B.E./B.Tech SEMESTER ARREAR EXAMINATIONS, APRIL/MAY 2012

47

MECHANICAL ENGINEERING

5TH SEMESTER – (R-2004)

ME 374 – DESIGN OF MACHINE ELEMENTS

Time : 3 Hrs Max.marks: 100

Answer all Questions

PART – A (10 x 2 = 20)

1. Enlist the various phases of a design process
2. Define isotropy and resilience
3. What is known as flexible shaft
4. Differentiate clutch and coupling
5. State the advantages of pre loading of bolts
6. Name any two tests which are carried out to check the strength of the bonded joints.
7. Why camber is provided in leaf springs?
8. State the advantages of helical springs over other springs
9. Draw a neat sketch of rolling contact bearing and sliding contact bearing with labelling.
10. What are the types of crank shafts

PART – B (5 x 16 = 80)

11. A welded connection, as shown in fig 11, is subjected to an eccentric force of 7.5 kN. Determine the size of the welds if the permissible shear stress for the welds is 100 N/mm^2. Assume static conditions. (16 marks)

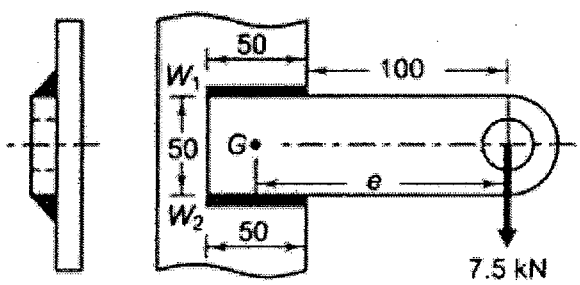

FIG 11

12. (a) A central horizontal section of a hook is a symmetrical trapezium 60 mm deep, the inner width being 60 mm and the outer width being 30 mm. Estimate the extreme intensities of stress when the hook carries a load of 20 kN. The load line passes at 40 mm from the inside edge of the section and the centre of curvature lies in the load line

(OR)

12. (b) A machine element is subjected to the following stresses σ_x= 60 MPa, σ_y= 45 MPa and τ_{xy}= 30 MPa. Find the factor of safety if it is made of C45 steel having yield stress as 353 MPa, using the following theories of failure. (i) Max. Principal stress theory (ii) Max. shear stress theory (iii) Strain energy theory and (iv) Max. strain theory taking poison's ratio as 0.3.

13. (a) The layout of a transmission shaft carrying two pulleys B and C and supported on bearings A and D is shown in fig 13(a). Power is supplied to the shaft by means of a vertical belt on the pulley B, which is then transmitted to the pulley C carrying a horizontal belt. The maximum tension in the belt on the pulley B is 2.5 kN. The angle of wrap for both the pulleys is 180° and the co efficient of friction is 0.24. The shaft is made of plain carbon steel 30C8 (S_{yt} = 400 N/mm^2) and the factor of safety is 3. Determine the shaft diameter on strength basis.

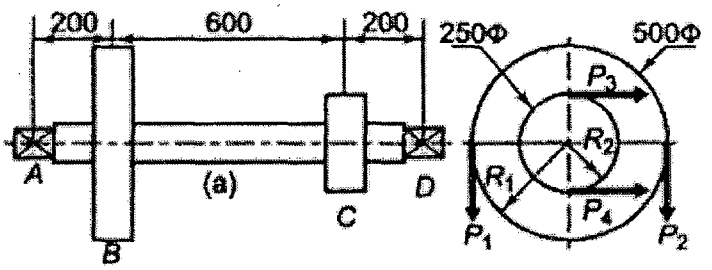

FIG 13(a)

(OR)

13. (b) Design a muff coupling to connect two steel shafts transmitting 25 kW power at 360 rpm. The shafts and key are made of plain carbon steel 30C8 (S_{yt} = S_{yc} = 400 N/mm^2). The sleeve is made of grey cast iron FG 200(S_{ut}=200 N/mm^2). The factor of safety for the shafts and key is 4. For the sleeve, the factor of safety is 6 based on ultimate strength.

14. (a) A semi elliptic leaf spring used for automobile suspension consists of three extra full length leaves and 15 graduated length leaves, including the master leaf. The centre to centre distance between two eyes of the springs is 1m. The maximum force that can act on the spring is 75 kN and E=207000 N/mm^2. For each leaf, the ratio of width to thickness is 9:1.The leaves are pre stressed in such a way that when the force is maximum, the stresses induced in all leaves are 450 N/mm^2. Determine dimensions, initial nip and initial pre load required to close the gap.

(OR)

14. (b) One helical spring is nested inside another; The dimensions are as tabulated. Both springs have the same free length and carry a total maximum load of 2500 N.

	Outer Spring	Inner Spring
Number of active coils	6	10
Wire diameter, mm	12.5	9.00
Mean coil diameter, mm	100	70

Determine (i) the maximum load carried by each spring (ii) the total deflection of each spring (iii) the maximum stress in the two springs. Take G = 83 GN/m^2.

15. (a) In a journal bearing of diameter of shaft 75 mm, L/D = 1, radial clearance = 0.05 mm, minimum film thickness = 0.02 mm, speed of the journal is 400 rpm, radial load = 3.5 N, Specific gravity of oil is 0.9 and specific heat = 1.75 kJ/kg/°C. Calculate viscosity of suitable oil, power lost in friction and resultant temperature rise.

(OR)

15. (b) A shaft is supported between two bearings 0.5 m apart. It carries a pulley weighing 1200 N at the middle. The tensions in the belts in horizontal direction are 2500 N and 1250 N on tight and slack side respectively. Select the proper bearing for the shaft diameter 50 mm. There is an axial thrust of 2000 N at the right hand side bearing. Life of bearing should be 6000 hours at 300 rpm.
