Fourth Semester B.E. Degree Examination, December 2011
Kinematics of Machines

Time: 3 hrs.

Max. Marks:100

Note: *Answer any FIVE full questions, selecting at least TWO questions from each part.*

PART – A

1 a. Define the following, with sketches:
   i) Link   ii) Mechanism   iii) Machine   iv) Inversion.   (08 Marks)

   b. Explain: i) Lower pairs   ii) Higher pairs.   (06 Marks)

   c. Describe with a neat sketch, the crank and slotted lever mechanism, an inversion of a slider crack mechanism.   (06 Marks)

2 a. Explain the Whitworth quick return motion mechanism, with a neat sketch.   (10 Marks)

   b. Derive the expression for necessary condition of correct steering. Explain with a neat sketch, the Ackerman steering gear mechanism.   (10 Marks)

3 A single slider crank mechanism shown in Fig.Q3, has the crank CB = 100mm and connecting rod BA = 300mm, with centre of gravity G 100mm from B. The crankshaft has a speed of 75 rad/sec and an angular acceleration of 1200 rad/sec^2. Find
   i) The velocity of G and the angular velocity of AB.
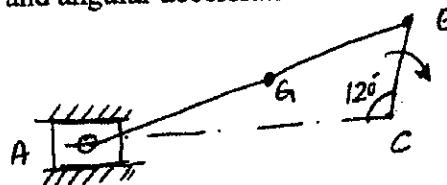   ii) The acceleration of G and angular acceleration of AB.   (20 Marks)

Fig.Q3

4 a. Locate all the instantaneous centres and find the angular velocity of the link BC. The link dimensions of the mechanism are AB = 300mm, BC = BD = 360mm and AD = 600mm. The angle BAD = 60°. The crank rotates at 100 rpm. [Refer Fig.Q4(a)]   (10 Marks)
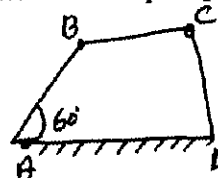

Fig.Q4(a)

   b. The lengths of the crank and the connecting rod of a reciprocating engine are 200mm and 700mm respectively. The crank rotates in clockwise direction at 120 rad/sec. When the crank is at 30°C to TDC, by using the Klein's construction, determine
   i) The velocity and acceleration of the piston ii)Angular velocity and acceleration of the CR.   (10 Marks)

PART – B

5　The crank and connecting rod of an engine are 0.3m and 1.5 in length respectively. The crank rotates at 180 rpm clockwise. Determine the velocity and acceleration of the piston when the crank is 40° from TDC. Also determine the position of the crank for zero acceleration of the piston.　**(20 Marks)**

6　a.　Derive the expression for the length of arc of contact in a pair of spur gears in a mesh.

(08 Marks)

　　b.　Two mating gears have 20 and 40 involute teeth of module 10mm and 20° pressure angle. The addendum of each wheel is to be made of such a length that the line of contact on each side of the pitch point has half the maximum possible length. Determine the addendum length for each wheel, length of path of contact, arc of contact and contact ratio.　**(12 Marks)**

7　a.　Explain with a neat sketch the "Sun & planet wheel".　**(04 Marks)**

　　b.　In an epicyclic gear train, an arm carries two gears A and B having 36 and 45 teeth, respectively. If the arm rotates at 150 rpm in the anticlockwise direction about the centre of gear A which is fixed, determine the speed of the gear B, if the gear A instead of being fixed, makes 300 rpm in the clockwise direction. [Refer Fig.Q7(b)].　**(16 Marks)**

Fig.Q7(b)
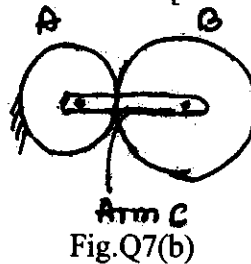
8　Construct the profile of a cam to suit the following specifications:

Cam shaft diameter = 40mm　　　　Least radius of cam = 25mm
Diameter of the roller = 25mm　　　Angle of lift = 120°
Angle of fall = 150°　　　　　　　　Lift of the follower = 40mm
No. of pauses are two of equal interval between motion.

During the lift the motion is SHM. During the fall motion is UARM. The speed of camshaft is uniform. The line of stroke is offset to 12.5mm from the centre of the cam.　**(20 Marks)**

* * * * *