SV-90

Total No. of Pages : 5

Seat No.	

T.E. (Mechanical) (Semester - VI) (Revised) Examination, May - 2018
MACHINE DESIGN - II
Sub. Code :66840

Day and Date : Saturday, 12- 5 - 2018

Time :2.30 p.m. to 5.30 p.m.

Total Marks : 100

Instructions :

1) Figures to the right indicate full marks.
2) Assume suitable data wherever necessary.
3) Use of Non - programmable calculator is allowed.

Q1) a) Draw Soderberg and Goodman fatigue diagram. Explain its significance. [8]

OR

a) Describe the process of fatigue design under combined stresses. [8]

b) A machine shaft carries a pulley between two bearings. The bending moment at the pulley varies from 200 N-m to 600 N-m and the torsional moment in the shaft varies from 70 N-m to 200 N-m. The frequencies of variation of bending and torsional moments are equal to the shaft speed. The shaft is made of steel FeE 400 (Sut = 540 N/mm^2 and Syt = 400 N/mm^2) and the corrected endurance strength of shaft is 200 N/mm^2. Determine the diameter of the shaft using factor of safety of 2. [10]

Q2) a) Explain 'Stiffening factor' in design of plastics. What are various ways of stiffening in plastics? [6]

OR

a) Explain significance of DFM and its effect on design quality. [6]

b) A single row deep groove ball bearing No. 6002 is subjected to an axial thrust of 1000 N and a radial load of 2200 N. Find the expected life that 50% of the bearings will complete under this condition. Use Table 1 for data. [10]

P.T.O.

Principal Dimensions (mm			Basic Load Ratings (N)		Designation
d	D	B	C	Co	
10	19	5	1480	630	61800
	26	8	4620	1960	6000
	30	9	5070	2240	6200
	35	11	8060	3750	6300
15	24	5	1560	815	61802
	32	9	5590	2500	6002
	35	11	7800	3550	6202
	42	13	11400	5400	6302
20	32	7	2700	1500	61804
	42	8	7020	3400	16404
	42	12	9360	4500	6004
	47	14	12700	6200	6204

Table 1 : Parameters for Single - row deep groove ball bearings.

$\left(\frac{F_a}{C_0}\right)$	$\left(\frac{F_a}{F_r}\right) \leq e$		$\left(\frac{F_a}{F_r}\right) > e$		e
	X	Y	X	Y	
0.025	1	0	0.56	2.0	0.22
0.040	1	0	0.56	1.8	0.24
0.070	1	0	0.56	1.6	0.27
0.130	1	0	0.56	1.4	0.31
0.250	1	0	0.56	1.2	0.37
0.500	1	0	0.56	1.0	0.44

Table 2: X and Y factors

Q3) a) Derive Striback's Equations. [8]

OR

a) What are the various Tribological considerations used in design of bearings. [8]

b) A following data is given for a 360° hydrodynamic bearing. [8]

Journal diameter = 100 mm

Bearing length = 100 mm

Radial load = 50 KN

Journal speed = 1440 rpm

Radial clearance = 0.12 mm

Viscosity of lubricant = 16Cp.

Calculate:

i) Minimum oil film thickness

ii) Coefficient of friction

iii) Power lost in friction

Refer following data Table:

l/d	ε	h_o/C	S	ϕ	(r/C)f	$Q/(rCn_sl)$
	0.4	0.6	0.264	63.10	5.79	3.99
	0.6	0.4	0.121	50.58	3.22	4.33
1	0.8	0.2	0.0446	36.24	1.70	4.62
	0.9	0.1	0.0188	26.45	1.05	4.74
	0.97	0.03	0.0047	15.47	0.514	4.82

Q4) a) Explain the term static and dynamic loads on gear tooth. Describe various parameters which contribute dynamic load. [7]

OR

b) Explain the different methods of gear lubrication system. **[7]**

c) Design a pair of spur gears with 20° full depth involute teeth consist of 17 teeth pinion meshing with 68 teeth gear. The module and face width are 2.5 and 25 mm respectively. The gears are machined to meet the specification of grade 10 and heat treated to surface hardness of 250 BHN. For grade 10, $e = 32 + 2.5\,(m + 0.25\sqrt{d})$ in μm. Use M.F.Spotts approach for the dynamic load. Determine: **[11]**

i) The optimum speed for maximum power transmitting capacity.

ii) The optimum power transmitted by the gears at the above speed.

Q5) a) A pair of parallel helical gears consists of a 20 teeth pinion meshing with a 100 teeth gear. The pinion rotates at 720 rpm. The normal pressure angle is 20° and the helix angle is 25°. The normal module is 4 mm and the face width is 40 mm. The pinion and the gear is made of steel 40C8 ($S_{ut} = 600 N/mm^2$) and heat treated to a surface hardness of 300 BHN. The service factor and factor of safety are 1.5 and 2 respectively. Assume that the velocity factor accounts for the dynamic load and calculate the power transmitting capacity of gears. Use Y for 26 teeth = 0.344 and Y for 27 teeth = 0.348. **[10]**

OR

b) A pair of straight tooth bevel gears has a velocity ratio 2:1 The pitch circle diameter of the pinion is 80 mm at large end of the tooth. 5 KW power is supplied to the pinion, which rotates at 800 rpm. The face width is 40 mm and the pressure angle is 20°. Determine the tangential, radial and axial components of resultant tooth force acting on the pinion. **[10]**

c) Explain with the help of neat sketch force analysis of helical gear. **[6]**

Q6) a) Explain with neat sketch the following terms in reference to bevel gears. **[8]**

i) Pitch cone

ii) Pitch angles for pinion and gear

iii) Cone distance

iv) Cone distance

OR

b) Discuss the thermal consideration in the design of worm and worm wheel drive. **[8]**

c) A pair of worm gear is designated as 1/40/10/4 has an effective surface area of 0.25 m^2. A fan is mounted on the worm shaft to circulate air over the surface of the fins. The coefficient of heat transfer can be taken as 25 $W/m^2 {}^\circ C$. The permissible temperature rise of the lubricating oil above the atmospheric temperature is 45°C. The coefficient of friction is 0.035. The worm shaft is rotating at 1440 rpm and the normal pressure angle is 20°. Calculate the power transmitting capacity based on thermal considerations. **[8]**

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