

Total No. of printed pages = 4

ME 181104

Roll No. of candidate

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2022

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(GIMT & GIPU)
Azara, Haldighowapara,
Guwahati - 781017

B.Tech. 2nd Semester End-Term Examination

ENGINEERING MECHANICS

(New Regulation and New Syllabus)

Full Marks – 70

Time – Three hours

The figures in the margin indicate full marks
for the questions.

Answer question No. 1 and any *four* from the rest.

1. Choose the correct answer : (10 × 1 = 10)
- (i) A system of three forces acts on a body and keeps it in equilibrium, the forces need to be
- (a) Coplanar only
 - (b) Concurrent only.
 - (c) Coplanar as well as concurrent.
 - (d) Coplanar but may or may not be concurrent
- (ii) The free body diagram of a body shows the body
- (a) with its surrounding and external forces acting on it.
 - (b) isolated from all external effects
 - (c) isolated from its surroundings
 - (d) isolated from its surrounding and all external actions acting upon it
- (iii) Method of sections of truss analysis is generally found useful to determine
- (a) forces in all members
 - (b) forces in selective members
 - (c) weights of the members
 - (d) bending of members

[Turn over

- (iv) On a ladder resting on a smooth ground and leaning against a rough vertical wall the force of friction acts
- (a) Towards the wall at its upper end
 - (b) Away from the wall at its upper end
 - (c) Upwards at its upper end
 - (d) Downwards at its upper end
- (v) When a body is suspended about a horizontal axis, its centre of gravity lies
- (a) above the point of suspension
 - (b) anywhere on the body
 - (c) vertically below the point of suspension
 - (d) at the point of suspension.
- (vi) The mass moment of inertia gives a measure of
- (a) resistance to rotation about an axis
 - (b) resistance to bending about an axis
 - (c) resistance to twisting about an axis
 - (d) resistance to elongation
- (vii) Which of the following is the example of lever of first order
- (a) arm of man
 - (b) pair of scissors
 - (c) all of the above
 - (d) none of the above
- (viii) In virtual work principle, the work done by the self weight of a body is zero while
- (a) centre of gravity moves vertically
 - (b) shear centre moves horizontally
 - (c) centre of gravity moves horizontally
 - (d) shear centre moves vertically
- (ix) The velocity of a body on reaching the ground from a height h is
- (a) \sqrt{gh}
 - (b) $2\sqrt{gh}$
 - (c) $2g\sqrt{h}$
 - (d) $\sqrt{2gh}$
- (x) During inelastic collision of two particles, which one of the following is conserved?
- (a) Total linear momentum only
 - (b) Total kinetic energy only
 - (c) Both linear momentum and kinetic energy
 - (d) Neither linear momentum nor kinetic energy

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2. (a) In a plane, add a 120 N force at 30° and a 100N force at 90° using the parallelogram method as shown in figure 1

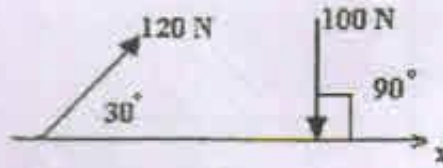


Figure. 1

- (b) The roller of mass 150 kg. is shown in Figure 2. What force T is necessary to start the roller over the block

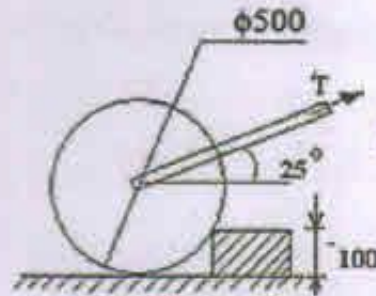


Figure 2

(5+10=15)

3. (a) What is a framed structure? State the assumptions made while making an analysis of a framed structure.
 (b) Determine the forces in bars of the cantilever truss loaded as shown in figure 3.

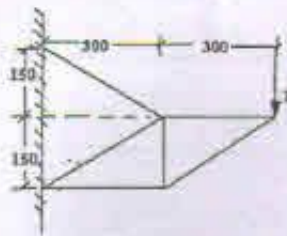


Figure 3

(5+10=15)

4. (a) Define friction. Is it possible to eliminate friction completely from mechanical parts in machines? Discuss.
 (b) Referring to figure 4, $M_A = 45\text{Kg}$, $M_B = 90\text{Kg}$. Block A rests on block B and is tied with a horizontal string to the wall. If $\mu_{AB} = 1/4$, $\mu_{BS} = 1/3$. What horizontal force P is necessary to move the block B.

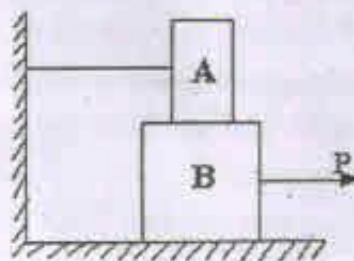


Figure 4

(5+10=15)

5. (a) By direct integration, find the centroid of area of a circular sector as shown in figure 5

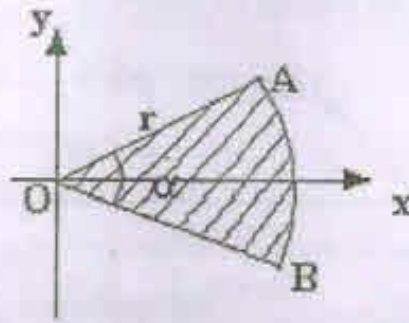


Figure 5

- (b) Find the Moment of inertia of the section about an axis parallel to XX and YY axis passing through the centre of gravity of the section as shown in figure 6. (5+10=15)

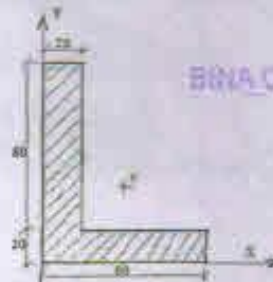


Figure 6

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6. (a) A beam has been loaded and supported as shown in figure 7. Use the method of virtual work to determine the reactions at the end supports.

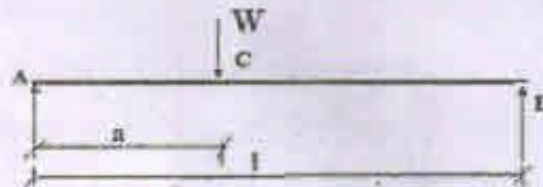


Figure 7

- (b) In a lifting machine an effort of 150 N raised a load of 7700 N. What is the mechanical advantage? Find the velocity ratio if the efficiency at this load is 60%. If by the same machine, a load of 13200 is raised by an effort of 250 N, what is the efficiency? Calculate the maximum mechanical advantage and the maximum efficiency. (5+10=15)
7. (a) An airplane while taking off moves with a constant acceleration over a runway of 400 m in 8 seconds. Determine the velocity with which it takes off. Also, determine its constant acceleration.
- (b) A ball of 50 gm mass is dropped from a height of 10m and after striking the floor it rebounds to a height of 7 m. Determine
- the impulse of the force.
 - the average force exerted by the floor on the ball if the force acts for a fraction $1/60^{\text{th}}$ of a second. (5+10=15)