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

## Question Paper Code: R3A03

B.E./B.Tech. DEGREE EXAMINATION, NOV 2024

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. According to the Newton's First Law, The Resultant R is CO1 -U

   (a) $R \neq 0$ (b) R = 1 (c) R is infinitive (d) 0

2. The unit of weight _____. CO2-App

   (a) kilogram (b) Newton (c)Watt (d)Gram

3. Forces passing through a common point are known as CO1 -U

   (a) collinear forces (b) Concurrent forces (c) Multiple forces (d) Scalar forces

4. Following is not a scalar quantity? CO1 -U

   (a) Density (b) mass (c)Volume (d) Acceleration

5. Two dimensional element the G is CO1 -U

   (a) Centre of gravity (b) Centre of the area (c) Centroid (d) Cycloid

6. Unit of moment of inertia if an area is CO1 -U

   (a) kg-$m^2$ (b) kg-m-$s^2$ (c) kg/$m^2$ (d) $m^4$

7. A stationary object of 10*kg* mass is acted upon by 20*N* force for 5 *seconds*. The object will attain a final velocity of CO2-App

   (a) 1 m/sec (b) 10 m/sec (c) 20 m/sec (d) 30 m/sec

8. The total motion possessed by a body, is called CO1 -U

   (a) moment (b) mass (c)weight (d) Momentum

9. Which of the following is a vector quantity? CO1 -U

(a) Density (b) Mass (c) Volume (d) Acceleration

10. When there is no relative force between touching surfaces, which of the following force is developed? CO1 -U

(a) Dry friction (b) Dynamic friction (c) Fluid friction (d) Static friction

PART – B (5 x 2= 10 Marks)

11. Illustrate Lami's theorem with a sketch. CO1 -U

12. Demonstrate force couple system CO1 -U

13. Compare and contrast the Area moment of Inertia with mass moment of inertia. CO1 -U

14. Compare linear and angular momentum. CO1 -U

15. What is co-efficient of Rolling resistance? CO1 -U

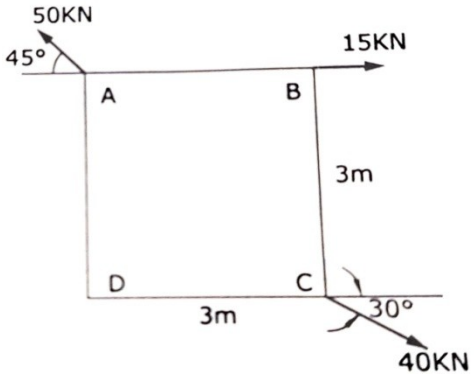
PART – C (5 x 16= 80 Marks)

16. (a) Predict the resultant of the system of forces given below: CO2 App (16)
(i) 20N inclined at 30º towards north of east.
(ii) 25 N towards North.
(iii) 30N towards north west.
(iv) 35N inclined at 40º towards south of west.

Or

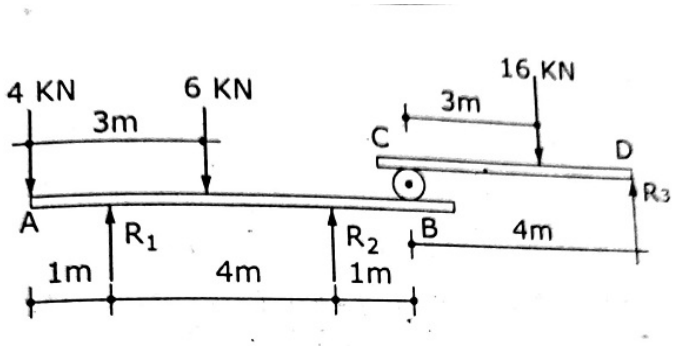
(b) A force vector of magnitude 100N is represented by a line AB of coordinates A (1,2,3) and B(5,8,12) Determine CO2 App (16)
i) the components of the force along x,y,z axes.
ii) angles with x,y,z axes
iii) specify the force vector

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

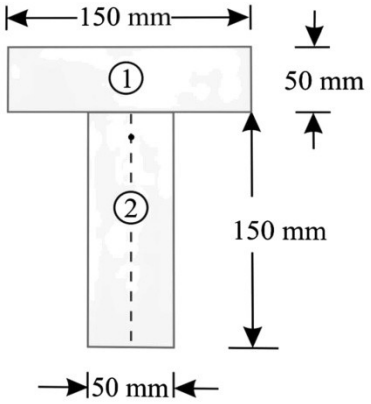



Or

(b) Predict the reactions R1, R2 and R3 for the beams AB and CD supported as shown in the figure. There being a hinge connecting B and C. CO2 App (16)

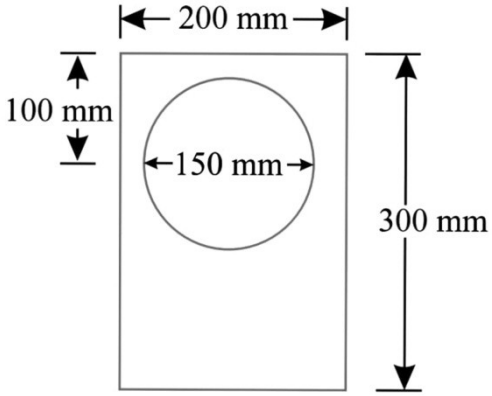



18. (a) Find the moment of inertia of a T-section with flange as 150mm x 50mm and web as 150mm x 50mm about X-X and Y-Y axes through the centre of gravity of the section. CO2 App (16)




Or

(b) Find the moment of inertia of a hollow section shown in figure about an axis passing through its centre of gravity or parallel X-X axis. CO2 App (16)



19. (a) A particle moves along a straight line with variable acceleration. If the displacement is measured in m, and given by the relation in terms of time taken t, as below. CO2 App (16)

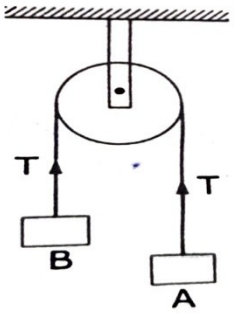
$S= 3t^3 + 2t^2 + 7t + 3.$

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

ii) Acceleration at start and after 3 seconds.

Or

(b) Two blocks A and B of weight 80N and 60N are connected by a string, Passing through a smooth pulley, as shown in figure. Calculate the acceleration of the body and the tension in the string. CO2 App (16)




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 CO2 App (16)

Or

(b) A Body of weight 150N is resting on a rough inclined plane as shown in figure. The block is tied up by a horizontal string, which has a tension of 50N. Find i) The frictional force on the block ii) The normal reaction of the inclined plane iii) The coefficient of friction between the surface of contact. CO2 App (16)