GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–IV (NEW) EXAMINATION – SUMMER 2024

Subject Code:3144102   **Date:01-07-2024**
Subject Name: Kinematics and Dynamics of Machines
Time:10:30 AM TO 01:00 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: 1) Kinematic Pair, 2) Kinematic Chain and 3) Degree of Freedom.	**03**
	(b)	Explain inversions of Four-bar chain Mechanism.	**04**
	(c)	Describe in detail Exact and Approximate Straight Line Mechanisms.	**07**
Q.2	**(a)**	Enlist methods for determining the velocity and acceleration of link in mechanism.	**03**
	(b)	Describe the types of instantaneous centers.	**04**
	(c)	In a four bar mechanism ABCD link AD is fixed and the crank AB rotates at 10 radians per second in clockwise, lengths of the links are AB = 60 mm, BC = CD = 70 mm, DA = 120 mm, when angle DAB = 60° and both B and C lie on the same side of AB, find angular velocities of BC and CD link.	**07**

OR

(c) The mechanism, as shown in Figure 1 below, has the dimensions of various   **07**
links as follows :
AB = DE = 150 mm ; BC = CD = 450 mm ; EF = 375 mm. The crank AB
makes an angle of 45° with the horizontal and rotates about A in the clockwise
direction at a uniform speed of 120 r.p.m. The lever DC oscillates about the
fixed point D, which is connected to AB by the coupler BC. The block F
moves in the horizontal guides, being driven by the link EF.
Determine:
1. velocity of the block F,
2. angular velocity of DC, and
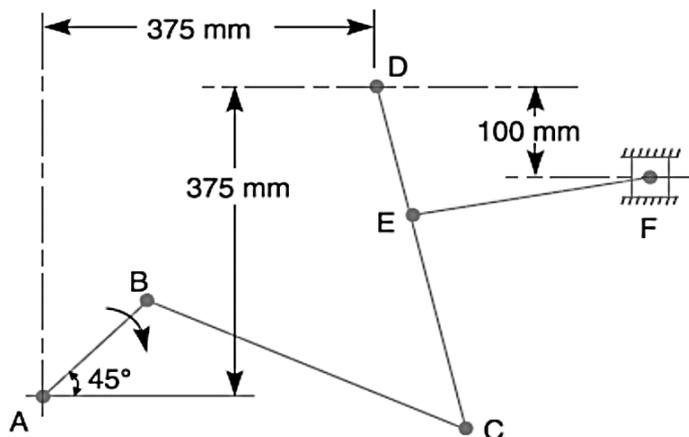3. rubbing speed at the pin C which is 50 mm in diameter.

Figure 1

Q.3	(a)	Classify and define types vibrations.	03
	(b)	Describe the Law of Gearing	04
	(c)	Explain the gear terminology with neat figure	07

OR

Q.3	(a)	Define following terms of gear terminology: - Module, Clearance and Total depth.	03
	(b)	Describe in short: Path of Contact, Arc of Contact, Contact Ratio and module.	04
	(c)	A cantilever shaft 50mm diameter and 300 mm long has a disc of mass 100 kg at its free end. The young's modulus for the shaft material is 200 GN/m^2. Determine the natural longitudinal frequency in Hz.	07

Q.4	(a)	Define Static and Dynamic balancing.	03
	(b)	Describe gyroscopic effect on naval ships during pitching.	04
	(c)	Four masses m_1, m_2, m_3 and m_4 are 200 kg, 300 kg, 240 kg and 260 kg respectively. The corresponding radii of rotation are 200 mm, 150 m, 250 m and 300 m respectively and the angles between successive masses are 45°, 75° and 135°. Find the position and magnitude of the balance mass required, if its radius of rotation is 0.2 m.	07

OR

Q.4	(a)	Why balancing is required in machines?	03
	(b)	Explain gyroscopic effect on naval ships during steering.	04
	(c)	An inside cylinder locomotive has its cylinder centre lines 0.7 m apart and has a stroke of 0.6 m. The rotating masses per cylinder are equivalent to 150 kg at the crank pin, and the reciprocating masses per cylinder to 180 kg. The wheel centre lines are 1.5 m apart. The cranks are at right angles. The whole of the rotating and 2/3 of the reciprocating masses are to be balanced by masses placed at a radius of 0.6 m. Find the magnitude and direction of the balancing masses. a crank speed is 300 r.p.m.	07

Q.5	(a)	Define terms: - time period, cycle and frequency.	03
	(b)	Write short note Cam Terminology.	04
	(c)	Draw the cam profile for following conditions: Follower type = roller follower, off set to the right of cam axis by 18mm; lift = 35mm; base circle radius = 50mm; roller radius = 14mm; out stroke with SHM in 0.05sec; dwell for 0.0125sec; return stroke with UARM, during 0.125sec; dwell for the remaining period. During return stroke, acceleration is 3/5 times retardation. Determine max. velocity and acceleration during out stroke and return stroke if the cam rotates at 240 rpm.	07

OR

Q.5	(a)	Define terms: - Angular Velocity, Angular acceleration, Gyroscopic Torque.	03
	(b)	Explain in detail vibration transmissibility.	04
	(c)	Draw the cam profile for following conditions: Follower type = Knife edged, in-line; lift = 50mm; base circle radius = 50mm; out stroke with SHM, for 60° cam rotation; dwell for 45° cam rotation; return stroke with SHM, for 90° cam rotation; dwell for the remaining period. Determine max. velocity and acceleration during out stroke and return stroke if the cam rotates at 1000 rpm in clockwise direction.	07

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