Roll No ....

AU/IP/ME/PR - 403

B.E. IV Semester Examination, December 2014
Theory of Machines and Mechanisms
Time : Three Hours

Maximum Marks : 70

Note: i)　Answer five questions. In each question part A, B, C is compulsory and D part has internal choice.

　　ii)　All parts of each questions are to be attempted at one place.

　　iii)　All questions carry equal marks, out of which part A and B (Max.50 words) carry 2 marks, part C (Max.100 words) carry 3 marks, part D (Max.400 words) carry 7 marks.

　　iv)　Except numericals, Derivation, Design and Drawing etc.

Unit - I

l.　a)　What is redundant degree of freedom of a mechanism. Also explain grublers criterion for degree of freedom of 2-D (planar) mechanism.

　　b)　Define kinematic link and kinematic chain.

　　c)　Enlist the inversions of a double-slider-crank chain. Explain any one in detail. Give examples also.

　　d)　What are quick return mechanisms. Where are they used. Discuss the functioning of any one of them.

OR

What is the condition for correct steering. Enlist main types of steering mechanism. Explain any one steering mechanism with neat sketch.

Unit - II

2.　a)　What is velocity of rubbing and how it is found?

　　b)　What do you mean by centrode of a body? Explain its types.

　　c)　State and prove Kennedy's theorem as applicable to instantaneous centres of rotation of three bodies. How it is useful in locating various instantaneous centres of a mechanisms.

　　d)　What is coriolis acceleration component? In which cases does it occur? How it is determined.

OR

In a four-link mechanism, the crank AB rotates at 36 rad/sec. The length of the links are AB = 200 mm, BC = 400 mm, CD = 450 mm and AD = 600 mm. AD is the fixed link. At the instant when AB is at right angles to AD, determine the velocity of

　　i)　The midpoint of the link BC.

　　ii)　A point on the link CD, 100 mm from the pin connecting the links CD and AD.

Unit - III

3.　a)　Deduce an expression for velocity of sliding in a gear drive.

　　b)　Define the terms

　　　　i)　Pitch circle　　ii)　Pitch diameter　　iii)　Module

　　c)　With neat sketch explain the term interference and undercutting between two mating gears.

d) For a pair of spur gear with neat sketch explain following terms:
   i) Length of path of approach
   ii) Length of path of recess
   iii) Length of arc of contact
   iv) Pressure angle

OR

Two spur gears of 24 teeth and 36 teeth of 8 mm module and 20° pressure angle are in mesh. Addendum of each gear is 7.5 mm. The teeth are of involute form. Determine:1. The angle through which the pinion turns while any pair of teeth are in contact and, and 2. The velocity of sliding between the teeth when the contact on the pinion is at a radius of 102 mm. The speed of the pinion is 450 r.p.m.

Unit - IV

4. a) For a cam define base circle, pitch circle and trace point.
   b) What is reverted gear train? Where it is used.
   c) What is cam with specified contours. Explain their types.
   d) The following data relate to a cam operating an oscillating roller follower:

   Minimum radius of cam   = 44 mm
   Diameter of roller   = 14 mm
   Length of follower arm   = 40 mm
   Distance of fulcrum centre from cam centre   = 50 mm
   Angle of ascent   = 75°
   Angle of descent   = 105°
   Angle of dwell for follower in the highest position = 60°
   Angle of oscillation of follower = 28°
   Draw the profile of the cam if the ascent and descent both takes place with SHM.

OR

Determine a suitable train of wheels to satisfy the requirements of a clock, the minute hand of which is fixed to a spindle and the hour hand to a sleeve rotating freely on the same spindle. The pitch is the same for all the wheel and each wheel has at least 11 teeth. The total number of teeth should be as small as possible.

Unit - V

5. a) Explain steering and pitching motion of a naval ship.
   b) What do you mean by spin, precession and gyroscopic planes.
   c) Explain the application of gyroscopic principles to aircrafts.
   d) Discuss the effect of the gyroscopic couple on a two wheeled vehicle when taking turn.

OR

A ship is propelled by a turbine rotor having a mass of 6 tonnes and a speed of 2400 rpm. The direction of rotation of rotor is clockwise when viewed from stern. The radius of gyration of the rotor is 450 mm. Determine the gyroscopic effect when the
   i) Ship steers to the left in a curve of 60 mm radius at a speed of 18 knots (1 knot = 1860 m/hr)
   ii) Ship pitches 7.5 degree above and 7.5 degree below the normal position and the bow is descending with its maximum velocity; the pitching motion is simple harmonic with a periodic time of 18 seconds.

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