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Question Paper Code: U3705

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

Third Semester

Mechanical Engineering

21UME305 – BASICS OF ENGINEERING MECHANICS

(Regulations 2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

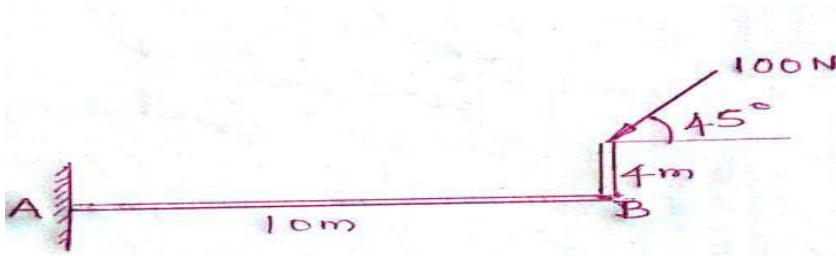
PART A - (10 x 1 = 10 Marks)

- Number of forces are acting at a point, their resultant will be inclined at an angle θ with the horizontal, such that
(a) $\tan \theta = \frac{\sum V}{\sum H}$ (b) $\tan \theta = \frac{\sum H}{\sum V}$ (c) $\tan \theta = \frac{\sum V \times \sum V}{\sum V + \sum V}$ (d) $\tan \theta = \frac{\sum V}{\sum V + \sum V}$ CO2- U
- According to the Newton's First Law, The Resultant R is
(a) $R \neq 0$ (b) $R = 1$ (c) R is infinitive (d) 0 CO2- U
- Which one of the following is not a scalar quantity ?
(a) Density (b) mass (c) Volume (d) Acceleration CO2- U
- Forces passing through a common point are known as
(a) collinear forces (b) Concurrent forces (c) Multiple forces (d) Scalar forces CO2- U
- Two dimensional element the G is
(a) Centre of gravity (b) Centre of the area (c) Centroid (d) Cycloid CO2- U
- Polar Moment of Inertia follows _____
(a) Parallel Axis Theorem (b) Perpendicular Axis Theorem
(c) Centroidal Axis Theorem (d) Radius of Gyration CO2- U
- Two non-collinear parallel equal forces acting in opposite direction
(a) Balance each other (b) constitute a moment
(c) Constitute a couple (d) constitute a moment of couple CO2- U

8. The maximum frictional force increase as the _____ force between the bodies CO2- U increase.
- (a) Parallel (b) inclined (c) normal (d) gravitational
9. Frictional force encountered after commencement of motion is called CO2- U
- (a) Post friction (b) Limiting friction (c) Angle of friction (d) dynamic friction.
10. Coulomb friction is the friction between CO2- U
- (a) Bodies having relative motion (b) two dry surfaces
- (c) Two lubricated surfaces (d) solids and liquids

PART – B (5 x 2= 10Marks)

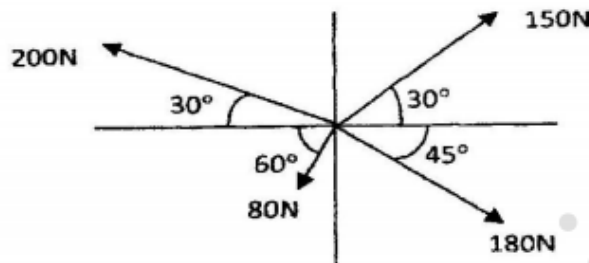
11. Show the free body diagram with example CO2- U
12. Solve the moment of the 100 N force about point A and B CO3- App



13. Show product of inertia with formula.. CO2- U
14. Compare and contrast the impact and elastic impact. CO2- U
15. Illustrate Coulomb's laws of dry friction. CO2- U

PART – C (5 x 16= 80 Marks)

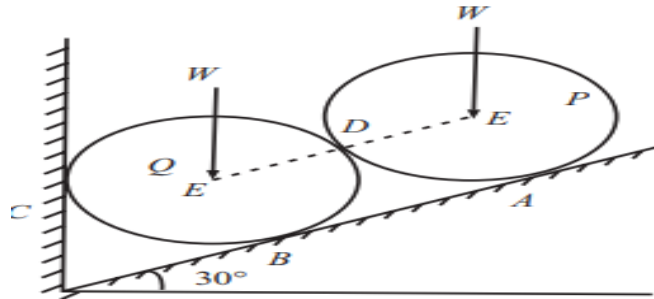
16. (a) Predict the Resultant of the concurrent force system shown in the following Figure. CO3-App (16)



Or

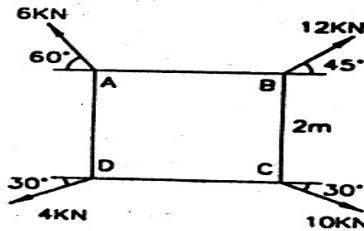
- (b) The resultant of the two forces, when they act at an angle of 60° is 14 N. If the same forces are acting at right angles, their resultant is $\sqrt{137}$ N. Compute the magnitude of the two forces. CO3-App (16)

17. (a) Two identical rollers, each of weight $W = 50\text{N}$ are supported by an inclined plane and a vertical wall as shown in figure below. Solve the reactions at the point of supports. Assume all the surfaces to be smooth. CO3-App (16)

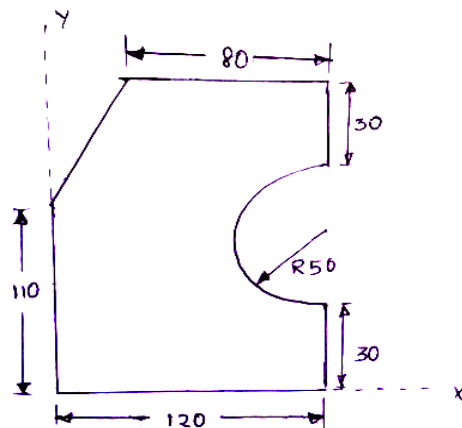


Or

- (b) Four forces of magnitude and direction acting on a square ABCD of side 2 m are shown in the figure. Solve the resultant in magnitude and direction and also locate its point of application with respect to the sides AB and AD CO3-App (16)



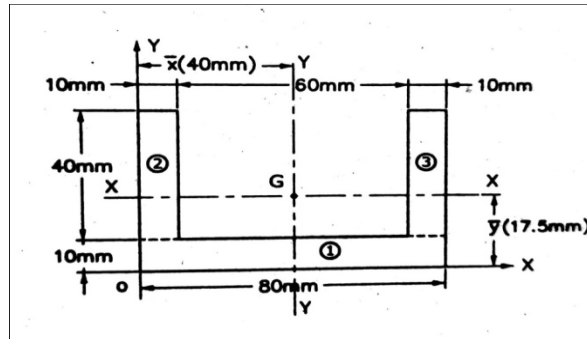
18. (a) Predict the centroid of the area shown in figure below. The dimensions are in mm. CO3- App (16)



Or

(b) Solve the moment of inertia of the section shown below.

CO3- App (16)

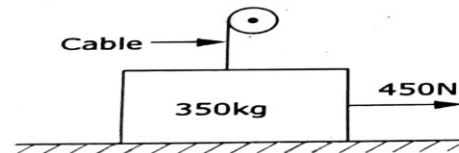


19. (a) Two bodies one of mass 30 kg, moves with a velocity of 9 m/sec strikes on an another body of mass 15 kg moving in the opposite direction with the velocity of 9 m/sec centrally. Solve the velocity of each body after impact if coefficient of restitution is 0.8. CO3- App (16)

Or

(b) Two bodies one of mass 50 kg, moves with a velocity of 8 m/sec strikes on an another body of mass 20 kg moving in the opposite direction with the velocity of 10 m/sec centrally. Solve the velocity of each body after impact if coefficient of restitution is 0.9 CO3- App (16)

20. (a) A man can pull horizontally with a force of 450N. A mass of 350 kg is resting on a horizontal surface on which the coefficient of friction is 0.20. The vertical cable of a crane is attached to the top of the block as shown in fig what will be the tension in the cable if the man is just able to start the block to the right? CO3- App (16)



Or

(b) A Body of weight 100n is placed on a rough horizontal plane and pushed by a force of 45N shown in fig. (a),(b) and (c) to just cause sliding over the horizontal plane. Determine the co-efficient of friction in all the three cases. CO3- App (16)

