Code No: RR312403 | RR | SET-1

**B. Tech III Year I Semester Examinations, December - 2011**
**KINEMATICS OF MACHINERY**
**(AUTOMOBILE ENGINEERING)**

**Time: 3 hours** **Max. Marks: 80**

**Answer any five questions**
**All questions carry equal marks**
**---**

1.a) Define "Inversion" of a mechanism. Describe how the Pantograph can be considered as an inversion of four bar chain.

b) In a crank and slotted lever mechanism, the driving crank is 50 mm long, and the time ratio of cutting stroke to return stroke is 1.8. If the length of working stroke of the ram is 120 mm, find the distance between the fixed centres, and the slotted lever length. [8+8]

2. A double slider crank mechanism is shown in the figure 1 below. The crank 2 rotates at a constant angular velocity of 10 rad/s. $O_2A$ = 100mm; AB = AC = 200mm.

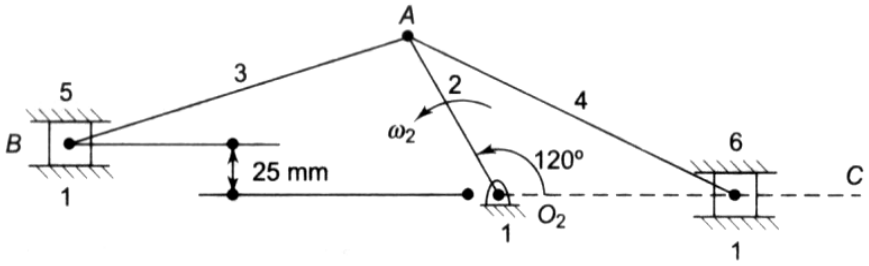


Figure-1

Determine the velocity of each slider using the ***Instantaneous centre method***. [16]

3.a) A vehicle is moving in a straight path. The distance between the pivots of the front axle of a Davis steering gear is 1.2 m and the wheel base is 2.7 m. Find the inclination of the track arm to the longitudinal axis of the vehicle.

b) Prove that the ratio of angular velocities of the driven and driving shafts for a Hook's joint is given by: $\frac{\omega_2}{\omega_1} = \frac{\cos \alpha}{1 - \cos^2 \theta \, . \, \sin^2 \alpha}$

Where α = angle of inclination of the driven shaft with the driving shaft, and θ is the angle turned by the driving shaft at any instant. [6+10]

4. The crank and connecting rod of a reciprocating engine are 125 mm and 500 mm long respectively. The crank makes an angle of $40^0$ with the inner dead centre, and revolves at a uniform speed of 250 rpm. Find the acceleration of the slider by Klein's construction method. [16]

5. A roller of diameter 8 mm is moved outwards through 30 mm during $180^0$ of a cam rotation with cycloidal motion. The roller dwells for $20^0$ of cam rotation, and returns with uniform velocity during the remaining $160^0$ of the cam rotation. The base circle diameter of the cam is 28 mm, and the axis of the follower is offset by 6 mm to the left. Draw the profile of the cam, and determine the maximum

velocity and acceleration of the follower during the outstroke if the cam rotates at 1500 rpm counter clockwise. [16]

6.a) If the angle of obliquity of a pair of gear wheels is $20^0$, and the arc of approach or recess is not less than the pitch, what will be the least number of teeth on the pinion?

b) Derive the expression for the path of contact between two mating spur gears. [8+8]

7. 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 the different wheels are such that the planet C rotates at $\boldsymbol{1/5^{th}}$ of the speed of sun wheel S. If the wheels S, E, and P have 16, 64, and 24 teeth respectively, find the torque needed to keep the internal gear stationary. The driving torque on the sun wheel S is 100 Nm. [16]

8. Write short notes on:
a) Successfully constrained motion with examples
b) Double Hooke's joint
c) Tchebicheff mechanism. [16]

**--ooOoo--**

Code No: RR312403 | RR | SET-2

**B. Tech III Year I Semester Examinations, December - 2011**
**KINEMATICS OF MACHINERY**
**(AUTOMOBILE ENGINEERING)**

**Time: 3 hours** **Max. Marks: 80**

**Answer any five questions**
**All questions carry equal marks**
**---**

1.a) A vehicle is moving in a straight path. The distance between the pivots of the front axle of a Davis steering gear is 1.2 m and the wheel base is 2.7 m. Find the inclination of the track arm to the longitudinal axis of the vehicle.

b) Prove that the ratio of angular velocities of the driven and driving shafts for a Hook's joint is given by: $\frac{\omega_2}{\omega_1} = \frac{\cos \alpha}{1 - \cos^2 \theta \cdot \sin^2 \alpha}$

Where $\alpha$ = angle of inclination of the driven shaft with the driving shaft, and $\theta$ is the angle turned by the driving shaft at any instant. [6+10]

2. The crank and connecting rod of a reciprocating engine are 125 mm and 500 mm long respectively. The crank makes an angle of $40^0$ with the inner dead centre, and revolves at a uniform speed of 250 rpm. Find the acceleration of the slider by Klein's construction method. [16]

3. A roller of diameter 8 mm is moved outwards through 30 mm during $180^0$ of a cam rotation with cycloidal motion. The roller dwells for $20^0$ of cam rotation, and returns with uniform velocity during the remaining $160^0$ of the cam rotation. The base circle diameter of the cam is 28 mm, and the axis of the follower is offset by 6 mm to the left. Draw the profile of the cam, and determine the maximum velocity and acceleration of the follower during the outstroke if the cam rotates at 1500 rpm counter clockwise. [16]

4.a) If the angle of obliquity of a pair of gear wheels is $20^0$, and the arc of approach or recess is not less than the pitch, what will be the least number of teeth on the pinion?

b) Derive the expression for the path of contact between two mating spur gears. [8+8]

5. 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 the different wheels are such that the planet C rotates at ***1/5$^{th}$*** of the speed of sun wheel S. If the wheels S, E, and P have 16, 64, and 24 teeth respectively, find the torque needed to keep the internal gear stationary. The driving torque on the sun wheel S is 100 Nm. [16]

6. Write short notes on:
a) Successfully constrained motion with examples
b) Double Hooke's joint
c) Tchebicheff mechanism. [16]

7.a) Define “Inversion” of a mechanism. Describe how the Pantograph can be considered as an inversion of four bar chain.

b) In a crank and slotted lever mechanism, the driving crank is 50 mm long, and the time ratio of cutting stroke to return stroke is 1.8. If the length of working stroke of the ram is 120 mm, find the distance between the fixed centres, and the slotted lever length. [8+8]

8. A double slider crank mechanism is shown in the figure 1 below. The crank 2 rotates at a constant angular velocity of 10 rad/s. $O_2A$ = 100mm; AB = AC = 200mm.

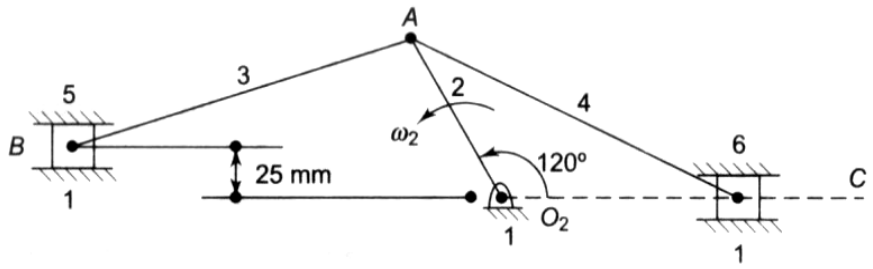


Figure-1

Determine the velocity of each slider using the ***Instantaneous centre method***. [16]

**--ooOoo--**

Code No: RR312403 | RR | SET-3

**B. Tech III Year I Semester Examinations, December - 2011**
**KINEMATICS OF MACHINERY**
**(AUTOMOBILE ENGINEERING)**

**Time: 3 hours** **Max. Marks: 80**

**Answer any five questions**
**All questions carry equal marks**
**---**

1. A roller of diameter 8 mm is moved outwards through 30 mm during $180^0$ of a cam rotation with cycloidal motion. The roller dwells for $20^0$ of cam rotation, and returns with uniform velocity during the remaining $160^0$ of the cam rotation. The base circle diameter of the cam is 28 mm, and the axis of the follower is offset by 6 mm to the left. Draw the profile of the cam, and determine the maximum velocity and acceleration of the follower during the outstroke if the cam rotates at 1500 rpm counter clockwise. [16]

2.a) If the angle of obliquity of a pair of gear wheels is $20^0$, and the arc of approach or recess is not less than the pitch, what will be the least number of teeth on the pinion?

b) Derive the expression for the path of contact between two mating spur gears. [8+8]

3. 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 the different wheels are such that the planet C rotates at ***1/5th*** of the speed of sun wheel S. If the wheels S, E, and P have 16, 64, and 24 teeth respectively, find the torque needed to keep the internal gear stationary. The driving torque on the sun wheel S is 100 Nm. [16]

4. Write short notes on: a) Successfully constrained motion with examples
b) Double Hooke's joint c) Tchebicheff mechanism. [16]

5.a) Define "Inversion" of a mechanism. Describe how the Pantograph can be considered as an inversion of four bar chain.

b) In a crank and slotted lever mechanism, the driving crank is 50 mm long, and the time ratio of cutting stroke to return stroke is 1.8. If the length of working stroke of the ram is 120 mm, find the distance between the fixed centres, and the slotted lever length. [8+8]

6. A double slider crank mechanism is shown in the figure 1 below. The crank 2 rotates at a constant angular velocity of 10 rad/s. $O_2A$ = 100mm; AB = AC = 200mm.

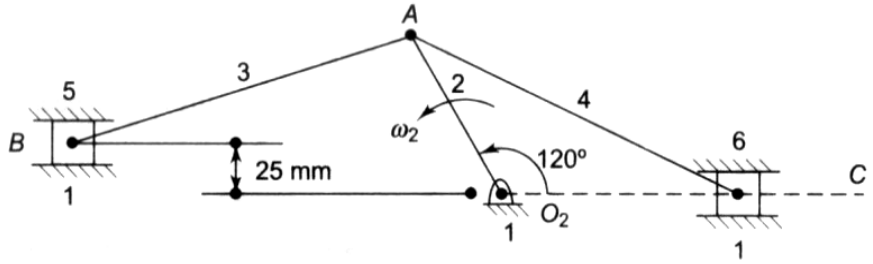


Figure-1

Determine the velocity of each slider using the ***Instantaneous centre method***. [16]

7.a) A vehicle is moving in a straight path. The distance between the pivots of the front axle of a Davis steering gear is 1.2 m and the wheel base is 2.7 m. Find the inclination of the track arm to the longitudinal axis of the vehicle.

b) Prove that the ratio of angular velocities of the driven and driving shafts for a Hook's joint is given by: $\frac{\omega_2}{\omega_1} = \frac{\cos \alpha}{1 - \cos^2 \theta \, . \, \sin^2 \alpha}$

Where $\alpha$ = angle of inclination of the driven shaft with the driving shaft, and $\theta$ is the angle turned by the driving shaft at any instant. [6+10]

8. The crank and connecting rod of a reciprocating engine are 125 mm and 500 mm long respectively. The crank makes an angle of $40^0$ with the inner dead centre, and revolves at a uniform speed of 250 rpm. Find the acceleration of the slider by Klein's construction method. [16]

**--ooOoo--**

Code No: RR312403 | RR | SET-4

**B. Tech III Year I Semester Examinations, December - 2011**
**KINEMATICS OF MACHINERY**
**(AUTOMOBILE ENGINEERING)**

**Time: 3 hours** **Max. Marks: 80**

**Answer any five questions**
**All questions carry equal marks**
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1. 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 the different wheels are such that the planet C rotates at ***1/5$^{th}$*** of the speed of sun wheel S. If the wheels S, E, and P have 16, 64, and 24 teeth respectively, find the torque needed to keep the internal gear stationary. The driving torque on the sun wheel S is 100 Nm. [16]

2. Write short notes on:
   a) Successfully constrained motion with examples
   b) Double Hooke's joint
   c) Tchebicheff mechanism. [16]

3.a) Define "Inversion" of a mechanism. Describe how the Pantograph can be considered as an inversion of four bar chain.

b) In a crank and slotted lever mechanism, the driving crank is 50 mm long, and the time ratio of cutting stroke to return stroke is 1.8. If the length of working stroke of the ram is 120 mm, find the distance between the fixed centres, and the slotted lever length. [8+8]

4. A double slider crank mechanism is shown in the figure 1 below. The crank 2 rotates at a constant angular velocity of 10 rad/s. $O_2A$ = 100mm; AB = AC = 200mm.

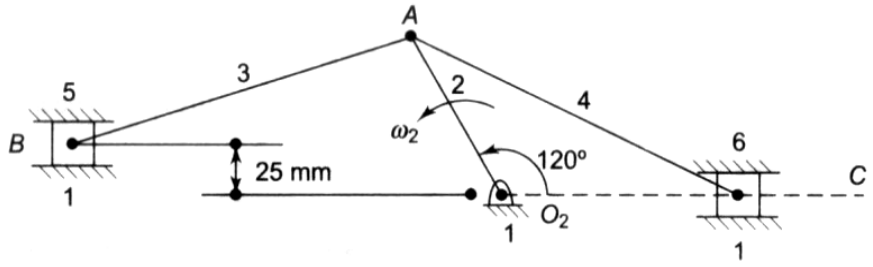


Figure-1

Determine the velocity of each slider using the ***Instantaneous centre method***. [16]

5.a) A vehicle is moving in a straight path. The distance between the pivots of the front axle of a Davis steering gear is 1.2 m and the wheel base is 2.7 m. Find the inclination of the track arm to the longitudinal axis of the vehicle.

b) Prove that the ratio of angular velocities of the driven and driving shafts for a Hook's joint is given by: $\frac{\omega_2}{\omega_1} = \frac{\cos\alpha}{1 - \cos^2\theta \cdot \sin^2\alpha}$

Where α = angle of inclination of the driven shaft with the driving shaft, and θ is the angle turned by the driving shaft at any instant. [6+10]

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8.a) If the angle of obliquity of a pair of gear wheels is $20^0$, and the arc of approach or recess is not less than the pitch, what will be the least number of teeth on the pinion?

b) Derive the expression for the path of contact between two mating spur gears. [8+8]

**--ooOoo--**