

**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, corroilis 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  $34^\circ$  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  $90^\circ$  of cam rotation with SHM, follower having  $30^\circ$  of dwell period, the follower with decent to its original position during  $90^\circ$  of cam rotation with uniform acceleration and deceleration 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  $0.5 \text{ MN/mm}^2$ . 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  $20^\circ$  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**

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