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Total Number of Pages: 02

Course: IDD (B.Tech and M.Tech)
Sub_Code: 23ES1004

2nd Semester Regular/Back Examination: 2024-25

SUBJECT: Engineering Mechanics

BRANCH(S): AE, AEIE, AERO, AUTO, BIOMED, BIOTECH, CHEM, CIVIL, CSE, CSEAI, CSEAIML, CSEDS, CST, ECE, EEE, ELECTRICAL, ELECTRICAL & C.E, ELECTRONICS & C.E, ETC, MANUTECH, MECH, METTA, MINING, PLASTIC

Time: 3 Hours

Max Marks: 100

Q.Code: S464

Answer Question No.1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1 Answer the following questions: (2 x 10)

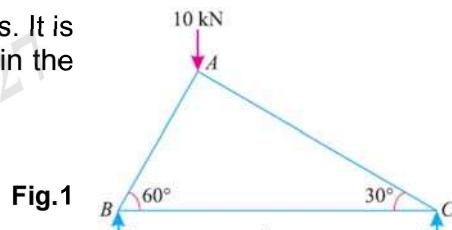
- a) Two forces of 100 N and 150 N are acting simultaneously at a point. What is the resultant of these, if the angle between two forces is 45°?
- b) What is meant by moment of a force? How will you explain it mathematically?
- c) How will you find the forces in the members of a truss by method of joints when the truss is supported on rollers at one end and hinged at other end and carries vertical load.
- d) State the difference between co-efficient of friction and angle of friction.
- e) State the principle of virtual work with a suitable example.
- f) Find the centroid of a triangular lamina with base 6 m and height 4 m.
- g) Find an expression for the moment of inertia of a rectangular section:
(I) about a horizontal axis passing through the C.G. of the rectangular section, and
(II) about a horizontal axis passing through the base of the rectangular section.
- h) State the D' Alembert's Principle giving equations expressing the principle for a rigid body in plane motion.
- i) A projectile is fired at an angle of 30° with a velocity of 50 m/s. Calculate the maximum height and range.
- j) A body of mass 5 kg is moving with a velocity of 10 m/s. Calculate its kinetic energy and momentum.

Part-II

Q2 Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve) (6 x 8)

- a) Find the angle between two equal forces P, when their resultant is equal to (I) P and (II) P/2.
- b) A beam AB of length 5 m supported at A and B carries two point loads W_1 and W_2 of 3 kN and 5 kN which are 1 m apart. If the reaction at B is 2 kN more than that at A, find the distance between the support A and the load 3 kN.
- c) Three forces acting on a particle are in equilibrium. The angles between the first and second is 90° and that between the second and third is 120°. Find the ratio of the forces.
- d) State and prove Lami's Theorem.
- e) Explain the method of joints for analysis of trusses with a suitable example.
- f) Derive the expression for moment of inertia of a rectangular area about its centroidal axis.
- g) A simply supported beam AB of span 4 m is subjected to a point load of 10 kN at a distance of 1.5 m from A. Using the principle of virtual work, determine the reactions at the two supports.

h) The truss ABC shown in Fig. 1 has a span of 5 metres. It is carrying a load of 10 kN at its apex. Find the forces in the members AB and AC.



i) Derive an expression for the moment of inertia of a triangular section about an axis passing through the C.G. of the section and parallel to the base.

j) A body of weight 300 N is lying on a rough horizontal plane having a coefficient of friction as 0.3. Find the magnitude of the force, which can move the body, while acting at an angle of 25° with the horizontal.

k) A body is moving with a velocity of 3 m/s. After five seconds the velocity of the body becomes 13 m/s. Find the acceleration of the body.

l) A bullet of mass 10 gm is fired into a body of mass 1 kg, which is suspended by a string 1 m long. The bullet gets embedded in the body and due to the impact, the body swings through an angle of 11.2° . Find the velocity of the bullet.

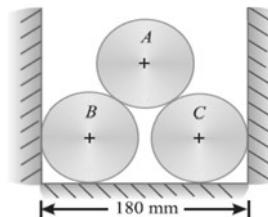
Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

(16 x 2)

Q3

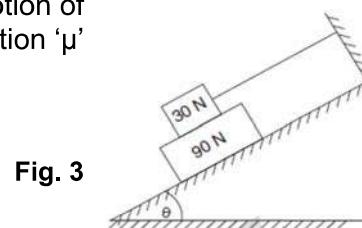
Three cylinders weighting 100 N each and of 80 mm diameter are placed in a channel of 180 mm width as shown in Fig. 2. Determine the pressure exerted by the cylinder A on B at the point of contact.



(16)

Q4

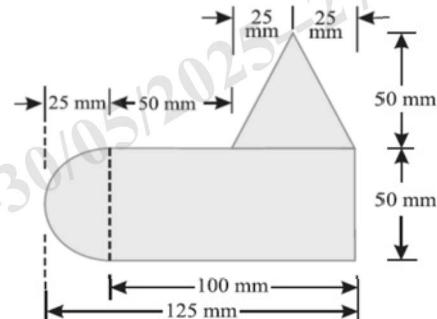
What should be the value of the angle θ in Fig. 3 so that the motion of the 90 N block impends down the plane? The co-efficient of friction ' μ ' for all the surfaces is $1/3$.



(16)

Q5

A uniform lamina shown in Fig. 4 consists of a rectangle, a semi-circle and a triangle. Determine the centroid of the lamina. All dimensions are in mm.



(16)

Q6

Find the acceleration of bodies and tension in the string joining A and B as shown in Fig. 5.



(16)