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Question Paper Code: 53A05

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

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)

- In a reciprocating steam engine, which of the following forms a kinematic link CO1- R
 - Cylinder and piston
 - Piston rod and connecting rod
 - Crank shaft and fly wheel
 - Flywheel and engine frame
- Which of the following mechanism is made up of turning pairs? CO1- U
 - Scott Russel's mechanism
 - Peaucellier's mechanism
 - Hart's mechanism
 - None of the above
- The magnitude of linear velocity of a point B on a link AB relative to point A is CO2- U
 - $\omega \cdot AB$
 - $\omega(AB)^2$
 - $\omega^2 \cdot AB$
 - $(\omega \cdot AB)^2$
- The direction of linear velocity of any point on a link with respect to another point on the same link is CO2- R
 - Parallel to the link joining the points
 - Perpendicular to the link joining the points
 - At 45° to the link joining the points
 - None of the above
- The size of a cam depends on CO3- R
 - Base circle
 - Pitch circle
 - Prime circle
 - Pitch curve
- When the flat faced follower is circular, it is called a CO3- R
 - Roller follower
 - Spherical follower
 - Mushroom follower
 - Offset follower
- The size of gear is usually specified by CO4- R
 - Pressure angle
 - Circular pitch
 - Diametral pitch
 - Pitch circle diameter

8. The contact ratio of gear is CO4- R
- (a) Zero (b) Less than one
- (c) Greater than one (d) None of the above
9. When the axes of first and last gear are co-axial , then gear train is known as CO5- R
- (a) Simple gear train (b) Compound gear train
- (c) Reverted gear train (d) Epicyclic gear train
10. A differential gear in an automobile is a CO5- R
- (a) Simple gear train (b) Epicyclic gear train
- (c) Compound gear train (d) None of the above

PART – B (5 x 2 = 10 Marks)

11. What is Grashoff's law? CO1-U
12. What is Relative velocity? CO2-U
13. Classify the different types of followers. CO3-R
14. What is contact ratio? CO4-U
15. Define speed ratio of gear train. CO5- R

PART – C (5 x 16= 80 Marks)

16. (a) Explain Whitworth quick return mechanism with a neat sketch. CO1- U (16)
- Or
- (b) Explain Peaucellier and Watt mechanisms with neat sketches. CO1- U (16)
17. (a) In a four bar chain ABCD, AD is fixed and is 150 mm long. The crank AB is 40mm long and rotates at 120 r.p.m. clockwise, while the link CD = 80 mm oscillates about D. BC and AD are of equal length. Find the angular velocity of link CD when angle BAD = 60°. CO2- App (16)
- Or
- (b) The crank of a slider crank mechanism rotates clockwise at a constant speed of 300 r.p.m. The crank is 150 mm and the connecting rod is 600 mm long. Determine CO2- App (16)
- (i) Linear velocity and acceleration of the midpoint of the connecting rod,
- (ii) Angular velocity and angular acceleration of the connecting rod, at a crank angle of 45° from inner dead centre position.

18. (a) A cam is to give the following motion to a knife-edged follower : CO3- App (16)
1. Outstroke during 60° of cam rotation;
 2. Dwell for the next 30° of cam rotation ;
 3. Return stroke during next 60° of cam rotation and 4. Dwell for the remaining 210° of cam rotation. The stroke of the follower is 40 mm and the minimum radius of the cam is 50mm. The follower moves with uniform velocity during both the outstroke and return strokes. Draw the profile of the cam when
- (i) the axis of the follower passes through the axis of the cam shaft.
 - (ii) the axis of the follower is offset by 20 mm from the axis of the cam shaft.

Or

- (b) A cam drives a flat reciprocating follower in the following CO3- App (16)
manner:
- During first 120° rotation of the cam, follower moves outwards through a distance of 20mm 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 25mm. Draw the profile of the cam.

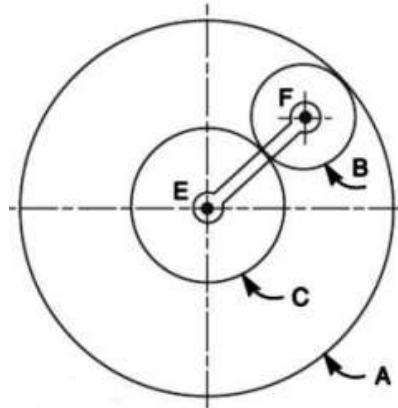
19. (a) A pinion of 20 involute teeth and 125 mm pitch circle diameter drives a rack. The addendum of both pinion and rack is 6.25mm. What is the least pressure angle which can be used to avoid interference? With this pressure angle, find the length of the arc of contact and the minimum number of teeth in contact at a time. CO4- U (16)

Or

- (b) A pinion having 30 teeth drives a gear having 80 teeth. The profile of the gears is involute with 20° pressure angle, 12mm module and 10mm addendum. Find the length of path of contact, arc of contact and the contact ratio.. CO4- U (16)

20. (a) An epicyclic gear consists of three gears A, B and 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 CO5- App (16)

arm EF which rotates about the center of A at 18 r.p.m. If the gear A is fixed, determine the speed of gears B and C.



Epicyclic gear

Or

- (b) An internal wheel B with 80 teeth is keyed to a shaft F. A fixed internal wheel C with 82 teeth is concentric with B. A compound wheel D-E gears with the two internal wheels; D has 28 teeth and gears with C while E gears with B. The compound wheels revolve freely on a pin which projects from a disc keyed to a shaft A coaxial with F. If the wheels have the same pitch and the shaft A makes 800 r.p.m., what is the speed of the shaft F? Sketch the arrangement. CO5- App (16)