Activities

CAMS

Q1. A plate cam rotating clockwise is to give an in-line, knife-edge follower the following motion.

0–120°	lift 32 mm with uniform velocity
120–180°	dwell
180–360°	fall 32 mm with simple harmonic motion

(i) Draw the cam profile if the minimum cam radius is 38 mm and the camshaft diameter is 24 mm.
(ii) Draw the displacement diagram for the follower.

Q2.
(i) Draw a radial cam with minimum radius of 36 mm and clockwise rotation to give the following motion to a knife-edge follower.

0–120°	rise 30 mm with simple harmonic motion
120–210°	rise of 22 mm with uniform velocity
210–360°	fall of 52 mm with uniform acceleration and retardation

(ii) Draw the displacement diagram for the follower.

Q3. Draw a radial cam with a minimum radius of 30 mm and anti-clockwise rotation to give the following motion to an in-line, knife-edge follower.

0–90°	rise 30 mm with uniform velocity
90–120°	dwell
120–210°	rise 20 mm with simple harmonic motion
210–360°	fall to initial position with uniform acceleration and retardation

Q4. Draw a radial cam with minimum radius of 30 mm and clockwise rotation to give the following motion to an in-line, knife-edge follower.

0–90°	rise 30 mm with simple harmonic motion
90–240°	rise 24 mm with uniform acceleration and retardation
240–360°	fall 54 mm with uniform velocity

Q5. Fig. 17.147 shows the profile of a radial cam, which operates a knife-edge follower.
(i) Draw the cam.
(ii) Draw the displacement diagram for this cam showing displacement per second. The cam rotates at 6 revolutions per minute.

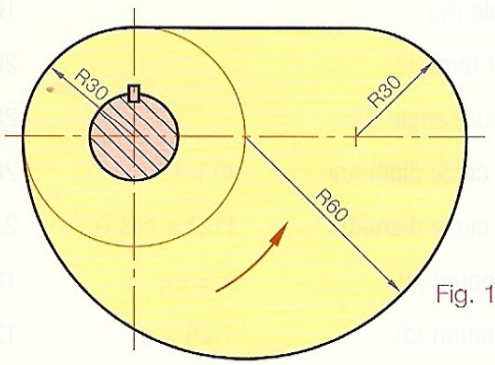


Fig. 17.147

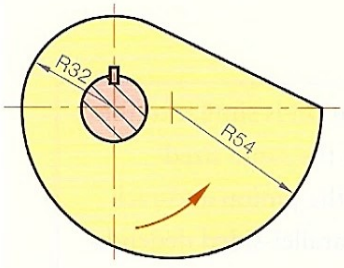


Fig. 17.148

Q6. Fig. 17.148 shows the profile of a radial cam, which operates a knife-edge follower.
(i) Draw the cam.
(ii) Draw the follower displacement diagram showing displacement per second. The cam turns once every 18 seconds.

Q7. Fig. 17.149 shows the profile of a radial plate cam, which operates a knife-edge follower.

(i) Draw the cam.

(ii) Draw the follower displacement diagram showing displacement every second. The cam rotates 2 times per minute.

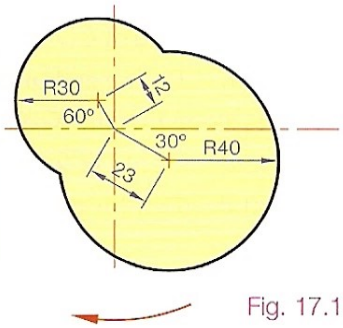


Fig. 17.149

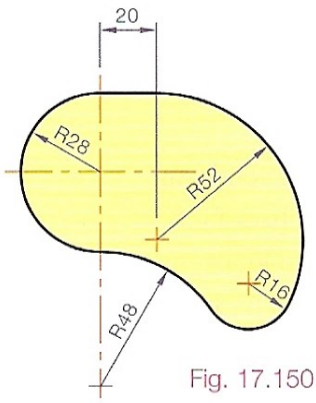


Fig. 17.150

Q8. Fig. 17.150 shows the profile of a radial plate cam which operates a knife-edge follower and rotates 3 times per minute.

(i) Draw the cam.

(ii) Draw the follower displacement diagram showing displacement every second.

MECHANISMS

Q9. Crank O_1A rotates about O_1. Arm O_2A rotates about O_2. The joints A, B and C are pin joints. D slides along the path indicated.

(i) Draw the locus of C for one revolution of crank O_1A.

(ii) Draw a displacement diagram for slider D.

O_1A = 25 mm CD = 62 mm
AB = 74 mm O_2A = 62 mm
BC = 50mm

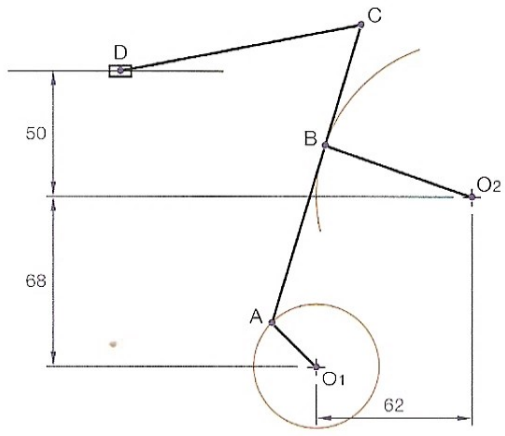
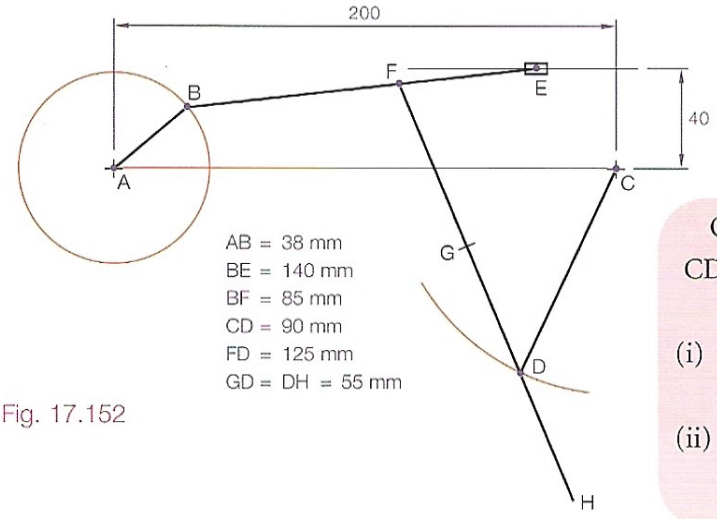


Fig. 17.151



AB = 38 mm
BE = 140 mm
BF = 85 mm
CD = 90 mm
FD = 125 mm
GD = DH = 55 mm

Fig. 17.152

Q10. Crank AB rotates about A for one revolution. Arm CD rotates about C. Joints B, D and F are pin joints. E slides along the path shown.

(i) Draw the locus of point G and point H for the movement.

(ii) Draw the displacement diagram for slider E for one revolution of the crank.

Q11. Crank AB rotates about A. Arm CD rotates about point C. Joint B slides along the arm CD. The end of the connecting rod DE slides along the line X–X.

(i) Plot the locus of the midpoint of DE for one full revolution.

(ii) Draw the displacement diagram for point E.

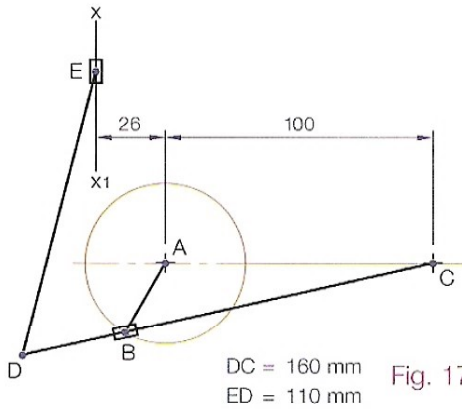


Fig. 17

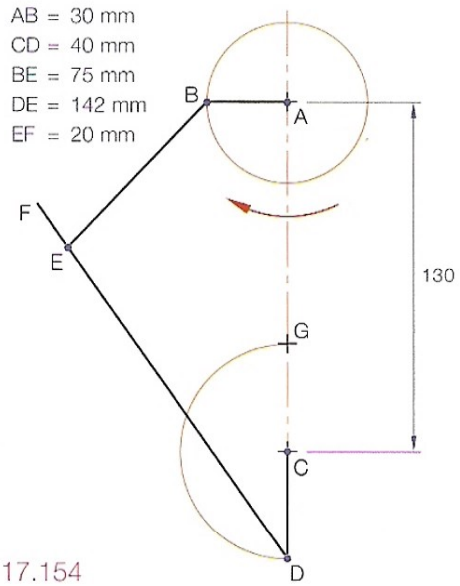


Fig. 17.154

Q12. Crank AB rotates about A for one revolution. Arm CD rotates about C. Arm CD rotates to G and back for one revolution of AB. Joints B, D and E are pin joints. Draw the locus of F for one full revolution of the crank.

CAMS

Q13. Draw the profile and displacement diagram for a cam rotating in an anti-clockwise direction. The cam has a minimum radius of 40 mm. The follower is a 24 mm diameter roller and has the following motion:

0–90°	rise of 30 mm with uniform velocity
90–180°	dwell
180–270°	rise of 20 mm with simple harmonic motion
270–300°	fall of 15 mm with simple harmonic motion
300–360°	fall of 35 mm with uniform velocity

Q14. Construct a cam profile to give an in-line, flat-ended follower the following motion. Followe base extends 8 mm each side of the centre line.

0–60°	dwell
60–180°	rise of 40 mm with uniform acceleration and retardation
180–210°	dwell
210–360°	fall of 40 mm with simple harmonic motion

The cam rotates clockwise and its minimum radiu is 30 mm.

HIGHER LEVEL

Q15. Draw the profile and follower displacement diagram for a cam rotating in a clockwise direction. The cam has a minimum radius of 40 mm and has an in-line roller follower of 20 mm diameter.

0–120°	rise of 40 mm with uniform acceleration and retardation
120–210°	fall of 20 mm with simple harmonic motion
210–270°	dwell
270–360°	fall of 20 mm with uniform velocity

Q16. A plate cam rotates anti-clockwise at 5 rpm. The cam gives an in-line roller follower of 9 mm radius the following motion:

Lift of 40 mm with simple harmonic motion in 3 seconds. Dwell for 1.5 seconds.
Fall 18 mm with uniform velocity in 2 seconds.
Fall 22 mm with uniform acceleration and retardation in 4 seconds. Dwell for the remainder of the revolution.

The nearest approach of the roller centre to the cam centre is 52 mm.

Given the above information, draw the cam profile and the follower displacement diagram.

Q17. Draw the follower displacement diagram and the cam profile of a plate cam rotating clockwise which gives a flat-ended follower the following motion:

0–120°	rise 30 mm with uniform acceleration and retardation
120–180°	dwell
180–240°	rise 16 mm with uniform velocity
240–360°	fall 46 mm with simple harmonic motion

The follower extends 7 mm each side of the centre line. The minimum diameter of the cam is 40 mm.

GEARS: INVOLUTE TEETH

Q18. Draw full-size, five teeth of an involute gear. The gear is to have 32 teeth of module 6 and a pressure angle of 20°.

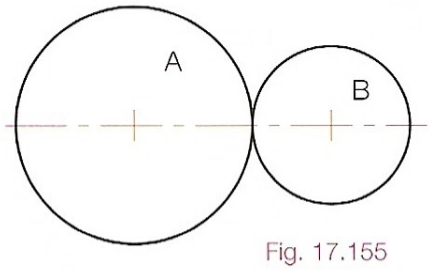


Fig. 17.155

Q19. Gear A has 24 teeth and a module of 8. Gear B has 16 teeth and a module of 8. Show 4 teeth in mesh on each gear and use conventions for the rest of the gears.

Q20. The centre distances of two involute spur gears is 180 mm. The gear ratio is 5:4. The module is 10 and the pressure angle is 20°.

(i) Calculate all relevant information and show it in tabular form.

(ii) Draw the profile of the gear wheels showing three teeth from each wheel in mesh.

Q21. A pinion with 16 teeth is to mesh with a rack whose teeth have a pressure angle of 20° and an addendum of 12 mm. The travel of the rack is to be 250 mm.

Draw all the teeth on the rack and five teeth in mesh on the pinion. Tabulate all necessary data. The teeth of the pinion are of involute form.

GEARS: EPICYCLOIDAL TEETH

Q22. A cycloidal gear wheel with 20 teeth and module of 12 is in mesh with a cycloidal gear pinion. The gear ratio is 5:3. Both gears have radial dedenda.

(i) Calculate all relevant information and show it in tabular form.

(ii) Draw the profile of the gear wheels in mesh, showing five teeth on each gear.

Q23. A pinion with 15 teeth is to mesh with a rack. The pinion has cycloidal teeth form and a module of 12. Its dedenda are to be radial.

(i) Calculate all relevant data and show it in tabular form.

(ii) Draw the profile of the rack and pinion in mesh showing five teeth on each.