B.E / B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, APRIL / MAY 2011

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 What are the factors that govern selection of materials while designing a machine component?

2 What do you mean by stiffness and rigidity with reference to shafts?

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'?

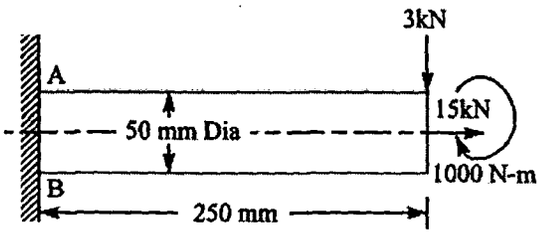
8 For a journal bearing the maximum operating temperature must be less than 80°C. Why?

9 Sketch and indicate the salient parts of a flange coupling.

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

PART B (5 x 16 = 80 Marks)

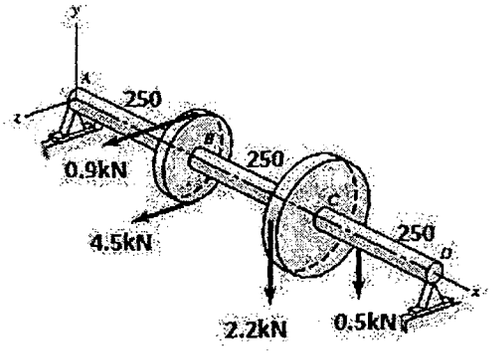
11 (i) A shaft as shown in Figure below, is subjected to a bending load of 3kN, pure torque of 1000N-m and an axial pulling force of 15kN. Calculate the stresses at A and B.



(8)

(ii) A mild steel of shaft of 50mm diameter is subjected to a bending moment of 2000 N-m and a torque T. If the yield point of the steel in tension is 200 MPa, find the maximum value of this torque without causing yielding of the shaft according to Maximum shear stress theory and maximum distortion strain energy theory of yielding. (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]

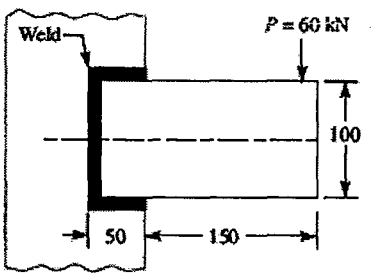
12b A knuckle joint is to transmit a force of 200kN. Allowable stresses in tension, shear and compression are 75N/mm^2, 65 N/mm^2 and 140 N/mm^2 respectively. Design the joint. (16)

13a The head of the steam cylinder of 400mm diameter is subjected to steam pressure of 1.5N/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 rectangular steel plate is welded as a cantilever to a vertical column and supports a single concentrated load P, as shown in the figure below. Determine the weld size if shear stress in the same is not to exceed 100 MPa.



(16)

14a A helical compression spring made of oil tempered carbon steel, is subjected to a load which varies from 400N to 1000N. The spring index is 6 and the design factor of safety is 1.25. If the yield stress in shear is 770 MPa and endurance stress in shear is 350 MPa, find: 1. Size of the spring wire, 2. Diameter of the spring, 3. Number of turns of the spring and 4. Free length of the spring.

The compression of the spring at the maximum load is 30 mm. The modulus of rigidity for the spring material may be taken as 80kN/mm^2.

(16)

14b A semi elliptical laminated spring is made of 45 mm wide and 3.5 mm thick plates. The length between the supports is 750mm and the width of the band is 100mm. The spring has two full length leaves and six graduated leaves. If the spring carries a central load of 1500N find:

(i) Maximum stress in full length and graduated leaves for an initial

condition of no stress in the leaves (16)

(ii) The maximum stress if the initial stress is provided to cause equal stress when loaded.

(iii) The deflection in parts (i) and (ii).

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 240 rpm. The work done by the gases during expansion stroke is 2.5 times the work done on the gases during compression stroke; the work done during suction and exhaust strokes being negligible. If the total fluctuation of speed is not to exceed ±2% of the mean speed, and the turning moment diagram during compression and expansion is assumed to be triangular in shape; determine the moment of inertia of the flywheel. (16)