

(FOR THE CANDIDATES ADMITTED

SUBJECT CODE **23 UPS 304**

DURING THE ACADEMIC YEAR 2023-24 ONLY)

REG.NO. **N.G.M.COLLEGE (AUTONOMOUS) : POLLACHI****END-OF-SEMESTER EXAMINATIONS : NOVEMBER – 2024****B.Sc. – PHYSICS****MAXIMUM MARKS: 75****III SEMESTER****TIME : 3 HOURS****PART – III****MATHEMATICAL PHYSICS****SECTION – A****(10 X 1 = 10 MARKS)****ANSWER THE FOLLOWING QUESTIONS.****(K1)**

1. Curl of $(1/r)$ is equal to
 (a) r/r^2 (b) $-r/r^2$ (c) $-r/r^3$ (d) xyz/r^2
2. The trace of a square matrix is
 (a) The sum of its diagonal terms (b) The sum of its non diagonal terms
 (c) The product of its diagonal terms (d) The product of its non diagonal terms
3. Inverse Laplace transform of $\frac{1}{s^2 + a^2}$
 (a) Sin at (b) Sinhat (c) Cos at (d) Coshat
4. The conditions imposed on function to be represented by Fourier series expansion are called
 (a) Parseval's conditions (b) Fourier's conditions
 (c) Euler's conditions (d) Dirichlet's conditions
5. The cube root of 12 by Newton-Raphson method up to three decimal places is
 (a) 2.302 (b) 2.289 (c) 2.278 (d) 2.928

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

6. Define divergence of a vector function.
7. Define Hermitian matrix.
8. Mention any two properties of Laplace transform.
9. What is the value $\Gamma_{\frac{1}{2}}$?
10. Write the Taylor series expansion formula. .

SECTION – B**(5 X 5 = 25 MARKS)****ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.****(K3)**

11. a) Explain the physical significance of a curl of a vector function.

(OR)

- b) Express gradient and divergence in spherical polar coordinates.

(CONTD 2)

12. a) Find the rank of a matrix where $[A] = \begin{bmatrix} 6 & 1 & 3 & 8 \\ 4 & 2 & 6 & -1 \\ 10 & 3 & 9 & 7 \\ 16 & 4 & 12 & 15 \end{bmatrix}$

(OR)

b) Show that every square matrix can be uniquely expressed as the sum of a Hermitian and Skew -Hermitian matrix.

13. a) Obtain Laplace transform of function $f(t) = \sinh at \sin (at)$.

(OR)

b) Find the inverse Laplace transform of $\frac{1}{(s+1)(s^2+1)}$

14. a) Evaluate Parseval's identity for Fourier series

(OR)

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

15. a) Evaluate $\int_{-3}^3 x^4 dx$ by using Trapezoidal rule

(OR)

b) Use Taylor's series method to find y for $x = 0.1$, correct to four places of decimal if y satisfies $\frac{dy}{dx} = x - y^2$ with $y_0 = 1, x_0 = 0$.

SECTION – C**(5 X 8 = 40 MARKS)****ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.****(K4 (Or) K5)**

16. a) Use Gauss divergence theorem to prove the following results.

$$(i) \iiint_v \nabla \phi ds = \iint_s \phi dS \quad (ii) \iiint_v \nabla \times F dV = \iint_s dS \times F$$

(OR)

b) State and prove Stoke's theorem in vector analysis.

17. a) Find the characteristic equation of the following matrix and verify the Cayley –

Hamilton theorem. $\begin{bmatrix} 1 & 2 & 3 \\ 2 & -1 & 4 \\ 3 & 1 & 1 \end{bmatrix}$

(OR)

b) Discuss the types of matrices with examples.

18. a) Use convolution theorem to find the functions whose Laplace transforms are

$$(i) \frac{1}{(s+a)(s+b)} \quad (ii) \frac{s^2}{(s^2+a^2)^2} \quad (iii) \frac{1}{(s^2+a^2)^2}$$

(OR)

b) Explain the properties of Laplace transform.

19. a) Discuss Dirichlet's theorem and conditions

(OR)

b) Discuss in detail the transformation of Beta function into other forms.

20. a) Use Runge Kutta method to find by (0.2) for the equation $\frac{dy}{dx} = \frac{y-x}{y+x}$, $y(0) = 1$, take

 $h = 0.2$

(OR)

b) Discuss the theory of Newton Raphson's method.