UNIT 2-FORCE VECTORS

$F_x = Fcos(\alpha)$	$F_y = Fcos(\beta)$	$F_z = Fcos(\gamma)$	$\frac{F_x}{\sin(\alpha)} = \frac{F_y}{\sin(\beta)} = \frac{F_y}{\sin(\gamma)} = F$

$\vec{r}_{AB} = \vec{r}_B - \vec{r}_A = (x_B - x_A)\hat{\imath} + (y_B - y_A)\hat{\jmath} + (z_B - z_A)\hat{k}$	$r_{AB} = \sqrt{(x_B - x_A)^2 + (y_B - y_A)^2 + (z_B - z_A)^2}$
$\hat{U}_{AB} = \frac{(x_B - x_A)\hat{\imath}}{r_{AB}} + \frac{(y_B - y_A)\hat{\jmath}}{r_{AB}} + \frac{(z_B - z_A)\hat{k}}{r_{AB}}$	$A_xB_x + A_yB_y + A_zB_z += \vec{A} \cdot \vec{B} = ABcos(\theta)$

UNIT 3-EQUILIBRUM IN 3D

$F = kx$	$\Sigma F_{x,y,z} = 0$

UNIT 4-FORCE SYSEM RESULTANTS

$M_o = Fd$	$\vec{M}_o = \vec{r} \times \vec{F} = \begin{vmatrix} \hat{\imath} & \hat{\jmath} & \hat{k} \\ r_x & r_y & r_z \\ F_x & F_y & F_z \end{vmatrix} = (r_yF_z - r_zF_y)\hat{\imath} - (r_xF_z - r_zF_x)\hat{\jmath} - (r_xF_y - r_yF_x)\hat{k}$
	$\vec{M}_a = \begin{vmatrix} U_{ax} & U_{ay} & U_{az} \\ r_x & r_y & r_z \\ F_x & F_y & F_z \end{vmatrix} = (r_yF_z - r_zF_y)U_{ax} - (r_xF_z - r_zF_x)U_{ay} - (r_xF_y - r_yF_x)U_{az}$

UNIT 5-EQUILIBRIUM OF A RIGID BODY

$\Sigma F_{x,y,z} = 0$	$\Sigma M_{x,y,z} = 0$

UNIT 6-STRUCTURAL ANALYSIS

$$M = 2J - 3$$

UNIT 7-INTERNAL FORCES – shear and bending moment diagrams

$\frac{dv}{dx} = -w(x)$	$\frac{dm}{dx} = v(x)$
$\Delta v_{AB} = -\int_A^B w(x)dx$	$\Delta m_{AB} = -\int_A^B v(x)dx$
$\deg(m(x)) = \deg(v(x)) + 1$	$v_f = m_f = 0$

UNIT 8-FRICTION

$F_s = \mu_s N$	$F_k = \mu_k N$

UNIT 9-CENTER OF GRAVITY AND CENTROID

$\bar{x} = \frac{\Sigma \tilde{x} w}{\Sigma w}$	$\bar{x} = \frac{\Sigma \tilde{x} V}{\Sigma V}$	$\bar{x} = \frac{\Sigma \tilde{x} A}{\Sigma A}$	$\bar{x} = \frac{\Sigma \tilde{x} L}{\Sigma L}$
$\bar{x} = \frac{\int \tilde{x} dw}{\int dw}$	$\bar{x} = \frac{\int \tilde{x} dv}{\int dv}$	$\bar{x} = \frac{\int \tilde{x} dA}{\int dA}$	$\bar{x} = \frac{\int \tilde{x} dl}{\int dl}$

UNIT 10-MOMENTS OF INERTIA

$I_x = \int_A y^2 dA$	$I_y = \int_A x^2 dA$	$J_o = \int_A r^2 dA$	$I_{xy} = \int_A xydA$
$I_x = \bar{I}_{x'} + A(d_y)^2$	$I_y = \bar{I}_{y'} + A(d_x)^2$	$J_o = \bar{J}_c + A(d_c)^2$	$I_{xy} = \bar{I}_{x'y'} + Ad_xd_y$

$K_x = \sqrt{\frac{I_x}{A}}$	$K_y = \sqrt{\frac{I_y}{A}}$
$I_u = \frac{I_x + I_y}{2} + \frac{I_x - I_y}{2}\cos(2\theta) - I_{xy}\sin(2\theta)$	$I_v = \frac{I_x + I_y}{2} - \frac{I_x - I_y}{2}\cos(2\theta) + I_{xy}\sin(2\theta)$
$I_{uv} = \frac{I_x - I_y}{2}\sin(2\theta) + I_{xy}\cos(2\theta)$	$J_o = I_u + I_v = I_x + I_y$

$I_x = \int_A y^2 dm$	$I_y = \int_A x^2 dm$	$I_G = \int_A r^2 dm$

$$I = I_G + md^2$$

GENERAL FORMULA

$$C = \sqrt{A^2 + B^2 - 2ABcos(c)}$$

$\vec{A} \times \vec{B} = -\vec{B} \times \vec{A}$	$a(\vec{A} \times \vec{B}) = (a\vec{A}) \times \vec{B} = (\vec{A} \times \vec{B})a = \vec{A} \times (a\vec{B})$	$\vec{A} \times (\vec{B} + \vec{D}) = \vec{A} \times \vec{B} + \vec{A} \times \vec{D}$