

Code No: RT22031

R13

SET - 1

II B. Tech II Semester Regular/Supplementary Examinations, April/May-2017

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 Kinematic Chain (3M)
- b) What are the applications of inversion of double slider crank chain mechanism? (3M)
- c) Explain Klein's construction (4M)
- d) Compare Roller and mushroom follower of a cam. (4M)
- e) What is bevel gearing? Mention its types. (4M)
- f) What are the belt materials? (4M)

PART -B

2. a) Explain different types of Links. (8M)
- b) Classify and explain the Kinematic pairs. (8M)
3. Explain with neat sketch about (16M)
 - (a) Robert's mechanism
 - (b) Scott Russell Mechanism
4. Locate all instantaneous centers of the slider crank mechanism; the length of crank OB and Connecting rod AB are 125 mm and 500 mm respectively. The crank speed is 600 rpm clockwise. When the crank has turned 45° from the IDC. Determine (i) velocity of slider 'A' (ii) Angular Velocity of connecting rod 'AB'. (16M)
5. Draw the profile of a cam operating a roller reciprocating follower and with the following data: (16M)
Minimum radius of cam = 25 mm; lift = 30 mm; Roller diameter = 15 mm. The cam lifts the follower for 120° with SHM, followed by a dwell period of 30° . Then the follower lowers down during 150° of cam rotation with uniform acceleration and retardation followed by a dwell period. If the cam rotates at a uniform speed of 150 RPM. Calculate the maximum velocity and acceleration of follower during the descent period.

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PART -A

1. a) What are the important applications of a single slider crank mechanism? (3M)
- b) Explain Scott Russel mechanism with necessary equation (3M)
- c) Explain coriolis component of equation and determine its magnitude of direction (4M)
- d) What are the classifications of cam based on the follower movement? (4M)
- e) What are the advantages and limitations of gear drive? Write any two. (4M)
- f) What is the centrifugal effect on belts? (4M)

PART -B

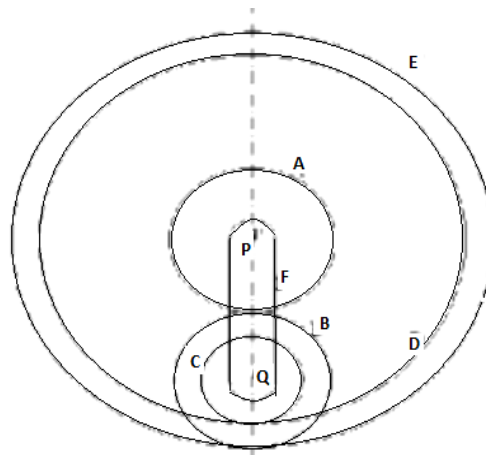
2. a) Explain any two inversion of four bar chain. (8M)
- b) Explain the first inversion of Single Slider Crank Chain. (8M)
3. a) Sketch a pantograph, explain its working and show that it can be used to reproduce to an enlarged scale a given figure? (8M)
- b) Explain with neat sketch about Hart mechanism (8M)
4. In a slider crank mechanism, the length of the crank and the connecting rod are 100 mm and 400 mm respectively./ The crank [position is 45° from IDC, the crank shaft speed is 600 r.p.m. clockwise. Using analytical method Determine (i)Velocity and acceleration of the slider, and (ii) Angular velocity and angular acceleration of the connecting rod. (16M)
5. Draw the profile of a cam operating a Knife-edged follower from the following data: (16M)
 - (a) Follower to move outward through 40 mm during 60° of a cam rotation;
 - (b) Follower to dwell for the next 45°
 - (c) Follower to return its original position during next 90°
 - (d) Follower to dwell for the rest of cam 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. If the cam rotates at 300 r.p.m., determine the maximum velocity and acceleration of the follower during the outward stroke and return stroke.

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SET - 2

6. a) Two 20° involute spur gears have a module of 10 mm. The addendum is one module. The larger gear has 50 teeth and pinions 13 teeth. Does the interference occur? If it occurs, to what value should the pressure angle be changed to eliminate interference? (8M)
- b) Two mating involute spur gears 20° pressure angle have a gear ratio of 2. the number of teeth on the pinion is 20 and its speed is 250 rpm. The module pitch of the teeth is 12 mm. if the addendum on each wheel recess on each side are half the maximum possible length each, find (1) the addendum for pinion and gear wheel (2) the length of arc of contact (3) the maximum velocity of sliding during approach and recess. Assume pinion to be driver (8M)
7. A compound epicyclic gear is shown in figure. The gears A, D and E are free to rotate on axis P. The compound gears B and C rotate together on the axis Q at the end of arm F. All the gears have equal pitch. The number of external teeth on gears, A B and C are 18, 45 and 21 respectively. The gears D and E are annulus gears. The gear A rotates at 100 rpm in anticlockwise direction and the gear D rotates at 450 rpm clockwise. Find the speed and direction of the arm and the gear E. (16M)



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**PART -A**

1. a) Define Degrees of Freedom. (3M)
- b) Explain Hooke's joint with necessary derivation. (3M)
- c) What are the important concepts in velocity analysis? (4M)
- d) Define undercutting in cam. How is occurs? (4M)
- e) Define cycloidal tooth profile and involute tooth profile. (4M)
- f) Write down the disadvantage of V-belt drive over flat belt? (4M)

**PART -B**

2. a) Explain first inversion of Double Slider crank chain. (8M)
- b) Explain third inversion of double slider crank chain. (8M)
3. What are straight-line mechanisms? Sketch the Peaucellier straight-line motion mechanism and prove that the generating point moves straight line in (16M)
4. a) Derive the expressions for Velocity and acceleration of piston in reciprocating steam engine mechanism with neat sketch (8M)
- b) Derive the expression for Coriolis component of acceleration with neat sketch (8M)
5. A tangent cam to drive a roller follower through a total lift of 12.5 mm for a cam rotation of 75°. The cam speed is 600 rpm. The distance between cam centre and follower centre at full lift is 45 mm and the roller is 20 mm in diameter. Find the cam proportions and plot displacement, velocity and acceleration for one full cycle (16M)
6. a) A pair of spur gear with involute teeth is to give a gear ratio of 4:1. The arc of approach is not be less than the circular pitch and the smaller wheel is the driver. The angle of pressure is 14.5 What is the least number of teeth can be used on each wheel? What is the addendum of the wheel in terms of circular pitch? (8M)
- b) A pair 20° full depth involute spur gear having 30 and 50 teeth respectively module 4 mm arc in mesh, the smaller gear rotates at 1000 rpm. Determine (8M)
  - (i) Sliding velocities at engagement and disengagement of a pair of teeth and
  - (ii) Contact ratio.
7. The arm of an epicyclic gear train rotates at 100 rpm in the anticlock wise direction. The arm carries two wheels A and B having 36 and 45 teeth respectively. The wheel A is fixed and the arm rotates about the centre of wheel A. Find the speed of wheel B. What will be the speed of B, if the wheel A instead of being fixed, makes 200 rpm (clockwise). (16M)

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2. Answer **ALL** the question in **Part-A**  
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**PART -A**

1. a) Define Kinematic Pair (3M)
- b) Derive the condition for correct steering. (3M)
- c) What are the methods for determining the velocity of a body? (4M)
- d) Compare Roller and mushroom follower of a cam. (4M)
- e) What is the externally applied torques used to keep the gear train in equilibrium? (4M)
- f) What is the centrifugal effect on belts? (4M)

**PART -B**

2. a) Explain the offset slider crank mechanism. (8M)
- b) Explain Straight line mechanism with neat sketch (8M)
3. Explain Ackermans steering gear mechanism with neat sketch (16M)
4. In a slider crank mechanism, the length of the crank and the connecting rod are 100 mm and 400 mm respectively. The crank [position is  $45^\circ$  from IDC, the crank shaft speed is 600 r.p.m. clockwise. Using analytical method Determine (a) Velocity and acceleration of the slider, and (b) Angular velocity and angular acceleration of the connecting rod. (16M)
5. Construct a tangent cam and mention the important terminologies on it. Also derive the expression for displacement, velocity, acceleration of a reciprocating roller follower when the roller has contact with the nose. (16M)
6. a) A pair of spur gear with involute teeth is to give a gear ratio of 4:1. The arc of approach is not be less than the circular pitch and the smaller wheel is the driver. The angle of pressure is  $14.5^\circ$  What is the least number of teeth can be used on each wheel? What is the addendum of the wheel in terms of circular pitch? (8M)
- b) A pair  $20^\circ$  full depth involute spur gear having 30 and 50 teeth respectively module 4 mm arc in mesh, the smaller gear rotates at 1000 rpm. Determine (a) Sliding velocities at engagement and disengagement of a pair of teeth and (b) Contact ratio. (8M)
7. In an epicyclic gear train the internal wheels A and B and compound wheels C and D rotate independently about axis O. The wheels E and F rotate on pins fixed to the arm G. E gears with A and C. Wheel F gear with B and D. All the wheels have the same module and the number of teeth are:  $T_C = 28$   $T_D = 26$ ;  $T_E = T_F = 18$ . (16M)  
(1) Sketch the arrangement, (2) Find the number of teeth on A and B, (3) If the arm G makes 100 rpm clockwise and A is fixed, find the speed of B, and (4) If the arm G makes 100 rpm clockwise and wheel A makes 10 rpm counter clockwise; Find the speed of wheel B.