The prac assignments can be submitted in CloudDeakin, within 2 weeks after completion of the prac.

The front page of your report should contain the following:

1) Prac Title: Prac 1
2) Unit code: SEM222
3) Unit Name: Stress Analysis
4) Student Name:
5) Student no.:
6) Date prac conducted:
7) Due date: (2 weeks from date of prac)

Your prac report should contain the following sections:

1) Aim:
2) Introduction:
3) Method:
4) Results and Calculations (show sample calculations)
5) Discussion and Conclusions
6) References: (must reference using the Deakin numbered citation style, refer to http://www.deakin.edu.au/current-students/study-support/study-skills/handouts/numbered-citation.php for details.)
   Software such as *Endnote* is a worthy tool, which can be downloaded from the Deakin software website.
   (http://www.deakin.edu.au/software/teaching.php?anchor=endnote)

A generalised aim, intro and discussion method can be written but each prac must contain an individual method, results and conclusion section.

Ensure all calculations are typed out correctly and graphs have appropriate axis and legends.

Notes:

1) Read this lab manual before entering the prac and bring it with you.
2) Enclosed shoes must be worn in the lab to meet safety standards (NO THONGS or open-toed shoes allowed).
3) Ensure that you apply proper units, i.e. distance (mm), force (N) and stress (MPa).
4) Manual drawings of graphs will not be accepted. (Must be completed using Excel, Origin or equivalent).

TABLE OF CONTENTS:

Experiment 1:
Bending stress in a T-beam

As well as the information given in the unit, you will need the following formulae:

$$\sigma = E\varepsilon$$

Where,

σ = Stress (Nm^{-2})
ε = Strain
E= Young's modulus for the beam material (Nm^{-2})

(Typically $69 \times 10^9 Nm^{-2}$ or 69 GPa)

And,

$$\sigma = \frac{My}{I}$$

Where,

M = Bending Moment (Nm)
I = Second moment of area of the section (m^4)
σ = Stress (Nm^{-2})
y = Distance from the neutral axis.

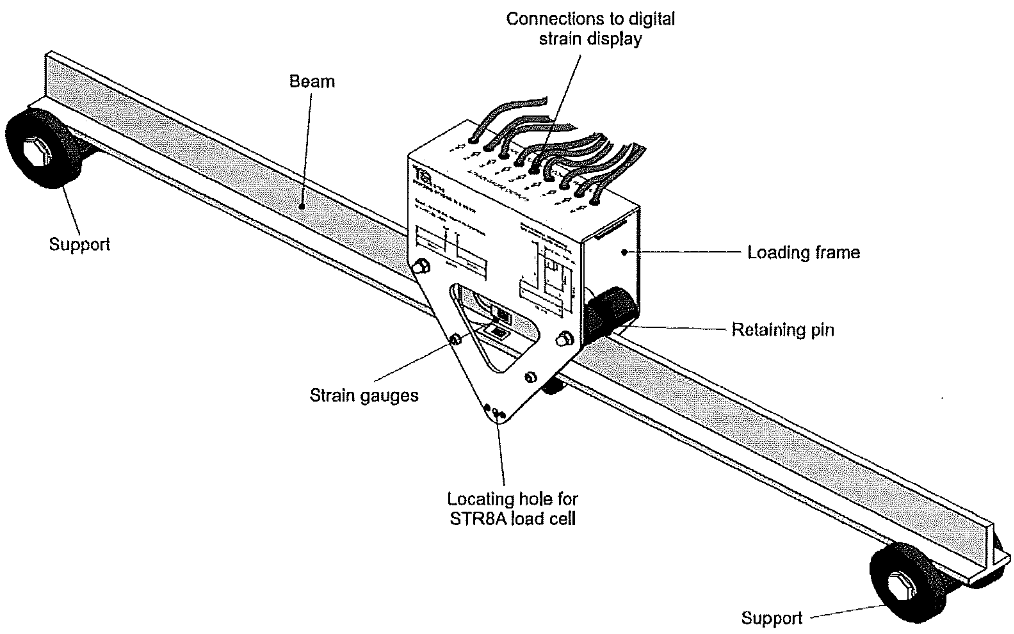


Figure 1 Bending stress in a beam experiment

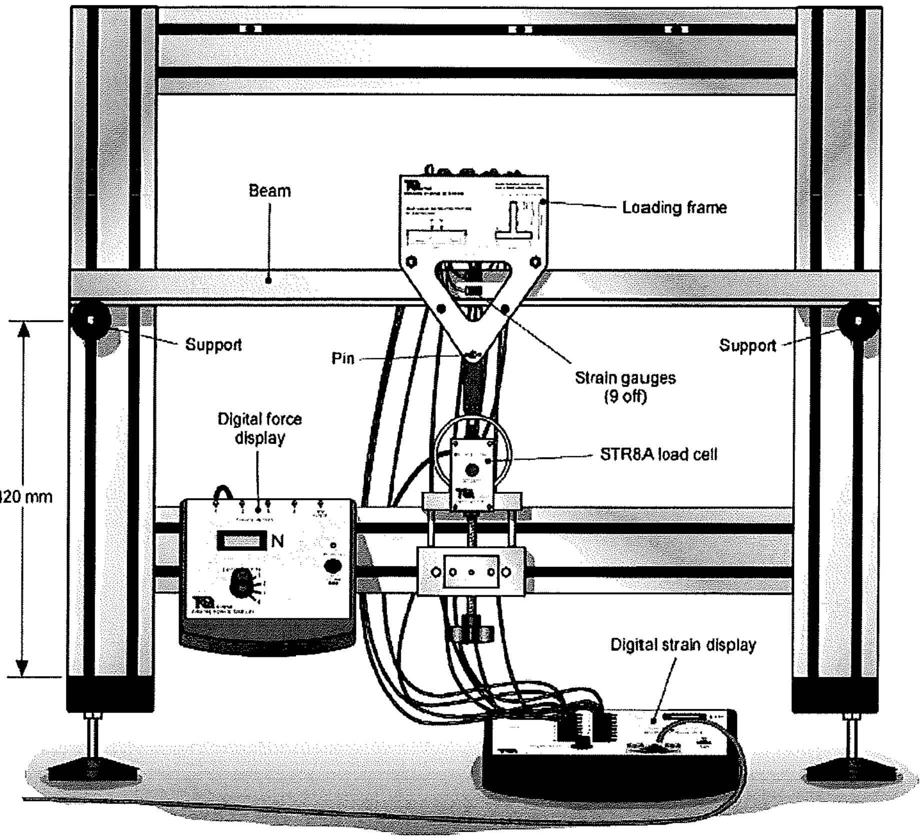


Figure 2 Bending stress in a beam experiment in the structures frame

Measurements:

1) Adjust the load on the beam such that the digital force display meter reads zero with no load.
2) Read each value from digital strain display and record from 1-9.
3) Adjust the load to 100N positioned 350 mm from each support as shown in Figure 3.

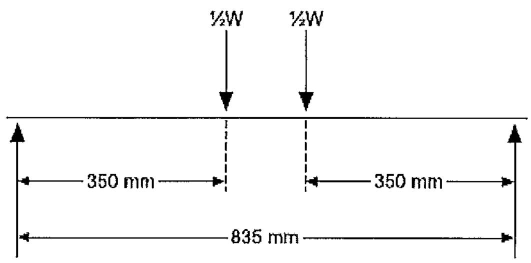


Figure 3 – Beam set-up and schematic

4) Record the displayed strain from the digital strain display in the Table 1.
5) Repeat steps 3-4, increasing load by 100N until 500M maximum load is reached.
6) Calculate the corrected bending moments at the cut section and record in Table 2.

Gauge number	Load (N)					
	0	100	200	300	400	500
1	100	-8	-106	-222	-326	-435
2	61	-13	-80	-161	-231	-307
3	48	-27	-96	-177	-250	-325
4	49	38	27	12	-0.1	-12
5	46	33	19	3	-11	-25
6	-156	-134	-112	-91	-67	-47
7	-008	16	34	61	82	108
8	-67	-18	28	79	129	126
9	-124	-74	-32	23	71	123

Table 1- Results for Experiment 1 (uncorrected)

Gauge number	Load (N)					
	0	100	200	300	400	500
1						
2						
3						
4						
5						
6						
7						
8						
9						

Table 2- Results for Experiment 1 (corrected)

Calculations:

7) Calculate the average strain readings from the pairs of gauges and enter the results in Table 3.
8) Measure the actual strain gauge positions and enter the values.

Gauge Number	Nominal Vertical position (mm)	Actual Vertical position (mm)	Bending moment (Nm)					
			0	17.5	35	52.5	70	87.5
1	0							
2,3	8							
4,5	23							
6,7	31.7							
8,9	38.1							

Table 3- Average strain readings for Experiment 1

9) Plot the strain (x-axis) against the relative vertical position (y-axis) on the same graph for each value of the bending moments. Taking the top of the beam as the origin/datum.

10) Plot Strain against bending moment.

11) Calculate the second moment of area and position of the neutral axis and add the position of the neutral axis to the plot.

12) Calculate the maximum stress in the section and compare this to the theoretical value.

Experiment 2

Transverse Shear Stress variation with changes in point load position

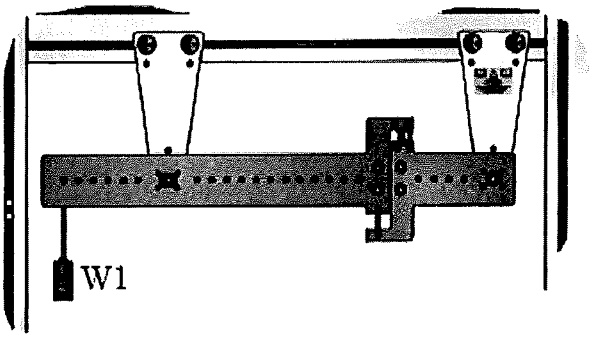


Figure 1- sample configuration for shear stress experiment

The aim of this experiment it to study the Transverse shear stress variations along the cross section of an I beam at the specified position. The loading condition will be varied and the corresponding shear stress distribution at the specified point will be evaluated and plotted as will be given in the procedure.

Procedure:

1. Without the load present, zero the digital force display.
2. Apply point loads of

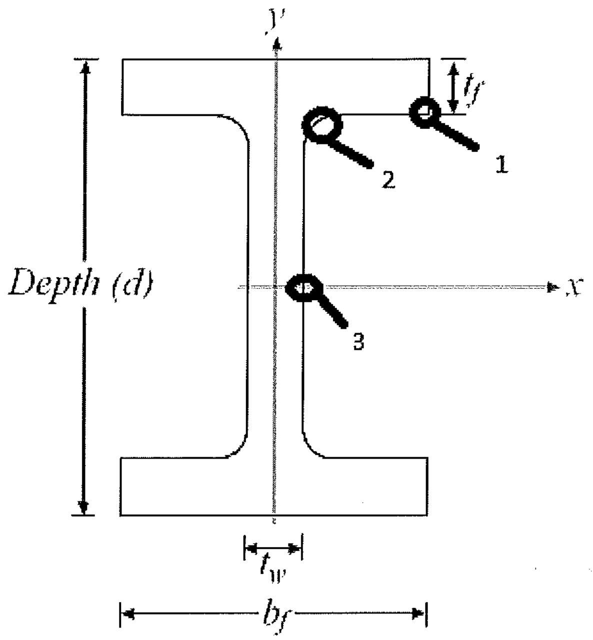
   W1=____ on a1=______ distance from left support

   W2=____ on a2=______ distance from left support

3. Record the Shear Force (V) in Newtons
4. Repeat this exercise 3 times

W1 (N)	W2 (N)	A1(mm)	A2 (mm)	V experimental (N)	V(theoretical) (N)
200	0	140		-0.6	
200	100	140	80	-0.8	
400	100	-80	80	0.2	
200	100	-40	40	0	

5. For each loading plot the shear force variation diagram along x.
6. For the provided cross sectional area of the I beam calculate the Moment of Inertia, I about the centroidal z axis.
7. Determine Q factor at 3 the points shown below



Tf,mm	Tw,mm	Bf, mm	D, mm

8. Calculate the Transverse Shear Stress at the 3 points shown above using

$$\tau = \frac{VQ}{It}$$

Where V is the shear force (N)
Q is the q factor in mm^3
I is the moment of inertia of the cross section about the centroidal axis in mm^4
t, is the web or flange thickness in mm

9. Plot the Transverse shear stress distribution along this cross section.
10. REPEAT FOR ALL LOADING CONDITIONS.