Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–III (NEW) EXAMINATION – WINTER 2021

Subject Code:3131906 Date:23-02-2022

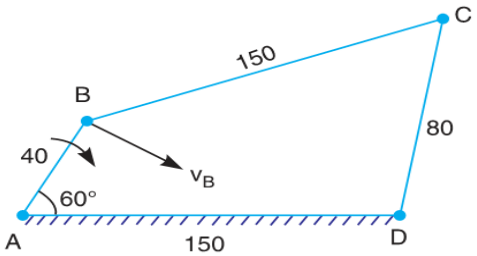
Subject Name:Kinematics and Theory of Machines

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 the following term: a) Kinematic chain b) Degree of freedom c) Mechanism	**03**
	(b)	Explain different types of kinematic pairs.	**04**
	(c)	Explain various inversion of double slider kinematic chain with examples.	**07**
Q.2	**(a)**	Describe working principle of internal expanding shoe brake with a neat sketch.	**03**
	(b)	Construct three position synthesis of single slider crank mechanism by relative pole method.	**04**
	(c)	A four bar mechanism is to be designed, by using three precision points, to generate the function $y = x^{1.5}$, for the range $1 \leq x \leq 4$. Assuming 30° starting position and 120° finishing position for the input link and 90° starting position and 180° finishing position for the output link, find the values of x, y, θ and φ corresponding to the three precision points.	**07**
		OR	
	(c)	Derive Freudenstein's equation for four bar mechanism.	**07**
Q.3	**(a)**	Explain and prove Arnold Kennedy theorem.	**03**
	(b)	Define the terms: a) Instantaneous center b) Body centrode & Space centrode c) Relative velocity	**04**
	(c)	In a four bar chain ABCD, AD is fixed and is 150 mm long. The crank AB is 40 mm long and rotates at 120 r.p.m. clockwise, while the link CD = 80 mm oscillates about D. BC and AD are of equal length. Find the angular velocity of link CD when angle BAD = 60º.	**07**



OR

Q.3	**(a)**	Explain coriolis component and derive its equation.	**03**
	(b)	Draw an acceleration diagram of single slider crank mechanism.	**04**

(c) An engine mechanism is shown in fig. The crank CB=100mm and the connecting rod BA=300 mm with G point 100 mm from B. In the position shown, the crank shaft has a speed of 75 rad/sec and an angular acceleration of 1200 rad/sec^2. Find 1. velocity of G and angular velocity of AB and 2. acceleration of G and angular acceleration of AB. **07**

Q.4 **(a)** Classify the toothed gear. **03**

(b) State and derive law of gearing. **04**

(c) Design a cam for operating the exhaust valve of an oil engine. It is required to give equal uniform acceleration and retardation during opening and closing of the valve each of which corresponds to 60º of cam rotation. The valve must remain in the fully open position for 20º of cam rotation. **07**
The lift of the valve is 37.5mm and the least radius of the cam is 40mm. The follower is provided with a roller of radius 20mm and its line of stroke passes through the axis of cam.

OR

Q.4 **(a)** Define the terms: **03**
a) pressure angle
b) helix angle
c) circular pitch

(b) Explain the term 'Interference' as applied to gears. **04**

(c) A cam rotating CW at a uniform speed of 1000 rpm is required to give a roller follower the motion defined below: **07**
1. Follower move outwards through 50 mm during 120º of cam rotation
2. Follower to dwell for next 60º of cam rotation
3. Follower to return to its starting position during next 90º of cam rotation
4. Follower to dwell for the rest of the cam rotation.
The minimum radius of the cam is 50 mm and diameter of roller is 10mm. The line of stroke of the follower is off set by 20mm from the axis of the cam shaft. If the displacement of the follower takes place with uniform and equal acceleration and retardation on both the outward and return strokes, draw the profile of cam.

Q.5 **(a)** Derive the empirical relation for the ratio of driving tensions for flat belt drive. **03**

(b) A casting weighing 9 kN hangs freely from a rope which makes 2.5 turns round a drum of 300 mm diameter revolving at 20 r.p.m. the other end of the rope is pulled by a man. The coefficient of friction is 0.25. Determine: (1) The force required by the man and (2) the power to raise the casting. **04**

(c) A multi disc clutch has three discs on the driving shaft and two on the driven shaft. The outside diameter of the contact surfaces is 240mm and inside diameter 120mm. Assuming uniform wear and coefficient of friction as 0.3, find the maximum axial intensity of pressure between the discs for transmitting 25 KW at 1575 rpm. **07**

OR

Q.5 **(a)** Define the terms: **03**
a) Dry friction
b) film friction
c) limiting angle of friction

(b) Describe with a neat sketch the working of a single plate clutch. **04**

(c) A shaft rotating at 200 r.p.m. drives another shaft at 300 r.p.m. and transmits 6 kW through a belt. The belt is 100 mm wide and 10 mm thick. The distance between the shafts is 4 m. the smaller pulley is 0.5 m in diameter. Calculate the stress in the belt, if it is (1) an open belt drive, and (2) a cross belt drive. Take $\mu = 0.3$. **07**

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