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Question Paper Code: 54072

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2017

Fourth Semester

Mechanical Engineering

15UME402 - KINEMATICS OF MACHINERY

(Regulation 2015)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

- The relation between number of links and number of lower pairs is given as $n = 2p - 4$. If L.H.S is less than R.H.S of this equation then the chain is
 - constrained
 - locked
 - structure
 - unconstrained
- Watt's mechanism is based on
 - inversions of single slider chain mechanism
 - inversions of double slider chain mechanism
 - inversions of four bar chain mechanism
 - inversions of five bar chain mechanism
- According to Aronhold Kennedy's theorem, if three bodies move relatively to each other, their instantaneous centres will lie on a?
 - straight line
 - parabolic curve
 - ellipse
 - none of these
- The coriolis component of acceleration is taken into account for
 - slider crank mechanism
 - four bar chain mechanism
 - quick return motion mechanism
 - none of these
- Which one of the following is not a CAM nomenclature?
 - Prime circle
 - Pitch circle
 - Clearance circle
 - Base circle
- Which of the following statements is/are true for cam profile?
 - Pitch point on the pitch curve has minimum pressure angle
 - In case of roller follower, trace point represents centre of the roller

- (c) Pitch circle is drawn through trace point from the center of cam
- (d) All of the above

7. Herring-bone gears are also known as
- (a) Hypoid gears
 - (b) Helical gears
 - (c) Spiral gears
 - (d) None of the above
8. Interference in gear tooth profiles can be avoided by
- (a) modifying tooth profile
 - (b) modifying center distance between pinion and wheel
 - (c) both a and b
 - (d) none of the above
9. In which type of gear trains, shaft axes which are mounted by gear wheels have relative motion between them
- (a) Compounded gear train
 - (b) Simple gear train
 - (c) Epicyclic gear train
 - (d) Reverted gear train
10. In which type of vehicles, differential gear box is mounted on rear wheel axle
- (a) Light duty vehicles
 - (b) Heavy duty vehicles
 - (c) both a and b
 - (d) none of the above

PART - B (5 x 2 = 10 Marks)

11. Define the term Kinematic Chain.
12. Distinguish normal component of acceleration and tangential component of acceleration.
13. Where are the roller follower extensively used?
14. State law of Gearing.
15. What is meant by contact ratio in gears?

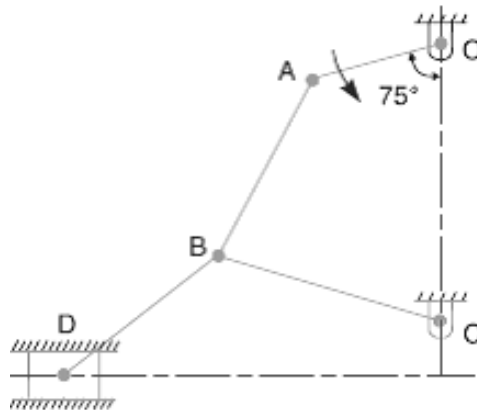
PART - C (5 x 16 = 80 Marks)

16. (a) Sketch and describe the inversions of slider crank mechanisms. Give examples of their applications. (16)

Or

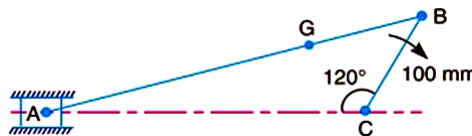
- (b) Explain the Rotary engine and Scotch yoke mechanism with neat sketches. (16)
17. (a) In the figure 17.a.the angular velocity of the crank OA is 600 r.p.m. Determine the linear velocity of the slider D and the angular velocity of the link BD, when the crank is inclined at an angle of 75° to the vertical. The dimensions of various links are : OA = 28 mm ; AB = 44 mm ; BC 49 mm ; and BD = 46 mm. The centre

distance between the centres of rotation O and C is 65 mm. The path of travel of the slider is 11 mm below the fixed point C. The slider moves along a horizontal path and OC is vertical. (16)



Or

- (b) An engine mechanism is shown in below 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 crankshaft has a speed of 75 rad/s and an angular acceleration of 1200 rad/s². Find: (i) Velocity of G and angular velocity of AB, and (ii) Acceleration of G and angular acceleration of AB. (16)



18. (a) A cam is to be designed for a knife edge follower with the following data :
1. Cam lift = 40 mm during 90° of cam rotation with simple harmonic motion.
 2. Dwell for the next 30° .
 3. During the next 60° of cam rotation, the follower returns to its original position with simple harmonic motion.
 4. Dwell during the remaining 180° .

Draw the profile of the cam when the line of stroke is offset 20 mm from the axis of the cam shaft. The radius of the base circle of the cam is 40 mm. Determine the maximum velocity and acceleration of the follower during its ascent and descent, if the cam rotates at 240 r.p.m. (16)

Or

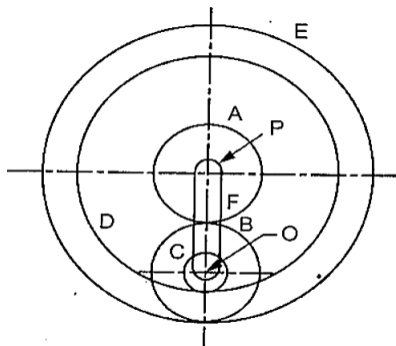
- (b) Draw a cam profile to drive an oscillating roller follower to the specifications given below: (i) Follower to move outwards through an angular displacement of 20° during the first 120° rotation of cam; (ii) Follower to return to its initial position during next 120° rotation of cam; (iii) Follower to dwell during the next 120° of cam rotation. The distance between pivot centre and roller centre = 120 mm; distance

between pivot centre and cam axis = 130 mm; minimum radius of cam = 40 mm; radius of roller = 10 mm; inward and outward strokes take place with SHM. (16)

19. (a) A pair of gears, having 40 and 20 teeth respectively, are rotating in mesh, the speed of the smaller being 2000 r.p.m. Determine the velocity of sliding between the gear teeth faces at the point of engagement, at the pitch point, and at the point of disengagement if the smaller gear is the driver. Assume that the gear teeth are 20° involute form, addendum length is 5 mm and the module is 5 mm. Also find the angle through which the pinion turns while any pairs of teeth are in contact. (16)

Or

- (b) Two mating gears have 20 and 40 involute teeth of module 10 mm and 20° pressure angle. The addendum on each wheel is to be made of such a length that the line of contact on each side of the pitch point has half the maximum possible length. Determine the addendum height for each gear wheel, length of the path of contact, arc of contact and contact ratio. (16)
20. (a) A compound epicyclic gear is shown in below figure. The gears A, D and E are free to rotate on axis P. The compound gears B and C rotate together on the axis O at the end of arm F. All gears have equal pitch. The number of external teeth on gears A, B and C are 35, 45 and 20 respectively. The gears D and E are annulus gears. The gear A rotates at 100 rpm in anticlockwise and gear D rotates at 450 rpm clockwise. Find the speed and direction of the arm and the gear E. (16)



Or

- (b) In a reverted epicyclic gear train, the arm A carries two gears B and C and a compound gear D - E. The gear B meshes with gear E and the gear C meshes with gear D. The number of teeth on gears B, C and D are 75, 30 and 90 respectively. Find the speed and direction of gear C when gear B is fixed and the arm A makes 100 r.p.m. clockwise. (16)