ENGG MATHEMATICS –II (21003)

LIST OF FORMULAE

UNIT –I-CIRCLES

1. The equation of the circle with **centre (h,k) and radius 'r'** is
   $(\boldsymbol{x-h})^2 + (\boldsymbol{y-k})^2 = \boldsymbol{r}^2$ (centre –radius form).

2. The equation of the circle with **centre (0,0) or origin** and **radius 'r'**
   is $\boldsymbol{x^2 + y^2 = r^2}$

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

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

4. The **general** circle equation is $\mathbf{x^2+y^2+2gx+2fy+c = 0}$,
   where g = $\frac{co-efficient\ of\ 'x'}{2}$,f = $\frac{co-efficient\ of\ 'y'}{2}$.

5. **Centre (c) = (-g , -f) , radius (r) =** $\sqrt{g^2 + f^2 + c}$.

6. The equation of the circle described on the line joining **the points (x_1, y_1) and (x_2, y_2)**
   as a **diameter** $\mathbf{(x-x_1)(x-x_2) + (y-y_1)(y-y_2) = 0}$.

LENGTH OF TANGENT:

7. The **length of the tangent** at (x_1, y_1) on the circle $x^2+y^2+2gx+2fy+c = 0$
   is $\sqrt{(x_1^2 + y_1^2 + 2gx_1 + 2fy_1 + c)}$.

8. The **equation of the tangent** at (x_1, y_1) on the circle $x^2+y^2+2gx+2fy+c = 0$
   is $\mathbf{xx_1+yy_1+g(x+x_1)+(y+y_1)+c = 0}$.

9. The **length of the tangent** at (x_1, y_1) on the circle $\mathbf{x^2+y^2 = r^2}$ is $\mathbf{xx_1+yy_1 = r^2}$.

UNIT –II- FAMILY OF CIRCLES

CONCENTRIC CTRCLES:

10. The **general** circle equation is **$x^2+y^2+2gx+2fy+c = 0$,** then the concentric at a point (x_1,y_1) is **$x^2+y^2+2gx+2fy+k = 0$.**

11. If $C_1$and C_2 are the centres of two circles with radius R_1 and R_2 then **$D=C_1C_2=R_1+R_2$** then the circles touch each other **externally**.then the co-ordinates of

    P is $\left(\frac{mx_2+nx_1}{m+n}, \frac{n\,y_2+ny_1}{m+n}\right)$, where m= r_1 and n= r_2.

12. If $C_1$and C_2 are the centres of two circles with radius R_1andR_2 then **$D=C_1C_2=R_1-R_2$** then the circles touch each other **internally**.then the co-ordinates of

    P is $\left(\frac{mx_2-nx_1}{m-n}, \frac{n\,y_2-ny_1}{m-n}\right)$,where m= r_1 and n= r_2.

13. The equation of the **common tangent is S_1-S_2 = 0** .
    where S_1-1st circle , S_2 – 2nd circle.

14. The condition for **two circles cut orthogonally , $2gg_1+2ff_1= c +c_1$.**

PROPERTIES OF LIMITS :

15. **Addition rule** :$\lim_{x\to a}[f(x)+g(x)]$ =$\lim_{x\to a} f(x)$+$\lim_{x\to a} g(x)$.
16. **Subtraction rule** :$\lim_{x\to a}[f(x)-g(x)]$ =$\lim_{x\to a} f(x)-\lim_{x\to a} g(x)$.
17. **Product rule** : $\lim_{x\to a}[f(x)*g(x)]$ =$\lim_{x\to a} f(x)*\lim_{x\to a} g(x)$.
18. **Division rule** : $\lim_{x\to a}\left[\frac{f(x)}{g(x)}\right]=\frac{\lim_{x\to a} f(x)}{\lim_{x\to a} g(x)}$.
19. If $f(x) \le g(x)$ then $\lim_{x\to a} f(x)\le\lim_{x\to a} g(x)$.
20. $\lim_{x\to a}\frac{x^n-a^n}{x-a}=na^{n-1}$.
21. $\lim_{\emptyset\to 0}\frac{sin\emptyset}{\emptyset}=1$.
22. $\lim_{\emptyset\to 0}\frac{sinn\emptyset}{\emptyset}=n$.
23. $\lim_{\emptyset\to 0}\frac{tan\emptyset}{\emptyset}=1$.
24. $\lim_{\emptyset\to 0}\frac{tann\emptyset}{\emptyset}=n$.
25. To find the $\lim_{x\to\infty} f(x)$, put $x=\frac{1}{y}$ and after simplification $\lim_{x\to 0} f(x)$.

DIFFERENTIATION OF STANDARD FUNCTIONS:

S.NO	FUNCTION = Y	DIFFERENTIATION = $\frac{dy}{dx}$
1	x^n	$n x^{n-1}$
2	$\sqrt{x}$	$\frac{1}{2\sqrt{x}}$
3	$\frac{1}{x^n}$	$\frac{-n}{x^{n+1}}$
4	e^x	e^x
5	$\log x$	$\frac{1}{x}$
6	$\sin x$	$\cos x$
7	$\cos x$	$-\sin x$
8	$\tan x$	$sec^2 x$
9	$\cot x$	$-cosec^2 x$
10	$\sec x$	$\sec x \tan x$
11	$\operatorname{cosec} x$	$-\operatorname{cosec} x \cot x$
12	Constant (k)	0
13	$\sin^{-1} x$	$\frac{1}{\sqrt{1-x^2}}$
14	$\cos^{-1} x$	$\frac{-1}{\sqrt{1-x^2}}$
14	$\tan^{-1} x$	$\frac{1}{1+x^2}$
16	$\cot^{-1} x$	$\frac{-1}{1+x^2}$
17	$\sec^{-1} x$	$\frac{1}{x\sqrt{x^2-1}}$
18	$\operatorname{cosec}^{-1} x$	$\frac{-1}{x\sqrt{x^2-1}}$

26.**Addition rule** :$\frac{d}{dx}[f(x) + g(x)] = \frac{d}{dx}f(x) + \frac{d}{dx}g(x)$.

27.**Subtraction rule** :$\frac{d}{dx}[f(x) - g(x)] = \frac{d}{dx}f(x) - \frac{d}{dx}g(x)$.

28.**Product rule** : (i) $\frac{d}{dx}[UV]$ = U$\frac{dV}{dx}$ + V $\frac{dU}{dx}$.

(ii)$\frac{d}{dx}[UVW]$ = VW $\frac{dU}{dx}$ + WU $\frac{dV}{dx}$ +UV $\frac{dW}{dx}$.

29.**Division rule** :$\frac{d}{dx}\left[\frac{U}{V}\right] = \frac{V\frac{dU}{dx} - U\frac{dV}{dx}}{V^2}$.

30.$\frac{d}{dx}[K\, f(x)]$ = K $\frac{d}{dx}$ f(x).

UNIT –III-DIFFERENTIATION METHODS

31.**Function of function** : $\frac{dy}{dx} = \frac{dy}{du} * \frac{du}{dx}$.

32.**Chain rule** : $\frac{dy}{dx} = \frac{dy}{du} * \frac{du}{dv} * \frac{dv}{dx}$.

33.**Parametric functions** : $\frac{dy}{dx} = \left(\frac{\frac{dy}{d\emptyset}}{\frac{dx}{d\emptyset}}\right)$.

UNIT –IV- APPLICATION OF DIFFERENTIATION-I

34.**Area of circle**: πr^2.

35.**Area of square** :a^2 .

36.**Area of rectangle** :(lb).

37.**Voiume of cone** : $\frac{1}{3}\pi r^2 h$.

38.**Volume of sphere** : $\frac{4}{3}\pi r^3$.

39.**Volum of cube : a^3.**

40.**Surface area of sphere : 4 πr^2.**

41.**Velocity (V)** = $\frac{ds}{dt}$.

42.**Acceleration (A)** = $\frac{dV}{dt}$ = $\frac{d^2 s}{dt^2}$.

43.Slope of the tangent (m) = $\left(\frac{dy}{dx}\right)_{(x1,y1)}$

44.Slope of the normal (-1/m) = $\frac{-1}{\left(\frac{dy}{dx}\right)_{(x1,y1)}}$.

45.Equation of the tangent at $(x1, y1)$is **$y-y_1$ = m $(x-x_1)$.**

46.Equation of the normal at $(x1, y1)$is **$y-y_1$ = -1/ m $(x-x_1)$.**

UNIT-V- APPLICATION OF DIFFERENTIATION-II

47.**Minimum condition** : (i) $\frac{dy}{dx} = 0$ and (ii) $\frac{d^2y}{dx^2}$ **= + ve value.**

48.**Maximum condition** : (i) $\frac{dy}{dx} = 0$ and (ii) $\frac{d^2y}{dx^2}$ **= - ve value.**

49.**Homogeneous function** : a function f(x , y) of two variables x and y is said to be of degree 'n' if **f(tx , ty) = t^n (x , y).**

50.**Euler's theorem** : if 'f ' is a **homogeneous function** of degree 'n' in x and y Then$x \frac{\partial f}{\partial x} + y \frac{\partial f}{\partial y} = nf$.

BEST WISHES

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