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

Question Paper Code:R3A03

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2025

Third Semester

Agricultural Engineering

R21UAG303 – INTRODUCTION TO ENGINEERING MECHANICS

(Regulations R2021)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Which of the following is a scalar quantity? CO1-U

   (a) Force (b) Velocity (c) Mass (d) Acceleration

2. Which of the following is NOT a fundamental force system in statics? CO1-U

   (a) Coplanar concurrent forces (b) Coplanar non-concurrent forces

   (c) Parallel forces (d) Rotational forces

3. The principle of moments is also known as: CO1-U

   (a) Newton's third law (b) Varignon's theorem (c) Lami's theorem (d) Hooke's law

4. In 2D equilibrium, the conditions are: CO1-U

   (a) $\sum Fx = 0$ (b) $\sum Fy = 0$ (c) $\sum M = 0$ (d) All of the above

5. Moment of inertia is the measure of: CO1-U

   (a) Area (b) Force (c) Rotational inertia (d) Torque

6. The unit of moment of inertia in SI units is: CO1-U

   (a) kg (b) $kg \cdot m^2$ (c) m^4 (d) $N \cdot m$

7. The relation F=ma is valid only for CO1-U

   (a) Non-inertial frames (b) Inertial frames

   (c) Stationary bodies (d) Rotating bodies

8. Which of the following laws derive impulse moment principle? CO1-U

(a) Newton's 3rd law (b) Newton's 2rd law

(c) Newton's 1rd law (d) all of the above

9. The maximum static friction is called CO1-U

(a) Coefficient of friction (b) Limiting friction

(c) Rolling resistance (d) Sliding friction

10. The friction between a car's tires and the road is: CO1-U

(a) Static (b) Kinetic (c) Rolling (d) Fluid

PART – B (5 x 2= 10 Marks)

11. Define moment of a force and write its unit. CO1-U

12. Differentiate between concurrent and non-concurrent forces CO1-U

13. State Perpendicular axis theorem. CO1-U

14. Define retardation. CO1-U

15. Define angle of friction CO1-U

PART – C (5 x 16= 80 Marks)

16. (a) Predict the resultant of the system of forces given below: CO2-App (16)

(i) 25N inclined at 35° towards north of east.

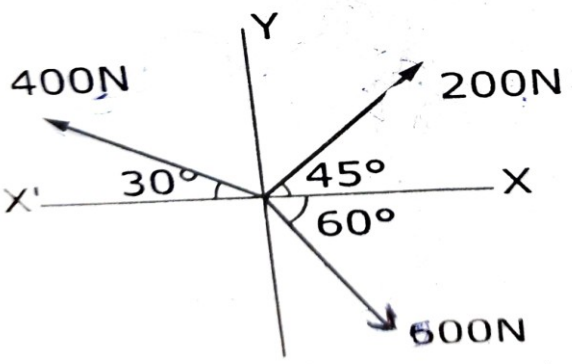
(ii) 30 N towards North.

(iii) 35N towards north west.

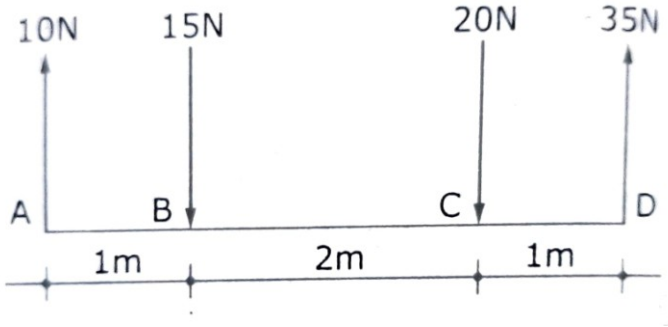
(iv) 40N inclined at 40° towards south of west.

Or

(b) Three coplanar concurrent forces are acting at a point as shown in figure. Determine the resultant in magnitude and direction. CO2-App (16)

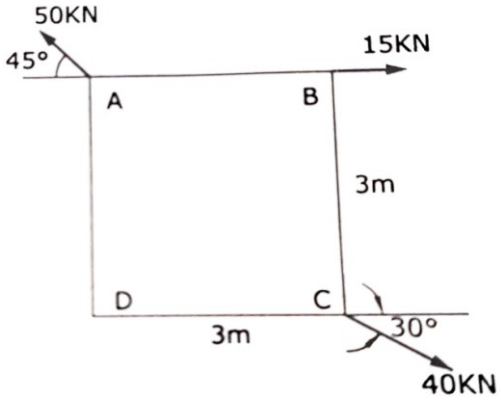


17. (a) Four parallel forces of magnitudes 10N, 15N, 20N and 35N are shown in figure. Determine the magnitude and direction of the Resultant. Find the distance of the resultant from point A. CO2-App (16)

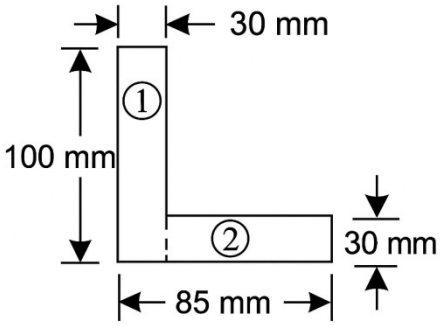


Or

(b) Determine the magnitude and line of action of the resultant of forces shown in figure. CO2-App (16)

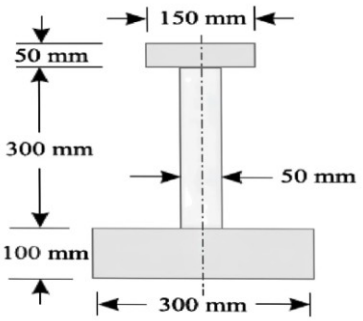


18. (a) Find the moment of inertia about the centroidal X-X and Y-Y axes of the angle section shown in figure. CO3-App (16)



Or

(b) Solve the moment of inertia of shaded area as shown in figure about Ixx axis and Iyy axis. CO3-App (16)



19. (a) A car is moving with a velocity of 25m/sec. The car is brought to rest by applying brakes in 8 seconds. Determine i) The retardation ii) Distance travelled by the car after applying brakes. CO4-Ana (16)

Or

(b) A particle moves along a straight line with variable acceleration. If the displacement is measured in m, and given by the relation interms of time taken t, as below. CO4-Ana (16)

$S= 3t^3 + 2t^2 + 7t + 3.$

Solve i) Velocity at start ,and after 3 seconds,

ii) Acceleration at start and after 3 seconds.

20. (a) A Uniform ladder of weight 900 N and length 3 m rests on a horizontal ground and leans against a smooth vertical wall. The ladder makes an angle of 60^0 with horizontal , when a man of weight 700 N stands on the ladder at a distance of 2 m from the top of the ladder , the ladder is at the point of sliding .Determine the Coefficient of friction between ladder and the floor CO5-App (16)

Or

(b) Block (2) rests on block (1) and is attached by a horizontal rope AB to the wall as shown in fig. What force P is necessary to cause motion of block (1) to impend? The co-efficient of friction between the blocks is ¼ and between the floor and block (1) is 1/3. Mass of blocks (1) and (2) are 14kg and 9 kg respectively. CO5-App (16)