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NME102/NME202

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PAPER ID : 199229

Roll No.

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B. Tech.

(SEM. II) THEORY EXAMINATION, 2014-15
ENGINEERING MECHANICS

Time : 3 Hours]

[Total Marks : 100

Note : Assume suitable data if necessary.

PART-A (Compulsory)

1 Attempt all questions :

10×2=20

- How do you find the resultant of non coplaner concurrent force system ?
- "Friction is both desirable and undesirable". Explain.
- With neat sketches describe in brief different types of beams.
- What assumptions are made while determining stresses in a truss ?
- What is the difference between centroid and center of gravity ?

- (f) State and explain perpendicular axis theorem.
- (g) The equation of motion for motion of a particle is given by $S = 18t + 3t^2 - 2t^3$. Find acceleration and velocity at $t = 2$ sec.
- (h) State and explain D'Alembert's Principle.
- (i) Draw stress strain diagram for mild steel indicating salient points.
- (j) How is shear stress developed due to torsion ? Explain.

PART-B

2 Attempt any three parts of the following : 10×3=30

- (a) Derive the expression of mass moment of inertia for a circular disc about its diametral axis.
- (b) A uniform ladder, 5m long weighs 180 N. It is placed against a wall making an angle of 60° with the floor. The coefficient of friction between the wall and ladder is 0.25 and between the floor and the ladder is 0.35. The ladder has to support a mass 900 N at its top. Calculate the horizontal force 'p' to be applied to the ladder at the floor level to prevent slipping.
- (c) A steel beam of hollow square section having outer side of 60 mm and inner side of 50 mm is simply supported on a span of 4 m. Find the maximum point load that the beam can carry at the middle of the span if the bending stress is not to exceed 120 N/mm^2 .

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- (d) Determine the reaction at support A and D in the structure shown in fig. 1

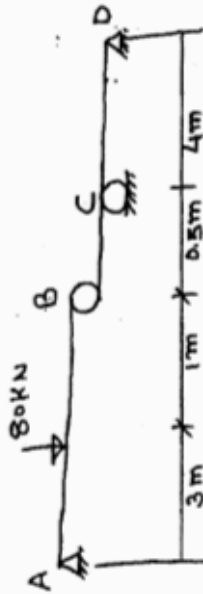


fig. 1

- (e) A cylinder of weight 1000 N and radius 40 cm is in equilibrium as shown in fig 2. Find the tension in the rope AC. Length of BC is 2 mtr.

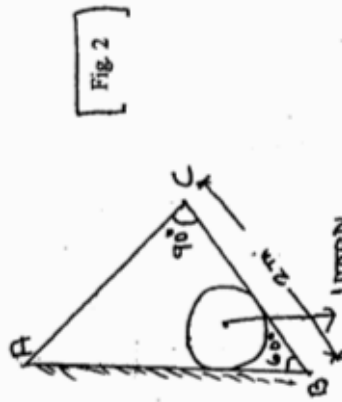


Fig 2

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PART-C

3 Attempt any one part of the following : $10 \times 1 = 10$

- (a) A system of weight connected by string passing over pulleys A and B shown in fig 3. Find the acceleration of three weights. Assuming string is weightless and ideal condition for pulleys.

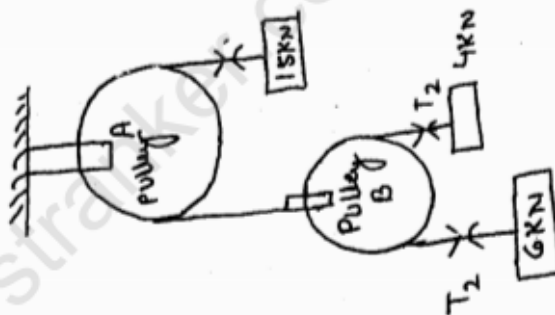


Fig 3

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- (b) Determine the force P required to impend the motion of the block B Shown in Fig. 4 Take coefficient of friction = 0.3 for all contact surface.

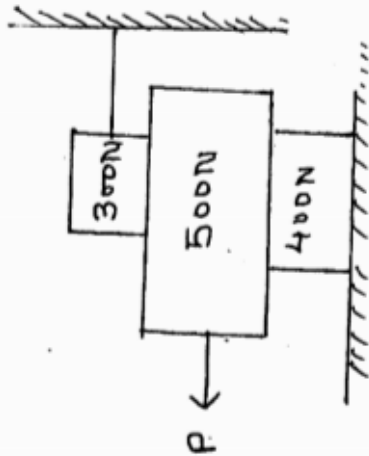


Fig 4

4 Attempt any one part of the following : $10 \times 1 = 10$

- (a) Determine SFD and BMD for the simply supported beam as shown in fig 5 and also find maximum B.M.

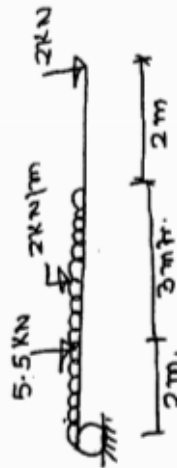


Fig 5

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- (b) Determine the forces in all members of the truss as shown in fig. 6

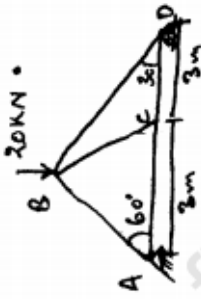


Fig. 6

- 5 Attempt any one part of the following : $10 \times 1 = 10$
- (a) Show that the product of inertia of an area about two mutually perpendicular axis is zero if the area is symmetrical about one of these axis.
- (b) Locate the centroid of the shaded area shown in fig. 7 All dimensions are in meters.

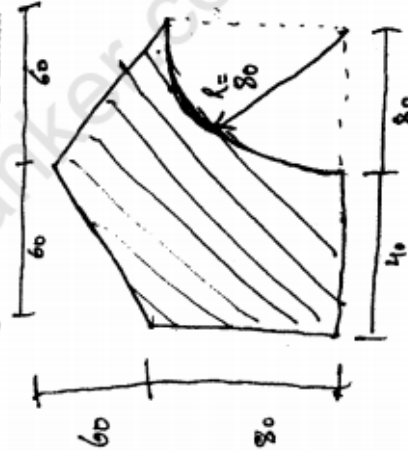


Fig. 7

- 6 Attempt any one part of the following : $10 \times 1 = 10$

- (a) (i) A stone is dropped into a well and is heard to strike the water after 4 seconds. Find the depth of the well if the velocity of sound is 350 m/s.
- (ii) Discuss and describe the laws of motion applied to planar translation and rotation.
- (b) Write short notes on :
- (i) Principle of work and energy
- (ii) Law of conservation of energy
- (iii) Law of conservation of linear momentum
- (iv) Plane motion of rigid bodies.

- 7 Attempt any one part of the following : $10 \times 1 = 10$

- (a) (i) Discuss the principle of Superposition for elongation.
- (ii) A steel Bar 2m long, 20 mm wide, 10 mm thick is subjected to a pull of 20 kN in the direction of length. Find the changes in length, breadth, thickness of bar. Take $E = 2 \times 10^5 \text{ N/mm}^2$ and Poisson's ratio 0.3.

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