

Reg. No. :

--	--	--	--	--	--	--	--	--	--

Question Paper Code: 44702

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2019

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)

- In a 4-bar linkage, if the lengths of shortest, longest and the other two links are denoted by s , l , p and q , then it would result in Grashof's linkage provided that
 - $l + p < s + q$
 - $l + s < p + q$
 - $l + p = s + q$
 - None of these
- In a four bar chain or quadric cycle chain
 - each of the four pairs is a turning pair
 - one is a turning pair and three are sliding pairs
 - three are turning pairs and one is sliding pair
 - each of the four pairs is a sliding pair
- There are two points P and Q on a planar rigid body. The relative velocity between two points
 - Should always be along PQ
 - Can be oriented along any direction
 - Should always be perpendicular to PQ
 - Should be along QP when the body undergoes pure translation
- Instantaneous centre of rotation of a link in a four bar mechanism lies on
 - Right side pivot of this link
 - Lift side pivot of this link
 - A point obtained by intersection on extending adjoining links
 - Bottom side of this link

5. Cam size depends on
- (a) Base circle (b) Pitch circle
(c) Prime circle (d) Outer circle
6. For a given lift of the follower of a cam follower mechanism, a smaller base circle is desired
- (a) because it will give a steeper cam and higher pressure angle
(b) because it will give a profile with lower pressure angle
(c) because it will avoid jumping
(d) None of these
7. For a speed ratio of 100, smallest gear box is obtained by using
- (a) a pair of spur gears
(b) a pair of helical and a pair of spur gear compounded
(c) a pair of bevel and a pair of spur gear compounded
(d) a pair of helical and a pair of worm gear compounded
8. Purpose of using differential gear in automobile is to
- (a) Control speed (b) Avoid jerks
(c) Help in turning (d) Obtain rear movement
9. For a machine to be self-sustaining
- (a) $\alpha = \varphi$ (b) $\alpha > \varphi$ (c) $\alpha < \varphi$ (d) $\alpha = \varphi = 0$
Where α = slope of threads, φ = angle of friction
10. Which of the following clutches is positive type
- (a) Cone (b) Disc (c) Jaw (d) Centrifugal

PART - B (5 x 2 = 10 Marks)

11. Difference between machine and structure.
12. Define rubbing velocity at a pin joint.
13. What are the types of follower motion?
14. Define pressure angle of a gear.
15. Write four applications of band brakes.

PART - C (5 x 16 = 80 Marks)

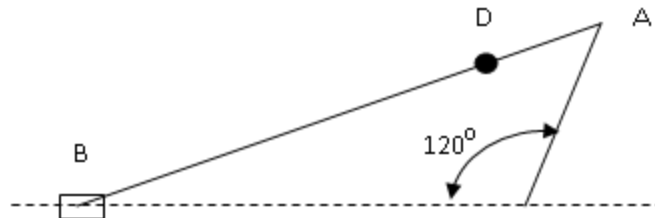
16. (a) Sketch and describe the working of two different types of quick return mechanisms. Give examples of their applications. Derive an expression for the ratio of times taken in forward and return stroke for one of these mechanisms. (16)

Or

- (b) Explain the application of kutzbach Criterion to Plane Mechanisms. (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) Figure shows configuration of an engine mechanism. The dimensions are, crank $OA = 200 \text{ mm}$, connecting rod $AB = 600 \text{ mm}$, distance of center of mass of the connecting rod from crank end $AD = 200 \text{ mm}$. At the instant, the crank has an angular velocity of 50 rad/s clockwise and an angular acceleration of 800 rad/s^2 , calculate the (i) velocity of D and angular velocity of AB (ii) acceleration of D and angular acceleration of AB . (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

- (b) Draw the profile of the cam when the roller follower moves with cycloidal motion during out stroke and return stroke, as given below: 1. Out stroke with maximum displacement of 31.4 mm during 180° of cam rotation, 2. Return stroke for the next 150° of cam rotation, 3. Dwell for the remaining 30° of cam rotation. The minimum radius of the cam is 15 mm and the roller diameter of the follower is 10 mm . The axis of the roller follower is offset by 10 mm towards right from the axis of cam shaft. (16)

19. (a) A pinion of 20 involute teeth and 125 mm pitch circle diameter drives a rack. The addendum of both pinion and rack is 6.25 mm . What is the least pressure angle which can be used to avoid interference? With this pressure angle, find the length of the arc of contact and the minimum number of teeth in contact at a time. (16)

Or

- (b) A pinion of 20° involute rotating at 275 rpm meshed with a gear and provides a gear of ratio of 1.8. The number teeth on the pinion is 20 and module is 8 mm . If the interference is just avoided, determine
- (i) Addenda of the wheel and pinion (6)
 - (ii) The path of contact (4)
 - (iii) The maximum velocity of sliding on both sides of the pitch point. (6)
20. (a) The contact surfaces in a cone clutch have an effective diameter of 75 mm . The semi-angle of the cone is 15° . The coefficient of friction is 0.3. Find the torque required to produce slipping of the clutch if an axial force applied is 180 N . This clutch is employed to connect an electric motor running uniformly at 1000 rpm with a flywheel which is initially stationary. The flywheel has a mass of 13.5 kg and its radius of gyration is 150 mm . Calculate the time required for the flywheel to attain full speed and also the energy lost in the slipping of the clutch. (16)

Or

- (b) Determine the width of a 9.75 mm thick leather belt required to transmit 15 kW from a motor running at 900 rpm . The diameter of the driving pulley of the motor is 300 mm . The driven pulley runs at 300 rpm and the distance between the centre of two pulleys is 3 m . The density of the leather is 1000 kg/m^3 . The maximum allowable stress in the leather is 2.5 MPa . The coefficient of friction between the leather and pulley is 0.3. Assume open belt drive and neglect the sag and slip of the belt. (16)