GUJARAT TECHNOLOGICAL UNIVERSITY
BE –SEMESTER 3(NEW SYLLABUS)EXAMINATION- WINTER 2019

Subject Code: 3132505   **Date: 3/12/2019**
**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.

			Marks
Q.1	**(a)**	Differentiate the machine, mechanism and structure.	**03**
	(b)	Write a short note on Degree of Freedom.	**04**
	(c)	Define inversion of kinematic chain and explain the inversion of four bar kinematic chain.	**07**
Q.2	**(a)**	List out the methods for determining the velocity and acceleration of link in mechanism.	**03**
	(b)	Explain the types of instantaneous centers.	**04**
	(c)	In an engine mechanism as shown in Fig. 1, the crank BC is 120 mm and connecting rod AB is 250 mm with centre of gravity point X' is 120 mm from 'B. The crankshaft has a speed of 75 rad/sec and angular acceleration 1400 rad/sec. Determine: (1) Velocity of point 'X' and angular velocity of AB. (2) Acceleration of X' and angular acceleration of AB.	**07**

BC = 120 mm
AB = 250 mm
XB = 120 mm

ω = 75 rad / sec
α = 1400 rad / sec^2

120°
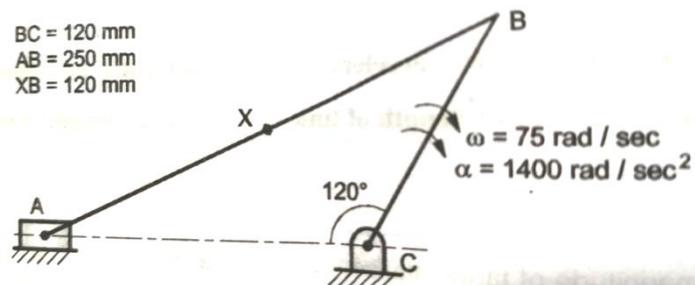
OR

	(c)	A four bar chain mechanism ABCD with its dimensions is shown in Fig. It is driven by the crank AB which rotates at 600 rpm in clockwise direction. The link AD is fixed. Find the absolute velocity of point C and angular velocity of links CB and CD using Relative velocity method.	**07**

46 cm

V_{BA}

15 cm

600 rpm

90°

30 cm

30 cm
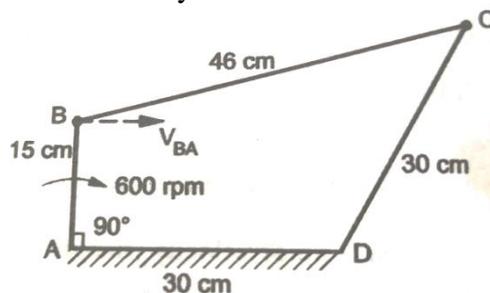
Q.3	**(a)**	Define following terms of gear terminology: - Pitch circle diameter, Circular pitch and Diametral pitch.	**03**
	(b)	Explain the law of gearing.	**04**

(c) Explain in brief the types of free vibration with suitable example. **07**

<div align="center">OR</div>

Q.3 **(a)** Define following terms of gear terminology: - Module, Clearance and Total depth. **03**

(b) Write a brief classification of toothed wheels. **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 frequency of longitudinal and transverse vibration of the shaft. **07**

Q.4 **(a)** Define Static and Dynamic balancing. **03**

(b) Explain gyroscopic effect on naval ships during steering. **04**

(c) The four masses m1, m2 m3 and m4 having their radii of rotation as 200 mm, 150 mm, 250 mm and 300 mm are 200 kg, 300 kg, 240 kg and 260 kg in magnitude respectively. The angles between the successive masses are 45˚, 75˚ and 135˚ respectively. Find the position and magnitude of the balance mass required, if its radius of rotation is 200 mm. Use analytical methods. **07**

<div align="center">OR</div>

Q.4 **(a)** Explain the need of balancing. **03**

(b) Explain gyroscopic effect on naval ships during pitching. **04**

(c) An inside cylinder locomotive has its cylinder centre lines 0.7 m apart and 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. **07**

Q.5 **(a)** Define following terms for vibratory motion: - time period, cycle, frequency. **03**

(b) Write short note vibration isolation. **04**

(c) Draw the profile of a cam operating a knife edge follower from the following data: - **(i)** Follower lifts through 3.8cm during its 60° rotation with simple harmonic motion (SHM). **(ii)** The follower remains at rest for next 40° rotation of the cam. **(iii)** The follower then descends to its original position during 90° rotation of the cam with SHM. **(iv)** The follower remains at rest for the rest of the revolution.
The least radius of the cam is 5 cm and the cam rotates at 300 r.p.m. **07**

<div align="center">OR</div>

Q.5 **(a)** Define following terms for vibratory motion: -Natural vibration, Forced vibration and Damped vibration **03**

(b) Write short note vibration transmissibility. **04**

(c) Draw the profile of a cam operating a roller follower of 30 cm diameter from the following data: (i) It lifts the follower through 3.75 cm during 60° rotation with S.H.M.
(ii) The follower remains at rest for next 45° of cam rotation.
(iii) The follower is then descent to its original position during 90° of cam rotation with uniform acceleration and retardation.
(iv) It remains at rest for the rest of cam rotation.
Least radius of cam is 5 cm. If the rotates at 300 r.p.m. **07**

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