



- Answer all the following questions
- Illustrate your answers with sketches when necessary

- No. of Questions : 1
- Total Mark: 20 Marks

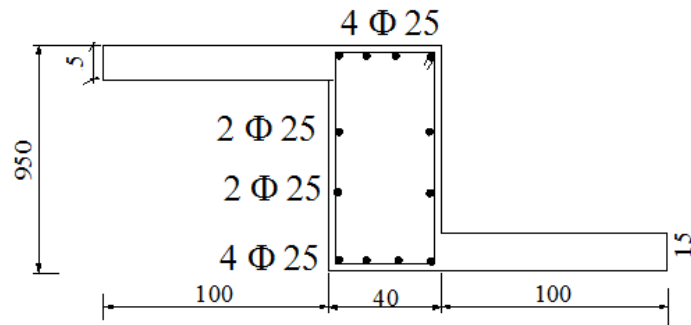
Notes:

- Systematic arrangement of calculations and clear neat sketches are essential;
- Try to answer all the following questions in order;

Question (1) (50 Marks) [ILO's: a3, b2, b3, d4]

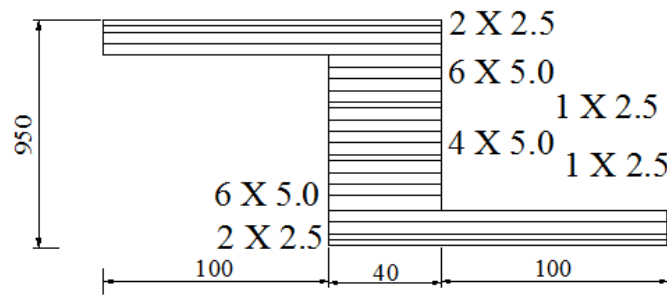
For the given section shown in Figure 1, the axial strain at mid height of the section $\epsilon_0 = -0.0006$ and the slope $\Phi = -0.00006$ ($d' = d'' = 2.5$ cm). Using the given stress-strain curves for steel and concrete in tension and compression, it is required to:

- Calculate and draw the strain distribution;
- Calculate and draw the stress distribution;
- Calculate axial, coupling and flexural stiffnesses (A, B and D) using the **Secant Modulus** of elasticity;
- Calculate section capacity (M and N);



(a) Beam Section

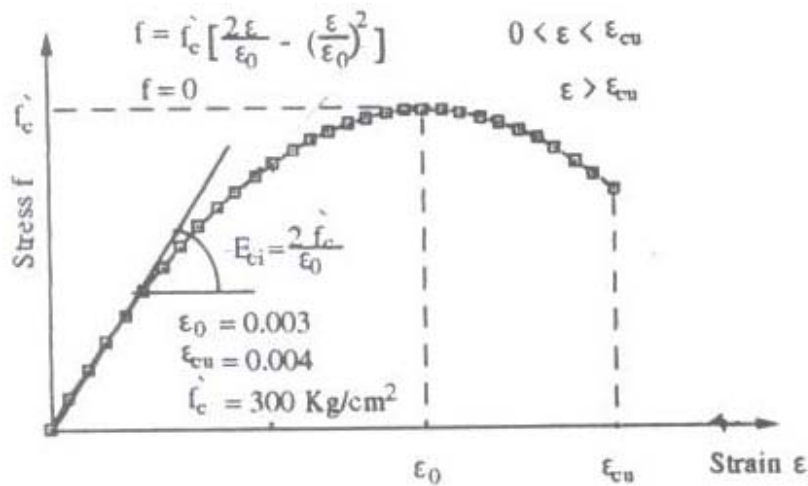
($d' = d'' = 2.5$ cm)



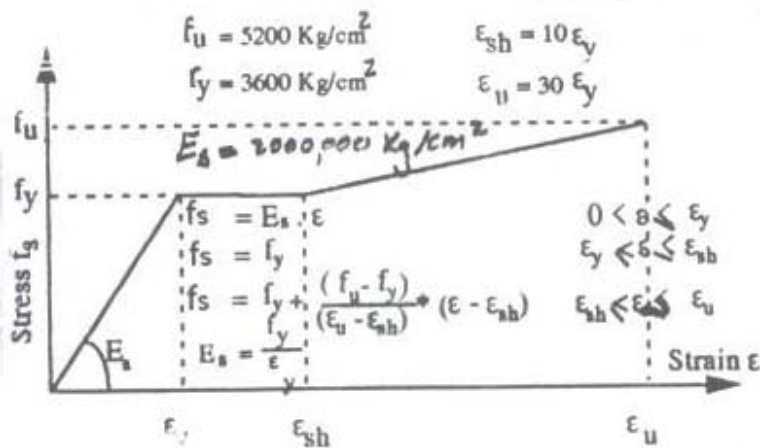
(b) Layered System

Fig (1)

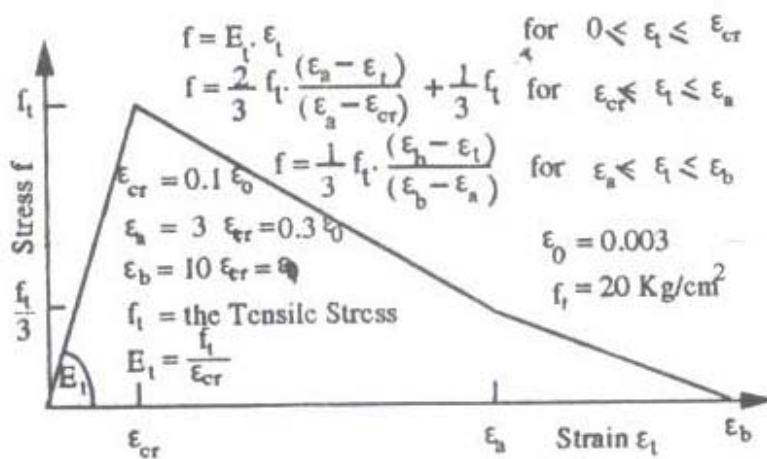
Best Wishes
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Dr. Taha Ibrahim



Concrete Stress- Strain Curve in Compression



Trilinear Idealized Stress-Strain Curve for Steel Reinforcement in Tension and Compression



Trilinear Model (Bilinear Softening) for Concrete in Tension

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