Code No: RR-222105

Set No: 1

II-B.Tech II-Semester-Regular-Examinations-April / May-2005

KINEMATICS OF MACHINERY

(Aeronautical Engineering)

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

Answer any FIVE questions

All questions carry equal marks

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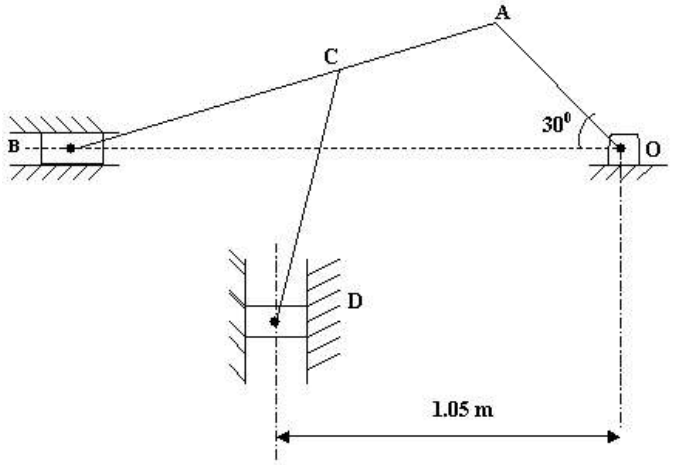
1. a) Distinguish clearly between a 'structure' and a 'Machine'.
   b) Explain various inversions of single and double slider crank chains.

2. Classify the straight-line motion mechanisms. Describe "a copied straight-line mechanism".

3. In the mechanism, as shown in Figure, the crank OA rotates at 20 r.p.m anticlockwise and gives motion to the sliding blocks B and D. The dimensions of the various links are OA = 300 mm; AB = 1200 mm; BC = 450 mm; and CD = 450 mm.
   For the given configuration, determine:
   (i) Velocities of sliding at B and D (ii) Angular velocity of CD
   (iii) Linear acceleration of D and (iv) Angular acceleration of CD.



4. a) Define the term instantaneous centre of rotation.
   b) Sketch a quick return motion of the crank and slotted lever type and explain the procedure of drawing the velocity and acceleration diagram, for any given configuration of the mechanism by instantaneous centre method.

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5. a) Derive the condition for correct steering.
   b) Sketch and explain Ackermann's Steering gear mechanism.
   c) List the merits and demerits of Ackermann and Davis Steering gear mechanism.

6. Determine the profile of cam to give oscillatory motion to the follower, with uniform angular velocity about its pivot.One oscillation is completed in one revolution of the cam. The distance between the cam centre and the pivot of the follower is 50 mm. The base circle diameter is 40 mm. Angle of oscillation is 30°. The length of the oscillating lever is 50 mm with roller of 5 mm diameter at the end.

7. A pair of 20^0 involute gears in mesh has a module of 6 mm. The number of teeth on pinion is 17 and that of gear wheel is 49. The addendum on pinion and gear wheel is one module. Calculate (i) the length of path of contact, arc of contact and the contact ratio. (ii) The angle turned through by the pinion and the gear wheel when one pair is in contact. (iii) The ratio of the sliding to rolling motion at the beginning of engagement, at the pitch point and at the end of engagement. (iv) What would be the effect of increasing addendum on pinion while maintaining the working depth the same as before?

8. a) Explain the difference between, simple, compound and Epicyclic gear trans trains.
   b) A compound train consists of six gears The number of teeth on the gears are as follows:

Gear	:	A	B	C	D	E	F
No. of teeth	:	60	40	50	25	30	24

The gears B and C are on one shaft while the gears D and E are on another shaft. The gear A drives gear B, gear C drives gear D and gear E drives gear F. If the gear A transmits 1.5 kW at 100 r.p.m and the gear train has an efficiency of 80 per cent, find the torque on gear F.

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Code No: RR-222105

Set No: 2

II-B.Tech II-Semester-Regular-Examinations-April / May-2005

KINEMATICS OF MACHINERY

(Aeronautical Engineering)

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

Answer any five questions

All questions carry equal marks

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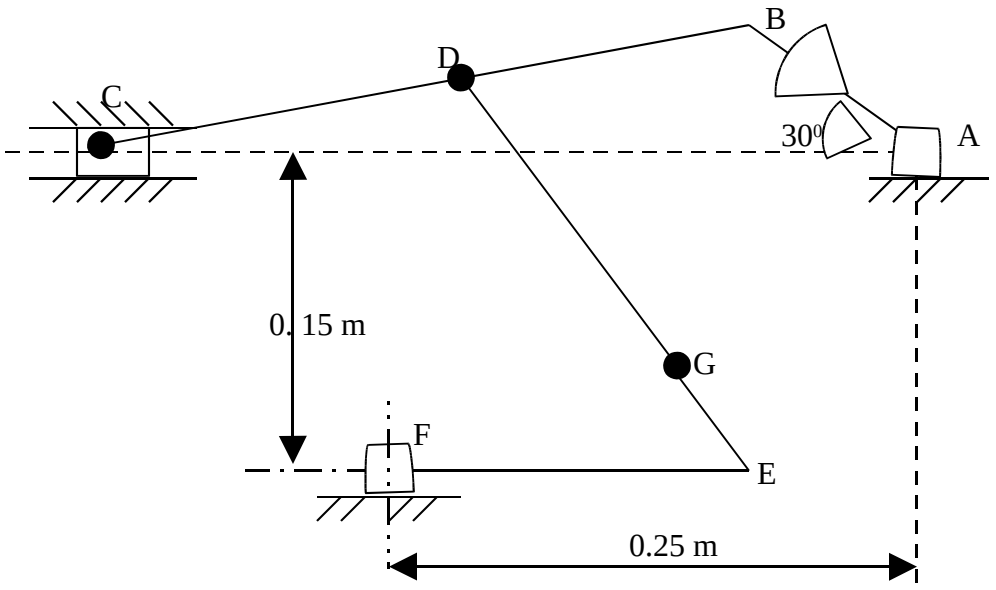
1. a) Show that the locus of the mid-point of the link connecting to the two slides in an elliptical trammel is a circle.
   b) Define frame of a machine? Which link of the machine is known as frame?

2. Derive the necessary equations for Hart's straight-line mechanism.

3. In a mechanism as shown in Figure, the link AB rotates with a uniform angular velocity of 30 rad/S. The lengths of various links are; AB = 100mm; BC = 300 mm; BD = 150 mm; DE = 250 mm; EF = 200 mm; DG=165 mm.
   Determine the velocity and acceleration of G for the given configuration.



4. a) Explain, with the help of a neat sketch, the space centrode and body centrode.
   b) 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 = 135^0. 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, and (ii) angular velocity and angular acceleration of the link CB and CD.

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5. a) What is the function of a steeing gear. What are the mechanisms used in general. Explain any one of them.

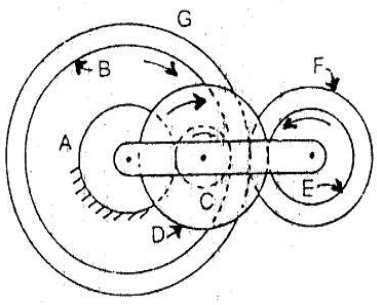
   b) In a Davis Steering gear the distance between the pivot's of the front axle is 1 metre and the wheel base is 2.5 metres. Find the inclination of the track arm to the longitudinal axis of the car. when it is moving along a straight path.

6. Design a cam to raise a value with uniform acceleration and retardation through 5 cm in 1/4rd of a revolution, keep it fully raised through 1/12 revolution and to lower it with simple harmonic motion in 1/4 revolution. The valve remains closed during the rest of the revolution. The diameter of the roller is 2 cm and the minimum radius of the cam is 2.5 cm. The diameter of the cam shaft is 2.5 cm. The axis of the valve rod passes through the axis of the cam shaft. If the cam shaft rotates at uniform speed of 300 r.p.m. find the maximum velocity and acceleration of a valve during raising and lowering.

7. a) Explain are 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?

8. Figure shown below is shows an epicyclic gear train with the following details: A has 40 teeth external (fixed gear); B has 80 teeth interna; C-D is a compound wheel having 20 and 50 teeth (external) respectively, E-F is a compound wheel having 20 and 40 teeth (external) respectively, and G has 90 teeth (external). The arm runs at 100 r.p.m. in clockwise direction. Determine the speeds for gears C,E, and B.



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Code No: RR-222105

Set No: 3

II-B.Tech II-Semester-Regular-Examinations-April / May-2005

KINEMATICS OF MACHINERY

(Aeronautical Engineering)

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

Answer any five questions

All questions carry equal marks

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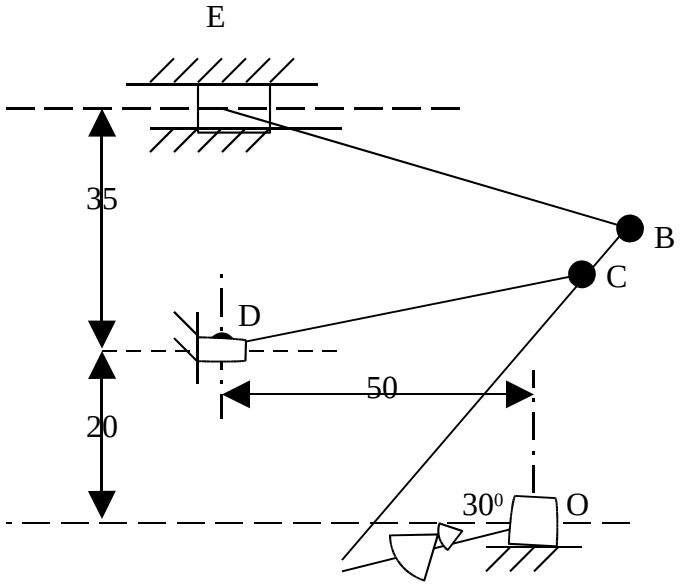
1. a) State the difference between the closed and unclosed pairs giving examples in each case.

   b) What is a Kinematic chain? How is it formed from the links?

2. What do you mean by a Pantograph? With a neat sketch explain the principal and working of the pantograph. What are its uses?

3. Figure shows a radial valve gear. The crank OA, 15 cm in length, turning uniformly at 150 r.p.m is pinned at A to rod AB. The lengths of the various links are AB = 55 cm ; AC = 45 cm ; DC = 50 cm and BE = 35 cm. Determine the velocity and acceleration of ram E for the given position of mechanism.



A **All the dimensions are in mm.**

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4.a)Discuss the three types of instantaneous centers for a mechanism.

b) The stroke of a steam engine is 15 cm and the connecting rod is 30 cm in length. Determine the velocity and acceleration of the piston when the crank has made 45^0 measured from the inner dead centre and rotates at 600 r.p.m. Also calculate the velocity and acceleration of point p, 5 cm on the connecting rod produced from the junction of the crank. Use instantaneous centre method.

5. a) Explain why two Hooke's Joints are used to transmit motion from the engine to the differential of an automobile.

b) A double universal joint is used to connect two shafts in the same plane. The intermediate shaft is inclined at an angle of 20° to the driving shaft as well as the driven shaft. Find the maximum and minimum speed of the intermediate shaft and the driven shaft if the driving shaft has a constant speed of 500 rpm.

6. A radial translating flat - face follower has a lift of 3 cm. The rise takes place with SHM for 180° of cam rotation, followed by dwell of 30° and simple harmonic return for 120° followed by another dwell. The base circle radius of the cam is 3 cm. Obtain the cam profile and the minimum length of the follower face with a clearance of 0.3 cm at both the ends. Assume anticlockwise rotation of the cam. What are the maximum velocity and accelerations values during the follower rise when cam rotates at 50 r.p.m.

7. a) Explain the type of gears used for Skew shafts with neat sketches?

b) Two meshing spur gears with 20^0 pressure angle have a module of 4 mm. The centre distance is 220 mm and the number of teeth on the pinion is 40. To what value should the centre distance be increased so that the pressure angle is increased to 22^0. Also find the circular pitch and pitch line velocity.

8. An epicyclic gear train, as shown in figure has a sun wheel S of 30 teeth and two planet wheel P.P. of 50 teeth. The planet wheels mesh with the internal teeth of a fixed annuals A. the driving shaft carrying the sunwheel, transmits 4 kW at 300 r.p.m. the driven shaft is connected to an arm which carried the planet wheels. Determine the speed of the driven shaft and the torque transmitted, if the overall efficiency is 95%.

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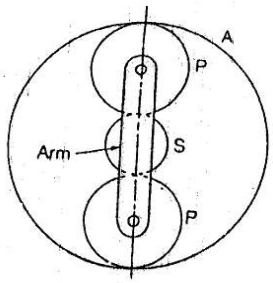
A
P
Arm
S
P

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Code No: RR-222105

Set No: 4

II-B.Tech II-Semester-Regular-Examinations-April / May-2005

KINEMATICS OF MACHINERY

(Aeronautical Engineering)

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

Answer any five questions

All questions carry equal marks

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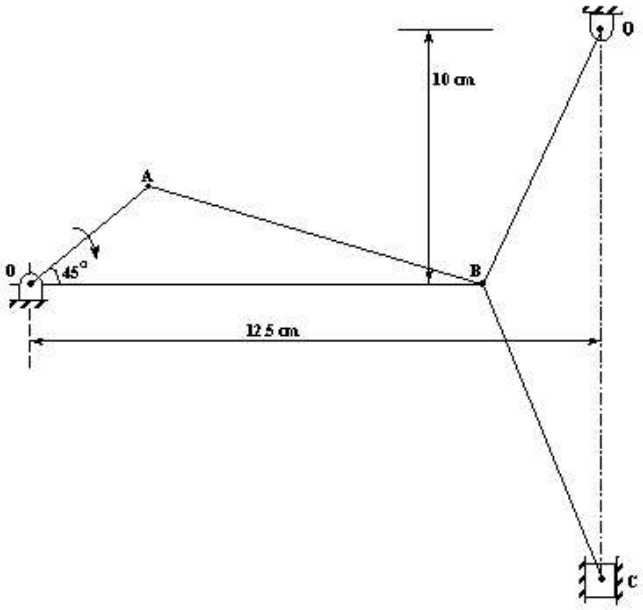
1. a) How are the slider crank chain and double slider crank chain derived from the quadric cycle chain? Describe with the help of sketches.
   b) Describe Oldham coupling. Where is it used in practice?

2. a) What are straight line motion mechanisms? Name the different types of mechanisms used for straight-line motion.
   b) Sketch the Peaucellier straight line motion and prove that the tracing point 'P' describes a straight-line path.

3. The crank AO of the mechanism shown in figure below rotates at a uniform speed of 90rpm in clockwise direction. The length of various links are OA = 2.5cm, AB = BC = BQ = 10cm, QC is vertical and 'O' is 12.5cm to the left and 10cm below 'Q'. For the configuration shown determine linear acceleration of slider C and angular acceleration of links AB, BQ and BC.



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4. a) State and prove Kennedy's theorm of instantaneous centers.
   b) In a four bar chain ABCD, A and D are fixed centers 12.5 cm apart. The driving crank AB = 6.25 cm, at certain instant makes an angle of 60^0 with AD. The driven crank CD and the coupler BC are 7.5 cm each. Determine the following when the driving crank makes 10 r.p.m in clockwise direction: (i) The angular velocities of the links CD and CB (ii) of the angular acceleration of the link CD by instantaneous centre method.

5. A Hook's joint is used to connect two shafts whose axes are inclined at 20^0. The driving shaft rotates uniformly at 6000 rpm. What are the extreme angular velocities of the driven shaft? Find the maximum value of retardation or acceleration and state the angle where both will occur.

6. A flat faced mushroom follower is operated by a uniformly rotating cam. The follower is raised through a distance of 25 mm in 120° rotation of the cam, remains at rest for the next 30° and is lowered during further 120° rotation of the cam. The raising and lowering both take place with uniform acceleration and deceleration. The least radius of the cam is 25 mm which rotates at 300 rpm.
   Draw the cam profile determine the values of the maximum velocity and maximum acceleration during raising and lowering of the follower.

7. a) Define the following: Involute, Cycloid, Epicycloid and Hypocycloid.
   b) Two mating involute spur gears with module pitch of 8 mm have 23 and 57 teeth of 20^0 pressure angle. The addenda on pinion and gear are equal to one module. Find: (i) number of pairs of teeth in contact, (ii) angle turned through by pinion and gear wheels, and (iii) ratio of sliding velocity to rolling velocity at the beginning of the contact, at the pitch point and at the end of contact.

8. A compound epicyclic gear is shown diagrammatically in figure given below. The gears A, D and E are free to rotate on the axis P. The compound gear b and C rotate together on the axis Q at the end of arm F. All the gears D and E are annular gears. The gear A rotates at 100 r.p.m. in the anti clockwise direction and the gear D rotates at 450 r.p.m. clockwise. Find the speed and direction of the arm and the gear E.

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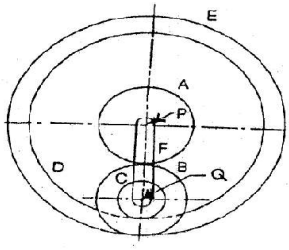
E
A
P
F
D
C
B
Q

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