ASSIGNMENT –I

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DEPARTMENT : MECHATRONICS

YEAR : II – YEAR (IV- SEMESTER)

ROLL NO : 23BMT010

SUBJECT : MECHANICS OF SOLIDS (U23MET09)

TOPICS. : FORMULA IN UNIT - 1

FORMULAS FOR UNIT – I

1) Stress = force / area

   Unit= N/mm^2

$$\sigma = \frac{P}{A} \quad \frac{N}{mm2} \quad (\qquad)$$

2) Strain = change in length /original length

$$\varepsilon = \frac{\delta l}{l}$$

3) Elasticity = stress/strain

   Unit = N/mm^2

$$E = \frac{Pl}{A\delta l} \quad \frac{(N)}{mm2}$$

4) Modulus of rigidity $C \text{ or } G = \frac{\tau \left(\frac{N}{mm2}\right)}{\phi}$

5) factor of safety = ultimate stress / permissible stress

6) Poisson ratio = lateral strain / longitudinal strain

$$\mu = \frac{e_t}{e_l}$$

7) Thermal stress $\sigma = E\alpha t$ (N / mm2)

8) Thermal strain e = $\frac{(\alpha tl - \delta)}{L}$

9) Change in length $dl = \frac{Pl}{E}$ mm

10) Stresses in a composite bar :

Expansion in bar 1= Expansion in bar 2

$dL_1 = dL_2$

$$\left(\alpha t - \frac{\sigma}{E}\right)_1 = \left(\alpha t - \frac{\sigma}{E}\right)_2$$

11) Relationship between Youngs modulus and modulus of rigidity

$$E = 2G\left(1 + \frac{1}{m}\right) \text{ or } E = 2C\left(1 + \frac{1}{m}\right)$$

12) Relationships between Youngs modulus and bulk modulus $E = 3K\left(1 - \frac{2}{m}\right)$

13) Analysis of stresses

1. A member subjected to a direct stress in one plane

$\sigma_n = \frac{P}{} \cos^2\theta$

$$\sigma_T = \frac{P}{A} \sin 2\theta$$

$$\sigma_{res} = ((\sigma_n 2) + (\sigma_t^2))^{½}$$

2.A member subjected to direct stresses in two mutually perpendicular directions

$$\sigma_n = \left(\frac{\quad}{2}\right)(\sigma 1 + \sigma 2) + (\sigma 1 - \sigma 2)$$

$$\sigma_T = \left(\frac{\quad}{2}\right)(\sigma 1 - \sigma 2) \sin 2\theta$$

$$\sigma_{Res} = (\sigma_n^2 + \sigma_t^2)^{½} \quad \tan\phi$$

$$= \sigma_t / \sigma_t$$

$$\tan_{max} = \frac{(\sigma 1 - \sigma 2)}{2}$$

3. A member subjected to a simple shear stress

$$\sigma n = q \sin 2\theta$$

$$\sigma t = -q \cos 2\theta$$

4.A member subjected to direct stress in one plain and accompanied by a simple shear stress

$$\sigma n = \frac{\sigma}{2}(1 + \cos 2\theta) + q \sin 2\theta$$

$$\sigma t = \frac{\sigma}{2}(\sin 2\theta - q \sin 2\theta)$$

$$\theta = \frac{2q \tan 2}{\sigma \sigma}$$

$$T_{max} = \frac{1}{2}(\sigma_2 + 4q_2)^{½}$$

5. A member subjected to two direct stresses in mutually perpendicular direction a combined by a simple shear stress

$$\sigma n = \frac{(\sigma 1+\sigma 2)}{2} + \frac{1}{2}((\sigma 1 - \sigma 2)2) + 4q^2)^{½}$$

$$\sigma t = \frac{(\sigma 1+\sigma 2)}{2} - \frac{1}{2}((\sigma 1 - \sigma 2)2) + 4q^2)^{½}$$

$$\sigma_{tmax} = \frac{-}{2}((\sigma 1 - \sigma 2)2) + 4q^{1\ \ 2})^{½}$$

$$\tan 2\theta = \frac{2q}{-\sigma 2}\sigma 1$$