

- OR**

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|------------|------------|---|-----------|
| Q.5 | (a) | What are various kinds of friction? Discuss each in brief. | 03 |
| | (b) | A differential band brake has a drum with a diameter of 800 mm. The two ends of the band are fixed to the pins on the opposite sides of the fulcrum of the lever at distances of 40 mm and 200 mm from the fulcrum. The angle of contact is 270° and the $\mu = 0.2$. Determine the brake torque when a force of 600 N is applied to the lever at a distance of 800 mm from the fulcrum. Consider clockwise rotation of the drum. | 04 |
| | (c) | Two 20° involute spur gears mesh externally and give a velocity ratio of 3. The module is 3 mm and the addendum is equal to 1.1 module. If the pinion rotates at 120 rpm, determine the (i) minimum number of teeth on each wheel to avoid interference, (ii) contact ratio. | 07 |

OR

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GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-III (NEW) EXAMINATION – SUMMER 2024****Subject Code:3131906****Date:06-07-2024****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

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|------------|--|-----------|
| Q.1 | (a) Define (1) Higher Pair (3) Structure (3) kinematic Link | 03 |
| | (b) State and explain Grashof's law of mechanism. | 04 |
| | (c) What do you know about inversion? Explain inversion of single slider crank mechanism with sketch. | 07 |
| Q.2 | (a) Explain how velocities of slider and connecting rod are obtain in slider crank mechanism | 03 |
| | (b) Explain briefly dimensional synthesis. | 04 |
| | (c) Design a four-bar mechanism to co-ordinate the input and output angles as follows: (hint: use Freudenstein's equation)
Input angles = 15° , 30° , and 45° ;
Output angles = 30° , 40° , and 55° . | 07 |
| OR | | |
| | (c) The crank and connecting rod of a theoretical steam engine are 0.5 m and 2 m long respectively. The crank makes 180 r.p.m. in the clockwise direction. When it has turned 45° from the inner dead centre position, determine:
1. The velocity of the piston,
2. Angular velocity of connecting rod,
3. The velocity of point E on the connecting rod 1.5 m from the gudgeon pin,
4. Velocities of rubbing at the pins of the crankshaft, crank and crosshead when the diameters of their pins are 50 mm, 60 mm and 30 mm respectively, 5. Position and linear velocity of any point G on the connecting rod which has the least velocity relative to the crankshaft. | 07 |
| Q.3 | (a) Define for cam (1) Prime Circle (2) Pitch Circle (3) Pressure Angle | 03 |
| | (b) Give classification of follower in different way. | 04 |
| | (c) A cam is to be designed for a knife-edge follower with the following data:
1. Cam lift = 40 mm during 90° of cam rotation with SHM.
2. Dwell for the next 30° .
3. During the next 60° of cam rotation, the follower returns to its original position with SHM.
4. Dwell during the remaining 180° .
Draw the profile of the cam when the line of stroke is offset 20 mm from the axis of the camshaft. The radius of the base circle of the cam is 40 mm. | 07 |
| OR | | |
| Q.3 | (a) State advantages and disadvantages of chain drive. | 03 |
| | (b) Explain various motion of follower. | 04 |
| | (c) Explain path function generation and motion function generation. | 07 |

- Q.4** (a) What you know about sun and planet wheel? Explain with neat sketch. **03**
 (b) Explain slip and creep in belt drive. **04**
 (c) Derive formula of length of belt for cross belt drive with usual notation **07**

OR

- Q.4** (a) What is degree of freedom? Write kutzbach and grubler's criterion to plain mechanism **03**
 (b) Elaborate function of fast and loose pulley with neat sketch. **04**
 (c) A 100 mm wide and 10 mm thick belt transmits 5 kW of power between two parallel shafts. The distance between the shaft centers is 1.5 m and the diameter of the smaller pulley is 440 mm. The driving and the driven shafts rotate at 60 rpm and 150 rpm respectively. The coefficient of friction is 0.22. Find the stress in the belt if the two pulleys are connected by an open belt drive. **07**

- Q.5** (a) Draw and label main components of cone clutch. **03**
 (b) State and explain types of gear train with sketch. **04**
 (c) What you know about band brake? explain with neat sketch also state its advantages and disadvantages. **07**

OR

- Q.5** (a) Explain laws of friction **03**
 (b) What are straight line mechanisms? Also explain watt's mechanism with line diagram **04**
 (c) Two involute gears in mesh have a 20° pressure angle. The gear ratio is 3 and the number of teeth on the pinion is 24. The teeth have a module of 6 mm. The pitch line velocity is 1.5 m/s and the addendum equal to one module. Determine the angle of action of a pinion (the angle turned by the pinion when one pair of teeth is in the mesh) and the maximum velocity of sliding. **07**

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-III(NEW) EXAMINATION – SUMMER 2023****Subject Code:3131906****Date:01-08-2023****Subject Name:Kinematics and Theory 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.

- Q.1**
- (a) Define the following terms. **03**
Link, Higher Pair, Mechanism, Machine
- (b) Write a inversion of double slider crank and explain any one inversion of double slider crank. **04**
- (c) What is degree of freedom in mechanism ? explain grublers crieteria. **07**
- Q.2**
- (a) Explain terms: relative velocity, coriolis component in acceleration, peripheral velocity **03**
- (b) What is instantaneous center? Explain kennedys theorem. **04**
- (c) Derive the equation of displacement, velocity and acc crank by slider craeleration of slider in slider crank mechanism. **07**
- OR**
- (c) Following data relates to reciprocating steam engine having crank 14.5 cm, connecting rod 60 cm, uniform speed of crank 250 rpm, radius of pin circle 15 cm, length of connecting rod between centers 60 cm. Direction of rotation of crank is clockwise when crank has turned 30 degree from inner dead center. Find acceleration of piston, acceleration of center of gravity of connecting rod. The center of gravity being 22 cm from big end center(piston end connection). **07**
- Q.3**
- (a) Explain analytic synthesis for four bar mechanism. **03**
- (b) Explain limiting tension ratio in flat belt drive and derive its equation. **04**
- (c) State chebishev spacing for mechanism and find three precision points for the function $f(x) = x^{1.3}$ in the interval $0 \leq x \leq 6$, take $\theta_c = 60^\circ$, $\Phi_1 = 50^\circ$ and $\Delta\Phi = 100^\circ$ **07**
- OR**
- Q.3**
- (a) What is synthesis? Explain type of synthesis. **03**
- (b) Explain three position synthesis for four bar mechanism. **04**
- (c) How many V Belts required to transmit 30 kw from grooved pulley of 250 mm pitch diameter with groove angle 34° rotating at 1000 rpm to another grooved pulley of 1m pitch diameter. Maximum load per belt is 700 N, mass of 1 belt is 0.3 kg, coefficient of friction is 0.2 center distance is 1meter. **07**
- Q.4**
- (a) Explain various application of cam. **03**
- (b) Describe with neat sketch working of single friction clutch. **04**

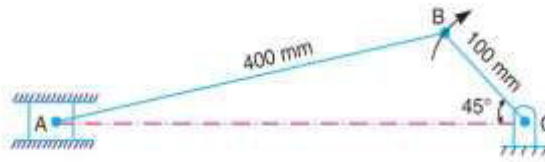
- (c) Draw the cam profile for roller follower of 30 mm diameter having lift of follower (ascend) 50 mm during 90° of cam rotation with SHM, follower having 30° of dwell period, the follower with decent to its original position during 90° of cam rotation with uniform acceleration and deacceleration it remains rest for rest of the cam operation. Least radius of cam 50 mm, if it rotates 300 rpm find maximum velocity and acceleration during ascent and decent. **07**
- OR**
- Q.4** (a) Write a short note on internal expanding shoe brake. **03**
 (b) State the type of motion for follower. Explain any one type of motion with neat sketch. **04**
 (c) A conical pivot supports a load of 25 KN. The intensity of pressure is 0.5 MN/mm^2 . Find the diameter of bearing surface and its cone angle if the face width is 0.75 times its diameter. If friction coefficient is 0.06 and shaft runs at 120 rpm find the power lost in friction. **07**
- Q.5** (a) What is interference in gears ? How it can be avoided ? **03**
 (b) Write a short note on automobile differential gear box. **04**
 (c) Determine minimum number of teeth required on pinion & wheel to avoid interference when gear ratio is 3 & when number of teeth on pinion and wheel is equal, consider pressure angle 20° and assume addendum of gear is 1.1 module. **07**
- OR**
- Q.5** (a) Write a short note on Epicyclic Gear Train **03**
 (b) Derive the expression for velocity of sliding of the mating teeth. **04**
 (c) An Epicyclic gear train of a sun and planet type has the fixed outer annular A. Sun wheel S rotating at a speed of 800 revolutions/minute. In clockwise direction and arm E carrying three planet wheels P needed to be driven. If the diametral pitch is same for all mating gears and sun wheel S and planet wheel P have 15 and 45 teeth respectively. Determine number of teeth on annular A and speed of direction of rotation of planet. **07**

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER– III (NEW) EXAMINATION – SUMMER 2022****Subject Code:3131906****Date:18-07-2022****Subject Name:Kinematics and Theory of Machines****Time:02:30 PM TO 05:00 PM****Total Marks:70****Instructions:**

1. Attempt all questions.
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3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

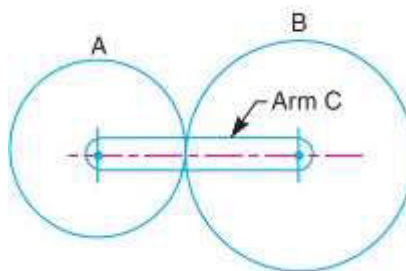
		MARKS
Q.1	(a) Sketch and describe four bar chain mechanism.	03
	(b) Explain the terms: 1. Lower pair 2. Higher pair 3. Kinematic link 4. Mechanism	04
	(c) Compare and discuss: kinematic link, kinematic pair, and kinematic chain.	07
Q.2	(a) Create displacement diagram for Simple Harmonic motion for desired dimensions.	03
	(b) Draw the displacement, velocity and acceleration diagrams for a follower when it moves with Uniform acceleration and retardation	04
	(c) A cam is to be designed for a knife edge follower with the following data : 1. Cam lift = 40 mm during 90° of cam rotation with simple harmonic motion. 2. Dwell for the next 30°. 3. During the next 60° of cam rotation, the follower returns to its original position with simple harmonic motion. 4. Dwell during the remaining 180°. Draw the profile of the cam when the line of stroke is offset 20 mm from the axis of the cam shaft. The radius of the base circle of the cam is 40 mm. Determine the maximum velocity and acceleration of the follower during its ascent and descent, if the cam rotates at 240 r.p.m	07
	OR	
	(c) Draw the profile of the cam when the roller follower moves with cycloidal motion during out stroke and return stroke, as given below : 1. Out stroke with maximum displacement of 31.4 mm during 180° of cam rotation, 2. Return stroke for the next 150° of cam rotation, 3. Dwell for the remaining 30° of cam rotation. The minimum radius of the cam is 15 mm and the roller diameter of the follower is 10 mm. The axis of the roller follower is offset by 10 mm towards right from the axis of cam shaft.	07
Q.3	(a) Explain the terms: Function Generation, Path Generation, Motion Generation	03
	(b) Formulate freudenstein's equation.	04
	(c) Locate all the instantaneous centres of the slider crank mechanism as shown in Fig. The lengths of crank OB and connecting rod AB	07

are 100 mm and 400 mm respectively. If the crank rotates clockwise with an angular velocity of 10 rad/s, find: 1. Velocity of the slider A, and 2. Angular velocity of the connecting rod AB



OR

- Q.3** (a) State and prove 'Aronhold Kennedy's Theorem' of three instantaneous centres. **03**
 (b) Explain briefly dimensional synthesis. **04**
 (c) A four bar chain mechanism is to be designed, by using three precision point to generate the function $Y = X^{1.5}$ for the range $1 \leq x \leq 4$ **07**
 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 value of x , y , θ and ϕ corresponding to three precision point.
- Q.4** (a) Differentiate between Involute and Cycloidal profile of gear tooth **03**
 (b) Define the term: **04**
 1. Pitch circle 2. Pitch Diameter 3. Pitch Point 4. Module
 (c) In an epicyclic gear train, 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 centre of the gear A which is fixed, determine the speed of gear B. If the gear A instead of being fixed makes 300 r.p.m. in the clockwise direction, what will be the speed of gear B? **07**



OR

- Q.4** (a) Define the following terms: **03**
 (1) Dry friction (2) Film friction (3) Limiting angle of friction
 (b) Discuss the various types of the brakes **04**
 (c) A bicycle and rider of mass 100 kg are travelling at the rate of 16 km/h on a level road. A brake is applied to the rear wheel which is 0.9 m in diameter and this is the only resistance acting. How far will the bicycle travel and how many turns will it make before it comes to rest? The pressure applied on the brake is 100 N and $\mu = 0.05$. **07**
- Q.5** (a) Explain what do you understand by 'initial tension in a belt' **03**
 (b) Interpret the Phenomenon of "slip" & "creep" in a belt drive. **04**
 (c) Power is transmitted using a V-belt drive. The included angle of V-groove is 30° . The belt is 20 mm deep and maximum width is 20 mm. If the mass of the belt is 0.35 kg per metre length and **07**

maximum allowable stress is 1.4 MPa, determine the maximum power transmitted when the angle of lap is 140° . $\mu = 0.15$.

OR

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|------------|------------|--|-----------|
| Q.5 | (a) | Show cone clutch with sketch. | 03 |
| | (b) | Illustrate with the neat sketch the “sun and planet wheel.” | 04 |
| | (c) | Explain the condition for correct steering. Sketch and show the Davis steering mechanism and discuss their advantages. | 07 |
