

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.
(For candidates admitted during the academic year 2019 – 2020)

SUBJECT CODE : 19PH/PC/MP14
M.Sc., DEGREE EXAMINATION NOVEMBER 2019
PHYSICS
FIRST SEMESTER

COURSE : CORE
PAPER : MATHEMATICAL PHYSICS - I
TIME : 3 HOURS
MAX. MARKS : 100

SECTION - A

ANSWER ALL QUESTIONS: (10x3=30)

1. List the properties of Δ and E.
2. What is interpolation and extrapolation.
3. What is meant by singularity of an analytic function?
4. State Cauchy's residue theorem.
5. What is a basis?
6. Give the relation between ket and bra vectors and inner product.
7. Give Einstein's summation convention.
8. If A^μ and B_ν are the components of a contravariant and covariant tensors of rank one, show that $C_\nu^\mu = A^\mu B_\nu$ are the components of a mixed tensor of rank two.
9. Show that the beta function is symmetric.
10. What are Henkel functions?

SECTION - B

ANSWER ANY FIVE QUESTIONS: (5x5=25)

11. State and prove Newton Gregory formula.
12. Expand $f(z) = \frac{1}{(z+1)(z+3)}$ as a Laurent's series valid for (a) $|z| < 1$ and (b) $1 < |z| < 3$.
13. Derive the equation of heat flow in solids.
14. Write a note on outer product and inner product of tensors.
15. Prove the recurrence relation: $xJ_n'(x) = xJ_n(x) - xJ_{n+1}(x)$.
16. Find the numerical solution of $\frac{dy}{dx} = x + y$, from $x = 0$ to 0.2 by Euler's method.
17. Derive the Cauchy Reimann equation for a function $f(z)$ to be analytic.

SECTION - C

ANSWER ANY THREE QUESTIONS: (3x15=45)

18. (a) Give the Newton Raphson formula to find the square root, cube root and p^{th} root of a number.
(b) Using Newton Raphson method to find the positive root of $f(x) = 2x^3 - 3x - 6 = 0$ correct to five decimal places.
19. (a) State and prove Cauchy's integral formula.
(b) Evaluate the integral $\oint_c \frac{z}{z^2 - 3z + 2} dz$ where c is the circle $|z-2| = \frac{1}{2}$.
20. Explain the Gram-Schmidt orthogonalisation process. Use it construct an orthonormal set of vectors from the set $X_1 = (1, 2, 1)$, $X_2 = (2, 1, 4)$ and $X_3 = (4, 5, 6)$.
21. Discuss the applications of tensors in Elasticity.
22. (a) Show that the Legendre's polynomials are orthogonal.
(b) Show that $P_n(1) = 1$