A   Reg. No. :

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Question Paper Code:53A05

B.E./B.Tech. DEGREE EXAMINATION, DEC 2021

Third Semester

Agricultural Engineering

15UAG305 - FUNDAMENTALS OF THEORY OF MACHINES

(Regulation 2015)

Duration: Three hours   Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The relation between the number of pairs (p) forming a kinematic   CO1- R
    chain and the number of links (l) is

    (a) l = 2p – 2   (b) l = 2p – 3   (c) l = 2p – 4   (d) l = 2p – 5

2. Which of the following is an inversion of double slider crank chain ___   CO1- R

    (a) Coupling rod of a locomotive   (b) Pendulum pump

    (c) Elliptical trammels   (d) Oscillating cylinder engine

3. The three precision points in the range $1 \le x \le 3$ are   CO2- R

    (a) 1.1, 2, 2.6   (b) 1.6, 2.5, 2.95   (c) 1.134, 2, 2.866   (d) 1.341, 2 , 2.686

4. The Coriolis component of acceleration is taken into account for_____.   CO2- R

    (a) Slider crank mechanism   (b) Four bar chain mechanism

    (c) Quick return motion mechanism   (d) None of these

5. The retardation of a flat faced follower when it has contact at the apex   CO3- R
    of the nose of a circular arc cam, is given by

    (a) $\omega^2 \times OQ$ (b) $\omega^2 \times OQ\sin\theta$ (c) $\omega^2 \times OQ\cos\theta$ (d) $\omega^2 \times OQ\tan\theta$

6. Offset is provided to a cam follower mechanism to _____.   CO3- R

    (a) Minimize the side thrust   (b) Accelerate

    (c) Avoid jerk   (d) None of these

7. The ratio of face width to transverse pitch of a helical gear with α as   CO4- R
    the helix angle is normally

    (a) more than 1.15/tan α   (b) more than 1.05/tan α

    (c) more than 1/tan α   (d) none of these

8. The contact ratio for gears is   CO4- R

    (a) ZERO   (b) Less than one   (c) Greater than one   (d) None of these

9. When the axes of first and last gear are coaxial, then the gear train is   CO5- R
    known as

    (a) Simple gear train   (b) Compound gear train

    (c) Reverted gear train   (d) Epicyclic gear train

10. The train value of a gear train is   CO5- R

    (a) equal to velocity ratio of a gear train (b) reciprocal of velocity ratio of a gear train

    (c) always greater than unity   (d) always less than unity

PART – B (5 x 2= 10 Marks)

11. Explain Kinematic Links.   CO1- R

12. Explain about rubbing velocity?   CO2- U

13. List the various types of CAMS.   CO3- U

14. State the four systems of gear teeth are commonly used in practice.   CO4- R

15. State the advantages of compound gear train over simple gear train.   CO5- U

PART – C (5 x 16= 80Marks)

16. (a) Describe the types of kinematic chains   CO1- U   (16)

                                    Or

    (b) Describe various inversions of double slider crank mechanism with   CO1- U   (16)
         sketches.

17. (a) In the mechanism shown in fig., the slider C is moving to the   CO2- App   (16)
         right with a velocity of 1 m/s and an acceleration of 2.5 m/s^2. The
         dimensions of various links are AB = 3 m inclined at 45° with the
         vertical and BC = 1.5 m inclined at 45° with the horizontal.
         Determine:
         1. The magnitude of vertical and horizontal component of the
         acceleration of the
         point B, and 2. The angular acceleration of the links AB and BC.

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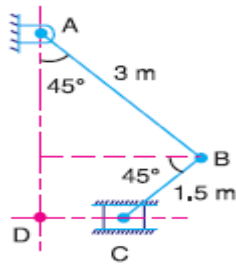
Or

(b) PQRS is a four bar chain with link PS fixed. The lengths of the links are PQ=62.5mm; QR=175mm; RS=112.5mm; and PS=200mm. the crank PQ rotates at 10rad/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.   CO2- App   (16)

18. (a) Design a cam for operating the exhaust valve of an oil engine. It is required to give equal uniform acceleration and retardation during opening and closing of the valve each of which corresponds to 60° of cam rotation. The valve must remain in the fully open position for 20° of cam rotation. The lift of the valve is 37.5 mm and the least radius of the cam is 40 mm. The follower is provided with a roller of radius 20 mm and its line of stroke passes through the axis of the cam.   CO3- App   (16)

Or

(b) A symmetrical cam with convex flanks operates a flat-footed follower. The lift is 8 mm, base circle radius 25 mm and the nose radius 12 mm. The total angle of the cam action is 120°.
1. Find the radius of convex flanks, 2. Draw the profile of the cam, and 3. Determine the maximum velocity and the maximum acceleration when the cam shaft rotates at 500 r.p.m   CO3- App   (16)

19. (a) Two involute gears of 20° pressure angle are in mesh. The number of teeth on pinion is 20 and the gear ratio is 2. If the pitch expressed in module is 5 mm and the pitch line speed is 1.2 m/s, assuming addendum as standard and equal to one module, find: a) The angle turned through by pinion when one pair of teeth is in mesh; and b). The maximum velocity of sliding..   CO4- U   (16)

Or

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(b) Determine the minimum number of teeth required on a pinion, in order to avoid interference which is to gear with 1.a wheel to give a gear ratio of 3 to 1; and 2.an equal wheel. The pressure angle is 20 ° and a standard addendum of one module for the wheel may be assumed.   CO4- App   (16)

20. (a) Two shafts A and B are co-axial. A gear C (50 teeth) is rigidly mounted on shaft A. A compound gear D-E gears with C and an internal gear G. D has 20 teeth and gears with C and E has 35 teeth and gears with an internal gear G. The gear G is fixed and is concentric with the shaft axis. The compound gear D-E is mounted on a pin which projects from an arm keyed to the shaft B. Sketch the arrangement and find the number of teeth on internal gear G assuming that all gears have the same module. If the shaft A rotates at 110 r.p.m., find the speed of shaft B.   CO5- App   (16)

Or

(b) Two parallel shafts, about 600mm apart are to be connected by spur gears. One shaft is to run at 360 r.p.m. and the other at 120 r.p.m. design the gears, if the circular pitch is to be 25mm.   CO5- App   (16)

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