PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

MSc DEGREE EXAMINATION MAY 2023
(Second Semester)

Branch – **PHYSICS**

MATHEMATICAL PHYSICS

Time: Three Hours Maximum: 50 Marks

SECTION-A (5 Marks)
Answer **ALL** questions
ALL questions carry **EQUAL** marks (5 x 1 = 5)

1. How do you call the point in which the function is not differentiable?
   (i) Singular point (ii) Null point
   (iii) Diverge point (iv) Invalid point

2. Find the value of Fourier integral $\int_0^\infty \frac{Sin\ ax}{x} dx = ?$
   (i) $\pi/3$ (ii) $\pi/2$
   (iii) $\pi/6$ (iv) $\pi/4$

3. Identify the Legendre equation $P_n(1)=?$
   (i) -1 (ii) 0
   (iii) 1 (iv) Infinity

4. What is the name of matrix if its determinant is zero?
   (i) Square Matrix (ii) Hermitian Matrix
   (iii) Null Matrix (iv) Singular Matrix

5. Find the value of 1/31 using Newton-Rapson method up to four decimal.
   (i) 0.0323 (ii) 0.0320
   (iii) 0.0332 (iv) 0.0302

SECTION - B (15 Marks)
Answer **ALL** Questions
ALL Questions Carry **EQUAL** Marks (5 x 3 = 15)

6. a) Obtain the Laplace's equations in two dimensions.
   OR
   b) Write a note on residue of a function f(z).

7. a) Define the Fourier sine transform of a derivative.
   OR
   b) Find the Laplace transform of the function F(t)=t.

8. a) Write down the steps involved to find the solution of partial differential equation by the method of separation of variables.
   OR
   b) Show that the given expressions i)$J_0'(x)=-J_1(x)$, ii) $2J_0''(x)=J_2(x)-J_0(x)$

Cont...

9. a) Explain the Hermitian and Skew Hermitian matrices.

OR

b) Define the rank of matrix with its properties.

10. a) Explain the principle of least squares.

OR

b) Evaluate the given below integration using simpson one third rule.

$$\int_0^6 \frac{dx}{1+x^2}$$

SECTION -C (30 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** Marks (5 x 6 = 30)

11. a) Define analytic function and derive Cauchy-Riemann's equations.

OR

b) State and prove Cauchy's residue theorem.

12. a) Find the solution using Fourier sin transform of e^{-bx}.

OR

b) Find the solution using Laplace transform of sin at and cos at.

13. a) Write down the solution of Laplace equation in Cartesian coordinates.

OR

b) Derive the generating function of Bessel function $J_n(x)$.

14. a) Explain the Cayley Hamilton theorem in detail.

OR

b) Determine the eigen values and eigen vectors of the matrix $A=\begin{bmatrix}5 & 4\\ 1 & 2\end{bmatrix}$.

15. a) Explain the Newton-Raphson method in detail.

OR

b) Apply the Runge-Kutta fourth order method to find an approximate value of y when x =0.2,given that dy/dx = x + y and y =1 when x = 0.

Z-Z-Z END