LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION –**PHYSICS**

THIRD SEMESTER – **APRIL 2018**

PH 3506– MATHEMATICAL PHYSICS

Date: 05-05-2018　　Dept. No. 　　Max. : 100 Marks

Time: 01:00-04:00

Part –A

Answer all questions **($10\times 2 = 20$marks)**

1. Define an analytic function
2. Separate the following into real and imaginary part of $\sin\ (x+iy)$
3. Find the unit normal to the surface $x^2+y^2=z$ at point (1,2,5)
4. State Stoke's theorem.
5. Define Euler coefficients for even half range expansion
6. Using Laplace integral, evaluate $\int_0^\infty \frac{\cos\omega\ d\omega}{1+\omega^2}$
7. What is a triangular matrix? Give an example
8. Determine the rank of a matrix $\begin{bmatrix} 1 & 1 & 1 \\ 1 & -1 & -1 \\ 3 & 1 & 1 \end{bmatrix}$
9. Express Gauss' integral formula and give its importance.
10. Write down the difference operator for f(x) by 'h'.

Part- B

Answer any four questions. **($4\times 7.5 = 30$ marks)**

11. (a) Show that $|Z - i|^2$ =1 describes a circle centered at the (0,i) with radius 1.

    (b) Simplify (1+i) (2+i) and locate it in the complex plane.

12. Using Green's theorem, evaluate $\int_c\ (x^2y\,dx + x^2dy)$ where C is boundary described counter –clock wise of the triangle with vertices (0,0) (1,0), (1,1).
13. Obtain a Fourier expression for f(x) = x for $-\pi < x < \pi$.
14. Verify Cayley – Hamilton theorem for the matrix $\begin{pmatrix} 1 & 2 & 0 \\ 2 & -1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$ and find its inverse.

15. Using Lagrange's interpolation formula, find the value of Y when X=10 from the following data.

X	5	6	9	11
Y	12	13	14	16

16. Use Cauchy's integral theorem to evaluate the integral $\oint_C \frac{dz}{z^2+1}$ where $C: |z+i| = 1$ in the counter clockwise direction.

Part –C

Answer any four questions. **($4\times$ 12.5 = 50 marks)**

17. Establish that the real and complex part of an analytic function satisfies the Laplace equation.

18. (a) Prove that $\nabla.\nabla\times F = 0$, where F is a three dimensional vector in Cartesian coordinates.

    (b) Using Gauss –divergence theorem, evaluate $\iint_S\ (x^3dydz + y^3dzdx + z^3dxdy)$ where S is the surface of the sphere $x^2 + y^2 + z^2 = 4$.

19. write down the functional form of a square wave of period 2π and obtain its Fourier series.

20. Determine the eigen values of A = $\begin{bmatrix} 2 & 0 & -2 \\ 0 & 0 & -2 \\ -2 & -2 & 1 \end{bmatrix}$ and show that matrix A satisfies its own characteristic equation.

21. Calculate the approximate value of $\int_{-3}^{+3} x^4\ dx$ by Simpon's $\frac{1}{3}$ rd rule. Compare it with the exact value and the value obtained by Trapezoidal.

22. (a) Find the directional derivate of g =$(x^2 + y^2 + z^2)^{-1/2}$ at (4,2,-4) in the direction of (1,2,-2).

    (b) If $\vec{U} = yz\,\hat{\imath} + zx\,\hat{\jmath} + xy\,\hat{k}$ and f = xyz, find curl (f$\vec{U}$)

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