Reg. No. :

Question Paper Code: 41742

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2016

Fourth Semester

Mechanical Engineering

14UME402 - KINEMATICS OF MACHINERY

(Regulation 2014)

Duration: Three hours   Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. ABCD is a mechanism with link lengths AB=200, BC=300, CD=400 and DA=350. Which one of the following links should be fixed for the resulting mechanism to be a double crank mechanism? (All lengths are in mm)

    (a) AB   (b) BC   (c) CD   (d) DA

2. In a four-bar linkage, S denotes the shortest link length, L, is the longest link length, P and Q are the lengths of other two links. At least one of the three moving links will rotate by 360° if

    (a) S+L ≤ P+Q   (b) S+P ≤ L+Q   (c) S+L > P+Q   (d) S+P > L+Q

3. There are two points P and Q on a planar rigid body. The relative velocity between two points

    (a) Should always be along PQ
    (b) Can be oriented along any direction
    (c) Should always be perpendicular to PQ
    (d) Should be along QP when the body undergoes pure translation

4. The number of instantaneous centres for a planar 4 bar mechanism is

    (a) 2   (b) 4   (c) 6   (d) 8

5. In a plate cam mechanism with reciprocating roller follower, the follower has a constant acceleration in the case of

    (a) Cycloidal motion   (b) Simple harmonic motion

    (c) Parabolic motion   (d) 3-4-5 polynomial motion

6. For a spring-loaded roller-follower driven with a disc cam

    (a) The pressure angle should be larger during rise than that during return for ease of transmitting motion

    (b) The pressure angle should be smaller during rise than that during return for ease of transmitting motion

    (c) The pressure angle should be large during rise as well as during return for ease of transmitting motion

    (d) The pressure angle does not affect the ease of transmitting motion

7. In a reverted gear train, two gears p and Q are meshing, Q-R is a compound gear and R and S are meshing. The modulus of P and R are 4 mm and 5mm respectively. The numbers of teeth in P, Q and R are 20, 40 and 25 respectively. The number of teeth in S is

    (a) 23   (b) 35   (c) 50   (d) 53

8. A gear having 100 teeth is fixed and another gear having 25 teeth revolves around it, centre lines of both the gears being jointed by an arm. How many revolutions will be made by the gear of 25 teeth for one revolution of arm?

    (a) 3   (b) 4   (c) 5   (d) 6

9. The ratio of tension on the tight side to that on the slack side in a flat belt drive is

    (a) Proportional to the product of coefficient of friction and lap angle

    (b) An exponential function of the product of coefficient of friction and lap angle

    (c) Proportional to the lap angle

    (d) Proportional to the coefficient of friction

10. What is the efficiency of a self-locking power screw?

    (a) 70%   (b) 60%   (c) 55%   (d) < 50 %

PART - B (5 x 2 = 10 Marks)

11. Write down the Grashoff's law for four bar mechanism.

12. What is the expression for Corioli's component of acceleration?

13. Define the term Pressure Angle related to cams.

14. Define (i) Module (ii) Diametral Pitch of gears.

15. Differentiate between self-energising and self-locking brakes.
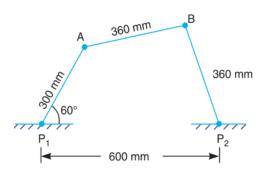
PART - C (5 x 16 = 80 Marks)

16. (a) Sketch and explain the inversions of double slider crank chain. (16)

Or

(b) Explain the working principle and time ratio of crank and slotted lever quick return mechanism. (16)

17. (a) The Crank of a slider crank mechanisms rotates clockwise at a Constant speed of 300 rpm. The crank is 150 mm and connecting rod is 600 mm long. Determine 1. Linear velocity and acceleration of the mid Point of the connecting rod, and 2. Angular velocity and angular acceleration of the connecting rod, at a crank angle of 45° from inner dead centre position. (16)

Or

(b) The dimensions and configuration of the four bar mechanism, shown below are as follows: P_1A=300 mm, P_2B=360 mm, AB=360 mm and P_1P_2=600 mm. The angle AP_1P_2=60°. The crank P_1A has an angular velocity of 10 rad/s and an angular acceleration of 30 rad/s², both clockwise. Determine the angular velocities and angular accelerations of P_2B, and AB and the velocity and acceleration of the joint B. (16)

18. (a) A cam is to give the following motion to a knife edged follower: (a) Outstroke during 60° of cam rotation (b) Dwell for the next 30° of cam rotation (c) Return stroke during next 60° of cam rotation and (d) Dwell for the remaining of cam rotation. The stroke of the follower is 40 mm and the minimum radius of the cam is 50 mm. The follower moves with uniform velocity during both the outstroke and return strokes. Draw the profile of the cam when the axis of the follower passes through the axis of the cam shaft. (16)

Or

41742

(b) A cam drives a flat reciprocating follower in the following manner: During first 120° rotation of the cam, follower moves outwards through a distance of 20 mm with simple harmonic motion. The follower dwells during next 30° of cam rotation. During next 120° of cam rotation, the follower moves inwards with simple harmonic motion. The follower dwells for the next 90° of cam rotation. The minimum radius of the cam is 25 mm. Draw the profile of the cam. (16)

19. (a) The number of teeth on each of the two spur gears in mesh is 40. The teeth have 20° involute profile and the module is 6mm. If the arc of contact is 1.75 times the circular pitch. Find the addendum. (16)

Or

(b) The arm of an epicyclic gear train rotates at 100 rpm in the anti-clock wise direction. The arm carries two wheels A and B having 36 and 45 teeth respectively. The wheel A is fixed and the arm rotates about the centre of wheel A. Find the speed of wheel B. What will be the speed of B, if the wheel A instead of being fixed, makes 200 rpm (clockwise). (16)

20. (a) A single plate clutch, with both sides effective, has outer and inner diameters 300 mm and 200 mm respectively. The maximum intensity of pressure at any point in the contact surface is not to exceed 0.1 N/mm². If the coefficient of friction is 0.3, determine the power transmitted by a clutch at a speed 2500 rpm. (16)

Or

(b) A 360 mm radius brake drum contacts a single shoe as shown in the figure, resists a torque of 225 N-m at 500 rpm. The coefficient of friction is 0.3. Determine (i) the normal reaction on the shoe (ii) the force to be applied at the lever end for counter clockwise rotation of the drum if e=0 (iii) the force to be applied at the lever end for clockwise rotation of the drum if e=40mm (iv) the force to be applied at the lever end for counter clockwise rotation of the drum if e=40mm. (16)

41742