. The power transmitted by the belt is 30KW and load correction factor is 1.3 The belt should operate at a velocity between 17.8 to 22.9 m/s. The power transmitting capacity of the belt per mm width per ply at 180° arc of contact and at a belt velocity of 5.08 m/s is 0.0 147 KW. Select preferred pully dimensions & specify the belt (i - e length, width, no of plies etc). Arc of contact factor = 1.08. **[12]**

b) Write a short note on polygonal effect in chain drives. **[4]**

OR

Q8) a) Explain the following with neat sketches.

i) Lay of wire ropes.

ii) Stresses developed in wire ropes. **[4]**

b) The following data is given for an open - type V - belt drive.

diameter of driving pulley = 200mm

diameter of driven pulley = 600 mm

groove angle for sheaves = 34°

mass of belt = 0.5kg/m

man. permissible tension in belt = 500N

co-efficient of friction = 0.2

contact angle for smallet pulley = 157°

speed of smaller pulley = 1440 rpm

power to be transmitted = 10 KW.

How many V - belts should be used, assuming each belt takes its proportional part of the load. **[12]**

Q9) a) Explain how pressure development takes place in hydrodynamic bearing with the help of neat sketches. Write basic Reynolds equation. **[6]**

b) A hardened and ground journal, 50 mm in diameter rotates at 1440 rpm in a lathe turned bronze bushing which is 50 mm long.

The data of machining as follows:

Part	Machining method	Surface roushess (c/a)
Shaft	grinding	0.8 μm
Bearing	turning/ boaring	1.6 μm

The minimum oil film thickness is 5 times the sum of surface roughness (c/a) values. The class of fit is H8 d8 and the viscosity of the lubricant is 18cp. Petermine the maximum radial load that the journal can carry & still operate under hydrodynamic conditions. Use following data:

limits of tolerances for H8 : 0.00 to + 38 μm

d8 : –80 μm to – 119 μm

[12]

OR

Q10)a) Derive the expression of temperature rise in a hydrodynamic bearing.**[6]**

b) The following data is given for 360° hydrodynamic bearing:

radial load = 5KN
journal diameter = 50mm
bearing length = 50mm
viscosity of oil = 20 mpas

Specify the radial clearance that need to be provided So that when journal is rotating at 2880 rpm, the minimum oil film thickness is 30 μm. Evaluate corresponding co-efficient of friction & total oil flow. (Refer table 1 for data)

[12]

Table - 1

$\left(\frac{1}{d}\right)$	E	$\left(\frac{ho}{c}\right)$	S	ϕ	$\left(\frac{r}{c}\right)f$	$\left(\frac{Q}{rcn_s l}\right)$	$\left(\frac{Q_s}{Q}\right)$	$\left(\frac{P}{P_{max}}\right)$
∞	0	1.0	∞	(70.92)	∞	π	0	–
	0.1	0.9	0.240	69.10	4.80	3.03	0	0.826
	0.2	0.8	0.123	67.26	2.57	2.83	0	0.814
	0.4	0.6	0.0626	61.94	1.52	2.26	0	0.764
	0.6	0.4	0.0389	54.31	1.20	1.56	0	0.667
	0.8	0.2	0.021	42.22	0.961	0.760	0	0.495
	0.9	0.1	0.0115	31.62	0.756	0.411	0	0.358
	0.97	0.03	–	–	–	–	0	–
	1.0	0	0	0	0	0	0	0
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	0280	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