SLIATE

SRI LANKA INSTITUTE OF ADVANCED TECHNOLOGICAL EDUCATION

(Established in the Ministry of Higher Education, vide in Act No. 29 of 1995)

# Higher National Diploma in Engineering (Mechanical /Civil) BSE)
## First Year, Second Semester Examination – 2016
## CM1207 STRENGTH OF MATERIALS

Instructions for Candidates:

**Answer any four questions**

No. of questions : 05

No. of pages : 02

Time : **02 hours**

1.

a. Define stress and strain. Write down the units of stress and strain.

(07 marks)

b. A beam weighing 450N is held in a horizontal position by three vertical wires, one attached to each end of the beam, one to the middle of its length. The outer wires are of brass of diameter 1.25 mm and the central wire is of steel of diameter 0.625 mm. If the beam is rigid and wires of the same length and unstressed before the beam is attached, estimate the stresses induced in the wires. Take Young's modulus for brass as 86 GN/m$^2$ and for steel 210 GN/m$^2$.

(18 marks)

2.

a. Define principal planes and principal stresses.

(07 marks)

b. An elemental cube is subjected to tensile stresses of 60 N/mm$^2$ and 20 N/mm$^2$ acting on two mutually perpendicular planes and a shear stress of 20 N/mm$^2$ on the plane. Use the following methods to find the magnitude and the directions of principal stresses.

i. Mohr's circles method

ii. Analytical method

(13 marks)

c. What is the value of maximum shear stress?

(05 marks)

3.

A simply supported beam carries the uniformly distributed load and two point loads as shown in Fig Q3. Draw the shear force and bending moment diagrams. Also calculate the maximum bending moment.

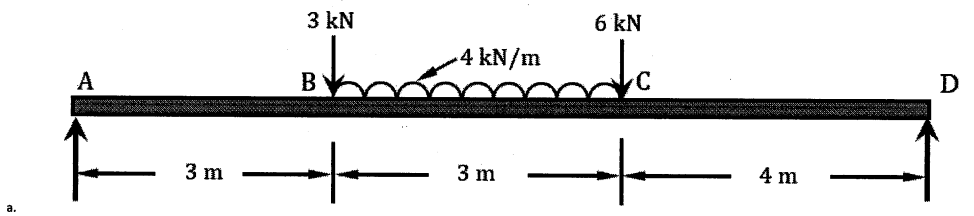


Fig Q3

(25 marks)

4.

A Beam ABC of length 2L is simply supported and loaded as shown in the Fig.Q4.
(i). Find slopes over each support.
(ii). Find the central deflection.

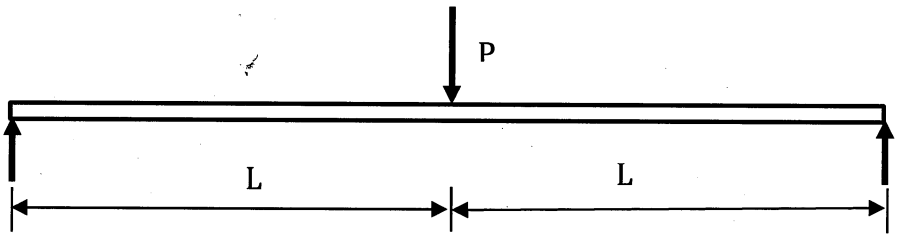


Fig. Q4

(25 marks)

5.

a. A hollow steel shaft having an external diameter of 400mm transmits 9 MW at 120 rpm. If the angle of twist measured over a length of 2m is $0.45^0$ and the modulus of rigidity G is 80 $GN/m^2$,
Estimate
   i. the internal diameter of the shaft,
   ii. the maximum shearing stress
   iii. the strain energy per meter length of shaft.

(3x 05 marks)

b. Find the diameter of the solid shaft which will transmit the same power at the same maximum stress and find the ratio of strain energy per meter length in this shaft to that in the hollow shaft.

(10 marks)