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*"Aggies do not lie, cheat, or steal, or tolerate those who do."*

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Name: Manisha Subrahmanya

Section: 566

Assignment: Lab 5b - Act 1

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## **LAB 5B – Activity 1**

### ***a) Young's modulus***

For the linear elastic portion,

$Y = \text{Stress} / \text{Strain}$

$$= (43 - 0) / (0.01 - 0)$$

$$= 4300$$

### ***b) Stress-Strain Coordinates***

$$O = (0, 0)$$

$$A = (0.01, 43)$$

$$C = (0.06, 43.5)$$

$$B = (0.18, 60)$$

$$D = (0.27, 51)$$

### ***c) Linear Approximation***

If  $0 < \text{strain} < 0.01$ , (from O- A, elastic region)

$$\text{slope} = Y = (43-0)/(0.01-0)$$

$$y = \text{slope}(x-0.01) + 43$$

$$= 4300(x - 0.01) + 43$$

$$y = 4300x$$

$$\text{stress} = 4300 * \text{strain}$$

if  $0.01 < \text{strain} < 0.06$ , (from A – C, plastic region)

$$\text{slope} = (43.5 - 43)/(0.06-0.01)$$

$$y = \text{slope}(x - 0.06) + 43.5$$

$$y = 10x + 42.9$$

$$\text{stress} = 10 * \text{strain} + 42.9$$

if  $0.06 < \text{strain} < 0.18$ , (from C – D, strain hardening region)

$$\text{slope} = (60-43.5)/(0.18-0.06)$$

$$y = \text{slope}(x - 0.06) + 43.5$$

$$y = 137.5x + 35.25$$

$$\text{stress} = 137.5 * \text{strain} + 35.25$$

if  $0.18 < \text{strain} < 0.27$  (from D – E, necking region)

$$\text{slope} = (51-60)/(0.27-0.18)$$

$$y = \text{slope}(x - 51) + 0.27$$

$$y = -100x + 78$$

$$\text{stress} = -100 * \text{strain} + 78$$

*Function:*

|   |                                  |                               |
|---|----------------------------------|-------------------------------|
| $\text{stress} = f(\text{strain}) = \{$ | $4300 * \text{strain},$          | $0 < \text{strain} < 0.01$    |
|   | $10 * \text{strain} + 42.9,$     | $0.10 < \text{strain} < 0.06$ |
|   | $137.5 * \text{strain} + 35.25,$ | $0.06 < \text{strain} < 0.18$ |
|   | $-100 * \text{strain} + 78,$     | $0.18 < \text{strain} < 0.27$ |

#### ***d) Variable List***

- Strain
- A
- C
- D
- E
- slope
- stress

#### ***e) Test Cases***

Strain = -0.34

Strain = -0.001

Strain = 0.01

Strain = 0.06

Strain = 0.18

Strain = 0.27

Strain = 0.28

Strain = 0.1

Strain = 2

Strain = 0

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