KADI SARVA VISHWAVIDHYALAYA
B.E MECHANICAL Semester–III

Subject: Kinematics of Machines **Date: 27/11/2013**
Subject Code: ME-302 **Time: 10:00 am to 1:00 pm**
Total Marks: 70

Instructions:
1. Answer each section in separate Answer sheet.
2. Use of Scientific calculator is permitted.
3. All questions are **Compulsory**.
4. Indicate **clearly**, the options you attempt along with its respective question number.

SECTION-I

Que:1 (A) State and explain Grashof's criterion. **[5]**

(B) What is the condition of correct steering of a four wheeler? Explain Davis steering gear mechanism. **[5]**

(C) Explain the kinematic link. Give the classification of kinematic link. **[5]**

OR

(C) Explain with neat sketch the working of 'Whitworth Quick return mechanism'. **[5]**

Que:2 The crank of a slider crank mechanism rotates at a constant speed of 300 r.p.m. The crank is 150 mm and the connecting rod is 600 mm long. Determine: angular velocity and angular acceleration of the connecting rod, at a crank angle of 45^0 from inner dead center position. **[10]**

OR

Que:2 The diagrams shows a "rocking lever" mechanism in which steady rotation of the wheel produces an oscillating motion of lever OA.Both the wheel and lever are mounted in fixed centers. The wheel rotates clockwise at a uniform angular velocity (w) of 100rad/s. For the configuration shown, determine the following. **[10]**

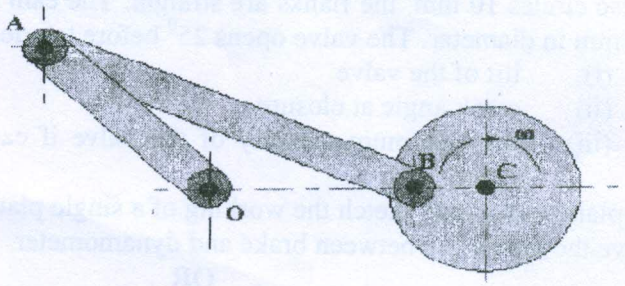
(i) The angular velocity of the link AB and the absolute velocity of point A.

(ii) The centrifugal accelerations of BC and OA.

(iii) The magnitude and direction of the acceleration of point A.

The lengths of the links are as follows.

BC=25 mm, AB=100 mm, OA= 50 mm, OC=90 mm



Que:3 (A) Explain Slip of Belt and Creep of Belt. **[5]**

(B) A rope drive transmits 74 KW through a 1.50 m diameter 45^0 grooved pulley rotating at 200 r.p.m. Angle of lap is 160^0 . The mass of each rope is 0.06 kg/m and can safely take a pull of 800 N. Taking centrifugal tensions into account, determine (a) Initial rope tension, and (b) the number of ropes **[5]**

required. Take μ=0.30.

OR

(A) Derive the expression for limiting tension ration in case of flat belt drive. **[5]**

(B) A belt embraces the shorter pulley 165^0 and runs over at a speed of 1700 m/min. dimensions of the belt are width 20 cm, thickness 8 mm. it weighs 1 gm/cm^3. Determine the maximum power that can be transmitted at the above speed, if the maximum permissible stress in the belt is not to exceed 20×10^5 N/m^2. Take μ=0.25. **[5]**

SECTION-II

Que:4 (A) Define the following terms: **[5]**

Module, Diameter pitch, Pressure angle, Backless, Pitch circle diameter

(B) Explain the law of gearing. **[5]**

(C) Two involute gears of 20^0 pressure angle are rotating in mesh. The speed of smaller gear is 1440 rpm. The number of teeth on pinion is 20 and gear ratio is 2.If the addendum of pinion and wheel is standard and equal to one module and module is 5 mm, find: **[5]**

(i) Length of path of contact.
(ii) Length of arc of contact.
(iii) Angle turned through by pinion and wheel.
(iv) Velocity of sliding at the point of contact.

OR

(C) An epicyclic train is composed of fixed annular wheel A having 150 teeth. Meshing with A is wheel B which drives wheel D through an idle wheel C, wheel D being concentric with A. wheels B and C are carried on an arm E which revolves clockwise at 100 rpm about the axis of A and D. If the wheel B and have 25 and 40 teeth respectively, find the number of teeth on C and sense of rotation of C. Also sketch the arrangement. **[5]**

Que:5 (A) The following relate to a cam operating an oscillating roller follower, in which the follower moves with S.H.M. during the lift and returning. **[10]**
Minimum radius of cam=25 mm, Roller radius=10 mm, Length of follower arm=70 mm, Distance between pivot center and cam axis=75 mm, Angle of ascent=120^0, Angle of descent=120^0, Angle of dwell=120^0, Angle of oscillation of follower=20^0. Draw the cam profile.

OR

(A) A valve is actuated by a cam having the following dimensions, base circle 20 mm, nose circle 15 mm in diameter, distance between the centers of these circles 10 mm, the flanks are straight. The cam acts on a tappet roller 20 mm in diameter. The valve opens 25^0 before top dead enter. Determine: **[10]**

(i) lift of the valve
(ii) crank angle at closure
(iii) the maximum velocity of the valve if camshaft rotates at 300 r.p.m.

Que:6 (A) Explain with a neat sketch the working of a single plate friction clutch. **[5]**

(B) Give the difference between brake and dynamometer. **[5]**

OR

(A) Explain internal expanding shoe brake. **[5]**

(B) Derive the equation for torque required to overcome the friction for cone clutch. Assume uniform pressure and uniform wear theory. **[5]**

Best of luck

KADI SARVA VISHWAVIDHYALAYA
B.E. MECHANICAL Semester–III

Subject: KINEMATICS OF MACHINES **Date: 26/04/2014**
Subject Code: ME302 **Time: 10:30 am to 01:30 pm**
Total Marks: 70

Instructions:
1. Answer each section in separate Answer sheet.
2. Use of Scientific calculator is permitted.
3. All questions are **Compulsory**.
4. Indicate **clearly**, the options you attempt along with its respective question number.
5. Use the last page of main supplementary of **rough work**.

SECTION-I

Que:1 **(A)** Explain the following terms: **[5]**
(i) Lower pair (ii) Higher pair (iii) Kinematics Chain
(iv) Inversion (v) Link

(B) Sketch and describe the working of whit-worth Quick return motion mechanism. **[5]**

(C) Sketch and explain any two inversions of a double slider crank chain. **[5]**

OR

(C) Describe briefly Types of Constrained Motions. **[5]**

Que:2 **(A)** Explain Three Centers in Line Theorem. **[5]**

(B) The crank of oscillating cylinder engine mechanism is 50 mm longhand it rotates at 300 rpm. The piston rod is 150mm long and distance between crank shaft and trunnion is 250mm. Draw velocity and acceleration diagram at the instant when crank is at 60 degree from IDC. And determine **[5]**
1. Velocity and acceleration of sliding piston.
2. Angular velocity of a connecting rod.

OR

(A) State and explain Grashof's criterion. **[5]**

(B) The crank and connecting rod of a steam engine are 0.5 and 2m long respectively. The crank makes 180 rpm in the clockwise direction. When it has turned 45° from the inner Dead centre determine: **[5]**
(1)Velocity of Piston.
(2)Angular velocity of connecting rod.
(3)Velocity of point E on the connecting rod 1.5m from the gudgeon pin.

Que:3 **(A)** Derive expression for length of belt for cross belt drive. **[5]**

(B) Two parallel shaft 6m apart are to be connected by a belt running over a pulley of diameter 600 mm and 400 mm respectively. Find exact and approx lengths of belt when belt is open and when belt is crossed. **[5]**

OR

(A) Derive the expression for limiting tension ratio in case of flat belt drive. **[5]**

(B) Power is transmitted using a V-belt drive. The included angle of V-groove is 30°. The belt is 20mm deep and maximum width is 20mm.If the mass of the belt is 0.35Kg.per meter length and maximum allowable stress is 1.4Mpa.Determine the maximum power transmitted when the angle of lap is140°.μ=0.15 **[5]**

SECTION-II

Que:4 **(A)** Describe with a neat sketch a cone clutch and deduce an equation for the **[5]**

total Torque transmitted.

(B) Derive the equation of effort required to move the body up the plane Considering friction. **[5]**

(C) Differentiate between overhauling and self locking of screw. **[5]**

OR

(C) A simple band brake is applied to a rotating drum of 500 mm diameter. The angle of lap of the band on the drum is 260°. One end of the band is attached to a fulcrum pin of the lever and other end is to a pin 100 mm from the fulcrum. If coefficient of friction is 0.25, and a braking force of 100 N is applied at a distance of 750 mm from the fulcrum, determine the braking torque when the drum rotates in anti clock wise direction. **[5]**

Que:5 (A) 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 and F gears with B and D. All the wheels have the same module and the numbers of teeth are: TC = 28, TD = 26, TE = TF = 18. **[10]**

(1) Find the number of teeth on A and B.

(2) If the arm G makes 100 rpm clockwise and A is fixed, find the speed of B.

(3) If the arm G makes 100 rpm clockwise and wheel A makes 10 rpm counterclockwise, find the speed of wheel B.

OR

(A) An epicyclic gear train consists of sun wheels S, a stationary internal gear E and three identical planet wheels P carried on a star-shaped planet carrier C.The size of Different toothed wheels are such that the planet carrier C rotates at 1/5th of the speed of the sun wheel S.The minimum number of teeth on any wheel is 16.The driving **[10]**

Torque On the sun wheel is 100N-M.Determine

1. Numbers of teeth on different wheels of the train.

2.Torque necessary to keep the internal gear stationary

Que:6 (A) A cam operates a flat faced follower which moves with cycloidal motion during ascent and descent. The further specifications are: **[10]**

Min radius of cam=30 mm, Angle of ascent =120 Angle of dwell=60

Lift of follower = 40 mm, Angle of decent=90, speed of cam =300 rpm

Draw cam profile.

OR

(A) Draw the profile of a cam operating a roller follower of 30 mm diameter from the following data: **[10]**

(i) It lifts the follower through 50 mm during 90^{o} rotation with S.H.M.

(ii) The follower remains at rest for next 30^{0} of cam rotation.

(iii) The follower is then descent to its original position during 60^{0} of cam rotation with uniform acceleration and retardation.

(iv) It remains at rest for the rest of cam rotation.

Least radius of cam is 50 mm. If it rotates at 300 rpm.

Best of luck

Kadi Sarva Vishwavidyalaya

B.E. Sem IV (Mechanical/Automobile Engineering)

Subject: Kinematics of Machines (ME-302)

Date: 13/11/2014 Time: 3 Hrs Max. Marks: 70

Instructions:

(1) Answer each section in separate Answer sheet.
(2) Use of Scientific calculator is permitted.
(3) All questions are compulsory.
(4) Indicate clearly, the options you attempt along with its respective question number.
(5) Assume suitable data if necessary.
(6) Use the last page of main supplementary of rough work.

Section – I

Q.1

[A] What is inversion of mechanism? Explain with neat sketch any two inversion of double slider crank chain mechanism **[5]**

[B] For the kinematic linkages shown in fig.1, calculate the following. **[5]**

- The number of ternary links
- The number of other links
- The number of total links
- The number of loops
- The number of pair with 1 DOF
- The number of pair with 2 DOF
- Total number of DOF

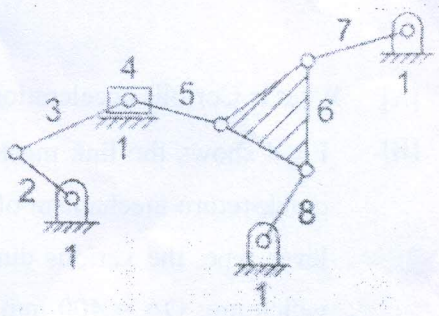


Fig.1

[C] Locate all the instantaneous centres of the slider crank mechanism as shown in Fig.2.The lengths of crank OB and connecting rod AB are 100mm and 400 mm respectively. If the crank rotates clockwise with an angular velocity of 10 rad/s, Find: 1.Velocity of the slider A, and2.Angular velocity of the connecting rod AB. **[5]**

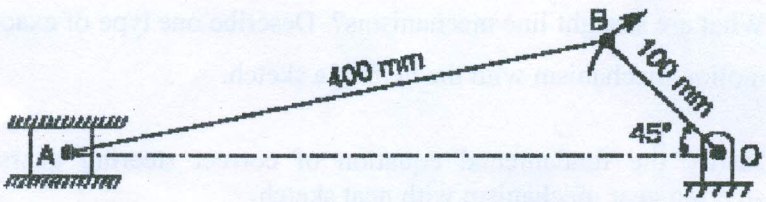


Fig.2

OR

[C] Explain Pantograph mechanism with neat sketch. **[5]**

Q.2

[A] The lengths of various links of a mechanism shown in fig.3 are as follows: OA= 150 mm, AC = 600 mm, CQ = QD = 145 mm, CD = 125 mm, BD = 500 mm and OQ = 625 mm, the crank OA rotates at 60 rpm in the counter clockwise direction. Determine the velocity of the slider B and the angular velocity of the link BD when the crank has turned an angle of 45° with the vertical. [7]

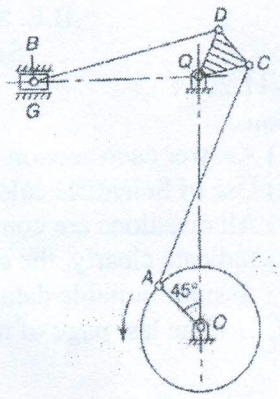


Fig. 3

[B] Explain Types of Instantaneous Centres and also state Aronhold Kennedy (or Three Centres in Line) Theorem [3]

OR

Q.2

[A] What is Coriolis acceleration component? How does it determine? [3]

[B] Fig.4 shows the link mechanism of a quick-return mechanism of the slotted lever type, the various dimensions of which are: OA = 400 mm, OP = 200 mm, AR = 700 mm, RS = 300 mm [7]

For the configuration shown, determine acceleration of the cutting tool at S and the angular acceleration of the link RS. The crank OP rotates

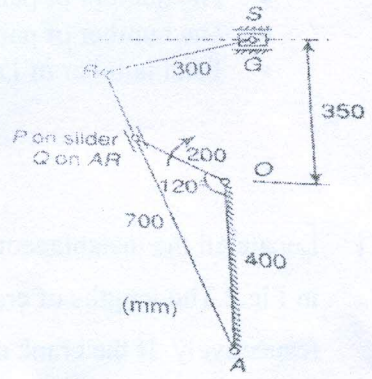


Fig. 4

Q.3

[A] What are straight line mechanisms? Describe one type of exact straight line motion mechanism with the help of a sketch. [6]

[B] Justify the fundamental equation of correct steering gears. Explain any one steering gear mechanism with neat sketch. [4]

OR

Q.3

[A] In an open belt drive, the linear velocity of the belt is 3 m/s. The angle of lap on the smaller pulley is 166°, the co-efficient of friction is 0.3 and power transmitted is 3 kW. Determine the effect of power transmission in the following cases: [6]

(i) Initial tension in the belt is increased by 10%.

(ii) Angle of lap is increased by 10% by the use of an idler pulley, for the same

speed and tension on tight side.

(iii) μ is increased by 10%.

[B] Explain the phenomenon of "slip" and "creep" in a belt drive. [4]

Section – II

Q.4

[A] Derive the equation for maximum efficiency of a screw jack for raising a load. [5]

[B] A multiple disc clutch transmits 75 kW of power at 2000 rpm. Coefficient of friction for the friction surfaces is 0.2. Axial intensity of pressure is not to exceed 180 kN/m^2 .Internal radius is 100 mm and is 0.8 times the external radius. Find the number of plates needed to transmit the required torque. Assume uniform wear conditions. [5]

[C] What are different types of chains? Explain with neat sketches, the power transmission chains. [5]

OR

[C] A simple band brake is applied to a rotating drum of 500 mm diameter. The angle of lap of the band on the drum is 260°. One end of the band is attached to a fulcrum pin of the lever and other end is to a pin 100 mm from the fulcrum. If coefficient of friction is 0.25, and a braking force of 100 N is applied at a distance of 750 mm from the fulcrum, determine the braking torque when the drum rotates in anti clock wise direction. [5]

Q.5 [A] An Epicyclic gear train consists of sun wheels S, a stationary internal gear E and three identical planet wheels P carried on a star-shaped planet carrier C. The sizes of different toothed wheels are such that the planet carrier C rotates at 1/5th of the speed Of the sun wheel S. The minimum number of teeth on any wheel is 16.The driving Torque On the sun wheel is 100N-M. [6]

Determine:

1. Numbers of teeth on different wheels of the train.
2. Torque necessary to keep the internal gear stationary.

[B] Define: (1) Contact Ratio (2) Module (3) Circular pitch (4) Addendum [4]

OR

Q.5 [A] An Epicyclic train is composed of fixed annular wheel A having 150 teeth. Meshing with A is wheel B which drives wheel D through and idle wheel C,wheel D being concentric with A. Wheels B and C are carried on an arm E which resolves clockwise at 100 r.p.m. about the axis of A and D. If the wheel B and D [6]

have 25 and 40 teeth respectively, find the number of teeth on C and sense of rotation of C. Also sketch the arrangement.

[B] What do you mean by interference in gear? [4]

Q.6 [A] Classify followers and explain with neat sketch [3]

[B] Construct cam profile for a knife edge follower. Minimum radius of cam = 30mm, Stroke of follower = 24mm, Angle of rise = 90^0, Dwell after rise = 60^0, Angle of return = 120^0, Dwell after return for rest of the period. Follower to move outwards with uniform velocity and return back with simple harmonic motion. The follower is offset to right by 15mm. The cam is to rotate in anticlockwise direction [7]

OR

Q.6 [A] Differentiate between overhauling and self locking of screw. [3]

[B] Draw a cam profile to drive an oscillating roller follower to the specifications given below. [7]

(1)Follower to move outwards through an angular displacement of 20° during the first 120 rotation of the cam;

(2)Follower to return to its initial position during next 120° rotation of the cam.

(3)Follower to dwell during the next 120° of cam rotation.

The distance between pivot centre and roller centre=120mm;distance between Pivot centre and cam axis =130mm;minimum radius of cam=40mm;radius of roller=10mm Inward and outward strokes take place with simple harmonic motion.

*******BEST OF LUCK*******

Kadi Sarva Vishwavidyalaya

B.E. Sem IV (Mechanical/Automobile Engineering)

Subject: Kinematics of Machines (ME-302)

Date: 13/11/2014 Time: 3 Hrs Max. Marks: 70

Instructions:

(1) Answer each section in separate Answer sheet.
(2) Use of Scientific calculator is permitted.
(3) All questions are compulsory.
(4) Indicate clearly, the options you attempt along with its respective question number.
(5) Assume suitable data if necessary.
(6) Use the last page of main supplementary of rough work.

Section – I

Q.1

[A] What is inversion of mechanism? Explain with neat sketch any two inversion of double slider crank chain mechanism [5]

[B] For the kinematic linkages shown in fig.1, calculate the following. [5]

- The number of ternary links
- The number of other links
- The number of total links
- The number of loops
- The number of pair with 1 DOF
- The number of pair with 2 DOF
- Total number of DOF

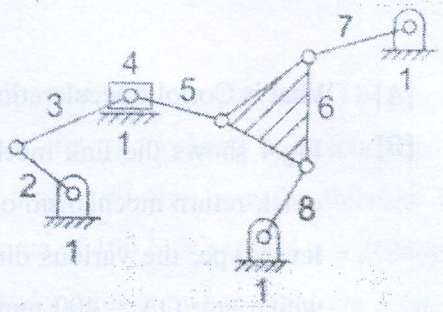


Fig.1

[C] Locate all the instantaneous centres of the slider crank mechanism as shown in Fig.2.The lengths of crank OB and connecting rod AB are 100mm and 400 mm respectively. If the crank rotates clockwise with an angular velocity of 10 rad/s, Find: 1.Velocity of the slider A, and2.Angular velocity of the connecting rod AB. [5]

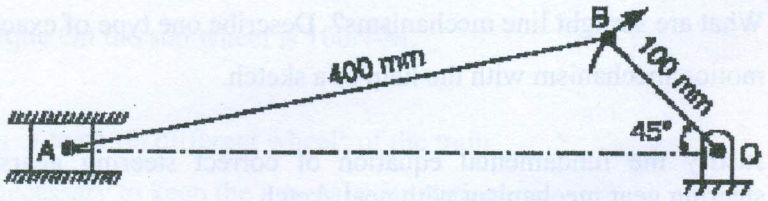


Fig.2

OR

[C] Explain Pantograph mechanism with neat sketch. [5]

Q.2

[A] The lengths of various links of a mechanism shown in fig.3 are as follows: OA= 150 mm, AC = 600 mm, CQ = QD = 145 mm, CD = 125 mm, BD = 500 mm and OQ = 625 mm, the crank OA rotates at 60 rpm in the counter clockwise direction. Determine the velocity of the slider B and the angular velocity of the link BD when the crank has turned an angle of 45° with the vertical. [7]

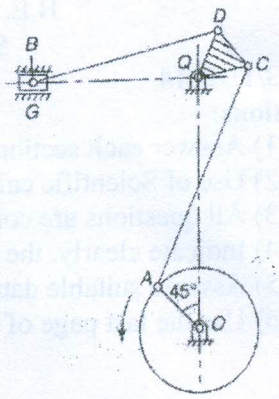


Fig. 3

[B] Explain Types of Instantaneous Centres and also state Aronhold Kennedy (or Three Centres in Line) Theorem [3]

OR

Q.2

[A] What is Coriolis acceleration component? How does it determine? [3]

[B] Fig.4 shows the link mechanism of a quick-return mechanism of the slotted lever type, the various dimensions of which are: OA = 400 mm, OP = 200 mm, AR = 700 mm, RS = 300 mm [7]

For the configuration shown, determine acceleration of the cutting tool at S and the angular acceleration of the link RS. The crank OP rotates

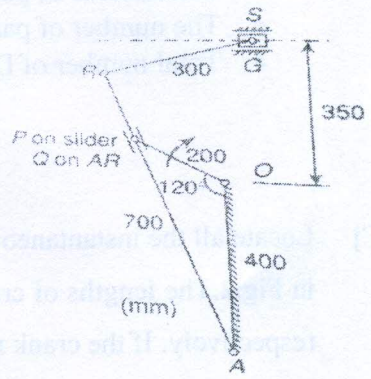


Fig. 4

Q.3

[A] What are straight line mechanisms? Describe one type of exact straight line motion mechanism with the help of a sketch. [6]

[B] Justify the fundamental equation of correct steering gears. Explain any one steering gear mechanism with neat sketch. [4]

OR

Q.3

[A] In an open belt drive, the linear velocity of the belt is 3 m/s. The angle of lap on the smaller pulley is 166°, the co-efficient of friction is 0.3 and power transmitted is 3 kW. Determine the effect of power transmission in the following cases: [6]

(i) Initial tension in the belt is increased by 10%.

(ii) Angle of lap is increased by 10% by the use of an idler pulley, for the same

speed and tension on tight side.

(iii) μ is increased by 10%.

[B] Explain the phenomenon of "slip" and "creep" in a belt drive. [4]

Section – II

Q.4

[A] Derive the equation for maximum efficiency of a screw jack for raising a load. [5]

[B] A multiple disc clutch transmits 75 kW of power at 2000 rpm. Coefficient of friction for the friction surfaces is 0.2. Axial intensity of pressure is not to exceed 180 kN/m^2 .Internal radius is 100 mm and is 0.8 times the external radius. Find the number of plates needed to transmit the required torque. Assume uniform wear conditions. [5]

[C] What are different types of chains? Explain with neat sketches, the power transmission chains. [5]

OR

[C] A simple band brake is applied to a rotating drum of 500 mm diameter. The angle of lap of the band on the drum is 260°. One end of the band is attached to a fulcrum pin of the lever and other end is to a pin 100 mm from the fulcrum. If coefficient of friction is 0.25, and a braking force of 100 N is applied at a distance of 750 mm from the fulcrum, determine the braking torque when the drum rotates in anti clock wise direction. [5]

Q.5 [A] An Epicyclic gear train consists of sun wheels S, a stationary internal gear E and three identical planet wheels P carried on a star-shaped planet carrier C. The sizes of different toothed wheels are such that the planet carrier C rotates at 1/5th of the speed Of the sun wheel S. The minimum number of teeth on any wheel is 16.The driving Torque On the sun wheel is 100N-M. [6]

Determine:

1. Numbers of teeth on different wheels of the train.
2. Torque necessary to keep the internal gear stationary.

[B] Define: (1) Contact Ratio (2) Module (3) Circular pitch (4) Addendum [4]

OR

Q.5 [A] An Epicyclic train is composed of fixed annular wheel A having 150 teeth. Meshing with A is wheel B which drives wheel D through and idle wheel C,wheel D being concentric with A. Wheels B and C are carried on an arm E which resolves clockwise at 100 r.p.m. about the axis of A and D. If the wheel B and D [6]

have 25 and 40 teeth respectively, find the number of teeth on C and sense of rotation of C. Also sketch the arrangement.

[B] What do you mean by interference in gear? [4]

Q.6 [A] Classify followers and explain with neat sketch [3]

[B] Construct cam profile for a knife edge follower. Minimum radius of cam = 30mm, Stroke of follower = 24mm, Angle of rise = 90^0, Dwell after rise = 60^0, Angle of return = 120^0, Dwell after return for rest of the period. Follower to move outwards with uniform velocity and return back with simple harmonic motion. The follower is offset to right by 15mm. The cam is to rotate in anticlockwise direction [7]

OR

Q.6 [A] Differentiate between overhauling and self locking of screw. [3]

[B] Draw a cam profile to drive an oscillating roller follower to the specifications given below. [7]

(1)Follower to move outwards through an angular displacement of 20° during the first 120 rotation of the cam;

(2)Follower to return to its initial position during next 120° rotation of the cam.

(3)Follower to dwell during the next 120° of cam rotation.

The distance between pivot centre and roller centre=120mm;distance between Pivot centre and cam axis =130mm;minimum radius of cam=40mm;radius of roller=10mm Inward and outward strokes take place with simple harmonic motion.

*******BEST OF LUCK*******

Kadi Sarva Vishwavidyalaya

B.E. Sem III (Mechanical Engineering)

Subject: Kinematics of Machine (ME-302/AE-302)

Date: 01/12/2015 Time: 3 Hrs Max. Marks: 70

Instructions:

(1) Answer each section in separate Answer sheet.
(2) Use of Scientific calculator is permitted.
(3) All questions are compulsory.
(4) Indicate clearly, the options you attempt along with its respective question number.
(5) Assume suitable data if necessary.
(6) Use the last page of main supplementary of rough work.

Section – I

Q.1

[A] Difference [5]

1) Machine V/S Mechanism
2) Completely constraint motion V/S successfully constraint motion

[B] For the kinematic linkages shown in fig.1, calculate the following. [5]

- The number of ternary links
- The number of other links
- The number of total links
- The number of loops
- The number of pair with 1 DOF
- The number of pair with 2 DOF
- Total number of DOF

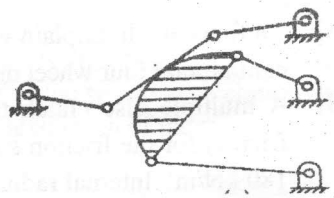


Fig.1

[C] Explain with neat sketch, classification of kinematic pair [5]

OR

[C] Sketch and explain any two inversions of double slider crank chain mechanism [5]

Q.2

[A] What are straight line mechanisms? Describe one type of exact straight line motion mechanism with the help of a sketch. [5]

[B] Discuss with neat sketch different types of steering gear mechanism of automobile in detail. [5]

OR

Q.2

[A] Derive the expression for limiting tension ratio in case of flat belt drive. [5]

[B] Two parallel shaft 6m apart are to be connected by a belt running over a pulley of diameter 600 mm and 400 mm respectively. Find exact and approx lengths of belt when belt is open and when belt is crossed. [5]

Q.3 Explain the following : [10]

1. Rubbing Velocity
2. Instantaneous centre
3. Kennedy's theorem
4. Degree of freedom
5. Coriolis acceleration component

OR

Q.3 In the mechanism shown in Fig. 2, the slider C is moving to the right with a velocity of 1 m/s and an acceleration of 2.5 m/s2. The dimensions of various links are AB = 3 m inclined at 45° with the vertical and BC = 1.5 m inclined at 45° with the horizontal. [10]

Determine:

1. The magnitude of vertical and horizontal component of the acceleration of the point B,
2. The angular acceleration of the links AB and BC.

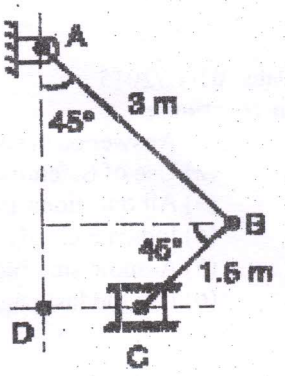


Fig. 2

Section – II

Q.4

[A] Define Clutch. Explain with neat sketch, working of a clutch generally used in commercial four wheel drive. [5]

[B] A multiple disc clutch transmits 75 kW of power at 2000 rpm. Coefficient of friction for the friction surfaces is 0.2. Axial intensity of pressure is not to exceed 180 kN/m^2. Internal radius is 100 mm and is 0.8 times the external radius. Find the number of plates needed to transmit the required torque. Assume uniform wear conditions. [5]

[C] State and prove the law of gearing [5]

OR

[C] Derive the equation for maximum efficiency of a screw jack for raising a load. [5]

Q.5 [A] A pair 20° involute gear has module of 5 mm. The pinion has 20 teeth and gear has 60 teeth. Addendum on the pinion and gear wheel in terms of module is one. Find the followings: (1) Number of pairs in contact. (2) Angle turned through by the pinion and gear wheel for one pair in contact. [6]

[B] Define: (1) Contact Ratio (2) Module (3) Circular pitch (4) Addendum [4]

OR

Q.5 [A] An Epicyclic train is composed of fixed annular wheel A having 150 teeth. Meshing with A is wheel B which drives wheel D through and idle wheel C,wheel D being concentric with A. Wheels B and C are carried on an arm E which resolves clockwise at 100 r.p.m. about the axis of A and D. If the wheel B and D have 25 and 40 teeth respectively, find the number of teeth on C and sense of rotation of C. Also sketch the arrangement. [10]

Q.6 [A] Explain types of followers with neat sketch. [3]

[B] Construct cam profile for a knife edge follower. Minimum radius of cam = 35mm, Stroke of follower = 24mm, Angle of rise = 120^0, Dwell after rise = 60^0, Angle of return = 90^0, Dwell after return for rest of the period. Follower to move outwards with uniform velocity and return back with simple harmonic motion. The follower is offset to right by 15mm. The cam is to rotate in anticlockwise direction [7]

OR

Q.6 Draw the profile of a cam operating a roller reciprocating follower and with the following data: [10]
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 the cam rotation with uniform acceleration and deceleration followed by a dwell period. If the cam rotates at a uniform speed of the 150 rpm,
Calculate:
The maximum velocity and acceleration of the follower during the ascent and descent period. Also draw the displacement, velocity and acceleration diagram for the motion of the follower for one complete revolution of the cam.

****