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Engineering Mathematics-I
Assignment-I

1. Prove that $\log(x\cot x) = -\frac{x^2}{3} - \frac{7}{90}x^4 .....$

2. Prove that $\sin^{-1}\left(\frac{2x}{1+x^2}\right) = 2\left\{n\pi + x - \frac{x^3}{3} + \frac{x^5}{5} - ...\right\}$

3. Expand secx using Maclaurin's series

$\left(Ans: 1 + \frac{x^2}{2!} + \frac{x^5}{4!} + ...\right)$

4.Expand $e^{\sin x}$ using Maclaurin's series

$\left(Ans: 1 + x + \frac{1}{2}x^2 - \frac{1}{8}x^4 - \frac{1}{15}x^5 + ...\right)$

3.If $x^3 + y^3 + xy - 1 = 0$ then show that $y = 1 - \frac{x}{3} + \frac{26}{81}x^3$

4.Show that $\cos x \cosh x = 1 - \frac{2^2 x4}{4!} + \frac{2^4 x8}{8!} - .....$

5.P.T. $\log(1+\sin x) = x - \frac{1}{2}x^2 + \frac{1}{6}x^3 .....$

6.P.T. $(1+x)^x = 1 + x^2 - \frac{1}{2}x^3 + \frac{5}{6}x^4 .....$

7.If $y = x + \frac{x^2}{2!} + \frac{x^3}{3!} + ...$ *then prove that* $x = y - \frac{y^2}{2} + \frac{y^3}{3} - \frac{y^4}{4} + ...$

8.Prove that $\log\left(\frac{\sinh x}{x}\right) = \frac{x^2}{6} - \frac{1}{180}x^4 +$

9.Show that $e^{ax}\sin bx = bx + abx^2 + \frac{b(3a^2 - b^2)}{3!}x^2 + ...$

10.If $f(x) = x^3 - 2x + 5$ then find the value of f(2.001) using **Taylor's theorem.**

(a) Expand log x in powers of (x-2)

(b)Expand tan x in powers of $\left(x - \frac{\pi}{4}\right)$

(c)Expand $x^4 - 3x^3 + 2x^2 - x + 1$ in powers of (x-3)

11.Expand sin x cos h x in power of x up to x^5

12.P.T. $\log(1+e^x) = \log 2 + \frac{1}{2}x + \frac{1}{8}x^2 ...$

13.P.T. $\cos^2 x = 1 + \sum(-1)^n \frac{2^{2n-1} x2n}{(2n)!}$

Hint: $\cos^2 x = \frac{1+\cos 2x}{2}$ & use standard expansion cos x

14.Show that $\sin^{-1}(3x-4x^3)=3\left(x+\frac{x^3}{6}+\frac{3x^5}{40}+...\right)$

15.Expand $\log(1+\cos x)$ up to x^4 $\left(\log 2-\frac{1}{4}x^2-\frac{1}{96}x^4+...\right)$

16.P.T. $\cos^{-1}\left(\frac{3x-x^3}{1-3x^2}\right)=\frac{\pi}{2}-3\left(x-\frac{1}{3}x^3+\frac{1}{5}x^5\right)$

Hint: $x=\tan\theta$ & $\cot\left(\frac{\pi}{2}-3\theta\right)=\tan 3\theta$

17.P.T. $\tan^{-1}\left(\frac{\sqrt{1+x^2}-1}{x}\right)=\frac{1}{2}\left(x-\frac{x^3}{3}+\frac{x^5}{5}....\right)$

18.P.T. $\sec^2 x=1+x^2+\frac{2x^4}{3}+.....$

19. Expand $\log(\tan\pi/4+x)$ up to x^5.

20. Using Taylor's series express $(x-2)^4-3(x-2)^3+4(x-2)^2+5$ in powers of x.

21. Show that $\frac{\sin^{-1}x}{\sqrt{1-x^2}}=x-\frac{2}{3}x^3+\frac{2.4}{3.5}\frac{x^5}{5}+...$ (by forming diff. equn)

22. Expand $\frac{x}{e^x-1}$ up to x^4.

23. Expand $\log(1+x+x^2+x^3)$ up to x^8.