B.E / B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, APRIL / MAY 2012

MANUFACTURING ENGINEERING BRANCH

FOURTH SEMESTER – (REGULATION 2004)

ME 374 – DESIGN OF MACHINE ELEMENTS

Use of approved design data book permitted.

Time : 3 hr. Max. Mark :100

Answer ALL Questions

Part A (10 x 2 = 20 Marks)

1 How do you classify materials for engineering use?

2 Why are metals in their pure form unsuitable for industrial use ?

3 Suggest suitable couplings for shaft with parallel misalignment and shafts with angular misalignment of 10°.

4 What are the reasons of replacing riveted joint by welded joint in modern equipment?

5 Explain the possible ways to reduce the severity of stress concentration by correcting the geometric shape.

6 Sketch a modified Good-man diagram for bending stress due to fluctuating stress and the equation for factor of safely.

7 What is a 'bearing characteristic number'?

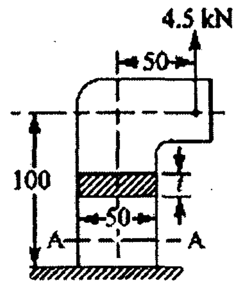
8 For a journal bearing the maximum operating temperature must be less than 80°C. Why?

9 Sketch and indicate the salient parts of a knuckle joint.

10 Define 'coefficient of fluctuation of speed' in a flywheel.

PART B (5 x 16 = 80 Marks)

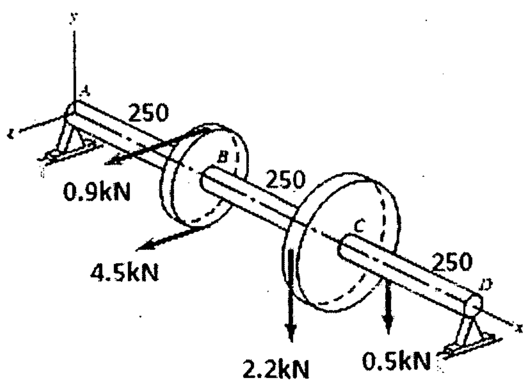
11 (i) A steel bracket is subjected to a load of 4.5kN as shown below. Determine the required thickness of the section at A-A in order to limit the tensile stress to 70MPa.



(8)

(ii) Determine the diameter of a circular rod made of ductile material with a fatigue strength (complete stress reversal), σ_e = 265 MPa and a tensile yield strength of 350MPa. The member is subjected to a varying axial load from W_{min} = -300 $x10^3$N to W_{max}= +700 $x10^3$N and has a stress concentration factor = 1.8. Use factor of safety as 2.0. (8)

12a The 40 mm diameter solid steel shaft shown in Figure below is simply supported at the ends. Two pulleys are keyed to the shaft where pulley B is of diameter is 200 mm and pulley C is of diameter of 350mm. Considering bending and torsional stresses only, determine the locations and magnitudes of the greatest tensile, compressive and shear stresses in the shaft.



(16)

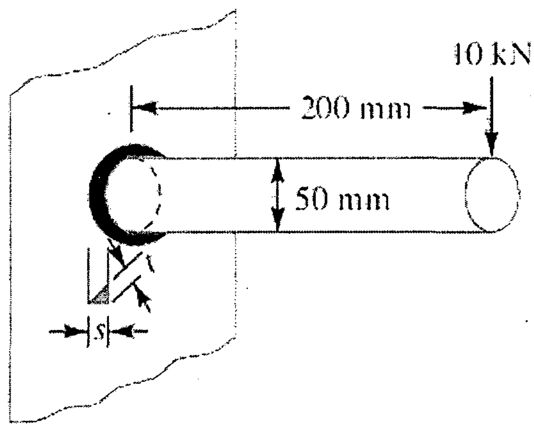
[OR]

12b Design a sleeve and cotter joint to resist a tensile load of 60kN. All parts of the joint are made of the same material with the following allowable stresses: σ_t=60MPa; τ = 70MPa; and σ_c=125MPa. (16)

13a The head of the steam cylinder of 400mm diameter is subjected to steam pressure of $1.5 N/mm^2$. The head is held in place by 16 bolts of M36 size. A soft copper gasket is used to make the joint steam tight. Determine the stress induced in the bolts. (16)

[OR]

13b A 50 mm diameter solid shaft is welded to a flat plate as shown below. If the size of the weld is 15mm, find the maximum normal and shear stress in the weld.



(16)

14a A Load of 2kN is dropped axially on a close coiled helical spring, from a height of 250mm. The spring has 20 effective turns, and it is made of 25 mm diameter wire. The spring index is 8. Find the maximum shear stress induced in the spring and the amount of compression produced. The modulus of rigidity for the material of the spring wire is $84 kN/mm^2$. (16)

[OR]

14b A semi elliptical laminated spring has ten leaves in all, with two full length leaves extending 625 mm. It is 62.5 mm wide and 6.25 mm thick. Design a helical spring with mean diameter of coil 100mm which will have approximately the same induced stress and deflection for any load. The Young's modulus for the material of the semi elliptical spring may be taken as $200 kN/mm^2$ and modulus of rigidity for the material of helical spring is $84 kN/mm^2$. (16)

15a A journal bearing is proposed for a steam engine. The load on the journal is 3kN, diameter 50 mm, length 75 mm, speed 1600 rpm, diametral clearance 0.001 mm, ambient temperature 15.5 degree centigrade. Oil SAE 10 is used and the film temperature is 60 degree centigrade. Determine the heat generated and heat dissipated. (16)

[OR]

15b A single cylinder 4-stroke I.C engine develops 20kW at 300 rpm. The work done by the gases during expansion stroke is 2.53 times the work done on the gases during compression stroke; the work done during suction and exhaust strokes being negligible. The speed is to be maintained within ±1% of the mean speed, determine the moment of inertia of the flywheel. (16)