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Question Paper Code : 80045

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2019.

Second Semester

BioMedical Engineering

BM 8251 – ENGINEERING MECHANICS FOR BIOMEDICAL ENGINEERS

(Common to Medical Electronics)

(Regulation 2017)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. State the governing laws of mechanics.
2. Write the equilibrium equations for a particle in space.
3. Distinguish moments and couples
4. State the Varignon's theorem and its application.
5. What do you mean by principal moments of inertia?
6. Centre of gravity of an object always lies within the object. True or false? Justify.
7. Detergents remove stain. State the principle behind this phenomenon.
8. What is viscoelasticity. Name few viscoelastic materials.
9. Find the-acceleration of a 10 kg mass moving with a uniform velocity of 2 m/s.
10. State the Newton's law of motion which defines inertia.

PART B — (5 × 13 = 65 marks)

11. (a) A collar which may slide on a vertical rod is subjected to the 3 forces shown in Fig 11(a). Determine the angle 'α' for which the resultant is horizontal and the corresponding magnitude of the resultant.

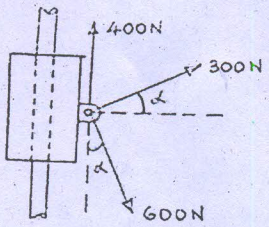

Fig. 11 (a)

Or

(b) A precast concrete wall section is temporarily held by the cables shown in Fig 11(b). Knowing that the tension is 4200N in cable AB and 6000N in cable AC, determine the magnitude and direction of the resultant of the forces exerted by cables AB and AC on stake A. All distances are in meters.

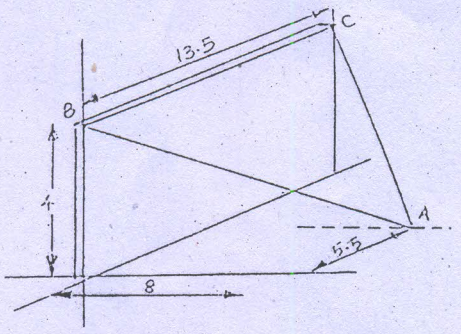

Fig. 11 (b)

12. (a) Determine the equilibrant of the system shown in Fig 12(a). Also find its intercepts with OX and OY axis.

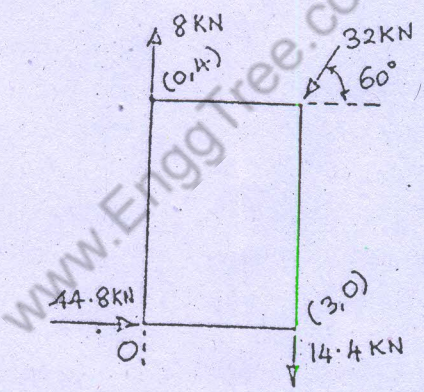

Fig. 12 (a)

Or

(b) Determine reactions at A & B for a beam loaded as shown in Fig 12(b).

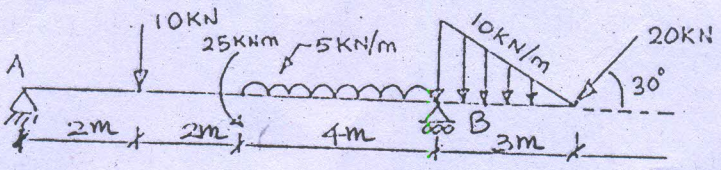

Fig. 12 (b)

13. (a) Find the centroid of the shaded lamina shown in Fig 13(a) about the base and left edge. All dimensions are in mm.

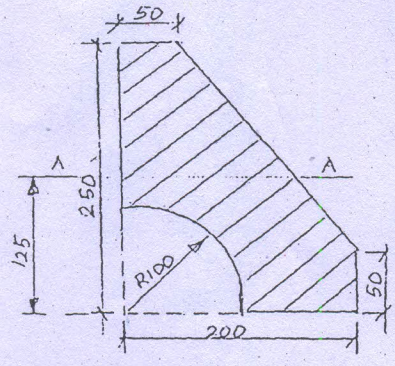

Fig. 13 (a)

Or

(b) Find the moment of inertia of the shaded portion of the lamina shown in Fig 13(b) about its centroidal axes.

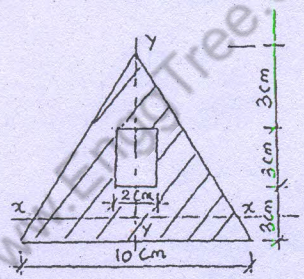

Fig. 13 (b)

14. (a) (i) 10 m^3 of mercury weights 136×10^4 N. Calculate its specific weight mass density, specific volume and specific gravity. (8)

(ii) Explain the different types of fluids with shear stress - velocity gradient diagram. (5)

Or

(b) A crude oil of viscosity 0.97 paise and relative density 0.9 is flowing through a horizontal circular pipe of diameter 100 mm and of length 10 m. Calculate the difference of pressure at the two ends of the pipe, if 100 kg of the oil is collected in a tank in 30 seconds. Assume laminar flow.

15. (a) What is the least value of P required to cause the motion impend. Assume Co-efficient of friction on all contact surfaces as 0.2?

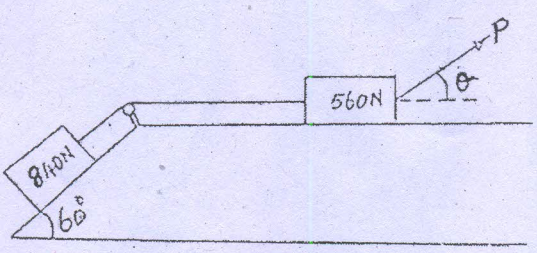

Fig. 15 (a)

Or

(b) A block weighing 2500 N rests on a level horizontal plane for which μ=0.2.This block is pulled by a force of 1000N acting at an angle of 30° to the horizontal, Find the velocity of the block after it moves 30m starting from rest, If the force of 1000N is then removed, how much further will it move. Use work energy method.

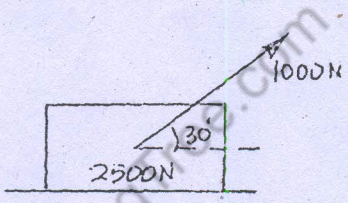

Fig. 15 (b)

PART C — (1 × 15 = 15 marks)

16. (a) Find the density of a metallic body which floats at the interface of mercury of sp. gr. 13.6 and water such that 40% of its volume is submerged in mercury and 60% in water.

Or

(b) A body moves along a straight line and its acceleration a which varies with t is given by $a = 2 - 3t$. After 5 seconds from start of observations its velocity is observed to be 20m/s. After 10 seconds from start of observations the body was 85 m from the origin.

(i) Determine its acceleration, velocity and distance from the origin at the start of observations

(ii) Determine the time after start of observation in which the velocity becomes zero and its distance from origin.

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