



# TECHNICAL UNIVERSITY OF MOMBASA

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FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

**UNIVERSITY EXAMINATION FOR:**

**BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING**

**EMG 2309 SOLID AND STRUCTURAL MECHANICS II**

**END OF SEMESTER EXAMINATION**

**SERIES: APRIL 2016**

**TIME: 2 HOURS**

**DATE:** Pick Date Select Month Pick Year

## **Instructions to Candidates**

You should have the following for this examination

*-Answer Booklet, examination pass and student ID*

This paper consists of **FIVE** questions. Attempt any **THREE** questions.

**Do not write on the question paper.**

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## **Question ONE**

An I- section girder, 250 mm wide by 300 mm deep, with flange and web thickness 20 mm is used as a simply supported beam over a span of 7 m. The girder carries a distributed load of 5kN/m and a concentrated load of 20 KN at mid span.

Determine:-

- (a) The second moment of area of the cross-section of the girder. ( 5marks)
- (b) The maximum stress set up. (15 marks)

## **Question TWO**

At a certain section a beam has the cross-section shown in Fig.Q2. The beam is simply supported at its end and carries a central concentrated load of 400 KN together with a load of 250 KN/m uniformly distributed across the complete span of 4m. Draw the shear stress distribution diagram for a section 1 m from the left-hand support

### Question THREE

A simply supported beam is loaded as shown in Fig. Q3. AB length is 6 m with a point load of 30KN applied at a distance 4 m from A.

Determine:-

- (a) The equations of the elastic curve between each change of load point. (10 marks)
- (b) The maximum deflection of the beam. (10 marks)

### Question FOUR

A fletched composite beam consists of two timber sections each 150 mm wide by 400 mm deep and a steel plate 30 mm thick by 400 mm deep as shown in Fig. Q4. Using the method of equivalent sections;

- (a) Determine the moment of resistance of the composite beam if the maximum stress in the timber is limited to 7.5 MN/m<sup>2</sup>. (10 marks)
- (b) Find the maximum intensity of a uniformly distributed load which the beam can carry over a simply supported span of 5m.

Take  $E_{\text{Steel}} = 200 \text{ GPa}$  and  $E_{\text{Timber}} = 10 \text{ GPa}$  (10 marks)

### Question FIVE

- (a) From the figure shown Fig. Q5, show that for a body subjected to direct stresses in two mutually perpendicular directions accompanied by a simple shear stress is given by:-

$$\sigma = \frac{\sigma_x + \sigma_y}{2} - \frac{\sigma_x - \sigma_y}{2} \cos 2\theta - \tau_{xy} \sin 2\theta \quad \text{and} \quad \tau = \frac{\sigma_x - \sigma_y}{2} \sin 2\theta - \tau_{xy} \cos 2\theta$$

- (b) Using (a) above, show that

$$\sigma_{1,2} = \frac{\sigma_x + \sigma_y}{2} \pm \sqrt{\left[\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau_{xy}^2\right]}$$

FIGURES

EMG 2309

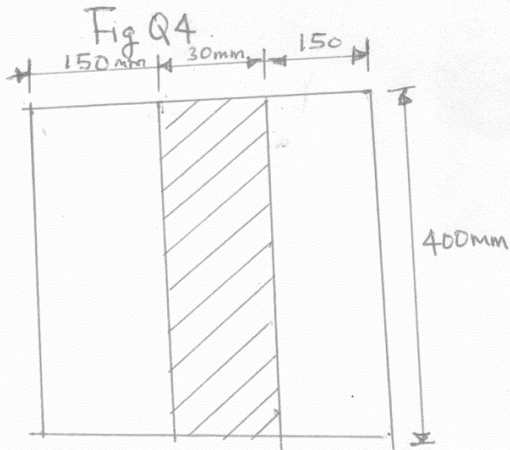
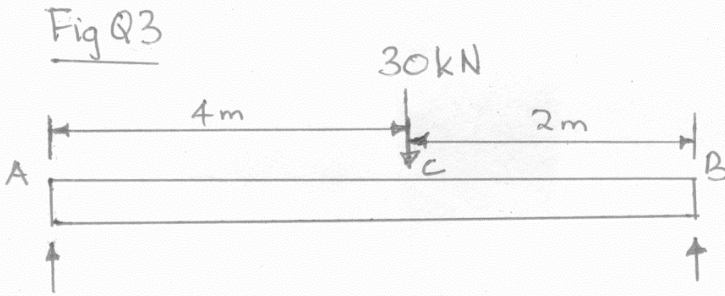
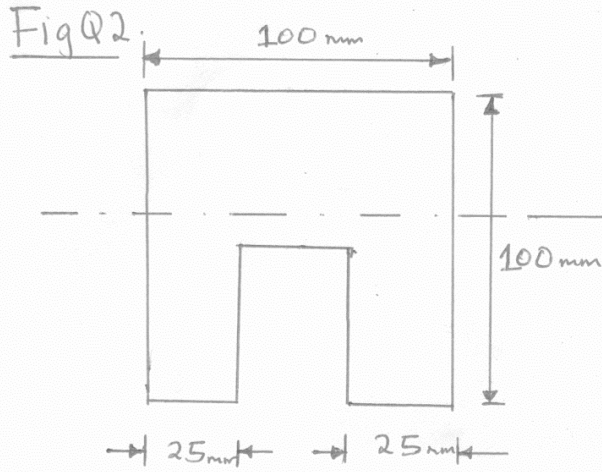


Fig Q5

