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Question Paper Code: 52909

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2019

Second Semester

Chemical Engineering

15UCH209 - PRINCIPLES OF MECHANICS

(Regulation 2015)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Due to rusting the weight of iron CO1- R
(a) decreases (b) increases (c) remains the same (d) uncertain
2. Which of the following metal can be cut down with the help of knife? CO1- R
(a) Sodium (b) Potassium (c) Gallium (d) All of the above
3. _____ is a vector whose magnitude is zero. CO2- R
(a) Unit vector (b) Null vector (c) Sliding vector (d) Position vector
4. _____ is giving the physical representation of a body and the CO2- R
forces acting on its including the distances.
(a) Space diagram (b) Free body diagram
(c) Free body (d) None of the above
5. A single force and a couple acting in the same plane upon a rigid body CO3- R
(a) Balance each other (b) Cannot balance each other
(c) Produce moment of a couple (d) Are equivalent
6. The thread angle in unified (ISO) thread is CO3- R
(a) 30° (b) 60° (a) 90° (b) 45°

7. The stress induced in a body, when suddenly loaded, is _____ CO4- R
the stress induced when the same load is applied gradually.
- (a) equal to (b) one-half (c) twice (d) four times
8. The deformation per unit length is called CO4 -R
(a) tensile stress (b) compressive stress (c) shear stress (d) strain
9. _____ is the point through which the whole weight of a body acts. CO5 -R
(a) Centre of gravity (b) centroid (c) moment (d) Moment of inertia
10. Moment of inertia of the triangle about its base is _____ CO5- R
(a) $bh/12$ (b) $bh^3/4$ (c) $bh^3/12$ (d) $bh^3/6$

PART – B (5 x 2= 10Marks)

11. What are the required properties of the materials for making thermocouples? CO1 -R
12. State Parallelogram law of forces. CO2 -R
13. Distinguish between couple and moment. CO3- R
14. A steel rod 5m long and 30mm in diameter is subjected to an axial tensile load of 50KN.find the the change in length, diameter and volume of the rod. Take $E=200 \times 10^3 \text{ N/mm}^2$ & $\mu=0.25$. CO4 -R
15. State parallel axis theorem and perpendicular axis theorem. CO5 -R

PART – C (5 x 16= 80Marks)

16. (a) A Curved bar is formed of a tube of 20 mm outside diameter and 7.5 mm thickness. The center line of this beam is a circular arc of radius 225 mm . A bending moment of 3 kNm tending to increase curvature of the bar is applied. Calculate the maximum tensile and compressive stresses set up, in the bar. CO1 -App (16)

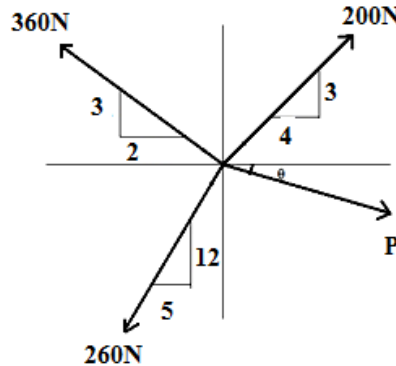
Or

- (b) A Curved bar of rectangular section 60 mm wide by 75 mm deep in the plane of bending initially unstressed is subjected to bending moment of 2.25kNm which tends to straighten the bar.The mean radius of curvature is 150 mm.Find CO1 -App (16)
- (i)The position of the neutral axis
- (ii)The greatest bending to show approximately how the stress varies across the section.

- 17 (a) (i) A force vector of magnitude 100 N is represented by a line AB of co-ordinates A (1,2,3) and B (5,8,12). CO2- Ana (8)

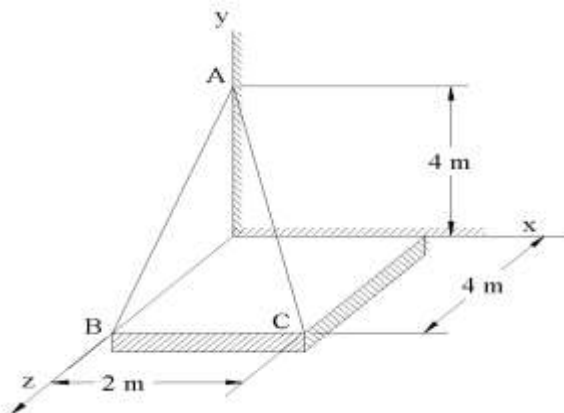
Determine

- (a) The components of the force along x, y and z axis.
 (b) Angles with x, y and z axis.
- (ii) The resultant of the system as shown in the figure is 520 N along the negative direction of Y-axis. Determine P & θ CO2 Ana (8)

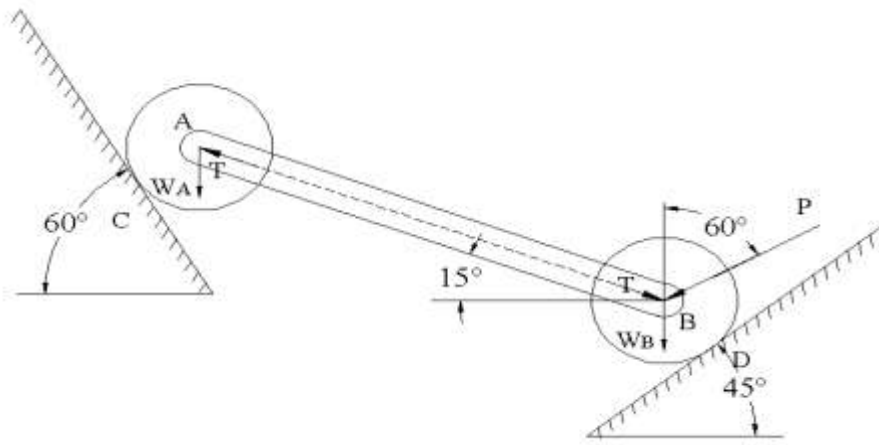


Or

- (b) The tension in cables AB and AC are 100N and 120N respectively in fig. Determine the magnitude of the resultant force acting at A. CO2- Ana (16)

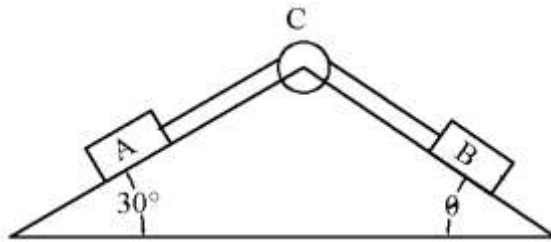


18. (a) The figure shows cylinders, A of weight 100N and B of Weight 50N, resting on smooth inclined planes. They are connected by a bar of negligible weight hinged to each cylinder at their geometric centers by smooth pins. Find the force P as shown, that holds the system in the given position CO3- Ana (16)



Or

- (b) A and B weighing 40N and 30N respectively, rest on smooth planes as shown in fig. they are connected by a weightless cord passing over a friction less pulley. Determine the angle θ and the tension in the cord for equilibrium. CO3- Ana (16)



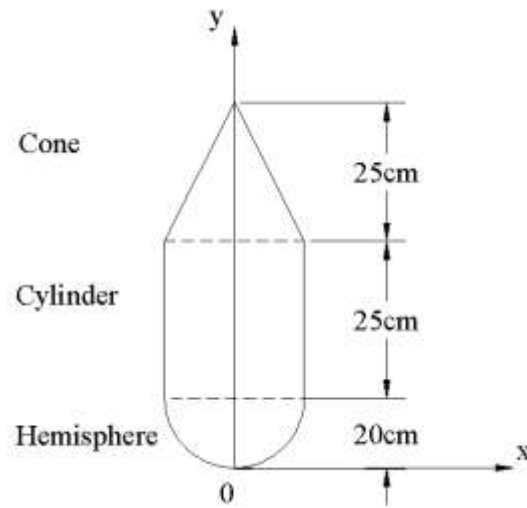
19. (a) The inside and outside diameters of a cast-iron cylinder are 240 mm and 150 mm respectively. If the ultimate strength of a cast iron is 180 MN/m², Identify according to each of the following theories the internal pressure which would cause rupture: CO4 -U (16)
- (i) maximum principal stress theory (5)
 - (ii) maximum strain theory and (5)
 - (iii) maximum strain energy theory. Poison's ratio = 0.25. Assume no longitudinal stress in the cylinder(6)

Or

- (b) A bolt is subjected to an axial pull of 10 kN together with a transverse shear force of 5 kN. Solve the diameter of the bolt by using CO4 -Ana (16)
- (i) maximum principal stress theory
 - (ii) (ii) maximum strain theory
 - (iii) (iii) Octahedral shear stress theory

20. (a) Locate the centroid of the volume as shown in fig.

CO5- U (16)



Or

(b) Find the moment of inertia of a T section of flange 100 mm x 30 mm and web 20 mm x 80 mm about its centroidal axes. CO5- U (16)

