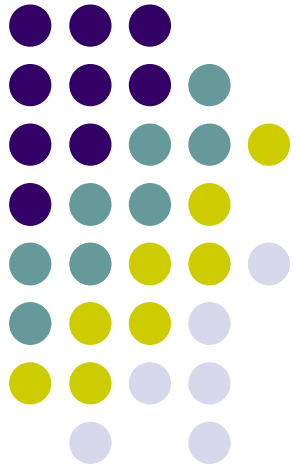
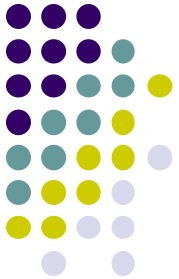
Compression Test of Concrete



Objective



- To test a concrete specimen under compressive loading
- To draw the stress strain diagram
- To Study the failure characteristics of the specimen

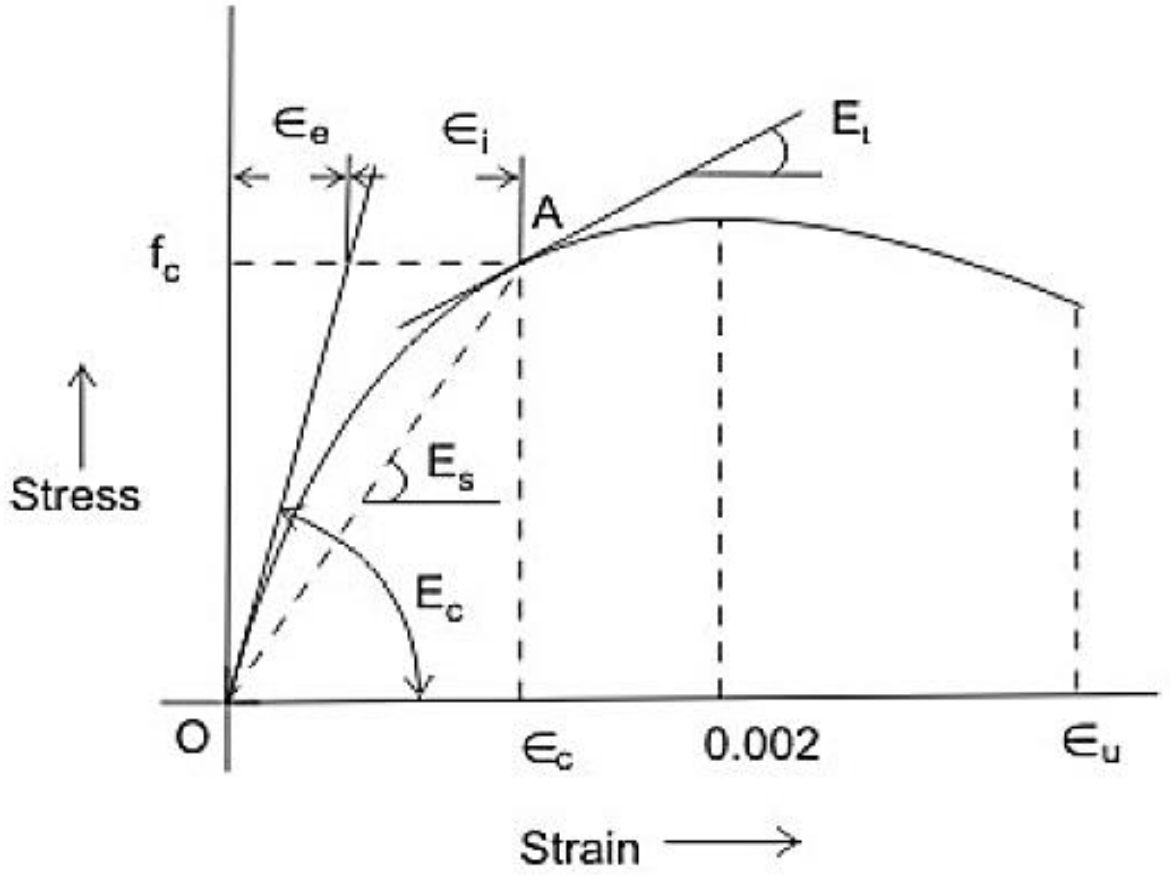
Calculation

- To Determine the following properties

1. Yield Strength at 0.01% offset
2. Ultimate Strength/Compressive Strength (f_c')
3. Initial Tangent Modulus of Elasticity
4. Secant Modulus of elatsticity at stresses 5, 10 and 15 Mpa
5. Static Moulus of Elasticity(=$47\sqrt{f_c'}$)
6. Failure Pattern

1. Flexural Strength (fck= $0.7\sqrt{f'c}$)

Typical Stress strain diagram



E_c = initial tangent modulus at the origin, also known as short term static modulus

E_s = secant modulus at A

E_t = tangent modulus at A

Sample Data Sheet

Length Measurement	Diameter
L_1= L_2= L_3= L_4=	D_1= D_2= D_3= D_4=
Avg. Length, L=……mm	Avg. Diameter, D=……mm
	Cross Sectional Area, A=…… mm^2

Observation No.	*Load reading*	*Actual load (kN)*	*Strain gauge reading*	*Deformation (mm)*	*Stress (N/mm^2)*	*Strain (mm/mm)*
1						
2						
3						
4						
5						
6						

Test conditions

- Standard Ref : ASTM D 143
- Strain rate = 0.003 in./in. of nominal specimen length/min
- Observation : 4 unit of interval of load reading corresponding deformation

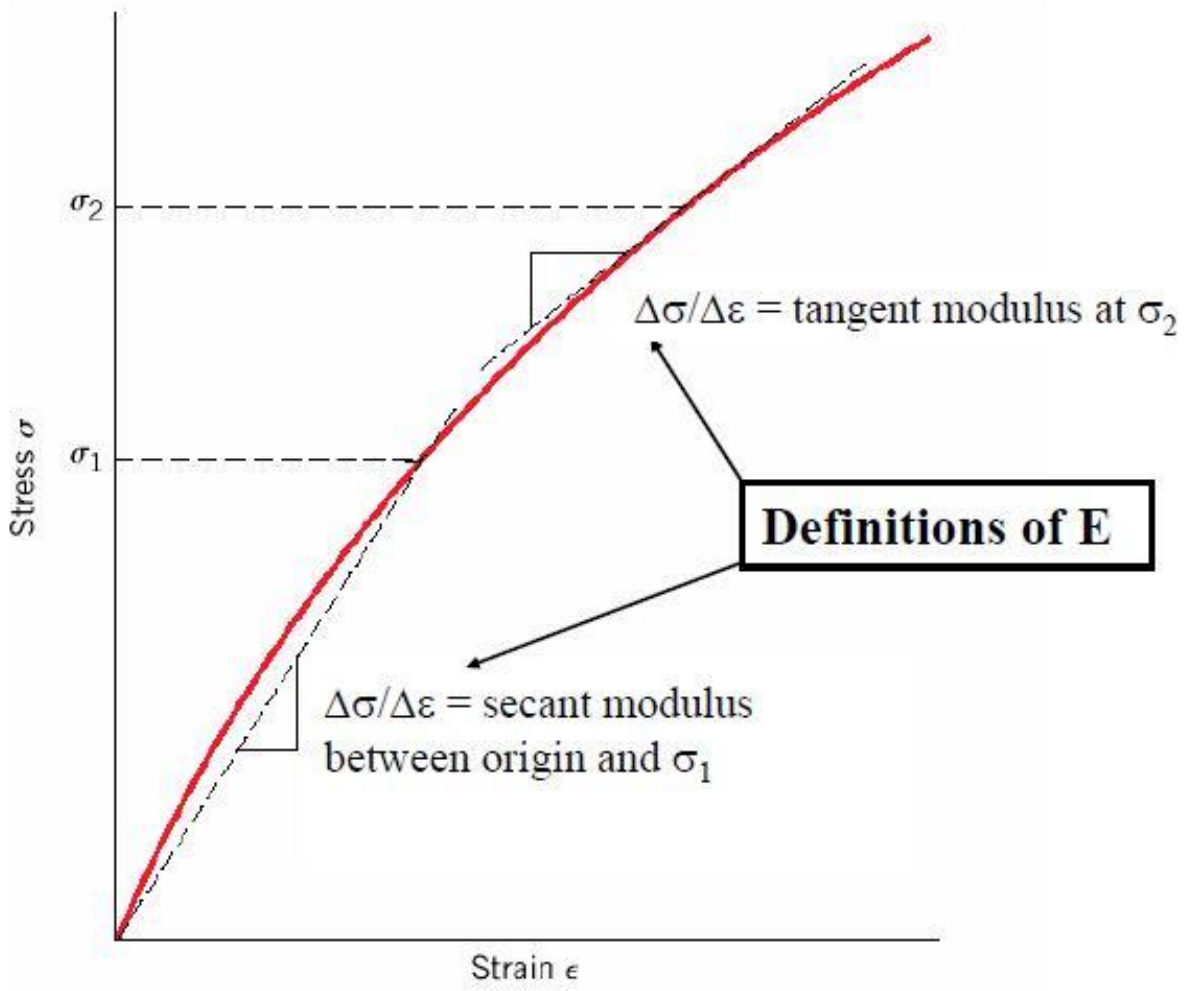
Experimental Setup (Digital)


Compression Testing Machine
MIN
MAX

Experimental Setup (Analog)

Elastic Deformation: Nonlinear Elastic Behavior

In some materials (many polymers, concrete...), elastic deformation is not linear, but it is still reversible.



Failure Pattern

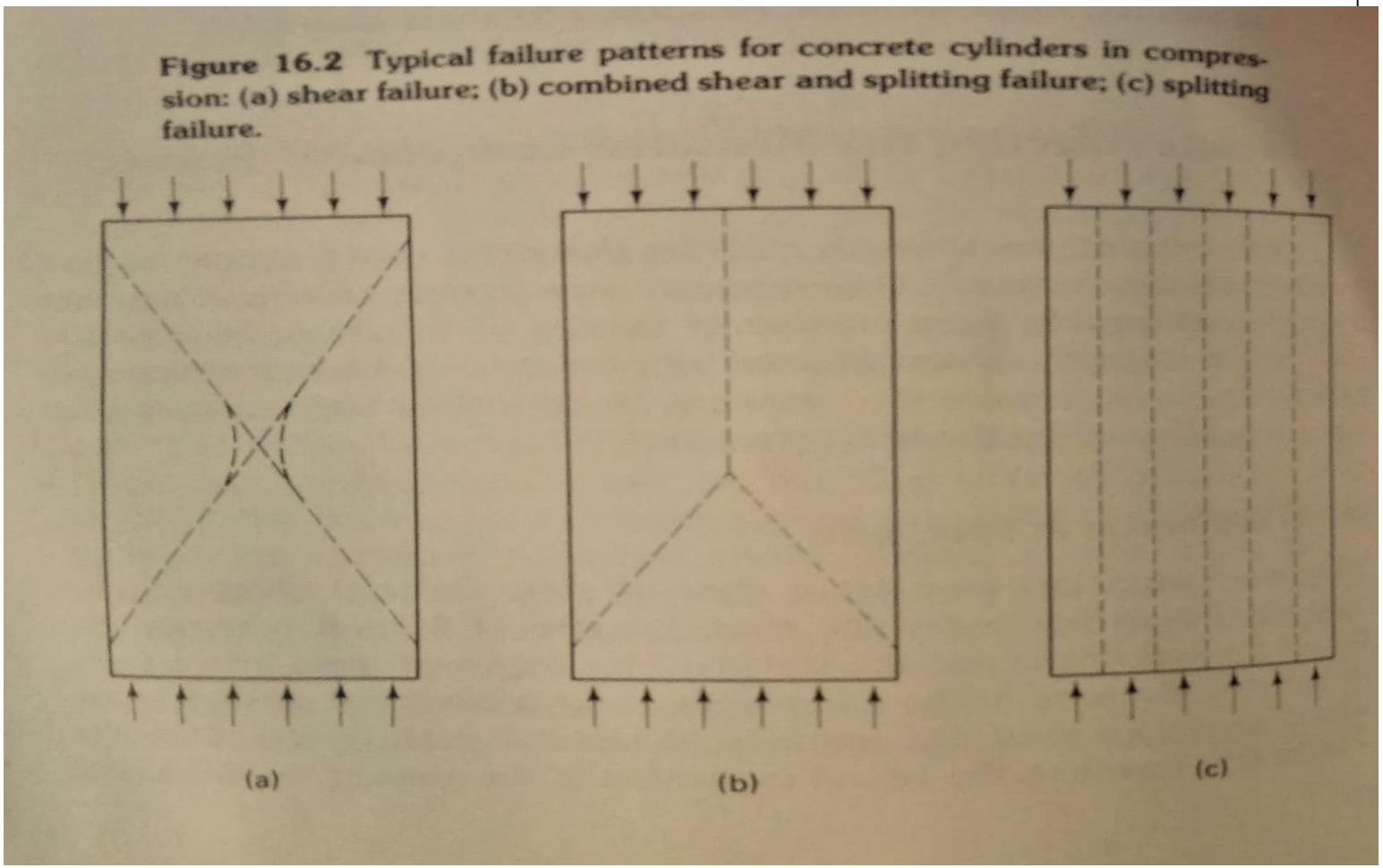
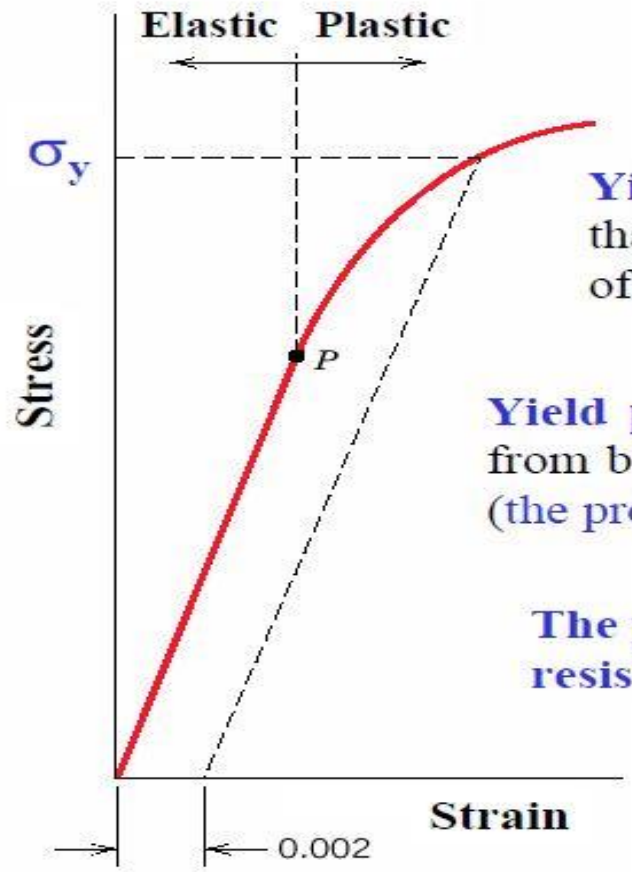


Figure 16.2 Typical failure patterns for concrete cylinders in compression: (a) shear failure; (b) combined shear and splitting failure; (c) splitting failure.

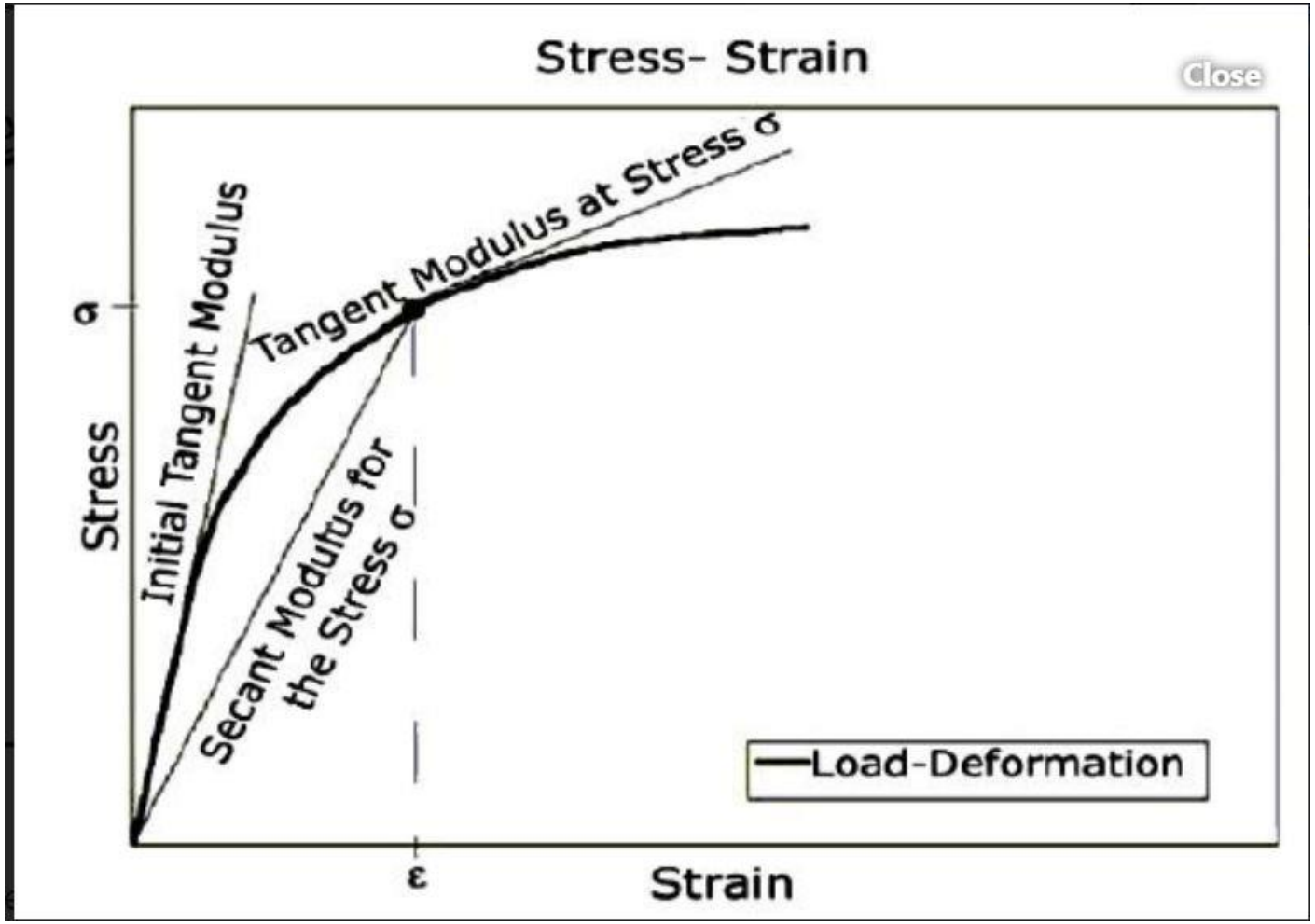
Tensile Properties: Yielding

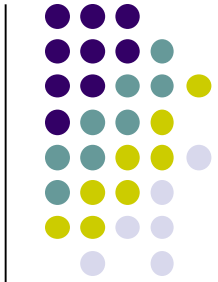


Yield strength σ_y - is chosen as that causing a permanent strain of 0.002

Yield point P - the strain deviates from being proportional to the stress (the proportional limit)

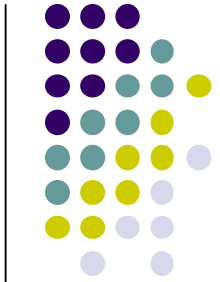
The yield stress is a measure of resistance to plastic deformation


Stress- Strain
Close
Tangent Modulus at Stress σ
Initial Tangent Modulus
Secant Modulus for the Stress σ
σ
Stress
ε
Strain
Load-Deformation



Stress is proportional to strain within the proportionality limit. Thus, youngs modulus holds good here. After this limit, youngs modulus does not hold good. Thus, you talk about tangent modulus and secant modulus.

Tangent modulus is the slope of the tangent to any point in the inelastic region .
Secant modulus is the slope of the line joining any point in the inelastic region to the origin.



These two modulus talk of material behavior in the inelastic region and used to quantify the softening or hardening behavior which occurs after yielding during necking and strain hardening.

These modulus are also used to determine the stress concentration factor in the plastic regime.