

ME 281 KINEMATICS OF MACHINES

Time : 3 hr

Max Mark : 100

Drawing sheet will be provided on request

Part A (10 X 2 = 20 mark)

Answer all questions

1. What is the difference between lower and higher kinematic pair ? Give one example for each case.
2. Identify the following to which mechanism they belong to :
 - i. Wind shield wiper mechanism
 - ii. Coupler rod mechanism
 - iii Oldham's coupling
 - iv. Oscillating cylinder engine
- 3 State Grashoff's condition for planar linkages.
- 4.What do you understand by instantaneous centre of rotation of a link.
5. Sketch the velocity and acceleration diagram of a rise-dwell-fall follower subjected to uniform acceleration and retardation.
6. Define the following in cams : i. pitch curve ii. Pressure angle
7. With a simple sketch, indicate the following in the meshing of two spur gear tooth
 - i. Path of approach
 - ii. Path of recess
 - iii. Arc of contact
8. What are the advantages and limitations of worm gear trains ?
9. In calculating friction power loss in collar bearings, under what situation, uniform wear condition can be used ? Justify your answer.
10. For the same contact angle and same friction coefficient , V belt can transmit more power than flat belt. Why ?

Part B (5 X 16 mark = 80 mark)

11. In the slider mechanism shown in Fig Q 11 a . , the line of stroke of slider P is offset by a distance 50 mm from the centre O. The links OC and CP are 200 mm and 750 mm long respectively . The crank-OA rotating clockwise at a uniform speed of 200 rpm. When the angle AOC is 135° Determine 1 acceleration of the slider 2 angular acceleration of the link CP.

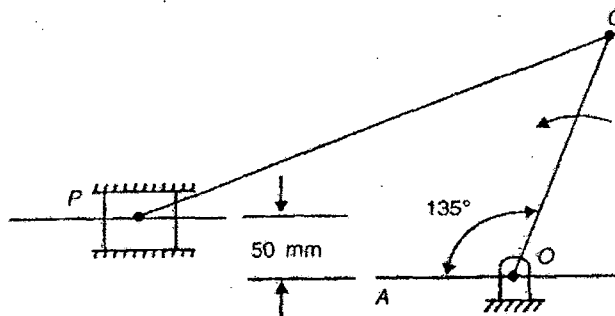


Fig Q 11(a)

- 12.a. i. Describe with a neat sketch the Whitworth quick return mechanism and how quick return motion is obtained in such a mechanism (10 mark)
- ii. Show that the Ackermann steering mechanism is the inversion of basic four bar mechanism. (6 mark)

OR

(b) The following data relate to a horizontal slider crank mechanism:

Crank radius = 150 mm, length of connecting rod = 600 mm, crank angle from the line of stroke = 45° , crank speed = 300 rpm cw.

Determine the following :

- i. acceleration of the piston and midpoint of connecting rod (12 mark)
- ii. angular acceleration of the connecting rod (4 mark)

13. a. From the following data, draw the profile of the cam in which the follower moves with uniform acceleration & deceleration during ascent and descent.

Least radius of the cam = 40 mm, ascent angle = 120° , angle of dwell = 60° , angle of descent = 120° , remaining period dwell. The lift is 30 mm and the diameter of the roller is 20 mm. The roller centre is offset from cam centre by 20 mm. The follower rotates in clockwise direction at 300 rpm. Find the maximum velocity and acceleration during descent. Draw the profile of the cam using 1:1 scale.

OR

(b) The exhaust valve of a petrol engine opens 50° before bottom dead centre and closes 20° after top dead centre. A cam operates this valve. The minimum radius and lift of cam are 35 mm and 30 mm respectively. The valve opens with constant acceleration and deceleration, the acceleration being twice the deceleration. The period for closing the valve is same as opening. The follower returns with SHM. Draw the profile of the cam if the roller radius is 15 mm and offset is 10 mm to the left of the cam centre. The cam rotates in clockwise direction. Use 1:1 scale

- 14(a) i. State and prove law of gearing. (10 mark)
- ii. Explain any two methods of avoiding interference in involute gearing (6 mark)

OR

(b) i. Explain with a neat sketch the working principle of a rear differential gear train of an automobile. (8 mark)

ii. Briefly describe the following :

1. reverted gear train
2. compound gear train (8mark)

Contd..3

15.(a) A flat belt is to be used to transmit 75 k W at belt speed 22 m/ s between two pulleys of diameter 200 mm and 400 mm having centre distance of 1 m . The allowable belt stress is 7 MN / m² and belt is available having a thickness to width ratio of 0.12 and density 1000 kg / m³ . If the coefficient of friction is 0.35 , determine the required width of the belt.

OR

(b) The semi cone angle of a cone clutch is 12. ° and the contact surfaces have a mean diameter of 78 mm The coefficient of friction is 0.30 . The clutch is used to connect an electric motor with a stationary flywheel . The motor speed is 500 rpm and the moment of inertia of the flywheel is 0.5 kg m² . Determine the following :

- i. minimum torque required to produce slipping of clutch for a axial force of 200 N . (8mark)
- ii. required time to reach full speed and energy loss during slipping (8mark)

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