USN | | | | | | | | | | |

06ME44

Fourth Semester B.E. Degree Examination, June/July 2014

Kinematics of Machines

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Define the following and state the degree of freedom:
   i) Turning pair
   ii) Sliding pair
   iii) Screw pair
   iv) Spherical pair **(08 Marks)**

   b. Sketch and explain the following:
   i) Coupling rod of locomotive
   ii) Oscillating cylinder engine mechanism
   iii) Scotch yoke mechanism **(12 Marks)**

2 Sketch and explain the following mechanisms:
   a. Geneva wheel mechanism **(08 Marks)**
   b. Crank and slotted lever mechanism **(06 Marks)**
   c. Peancellier's mechanism **(06 Marks)**

3 The crank of a slider crank mechanism is 300 mm and the connecting rod is 1500 mm long. The crank rotates at constant speed of 450 rpm in clockwise direction. It has turned through 45° from the inner dead centre. Draw velocity and acceleration diagrams and hence determine:
   i) Velocity and acceleration of piston
   ii) Velocity and acceleration of mid point of connecting rod
   iii) Angular velocity and angular acceleration of connecting rod. **(20 Marks)**

4 a. Locate all the instantaneous centres for mechanisms shown in Fig.Q4(a)(i) and Fig.Q4(a)(ii).

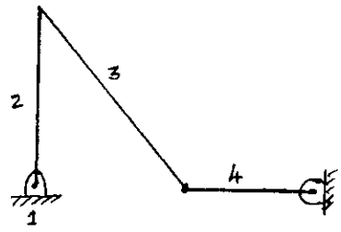

Fig.Q4(a)(i)

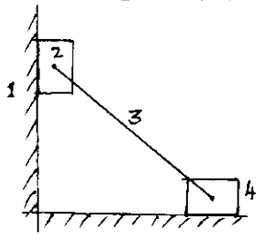

Fig.Q4(a)(ii) **(08 Marks)**

   b. The length of crank and connecting rod of a reciprocating engine are 200 mm and 800 mm respectively. The crank is rotating at a uniform speed of 480 rpm and has turned through 45° rpm from inner dead centre. By using Klein's construction, find:
   i) Velocity and acceleration of piston.
   ii) Angular velocity of connecting rod.
   iii) Acceleration of mid point of connecting rod. **(12 Marks)**

PART – B

5 a. Using complex algebra derive expressions for angular velocity of link 3 and 4 of 4 bar mechanism shown in Fig.Q5(a).

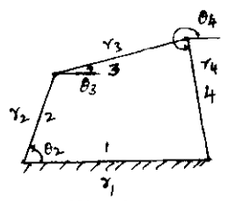

Fig.Q5(a) **(08 Marks)**

b. If the crank and connecting rod are 150 mm and 600 mm long respectively. The crank rotates at a uniform speed of 100 rpm clockwise and has turned through 30° from inner dead centre. Using complex algebra method, determine:
   i) Velocity and acceleration of piston.
   ii) Angular velocity and angular acceleration of connecting rod. **(12 Marks)**

6 a. Define the following:
   i) Circular pitch ii) Module
   iii) Backlash iv) Length of path of contact **(08 Marks)**

b. Two gears in mesh have a module of 8 mm and a pressure angle of 20°. The gear has 57 teeth and pinion has 23 teeth. If the addendum on pinion and gear are equal to one module, find:
   i) Length of path of contact
   ii) Arc of contact
   iii) Contact ratio **(12 Marks)**

7 a. Explain algebraic method of finding velocity ratio of an epicyclic gear train. **(06 Marks)**

b. In the epicyclic gear train shown in Fig.Q7(b) gears B and C are keyed to a shaft carries on a revolving arm R. Arm R turns about the axis of gears A and D. If all the gears have same pitch, find the number of teeth on gear D. If gear D rotates at 600 rpm clockwise. Find the speed and sense of rotation of arm R. **(14 Marks)**

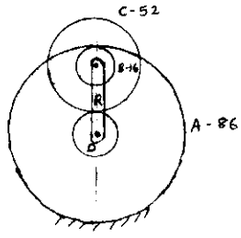

Fig.Q7(b)

8 A cam with 30 mm as minimum radius is rotating clockwise at a uniform speed of 1200 rpm and has to give the motion to the knife edge follower whose axis is offset to the right by 10 mm, as defined below:
   i) Follower to move outward through 30 mm during 120° of cam rotation with SHM.
   ii) Dwell for the next 60°.
   iii) Follower to return to its starting position during the next 90° with UARM.
   iv) Dwell for the remaining period.

   Draw the cam profile and find the maximum velocity and acceleration during outward stroke. **(20 Marks)**

* * * * *