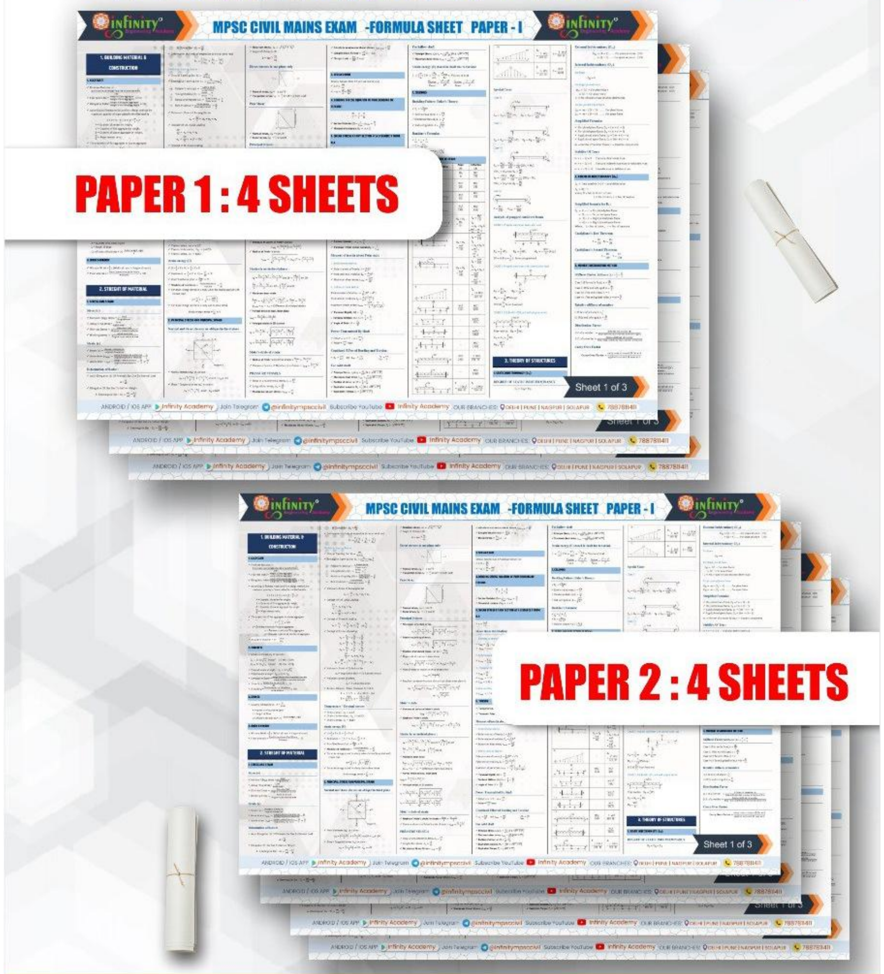
FORMULA SHEETS [A2 SIZE]



COVER ALL 20 SUBJECT FORMULAE

Infinity Academy Office

पुणे इन्फिनिटी अकॅडमी, मानकर वाडा, मोदी गणपती जवळ, नारायण पेठ, पुणे

8263954946 | 9607155111

नाशिक इन्फिनिटी अकॅडमी, उपाध्ये बिल्डिंग, अशोकस्तंभ, नाशिक

9119587182

1. BUILDING MATERIALS & CONSTRUCTION

2. STRENGHT OF MATERIAL

3. THEORY OF STRUCTURES

8. SLOPE AND DEFLECTION OF BEAM :

Types of beam and loading	Slope (θ)	Deflection (δ)
1.	$\frac{ML}{EI}$	$\frac{ML^2}{2EI}$
2.	$\frac{WL^2}{2EI}$	$\frac{WL^3}{3EI}$
3.	$\frac{WL^3}{6EI}$	$\frac{WL^3}{8EI}$
4.	$\frac{WL^3}{24EI}$	$\frac{WL^4}{30EI}$
5.	$\theta_A = \theta_B = \frac{Ma}{EI}$	$\delta_B = \frac{Ma^2}{2EI}$, $\delta_A = \delta_B + \theta_B . b = \frac{Ma^2}{2EI} + \frac{Ma}{EI} . b$
6.	$\theta_A = \theta_B = \frac{wa^2}{2EI}$	$\delta_B = \frac{wa^3}{3EI}$, $\delta_A = \delta_B + \theta_B . b = \frac{wa^3}{3EI} + \frac{wa^2}{2EI} . b$
7.	$\theta_A = \theta_B = \frac{wa^3}{6EI}$	$\delta_B = \frac{wa^4}{8EI}$, $\delta_A = \delta_B + \theta_B . b = \frac{wa^4}{8EI} + \frac{wa^3}{6EI} . b$
8.	-	$\delta_A = \frac{11}{120}\frac{WL^4}{EI}$
9.	$\frac{WL^2}{16EI}$	$\frac{WL^3}{48EI}$

$\theta = \frac{ML}{2EI}$, $\delta_{max} = \frac{ML^2}{8EI}$

Analysis of propped cantilever beam

CASE 1. Propped cantilever beam with u.d.l

$R_A = \frac{5}{8} WL$, $R_B = \frac{3}{8} WL$, $M_A = -\frac{WL^2}{8}$ (hog)

SF = 0 @ $x = \frac{3}{8} L$ from propped end

CASE 2. Propped cantilever with central point load

$R_A = \frac{11}{16} w$, $R_B = \frac{5}{16} w$

$M_A = -\frac{3}{16} WL$ (hog)

POC @ $\frac{3L}{11}$ from fixed end

CASE 3. S.S.B with UDL and with prop at centre

$D_k = NJ - r$

where, N = No. of D.O.F. of Joint

J = No. of Joint , r = No. of reaction

Simplified formula for D_k :

$D_k = 2J - r \rightarrow$ Pin jointed plane frame

$= 3J - r \rightarrow$ Pin jointed space frame

$= 3J - r \rightarrow$ Rigid jointed plane frame

$= 6J - r \rightarrow$ Rigid jointed space frame

Where, J = No. of joints , r = No. of reactions.

Castigliano's first Theorem:

$P = \frac{\partial U}{\partial \Delta}$, $M = \frac{\partial U}{\partial \theta}$

Castigliano's Second Theorem:

$\Delta = \frac{\partial U}{\partial P}$, $\theta = \frac{\partial U}{\partial M}$

3. MOMENT DISTRIBUTION METHOD

Stiffness Factor:Stiffness (k) $= \frac{F}{\Delta} = \frac{M}{\theta}$

Case i) If far end is fixed, $k = \frac{4EI}{L}$

4. STRUCTURAL ANALYSIS

1. ARCH

Three hinged arch

3. CABLE

4. MATRIX METHOD

PLASTIC ANALYSIS

FORMULAE FOR FIXED END MOMENTS

SLOPE DEFLECTION METHOD

2. TWO HINGED ARCH

5. STEEL STRUCTURE

BASICS OF STEEL STRUCTURE

WELD

TENSION MEMBER

Size of butt weld : (Throat thickness)

$t_t = \frac{5}{8} t_{min}$ ……………… *for single U, V, J weld*

(Partially Penetrate)

$= t_{min}$ ……………… *for double U, V, J weld*

(Fully Penetrate)

Area of butt weld: $A_w = t_t . L_w$

Analysis :

i. Design axial strength of butt weld –

$$T_{dw} = \frac{f_y'}{\gamma_{mw}} . l_w . t_t \text{ ……………… LSM}$$

$$= \sigma_{tw} . l_w . t_t \text{ ……………… WSM}$$

ii. Design shear strength of butt weld –

$$V_{dw} = \frac{f_{yw}'}{\gamma_{mw}} . l_w . t_t$$

$$= \frac{f_{yw}}{\sqrt{3}\,\gamma_{mw}} l_w . t_t \text{ ……………… LSM}$$

$$V_s = f_{sw} . l_w . t_t \text{ ……… WSM}$$

f'_{yw} = Smaller of shear stress of weld $\frac{f_{yw}}{\sqrt{3}}$

γ_{mo}

2. Design Strength Due to rupture of net Section:

$$T_{dn} = \frac{0.9\, A_n\, f_u}{\gamma_{ml}}$$

3. Design block shear strength:

$$T_{db} = \frac{A_g f_y}{\sqrt{3}\gamma_{m0}} + \frac{0.9 A_{net} f_u}{\gamma_{ml}}$$

$$= \frac{0.9 A_{ns} f_u}{\sqrt{3}\gamma_{m1}} + \frac{A_{gt} f_y}{\gamma_{mo}} \text{ ….} \textit{whichever is less.}$$