Code No: R05222106 **Set No. 1**

II B.Tech II Semester Supplimentary Examinations, Aug/Sep 2007
MECHANISMS AND MECHANICAL DESIGN
(Aeronautical Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain the Gruebler's Criterion for plane Mechanism.
   (b) What do you mean by degrees of freedom of the mechanism?
   (c) Determine the degrees of freedom of the mechanism shown in figure 1c.

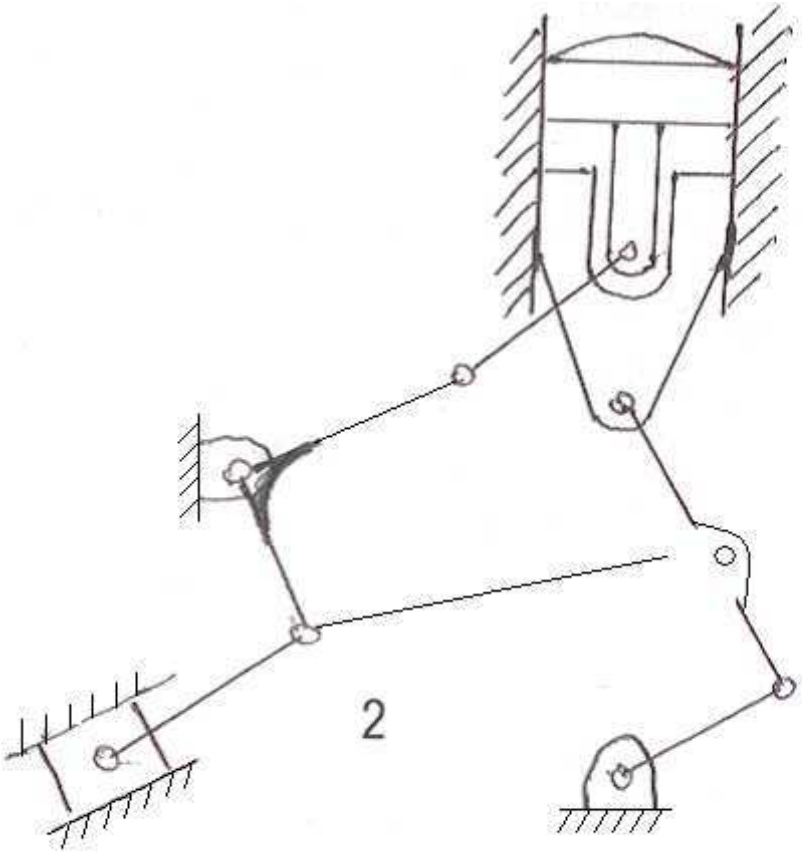

Figure 1c

2. (a) What are straight line motion mechanisms? How are they classified?
   (b) Describe grasshopper mechanism with a neat sketch and prove that the tracing point describes an approximate straight line motion.

3. The length of the links of a four-bar chain are : AB, 15 cm.; BC, 45 cm.; CD, 30 cm; and DA, 52.5 cm. The link AD is fixed and the link AB turns with uniform angular velocity. When angle BAD is 90^0 and B and C are on opposite sides of AD, find the position of the point E on BC which, at that instant, is accelerated along BC.

4. (a) State and prove three centres in-line theorem
   (b) A Watt 'walking-beam' mechanism is shown in figure4. Determine the velocity of the slider if the crank O_2A rotates with a speed of 1 rad/sec in a clockwise direction. Given O_2A = 2 cm, AB = 8.5 cm, BC = 7.5 cm, CD = 5.25 cm and O_5C = 7 cm. Use instant centre method.

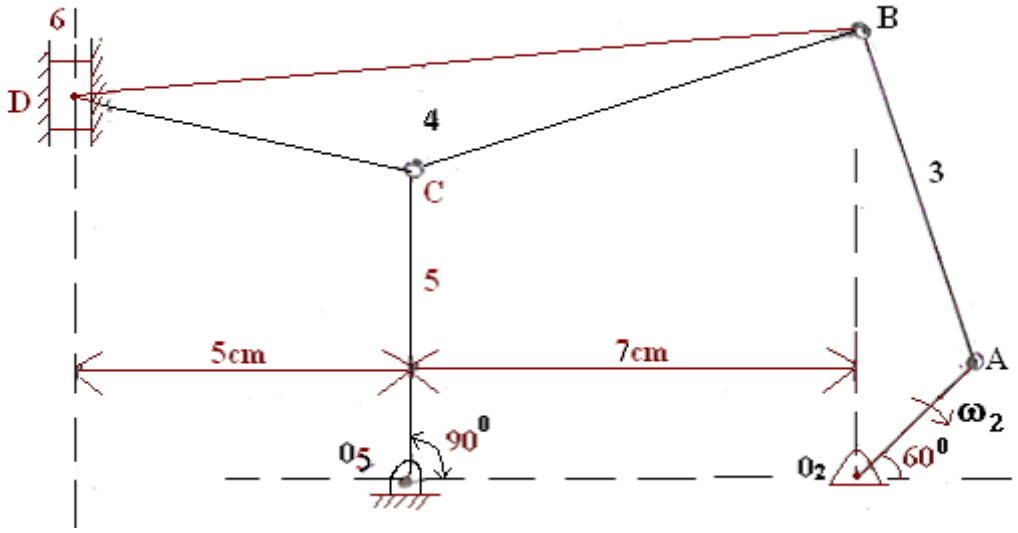

Figure 4

5. (a) What are different types of cams used in automobile engines? Explain them.
   (b) Draw the displacement, velocity and acceleration for uniform velocity of follower and derive the equations for maximum velocity and acceleration . [8+8]

6. A symmetrical cam with convex flanks operates a flat footed follower. The lift is 8 mm, base circle radius is 25 mm and the nose radius is 12mm. The total angle of the cam action is 12^0
   (a) Find the radius of the convex flanks
   (b) draw the profile of the cam and
   (c) determine the maximum velocity and the maximum acceleration when the cam shaft rotates at 500 rpm. [16]

7. (a) What are the differences between the type of assembly generally used in running fits and interference fits? Explain
   (b) Calculate maximum and minimum clearance for an assembly specified by 45 H7-g6. [8+8]

8. In an epicyclic gear train, an arm carries two wheels A and B having 36 and 45 teeth respectively. If the arm rotates at 150 rpm in the anticlock wise direction about the centre of the wheel A and is fixed, determine the speed of wheel B. If the wheel A instead of being fixed, makes 300 rpm in the clockwise direction, what will be the speed of B. [16]

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Code No: R05222106 **Set No. 2**

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MECHANISMS AND MECHANICAL DESIGN
(Aeronautical Engineering)

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

Answer any FIVE Questions
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1. (a) An assortment of five links of lengths 5 cm, 8 cm, 15 cm, 19 cm, and 28 cm is available for constructing a crank-rocker mechanism. Sketch the crank-rocker mechanism, indicating the crank and showing all the link lengths.
   (b) The crank and the connecting rod of a slider-crank mechanism are of the lengths 10 cm and 16 cm, respectively. Find out the maximum possible quick-return ratio that can be achieved.

2. Show that the tracing point P on the coupler of crossed four bar linkage describes an approximate straight line path if BC : AD : AB : : 1 : 2 : 2.5. Where AD is the fixed link BC is the coupler and AB is the driving link. AB = CD.

3. The mechanism of a variable-stroke feed pump is shown in figure 3. The drive is taken from the crank OA to the pin B on the connecting rod CBD. The end C of the connecting rod carries a die-block which moves along the curved slotted link EGF. The radius of curvature of the slot is equal to the length of the connecting rod CD and the stroke of the feed pump may be varied by rotating the slotted link about the fixed fulcrum G. If the crank OA makes 225 r.p.m. find for the given position of the mechanism.
   (a) the velocity of acceleration of the piston D,
   (b) the angular velocity and angular acceleration of the links AB and CD.

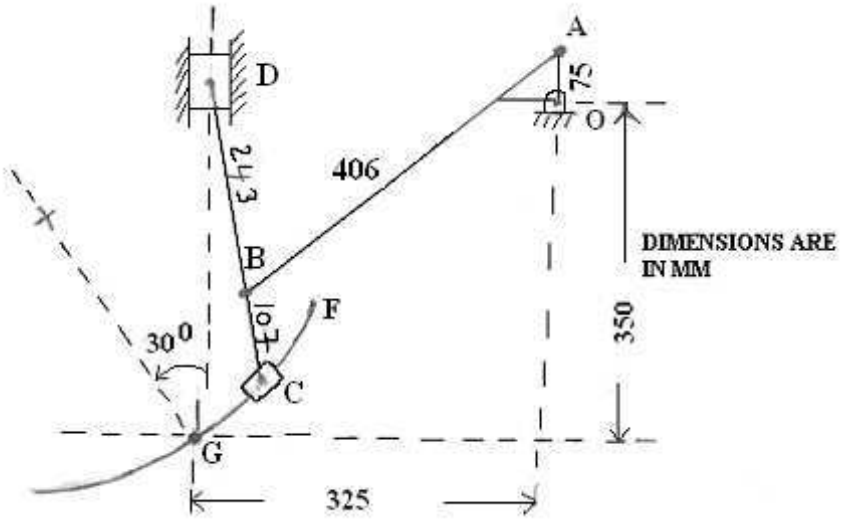

Figure 3

4. Find the velocities of points B, C, and D of the double-slider mechanism shown in the figure 4 if crank 2 rotates at 42 rad/s cw. Use instant centre method.
   O_2A = 50, AB = 250, AC = 100, BC = 225, CD = 8 200.

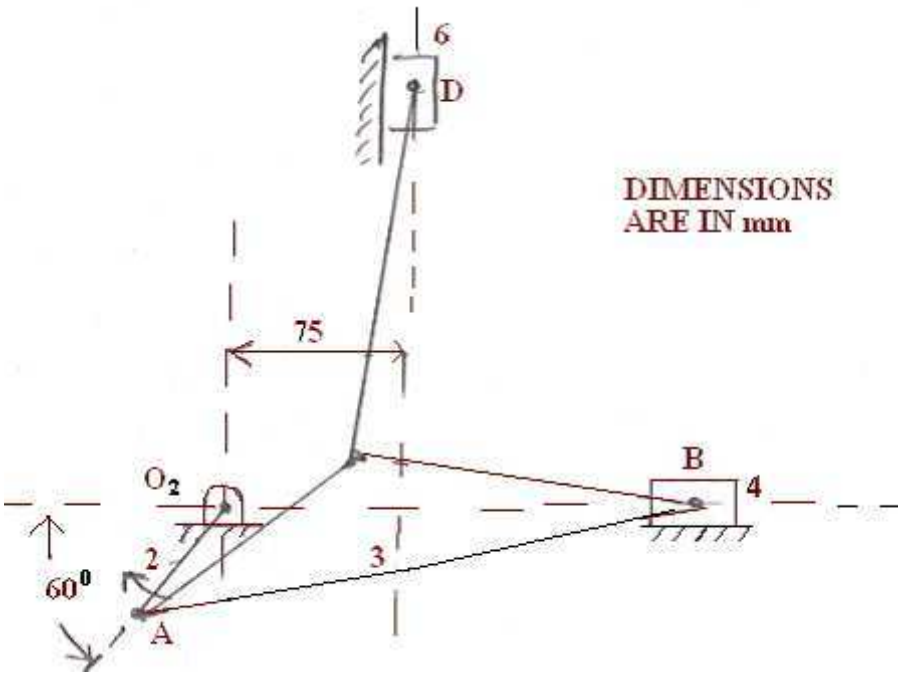

Figure 4

5. (a) Explain the functions of cams and followers. What are different applications cams in automobiles.
   (b) Derive the equations for the estimation of maximum acceleration and maximum velocity if the rotation of the follower follows simple harmonic motion. [8+8]

6. (a) Derive the equation for the estimation of maximum velocity and maximum acceleration for circular arc cam with straight flank.
   (b) Draw the profile of tangent cam with concave flank and explain the terminology and functionality of the cam. [16]

7. Design and draw a muff coupling is used to connect two shafts transmitting 40 kW at 350 rpm. The material for the shafts and key is plain carbon steel for which allowable shear and crushing stresses may be taken as 40 N/mm^2 and 80 N/mm^2 respectively. The material for the cast iron for which the allowable shear stress may be taken as 15 N/mm^2. [16]

8. In a reverted epicyclic gear train, the arm A carries two wheels B and C and a compound wheel D-E. The wheel B gears with wheel E and the wheel C gears with the wheel D. The number of teeth on wheels B, C and D are 75, 30 and 90 respectively. Find the speed and direction of wheel C when wheel B is fixed and the arm A makes 100 rpm clockwise. [16]

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Code No: R05222106 **Set No. 3**

II B.Tech II Semester Supplimentary Examinations, Aug/Sep 2007
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(Aeronautical Engineering)

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

Answer any FIVE Questions
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1. (a) Define Inversion of a Mechanism
   (b) Explain Grashof 's law
   (c) Describe with the help of sketches all the inversions of a quadric cycle chain.

2. (a) Sketch the Scott-Russel straight line motion mechanism and prove that the tracing point describes a straight line path.
   (b) Let O R be the diameter of a circle and Q a point on the circumference of the circle. join O to Q and let P be a point on OQ produced. Show that, if OQ turns about O as centre and the product OQ.OP remains constant, the point P will move along a straight path perpendicular to the diameter O R.

3. For the straight-line mechanism shown in the figure3, $\omega_2 = 20$ rad/s cw and $\alpha_2 = 140$ rad/s^2 cw. Determine the velocity and acceleration of point B and the angular acceleration of link 3.

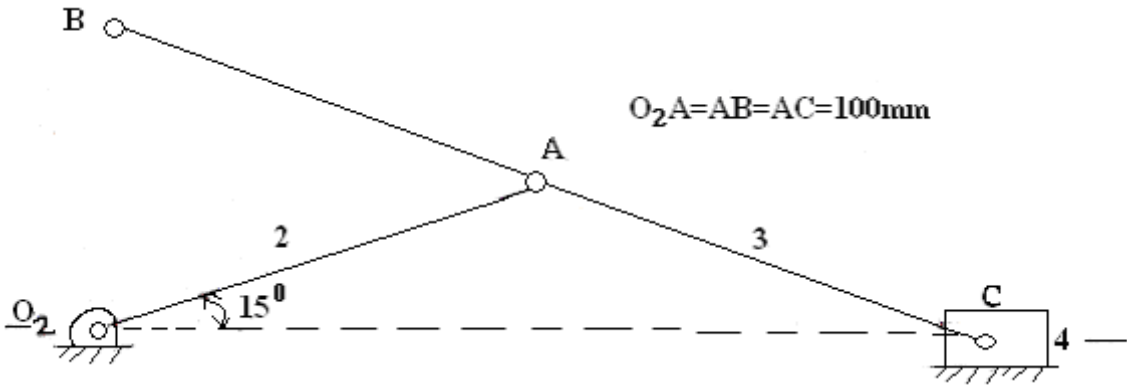

Figure 3

4. In the mechanism shown in figure 4b OA = 300 mm, AB = 600 mm, AC = 1200 mm and BD = 1200 mm. OD is horizontal at the instant shown and OA rotates at 20 r.p.m. CW direction. Find
   (a) velocities of C and D
   (b) angular velocities of links AC and BD.
   Use instant centre method.

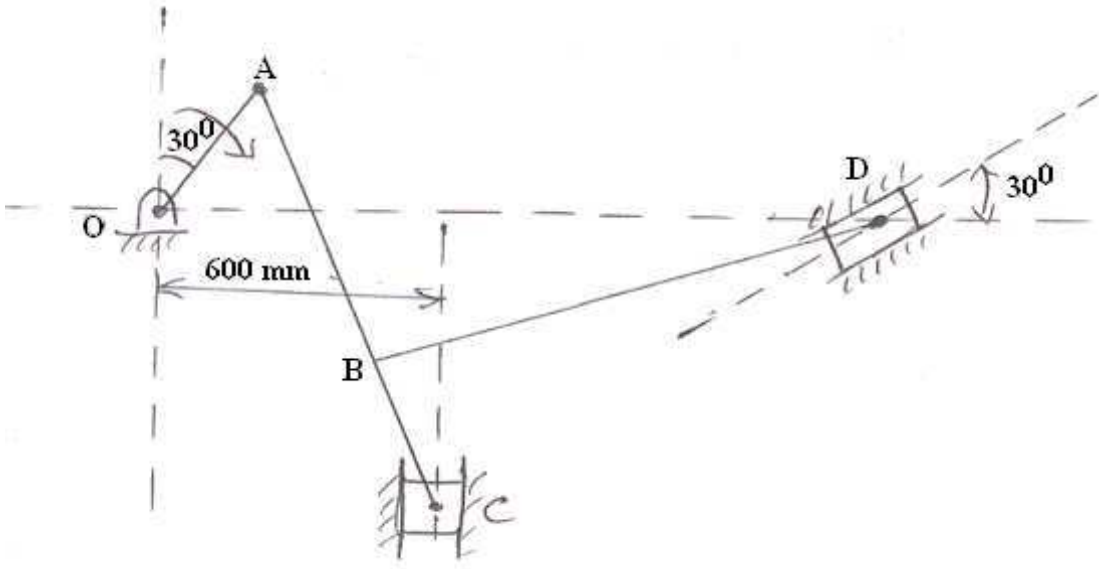

Figure 4b

5. Draw the profile of a cam operating a knife edged follower with the following data:
   (a) follower to move outward through 30 mm with SHM during 120^0 of cam rotation
   (b) dwell for 60^0
   (c) to return to its original position with uniform velocity during 90^0 and
   (d) dwell for the rest of the rotation.

   The least radius of the cam is 20 mm and the cam rotates at 240 rpm. Determine the maximum velocity and acceleration during outward stroke and return stroke. [16]

6. The exhaust valve of four stroke petrol engine is operated by circular arc cam with a flat faced follower. The lift of the follower is 10 mm, base circle diameter of the cam is 40 mm and the nose radius is 2.5 mm. The crank angle when exhaust valve opens is 140 before bottom dead center and when the exhaust valve closes, the crank angle is 15^0 after top dead centre. If the cam shaft rotates at 600 rpm, determine
   (a) maximum velocity of the valve and maximum acceleration and retardation of the valve. [16]

7. (a) What are the differences between the type of assembly generally used in running fits and interference fits? Explain
   (b) Calculate maximum and minimum clearance for an assembly specified by 45 H7-g6. [8+8]

8. (a) Explain the design procedure for spur gears for the specified load.

(b) List any four types of gears and discuss their applications along with the materials of manufacture. [8+8]

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Code No: R05222106 **Set No. 4**

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(Aeronautical Engineering)

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

Answer any FIVE Questions
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1. A nose wheel-assembly for a small aircraft is shown in figure 1. Classify the motion of this four-bar mechanism based on the configuration of the links.

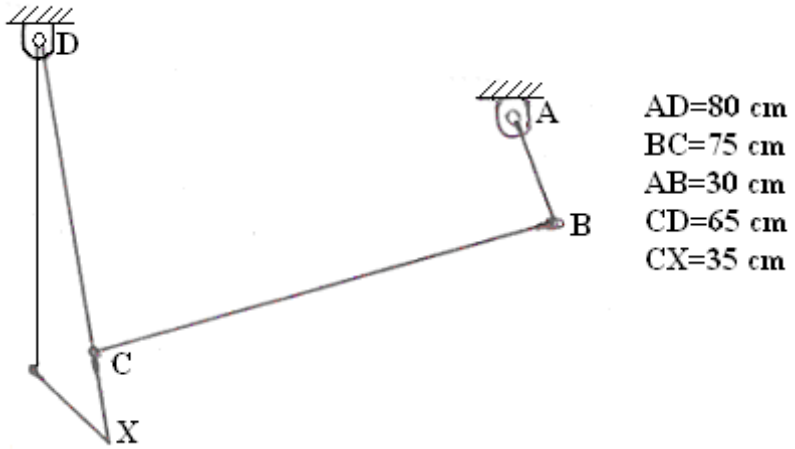

Figure 1

2. (a) Describe with neat sketches any two forms of the pantograph mechanism ?
   (b) Find the ratio of magnification for a pantograph given in Figure 2b. The point Q describes a circle of 30 mm in diameter. The copying point P will describe an enlarged circle similar to one produced by Q.

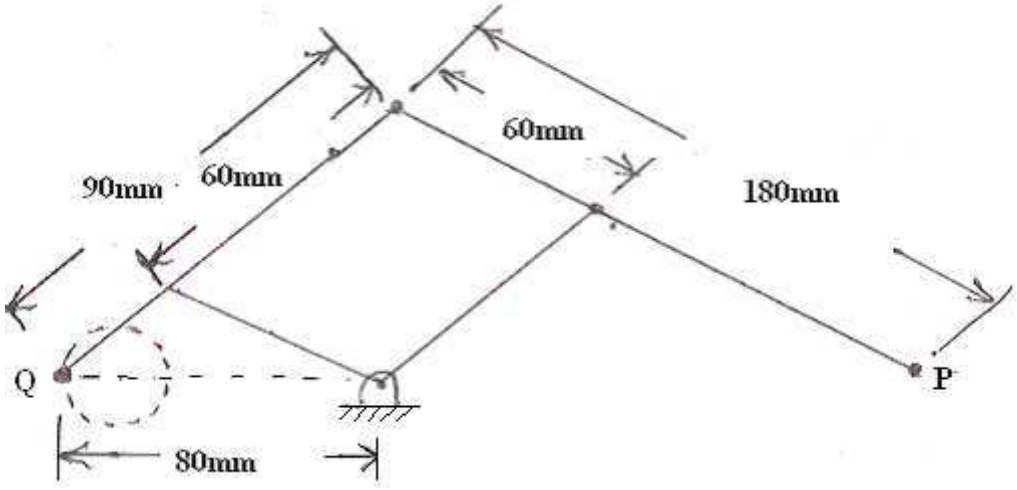

Figure 2b

3. The crank of an oil engine is 18.75 cm. long, the connecting rod is 82.5 cm. long and the crank rotates at a uniform speed of 310 r.p.m. Calculate the velocity and the acceleration of the piston for crank positions of 45^0 and 90^0.

4. In the mechanism shown in figure4 O and Q are fixed centres. If the crank OC revolves at a uniform speed of 120 r.p.m. find the angular velocities of the links CP, PA and AQ. Use instant centre method.

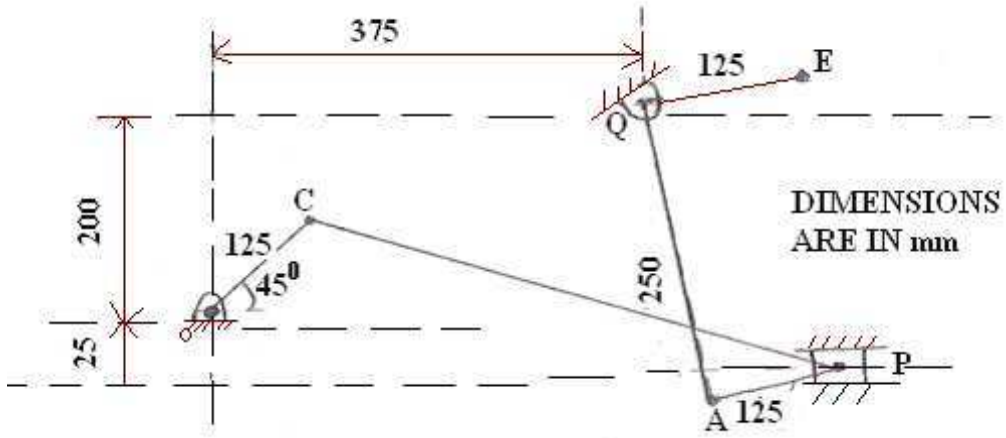

Figure 4

5. (a) Explain the functions of cams and followers. What are different applications cams in automobiles.

   (b) Derive the equations for the estimation of maximum acceleration and maximum velocity if the rotation of the follower follows simple harmonic motion. [8+8]

6. For a symmetrical tangent cam operating a roller follower, find

   (a) acceleration at the beginning of the lift, where the roller just touches the nose and

   (b) at the apex of the circular nose with straight flank with the following data. Least radius of cam = 25 mm, roller radius = 20mm, total lift = 20 mm, angle of lift = 75^0 and speed of the cam = 300 rpm. Assume there is no dwell between ascent and descent. [16]

7. Design a protective type flange coupling to connect two shafts in order to transmit 15 HP at 500 rpm. The following permissible stresses may be used : shear stress for shaft, bolt and key material is 40 N/mm^2, crushing stress for cast iron is 80 N/mm^2 and shear stress for cast iron is 40 N/mm^2. [16]

8. (a) Discuss the design procedure for helical gear from first principles.

   (b) Differentiate between bevel gears and warm gears with suitable applications. [8+8]

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