Engineering Mechanics - I
Subject Code: UG11T2105/ UG11T1105

Time: 3 hrs   Max Marks: 100
Date: 23.12.2015   Pass Marks: 50

<u>**Part - A**</u>   **(10x3 = 30 Marks)**
Compulsory Question

1. a) What are the systems of forces?
    b) How can you define the nature of force in a member of truss?
    c) Write down the positions of centroids of the following plane geometrical figures:
        (i) Rectangle, (ii) Circle and (iii) semi-circle from base
    d) Define Mass moments of Inertia?
    e) A force of 500 N forms an angle of 60^0, 45^0, 120^0 with x, y and z axes respectively. Find the components F_x, F_y and F_z of the force.
    f) State & Explain Lami's theorem?
    g) Determine the reactions at the supports when the simply supported beam of length 'L ' carrying point load at a distance 'a' from left hand support, by principle of virtual work method
    h) Define rectilinear motion, curvilinear motion and projectile motion
    i) Define Mechanical advantage, velocity ratio and Ideal machine
    j) State the principle of work and Energy.

<u>**Part- B**</u>   **(5x14 = 70 Marks)**
Answer any Five of the Following

2. Determine the reaction and the forces in each member of a simple triangle truss supporting two loads as shown in Fig1.   (14 marks)
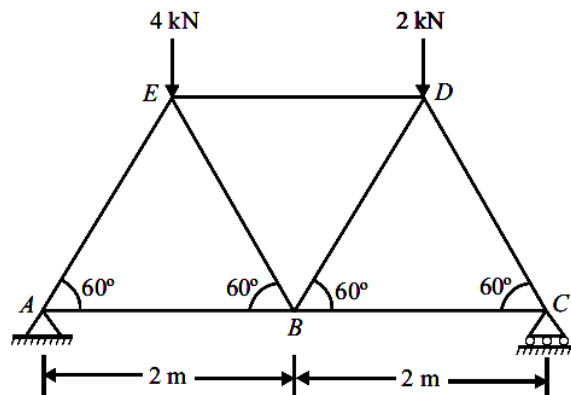

Figure-1

3. In a lifting machine, an effort of 40 N raised a load of 1 KN. What is the mechanical advantage? Find the velocity ratio, if the efficiency at this load is 50%.

   If on this machine, an effort of 74 N raised a load of 2 KN, what is now the efficiency? What will be the effort required to raise a load of 5 KN?   (14 marks)

4. Calculate the moment of inertia about horizontal and vertical gravity axes (I_{xx} and I_{yy}) of the section shown in Fig.2   (14 marks)
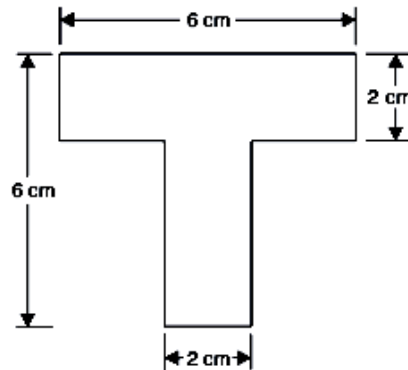

Figure-2

5. A semi-circular area is removed from a trapezium as shown in fig.3. Determine the centroid of the remaining shaded area. (All dimensions in mm)   (14 marks)
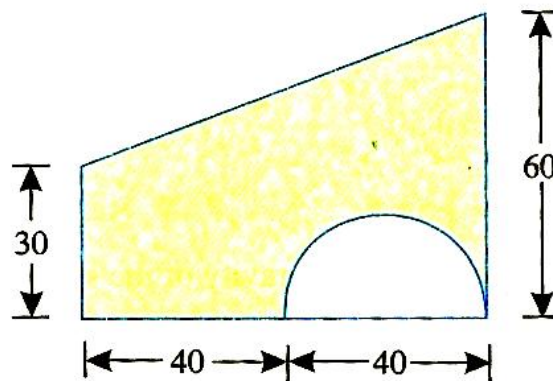

Figure -3

6. The motion of the particle is defined by the relation $x=t^2+5t$ and $y=t^3-8t^2+2$ where 'x' and 'y' are expressed in metres and 't' is in seconds. Determine the velocity and acceleration at t=2 sec.   (14 marks)

7. A particle moves with simple harmonic motion, when it is at 1.2 m and 1.5 m from the centre of the path, its velocities are 5 m/sec and 3 m/ sec respectively. Find the period of simple harmonic motion and acceleration at the greatest distance from centre of motion.
                    (14 marks)

8. A block of weight 12 KN falls at a distance of 0.75 m on top of the spring. Determine the spring constant if it is compressed by 150 mm to bring the weight momentarily to rest.
                    (14 marks)

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