A **Reg. No. :** | | | | | | | | | | | | |

Question Paper Code: RA404

B.E. / B.Tech. DEGREE EXAMINATION, APRIL / MAY 2025

Fourth Semester

Agricultural Engineering

R21UAG404 – THEORY OF MACHINES

(Regulation- R2021)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The Grubler's criterion for determining the degrees of freedom (n) of a mechanism having plane motion is CO1-U

   (a) n = (l – 1) – j (b) n = 2(l – 1) – 2j (c) n = 3(l – 1) – 2j (d) n = 4(l – 1) – 3j

2. A link which is partly deformed in a manner not to affect the transmission of motion is called CO1-U

   (a) Rigid link (b) Flexible link (c) Fluid link (d) None of the above

3. Co-efficient of sliding friction for steel is CO1-U

   (a) 0.030 (b) 0.70 (c) 0.18 (d) 0.004s

4. _____ Friction is the force of friction experienced by a body when it is at rest. CO1-U

   (a) Dynamic (b) Static (c) Sliding (d) Rolling

5. The size of a cam depends upon CO1-U

   (a) base circle (b) pitch circle (c) prime circle (d) prime curve

6. When the motion of the follower is along an axis away from the axis of the cam centre, it is called CO1-U

   (a) Radial follower (b) oscillating (c) off-set follower (d) Rotating

7. The common point of contact between two pitch circle is called CO1-U

   (a) Pitch point (b) Addendum (c) Dedendum (d) Base point

8. The working depth of an involute gear is equal to CO1-U

(a) addendum (b) dedendum (c) addendum + dedendum (d) 2 x addendum

9. When the sleeve of a porter governor moves upward, the governor speed CO1-U

(a) increases (b) decreases (c) remains unaffected (d) moderate

10. The following device is used regulate the mean speed of an engine CO1-U

(a) Brake (b) Governor (c) Gear box (d) wheel

PART – B (5 x 2= 10 Marks)

11. Distinguish between Kinematic link and pair CO1-U

12. Outline the term of lead in screw. CO1-U

13. What ate the different motions of the follower? CO1-U

14. Differentiate addendum and dedendum circle. CO1-U

15. Give the short notes on isochronisms of governor. CO1-U

PART – C (5 x 16= 80Marks)

16. (a) Derive an expression for the length of stroke in terms of the link lengths and explain, with a neat sketch, the working of the crank and slotted lever quick return motion mechanism. CO2-App (16)

Or

(b) Derive an equation for the ratio of the time taken for the return stroke to the forward stroke, and state and explain the Whitworth quick return mechanism. CO2-App (16)

17. (a) A shaft rotating at 300 rpm drives another shaft at 500 rpm and transmits 8 kw through a belt. The belt is 110 mm wide and 11 mm thick. The distance between the shafts is 5 m. The smaller pulley is 0.6 m in diameter. Calculate the stress in the belt, if it is an open belt drive. Take μ=0.3. CO2-App (16)

Or

(b) A body, resting on a rough horizontal plane required a pull of 200 N inclined at 25º to the plane just to move it. It was found that a push of 260 N inclined at 25º to the plane just moved the body. Determine the weight of the body and the coefficient of friction. CO2-App (16)

18.	(a)	A cam is designed for a knife follower with the following data. (i) Cam lift = 40 mm during 90° of cam rotation with SHM (ii) Dwell for the next 30° (iii) During the next 60° of cam rotation, the follower returns to original position with SHM. (iv) Dwell for the reaming 180° Draw the profile of the cam when the line of stoke is offset 20 mm from the axis of the cam shaft.	CO3-App	(16)
		Or		
	(b)	Design & draw the cam profile for the following data: Basic circle radius of cam = 60mm, Lift = 30mm, Angle of ascent with cycloidal = 60°, angle of dwell = 90°, angle of descent with uniform velocity = 90°, speed of cam = 300rpm, Follower offset = 10mm, Type of follower = knife Edge.	CO3-App	(16)
19.	(a)	Two equal spur gears in mesh have 40 teeth each, a 20° involute profile, and a module of 6 mm. The arc of contact is 1.75 times the circular pitch. Analyze the gear geometry by determining the addendum and evaluating its effect on the meshing characteristics	CO4-Ana	(16)
		Or		
	(b)	Two parallel shafts, 500 mm apart, are to be connected by spur gears. One shaft runs at 350 rpm and the other at 110 rpm, with a circular pitch of 25 mm. Analyze the gear design by determining the required pitch circle diameters, module, and number of teeth for each gear.	CO4-Ana	(16)
20.	(a)	The turning moment diagram for a petrol engine is drawn to the following scales: Turning moment, 1mm = 5N-m ; crank angle, 1mm $=1^{o}$.The turning moment diagram repeats itself at every half revolution of the engine and the areas above and below the mean turning moment line taken in order are 295, 685, 40, 340, 960, 270 mm^2. The rotating parts are equivalent to a mass of 36kg at a radius of gyration of 150mm. Determine the coefficient of fluctuation of speed when the engine runs at 1800 r.p.m.	CO5-App	(16)
		Or		
	(b)	A porter governor has equal arms each 250mm long and pivoted on the axis of rotation. Each ball has a mass of 5kg and mass of the central load on the sleeve is 15kg.The radius of rotation of the ball is 150mm when the governor begins to lift and 200mmwhen governor is at maximum speed. Find the maximum and minimum speeds and range of speed of the governor.	CO5-App	(16)