GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY UNIVESRITY, ODISHA, GUNUPUR
(GIET UNIVERSITY)

B. Tech(Fourth Semester - Regular) Examinations, April – 2025

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.	What is a machine? Giving example, differentiate between a machine and a structure.	1	K1
b.	State the ' Kennedy's Theorem' of three instantaneous centres.	3	K1
c.	Draw the velocity and acceleration diagram for a follower when it moves with constant velocity.	4	K3
d.	With a neat sketch find the gear ratio of compound gear train.	5	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.	6	K2

PART – B   **(10 x 5=50 Marks)**

Answer *ALL* the questions

		Marks	CO #	Blooms Level
2. a.	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
b.	Sketch and explain any two inversions of a double slider crank chain.	5	CO2	K2
	(OR)			
c.	Explain different kinds of kinematic pairs giving example for each one of them.	5	CO1	K2
d.	Sketch and explain Beam engine.	5	CO2	K2
3.a.	In a pin jointed four bar mechanism, crank AB = 300 mm, BC = CD = 360 mm, and fixed link AD = 600 mm. The angle BAD = 60°. The crankAB rotates uniformly at 100 r.p.m. Locate all the instantaneous centres and find the angular velocity of the link BC.	10	CO3	K3
	(OR)			
c.	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 is to give the following motion to a knife-edged follower : **1.** Outstroke during 60° of cam rotation ; **2.** Dwell for the next 30° of cam rotation ; **3.** Return stroke during next 60° of cam rotation, and **4.** Dwell for the remaining 210° of cam rotation. The stroke of the follower is 40 mm and the minimum radius of the cam is 50 mm. The follower moves with uniform velocity during both the outstroke and return strokes. Draw the profile of the cam (a) when the axis of the follower passes through the axis of the cam shaft. **(b)** the line of the stroke is offset 15 mm from the axis of the cam shaft.	10	CO4	K6

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° ;   10   CO4   K6

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 **(a)** 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.

5.a. Explain briefly the differences between simple, compound, and epicyclic gear trains. What are the special advantages of epicyclic gear trains ?   5   CO5   K2

b. The gearing of a machine tool is shown in Fig. The motor shaft is connected to gear A and rotates at 975 r.p.m. The gear wheels B, C, D and E are fixed to parallel shafts rotating together. The final gear F is fixed on the output shaft. What is the speed of gear F ? The number of teeth on each gear are as given below :

Gear	A	B	C	D	E	F
No. of teeth	20	50	25	75	26	65

5   CO5   K3
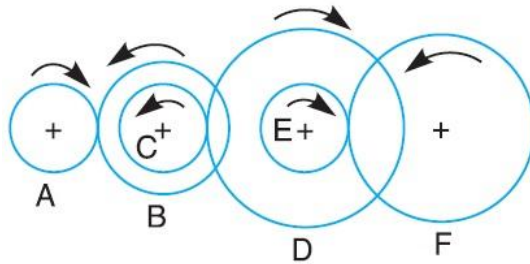
(OR)

c. In a reverted epicyclic gear train, the arm A carries two gears B and C and a compound gear D - E. The gear B meshes with gear E and the gear C meshes with gear D. The number of teeth on gears B, C and D are 75, 30 and 90 respectively. Find the speed and direction of gear C when gear B is fixed and the arm A makes 100 r.p.m. clockwise.   10   CO5   K4

6.a. Explain the advantages and disadvantages of Gear Drive. Sketch and explain Rack and pinion Mechanism.   5   CO5   K2

b. Two shafts are connected by a Hooke's joint. The driving shaft revolves uniformly at 500 r.p.m. If the total permissible variation in speed of the driven shaft is not to exceed ± 6% of the mean speed, find the greatest permissible angle between the centre lines of the shafts.   5   CO6   K3

(OR)

c. Explain with sketches the different types of cams and followers.   5   CO4   K2

d. What is the condition for correct steering? Sketch and show the two main types of steering gears and discuss their relative advantages.   5   CO6   K2

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