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

Question Paper Code: 53A03

B.E. / B.Tech. DEGREE EXAMINATION, DEC 2021

Third Semester

Agricultural Engineering

15UAG303 - FUNDAMENTALS OF ENGINEERING MECHANICS

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The forces with common line of action are called_____ CO1- R

   (a) Co-planar forces (b) Collinear forces (c) Parallel forces (d) Concurrent forces

2. Two vectors are at right angles to each other, the dot product of the vectors should be_____ CO1- R

   (a) One (b) Zero (c) Infinity (d) None of the above

3. If one end of the beam is fixed and the other end is free, then it is known as _____ CO2- R

   (a) Simply supported beam (b) Overhanging beam (c) Fixed beam (d) Cantilever

4. Roller support has _____ reaction CO2- R

   (a) Vertical (b) Horizontal (c) No (d) Both horizontal and vertical

5. If an area is symmetrical about any of the centroidal axes, then the product of inertia is ____ CO3- R

   (a) Zero (b) Maximum (c) Minimum (d) Infinity

6. The axes about which the product of inertia is zero are called _____ CO3- R

   (a) Major axes (b) Minor axes (c) Principal axes (d) None of the above

7. When a particle of the body move in a concentric circular path, then it is said to be _____ CO4- R

(a) Translation (b) Rotation (c) Angular motion (d) None of the above

8. A man pulls a cart of mass 120 kg and produces an acceleration 2 m/sec^2. The force exerted by the man is _____ CO4- R

(a) 240 N (b) 60 N (c) 122 N (d) 2400 N

9. The co-efficient of kinetic friction is _____to the co-efficient of friction CO5- R

(a) Equal (b) Greater (c) Lesser (d) All of the above

10. Angle of repose is equal to_____ CO5- R

(a) Angle of friction (b) Frictional force

(c) Co-efficient of friction (d) Normal reaction

PART – B (5 x 2= 10 Marks)

11. A force vector F has the components Fx=150N, Fy=-200N, Fz=300N.Determine its magnitude F and the angle made by force vector F with three coordinate axes. CO1-App

12. Draw the support reactions of roller, hinged and fixed support. CO2- U

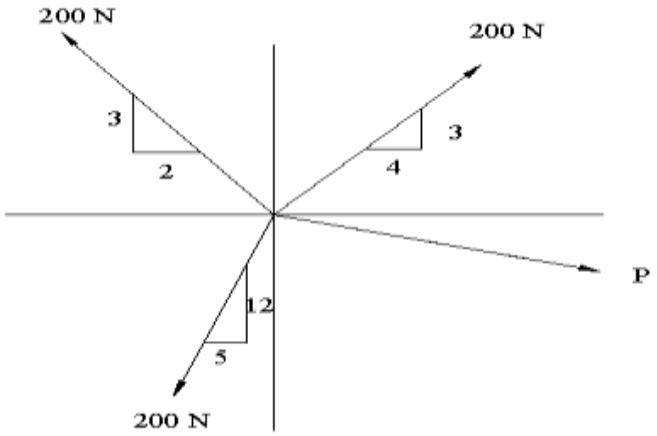
13. Differentiate centroid and centre of gravity. CO3- U

14. The rotation of a body is governed by the equation $\theta = t^3 - 8t+15$.Determine the angular velocity in 2 sec. CO4-App

15. A sphere of mass 1 kg moving with a velocity 2 m/s impinges directly on a sphere of mass 2 kg at rest. If the first sphere comes to rest after the impact, find the velocity of the second Sphere. CO5-Ana

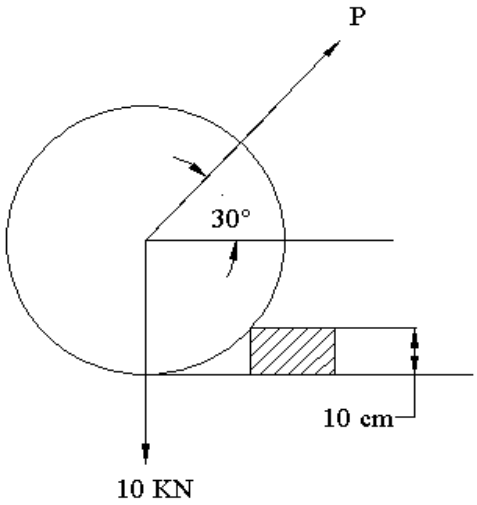
PART – C (5 x 16= 80 Marks)

16. (a) The resultant of the force system shown in fig is 520N along the negative direction of y axis. Determine P and θ. CO1- App (16)

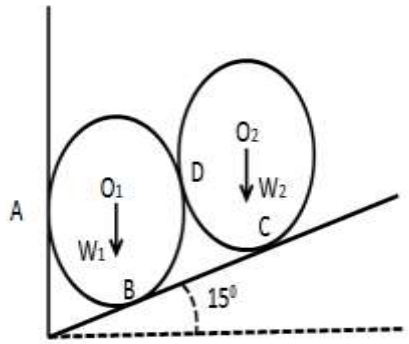


Or

(b) A cylindrical roller has a weight of 10KN and it is being pulled by a force which is inclined at 30° with the horizontal as shown in figure. While moving it comes across an obstacle 10cm high. Calculate the force required to cross the obstacle, if the diameter of the roller is 1meter. CO1- App (16)

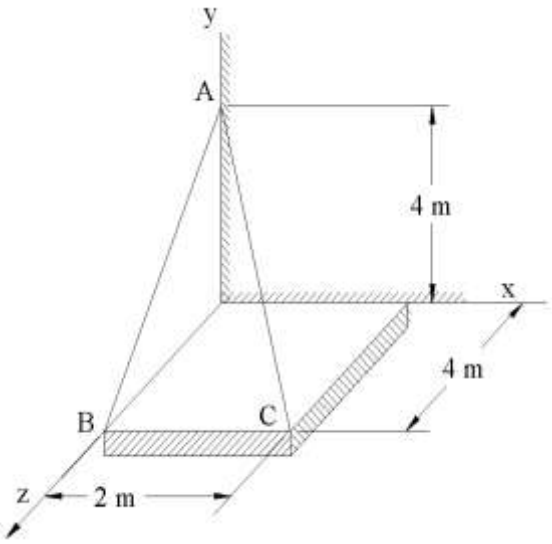


17. (a) Two cylinders of same diameter are supported by an inclined plane and vertical wall as shown in the figure. The weight of the lower cylinder (W_1) is 200 N and the weight of the upper cylinder (W_2) is 250 N. Assuming the surfaces to be smooth, find the reaction induced at the points of support A, B, C & D. CO2- App (16)

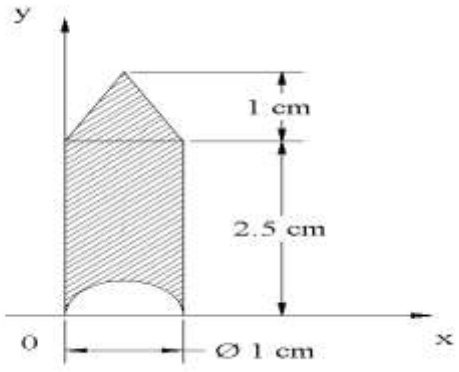


Or

(b) The tension in cables AB and AC are 100N and 120N respectively as shown in figure. Determine the magnitude of the resultant force acting at A. CO2- App (16)

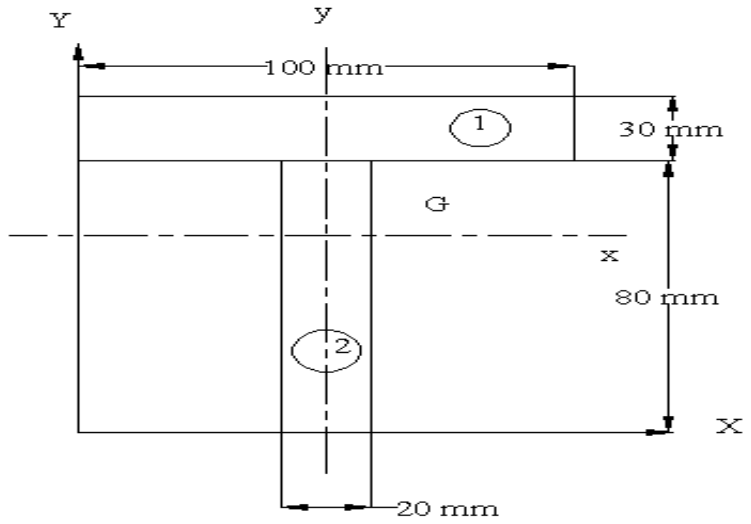


18. (a) Locate the centre of gravity of a bullet, 1 cm diameter with a cone in the front and a hemisphere cut from the back as shown in fig. assume the material to be homogeneous. CO3- App (16)

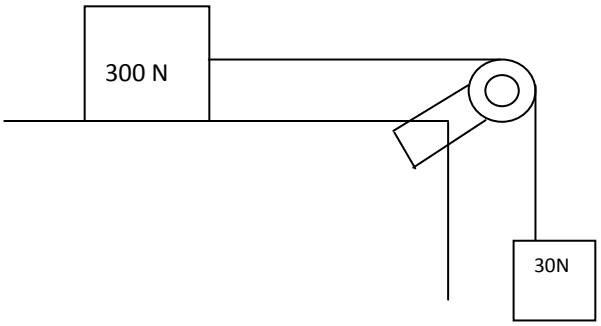


Or

(b) Find the moment of inertia of a channel section shown in fig. CO3- App (16)



19. (a) The figure shows a body of weight 300 N on a smooth horizontal plane which is attached by a string to a 30 N weight, which hangs vertically. Find the acceleration of the system and the tension in the string. CO4- App (16)



Or

(b) A motorist is driving at 80 km/hr on the curved path of a high way of 400 m radius. He suddenly applies the brakes that cause the speed of car to decrease to 45 km/hr at a constant rate in 8 seconds. Determine the tangential and normal components of acceleration immediately after the application of brakes and 4 second later. CO4- App (16)

20. (a) A body of weight 500 N is placed on a rough horizontal plane. CO5- App (8)

(i) Determine the frictional force developed in the surface, if it is subjected to a horizontal fore 'P'.

(ii) Determine the frictional force developed in the surface, if the force is applied at 20° with horizontal. Take co-efficient of friction as 0.3 CO5- App (8)

Or

(b) A ball of 0.5 kg moving with a velocity 1 m/sec impinges directly on a ball of mass of 3 kg at rest. If the first ball comes to rest after impact, find the velocity of the second ball and co-efficient of restitution. CO5- App (16)