



ZIMBABWE

MINISTRY OF HIGHER AND TERTIARY EDUCATION

**HIGHER EDUCATION EXAMINATIONS COUNCIL
(HEXCO)**

NATIONAL CERTIFICATE

IN

CIVIL, WATER, IRRIGATION ENGINEERING

SUBJECT: Applied Mechanics

PAPER NO: 313/S04

OCTOBER/NOVEMBER 2013 EXAMINATION

REQUIREMENTS

INSTRUCTIONS TO CANDIDATE

1. Answer any FIVE (5) questions.
2. All questions carry equal marks.

This paper consists of 4 printed pages.

QUESTION 1

- a) Draw a stress-strain graph for an elastic material and briefly explain the diagram. (5 marks)
- b) A concrete column of square cross-section 250mm x 250mm is required to support an axial load of 875KN. Determine the minimum number of steel rods, each of diameter 6mm, which would be required to reduce the stress in the concrete to 8N/mm^2 . For steel, $E = 200\text{ GN/m}^2$, concrete, $E = 12\text{ GN/m}^2$. (15 marks)

QUESTION 2

Draw shear force and bending moment diagrams for the cantilever shown in Fig. 1. Draw diagrams to show positive shear negative shear, hogging and sagging. (20 marks)

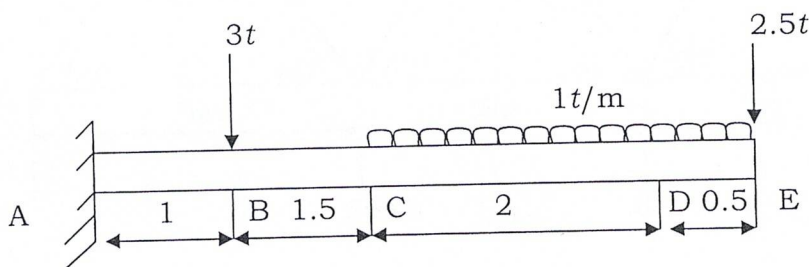
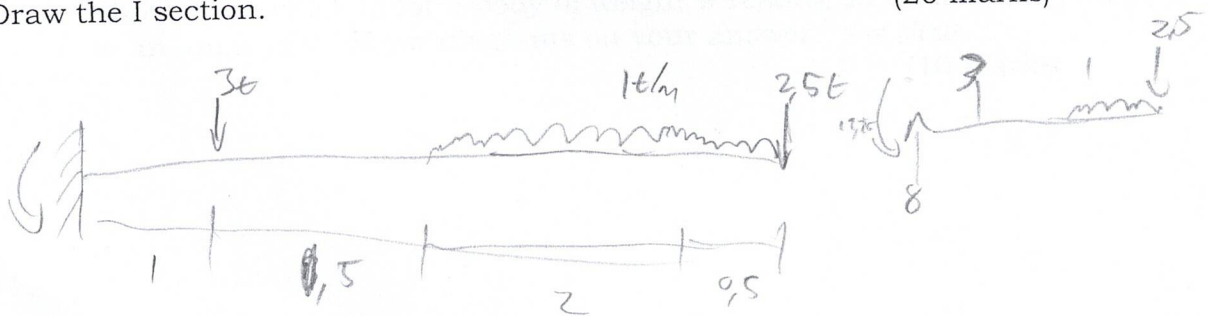


Fig. 1

QUESTION 3

An I section has flanges of width b and the overall depth is $2b$. The flanges and the web are of uniform thickness t . Find the ratio of the maximum shear stress intensity to the mean shear stress intensity. Draw the I section. (20 marks)



$$\sum F_v = 0 = R_A - 3t - 2.5t - 2.5t = 0$$

$$R_A = 3t + 2.5t + 2.5t = 8t$$

$$R_A = 8t$$

$$8 - 3 - 5 = 0$$

$$R_A = M = (3 \times 1) + (1 \times 3.75) + (2.5 \times 5)$$

$$M = 3 + 3.75 + 12.5$$

$$M = 19.25$$

$$-5.25 \uparrow 8$$

Take about A

$$M = 1 \times 1.25 + (3 \times 4) = 8$$

$$M + 13.25 = 8 - 5.25$$

$$M = 8 - 13.25$$

QUESTION 4

a) Define the following terms:

i) Beam

(1 mark)

ii) Simply supported beam

(1 mark)

b) Using the method of sections find the force in each of the members 1, 2 and 3 of the Warren girder shown. Draw the given girder to show the nature of the internal forces. (18 marks)

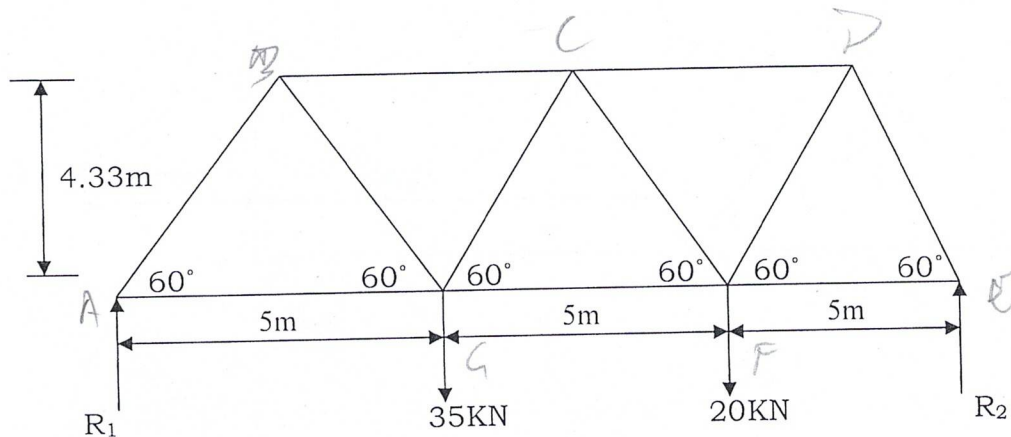


Fig. 2

QUESTION 5

a) A block of weight 200N rests on a plane incline at 15° to the horizontal. If the coefficient of friction between the block and plane is 0.25, find the horizontal force to just cause motion up the plane. (10 marks)

b) Show the coefficient for a body of weight w resting on an inclined plane to an angle of θ . Show diagrams on your answer. $\mu = \tan\theta$. (10 marks)

