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

06ME44

Fourth Semester B.E. Degree Examination, June 201
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 following; (i) Mechanism; (ii) Structure; (iii) Kinematic pair; (iv) Degree of freedom; (v) Inversions . **(10 Marks)**

b. Differentiate; (i)Machine and structure; (ii) Higher pair and lower pair; (iii) Unconstrained and completely constrained motion; (iv) Closed and unclosed pairs. **(08 Marks)**

c. Determine the mobility of four bar linkage. **(02 Marks)**

2 a. With neat sketch explain crank and slotted lever quick return mechanism. **(06 Marks)**

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

c. Draw and explain; (i)Ratchet and pawl mechanism; (ii) Geneva mechanism. **(08 Marks)**

3 A double slider is shown in fig.Q3. The crank OA rotates at constant angular velocity of 10 rad/sec. The links OA, AB and AC are 100 mm, 200 mm and 200 mm long respectively. Draw velocity and acceleration polygons and determine; (i) Velocity and acceleration of each slider; (ii) Angular velocity and angular acceleration of each connecting rod. **(20 Marks)**

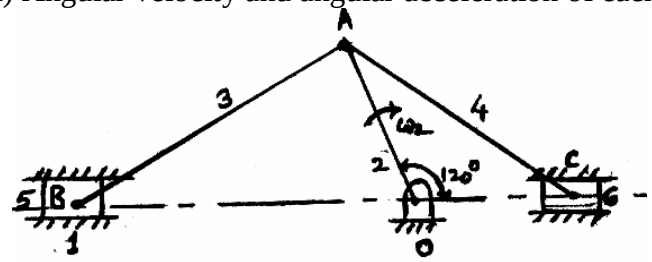

Fig.Q.3

4 a. Locate all the instantaneous centres of slider crank mechanism as shown in fig.Q4(a). The length of crank OB and connecting rod AB are 100 mm and 400 mm respectively. If the crank rotates clockwise with an angular velocity of 10 rad/sec, find; (i) Velocity of slider A; (ii) Angular velocity of connecting rod AB. **(12 Marks)**

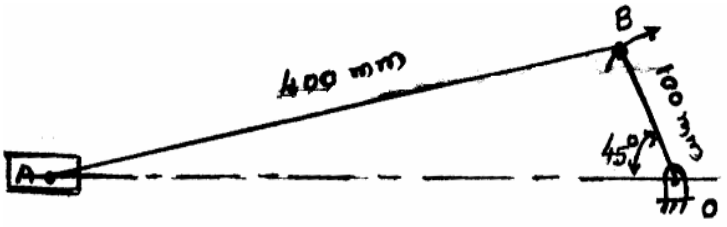

Fig.Q.4(a)

b. The crank of a reciprocating engine is 200 mm long and connecting rod is 700 mm, The crank rotates at 120 rad/sec. Find the velocity and acceleration of piston using Klein's construction, when crank is at 30° from inner dead center. Also find angular velocity and angular acceleration of connecting rod. **(08 Marks)**

PART – B

5 A four bar mechanism is shown in fig.Q5. The crank O_2A rotates at 100 rpm clockwise and an angular acceleration of 12 rad/sec^2 clockwise at an instant when crank makes an angle of 60° with horizontal. Determine the angular velocities and angular accelerations of links 3 & 4 by Raven's method. Also find the velocity and acceleration of point C by assuming AC is parallel to 0_20_4. **(20 Marks)**

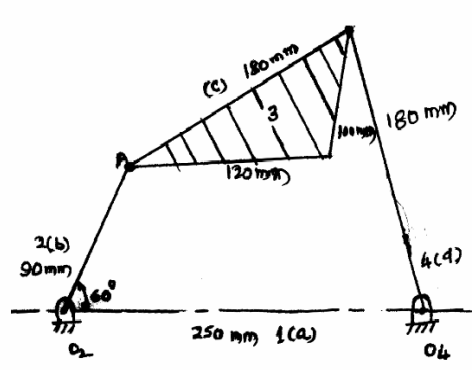

Fig.Q.5

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

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

c. Two 20° involute spur gears mesh externally and give a velocity ratio of 3. Module is 3 mm and addendum is equal to 1.1 module .If the pinion rotates at 120 rpm determine ;
(i) The minimum number of teeth on each wheel to avoid interference; (ii) The number of pairs of teeth in contact. **(08 Marks)**

7 a. Explain compound and reverted gear train. **(06 Marks)**

b. In an epicyclical gear train as shown in fig.Q7(b), the pitch diameter of internally toothed ring D is to be as nearly as possible 228 mm and the module is 4 mm. When the ring is stationery, the spider A which carries three planet wheels C of equal size is to make one revolution for every five revolutions of the driving spindle carrying sun wheel B. Determine the number of teeth for all wheels and exact pitch circle diameter of the ring D using tabular method. If the torque of 30 Nm is applied on sun wheel B, what torque will be required to keep the ring stationery? **(14 Marks)**

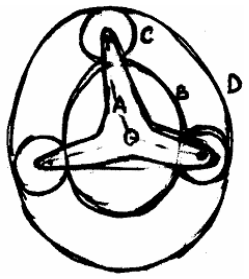

Fig.Q.7(b)

8 A cam with 25 mm as a minimum radius is rotating clockwise at a uniform speed of 100 rpm and has to give the motion to the knife edge follower as defined below ; (i) The follower to move outwards through 25 mm during 120° of cam rotation; (ii) Follower to dwell for the next 60° of cam rotating; (iii) Follower to return to its starting position during next 90° of cam rotation; (iv) Follower to dwell for rest of the cam rotating. The displacement of follower takes place with uniform and equal acceration and retardation both outward and return stroke. Draw the cam profile when follower axis is offset to right side by 10 mm from the axis of cam. Determine the maximum velocity and acceleration during outward and return stroke. **(20 Marks)**

* * * * *