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Total Number of Pages: 2

B.TECH
PCME4306

6th Semester Regular / Back Examination 2015-16

DESIGN OF MACHINE COMPONENTS

BRANCH: MECHANICAL

Time: 3 Hours

Max Marks: 70

Q.CODE: W104

**Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.**

Q1 Answer the following questions: **(2 x 10)**

- a) What do you mean by a self-locking brake?
- b) Write name of two materials for friction surface of a clutch. Also write the characteristics of a good friction material for clutch.
- c) How to ensure zero axial thrust in case of a helical gear?
- d) Explain notch sensitivity factor
- e) Name any two factors on which the endurance strength of a material depends.
- f) Define the term bearing modulus.
- g) Define the coefficient of fluctuation of speed in flywheel.
- h) What is meant by whipping of a connecting rod and what is its effect?
- i) Write the Goodman relation for design under fatigue loading
- j) If the load acting on bearing has radial as well as axial component which type of bearing is recommended.

Q2 a) A 310 deep groove ball bearing has a work cycle with 1000 rpm for one third of the time, 2000 rpm for the next third of the time and 4000 rpm for the last one third of the time. The outer race of the bearing rotates. Assume light shock condition. The radial load is 5 kN and the axial load is 3 kN. Determine the expected average life in hours if the basic dynamic capacity of the bearing is 50 kN. **(6)**

b) A bar of circular cross-section is subjected to an alternating tensile force varying from a maximum of 500 kN to a minimum of 200 kN. The ultimate tensile strength and endurance limit of the material of the bar are 900 MPa and 700 MPa respectively. Determine the diameter of the bar using Goodman relation. Consider factor of safety and stress concentration factor as 4 and 1.6 respectively. **(4)**

Q3 a) A cast iron cylinder of internal radius 100 mm and thickness 50 mm is subjected to a pressure of 5 N/mm². Calculate the tangential and radial stress at a radius of 120mm. **(4)**

b) A steel ring 80mm internal diameter is pressed into another steel ring 160mm external diameter, the diameter at the mating surface being 120mm. If the pressing operation increases the internal diameter of external ring by 0.05mm determine the junction pressure and radial displacement of the inner ring at mating surface. Take poisson's ratio 0.3. **(6)**

- Q4** A 14.5° involute spur gear pair is to transmit 10 kW at 300rpm of the pinion. The velocity ratio is 3:1. The static strength of steel pinion and cast iron gear are 100 MPa and 60 MPa respectively. Determine the face width, module and pitch diameter of gears. Also check for dynamic and wear load considering 16 teeth in pinion. Assume endurance limit as 600 MPa and Young's modulus of pinion and gear material as 200 GPa and 100 GPa respectively. **(10)**
- Q5 a)** The turning moment diagram for a multi-cylinder engine has been drawn to a scale of 1 mm=4° on abscissa and 1 mm=500 N-m in the ordinate. The area below and above the mean torque line taken in order are : -30, +380, -260, +314, -300, +240, -380, +260, and -230 mm². The engine is running at a mean speed of 400 rpm and the coefficient of fluctuation of speed is limited to 0.03. The mean diameter of the cast iron fly wheel is 1m and the hub and arms provide 10 % of its rotational inertia. Determine the dimension of the rectangular cross-section of the flywheel assuming width to thickness ratio as 1.5 and density as 7200 kg/m³. **(6)**
- b)** A 100mm diameter shaft running at 240rpm is supported on a foot-step bearing. The bearing area is annular with 100mm outside diameter and 50mm inside diameter. The permissible bearing pressure is 1.5 N/mm². Determine the heat generated at bearing if coefficient friction is 0.015. **(4)**
- Q6 a)** A journal bearing for a centrifugal pump is 80 mm in diameter and 125 mm in length. The journal is machined so as to give a radial clearance of 0.0015 mm per mm radius. The journal rotates at 1440 rpm and resists a load of 8 kN. Find the viscosity of oil being used at the operating temperature if 1 kW power is wasted in friction. **(5)**
- b)** A centrifugal clutch consists of four shoes each having a mass of 1.5 kg. In the engaged position, the distance of CG of the shoes from the axis is 110mm. The inner radius of the pulley rim is 145 mm and the coefficient of friction is 0.25. The pre-load in the spring is adjusted such that the spring force at the beginning of engagement is 700 N. Determine the speed at which engagement begins and the power transmitted by the clutch if the running speed is 1440 rpm. **(5)**
- Q7 a)** Explain the design procedure of simple and differential band brake **(7)**
- b)** What is meant by self-energizing brake? **(3)**
- Q8** Design a connecting rod using the following data: **(10)**
Piston diameter=100mm, mass of reciprocating parts=2kg
Length of connecting rod=300mm, stroke length=125mm,
Speed=1500rpm, maximum pressure=3.5N/mm², factor of safety=7,
Density=7850kg/m³. Yield stress under compression=300MPa