Register Number: ……………………..

B.E/B.TECHDEGREE EXAMINATIONS: DEC 2014
(Regulation 2009)
Second Semester
MEC102: ENGINEERING MECHANICS
(Common to AERO/AUTO/CE/MCT/MECH/FT/BT/TXT)

Time: Three Hours   **Maximum Marks: 100**
Answer all the Questions:-
PART A (10 x 1 = 10 Marks)

1. The units of potential energy is
   a) Nm   b) N/m
   c) Nm^2 d) N^2m

2. The number of scalar equations of equilibrium available for a particle subjected to coplanar forces is
   a) 3   b) 1
   c) 2   d) 6

3. Any number of coplanar forces acting on a rigid body may be reduced to
   a) A Single force   b) A single couple
   c) Either a single force or two couples   d) A single force and a couple in general

4. In general, the number of reaction components in a hinged support in two dimensional case is
   a) 1   b) 2
   c) 3   d) 4

5. The centroid of a semi circular section of radius R is at a distance of -------- from the base diameter
   a) $4R/3\pi$ b) $4\pi/3R$
   c) $3\pi/4R$ d) $3R/4\pi$

6. The polar moment of inertia of a circular section of radius R is
   a) $\pi R^4/4$ b) $\pi R^4/2$
   c) $\pi R^4/8$ d) $\pi R^3/4$

7. A rope is wrapped twice around a rough pole with a coefficient of friction μ. It is subjected to a force F_1 at one end. A gradually increasing force F_2 is applied at the other end till the rope just starts slipping. At this instant, the ratio of F_2 to F_1 is
   a) 1   b) $e^{4\mu\pi}$
   c) $e^{2\mu}$ d) $e^{360\mu}$

8. When a ladder is placed touching a smooth floor and a smooth vertical wall
   a) The ladder may be in equilibrium   b) The ladder can not be in equilibrium
   c) Equilibrium depends on the angle made   d) Nothing can be said definitely
      by the ladder with the horizontal plane.

9. In the case of a perfectly plastic impact, the coefficient of restitution is
   a) 1   b) Zero
   c) Infinity   d) More than 1

10. A person of weight 700 N walks on an inclined stair case of length 4m and comes down by 3m The work done by the weight of his body is
    a) 2800 Nm   b) 2100 Nm
    c) 4900 Nm   d) zero

PART B (10 x 2 = 20 Marks)

11. State the parallelogram law of forces.
12. What is a free body diagram? Give an example.
13. State Varignon's theorem.
14. Sketch three types of supports and the reactions which they can offer.
15. State the parallel axis theorem related to the product of inertia of a cross section.
16. A triangular section has base width, b and depth, h. What is the moment of inertia of this section about the axis which coincides with the base edge of the triangular section?
17. State the laws of Coulomb friction.
18. Explain how rolling resistance is calculated.
19. What is curvilinear motion of a particle?
20. State the principle of impulse and momentum.

PART C (5 x 14 = 70 Marks)

21. a) A particle P is acted upon by five coplanar forces as shown in Fig. 1. Determine the magnitude and direction of the resultant force. What is the equilibrant of the system?

(OR)

    b) (i) Distinguish between Newtonian Mechanics and Relativistic Mechanics (6)
       (ii) Explain Newton's law of gravitation and the principle of transmissibility of forces. (8)

22. a) A square plate of side 200mm is acted upon by four coplanar forces as shown in Fig.2 Determine the magnitude, direction and distance from A of the line of action of the resultant force.

(OR)

b)   A vertical post AE is subjected to pulls from four cables as shown in Fig. 3. Find the magnitude, direction and point of application of the resultant pull.

23.   a)   Locate the centroid and determine the moment of inertia of the section shown in Fig. 4 about that centroidal axis which is parallel to the ox axis.

(OR)

b)   From a semi circular area, a rectangular portion 4cm x 2cm is removed as shown in Fig. 5. Locate the position of the centroid of the section and calculate the moment of inertia of the section about the horizontal centroidal axis of the section.

24. a) A man wishing to slide a stone block of weight 1000N over a horizontal concrete floor, ties a rope to the block and pulls it in a direction inclined upward at an angle of 20^0 to the horizontal. Calculate the minimum pull required to slide the block if μ = 0.6. Also calculate 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.

(OR)

b) A 5m ladder of mass 25 kg is placed in a position where its inclination to a vertical wall is at an angle of 30^0. If the coefficient of friction is 0.20 at all contact points, find how far a man of 100 kg mass can climb up the ladder without slipping.

25. a) (i) A bomber flies along a horizontal line at an altitude of 1500m with a velocity of 360 km/hour
   Find at what horizontal distance before passing over a target on the ground, a bomb should be dropped so as to hit the target on the ground. (6)
   (ii) Calculate the magnitude and direction of the velocity with which the bomb will hit the target (6)
   (iii) Where will be the bomber when the bomb strikes the target? Take $g = 9.81$ m/s^2 (2)

(OR)

b) In a direct central impact, two bodies A and B of mass 5 kg and 10 kg respectively move with velocities as shown in Fig.6. If the coefficient of restitution is 0.7, find
   (i) The velocities of the bodies just after impact (8)
   (ii) The loss of kinetic energy during collision (6)

****