24355

B.Tech. 6th Semester (Mechanical Engineering)

Examination, May–2013

MECHANICAL MACHINE DESIGN–II

Paper–ME–304–F

Time allowed : 4 hours] *[Maximum marks : 100*

***Question 1 is compulsory** and attempt any **one** question from each section.*

***Note :** Use of PSG Design Data Book and Design Data Handbook for Mechanical Engineers by Mahadevan is permitted.*

1. (i) Explain the role of processing in design. 5

(ii) What is surging phenomenon in springs ? 5

(iii) What are static and dynamic load carrying capacities ? 5

(iv) How will you select material for gears, explain ? 5

Section–A

2. (i) What is ergonomics ? Discuss its scope in Machine Design. 6

(ii) A forged steel bar, 50 mm in diameter, is subjected to a reversed bending stress of 250 N/mm^2. The bar is made of steel 40C8 (S_{ut} = 600 N/mm^2). Calculate the life of the bar for a reliability of 90%. 8

(iii) Describe stress concentration factor. 6

3. (i) Explain various types of fluctuating stresses. 6

(ii) What is Fatigue Failure, endurance limit, Notch Sensitivity ? 6

(iii) Neglecting the effect of stress concentration, determine the diameter of a transmission shaft of cold steel 27 Mn 2 [(S_{ut} = 500 N/mm^2) and (S_{yt} = 300 N/mm^2)] which is subjected to a fluctuating torque which varies from – 100 N-mm to + 400 N-m. The factor of safety is 2 and the expected reliability is 90%. Assume the distortion energy theory of failure. 8

Section–B

4. (i) Explain the following for a shaft :

(a) Torsional Rigidity

(b) Flexural Rigidity

(c) Equivalent Bending Moment

(d) Equivalent Twisting Moment. 2×4=8

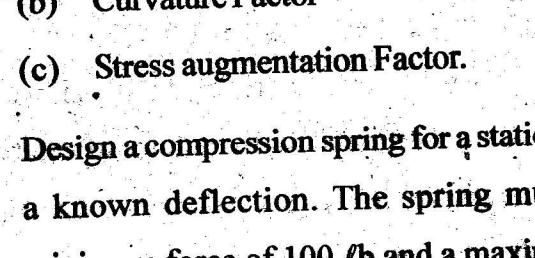
(ii) Explain how a ball bearing is located on a shaft. 2

(iii) A 16 hp motor generator runs at 3000 rpm. Determine the diameter of the shaft if it is made of steel FeE 400. Take a factor of safety of 2. It is necessary to provide a shoulder with fillet radius (r), to locate the supporting bearing at the ends, axially, The stress concentration factor to fillet can be

$$SCF = 1 + \frac{\left(r/d\right)^{-0.3\sigma - 0.2\left(D/d\right)}}{13 + 0.03\left(\frac{D}{d} - 1\right)}$$

Where, D = Shaft diameter, d = shaft diameter at fillet rigfillet radius = 3 mm.

Consider the following idagram :



10

5. (i) Explain the following in case of springs :

(a) Wahl's Factor

(b) Curvature Factor

(c) Stress augmentation Factor. 2×3=6

(ii) Design a compression spring for a static load over a known deflection. The spring must give a minimum force of 100 ℓb and a maximum force of 150 ℓb over an adjustment range of 0.75-in deflection. 10

(iii) Describe the phenomenon of buckling of a helical spring. 4

Section–C

6. (i) What is bearing construction ? Explain types of bearing constructions. 6

(ii) Explain the term viscosity. What is the effect of temperature rise on viscosity ? 4

(iii) Following data is given for a 360° hydrodynamic bearing :

radial load = 6.5 kN Journal speed = 1200 rpm

Journal dia = 60 mm bearing length = 60 mm

minimum oil film thickness = 0.009 m

The class of fit is H7e7 (fine) normal running fit.

Specify the viscosity of the lubricating oil that you will recommend for this application. 10

7. (i) Discuss different types of lubrication in detail. 6

(ii) Discuss the selection criteria of a suitable lubricant. 4

(iii) The following data is given for a full hydrodynamic bearing :

Radial Load = 22 kN, Journal speed = 960 rpm,

unit pressure in bearing = 2.4 MPa,

viscosity of lubricant = 20 cp

Also,

$$\frac{\ell}{d} = 1:1, \quad \frac{h_0}{c} = 0.2 = \frac{\text{Minimum oil thickness}}{\text{Radial clearance}}$$

Determine

(a) Dimensions of the bearing

(b) Minimum film thickness

(c) Requirements of oil flow. 10

Section–D

8. (i) Describe the terminology of Bevel gear. 8

(ii) What is the difference between velocity factor for a bevel gear teeth cut on milling machine and bevel gear teeth generated on a machine ? 4

(iii) A pair of straight bevel gears consists of 30 teeth meshing with a 45 teeth gear. Module and face widths are 6 mm and 50 mm, respectively. Calculate the following :

(a) Cone-pitch angles for pinion and gear

(b) Cone distance, R

(c) Face-cone angle, pinion

(d) Root-cone angle, pinion.

9. (i) What are the various basic dimensions of a worm gears having an involute helicoidal tooth form ? 10

(ii) A pair of worm and worm wheel is designated by 2/60/10/5. Worm is transmitting a power of 6 kW at 1440 rpm. Coefficient of friction between worm thread and wheel teeth is 0.8. If the normal pressure angle is 20°. Determine the components of gear tooth forces on the worm and gear wheel. 10