B.E./B.Tech. (Full Time) END SEMESTER EXAMINATIONS NOV / DEC 2011

MECHANICAL ENGINEERING

V SEMESTER – (REGULATIONS 2008)

ME9305 –DESIGN OF MACHINE ELEMENTS

Time: 3 hours Maximum marks: 100.

PART – A (10 x 2 = 20 Marks)

1. State maximum distortion energy theory.
2. Give the two methods of reducing stress concentration.
3. Why flexible bush is used in bushed-pin type flexible coupling?
4. What is meant by Gib-head key?
5. How the single V-butt weld joint is designated?
6. Draw and write the expression for tearing of socket across cotter slot in cotter joints.
7. When two concentric springs of stiffness 100N/mm and 50N/mm are subjected to an axial load of 750N, what will be the deflection of each spring?
8. Define the co-efficient of fluctuation of speed for flywheel.
9. What do you understand from bearing number 6408?
10. State the various loads acting on the connecting rod.

PART – B (5 x 16 = 80 Marks)

11. A shaft receives power through Pulley A and transmits power through Pulley B as shown in fig 11 .The ratio of tensions in the belt is 2.5:1 and maximum tension in each belt is limited to 3500N. The pulleys are keyed to the shaft. If K_b = 2 and K_t =1.5, determine the shaft diameter. If the permissible angle of twist is 2° per metre, determine the diameter of shaft by rigidity consideration. Ultimate tensile strength 560MPa, Yield strength 375MPa and Modulus of rigidity 80 x 10^3 MPa

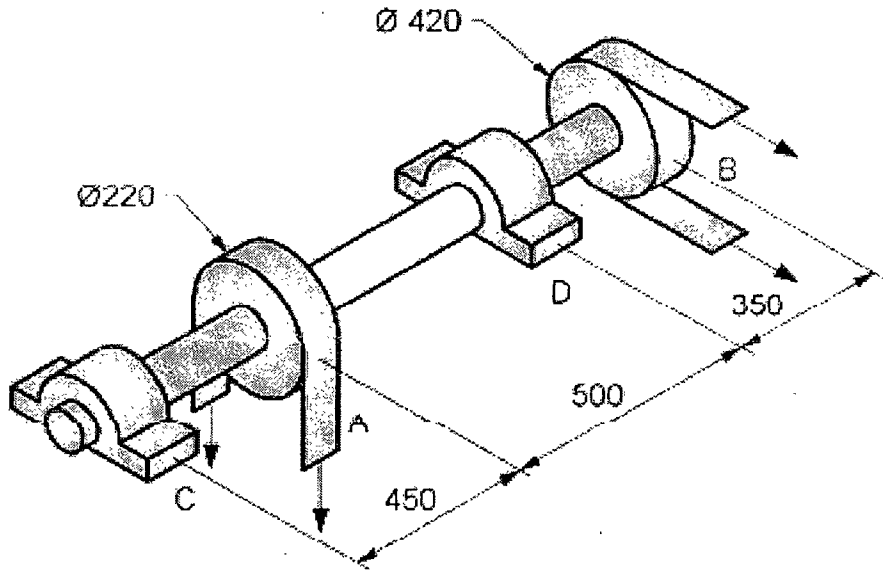

Fig. 11

12(a) A mild steel shaft of 40mm diameter is subjected to a bending moment of 1500 k –Nmm and a torque 'T'. If the yield strength of the steel in tension is 300MPa, find the maximum value of torque 'T' without causing yielding of the shaft according to (1) the maximum principal stress theory and (2) the maximum shear stress theory.

(OR)

12(b) A bushed fin type flange coupling is to be designed to transmit 25kW at a Speed of 1000 rpm. The following permissible stresses are used: shear stress for the shafts and keys 55 N/mm^2, Shear stress for the pin 28 N/mm^2, bearing pressure on rubber bush 0.3MPa and crushing stress for the key 100 MPa.

13(a) Design a knuckle joint to transmit a load of 140 kN. Use the following Stresses: Allowable tensile stress = 85 MPa, Allowable shear stress = 70 MPa and Allowable crushing stress = 165 MPa

(OR)

13(b) A bracket is supported by means of 4 rivets of same size, as shown in fig 13(b). If the maximum permissible shear stress for rivet is 150 N/mm^2, determine the diameter of rivets.

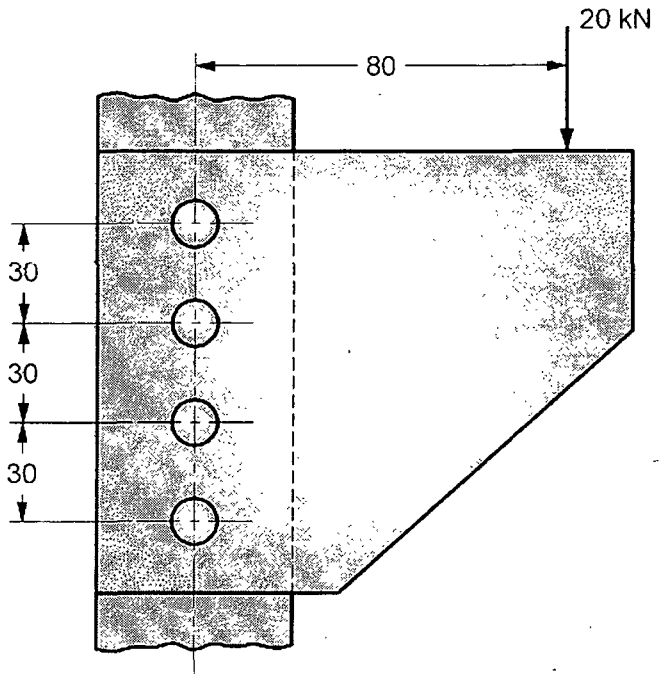

Fig 13(b)

14(a) A shaft fitted with a flywheel rotates at 250 r.p.m. and drives a machine. The Torque of machine varies in a cyclic manner over a period of 3 revolutions. The torque rises from 750Nm to 3000 Nm uniformly during half revolution and remains constant for the following revolution. It then falls uniformly to 750 Nm during the next half revolution and remains constant for one revolution, the cycle being repeated thereafter. Determine the power required to drive the machine. If the total fluctuation of speed is not to exceed 3 % of the mean speed, determine a suitable diameter and cross-section of the flywheel rim. The width of the rim is to be 4 times the thickness and the safe centrifugal stress is 6MPa. Material density may be assumed as $7200Kg/m^3$.

(OR)

14(b) It is required to design a helical compression spring for the valve mechanism. The axial force acting on the spring is 300N when the valve is open and 150N when the valve is closed. The length of the spring is 30mm when the valve is open and 35mm when the valve is closed. The spring is made of oil-hardened and tempered valve spring wire and the ultimate tensile strength is 1370N/mm^2. The permissible shear stress for spring wire should be taken as 30% of the ultimate tensile strength. The modulus of rigidity is 81370N/mm^2. The spring is to be fitted over a valve rod and the minimum inside diameter of the spring should be 20mm. Assume that the clearance between adjacent coils is 15% of the deflection under the maximum load.

15(a) A full journal bearing of 50 mm diameter and 100 mm length has a bearing pressure of 1.6 N/mm^2. The speed of the journal is 900 r.p.m. and the ratio of journal diameter to the diametral clearance is 1000. The lubricating oil used has absolute viscosity at operating temperature of 70° is 0.011 kg / m-s. The room temperature is 35°. Determine the amount of artificial cooling required and the mass of lubricating oil required if the difference between the outlet and inlet temperature of the oil is 10°. Take specific heat of oil as 1850 J/kg/ °C.

(OR)

15(b) Design a connecting rod for four stroke petrol engine with the following data:

- Piston diameter = 90 mm
- Stroke = 140 mm
- Length of connecting rod, center to center = 315 mm
- Weight of reciprocating parts = 18.2 N
- Speed = 1500 r.p.m. with possible overspeed of 2500 r.p.m.
- Compression ratio = 4:1
- Maximum explosion pressure = 2.45 N/mm^2