Code No: RT22031 **R13** SET - 1

II B. Tech II Semester Regular/Supply Examinations, April/May - 2016
KINEMATICS OF MACHINERY
(Com. to ME, AME, MM)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

~~~~~~

PART –A

1. a) Describe elliptical trammel. Show that it can describe a true ellipse?
b) What are the limitations of Scott Russell mechanism?
c) Explain Instantaneous center of rotation
d) Define the terms prime circle, pitch circle, base circle of a cam.
e) What is higher pair?
f) Discuss about selection of belt drive. [22]

PART -B

2. a) What is the differences between an element and a kinematic link of a mechanism? How do you classify links of a mechanism?
b) What do you mean by degree of freedom of a kinematic pair? How the pairs are classified? Give examples. [16]

3. a) What is coriolis component of acceleration? How is it determined?
b) Explain the procedure to determine the velocity and acceleration of a slider crank mechanism by Klein's construction. [16]

4. For the inverted slider-crank mechanism shown in Figure 1, find the angular velocity and angular acceleration of the link BC and the sliding velocity of the block on the link BC .The crank OA is 200 mm long and rotates at 30 rad/s in the clockwise direction. OB is 600 mm and angle BOA = 40^0. [16]

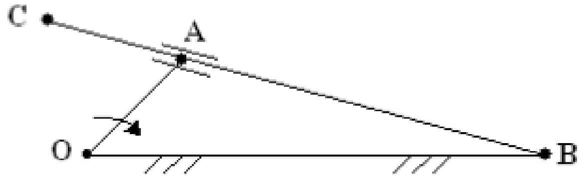

Figure-1
~~~~~~

5. A cam operating a knife - edged follower has the following data:
(i) Follower moves outwards through 40mm during 60^0 of cam rotation.
(ii) Follower dwells for the next 45^0.
(iii) Follower returns of its original position during next 90^0.
(iv) Follower dwells for the rest of the rotation.
The displacement of the follower is to take place with simple harmonic motion during both the outward and return strokes. The least radius of the cam is 50mm. Draw the profile of the cam when the axis of the follower is offset 20mm towards right from the cam axis. If the cam rotates at 300 r.p.m., determine maximum velocity and acceleration of the follower during the outward stroke and the return stroke [16]

6. Two spur gears of 24 teeth and 36 teeth of 8mm module and 20^0 pressure angle are in mesh. Addendum of each gear is 8mm. The teeth are of involute form and the pinion rotates at 450rpm. Determine the velocity of sliding when the pinion is at a radius of 102mm. [16]

7. A shaft runs at 80 rpm and drives another shaft at 150rpm through belt drive. The Diameter of the driving pulley is 600mm. Determine the diameter of the driven pulley in the following cases:
i) Neglecting belt thickness.
ii) Taking belt thickness as 5mm.
iii) Assuming for case (ii) a total slip of 4% and
iv) Assuming for case (ii) a slip of 2% on each pulley. [16]

****

Code No: RT22031 **R13** SET - 2

II B. Tech II Semester Regular/Supply Examinations, April/May - 2016
KINEMATICS OF MACHINERY
(Com. to ME, AME, MM)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**
~~~~~~

PART –A

1. a) Distinguish between a structure and a machine. (4M)
   b) What is a pantograph? (4M)
   c) Explain about Davis Steering gear? (4M)
   d) What are the uses of cam & follower? (4M)
   e) How gears are classified? (3M)
   f) Explain about Epicyclic gear train. (3M)

PART -B

2. Enumerate the inversions of the single slider crank chain. Explain each of them with their applications. [16]

3. In the mechanism shown in Figure 2. The crank OA rotates at 50 rpm and the lengths of the links are OA= 125 mm, AC= 600 mm, QC= 150 mm, QD= 150 mm, CD= 130 mm, BD= 550 mm and OQ= 625 mm. When the angle AOQ= 45 degrees, determine,
(i) The linear acceleration of the slider at B.
(ii) The angular acceleration of the links AC, CQD and BD. [16]

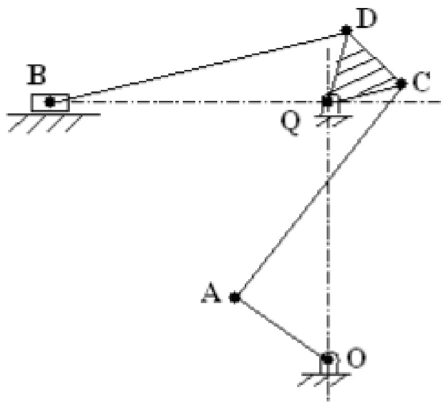

Figure-2

4. a) What is the purpose of a Pantograph? Explain it's working with a sketch
   b) Provide the mathematical proof for working of pantograph. [16]
~~~~~~

Code No: RT22031 **R13** SET - 2

5. a) Derive an expression for displacement, velocity and acceleration of a tangent cam with roller follower. When roller is in contact with flank.

   b) A tangent cam with straight working faces tangential to a base circle of 120mm diameter has a roller follower of 48mm diameter. The line of stroke of the roller follower passes through the axis of the cam. The nose circle radius of the cam is 12mm and the angle between the tangential faces of the cam 90^0 . If the speed of the cam is 180rpm, determine the acceleration of the follower when
   i) During the lift, the roller just leaves the straight flank.
   ii) The roller is at the outer end of its lift, i.e at the top of the nose. [16]

6. a) Explain the common materials used for gears?

   b) A gear wheel having 20 teeth of involute form of module pitch 6 mm and an angle of obliquity of 20^0, drives another wheel of the same dimensions. Calculate the length of the arc of contact if the addendum is one module. If the addendum was altered so that the arc of contact was the maximum possible, what would be the length of this arc and the addendum required for this? [16]

7. In an epicyclic gear train, as shown in figure 3, the number of teeth on wheels A, B, and C are 50, 25, and 52 respectively. If the arm rotates at 420rpm cw, find
   (a) speed of wheel C when A is fixed, and
   (b) speed of wheel A when C is fixed. [16]

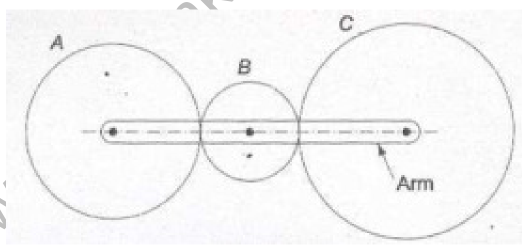

Figure-3

****

Code No: RT22031 **R13** SET - 3

II B. Tech II Semester Regular/Supply Examinations, April/May – 2016
KINEMATICS OF MACHINERY
(Com. to ME, AME, MM)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**
~~~~~~

PART –A

1. a) What is a Kinematic pair? (3M)
   b) Differentiate between Davis and Ackermann steering gears. (3M)
   c) Explain the Application of relative velocity method four bar chain. (4M)
   d) What are the different Types of followers and cams? (4M)
   e) Describe various types of gears used for connecting parallel shafts? (4M)
   f) Explain about automotive deferential. (4M)

PART -B

2. a) What is the difference between quick return motion of crank and slotted lever type and that of whit worth type?
   b) Find the distance between the fixed centers of a Whitworth quick return motion mechanism if the length of driving link is 40mm, return stroke is 150mm and time ratio of cutting to return stroke is 2. [16]

3. Two points A and B, 40 mm apart are to be connected by a pantograph. The motion of A to the motion of B is 13: 7. Find the distance of B from the fixed point O of the pantograph such that the point A moves at least 12.7cm in either direction of line OBA when it is horizontal. Find also the main dimensions of the pantograph [16]

4. The crank OA of a steam engine is 8 cm and the length of the connecting rod AB is 24 cm. The centre of gravity of the rod is at G, 8 cm from the crank pin. The engine speed is 600 rad/min. For the position when the crank makes 45^0 to the horizontal measured from the inner dead centre, fine the velocity and acceleration of the piston. Also fine the acceleration of the centre of gravity of the connecting rod. Use instantaneous centre method. [16]
~~~~~~

5. The following particulars refer to a cam with concave flank, circular nose and roller follower.
Base circle diameter = 80mm,
distance between nose circle and cam axis = 58 mm
Nose radius = 26 mm,
Concave flank radius = 60 mm
Follower roller radius = 10mm, Speed = 10 rad/s
Semi angle of action = 60^0
Determine the velocity and acceleration for the follower when the cam has rotated by 25^0 from the initial position of the rise of the follower [16]

6. a) What is meant by interference in involute gears? Explain
b) Two 20^0 involute spur gears have a module of 10mm. The addendum is one module. The larger gear has 50 teeth and the pinion 13 teeth. Does the interference occur? If it occurs, to what value should the pressure angle be changed to eliminate interference? [16]

7. In a reverted gear train, as shown in figure 4, two shafts A and B are in the same straight line and are geared together through an intermediate parallel shaft C. The gears connecting the shafts A and C have a module of 3mm and those connecting the shafts C and B have a module of 4.5mm. The speed of shaft A is to be 12 times the speed of shaft B. The ratio of each reduction is same. Find suitable number of teeth on all gears. The minimum number of teeth is 18. Also find the exact velocity ratio and the distance of shaft C from A and B. [16]

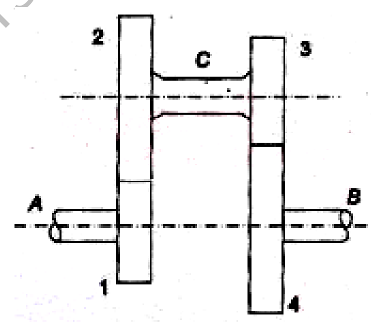

Figure-4

****

Code No: RT22031 **R13** SET - 4

II B. Tech II Semester Regular/Supply Examinations, April/May - 2016
KINEMATICS OF MACHINERY
(Com. to ME, AME, MM)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

~~~~~~

PART –A

1. a) Define ‘Machine’ and ‘Mechanism’. How are these different from each other (4M)
   b) What is a Hooke’s joint? What are its applications? (4M)
   c) State and Explain Kennedy’s theorem as applicable to instantaneous center of rotation of three bodies (4M)
   d) With the help at neat sketches explain the types of cams. (4M)
   e) Give detailed classification of gears. (3M)
   f) Classify gear trains. (3M)

PART -B

2. a) Distinguish between structure and a machine
   b) Explain completely, partially and incompletely constrained motion of a kinematic pair with examples. [16]

3. a) What are the limitations of Scott-Russell mechanism?
   b) Under what conditions scott-Russel mechanism traces out a straight line and an ellipse? [16]

4. For the configuration of the mechanism shown in below Figure 5, Determine the velocity and acceleration of P and the angular velocity and angular acceleration of BP when OA is rotating at 180rpm with an angular acceleration of 50radian/sec^2. P is constrained to move in horizontal direction [16]

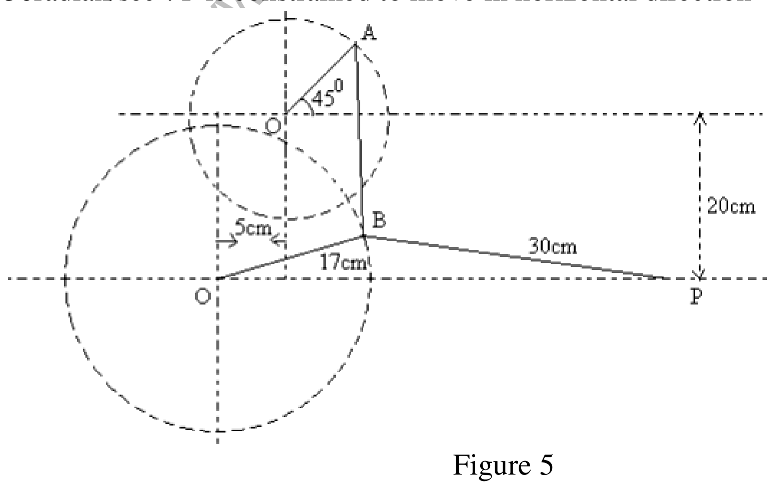

Figure 5
~~~~~~

Code No: RT22031 **R13** SET - 4

5. Draw the profile of a cam with oscillating roller follower for the following motion.
(a) Follower to move outwards through an angular displacement of 20 During 120^0 of cam rotation.
(b) Follower to dwell for 50^0 cam rotation.
(c) Follower to return to its initial position in 90^0 of cam rotation with uniform acceleration and retardation.
(d) Follower to dwell for the remaining period of cam rotation.
The distance between the pivot centre and the roller centre is 130mm and the distance between the pivot centre and cam axis is 150mm. The minimum radius of the cam is 80mm and the diameter of the roller is 50mm [16]

6. a) Define and explain the term (with the help of a neat sketch) path of approach, path of recess and path of contact between two mating gears.
b) Two mating involute spur gears have 28 and 45 teeth and a standard addendum of one module. Find the length of path of contact and length of arc of contact in terms of module when pressure angle is 20^0. [16]

7. An open belt drive connects two pulleys 1.5m and 0.5m diameter on parallel shafts 3.5m apart. The belt has a mass of 1 kg/m length and the maximum tension in the belt is not to exceed 2kN. The 1.5m pulley, which is the driver, runs at 250 rpm. Due to belt slip, the velocity of the driven shaft is only 730rpm. If the coefficient of friction between the belt and the pulley is 0.25, find
(a) torque on each shaft
(b) Power transmitted,
(c) power lost in friction,
(d) efficiency of the drive [16]

****