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**Question Paper Code: 41071**

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2015.

Fourth Semester

Mechanical Engineering

01UME402 – KINEMATICS OF MACHINERY

(Regulation 2013)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions.

PART A - (10 x 2 = 20 Marks)

1. Differentiate between machine and structure.
2. State the Kutzbach criterion.
3. Classify instantaneous centers.
4. Define Kennedy's theorem.
5. Define pressure angle in cam. State its importance.
6. Define the term trace point.
7. What are the condition and expression for maximum efficiency in spiral gears?
8. How epicyclic gear train differs from the other type of gear trains?
9. A body of 50N is placed on a  $20^\circ$  inclined plane whose coefficient of friction  $\mu = 0.3$ , what is the force required to hold the body at its position in the horizontal direction.
10. State the applications of multiple disc clutches.

PART - B (5 x 16 = 80 Marks)

11. (a) In a crank and slotter lever quick return motion mechanism, the length of fixed link is 300 mm and that of the driving crank is 150 mm. Determine the maximum angle the slotter lever will make with the fixed link. Also determine the ratio of the time of cutting and the return strokes. If the length of the slotter lever is 700 mm, what would be the length of the stroke, assume that the line of the stroke passes of extreme position of the free end of the slotter lever? (16)

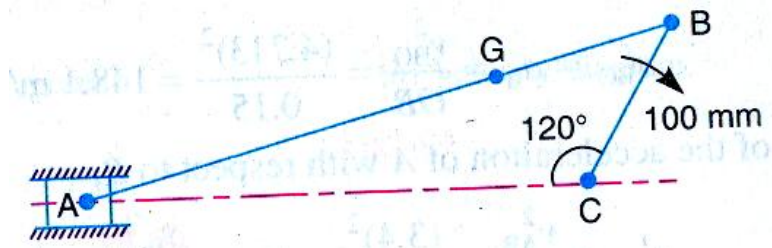
Or

- (b) Discuss about clamping and indexing mechanisms with neat sketches. (16)

12. (a) A engine mechanism is shown in figure. The crank CB = 100 mm and the connecting rod BA = 300 mm with centre of gravity G, 100 mm from B. In the position shown, the crank shaft has a speed of 75 rad/s and an angular acceleration of 1200 rad/s<sup>2</sup>.

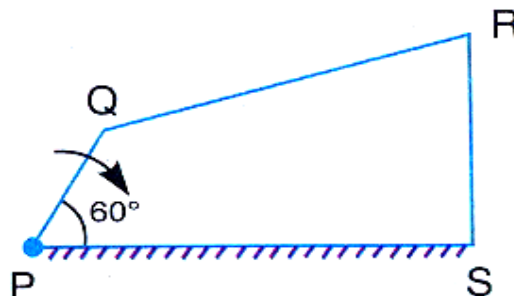
Find

- (i) velocity of G and angular velocity of AB  
 (ii) acceleration of G and angular acceleration of AB. (16)



Or

- (b) PQRS is a four bar chain with link PS fixed as shown in figure. The length 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 the links QR and RS. (16)



13. (a) The following data relates in a cam profile in which the follower moves with uniform acceleration and deceleration during an ascent and descent: Minimum radius of cam =  $25\text{mm}$ , Roller radius =  $7.5\text{mm}$ , Lift =  $28\text{mm}$ , Offset of follower axis =  $12\text{mm}$  towards the right, Angle of ascent =  $60^\circ$ , Angle of descent =  $90^\circ$ , angle of dwell between and Ascent and descent =  $45^\circ$ , Speed of the cam =  $200\text{rpm}$ . Draw the profile of the cam and determine the maximum velocity and uniform acceleration of the follower during the outstroke and return stroke. (16)

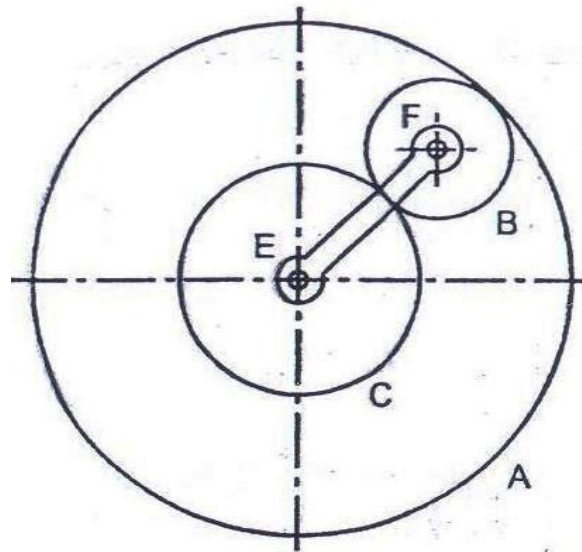
Or

- (b) A symmetrical circular cam operating a flat faced follower has the following particulars:

Minimum radius of the cam:  $30\text{mm}$ ; Total lift:  $20\text{mm}$ ; Angle of lift:  $75^\circ$ , Nose radius:  $5\text{mm}$ ; Speed:  $600\text{rpm}$ . Find

- (i) the principal dimensions of the cam
- (ii) the acceleration of the follower at the beginning of the lift, at the end of contact with the circular flank, at the beginning of contact with the nose and at the apex of the nose. (16)

14. (a) An epicyclic gear consist of three gears A, B & C as shown in figure. The 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  $18\text{rpm}$ .if the gear A is fixed, determine the speed of gears B and C. (16)



Or

- (b) The following data relate to a pair of  $20^\circ$  involute gears in mesh. Module = 6 mm, Number of teeth on pinion = 17, Number of teeth on gear = 49, Addenda on pinion and gear wheel = 1 module. Find 1. The number of pairs of teeth in contact 2. The angle turned through by the pinion and the gear wheel when one pair of teeth in contact and 3. The ratio of sliding to rolling motion when the tip of a tooth on the larger wheel.
- (i) is just making contact
  - (ii) is just leaving contact with its mating tooth and
  - (iii) is at the pitch point. (16)

15. (a) (i) An effort of 1200N is required, just move a certain body up an inclined plane of angle  $12^\circ$  with force parallel to the plane. If the angle of inclination is increased to  $15^\circ$ , then the effort required 1400 N. Find the coefficient of friction and weight of the body. (8)
- (ii) The efficiency of screw jack is 55%, when a load of 1500 N is lifted by an effort applied at the end of a Handle of length 0.5m. Determine the effort applied if the pitch of screw thread is 10mm. (8)

Or

- (b) A plate clutch has three discs on the driving shaft and two discs on the driven shaft, providing four pairs of contact surfaces. The outside diameter of the contact surfaces is 240 mm and inside diameter 120 mm. Assuming uniform pressure and Coefficient of friction is 0.3. Find the total spring load pressing the plates together to transmit 25 kW at 1575 rpm. If there are 6 springs, each of stiffness 13 kN/m and each of the contact surfaces has worn away by 1.25 mm, find the maximum power that can be transmitted, assuming uniform wear. (16)
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