Registration No. :

Total number of printed pages – 3

B. Tech

CPME 6306

Sixth Semester (Special) Examination – 2013

### MACHINE DESIGN - II

BRANCH : MECH

QUESTION CODE : E 513

Full Marks – 70

Time : 3 Hours

Answer Question No. 1 which is compulsory and any five from the rest.

The figures in the right-hand margin indicate marks.

1. Answer the following questions :   2×10

    (a) Sketch σ-N curve for ferrous and non-ferrous materials.

    (b) What do you mean by a pressure vessel ?

    (c) Name various types of varying stress.

    (d) Why single plate clutches are often called as dry clutch ?

    (e) What is a self-locking brake ?

    (f) Differentiate between pivot and collar bearing.

    (g) Differentiate between gear and belt drive.

    (h) What is meant by wear load of a gear tooth ?

    (i) What is the function of connecting rod in an IC engine ?

    (j) Name the possible modes of failure to be considered for the design of piston pin and crank pin.

2. (a) Define factor of safety and explain the reason for using it in machine design.   4

    (b) A shaft of 25 mm diameter is subjected to a torque of 60 Nm, a bending moment of 16 kNm and an axial load of 6 kN. Calculate the factor of safety, according to (i) maximum normal stress theory and (ii) maximum shear stress theory. Assume yield strength of shaft material is 400 MPa.   6
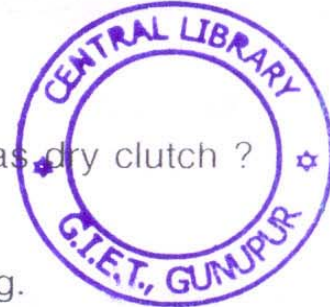
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3. A differential band brake is operated by a lever of length 500 mm. The brake drum has a diameter of 500 mm and the maximum torque on the drum is 1000 Nm. The band brake embraces $2/3^{rd}$ of the circumference. One end of the band is attached to a pin 100 mm from the fulcrum and the other end to another pin 80 mm from the fulcrum and on the other side of it when the operating force is also acting. If the band brake is lined with asbestos fabric having a coefficient of friction 0.3, find the operating force required. Design the steel band, shaft, key and lever. The permissible stresses may be taken as 70 N/mm² in tension, 50 N/mm² in shearing and 20 N/mm² in bearing. The bearing pressure for the brake lining should not exceed 0.2 N/mm². 10

4. (a) A thick cylinder is subjected to an internal pressure of 600 MPa. If the hoop stress on outer surface is 150 MPa; determine the hoop stress on inner surface. 5

   (b) A multiple disc clutch transmits 50 kW power at 1400 rpm. Axial intensity of pressure is not to exceed 0.15 N/mm², and the coefficient of friction for friction surface is 0.12. The inner radius of disk is 80 mm and is 0.7 times the outer radius. Determine the number of discs required to transmit the given power. Assume uniform wear condition. 5

5. (a) Explain the effect of variation of viscosity, speed and bearing pressure on the performance of a bearing. 5

   (b) A bearing 50 mm in diameter and 75 mm in length, supports an overhanging shaft, running at 900 rpm. The room temperature is 30° C and the bearing temperature is 75° C. The viscosity of oil used is 0.012 kg/m-s at the operating temperature of 120° C. The diametrical clearance is 0.05 mm and the bearing is to operate in still air, without any artificial cooling. Determine the permissible load on the bearing and power lost. 5

6. A pair of cast-iron bevel gears connects two shafts at right angle. The pitch diameter of pinion and gear are 80 mm and 120 mm respectively. The tooth profiles of gears are of 14.5° composite forms. The static strength for both the gear is 56 MPa. The pinion transmits 2.5 kW at 1200 rpm. Determine the module for the gears from the stand point of strength and check the design from the stand point of wear. Take surface endurance limit as 620 MPa and modulus of elasticity for cast-iron as 0.84×10^5 MPa. 10

7, Design the I-section connecting rod for a single-cylinder IC engine, using the
following specifications :   10

Diameter of piston $= 100$ mm

Mass of the reciprocating parts $= 2.25$ kg

Length of connecting rod $= 300$ mm

Stroke length $= 125$ mm

Speed $= 1500$ rpm

Maximum explosion pressure $= 3.5$ N/mm^2

Compression ratio $= 6$

Factor of safety $= 7$

Density of rod material $= 8000$ kg/m^3

Yield stress in compression $= 330$ MPa

Permissible tensile stress $= 60$ MPa

Assume any other data required.

8. Write short notes on any **two** of the following :   5×2

   (a)   Fly wheel

   (b)   Sodeberg criterion

   (c)   Bearing life

   (d)   Internal expanding shoe brake.

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