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Paper Code : ES-ME301 Engineering Mechanics

UPID : 003522

Time Allotted : 3 Hours *Full Marks :70*

The Figures in the margin indicate full marks.

Candidate are required to give their answers in their own words as far as practicable

Group-A (Very Short Answer Type Question)

1. Answer any ten of the following : [1 x 10 = 10]

(i) The path traced by a projectile in space is known as
(a)Coral
(b)Orbit
(c)Track
(d)Trajectory

(ii) Find the angle between two equal forces P, when their resultant is equal to (i) P and (ii) P/2.

(iii) What is a collinear system of forces for free body diagrams?
a) The force system having all the forces parallel to each other
b) The force system having all the forces perpendicular to each other
c) The force system having all the forces emerging from a single point
d) Forces cannot form a collinear system of forces, it is not possible

(iv) How does a gyroscope sensor work?

(v) What does the slope of a bending moment curve as a function of distance represent?

(vi) The force of friction between two bodies in contact
(a) Depends upon the area of their contact
(b) Depends upon the relative velocity between them
(c) Is always normal to the surface of their contact
(d) All of the above

(vii) Define the terms :Mass of a body and weight of a body.

(viii) What are the four main types of forces?

(ix) Gyroscopic effect is not observed in which of the following actions performed by the ships?
a. Rolling
b. Pitching
c. Steering
d. All of the above

(x) What is the bending moment at end supports of a simply supported beam?
a) Maximum
b) Minimum
c) Zero
d) Uniform

(xi) Variables in TensorFlow are also known as?
A. tensor variable
B. tensor keywords
C. tensor attributes
D. tensor objects

(xii) A free body diagram is an
A. Isolated joint with only body forces acting on it
B. Isolated joint with internal forces acting on it
C. Isolated joint with all the forces, internal as well as external, acting on it
D. None of the above

Group-B (Short Answer Type Question)

Answer any three of the following [5 x 3 = 15]

2. Define the terms:moment of inertia and radius of gyration. [5]

3. What is Euler's theorem statement? [5]

4. State and prove parallelogram law of forces [5]

5. State and prove the Varignons theorem. [5]

6. A beam of uniform rectangular cross-section is fixed at one end and carries an electric motor weighing 400 N at a distance of 300 mm from the fixed end. The maximum bending stress in the beam is 40 MPa. Find the width and depth of the beam, if depth is twice that of width [5]

Group-C (Long Answer Type Question)

Answer any three of the following [15 x 3 = 45]

7. (a) A force 25KN starts from a point P(1,3,2) and passes through the point Q(-8,5,3).Express the force in terms of unit vectors i, j and k [5]

   (b) Find the dot product of a= (1, 2, 3) and b= (4, –5, 6). What kind of angle the vectors would form? [5]

   (c) Two vectors A and B are given by: A = 2i – 3j + 7k and B= –4i + 2j –4k .Find the dot product of the given two vectors. [5]

8. Given a homogeneous point (1, 2, 3). Apply rotation 90 degree towards X, Y and Z axis and find out the new coordinate points. [15]

9. (a) State that Parallelogram Law of Forces. [5]

   (b) Resultant of two forces is equal to either of them. Determine the angle between the forces. [5]

   (c) Two coplanar force with magnitude 20KN and 15KN are oriented with angle of inclination equal to 60 degree .What would be their resultant in magnitude and direction if [5]
   (a)both the forces act away from their point of intersection O.
   (b) first force acts away from point O and the second force acts towards the point

10. (a) A body of weight 300 N is lying on a rough horizontal plane having a coefficient of friction of 0.3. Find the magnitude of the force, which can move the body, while acting at an angle of 25° with the horizontal. [8]

    (b) A body, resting on a rough horizontal plane, required a pull of 180 N inclined at 30° to the plane just to move it. It was found that a push of 220 N inclined at 30° to the plane just moved the body. Determine the weight of the body and the coefficient of friction [7]

11. (a) Two forces of magnitude 20N and 40N are acting on a particle such that the angle between the two is 135^0.If both these forces are acting away from the particle ,calculate their resultant and find its direction. [8]

    (b) Explain fully the following terms : [7]
    (i)Resolve part of given force in a given direction
    (ii)Lamis theorem