B.Sc. DEGREE EXAMINATION,NOVEMBER 2018
I Year II Semester
Allied Paper -II
ALLIED MATHEMATICS -II

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

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

Answer any **TEN** questions

1. Find the Euler constant $\mathbf{a_0}$ for the function $\mathbf{f}\left(\mathbf{x}\right)=\mathbf{x}+\mathbf{x^2}$ of period $\mathbf{2}\pi$ in $(-\pi, \pi)$.
2. What are the values of the Fourier constants when an odd function $\mathbf{f}\left(\mathbf{x}\right)$ is expanded in a Fourier series in the interval $(-\pi, \pi)$.
3. Form the partial differential equation by eliminating the arbitrary constants $\mathbf{a}$ and $\mathbf{b}$ from $\mathbf{z}=\left(\mathbf{x^2}+\mathbf{a}\right)\left(\mathbf{y^2}+\mathbf{b}\right)$.
4. Find the complete integral of $\mathbf{z}=\mathbf{p}x+\mathbf{q}y+\mathbf{p^2}-\mathbf{q^2}$.
5. Find the Laplace transform of $\mathbf{e^{-7t}}$.
6. Find $\mathbf{L}\left[\mathbf{s}in\ \mathbf{7t}\right]$.
7. Find $\mathbf{L^{-1}}\left[\dfrac{\mathbf{1}}{\left(\mathbf{s}-\mathbf{1}\right)^{\mathbf{2}}}\right]$.
8. Find inverse Laplace transform of $\dfrac{\mathbf{1}}{\left(\mathbf{s}+\mathbf{1}\right)^{\mathbf{2}}+\mathbf{1}}$.
9. If $\vec{\mathbf{v}}=\left(\mathbf{x}+\mathbf{3y}\right)\vec{\mathbf{i}}+\left(\mathbf{y}-\mathbf{2z}\right)\vec{\mathbf{j}}+\left(\mathbf{x}+\lambda\mathbf{z}\right)\vec{\mathbf{k}}$ is solenoidal, find the value of λ.
10. If $\phi=\mathbf{l}og\left(\mathbf{x^2}+\mathbf{y^2}+\mathbf{z^2}\right)$, then find $\nabla\phi$.
11. Eliminate the arbitrary function $\mathbf{f}$ from $\mathbf{z}=\mathbf{f}\left(\mathbf{x^2}-\mathbf{y^2}\right)$ and form a partial differential equation.
12. If $\vec{\mathbf{F}}=\mathbf{x^2}\vec{\mathbf{i}}+\mathbf{y^2}\vec{\mathbf{j}}$, evaluate $\int \vec{\mathbf{F}}\cdot\mathbf{d}\vec{\mathbf{r}}$ along the line $\mathbf{y}=\mathbf{x}$ from $(\mathbf{0},\mathbf{0})$ to $(\mathbf{1},\mathbf{1})$.

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

Answer any **FIVE** questions

13. Find the Fourier series for $\mathbf{f}\left(\mathbf{x}\right)=\mathbf{x^2}$ in $-\pi \le \mathbf{x} \le \pi$.
14. Solve $\mathbf{z}=\mathbf{p}x+\mathbf{q}y+\sqrt{\mathbf{1}+\mathbf{q^2}+\mathbf{p^2}}$.
15. Find $\mathbf{L}\left[\dfrac{\mathbf{1}-\mathbf{e^t}}{\mathbf{t}}\right]$.
16. Find $\mathbf{L^{-1}}\left[\dfrac{\mathbf{1}}{\mathbf{s}\left(\mathbf{s^2}-\mathbf{2s}+\mathbf{5}\right)}\right]$.

17. Find the directional derivative of $\phi = xy + yz + zx$ in the direction of the vector $\vec{i} + 2\vec{j} + 2\vec{k}$ at $(1, 2, 0)$.

18. Find the complete solution of $p + q = \sin x + \cos y$.

19. Evaluate $\iint_S \vec{F} \cdot \hat{n}\, ds$, where $\vec{F} = yz\ \vec{i} + zx\ \vec{j} + xy\ \vec{k}$ and S is that part of the surface of the sphere $x^2 + y^2 + z^2 = 1$ which lies in the first octant.

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

Answer any **THREE** questions

20. If $f(x) = \frac{1}{2}(\pi - x)$, then find the Fourier series of period 2π in the interval $(0, 2\pi)$. Hence deduce that $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \cdots = \frac{\pi}{4}$.

21. Solve $x(y - z)\,p + y(z - x)\,q = z(x - y)$.

22. Find $L[t \sin 3t \ \cos 2t]$.

23. Find $L^{-1}\left[\frac{1 - s}{(s + 1)(s^2 + 4s + 13)}\right]$.

24. Verify Green's theorem in the XY-plane for $\int_C \{(xy + y^2)\,dx + x^2 dy\}$, where C is the closed curve of the region bounded by $y = x$ and $y = x^2$.

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