ANNA UNIVERSITY COIMBATORE

B.E. / B.Tech. DEGREE EXAMINATIONS – DECEMBER 2008

THIRD SEMESTER – CIVIL / MECHANICAL / AUTOMOBILE ENGG.

MC302 - ENGINEERING MECHANICS

Time: Three Hours **Maximum: 100 Marks**

PART A – (20 x 2 = 40 Marks)

Answer ALL Questions

1. Two forces 60 N and 65 N act on a screw at an angle of 25^0 and 85^0 from the base. Determine the magnitude and direction of their resultant.
2. Distinguish the following types of forces: Coplanar and collinear.
3. State and prove Varignon theorem.
4. Define unit vector.
5. What are the direction cosines?
6. Locate the centroid of a square of size 2x2 cm.
7. A force has components Fx=200N,Fy=-300N,Fz=600N.Determine the magnitude of the force and angles θx, θy and θz it forms with the coordinate axes.
8. State parallel axis theorem.
9. Determine the resultant of the three forces,
   F1 = 2i+3j-2k, F2=-i+4j+5k,F3=8i+3j-2k
10. Prove F = ma.
11. A semi circular area having radius 100 mm is located in the xy plane such that its diameteral edge coincides with the y axis. Determine the x-coordinate of its centroid.
12. Define principal axis and principal moment of inertia.
13. The motion of a particle is defined by the relation $x = t^4-3t^3+2t^2-8$ where x is in meters and t in seconds. Determine the velocity and acceleration when t =2 sec.
14. Stete D'Alemberts Principle.
15. A body has ---------number of centre of gravity.
16. State Lame's Theorem.

17. State the laws of dry friction.

18. Define projectile.

19. Define impulse of a force.

20. Define friction.

PART B – (5 x 12 = 60 Marks)

Answer Any FIVE Questions

21. (a) In the equation, EI d^2y/dx^2 = K, x and y represent distance, K stands for moment and I stands for area moment of inertia. Determine the dimensions of E. (4)

    (b) The resultant of two forces when they act at right angles is 10N whereas when they act at an angle of 60°, the resultant is √148 N. Find the magnitude of the two forces. (8)

22. Three space forces act at a point P along PA, PB and PC with magnitudes 100N, 200N and 300N respectively. If the coordinates of points A,B,C with P as origin are (1,2,3), (-2,4,5) and (2,4,6) respectively, find the magnitude and angles made with the reference axis of the resultant force of the system.

23. State and prove Varignon's theorem

24. The cross section of a member is semicircular as shown in Fig.1: Calculate the moment of inertia of this semicircular area about
    a. an axis that coincides with AB
    b. the centroidal axis that is parallel to AB
    c. the axis that is parallel to AB and tangential to the semi circle
    d. the axis that is perpendicular to AB and tangential at A

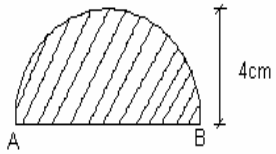

Fig:1

25. A ball is thrown from the top of a building of height 20m at an angle of elevation of 30°with a speed of 50m/s. Calculate (a) the maximum elevation reached by the ball above the ground level and (b) the velocity with which the ball will hit the ground.

26. A body of weight 10N moving in the direction AB at a speed of 3m/sec strikes another body of weight 2N moving in opposite direction BA at a speed of 8m/sec. If the velocity of 2N body is 3m/sec in the direction of AB after impact, find the velocity of 10N body after impact and the coefficient of restitution.

27. A man wishing to slide a stone block of weight 100N on a horizontal concrete floor, ties a rope to the block and pulls it in a direction upward at an angle of 20° to the horizontal. Calculate the pull necessary to slide the block if the coefficient of friction μ = 0.6. Calculate also the pull required if the inclination of the rope with the horizontal is equal to the angle of friction and prove that this is the least force required to slide the block.

28. A flywheel 1.5m in diameter accelerates uniformly from rest to 1200 rpm in 12 sec. What is its angular acceleration? How many revolutions does the flywheel make in attaining this speed?

*********THE END*********