ENGG MATHEMATICS-I (21002)

LIST OF FORMULAE

UNIT –I- ALGEBRA

- Cramer's rule : $x = \frac{\Delta x}{\Delta}$, $y = \frac{\Delta y}{\Delta}$, $z = \frac{\Delta z}{\Delta}$ where $\Delta \neq 0$.
- Singular matrix if $|A| = 0$.
- Non Singular matrix if $|A| \neq 0$.
- Adj A $=(A_C)^T$, where Ac- co-factor matrix - $\begin{pmatrix} A_{11} & A_{12} & A_{13} \\ A_{21} & A_{22} & A_{23} \\ A_{31} & A_{32} & A_{33} \end{pmatrix}$, T- transpose of a matrix.

  $\therefore$ Adj A $= \begin{pmatrix} A_{11} & A_{12} & A_{13} \\ A_{21} & A_{22} & A_{23} \\ A_{31} & A_{32} & A_{33} \end{pmatrix}^T$.
- $A^{-1} = \frac{\text{Adj A}}{|A|}$ provided $|A| \neq 0$.

(i) $AB = BA = I$

(ii) $(AB)^{-1} = B^{-1}A^{-1}$

(iii) $(A^T)^{-1} = (A^{-1})^T$

(iv) $(AB) \neq (BA)$

UNIT-II – BINOMIAL THEOREM

- $n! = 1 * 2 * 3 * \dots \dots \dots \dots . * n$
- $np_r = \frac{n!}{(n-r)!}$
- $nc_r = \frac{n!}{(n-r)!\ r!}$
- $nc_r = nc_{n-r}$
- $nc_r = nc_q \Rightarrow (r = q)$
- $r + q = n$
- Binomial theorem for positive integral index :

(i) $n! = n(n - 1)!$

(ii) $0! = 1$

(iii) $np_n = n!$

(iv) $np_1 = 1$

(v) $np_0 = 1$

(vi) $nc_0 = nc_n = 1$

(vii) $nc_1 = n$

$(x + a)^n = x^n + nc_1\, x^{n-1}a + nc_2\, x^{n-2}a^2 + \cdots + nc_r\, x^{n-r}a^r + \cdots + a^r$

- $T_{r+1} = nc_r\, x^{n-r}a^r$
- Middle term (odd) : $\left(\frac{n+1}{2}\right)$**th and** $\left(\frac{n+3}{2}\right)$ th **terms**.
- Middle term (even) : $\left(\frac{n+2}{2}\right)$ th **term**.

UNIT-III-STRAIGHT LINES

- The distance between **the point (x_1 ,y_1) and (x_2 ,y_2) is**

D = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$.

- Internal point of diviation : $\left(\frac{mx_2+nx_1}{m+n}, \frac{n.y_2+ny_1}{m+n}\right)$
- External point of diviation : $\left(\frac{mx_2-nx_1}{m-n}, \frac{n\,y_2-ny_1}{r-n}\right)$
- Mid point $= \left(\frac{x1+x2}{2}, \frac{y1+y2}{2}\right)$
- Area of triangle : $\frac{1}{2}[x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)]$.
- Slope – intercept form : y = mx + c.
- Slope – point form : $y-y_1 = m(x-x_1)$.
- Two –point form : $\frac{y-y1}{y1-y2} = \frac{x-x1}{x1-x2}$.
- Intercept form : $\frac{x}{a} + \frac{y}{b} = 1.$
- Angle between the st.line whose slopes are m1 and m2 is $\emptyset = \tan^{-1}\left[\frac{m1+m2}{1+m1m2}\right]$.
- Parellel condition : **m1 = m2** .
- Perpendicular condition : **m1m2= -1**.
- If A (x1,y1) and B (x2,y2) then the slope of AB is $\frac{y1-y2}{x1-x2} = \frac{y2-y1}{x2-x1}$.

- The general homogeneous equation of the second degree in ‘x’ and ‘y’ is

  $\mathbf{ax^2+2hxy+by^2 = 0}$ (pair of st. Lines through the origin).
- Sum of slopes : $\mathbf{m_1+m_2 = \frac{-2h}{b}}$.
- Product of slopes : $\mathbf{m_1m_2 = \frac{a}{b}}$.
- Angle between the st.lines $\mathbf{ax^2+2hxy+by^2 = 0}$ is $\mathbf{\tan\emptyset = \pm 2\frac{\sqrt{h^2-ab}}{a+b}}$.
- Parellel condition : $\boldsymbol{h^2 = ab.}$
- Perpendicular condition : $\mathbf{a + b = 0.}$
- The condtion for general equation ax2+2hxy+by2+2gx+2fy+c = 0 represents a

  pair of st.lines is $\begin{vmatrix} \boldsymbol{a} & \boldsymbol{h} & \boldsymbol{g} \\ \boldsymbol{h} & \boldsymbol{b} & \boldsymbol{f} \\ \boldsymbol{g} & \boldsymbol{f} & \boldsymbol{c} \end{vmatrix} = \mathbf{0}$ (or) $\boldsymbol{abc + 2fgh - af^2 - bg^2 - ch^2 = 0}$.
- Distance between two parallel lines $ax+by+c_1= 0$ and $ax+by+c_2 = 0$ is $\boldsymbol{\frac{|c_1-c_2|}{\sqrt{a^2+b^2}}}$.
- Length of perpendicular from a point (x_1,y_1) to a st.line $ax+by+c = 0$ is $\boldsymbol{\left|\frac{ax_1+by_1+c}{\sqrt{a^2+b^2}}\right|}$.

UNIT-IV TRIGONOMETRY –I

- $\boldsymbol{\sin(A+B) = \sin A\cos B + \cos A\sin B.}$
- $\boldsymbol{\sin(A-B) = \sin A\cos B - \cos A\sin B.}$
- $\boldsymbol{\cos(A+B) = \cos A\cos B - \sin A\sin B.}$
- $\boldsymbol{\cos(A-B) = \cos A\cos B + \sin A\sin B.}$

(i)	$sin\emptyset = \frac{opposite\ si}{hypotenuse}$
(ii)	$cos\emptyset = \frac{adjacent\ side}{hypotenuse}$
(iii)	$tan\emptyset = \frac{opposite\ side}{adjacent\ side}$

- $\tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$.
- $\tan(A-B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}$.
- $\sin(A+B)\sin(A-B) = sin^2 A - sin^2 B$.
- $\cos(A+B)\cos(A-B) = cos^2 A - cos^2 B$.
- $\sin 2A = 2\ \sin A \cos A = \frac{2\tan A}{1+tan^2\ A}$
- Cos 2A $= cos^2 A - sin^2 A$

  $= 2\, cos^2 A - 1$

  $= 1 - 2 sin^2 A$

  $= \frac{1 - tan^2\ A}{1 + tan^2\ A}$
- $\tan 2A = \frac{2\tan A}{1 - tan^2\ A}$.

(i) $\frac{sin\emptyset}{cos\emptyset} = tan\emptyset$

(ii) $\frac{cos\emptyset}{sin\emptyset} = cot\emptyset$

(iii) $\frac{1}{sin\emptyset} = cosec\emptyset$

(iv) $\frac{1}{cos\emptyset} = sec\emptyset$

(v) $\frac{1}{tan\emptyset} = cot\emptyset$

(vi) $sin^2\emptyset + cos^2\emptyset = 1$

(vii) $1 + tan^2\emptyset = sec^2\emptyset$

(viii) $1 + cot^2\emptyset = cosec^2\emptyset$

TABLE VALUES :

	0°	30°	45°	60°	90°	180°	270°	360°
$sin\emptyset$	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1	0	-1	0
$Cos\emptyset$	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0	-1	0	1
$tan\emptyset$	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	∞	0	−∞	0
$Cosec\emptyset$	∞	2	$\sqrt{2}$	$\frac{2}{\sqrt{3}}$	1			
$sec\emptyset$	1	$\frac{2}{\sqrt{3}}$	$\sqrt{2}$	2	∞			
$Cot\emptyset$	∞	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	0			

S.NO	I-(90-Ø) −	S.NO	(270 − Ø)
1.	$\sin(90-\emptyset) = \cos\emptyset$	1.	$\sin(270-\emptyset) = -\cos\emptyset$
2.	$\cos(90-\emptyset) = \sin\emptyset$	2.	$\cos(270-\emptyset) = -\sin\emptyset$
3.	$\tan(90-\emptyset) = \cot\emptyset$	3.	$\tan(270-\emptyset) = \cot\emptyset$
4.	$\mathrm{Cot}(90-\emptyset) = \tan\emptyset$	4.	$\mathrm{Cot}(270-\emptyset) = \tan\emptyset$
5.	$\mathrm{cosec}(90-\emptyset) = \sec\emptyset$	5.	$\mathrm{cosec}(270-\emptyset) = -\sec\emptyset$
6.	$\sec(90-\emptyset) = \mathrm{cosec}\,\emptyset$	6.	$\sec(270-\emptyset) = -\mathrm{cosec}\,\emptyset$
S.NO	**II-(90+Ø) − (180 − Ø) − SILVER**	**S.NO**	**IV-(270+Ø) − (360 − Ø) −CUPS**
1.	$\sin(90+\emptyset) = \cos\emptyset$	1.	$\sin(270+\emptyset) = -\cos\emptyset$
2.	$\cos(90+\emptyset) = -\sin\emptyset$	2.	$\cos(270+\emptyset) = \sin\emptyset$
3.	$\tan(90+\emptyset) = -\cot\emptyset$	3.	$\tan(270+\emptyset) = -\cot\emptyset$
4.	$\mathrm{Cot}(90+\emptyset) = -\tan\emptyset$	4.	$\mathrm{Cot}(270+\emptyset) = -\tan\emptyset$
5.	$\mathrm{cosec}(90+\emptyset) = \sec\emptyset$	5.	$\mathrm{cosec}(270+\emptyset) = -\sec\emptyset$
6.	$\sec(90+\emptyset) = -\mathrm{cosec}\,\emptyset$	6.	$\sec(270+\emptyset) = \mathrm{cosec}\,\emptyset$
S.NO	**(180-Ø)**	**S.NO**	(360 − Ø)
1.	$\sin(180-\emptyset) = \sin\emptyset$	1.	$\sin(360-\emptyset) = -\sin\emptyset$
2.	$\cos(180-\emptyset) = -\cos\emptyset$	2.	$\cos(360-\emptyset) = \cos\emptyset$
3.	$\tan(180-\emptyset) = -\tan\emptyset$	3.	$\tan(360-\emptyset) = -\tan\emptyset$
4.	$\mathrm{Cot}(180-\emptyset) = -\cot\emptyset$	4.	$\mathrm{Cot}(360-\emptyset) = -\cot\emptyset$
5.	$\mathrm{cosec}(180-\emptyset) = \mathrm{cosec}\emptyset$	5.	$\mathrm{cosec}(360-\emptyset) = -\mathrm{cosec}\emptyset$
6.	$\sec(180-\emptyset) = -\sec\emptyset$	6.	$\sec(360-\emptyset) = \sec\emptyset$
S.NO	**III-(180+Ø) − (270 − Ø) −TEA**	**S.NO**	**Negative angles (-Ø)**
1.	$\sin(180+\emptyset) = -\sin\emptyset$	1.	$\sin(-\emptyset) = -\sin\emptyset$
2.	$\cos(180+\emptyset) = -\cos\emptyset$	2.	$\cos(-\emptyset) = \cos\emptyset$
3.	$\tan(180+\emptyset) = \tan\emptyset$	3.	$\tan(-\emptyset) = -\tan\emptyset$
4.	$\mathrm{Cot}(180+\emptyset) = \tan\emptyset$	4.	$\mathrm{Cot}(-\emptyset) = -\cot\emptyset$
5.	$\mathrm{cosec}(180+\emptyset) = -\mathrm{cosec}\emptyset$	5.	$\mathrm{cosec}(-\emptyset) = -\mathrm{cosec}\,\emptyset$
6.	$\sec(180+\emptyset) = -\sec\emptyset$	6.	$\sec(-\emptyset) = \sec\emptyset$

UNIT-IV TRIGONOMETRY –II

- $\sin 3A = 3\sin A - 4\sin^3 A$.
- $\cos 3A = 4\cos^3 A - 3\cos A$.
- $\tan 3A = \frac{3\tan A - 4\tan^3 A}{1 - 3\tan^2 A}$.

SUM AND PRODUCT FORMULA :

- **Sin (A+B) + Sin (A-B) = 2SinA CosB .**
- **Sin (A+B) - Sin (A-B) = 2CosA SinB.**
- **Cos (A+B) + Cos (A-B) = 2CosA CosB.**
- **Cos (A+B) - Cos (A-B) = -2CosA CosB.**
- **SinC + SinD = 2Sin** $\left(\frac{C+D}{2}\right)$ **Cos** $\left(\frac{C-D}{2}\right)$.
- **SinC - SinD = 2Cos** $\left(\frac{C+D}{2}\right)$ **Sin** $\left(\frac{C-D}{2}\right)$.
- **CosC + CosD = 2Cos** $\left(\frac{C+D}{2}\right)$ **Cos** $\left(\frac{C-D}{2}\right)$.
- **CosC - CosD = -2Sin** $\left(\frac{C+D}{2}\right)$ **Sin** $\left(\frac{C-D}{2}\right)$.

1. $(a+b)^2 = a^2+b^2+2ab$.
2. $(a-b)^2 = a^2+b^2-2ab$
3. $(a^2-b^2) = (a+b)(a-b)$.
4. $(a+b)^3 = a^3+3a^2b+3ab^2+b^3$.
5. $(a-b)^3 = a^3-3a^2b+3ab^2-b^3$.
6. $a^3+b^3 = (a+b)(a^2-ab+b^2)$.
7. $a^3-b^3 = (a-b)(a^2-ab+b^2)$.
8. solution of quadratic equation $ax^2+bx+c= 0$ are $x = \frac{-b\pm\sqrt{b^2-4ac}}{2a}$.
9. $x^a + x^b = x^{a+b}$.
10. $(x^a)^b = x^{ab}$.
11. $\left(\frac{1}{x}\right)^a = \frac{1^a}{x^a} = 1^a x^{-a}$.
12. $\left(\frac{1}{x}\right)^0 = 0$
13. $\frac{1}{0} = \infty$.,
14. $\frac{0}{1} = 0$
15. $\log a + \log b = \log ab$.
16. $\log a - \log b = \log a/b$.
17. $a\log b = \log a^b$.

BEST WISHES

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