

LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034



B.Sc. DEGREE EXAMINATION – PHYSICS
THIRD SEMESTER – NOVEMBER 2019
PH 3506 – MATHEMATICAL PHYSICS

Date: 29-10-2019
Time: 01:00-04:00

Dept. No.

Max. : 100 Marks

PART – A

Answer All questions:

(10 X 2 = 20 Marks)

- Express $\frac{1+2i}{1-i}$ in the form of $f(z) = a + ib$
- Locate $1 + 3i$ and $1 - 7i$ in the complex plane
- When a vector to be called as irrotational?
- State stokes theorem.
- Determine the fundamental period of $\cos x$ and $\sin 2x$
- Define periodic function.
- What is the trace of the matrix $\begin{pmatrix} 1 & 1 & 1 \\ 1 & -1 & -1 \\ 3 & 1 & 1 \end{pmatrix}$
- What is a normal matrix? Give an example.
- Using Trapezoidal rule, evaluate $\int_1^2 x^2 dx$ with four ordinates
- Write Simpsons rule $1/3^{\text{rd}}$ rule.

PART – B

Answer any Four questions:

(4 X 7.5 = 30 Marks)

- Show that (a) $\cosh z = \cosh x \cos y + i \sinh x \sin y$
(b) $\sinh z = \sinh x \cos y + i \cosh x \sin y$.
- Derive the Cauchy – Riemann conditions for a function to be analytic.
- Find the Fourier Cosine series of $f(x) = 1$ for $0 \leq x < T/2$ and $f(x) = -1$ for $-T/2 \leq x < 0$
- Verify Cayley - Hamilton theorem for the matrix $\begin{pmatrix} 1 & 2 & 0 \\ 2 & -1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$
- Fit a straight line by method of least squares for the following data

X	0	1	2	3	4
Y	1	1.8	3.3	4.5	6.3

- State and prove Green's theorem in the plane.

PART – C

Answer any Four questions:

(4 X 12.5 = 50 Marks)

17. State and prove Cauchy's integral theorem.

18. State and prove Gauss divergence theorem. Using $\iiint \vec{\nabla} \times \vec{F} dV = \iint \vec{dS} \times \vec{F}$.

19. Find the Fourier series of the function with period 2π defined as $f(x) = f(x) = \begin{cases} x + \pi, & 0 \leq x \leq \pi \\ -x - \pi, & -\pi \leq x < 0. \end{cases}$

20. Find the eigen values and eigen vectors of $\begin{pmatrix} -2 & 2 & -3 \\ 2 & 1 & -6 \\ -1 & -2 & 0 \end{pmatrix}$

21. Find the solution to four decimals of the system

$$27x + 6y - z = 85$$

$$6x + 15y + 2z = 72$$

$$x + y + 54z = 110 \text{ Using Gauss-Seidel method.}$$

22. Using Lagrange's interpolation formula, Obtain the value for Y when X = 2

X	1	3	7	10
Y	11	19	59	110
