

**Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET University)**



B. Tech (Fourth Semester - Regular) Examinations, April 2026
23BMEPC24003 - Kinematics of Machinery
(Mechanical Engineering)

Time: 3 hrs

Maximum: 60 Marks

Answer ALL questions
(The figures in the right hand margin indicate marks)

PART – A**(2 x 5 = 10 Marks)**Q.1. Answer **ALL** questions

- | | CO # | Blooms
Level |
|---|------|-----------------|
| a. Define machine and mechanism. | CO1 | K1 |
| b. Explain the concept of inversion of mechanism with an example. | CO2 | K2 |
| c. Discuss different types of instantaneous centres for a mechanism. | CO3 | K1 |
| d. Explain the function and purpose of an idler gear in a gear train. | CO5 | K2 |
| e. In a Davis steering gear, the distance between the pivots 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. | CO6 | K2 |

PART – B**(10 x 5 = 50 Marks)**Answer **ALL** the questions

- | | Marks | CO # | Blooms
Level |
|---|-------|------|-----------------|
| 2. a. Explain the term kinematic link. Give the classification of kinematic link. | 5 | CO1 | K2 |
| b. Sketch and explain rotary engine mechanism and explain its working principle. | 5 | CO2 | K2 |
| (OR) | | | |
| c. Define Degrees of Freedom (DOF) of a mechanism. Derive the Gruebler's equation for a planar mechanism and explain the terms involved. | 5 | CO1 | K2 |
| d. Sketch and explain any two inversions of a double slider crank chain. | 5 | CO2 | K2 |
| 3.a. Locate all the instantaneous centers of the slider crank mechanism. The lengths of crank OB and connecting rod AB are 100 mm and 400 mm respectively. If the crank rotates clockwise with an angular velocity of 10 rad/s, find: 1. Velocity of the slider A, and 2. Angular velocity of the connecting rod AB. The angle AOB = 45°. | 10 | CO3 | K3 |
| (OR) | | | |
| b. The crank of a slider crank mechanism rotates clockwise at a constant speed of 300 r.p.m. The crank is 150 mm and the connecting rod is 600 mm long. Determine : 1. Linear velocity and acceleration of the midpoint of the connecting rod, and 2. angular velocity and angular acceleration of the connecting rod, at a crank angle of 45° from inner dead centre position. | 10 | CO3 | K3 |
| 4.a. A cam, with a minimum radius of 50 mm, rotating clockwise at a uniform speed, is required to give a knife edge follower the motion as described below : 1. To move outwards through 40 mm during 100° rotation of the cam ; 2. To dwell for next 80° ; 3. To return to its starting position during next 90°, and 4. To dwell for the rest period of a revolution i.e. 90°. Draw the profile of the cam when the line of stroke of the follower passes through the centre of the cam shaft. The displacement of the follower is to take place with uniform acceleration and uniform retardation. Determine the maximum velocity and acceleration of the follower when the cam shaft rotates at 900 r.p.m. Draw the | 10 | CO4 | K6 |

displacement, velocity and acceleration diagrams for one complete revolution of the cam.

(OR)

- b. A cam, with a minimum radius of 25 mm, rotating clockwise at a uniform speed is to be designed to give a roller follower, at the end of a valve rod, motion described below :

1. To raise the valve through 50 mm during 120° rotation of the cam ;
2. To keep the valve fully raised through next 30°;
3. To lower the valve during next 60°; and
4. To keep the valve closed during rest of the revolution i.e. 150° ;

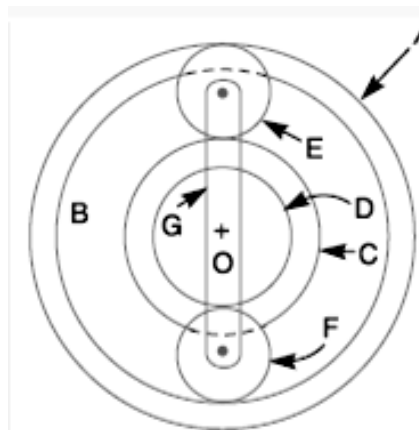
The diameter of the roller is 20 mm and the diameter of the cam shaft is 25 mm.

Draw the profile of the cam when the line of stroke of the valve rod passes through the axis of the cam shaft, The displacement of the valve, while being raised and lowered, is to take place with simple harmonic motion. Determine the maximum acceleration of the valve rod when the cam shaft rotates at 100 r.p.m. Draw the displacement, the velocity and the acceleration diagrams for one complete revolution of the cam.

- 5.a. Compare Spur, Helical, and Bevel gears based on their tooth construction, noise levels, and load-carrying capacity.

(OR)

- b. 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 the arm G. E gears with A and C and gears with B and D. All the wheels have the same module and the number of teeth are : $T_C = 28$; $T_D = T_E = T_F = 18$. 1. Find the number of teeth on A and B ; 2. If the arm G



to
F

26;

makes 100 r.p.m. clockwise and A is fixed, find the speed of B ; and 3. If the arm G makes 100 r.p.m. clockwise and wheel A makes 10 r.p.m. counter clockwise ; find the speed of wheel B.

- 6.a. Explain briefly the differences between simple, compound, and epicyclic gear trains. What are the special advantages of epicyclic gear trains ?
- b. Explain Ackermann and Davis steering mechanisms with neat sketches.

(OR)

- c. With a neat sketch find the gear ratio of compound gear train.
- d. Two shafts are connected by a universal joint. The driving shaft rotates at a uniform speed of 1200 r.p.m. Determine the greatest permissible angle between the shaft axes so that the total fluctuation of speed does not exceed 100 r.p.m. Also calculate the maximum and minimum speeds of the driven shaft.

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