ANNA UNIVERSITY OF TECHNOLOGY, COIMBATORE

B.E. / B.TECH. DEGREE EXAMINATIONS : NOV / DEC 2011

REGULATIONS : 2008

SECOND SEMESTER

080120002 - ENGINEERING MECHANICS

(COMMON TO AERONAUTICAL / AUTOMOBILE / BIOTECH. / CHEMICAL / CIVIL / FASHION TECH. / MECHANICAL / MECHATRONICS / TEXTILE CHEMISTRY / TEXTILE TECH. / ENVIRONMENTAL / PRODUCTION ENGG.)

Time : 3 Hours **Max. Marks : 100**

PART – A

(10 x 2 = 20 MARKS)

ANSWER ALL QUESTIONS

1. State "Parallelogram law of forces".
2. What is meant by "Single equivalent force"?
3. Mention the requirements for stable equilibrium.
4. Differentiate "Principle of moments and Varignon's principle".
5. Define centroid and centre of gravity.
6. Derive the relation between mass moment of inertia and area moment of inertia.
7. A motor car traveling at a speed of 100 kmph, halts after skidding 50m with uniform retardation on applying brake suddenly. Determine the time required to stop the car.
8. Which is called as restitution?
9. Define "Angle of friction and Angle of repose".
10. A wheel rotating about a fixed axis at 20 rpm is uniformly accelerated for 70 seconds during which time it makes 50 revolutions. Find the angular velocity at the end of this interval?

PART - B

(5 x 16 = 80 MARKS)

ANSWER ALL QUESTIONS

11. (a) (i) Find the magnitude of two forces such that, if they act at right angles, their resultant is 5N whilst when they act at an angle of 60 degrees, their resultant is $\sqrt{37}$ N. 8

(ii) A wheel has five equally spaced radial spokes, all in tension. If the tensions of three consecutive spokes are 500N, 700N and 600N respectively, find the tensions in the other two spokes. 8

(OR)

11. (b) The lines of action of three forces concurrent at the origin 'O' passes respectively through points A, B and C having coordinates A (-1, 2, 4), B (3, 0,-3) and C (2,-2, 4). The magnitudes of the forces are 40N, 10N and 30N respectively. Find the magnitude and direction of their resultant.

12. (a) (i) Define "Free body diagram" and draw the free body diagram for the two spheres resting on inclined walls. 6

(ii) A beam 6m long is simply supported at the ends and carries a UDL of 1.5 kN/m and three concentrated loads of 2kN, 3kN and 4kN acting respectively at a distance of 1.5m, 3m and 4.5m from the left end. Calculate the reactions at both ends. 10

(OR)

12. (b) A system of forces consists of force P= 3i+5j-6k acting through point (2, 1, -3), force Q= 5i-4j+3k acting through point (1, 4, 2) and a moment M=20i-35j-60k. The forces are in N, distances in metre and moment in Nm. Calculate:

(i) The component of the resultant force and its magnitude.

(ii) The total moment of the system about the origin O.

(iii) The moment of the system about the line through O which makes angles of 65 degrees and 75 degrees with the X and Y axes respectively.

13. (a) Derive an expression for the moment of inertia of a (i) Triangular section about an axis passing through the C.G. of the section and parallel to the base and (ii) Circular section. 10 6

(OR)

13. (b) Derive an expression for the mass moment of inertia for (i) rectangular prism and (ii) sphere from first principle. 10 6

14. (a) A bullet is fired upwards at an angle of 30 degree to the horizontal from a point P on a hill and it strikes a target which is 80m lower than P. The initial velocity of the bullet is 100 m/s. Calculate (i) The maximum height to which the bullet will rise above the horizontal. (ii) The actual velocity with which it will strike the target. (iii) The total time required for the flight of the bullet. (iv) Horizontal distance between hill position and the target.

(OR)

14. (b) A ball of mass 3 kg, moving with a velocity of 30m/s, strikes a ball of mass 3 kg, moving with a velocity of 45m/s. At the instant of impact, the velocities of the balls are inclined at an angle of 30 degree and 60 degree to the line joining their centres measured in opposite directions. If the coefficient of restitution is 0.9, find the magnitude and direction of velocities of both the balls after impact.

15. (a) (i) Taking the coefficient of rolling resistance as 2.75 mm, determine the horizontal force required to move a 2500kg automobile along a horizontal road at a constant speed. The diameter of each tyre is 1030 mm. 8

(ii) A belt is running over a pulley of diameter 1.3m at 275 rpm. The angle of contact is 160 degrees and coefficient of friction is 0.4. If the maximum tension in the belt is 475N, determine the power transmitted by the belt. 8

(OR)

15. (b) (i) In a crank connecting rod mechanism the lengths of connecting rod and crank are 200mm and 75mm respectively. The crank is rotating at 2000 rpm. Determine the velocity and acceleration of the piston when the crank is 40 degree with horizontal. 12

(ii) Write about general plane motion. 4

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