BACHELOR OF TECHNOLOGY (C.B.C.S.) (2014 COURSE)
B.Tech.Sem - V MECHANICAL : WINTER- 2022
SUBJECT : THEORY OF MACHINES

Day : Thursday | Time : 02:30 PM-05:30 PM

Date : 8/12/2022 | **W-13446-2022** | Max. Marks : 60

N.B.:

1) All questions are **COMPULSORY**.
2) Figures to the right indicate **FULL** marks.
3) Use of non-programmable **CALCULATOR** is allowed.
4) Draw neat and labeled diagram **WHEREVER** necessary.
5) Assume suitable data if necessary.

Q.1 Two gear wheels of diameters 75 mm and 250 mm have involute teeth of 5 mm module and 20^0 angle of obliquity. The addenda are equal and are as large as possible while avoiding interference. Find: **[10]**

i) The addendum
ii) The contact ratio
iii) The sliding velocity at the start of contact, if the pinion is driving at 2000 rev / min.

OR

From first principles, derive an expression for the minimum number of teeth on a pinion and gear having involute from in terms of pressure angle, gear ratio and a coefficient by which the standard addendum in module is to be multiplied.

Q.2 A pair of single helical gear is required to give a speed reduction of 4.2:1. The gears are to have a normal module of 3 mm, a pressure angle of 20^0 and a helix angle of 30^0. If the shaft centre-lines are to be approximately 400 mm apart, determine the number of teeth on each wheel and the exact centre distance. **[10]**

OR

Derive the expression for maximum efficiency of spiral gearing and velocity of sliding between spiral gears.

Q.3 An epicyclic train is composed of a fixed annual wheel A having 150 teeth. Meshing with A is a wheel B, which drives wheel D through an idle wheel C, D being concentric with A. Wheel B and C are carried on an arm which revolves clockwise at 100 rpm about the axis of A and D. if the wheels B and D have 25 and 40 teeth respectively, find the number of teeth on C and speed and sense of rotation of C. **[10]**

OR

In an epicyclic gear train, the internal wheels A and B and the compound wheels C and D rotate independently about axis O. The wheels E and F rotate on pins fixed to the arm G, E gears with A and C and F gears with B and D. All wheels have the same module and the number of teeth are:

$T_C = 28$, $T_D = 26$, $T_E = T_F = 18$

i) Sketch the arrangement.
ii) Find the number of teeth on A and B.
iii) If the arm G makes 100 r.p.m clockwise and A is fixed, find the speed B.
iv) If the arm G makes 100 r.p.m. clockwise and wheel A makes 10 r.p.m. counter clockwise, find the speed of wheel B.

P.T.O.

Q.4 A load of 15 KN is supported by a conical pivot. The angle of cone is 110^0 and intensity of pressure is not to exceed 350 KN / m^2. The external radius is 3.5 times the internal radius. Find the diameter of the bearing surface. If coefficient of friction is 0.06 and the shaft is rotating at 150 rpm , what is the power in KW which is absorbed by friction? **[10]**

OR

Explain with neat sketch internal expanding shoe brake and also derive the braking torque of them.

Q.5 Design a cam for operating the exhaust valve of an oil engine. It is required to give S.H.M. during opening and closing of the valve each of which corresponds to 60^0 of cam rotation. The valve must remain in the fully open position for 20^0 of cam rotation. The lift of the valve is 36 mm and the least radius of cam is 50 mm. The follower is provided with a roller of 40 mm diameter and its line of stroke passes through the axis of the cam. Find maximum velocity and acceleration of the follower during opening and closing periods for a cam shaft speed of 240 r.p.m. **[10]**

OR

The following data relate to a cam profile in which the follower is a flat faced follower and moves with SHM during the ascent and descent.

Minimum radius of cam	= 25 mm
Lift	= 30 mm
Angle of ascent	= 120^0
Angle of descent	= 100^0
Angle of dwell between ascent and descent	= 80^0
Speed of cam	= 200 r.p.m.

Draw profile of the cam and determine the maximum velocity and maximum acceleration during outstroke and the return stroke.

Q.6 A two wheeler of 350 mm wheel radius is negotiating a turn of radius 70 m at speed of 100 km / hr. The combined mass of vehicle with its rider is 250 kg. The C.G. of rider is 0.6 m above ground level. The mass moment of inertia of engine flywheel is 0.30 kg-m^2 and mass moment of inertia of each road wheel is 1 kg-m^2. If the speed of the engine is five times the speed of the wheel and in the same direction, find angle of wheel of vehicle. **[10]**

OR

Explain in details the terms sensitiveness, stability, isochronism and hunting in governor mechanism.

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