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(FOR THE CANDIDATES ADMITTED **SUBJECT CODE** **22 PPS 101**

DURING THE ACADEMIC YEAR 2022-23 ONLY) **REG.NO.**

N.G.M.COLLEGE (AUTONOMOUS) : POLLACHI

END-OF-SEMESTER EXAMINATIONS : DECEMBER – 2022

M.Sc. – PHYSICS **MAXIMUM MARKS: 50**

I SEMESTER **TIME : 3 HOURS**

MATHEMATICAL PHYSICS

SECTION – A (10 X 1 = 10 MARKS)

ANSWER THE FOLLOWING QUESTIONS.

(Objective Questions with four Multiple Choices) **(K1)**

1. Legendre differential equation has singular points …………………

   (a) $(0,\infty)$ (b) $(-\infty\ \ \infty)$ (c) $(-1,1)$ (d) none of these

2. Analytic functions have ------ types of singularities

   (a) One (b) two (c) three (d) four

3. Laplace's differential equation is ……………….

   a) $\nabla^2\varphi=0$ (b) $\nabla^2\varphi=\rho$ (c) $\nabla^2\varphi=-1$ (d) $\nabla^2\varphi=1$

4. The Fourier sine transform of a function $f(x) = e^{-ax}$ ………………………….

   (a) s/a^2+s^2 (b) a/a^2+s^2 (c) s/a^2-s^2 (d) s/a^2+s

5. Kronecker delta δ_μ^υ is ………………………

   (a) scalar (b) vector (c) tensor of rank 1 (d) tensor of rank 2

ANSWER THE FOLLOWING IN ONE (OR) TWO SENTENCES. **(K2)**

6. Write Legendre's differential equation.
7. State Cauchy residue theorem.
8. Write the Poisson's equation.
9. Define the term integral transform.
10. Define tensor.

SECTION – B (5 X 3 = 15 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.

(K3)

11. a) Prove the generating function for Hermite polynomial.

(OR)

b) Show that $P_n(1)=1$

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12. a) Use Cauchy's integral theorem to evaluate the integral $\iint_c dz/z$.

(OR)

b) Write a note on singularities of analytic function.

13. a) Derive the solution of heat flow equation

(OR)

b) Derive the diffusion equation.

14. a) State and prove linearity theorem of Fourier transform

(OR)

b) Explain finite Fourier cosine transform.

15. a) Explain dummy and real indices.

(OR)

b) Show that $\beta(m,n)=\beta(n,m)$.

SECTION – C (5 X 5 = 25 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.

(K4 / K5)

16. a) Evaluate $J_{1/2}$ (X) and $J_{-1/2}(x)$.

(OR)

b) Discuss the recurrence formula for Hermite Polynomial.

17. a) State and prove Cauchy's integral theorem.

(OR)

b) Derive the Cauchy Riemann equation in polar form.

18. a) Derive the solution of Laplace's equation in cylindrical coordinates.

(OR)

b) If S_n and S_m are zonal spherical harmonics, then prove that $\iint_v S_n S_m ds = 0,\ n \neq m$

19. a) Explain the convolution theorem of Fourier transform.

(OR)

b) Explain the Parsevals theorem of Fourier transform.

20. a) Explain contravariant and covariant vectors.

(OR)

b) Find the relation between beta and gamma function.

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