MAY 2025 **U/ID 32502/UCM1B**

Time : Three hours Maximum : 75 marks

PART A — (10 × 2 = 20 marks)

Answer any TEN questions.

1. Expand $\sin^n \theta$.
2. What is the value of $\cos\theta$?
3. Write the expansion of $\tan n\theta$.
4. State Demovire's Theorem.
5. State Euler's formula.
6. Prove that $\cosh^2 x - \sinh^2 x = 1$.
7. Prove that Logi $= i(4n+1)(\pi/2)$.
8. Find Log $(-e)$.
9. Find the sum of the series

   $\cos\alpha - 1/2\cos 2\alpha + 1/3\cos 3\alpha + \ldots$.
10. State Gregory series.
11. Separate into real and imaginary parts of $\sin(x+iy)$.
12. Expand $\sinh z$.

PART B — (5 × 5 = 25 marks)

Answer any FIVE questions.

13. Expand $\sin^5\theta$ in a series of sines of multiples of θ.

14. Find the equation whose roots are

$$\tan\frac{\pi}{5}, \tan\frac{2\pi}{5}, \tan\frac{3\pi}{5} \text{ and } \tan\frac{4\pi}{5}.$$

15. Prove that $\cosh^{-1} x = \log\left(x + \sqrt{x^2 - 1}\right)$.

16. Prove that $i^i = e^{-4(n+1)\frac{\pi}{2}}$.

17. Prove that $\pi = 2\sqrt{2}\left[1 - \frac{1}{3^2} + \frac{1}{5}\frac{1}{3^2} - \frac{1}{7}\frac{1}{3^2} + ...\right]$.

18. Expand $\cos 6\theta$ interms of $\sin\theta$.

19. Find the real and imaginary parts of $\tanh(1+i)$.

PART C — (3 × 10 = 30 marks)

Answer any THREE questions.

20. Expand $\sin^3\theta\cos^4\theta$ interms of sines of multiples of θ.

21. Show that $\cos\frac{\pi}{9}.\cos\frac{2\pi}{9}.\cos\frac{4\pi}{9}=\frac{1}{8}$.

22. If $\sin(A+iB)x+iy,$ prove that

(a) $\frac{x^2}{\cosh^2 B}+\frac{y^2}{\sinh^2 B}=1,$

(b) $\frac{x^2}{\sin^2 A}-\frac{y^2}{\cos^2 A}=1.$

23. If $i^{a+ib}=a+ib$, prove that $a^2+b^2=e^{-(4n+1)\pi b}$.

24. If $n\pi-\frac{\pi}{4}\le\theta\le n\pi+\frac{\pi}{4}$ then prove that $\theta-n\pi=\tan\theta-\frac{\tan^3\theta}{3}+\frac{\tan^5\theta}{5}-.....$

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