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Question Paper Code: 53A04

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2018

Third Semester

Agricultural Engineering

15UAG305 - FUNDAMENTALS OF THEORY OF MACHINES

Duration: Three hours

Maximum: 100 Marks

PART A - (10 x 1 = 10 Marks)

1. A kinematic pair is a joint of CO1- R
 - (a) Two links which are fixed
 - (b) Two links having same velocity
 - (c) Two links having relative motion between them
 - (d) Two links moving opposite direction

2. Which of the following is an open pair? CO1- R
 - (a) Journal bearing
 - (b) Ball and Socket joint
 - (c) Leave screw and nut
 - (d) None of the above

3. A higher pair has_____. CO2 -R
 - (a) Point contact
 - (b) Surface contact
 - (c) No contact
 - (d) None of the above

4. _____ is an inversion of Double slider crank chain. CO2 -R
 - (a) Coupling rod of a locomotive
 - (b) Scotch yoke mechanism
 - (c) Hand pump
 - (d) Reciprocating engine

13. Define law of gearing. CO3- R
14. Define reverted gear train and state its application. CO4 -R
15. Define pressure angle in cam profile . CO5 -R

PART – C (5 x 16= 80Marks)

16. (a) A four bar kinematic chain is represented by a quadrilateral ABCD in which AD is fixed and is 400 mm long. The crank AB 75 mm long rotates in a clockwise direction at 120 rpm and drives the link CD 125 mm long by means of the connecting link BC 350 mm long. Determine the angle through which CD oscillates and find the angular velocities of the links BC and CD in one of the positions when BC is perpendicular to AB.. CO1 -App (16)

Or

- (b) A shaft carries four masses A, B, C, and D of magnitude 200kg, 300kg, 400kg and 200kg respectively and revolving at radii 80mm, 70mm, 60mm and 80mm in planes measured from A at 300mm, 400mm and 700mm. The angles between the cranks measured anticlockwise are A to B 45° , B to C 70° and C to D 120° . The balancing masses are to be placed in planes X and Y. The distance between the planes A and X is 100mm, between X and Y is 400mm and between Y and D is 200mm. If the balancing masses revolve at a radius of 100mm, find their magnitude and angular positions. CO1- App (16)
17. (a) A man wishing to slide a stone block of 1000 N over a horizontal concrete floor, ties a rope to the block and pulls in a direction inclined upward at an angle of 20° to the horizontal. Calculate the minimum pull necessary to slide the block if the coefficient of friction is 0.6. Calculate also the pull required if the inclination of the rope with the horizontal is equal to the angle of friction and prove that this is the least force required to slide the block. CO2 -App (16)
- Or
- (b) Discuss the various types of friction experienced by a body. CO2 -Ana (16)
State the laws of static, solid, Dynamic and Fluid friction.
18. (a) Find an expression for the length of the path of contact between two mating spur gears. CO3- Ana (16)

Or

- (b) Two mating gears have 20 and 40 involute teeth of module 10mm and 20 degree 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. CO3 -Ana (16)
19. (a) In an epicyclic gear train a gear C is keyed to the driving shaft A which rotates at 900 rpm. Gears D and E are fixed together and rotate freely on a pin carried by the arm M which is keyed to the driven shaft B. Gear D is in mesh with gear C while the gear E is in mesh with a fixed annular wheel F. The annular wheel is concentric with the driven shaft B. If the shafts A and B are collinear and number of teeth on gears C, D, E and F are 21, 28, 14 and 84 respectively. Determine the speed and sense of rotation of the driven shaft B. CO4- U (16)

Or

- (b) In an epicyclic gear train, the internal wheels A and B and compound wheels C and D rotate independently about axis O. The wheels E and F rotate on pins fixed to the arm G. E gears with A and C and F gears with B and D. All the wheels have same module and the number of teeth are: $T_c=28$; $T_d=26$; $T_e=T_f=18$. [1] Sketch the arrangement; [2] Find the number of teeth on A and B; [3] If the arm G makes 100rpm clockwise and A is fixed, find the speed of B; and [4] If the arm G makes 100rpm clockwise and wheel A makes 10rpm counter clockwise; find the speed of wheel B. CO4- Ana (16)
20. (a) A cam is to give the following motion to a knife edged follower: outstroke during 60 degree of cam rotation. Dwell for the next 30 degree of cam rotation. Return stroke during next 60 degree of cam rotation and dwell for the remaining 210 degree of cam rotation. The stroke of the follower is 40mm 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 a. The axis of the follower passes through the axis of the cam shaft. b. The axis of the follower is offset by CO5- U (16)

20mm from the axis of the cam shaft.

Or

(b) Draw the profile of a cam to give the following motion to the reciprocating follower with a flat or mushroom contact face. CO5 -U (16)

- (i) Follower to move outwards through a distance of 20 mm during 120° of cam rotation,
- (ii) Follower to dwell for 45° of cam rotation,
- (iii) Follower to return to its original position during 120° of cam rotation,
- (iv) Follower to dwell for the rest of the cam rotation.

The minimum radius of cam is 25 mm and the flat face is at the right angles to the line of stroke of the follower. The outward and return strokes of the follower are to take place with simple harmonic motion. _____

