



LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – PHYSICS

THIRD SEMESTER – APRIL 2017

PH 3506- MATHEMATICAL PHYSICS

Date: 02-05-2017
09:00-12:00

Dept. No.

Max. : 100 Marks

Part – A (10x2 = 20 Marks) Answer all questions

1. Separate $\log_e z$ into real and imaginary parts.
2. What are harmonic functions?
3. Define a solenoidal vector field.
4. What do you mean by directional derivative.
5. Define a periodic function.
6. Check Whether $\sin x$ and $\cos x$ are odd or even functions.
7. What is a partition matrix?
8. Prove that eigenvalues of a Hermitian matrix are real.
9. Define interpolation and extrapolation.
10. Give the Simpson's 1/3 rule.

Part – B (4x7.5 = 30 Marks) Answer any four questions

11 Evaluate $\iint_{\Sigma} \nabla \cdot \mathbf{X} \mathbf{F} \cdot \mathbf{n} \, ds$ for vector $\mathbf{F} = (x^2+y-4)\mathbf{i} + 3xy\mathbf{j} + (2xz+z^2)\mathbf{k}$ over a hemisphere $x^2+y^2+z^2=16$ lying above x-y plane.

12. Derive the Cauchy - Riemann conditions.
13. Find the Fourier series of e^x in the interval $-\pi < x < \pi$
14. (i) State and prove the Cayley Hamilton theorem (ii) Define orthogonal and unitary matrices.(5.5+2)
15. Using the Method of Least squares fit a straight line to the data.

X 1 2 3 4

Y 1.7 1.8 2.3 3.2

16. Diagonalise $\begin{bmatrix} 4/3 & \sqrt{2}/3 \\ \sqrt{2}/3 & 5/3 \end{bmatrix}$

Part – C (4x12.5 = 50 Marks)
Answer any four questions

17. State and prove the Gauss divergence theorem . Using it evaluate (12.5 Marks)

$$\iiint \nabla \cdot \vec{X} F \, dV = \iint dS \cdot \vec{X} F$$

18 State and prove the Cauchy Integral theorem and hence prove $\int dz/z$ over a closed curve c

(9+3.5)

19 Apply Fourier transform to analyse a square wave.

20 Find the eigenvalues and eigenvectors of $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & 1 & 1 \end{bmatrix}$

21 Solve using Cramers rule solve $x+2y+3z = 10$; $2x-3y+z = 1$; $3x+y-2z = 9$

22 Solve using Euler and modified Euler method $dy/dx = x+y$ from $x=0$ to 0.2 . $x_0=0$ $y_0= 1$
