Total Printed Pages : 3

Roll No. .....

E-3013

B. E. IV Semester (Main & Re-Exam.) Examination – July, 2013

KINEMATICS AND MECHANISMS

Branch : Mechanical

Time : Three Hours] *[Maximum Marks : 75/50*
[Minimum Marks : 30/20

Note : Attempt all the questions of **Section-A**, *four* from **Section-B** and *three* questions from **Section-C**.

SECTION – A 1 × 10 = 10

(Objective Type Questions) 1.5 × 10 = 15

1. The degree of freedom of a superstructure is : 1.5

   (a) 0 ✓ (b) Positive

   (c) Negative (d) None

2. Ball and Socket joint is an example of : 1.5

   (a) Rolling Pair (b) Turning Pair

   (c) Screw Pair (d) Spherical Pair ✓

3. The number of instantaneous centre is given by : 1.5

   (a) $\frac{n(n+1)}{2}$ (b) $n(n-1)/2$

   (c) $n(n-1)^2/2$ (d) $n + 1/2$

4. In a reciprocating steam engine. Which of the following from a Kinematic link : 1.5

   (a) Cylinder and Piston (b) Piston rod and Connecting rod

   (c) Crank Shaft and Flywheel (d) Flywheel and engine Frame

5. The Size of cam depends upon : 1.5

   (a) Base Circle (b) Pitch Circle

   (c) Prime Circle (d) Pitch Curve

P T O

6. The ratio of the maximum fluctuation of speed to the mean speed is called .....

7. The cam follower used in automobile engine is .....

8. Crank shaft and bearing constitute a ..... pair.

9. In a kinematic chain, a ternary joint is equivalent to ..... binary joint.

10. Universal joint is an example of .....

$4 \times 4 = 16$

SECTION – B

(Short Answer Type)

$6 \times 4 = 24$

1. What is a machine ? Giving examples, different between a machine and a structure. 6

2. Explain the term Kinematic link Give the classification of Kinematic link. 6

3. Write a short note on primary and secondary balancing. 6

4. Explain the term : 6

   (a) Lower pair

   (b) Higher pair

   (c) Kinematic pair

5. Draw the acceleration diagram of a Slider Crank mechanism. 6

6. Write notes on complete and incomplete constraints in lower and higher pair, illustrating your answer with neat sketches. 6

$8 \times 3 = 24$

SECTION – C

(Long Answer Type)

$12 \times 3 = 36$

1. What is the classification of degree of freedom of Kinematic chain. When it function as a mechanism ? Give example. 12

2. Sketch and describe the four bar chain mechanism. Why it is considered to be the basic chain ? 12

3. Explain how the velocities of a slider and connecting rod are obtained in a Slider Crank mechanism. 12

4. What is the function of a Flywheel ? Explain the terms "Fluctuation of energy" and "Fluctuation of speed" as applied of Flywheels. 12

5. Explain clearly the terms "static balancing" and "dynamic balancing", state the necessary condition to achieve them. 12

Total Printed Pages : 4 **Roll No.** .....

E-3422

B. E. IV Semester (Main & Re-Exam), 2014

KINEMETICS & MECHANICS

Branch : ME–IV Sem

Time : Three Hours] ***Max. Marks : 75/50***

[Min. Marks : 30/20

Note : Attempt ***all*** the questions of ***Section-A, four*** from ***Section-B*** and ***three*** questions from ***Section-C.***

SECTION – A $1 \times 10 = 10$ (50)

(Objective Type Questions) $1.5 \times 10 = 15$ (75)

1. The coefficient of restitution for inelastic bodies is :

(a) zero (b) between zero and one

(c) one (d) more than one

2. The frequency of oscillation of a torsional pendulum is :

(a) $\frac{2\pi K_G}{r}\sqrt{\frac{g}{l}}$ (b) $\frac{r}{2\pi K_G}\sqrt{\frac{g}{l}}$

(c) $\frac{2\pi K_G}{r}\sqrt{\frac{l}{g}}$ (d) $\frac{r}{2\pi K_G}\sqrt{\frac{l}{g}}$

3. The relationship between the number of pairs (p) forming a kinematic chain and the number of links (l) is :

(a) $l = 2p - 2$ (b) $l = 2p - 3$

(c) $l = 2p - 4$ (d) $l = 2p - 5$

P. T. O.

4. A kinematic chain is known as a mechanism when :

(a) none of the links is fixed
(b) one of the link is fixed
(c) two of the links are fixed
(d) all the links are fixed

5. According to Aronhold Kennedy's theorem, if three bodies move relatively to each other, their instantaneous centres will lie on a :

(a) Straight line
(b) Parabolic curve
(c) Ellipse
(d) Cubic

6. When a slider moves on a fixed link having curved surface, their instantaneous centre lies :

(a) On their point of contact
(b) At the centre of curvature
(c) At the centre of circle
(d) At the pin joint

7. The coriolis component of acceleration is taken into account for :

(a) Slider Crank mechanism
(b) Four bar chain mechanism
(c) Quick return motion mechanism
(d) None of these

8. The efficiency of a screw jack is maximum, when :

(a) $d = 45° + \frac{\phi}{2}$
(b) $d = 45° - \frac{\phi}{2}$
(c) $d = 90° + \phi$
(d) $d = 90° - \phi$

9. The contact ratio for gears is :

(a) Zero
(b) Less than one
(c) One
(d) Greater than one

10. The cam follower generally used in automobile engines is :

(a) Knife edge follower
(b) Flat faced follower
(c) spherical faced follower
(d) roller follower

SECTION – B

$4 \times 4 = 16$ (50)

(Short Answer Type Questions)

$6 \times 4 = 24$ (75)

1. Differentiate between :

   (a) Lower and higher pair

   (b) Turning and screw pairs

   (c) Rolling and spherical pairs

   (d) Closed and unclosed pairs

2. Define degrees of freedom of a mechanism. Explain Gruebler's criterion for degrees of freedom for planar mechanism.

3. Explain with sketches the different types of cams and followers.

4. A four bar mechanism has the following :

   dimensions : DA = 300 mm;

   CB = AB = 360 mm; DC = 600 mm.

   The link DC is fixed and the angle ADC is 60°. The driving link DA rotates uniformly at a speed of 100 rpm clockwise and the constant driving torque has the magnitude of 50 N-m. Determine the velocity of the point B and angular velocity of the driven link CB. Also find the actual mechanical advantage and the resisting torque if the efficiency of the mechanism is 70 percent.

5. Define the terms 'coefficient of fluctuation of energy' and 'coefficient of fluctuation of speed' in the case of flywheels. Prove that the maximum fluctuation of energy is $\Delta E = E \cdot 2Cs$ where E = mean kinematic energy of flywheel, Cs = coefficient of fluctuation of speed.

6. What is the difference between piston effort, crank effort and crank-pin effort ?

SECTION – C

$8 \times 3 = 24$ (50)

(Long Answer Type Questions)

$12 \times 3 = 36$ (75)

1. What do you understand by movability of a mechanism ? State Grashof's law. Design a four-bar mechanism to coordinate three positions of the input and output links given by :

$$\theta_1 = 25^\circ,\ \phi_1 = 30^\circ;\ \theta_2 = 35^\circ,\ \phi_2 = 40^\circ,\ \theta_3 = 50^\circ,\ \phi_3 = 60^\circ$$

2. Derive the following expressions, for an uncoupled two cylinder locomotive engine :

   (a) Variation in tractive force,

   (b) Swaying couple,

   (c) Hammer blow.

3. Four masses A, B, C and D revolve at equal radii and are equally spaced along a shaft. The mass B is 7 Kg and radii of C and D makes angles of 90° and 240° respectively with the radius of B. Find the magnitude of the masses A, C and D and the angular position of A so that the system may be completely balanced.

4. Sketch and describe the working of two different types of quick return mechanisms. Give examples of their applications. Derive an expression for the ratio of times taken in forward and return stroke for one of these mechanisms.

5. A cam drives a flat reciprocating follower in the following manner :

   During first 120° rotation of the cam, follower moves outwards through a distance of 20 mm with simple harmonic motion. The follower dwells during next 30° of cam rotation. During next 120° of cam rotation, the follower moves inwards with simple harmonic motion. The follower dwells for the next 90° of cam rotation.

   The minimum radius of the cam is 25 mm. Draw the profile of the cam.

(Printed Pages 4)

Roll No. .....

E-64

B.E. IV Semester (Main & Re. Exam.) May 2015

Kinematics and Mechanisms

Mech. Engg.

Time: Three Hours] *[Max. Marks : 75*

[Min. Marks : 30

Note : Attempt all the questions of **Section-A, Four** from **Section-B** and **three** questions from **Section-C.**

Section - A

(Objective Type Questions)

Note : This section will contain **ten** objective type questions. The may be fill in the blanks, True/False or Multiple Choice Type. 1.5×10=15

1. In a kinematics pair, when the elements have surface contact while in motion, it is a : 1.5

   (a) Higher pair

   (b) Closed pair

   (c) Lower pair

   (d) Unclosed pair

2. Which of the following is an inversion of double slider crank chain? 1.5

   (a) With worth quick return mechanism

   (b) Reciprocating compressor

   (c) Scotch yoke

   (d) Rotary Engine

P.T.O.

3. The total number of Instantaneous centres of a Mechanism having 'n' links is : 1,5

(a) $\frac{n(n-1)}{2}$ (b) $\frac{(n-1)}{2}$

(c) $\frac{n(n+1)}{2}$ (d) $\frac{(n+1)}{2}$

4. The linear velocity of a point B on link rotating at an angular velocity ω relative to another point A on the same link is : 1.5

(a) ω^2. AB (b) ω.AB

(c) ω/AB (d) $\omega.(AB)^2$

5. A Hart Mechanism uses : 1.5

(a) 4 links (b) 6 links

(c) 8 links (d) 10 links

6. In a dynamically- equivalent system, a uniformly distributed mass is divided in to_____ Point masses. 1.5

(a) Two (b) Three

(c) Four (d) Five

7. The size of the cam depends on : 1.5

(a) Pitch Circle (b) Prime Circle

(c) Base Circle (d) Pitch Curve

8. In Reciprocating engines, the primary unbalanced force 1.5

(a) Cannot be balanced (b) Can be partially balanced

(c) Can be fully balanced (d) None of these

9. The angle between axis of the follower and normal to pitch curve is known as : 1.5

(a) Base angle (b) Pressure angle

(c) Pitch angle (d) Prime angle

10. The Maximum fluctuation of energy in a flywheel is equal to : 1.5

(a) $I\omega(\omega_1-\omega_2)$ (b) $I\omega^2k$

(c) 2KE (d) All

Section - B

(Short Answer Type)

Note : This section will contain **six** questions. Students will ask to attempt any **four** questions out of six questions. 6×4=24

1. What are quick-return Mechanism? Where are they used? Discuss the functioning of any one of them. 6
2. In a four link mechanism, The crank AB rotates at 36 rad/s. The lengths of the links are : AB=200 mm, BC=400 mm, CD=450 mm and AD=600 mm. AD is the fixed link. At the instant when AB is at right angle to AD, determine the velocity of 6
   (i) The mid point of link BC,
   (ii) a point on link CD, 100 mm from the pin connecting the links CD and AD.
3. Explain the procedure to construct Klein's construction to determine the velocity and acceleration of a slider crank Mechanism. 6
4. Describe the graphical method of considering the inertia of the connecting rod of reciprocating engine. 6
5. Deduce expression for variation in tractive force and hammer blow for an uncoupled two cylinder locomotive engine. 6
6. Define : Base Circle, Pitch Circle, Trace Point, Pitch curve, pressure angle and pitch point. 6

Section-C

(Short Answer Type)

Note : This section will contain **five** questions. Students will ask to attempt any **three** questions out of five questions. 12×3=36

1. The turning moment curve of an engine is represented by the equation. 12

   $T=(20{,}000+9500 \sin 2\theta - 5700 \cos 2\theta)$ N.m

   Where θ is an angle moved by the crank from the inner dead centre. If the Resistance Torque is constant Find.

   (i) Power developed by the engine.

   (ii) Moment of Inertia of flywheel in kgm^2 if the total fluctuation of speed is not to execd 1% of mean speed at 180 rpm.

   (iii) Angular acceleration of flywheel when crank has turn threw 45° from IDC.

2. A rotating shaft carries four radial masses A=8kg B=7 kg; C=6kg and D=5kg. The mass centres are 30 mm, 40 mm, 40 mm and 50 mm respectively from the axis of the shaft. The axial distance between planes of rotation of A and B is 400 mm and between B and C is 500 mm. The masses A and C are at right angles to each other. Find for complete Balance

(a) The angle of masses 'B' & 'D' from mass 'A'

(b) Axial distance the planes of rotation of C and D

(c) The magnitude of mass 'B' 12

3. Layout the profile of a 'Cam' so that the follower 12

- is moved outwards through 30mm during 180° of cam rotation with cycloidal motion.
- dwells for 20° of the cam rotation
- returns with uniform velocity during the remaining 160° of the cam rotation.

The base circle diameter of the cam is 28 mm and roller diameter 8 mm. The axis of the follower is offset by 6 mm to the left. What will be the maximum velocity and acceleration of the follower during the out stroke if the cam rotates at 1500 rpm counter clock wise.

4. A horizontal engine with crank pin radius of 300 mm has the mass of reciprocating parts as 250 kg. The difference between the pressures at driving and back end the piston is 0.35 N/mm^2. when crank has travelled 60 from IDC. The cylindrical bore is 0.5 m and connecting rod length between the centres is 1.2 m. The engine runs at 250 rpm. neglecting the effect of piston rod diameter. Calculate.

(a) Pressure on side of cylinder 12

(b) Thrust on connecting rod

(c) Tangential force on the crank pin.

(d) Turning moment on the crank shaft.

5. Describe briefly the functions of elliptical trammel and scotch yoke. 12

Total Printed Pages : 4

IV Sem

Roll No. .....

E-225

B. E. IV Semester (Main & Re-Exam) Examination – May, 2016

KINEMATICS & MECHANISM

Branch : Mech. Engg.

Time : Three Hours] *[Max. Marks : 75*

[Min. Marks : 30

Note : Attempt ***all*** the questions from ***Section – A, four*** questions from ***Section – B*** and ***three*** questions from ***Section – C .***

SECTION – A [Marks : 1.5 × 10 = 15

(Objective Type Question)

Note : Attempt ***all*** questions.

1. A ball and a socket joint forms a :

(a) Turning pair

(b) Rolling pair

(c) Sliding pair

(d) Spherical pair

2. A kinematic chain is known as a mechanism when :

(a) None of the links is fixed

(b) One of the links is fixed

(c) Two of the links are fixed

(d) All of the links are fixed

3. According to Kennedy's theorem, if three bodies moves relative to each other, their instantaneous centres will lie on a :

(a) Straight line

(b) Parabolic curve

(c) Ellipse

(d) None of these

P. T. O.

4. When a slider moves on a fixed link having curved surface, their instantaneous centre lies :

(a) On their point of contact

(b) At the centre of curvature

(c) At the centre of circle

(d) At the pin joint

5. The direction of linear velocity of any point on a link with respect to another point on the same link is :

(a) Parallel to the link joining the points

(b) Perpendicular to the link joining the points

(c) At 45° to the link joining the points

(d) None of these

6. The coriolis component of acceleration is taken into account for :

(a) Slider crank mechanism

(b) Four bar chain mechanism

(c) Quick return mechanism

(d) None of these

7. The size of a cam depends upon :

(a) Base circle

(b) Pitch circle

(c) Prime circle

(d) Pitch curve

8. The cam follower generally used in aircraft engines is :

(a) Knife edge follower

(b) Flat faced follower

(c) Spherical faced follower

(d) Roller follower

9. Offset is provided to a cam follower mechanism to :

(a) Minimise the side thrust

(b) Accelerate

(c) Avoid jerk

(d) None of these

10. If n links are connected at the same joint, the joint is equivalent to :
    (a) (n-1) binary joint
    (b) (n-2) binary joint
    (c) (2n-1) binary joints
    (d) none of these

SECTION – B

[Marks : 6 × 4 = 24

(Short Answer Type Questions)

Note : Attempt any *four* questions.

1. State and prove "Aronhold Kennedy's Theorem" of three instantaneous centres.
2. Define rubbing velocity at a pin joint. What will be the rubbing velocity at pin joint when the two links move in the same and opposite directions ?
3. Sketch and explain the various inversions of a slider crank chain.
4. Explain the terms : Lower pair, Higher pair, Kinematic chain and Inversion.
5. Two shafts with an included angle of 160° are connected by a Hook's joint. The driving shaft runs at a uniform speed of 1500 rpm. The driven shaft carries a flywheel of mass 12 kg and 100 mm radius of gyration. Find the maximum angular acceleration of the driven shaft and the maximum torque required.
6. Define the following terms as applied to cam with neat sketch :
    (a) Base circle
    (b) Pitch circle
    (c) Pressure angle
    (d) Stroke of the follower

SECTION – C

[Marks : 12 × 3 = 36

(Long Type Questions)

Note : Attempt any *three* questions.

1. A cam drives a flat reciprocating follower in the following manner :

During first 120° rotation of the cam, follower moves outwards through a distance of 20 mm with SHM. The follower dwells during next 30° of cam rotation. During next 120° of cam rotation, the follower moves inwards with SHM. The follower dwells for the next 90° of cam rotation. The minimum radius of the cam is 25 mm. Draw the profile of the cam.

2. In a pin jointed four bar mechanism ABCD, the lengths of various links are as follows :

AB = 25 mm, BC = 87.5 mm, CD = 50 mm and AD = 80 mm. The link AD is fixed and the angle BAD = 135°. If the velocity of B is 1.8 m/s in the clockwise direction, find

(i) Velocity and acceleration of the mid point of BC

(ii) Angular velocity and angular acceleration of link CB and CD.

3. Four masses m_1, m_2, m_3 and m_4 are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radii of rotation are 0.2 m, 0.15 m, 0.25 m and 0.3 m respectively and the angles between successive masses are 45°, 75° and 135°. Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m

4. The turning moment diagram for a four stroke gas engine may be assumed for simplicity to be represented by four triangles, the areas of which from the line of zero pressure are as follows :

Suction stroke = 0.45×10^{-3} m^2, Compression stroke = 1.7×10^{-3} m^2, Expansion stroke = 6.8×10^{-3} m^2, Exhaust stroke = 0.65×10^{-3} m^2. Each m^2 of area represents 3 MN-m of energy. Assuming the resisting torque to be uniform, find the mass of the rim of a flywheel required to keep the speed between 202 and 198 rpm. The mean radius of the rim is 1.2 m.

5. (a) What is the function of a flywheel ? How does it differ from that of a governor ?

(b) Explain the method of balancing of different masses revolving in the same plane.

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20 = 1
30 = 1.5

(Printed Pages 4) Roll No. .....

E-436

B.E.IV Semester (Main & Re-Exam) Examination, May 2017

Kinematics and Mechanism

Mech. Engg.

Time : Three Hours] *[Maximum Marks : 75*

[Minimum Marks : 30

Note : Attempt **all** the questions from section A, **four** questions from section B and **three** questions from section C.

Section-A

(Objective Type Questions)

Note : Attempt **all** questions. 1.5×10=15

1. When a particle moves along a straight path, then the particle has
   (a) Tangential acceleration only
   (b) Centripetal acceleration only
   (c) Both Tangential and Centripetal acceleration
   (d) None of these
2. Which of the following is a turning pair
   (a) Piston and cylinder of areciprocatin steam engine
   (b) Shaft with collar at both ends fitted in a circular hole
   (c) Lead screw of lathe with nut
   (d) Ball and socket joint
3. The total number of instantaneous centres for a mechanism consisting of n links are
   (a) n/2 (b) n
   (c) (n−1)/2 (d) n(n−1)/2
4. The magnitude of linear velocity of a point B on a link AB relative to point A is
   (a) ω. AB (b) ω. $(AB)^2$
   (c) ω^2. AB (d) $(\omega . AB)^2$

P.T.O.

5. The coriolis component of acceleration is taken account for

(a) Four bar chain mchanism (b) Quick return mechanism

(c) None of these (d) Slider crank mechanism

6. The coefficient of restitution for inelastic bodies is

(a) Zero (b) One

(c) Between zero and one (d) More than one

7. A hook joint is used to

(a) Connect two hub (b) Connect two shafts

(c) Disconnect two shafts (d) None of these

8. The steering mechanism is used for

(a) Changing the direction of two or more wheel axles

(b) Disconnect the wheels speed

(c) Both (a) and (b)

(d) None of these

9. For a high speed engines, the cam follower should move with

(a) Uniform velocity

(b) Simple harmonic motion

(c) Uniform acceleration and retardation

(d) Cycloidal motion

10. The balancing of rotating and reciprocating parts of an engine is necessary when it runs at

(a) Slow speed (b) High speed

(c) Medium speed (d) Both (a) and (c)

Section-B

(Short Answer Type Questions)

$6 \times 4 = 24$

Note : Attempt any **four** questions.

1. Define inversion of mechanism. Explain the inversion of quadric cycle chain mechanism?
2. What is coriolis component of acceleration? Explain.
3. Define instantaneous centre of rotation. What are the different types of instantaneous centres. With the help of neat sketch, Demonstrate all types of instantaneous centres for a four bar mechanism.

4. What is Cam? With the help of neat sketches, describe various types of cams.
5. Differentiate between the following
   (i) Base circle and prime circle
   (ii) Cam angle and pressure angle
   (iii) Pitch point and trace point
   (iv) Period of ascent and period of descent
   (v) Disc cams and cylindrical cams
6. Derive Expression for
   (i) The swaying couple
   (ii) The variation of tractive force
   (iii) The hammer blow

Section-C

(Long Answer Type questions) $12 \times 3 = 36$

Note : Attempt any **three** questions.

1. What is hook's joint? With a neat sketch describe the working of a hook joint. Also show that for a hook joint.

   $\text{Tan}\theta = \cos\alpha \tan\phi$

   Where α=angle of inclination of the driven shaft with driving shaft and θ and ϕ are the angle turned by driven and driving shafts at any instant.
2. A cam, with a minimum radius of 25mm, rotating clockwise at a uniform speed is to be designed to give a roller follower, at the end of a valve rod, motion described below
   (i) To raise the valve through 50mm during 120^0 rotation of the cam
   (ii) To keep the value fully raised through next 30^0
   (iii) To lower the value during next 60^0
   (iv) To keep the value closed during rest of the revolution i.e. 150^0

   The diameter of the roller is 20mm and the diameter of the cam shaft is 25mm. Draw the profile of the cam when (a) the line of the stroke of the valve rod passes through the axis of the cam shaft (b) the line of the stroke is offset 15mm from the axis of the cam shaft.

   The displacment of the valve while being raised and lowered, is to take place with SHM. Determine the maximum acceleration of the valve rod when the cam shaft rotates at 100 r.p.m. Draw the displacement, Velocity and acceleration diagram for one complete revolution of the cam.

3. A rotating shaft carries four unbalanced masses 18 kg, 14 kg, 16 kg and 12 kg at radii 50m, 60mm, 70mm, and 60mm respectively. The 2nd, 3rd and 4th masses revolve in plane 80mm, 160mm, and 280mm respectively measured from the plane of the first mass and are angularly located at 60^0, 135^0 and 270^0 respectively measured clockwise from the first mass looking from this mass end of the shaft. The shaft is dynamically balanced by two masses, both located at 30mm radii and revolving in planes mid-way between those of 1st and 2nd masses and midway those of 3rd and 4th masses. Determine graphically, the magnitudes of the masses and their respective angular positions.

4. The turning moment diagram for a multi-cylinder engine has been drawn to a scale of 1mm to 500 N-m torque and 1 mm to 6^0 of crank displacement. The intercepted areas between output torque curve and mean resistance link taken in order from one end in sq.mm are -30, +410, -280, +320, -330, +250, -360, +280, -260 sq.mm, when the engine is running at 800 r.p.m.

   The engine has a stroke of 300mm and the fluctuation of the speed is not exceed 2% of the mean speed. Determine a suitable diameter and cross section of the flywheel rim for a limiting value of the safe centrifugal stress of 7 Mpa. The material density may be assumed as 7200kg/m^3. The width of the rim is to be 5 times the thickess.

5. The crank of a slider crank machanism rotates clockwise at a constant speed of 300 r.p.m. The crank is 150mm and the connecting rod is 600mm long. Deterimine: 1 linerar velocity and acceleration of the mid-point of the connecting rod, 2. Angular velocity and angular acceleration of the connecting rod, at a crank angle of 45^0 from the inner dead centre position.

Total Printed Pages : 4

Roll No. .....

E-710

B. E. IV Semester (Main & Re-Exam) Examination, May – 2018

KINEMATICS AND MECHANISM

Branch : ME

Time : Three Hours] *[Maximum Marks : 60*

Note : Attempt ***all*** questions of ***Section – A four*** questions from ***Section – B*** and ***three*** questions from ***Section – C.***

SECTION – A

Note : Attempt ***all*** questions. 1.5 × 10 = 15

1. Which of the following Kinematic Pairs is classified depending upon the mechanical arrangement between the links ?

(a) Primatic Pair (b) Revolute Pair

(c) Force-closed Pair (d) Sliding Pair

2. Which of the following statement are true ?

(a) A resistant body transmits required motion and forces with deformation

(b) A resistant body transmits required motion and forces without deformation

(c) Structures transmit mechanical work

(d) None of the above

3. Which of the following is a lower pair ?

(a) Belt drive (b) Piston and cylinder

(c) Cam and follower (d) All of the above

4. Cam and follower is an example of :

(a) Forced-closed pairs (b) Unclosed pair

(c) Open pairs (d) All of the above

5. Instantaneous centre of rotation of a link in a four bar mechanism lies on :

(a) Right side pivot of this link

(b) Left side pivot of this link

(c) A point obtained by intersection on extending adjoining link

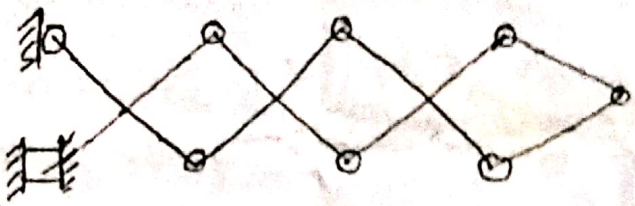
(d) Can't occour

P. T. O.

6. The minimum number of links in a single degree of freedom planer mechanism with both higher and lower kinematic pairs is :

(a) 2 (b) 3 (c) 4 (d) 5

7. The kinematic chain shown in the figure is :



(a) Structure

(b) Mechanism with one degree of freedom

(c) Mechanism with two degree of freedom

(d) Mechanism with more than two degree of freedom

8. For the same lift and same angle of Ascent, A smaller base circle will give :

(a) A small value of pressure angle

(b) A large value of pressure angle

(c) No relation with pressure angle

(d) All of the above

9. Corioli's component of acceleration exists when ever a point moves along a path that has :

(a) Linear displacement (b) Rotational motion

(c) Tangential acceleration (d) Centripetal acceleration

10. Scotch Yoke mechanism is the inversion of :

(a) Single Slider Kinematic chain

(b) Double Slider Kinematic chain

(c) Four bar chain

(d) None of the above

SECTION – B

Note : Attempt any ***four*** questions. $6 \times 4 = 24$

1. Sketch a Paucellier mechanism. Show that it can be used to trace a straight line. 6

2. What are quick return mechanism ? Where are they used ? Discuss the functioning of any one of them. 6

3. State and prove Kennedy's theorem. 6

4. Define the following terms used in cams 6

(i) Base circle

(ii) Pitch circle

(iii) Pressure angle

(iv) Stroke of the follower

5. A particle moving with a uniform velocity has no tangential acceleration. Explain clearly. 6

6. Find the maximum and minimum transmission angles for the mechanism : 6

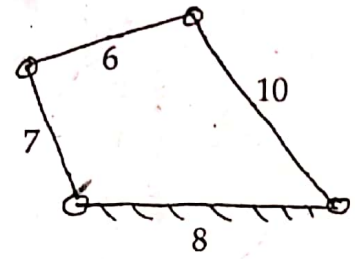
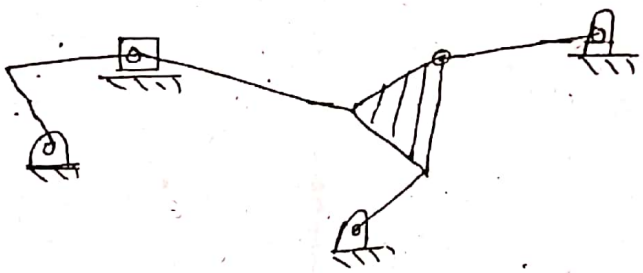


figure indicate the dimensions in standard units of length.

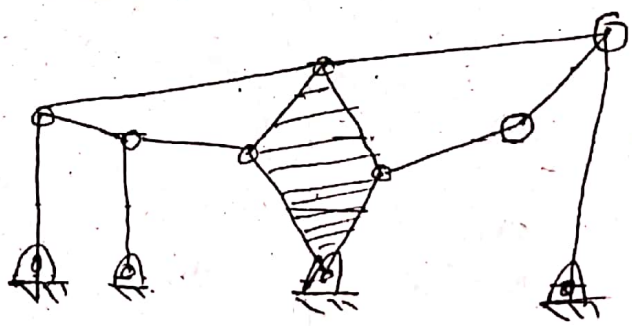
SECTION – C

Note : Attempt any *three* questions. $12 \times 3 = 36$

1. 1(a) Determine the degree of freedom of the mechanism : 6



(b) Show that the linkage shown in figure are structure. Suggest some changes to make them mechanism having one degree of freedom. The number of links should not be changed by more than ± 1. 6

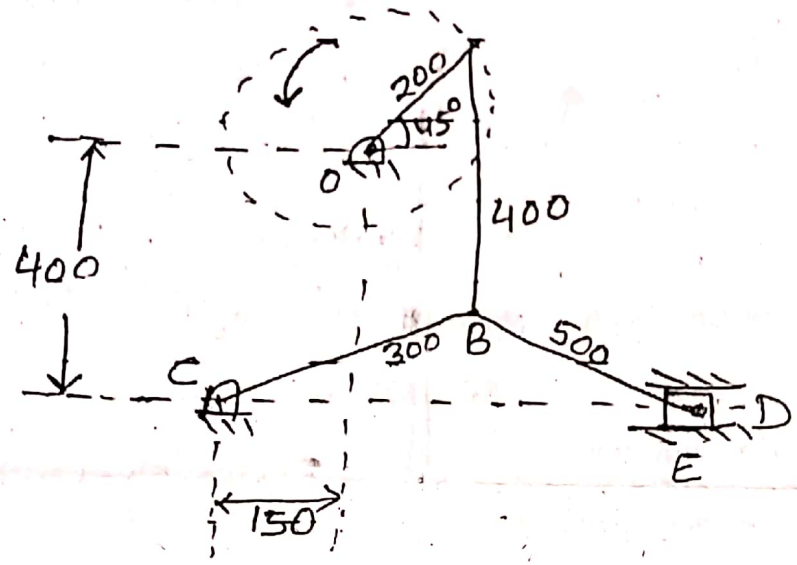


2. The whit worth quick return motion mechanism has the driving rank 150 mm long. The distance between fixed centres is 100 mm. The line of stroke of the ram passed through the centre of rotation of the slotted lever whose free end is connected to the ram by a connecting link. Find the ratio of time of cutting to time of return. 12

3. In the toggle mechanism, the crank OA rotates at 210 rpm counter clockwise increasing at the rate of 60 rad/sec^2. Far the given configuration, determine :

   (i) Velocity of Slider D and the angular velocity of link BD.

   (ii) Acceleration of slider D and the angular acceleration of the link BD.



4. Draw the profile of a cam operating a knife-edge follower having a lift of 30 mm. The cam raises the follower with S.H.M. far 150° of the rotation followed by a period of dwell for 60°.

   The follower descends far the next 100° rotation of the cam with uniform velocity again followed by a dwell period. The cam rotates at a uniform velocity of 120 rpm and has a least radius of 20 mm. What will be the maximum velocity and acceleration of the following during the lift and the return.
