Registration No. :

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Sixth Semester Regular Examination – 2015
DESIGN OF MACHINE COMPONENTS
BRANCH : MECH
QUESTION CODE : J 210

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) What is meant by eccentric loading and eccentricity ?

    (b) Distinguish thick cylinder and thin cylinder.

    (c) Explain the term "Notch sensitivity".

    (d) What are the commonly used materials or sliding contact bearings ?

    (e) Name the various forces acting on bevel gear.

    (f) Why is it necessary to dissipate the heat generated when clutches operate?

    (g) What is self-energizing brake? When a brake becomes self-locking ?

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

    (i) Explain the law of gearing.

    (j) What is the function of a fly-wheel ?

2. (a) A shaft is transmitting 97.5 Kw at 180 rpm. If the allowable shear stress in
         the material is 60 N/mm^2, find the suitable diameter for the shaft. The shaft
         is not to twist more than 1° in a length of 3m. The modulus of rigidity of shaft
         material is 80 kN/mm^2.   5

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(b) Determine the diameter of a circular rod made of ductile material with a fatigue strength (complete stress reversal), endurance limit is 265 N/mm² and tensile yield strength of 350N/mm². The member is subjected to a varying axial load from $W_{min} = -300kN$ to $W_{max} = 700kN$ and has a stress concentration factor $= 1.8$, use factor of safety as 2.　　　5

3. (a) A bronze spherical shell of thickness 15mm is installed in a chemical plant. The shell is subjected to an internal pressure of 1N/mm². Find the diameter of the shell, if the permissible stress for the bronze is 55N/mm². The efficiency may be taken as 80%.　　　5

   (b) A pair of helical gears with 30° helix angle is used to transmit 15kW at 10000 rpm of the pinion. The velocity ratio is 4 : 1. Both the gears are to be made of harden steel of static strength 100N/mm². The gears are 20° stub and the pinion is to have 24 teeth. The face width may be taken as 14 times the module. Find the module and face width from the stand point of strength and check the gears for wear.　　　5

4. A differential band brake is operated by a lever of length 500mm. 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 100mm 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 70N/mm² in tension, 50 N/mm² in shearing and 20 N/mm² in bearing. The bearing pressure for the brake lining should not exceed 0.2N/mm².　　　10

5. A centrifugal clutch is to be designed to transmit 15Kw at 900rpm. The shoes are four in number. The speed at which the engagement begins is $3/4^{th}$ of the running speed. The inside radius of pulley rim is 150mm. The shoes are lined with Ferrodo for which the coefficient of friction may be taken as 0.25. Determine the mass and the size of the shoes.　　　10

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

   (b) A bearing 50mm in diameter and 75mm in length, supports an overhanging shaft, running at 900rpm. The room temperature is 30°C and the bearing temperature is 75° C. The viscosity of oil used is 0.012kg/m-s at the operating temperature of 12°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

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

   Diameter of piston = 100mm

   Mass of the reciprocating parts = 2.25 kg

   Length of connecting rod = 300 mm

   Stroke length = 125 mm

   Speed = 1500 rpm

   Maximum explosion pressure = 3.5N/mm^2

   Compression ratio = 6

   Factor of safety = 7

   Density of rod material = 8000kg/m^3

   Yield stress in compression = 330MPa

   Permissible tensile stress = 60 MPa

   Assume any other data required.

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

   (a) Journal bearing

   (b) Internal expanding shoe brake

   (c) Crank shaft

   (d) Maximum shear stress theory

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