[05 – 2110]

II/IV B.E. DEGREE EXAMINATION.

First Semester

Electronics and Communication Engineering

ENGINEERING MECHANICS AND STRENGTH OF MATERIALS

(Common with EEE, EIE and Dual Degree Programme in EEE)

(Effective from the admitted batch of 2006-2007)

Time : Three hours Maximum : 70 marks

First question is compulsory.

Answer any FOUR from the remaining.

All questions carry equal marks.

1. (a) Explain the law of polygon of forces.

(b) Explain the term moment of a couple.

(c) Explain the term centre of gravity.

(d) What is mean by polar moment of inertia?

(e) State the D'Alembert's principle.

(f) Explain the Shear force and Bending moment.

(g) Explain equivalent Bending moment and twisting moment.

2. (a) Find the co-ordinates of the centroid of the area left after removing a square area from a square plate as shown in Figure 1.

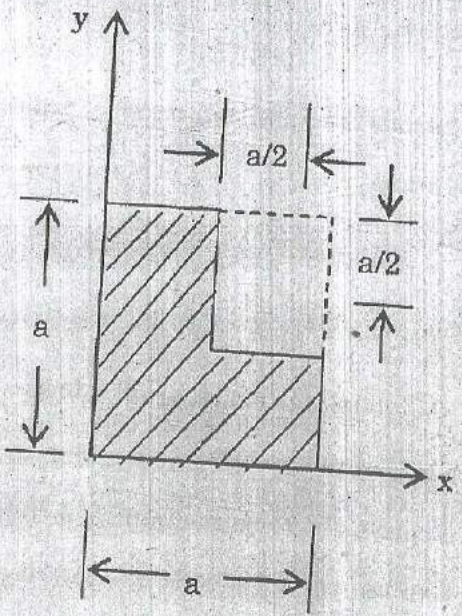

Figure 1

(b) Find the centroid of a channel section as shown in Figure 2.

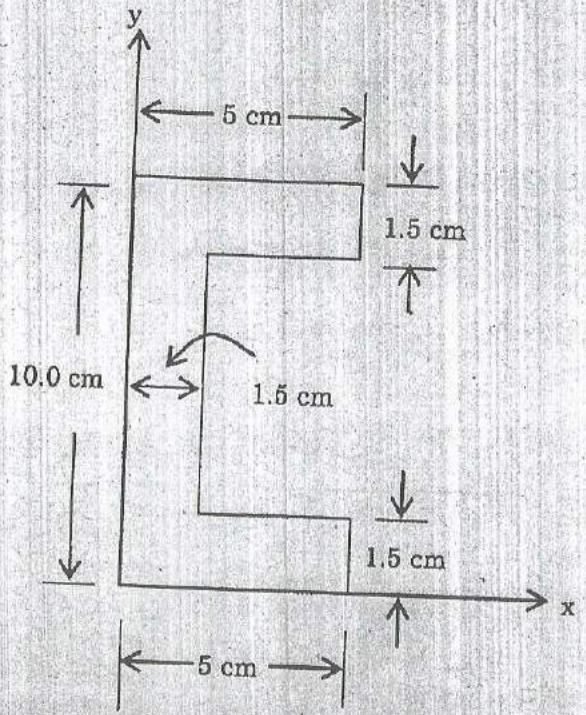

Figure 2

3. Find the moment of inertia of the area of the L-section about the centroidal x and y axis as shown in Figure 3.

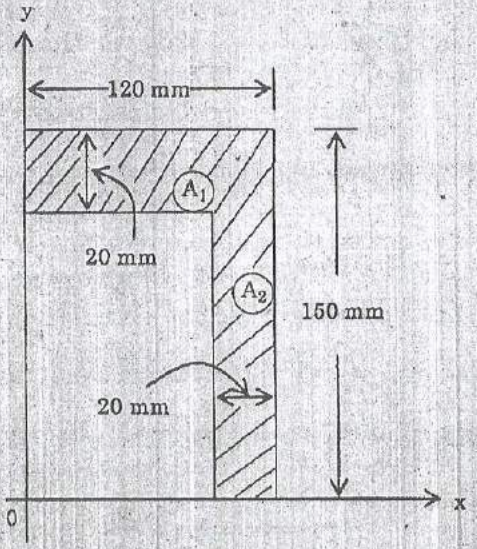

Figure 3

4. (a) (i) A flywheel starts rotating from rest and is given an acceleration of 1 rad/sec^2. Find the angular velocity and speed in r.p.m. after 1.5 minutes.

(ii) If the flywheel is brought to rest with a uniform angular retardation of 0.5 rad/sec^2, determine the time taken by the flywheel in seconds to come to rest.

(b) A flywheel is rotating at 150 rpm and after 8 seconds it is rotating at 120 rpm. If the acceleration is uniform determine the number of revolution made by the flywheel and the time taken by the flywheel before its comes to rest from the speed of 150 rpm.

5. (a) What is SHM? Give two examples. How are they different from mechanical vibration?

(b) A particle performing S.H.M. has a frequency of 10 oscillations per minute. At a distance of 8 cm from the mean position its velocity is $3/5^{th}$ of the maximum velocity. Find

(i) the amplitude of oscillation,

(ii) the maximum acceleration,

(iii) the velocity of the particle when it is at a distance of 5 cm from the mean position.

6. (a) Obtain the expressions for the maximum deflection, if a simply supported beam of span 'l' carries a u.d.l. for a distance $l/2$ from one support.

(b) A beam of rectangular crosssection 450 mm wide and 750 mm deep has a span of 6 meters. The beam is subjected to a uniformly distributed load of 20 kN per meter run (including the self-weight of the beam) over the whole span. The beam is also subjected to a longitudinal axial compressive load of 1500 kN. Find the extreme fibre stresses at the mid span section.

7. (a) Derive the expression for normal and shear stress for general case of planes ($\sigma_x^2, \sigma_y^2, \gamma_{xy}$ are given) also calculate the inclination of principal planes.

(b) The principal stresses at a point in a bar are 250 N/mm^2 (tensile) and 175 N/mm^2 (compressive) Determine the resultant stress in magnitude and direction on a plane inclined at 60° to the axis of the major principal stress. Also determine the maximum intensity of shear stress in the material at the point.

8. A beam of uniform section 10 meters long carries a uniformly distributed load of 10 kN per metre over the whole length and a concentrated load of 10 kN at the right end. If the beam is freely supported at the left end, find the position of the second support so that maximum bending moment for the beam shall be as small as posible. Find also the maximum bending moment for this case. Draw also SF and BM diagrams.