

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER-IV • EXAMINATION – SUMMER-2015

Subject Code: 141902**Date: 03/06/2015****Subject Name: Kinematics of Machines****Time: 10.30am-01.00pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Write notes on complete and incomplete constraints in lower and higher pairs, illustrating your answer with neat sketches. **07**
- (b) Sketch and explain any two inversions of a double slider crank chain. **07**
- Q.2** (a) State and prove the 'Aronhold Kennedy's Theorem' of three instantaneous centres. **04**
- (b) Locate all the instantaneous centres of the slider crank mechanism. The lengths of crank OB and connecting rod AB 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. **10**
- OR**
- (b) PQRS is a four bar chain with link PS fixed. The lengths of the links are PQ = 62.5 mm ; QR = 175 mm ; RS = 112.5 mm ; and PS = 200 mm. The crank PQ rotates at 10 rad/s clockwise. Draw the velocity and acceleration diagram when angle QPS = 60° and Q and R lie on the same side of PS. Find the angular velocity and angular acceleration of links QR and RS. **10**
- Q.3** (a) A cam is to be designed for a knife edge follower with the following data : **10**
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
- (a) the line of stroke of the follower passes through the axis of the cam shaft, and
- 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.
- (b) Define the following terms as applied to cam with a neat sketch :- **04**
- (a) Base circle, (b) Pitch circle, (c) Pressure angle, and (d) Stroke of the follower
- OR**
- Q.3** (a) Explain briefly the differences between simple, compound, and epicyclic gear trains. What are the special advantages of epicyclic gear trains ? **07**
- (b) Derive an expression for the length of the arc of contact in a pair of meshed spur gears. **07**
- Q.4** (a) An epicyclic gear consists of three gears A, B and C as shown in Fig. 1. The **07**

gear A has 72 internal teeth and gear C has 32 external teeth. The gear B meshes with both A and C and is carried on an arm EF which rotates about the centre of A at 18 r.p.m.. If the gear A is fixed, determine the speed of gears B and C.

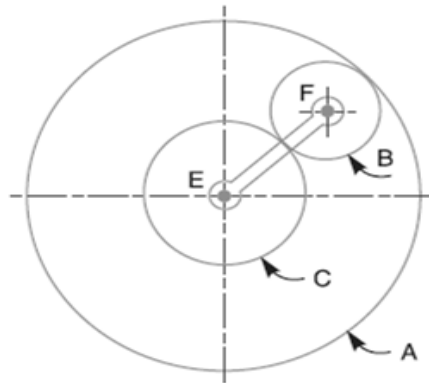


Figure 1

- (b) Write a short note on differential gear box used in automobile with neat sketch **07**

OR

- Q.4 (a)** State and prove the law of gearing. Show that involute profile satisfies the conditions for correct gearing. **07**
- (b)** Two mating gears have 20 and 40 involute teeth of module 10 mm and 20° pressure angle. The addendum on each wheel is to be made of such a length that the line of contact on each side of the pitch point has half the maximum possible length. Determine the addendum height for each gear wheel, length of the path of contact, arc of contact and contact ratio. **07**

- Q.5 (a)** What are straight line mechanisms ? Describe one type of exact straight line motion mechanism with the help of a sketch. **07**
- (b)** What is the condition for correct steering ? Explain in detail Ackerman Steering Mechanism with neat sketch. **07**

OR

- Q.5 (a)** Two shafts with an included angle of 160° are connected by a Hooke's joint. The driving shaft runs at a uniform speed of 1500 r.p.m. The driven shaft carries a flywheel of mass 12 kg and 100 mm radius of gyration. Find the maximum angular acceleration of the driven shaft and the maximum torque required **07**
- (b)** four bar mechanism is to be designed, by using three precision points, to generate the function $y = x1.5$, 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**
