Total No. of Questions : 10] *[Total No. of Printed Pages :6*

Roll No .....

AU/ME - 504

B.E. V Semester

Examination, December 2012

Machine Component Design

Time : Three Hours

Maximum Marks : 70/100

Note : *1. Attempt five questions in all selecting one question from each unit.*
2. All questions carry equal marks.
3. PSG design data / Mahadevan & Reddy's design data books are permitted to use.

Unit - I

1. a) Explain the term stress concentration. Write down the various methods of mitigation of stress concentration. 8

   b) A circular bar of 500mm length is supported freely at its two ends. It is acted upon by a central concentrated cyclic load having a minimum value of 20 kN and a maximum value of 50 kN. Determine the diameter of bar by taking a factor of safety of 1.5, size effect of 0.85, surface finish factor of 0.9. The material properties of bar are given by: ultimate strength of 650 MPa yield strength of 500 MPa and endurance strength of 350 MPa. 12

OR

2. a) Explain the applications of Soderbergs equation under axial loading, simple bending & torsion. 6

   b) The working cycle of a Mechival component subjected to reversed bending is as follows:

      i) $\pm$ 300 N/mm^2 for 75% of time.

      ii) $\pm$ 400 N/mm^2 for 15% of time.

      iii) $\pm$ 500 N/mm^2 for 10% of time.

      The material for the component is 50C4(σ_u = 660MPa) & the corrected endurance strength of the component is 280 N/mm^2. Determine the life of the component. 14

Unit - II

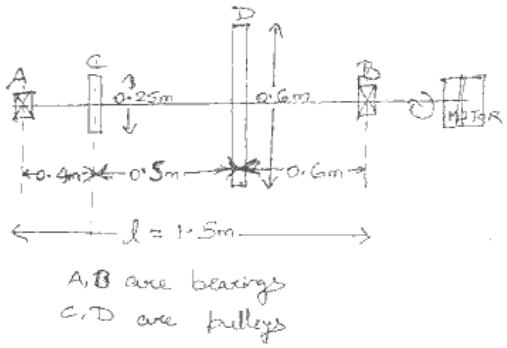
3. a) What is the function of coupling? Name various types of couplings. 6

   b) A marine engine shaft and coupling are to be designed for flange coupling to transmit 2900 kW at a speed of 100 r.p.m. Flanges are connected by 8 toper belts having a bermissible shear stress of 60 MPa. The material of the shaft & bolts used is same. Design the coupling completely. 14

OR

4. a) Explain the theories used for designing shaft subjected to combined bending & twisting moments. 6

   b) A countershaft receives 26.25 kW from a motor though a coupling and transmits it via two belts drives to two machine tools each consuming 11.25 kW. The diameter of pulleys are 0.25m and 0.6m and their corresponding weights are 400N and 750N. Shaft speed is 30 rod/sec. Both the belt drives are arranged horizontally. Find the diameter of the shaft. 14



Unit - III

5. a) Explain fatigue loading of helical springs. 6

   b) Design a semi-elliptical laminated spring 1.05m between centres of hooks held together at the centre by a 6.25cm wide band and carrying a total load of 5400 N. Take the permissible stress for the spring material as 490 MPa. Calculate the number of leaves, width and thickness of leaves if the deflection is not to exceed 7.5 cm, when-

   i) Leaves are unstressed initially and

   ii) Leaves are stressed initially.

   Two of the leaves must be of full length. 14

OR

6. a) Explain overhauling and self locking screw. 6

   b) The cutter of a broaching machine is pilled by square threaded screw of 55mm external diameter and 10mm pitch. The operating nut takes the axial load of 400 N on a flat surface of 50mm & 80mm internal & external diameters respectively. If the coefficient of friction is 0.15 for all contact surfaces on the nut, determine the

power required to rotate the operating nut when the cutting speed is 6m/min. Also find the efficiency of the screw. 14

Unit - IV

7. a) Explain the function of clutches in power transmission. List various type of clutches. 6

   b) A plate clutch has three discs on the driving shaft and two discs on the driven shaft, providing four pairs of contact surfaces. The outside diameter of the contact surfaces is 250mm and inside diameter 125mm. Find the total spring load pressing the plates together to transmit 30kW at 1500 r.p.m. take $\mu = 0.25$.

   If there are 6 springs each of stiffness 13 kN/m and each of the contact surfaces has worn away by 1.25mm, find the maximum power that can be transmitted, assuming uniform wear. 14

OR

8. a) Derive the expression for ratio of tensions in belt of a Band & block brake. 6

   b) An automotive internal-expanding shoe brake is shown in figure [see add. overleaf]. The face width of the friction lining is 50mm and the coefficient of friction is 0.4. The maximum intensity of pressure on the lining is 0.8 N/mm^2.

   The angle θ_1 may be assumed to be zero. Calculate-

   i) The actuating force.

   ii) The torque capacity of the brake. 14

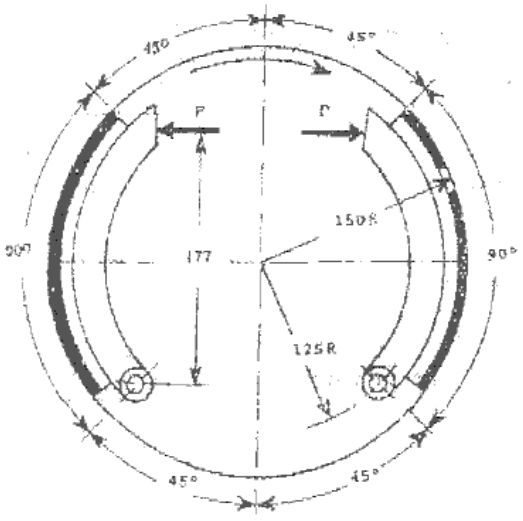


Figure for Question no. 8(b)

Unit - V

9. a) Discuss the following: 10

   i) Hydrodynamic lubrication.

   ii) Reynolds equation for bearings lubrication.

   b) The following data is given for a 360^0 hydrodynamic bearing.

   Radial load = 3.2 kN, Journal speed = 1490 r.p.m.

   Journal diameter 50mm. bearing length = 50mm.

   radial clearance = 0.05mm. viscosity = 25 centipoise.

   Calculate the power test in friction. 10

OR

10. a) Write short note on Reliability of roller bearings. 6

b) A ball bearing subjected to a radial load of 5 kN is expected to have a life of 8000 hours at 1450 r.p.m with a reliability of 99%. Calculate the dynamic load capacity of the bearing so that it can be selected from the manufacturers based on a reliability of 90%. 14

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