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6E3049

B. Tech VI Semester (Main/Back) Examination, May/June-2011

Mechanical Engineering (Common for Mech., P & I)

6ME1 Design of M/c Elements - II

Time : 3 Hours **Maximum Marks : 80**

Min. Passing Marks : 24

Instructions to Candidates:

*Attempt any **five** questions, selecting **one** question from **each** unit. All questions carry equal marks. (Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.)*

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. Design Data Handbook.

Unit - I

a) Explain stress concentration, its causes and how it can be mitigated. **(6)**

b) Determine the diameter of a circular rod made of ductile material with a fatigue strength (complete stress reversal) $\sigma_e = 280$ MPa and a tensile yield strength of 350 MPa. The member is subjected to a varying axial load from 700 kN to - 300 kN. Assume $K_t = 1.8$, F.S = 2. **(10)**

OR

a) Write soderberg's equation and state its application to different type of loadings. **(6)**

b) Determine the thickness of a 130 mm wide uniform plate for safe continuous operation if the plate is to be subjected to a tensile load that has a maximum value of 240 kN and a minimum value of 100 kN. The properties of the plate material are as follows :

Endurance limit stress = 225 MPa, yield point stress = 300 MPa. The factor of safety based on yield point stress = 1.5. **(10)**

Unit - IV

4. a) Explain the phenomenon of interference in involute gears. What are the conditions to be satisfied in order to avoid interference? (6)

b) A pair of spur gears transmitting power from a motor to a pump impeller shaft is to be designed with as small a centre distance as possible. The forged steel pinion ($S_o = 160$ MN/m^2) is to transmit 4kW at 600 rev/min to a cas steel gear ($S_o = 100$MN/m^2) with a transmission ratio of 4½ to 1 and 20° full depth involute teeth are to be used. Determine the necessary face width and module for strength only using the Lewis equation. (10)

OR

a) Discuss with neat sketches, the various types of worms and worm gears. (6)

b) A pair of precision cut helical steel gears on parallel shafts with a centre distance of 380mm transmits power with a velocity ratio of 4 to 1. The pinion rotates at 10,000 rev/min. Both gears are made from the same material, having $S_o = 100\,MN/m^2$. The teeth are 20° stub, with a 45° helix angle. The face width is 20mm, and the module is 1. Determine the maximum power that can be transmitted safely, considering wear and strength. Both gears have a brinells hardness of 400. (10)

Unit - V

5. a) Explain wedge film and squeeze film journal bearings. (6)

b) A water lubricated 100mm diameter by 100mm long full bearing supports a load of 1300N. The shaft rotates at 1000 rev/min. The diameter clearance is 0.1mm and the water has viscosity 0.0003kg/ms. Assume c = 4200 Nm/kg°C and p = 1000 kg/m^3. Using Raimondi and Boyal curves, determine the coefficient of friction, the minimum film thickness, the flow of lubricant into bearing, the end leakage of lubricant the temperature rise of oil and the power loss due to friction. (10)

OR

a) Write short note on classifications and different types of antifriction bearings. (6)

b) A single row deep groove ball bearing has a specific dynamic capacity of 46.3 kN (for 1,000,000 revolutions or 500 hours at 33.3 rev/min, that 90% of a group of bearings will complete or exceed).

i) If the speed of rotation is 1800 rev/min and the actual radial load applied to the bearing is 9 kN. What is the life in revolutions?

ii) How many hours of operation can be expected for the above?

iii) What is the average life that can be expected? (10)

Unit - II

2. a) Discuss the significance of the initial tightening load and the applied load so far as bolts are concerned. Explain which of the above loads must be greater for a property designed bolted joint and how each affects the total load on the bolt. **(6)**

b) A steam engine cylinder of size 300mm×400mm operates at 1.5N/mm^2 pressure. The cylinder head is connected by means of 8 bolts having yield point stress of 350 MPa and endurance limit of 240 MPa. The bolts are tightened with an initial pre load of 1.8 times the steam load. The joint is made leak proof by using soft copper gasket which renders the effect of external load to be half. Determine the size of bolts, if factor of safety is 2 and stress concentration factor is 3. **(10)**

OR

Design a screw jack for lifting a load of 50kN through a height of 0.25m. The screw is made of steel for which Rankine's constants are 330N/mm^2 and $\frac{1}{7500}$ for column pin jointed at both ends. Use a factor of safety of 4. The nut is made of gunmetal for which $f_s = 25N/mm^2$. Bearing pressure on the threads is limited to 10N/mm^2. The nut is fixed in C.I. housing and the screw is turned in the nut by using a tommy bar inserted in suitable holes in the head of the screw. The coefficient of friction of the threads and collar may be taken as 0.12. **(16)**

Unit - III

3. a) Discuss the materials and practical applications for the various types of springs. **(6)**

b) A semi-elliptical laminated spring is to carry a load of 3000N and consists of seven leaves 60 mm wide, two of the leaves extending the full length of the spring. The spring is to be 1.1m in length and is to be attached to the axle by two U bolts 75m apart. The leaves are to be made of silica manganese steel. Assuming an allowable stress of 350N/mm^2, determine the thickness for the leaves and the deflection. **(10)**

OR

a) Under what circumstances a fibre rope and a wire rope is used? What are the advantages of a wire rope over fibre rope? **(6)**

b) A V-bolt having a lap of 180 degrees has a cross sectional area of 2.5 sq. cm and runs in a groove of included angle $2\alpha = 45$ degrees. The density of the belt is 0.0005 kg per cu. cm and the maximum stress is limited to 40 kg per sq. cm, coefficient of friction being 0.15. Find the maximum power that can be transmitted if the wheel has a mean diameter of 30 cm and runs at 1000 rpm. **(10)**