B.Sc. DEGREE EXAMINATION,NOVEMBER 2019
I Year I Semester
Allied Mathematics - I

Time : 3 Hours **Max.marks :75**

Section A $(10 \times 2 = 20)$ Marks

Answer any **TEN** questions

1. Define an orthogonal matrix.
2. State Cayley-Hamilton theorem.
3. Show that $\frac{e+e^{-1}}{2} = 1 + \frac{1}{2!} + \frac{1}{4!} + \dots$
4. Show that $\log 2 = 1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \dots$
5. Prove that $\cosh^2 x - \sinh^2 x = 1$.
6. Write down the expansion of $\tan n\theta$.
7. Prove that $L(1) = \frac{1}{s}, s > 0$.
8. State the first shifting theorem for Laplace transforms.
9. State the shifting theorem for inverse Laplace transforms.
10. Find $L^{-1}\left[\frac{1}{(s+3)^5}\right]$.
11. Define a skew symmetric matrix and give an example.
12. Find the Laplace transform of $\sin^2 t$.

Section B $(5 \times 5 = 25)$ Marks

Answer any **FIVE** questions

13. Obtain the characteristic equation of the matrix $\begin{bmatrix} 1 & -1 & 2 \\ -2 & 1 & 3 \\ 3 & 2 & -3 \end{bmatrix}$.
14. Sum the series $1 + \frac{1}{3} + \frac{1.3}{3.6} + \frac{1.3.5}{3.6.9} + \dots$
15. Prove that $\frac{1+\tanh x}{1-\tanh x} = \cosh 2x + \sinh 2x$.
16. Find $L[\sin 3t \cos t]$.
17. Evaluate $L^{-1}\left(\frac{s^3}{s^4-a^4}\right)$.
18. Sum the series $1 - \log_e 2 + \frac{(\log_e 2)^2}{2!} - \frac{(\log_e 2)^3}{3!} + \dots$
19. Evaluate $L(t\, e^{-t} \sin t)$.

Section C $(3 \times 10 = 30)$ Marks

Answer any **THREE** questions

20. Obtain the characteristic equation of $\mathbf{A} = \begin{bmatrix} \mathbf{0} & \mathbf{0} & \mathbf{1} \\ \mathbf{3} & \mathbf{1} & \mathbf{0} \\ -\mathbf{2} & \mathbf{1} & \mathbf{4} \end{bmatrix}$ and hence find $\mathbf{A}^{-1}$.

21. If $\mathbf{a}, \mathbf{b}, \mathbf{c}$ denote three consecutive integers, prove that

$$\log \mathbf{b} = \frac{\mathbf{1}}{\mathbf{2}} \log \mathbf{a} + \frac{\mathbf{1}}{\mathbf{2}} \log \mathbf{c} + \frac{\mathbf{1}}{\mathbf{2ac+1}} + \frac{\mathbf{1}}{\mathbf{3}} \frac{\mathbf{1}}{(\mathbf{2ac+1})^{\mathbf{3}}} + \dots$$

22. Show that $\cos 8\theta = 128 \cos^8\theta - 256 \cos^6\theta + 160 \cos^4\theta - 32 \cos^2\theta + 1$.

23. Find $\mathbf{L}\left[\mathbf{t^2} \cos \mathbf{a}t\right]$.

24. Find $\mathbf{L}^{-1}\left[\frac{\mathbf{4s^2-3s+5}}{\mathbf{(s+1)(s-1)(s-2)}}\right]$.

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