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

10ME/AU44

Fourth Semester B.E. Degree Examination, June/July 2016
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:
   i) Kinematic chain
   ii) Mechanism
   iii) Structure
   iv) Inversion
   v) Degree of freedom. **(10 Marks)**

   b. Describe with neat figures two inversions of double slider-crank chain. **(10 Marks)**

2 a. With neat sketch, explain crank and slotted lever quick return mechanism. **(07 Marks)**

   b. Explain the pantograph mechanism, with a neat sketch. State its applications. **(07 Marks)**

   c. Draw a line diagram and explain peancellier's straight line mechanism. **(06 Marks)**

3 A four bar chain ABCD has a fixed link AD = 1 m. The driving crank AB = 0.3 m. The follower link CD = 0.6 m and the connecting link BC = 1.2 m. Find the velocity and acceleration of point 'P' midway between B and C, when the angle BAD = 135° and AB rotates clock wise at a speed of 300rpm with an angular acceleration of 20 rad/sec^2 in CCW direction. **(20 Marks)**

4 a. State and prove 'Kennedy's theorem'. **(05 Marks)**

   b. In a reciprocating engine, the length of crank is 250mm and length of connecting rod is 1000mm. The crank rotates at an uniform speed of 300rpm in clockwise direction and the crank is inclined at 30° with inner dead centre. The centre of gravity of the connecting rod is 400mm away from the crank end. By Klein's construction determine: i) Velocity and acceleration of piston; ii) Angular velocity and angular acceleration of connecting rod and iii) Velocity and acceleration at the centre of gravity of the connecting rod. **(15 Marks)**

PART – B

5 In a reciprocating engine length of crank is 250mm and length of connecting rod is 1000mm. The crank rotates at a uniform speed at 300rpm CW Crank is at 30° from IDC. Determine:
   i) Velocity of piston and angular velocity of connecting rod.
   ii) Acceleration of piston and angular acceleration of connecting rod by complex algebra method from first principal. **(20 Marks)**

6 a. State and prove law of gearing. **(06 Marks)**

   b. Derive an expression for path of contact. **(06 Marks)**

   c. A pair of spur gears has 16 teeth and 18 teeth, a module 12.5mm, an addendum 12.5mm and a pressure angle 14.5°. Prove that the gears have interference. Determine the minimum number of teeth and the velocity ratio to avoid interference. **(08 Marks)**

7 a. Explain epicyclic gear train with neat figure. **(05 Marks)**

b. An epicyclic gear train consists of a sun wheel (S), a stationary internal gear (E) and three identical planet wheels (P) carried on a star shaped planet carrier (C). The size of different toothed wheels are such that the planet carrier C rotates at 1/5 of the speed of the sun wheel. The minimum number of teeth on any wheel is 16. The driving torque on the sun wheel is 100Nm. Determine:

i) Number of teeth an different wheels of train.

ii) Torque necessary to keep the internal gear stationary. **(15 Marks)**

8 Draw the profile of a cam operating a roller reciprocating follower with the following data: minimum radius of cam = 25mm; lift = 30mm; roller diameter = 15mm. The cam lifts the follower for 120° with SHM followed by a dwell period of 30°. Then the follower lowers down during 150° of the cam rotation with uniform acceleration and deceleration followed by a dwell period. If the cam rotates at a uniform speed of 150rpm. Calculate the maximum velocity and acceleration of the follower during descent period. **(20 Marks)**

* * * * *