GUJARAT TECHNOLOGICAL UNIVERSITY
BE- IVth SEMESTER–EXAMINATION – MAY/JUNE- 2012

Subject code: 141902   **Date: 29/05/2012**
Subject Name: Kinematics of Machines
Time: 10:30 am – 01:00 pm   **Total Marks: 70**
Instructions:
1. **Read questions carefully & Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Define the following terms: **07**
1. Link 2. Locked Chain 3. Higher Pair   4. Ternary Joint 5. Degrees of freedom 6. Constrained Motion   7. Quaternary Link

(b) Define "Inversion of Mechanism". Draw sketches of any two inversions of **07** double slider crank mechanism and State their applications.

Q.2 **(a)** In I.C. engine mechanism, the length of stroke is 30 cm and length of **07** connecting rod is 70 cm. The crank rotates with 4 revolutions per second in clock wise direction. Determine 1. Angular velocity of connecting rod and 2. Velocity of piston when the crank is at 50° from IDC. 3. Does the magnitude of velocity of piston remain same if direction of rotation of crank is reversed at given crank position? Justify your answer.

(b) Determine Acceleration of the piston for the data mentioned in Q.2 (a). **07** State whether the piston is accelerated or retarded at mentioned position. Justify your answer.

OR

(b) Explain the following :   **07**
1. Rubbing Velocity 2. Instataneous center 3. Kennedy's theorem

Q.3 **(a)** In a flat belt drive, the initial tension measured in International System of **08** units is 2500. The coefficient of friction between the belt and the pulley is 0.35 and the angle of lap on the smaller and larger pulleys are 160° and 180° respectively. Determine the Horse Power transmitted by belt if smaller pulley of 200 mm diameter rotates at 420 revolutions per minute.

(b) State the criteria of selection of following for transmission of power: **06**
1. Belt Drive 2. Rope Drive 3. Chain Drive 4. Gear Drive

OR

Q.3 **(a)** Two Pulleys, one 450 mm diameter and the other 200 mm diameter are on **08** parallel shafts 2 meter apart and are connected by an open belt drive. If larger pulley rotates at 210 rpm and the maximum permissible tension in the belt is 1 KN, determine 1. Angle of contact between the belt and each pulley 2. Horse Power transmitted. Assume µ=0.3 Does the direction of rotation of pulleys affect power transmitted?

(b) Explain the phenomenon of "slip" and "creep" in a belt drive.   **06**

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Q.4 **(a)** An epicyclic gear train is composed of fixed annular wheel "A" having 300 **08** teeth. Meshing with A is wheel X which drives wheel Z through an idle wheel Y, wheel Z being concentric with A. Wheels X and Y are carried on an arm E which revolves clockwise at 120 revolutions per minute about the axis of A and Z. If the wheel X and Z have 50 and 80 teeth respectively, determine the number of teeth on Y and revolutions per minute of Y. Does the direction of rotation of arm E and gear Y are same?

(b) Define a Cam and a Follower. Sketch different types of follower and **06** mention specific characteristic of each.

OR

Q.4 **(a)** An epicyclic gear train of Sun and Planet type has the fixed outer annular A **08** , Sun Wheel S rotating at a speed of 720 revolutions per minute in clockwise direction and the Arm E carrying three planet wheels P needed to be driven. If diametral pitch is same for all mating gears and Sun Wheel S and Planet wheels P have 15 and 45 teeth respectively, Determine 1. No. of teeth on Annular A 2. Speed and direction of rotation of planets

(b) Define Clutch. Explain with neat sketch, working of a clutch generally used **06** in commercial four wheel drive.

Q.5 **(a)** Draw the profile of a cam rotating in anti clock wise direction and operating **08** a knife edge follower when the axis of the follower passes through the axis of the cam shaft from following data:
1. Follower moves outwards through 30 mm during 90° of cam rotation.
2. Follower dwells for next 120°
3. Follower returns to its original position during next 150°

The displacement of the follower is to take place with SHM during outward stroke and with uniform velocity during inward stroke. The least radius of the cam is 50 mm.

(b) A power of 35 KW is transmitted by a multi plate clutch which is quite old **06** at 1800 RPM. Axial intensity of pressure is not to exceed 15 N/mm^2 . The coefficient of friction for the friction surfaces is 0.20. The external radius of friction surface is 120 mm and is equal to 1.25 times the internal radius. Determine the no. of plates required on driving and driven shaft to transmit the required power. Justify the condition assumed.

OR

Q.5 **(a)** A conical pivot with semi cone angle of 60°, supports a vertical shaft of **08** 300 mm diameter and is subjected to a load of 20 KN. If speed of the shaft is 240 RPM determine power lost in friction assuming 1. Uniform pressure and 2. Uniform wear condition. From the following values of coefficient of friction: 0.02 & 0.30, which you will choose for solving the above numerical and why?

(b) A simple band brake is applied to a rotating drum of 500 mm diameter. The **06** angle of lap of the band on the drum is 260°. One end of the band is attached to a fulcrum pin of the lever and other end is to a pin 100 mm from the fulcrum. If coefficient of friction is 0.25, and a braking force of 100 N is applied at a distance of 750 mm from the fulcrum, determine the braking torque when the drum rotates in anti clock wise direction.

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