Code No. 6101

FACULTY OF ENGINEERING

B.E. 3/4 (M/P/AE) I – Semester (Main) Examination, November 2013

Subject : Design of Machine Elements

Time : 3 hours **Max. Marks : 75**

Note: Answer all questions from Part-A. Answer any FIVE questions from Part-B.

PART – A (10 x 2.5 = 25 Marks)

1. List the various types of materials used in machine design.
2. What are preferred numbers? Explain their importance in design.
3. Define the terms stress concentration factor and notch sensitivity.
4. What is Miner's rule?
5. Mention the applications and hallow and splined shafts.
6. Distinguish between split muff and flange coupling.
7. Mention the applications of cotter and knuckle joints.
8. Briefly describe bolts of uniform strength.
9. Distinguish between differential and compound screw.
10. Compare rivelted joints with welded joints.

PART – B (50 Marks)

11. At a critical sections in a shaft, the following stresses are induced.

    Bending stress = 60 MPa torsional shear stress = 40 MPa

    Determine the factor of safety, according to i) Max. normed stress theory ii) Maximum normal stress theory, and iii) Maximum principal strain theory. The proportional limit is a simple tension list is found to be 300 MPa. Take Poisson's ratio as 0.3. 10

12. A rod of circular cross section is subjected to an alternating tensile force, varying from 20 kN to 70 kN. Determine the diameter of the rods according to i) Gerber method ii) Goodman method and iii) Soderberg method ; using the following material properties ;

    Ultimate tensile strength = 1000 MPa
    Yield strength = 550 MPa

    Take factor of safety as 2. Neglect stress concentration effect and other corrections factors. 10

..2

Estelar

13. An overhung shaft carries a 1m diameter pulley, whose centre is 250mm from the centre of the nearest bearing. The weight of the pulley is 600 N and the angle of lap of the belt may be assumed as 180^0. The pulley is driven by a motor, placed below it, at an angle of 45^0. If the permissible tension in the belt is 2500N and coefficient of friction is 0.3 ; determine the size of the shaft. Assume the permissible shear stress in the shaft materials as 50 MPa. Take shock and fatigue factors for torsion and bending as 2 and 1.5 respectively. State the position of the motor so that the size of the shaft required is the least, and also determine its size. 10

14. Design a knuckle joint to withstand a load of 100 kN. All the parts of the joint are made of the same material with $\sigma_{ut} = \sigma_{uc} = 480$ MPa and $\tau_u = 360$ MPa. Use factor of safety of 6 on ultimate strength. Where σ_{ut} and σ_{uc} are ultimate tensile and compression strengths and τ_u is ultimate shear strength. 10

15. Design a triple riveted lap joint to join two plates of 6 mm thick. The permissible stresses are : $\sigma_t = 80$ MPa, $\sigma_c = 100$ MPa and $\tau = 60$ MPa. Calculate the rivet diameter, rivet petels, and distance between the rows of rivets. Use zig-zag riverting state how the joint will fail. 10

16.a) A shaft and key are made of the same material, and the key width is 1/3 rd of the shaft diameter. i) Considering shear only, determine the minimum length of the key in terms of the shaft diameter ii) Determine the thickness of the key, to make the key equally strong in shear and crushing; taking the shear strength of the key material as 40% of its crushing strength. 5

b) Design a clamp coupling to transmit 30 kW at 120 rpm. The shaft and the key are made of mild steel for which, permissible shear stress is 40 MPa. The two halves are connected by four bolts, and the permissible tensile stress in bolts is 70 MPa. The coefficient of friction between the sleeve and shaft surface may be taken as 0.3. 5

17. Write short notes on the following : 10
    a) Maximum principal and shear stress theory
    b) S-N diagram
    c) Design of gasket joints

*****

Eslelar