Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–IV EXAMINATION – WINTER 2025

Subject Code:3144102 **Date:20-11-2025**

Subject Name:Kinematics and Dynamics of Machines

Time:02:30 PM TO 05:00 PM **Total Marks:70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			MARKS
Q.1	**(a)**	Define the terms; i) Link ii) Kinematic pair iii) Kinematic chain	**03**
	(b)	Explain Coriolis component of acceleration.	**04**
	(c)	A power transmitted by a leather belt running at 250 rpm from a pulley of 1200 mm in diameter is 7.5 kW. The angle of wrap is 165° and the coefficient of friction between the belt and the pulley is 0.3. If the safe working stress for the leather belt is 1.5 MPa, density of leather 1 Mg/m^3 and thickness of belt 10 mm, determine the width of the belt taking centrifugal tension into account.	**07**
Q.2	**(a)**	Classify the cams and followers.	**03**
	(b)	State and prove the law of gearing.	**04**
	(c)	The dimensions and configuration of the four bar mechanism, shown in 2.1, The angle $AP_1P_2 = 60°$. The crank P_1A has an angular velocity of 10 rad/s and an angular acceleration of 30 rad/s^2, both clockwise. Determine the angular velocities and angular accelerations of P_2B, and AB and the velocity and acceleration of the joint B.	**07**

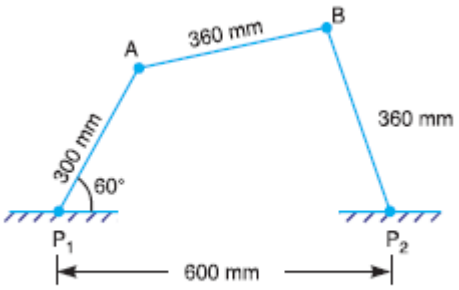

Figure 2.1

OR

(c) In the mechanism, as shown in Fig. 2.2, the crank OA rotates at 20 rpm anticlockwise and gives motion to the sliding blocks B and D. The dimensions of the various links are OA = 300 mm; AB = 1200 mm; BC = 450 mm and CD = 450 mm. For the given configuration, determine: (i) velocities of sliding at B and D, (ii) linear acceleration of D. **07**

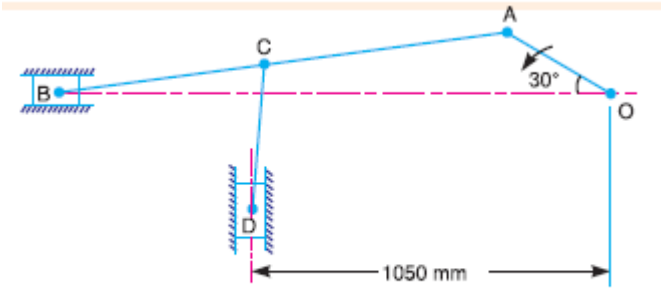

Figure 2.2

Q.3 **(a)** Define the terms i) Natural frequency, ii) Damping, iii) vibration isolation **03**

(b) Explain: Completely, incompletely and successfully constrained motions with neat sketch. **04**

(c) Sketch and explain any two inversions of a double slider crank chain. **07**

OR

Q.3 **(a)** Explain the phenomena of 'slip' and 'creep' in a belt drive. **03**

(b) Draw the velocity diagram for slider crank mechanism. **04**

(c) The following data apply to an outside cylinder uncoupled locomotive: **07**

Mass of rotating parts per cylinder = 360 kg;
Mass of reciprocating parts per cylinder = 300 kg;
Angle between cranks = 90°;
Crank radius = 0.3 m;
Cylinder centres = 1.75 m;
Radius of balance masses = 0.75 m;
Wheel centres = 1.45 m.

If whole of the rotating and two-thirds of reciprocating parts are to be balanced in planes of the driving wheels, find magnitude and angular positions of balance masses.

Q.4 **(a)** Explain the term interference in gear pairs. **03**

(b) An aeroplane makes a complete half circle of 50 meters radius, towards left, when flying at 200 km per hr. The rotary engine and the propeller of the plane has a mass of 400 kg and a radius of gyration of 0.3 m. The engine rotates at 2400 r.p.m. clockwise when viewed from the rear. Find the gyroscopic couple on the aircraft and state its effect on it. **04**

(c) In an epicyclic gear train as shown in figure 4.1, an arm carries two gears A and B having 36 and 45 teeth respectively. If the arm rotates at 150 r.p.m. in the anticlockwise direction about the center of the gear A which is fixed, determine the speed of gear B. **07**

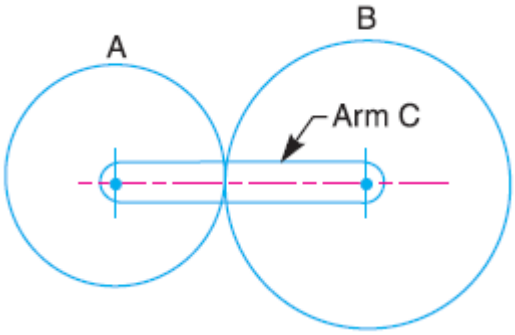

Figure 4.1

OR

Q.4	**(a)**	Explain the term gear train. List the different types of gear trains.	**03**
	(b)	Explain the effect of gyroscopic couple on naval ship.	**04**
	(c)	A cam drives a flat reciprocating follower in the following manner: During first 120° rotation of the cam, follower moves outwards through a distance of 20 mm with simple harmonic motion. The follower dwells during next 30° of cam rotation. During next 120° of cam rotation, the follower moves inwards with simple harmonic motion. The follower dwells for the next 90° of cam rotation. The minimum radius of the cam is 25 mm. Draw the profile of the cam.	**07**
Q.5	**(a)**	Differentiate between static and dynamic balancing.	**03**
	(b)	Explain the effect of the gyroscopic couple on a two wheeled vehicle when taking a turn.	**04**
	(c)	The damped vibration record of spring-mass-dashpot system shows the following data; Amplitude on second cycle = 12 mm Amplitude on third cycle = 10.5 mm Weight on the spring = 2 Kg Spring constant = 8 N / mm Determine damping constant of the viscous damping system	**07**

OR

Q.5	**(a)**	Give any 3 examples of each where vibration is desirable and undesirable.	**03**
	(b)	Explain the procedure of balancing of several masses by single mass rotating in a same plane.	**04**
	(c)	A machine of 100 kg is supported on springs of total stiffness 700 KN/m and has an unbalanced rotating element, which results in a disturbing force of 300 N at a speed of 2500rpm. Assuming a damping factor of 0.25, determine amplitude of forced vibration and force transmitted to the foundation.	**07**

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