KAMARAJ COLLEGE (Autonomous)

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(Affiliated to Manonmaniam Sundaranar University, Tirunelveli)

(4 Pages) **Reg. No:……**

Question Code: 26O03309 **Course Code : 25PMPH11**

PG Degree - End Semester Examinations, November 2026

First Semester

M.Sc. PHYSICS

Mathematical Physics - I

(For those who joined in June 2025 onwards)

Time : 3Hours **Maximum : 75 Marks**

PART – A (10 × 1 = 10 Marks)

Answer ALL Questions

Choose the correct answer :

CO:1 1. Div curl A=

K:1 (a) 0 (b) -1

(c) 1 (d) 2

CO:1 2. Poisson's equation is

K:2 (a) $\nabla^2 \phi=\rho$ (b) $\nabla^2 \phi= -\rho/\varepsilon_0$

(c) $\nabla^2 \phi=\rho_0$ (d) $\nabla^2 \phi=\rho/\varepsilon_0$

CO:2 3. The value of $(A^T)^T$ =

K:1 (a) A^2 (b) A

(c) 0 (d) 1

CO:2 4. The trace of the matrix is

K:1 (a) Always zero (b) The sum of the all elements equals zero

(c) Always one (d) The sum of principal diagonal elements

CO:3 5. A connected open set is called as

K:1 (a) Set (b) Internal set

(c) Domain (d) None of these

CO:3 K:2 6. The function is said to be analytic if it must satisfy the

(a) Cauchy-Riemann condition

(b) Cauchy-Riemann condition at sometimes

(c) Cauchy-Riemann condition and its value is 1

(d) Cauchy-Riemann condition and the value is zero

CO:4 K:2 7. The sample spaces with constant probability are called

(a) Event (b) Uniform

(c) Non uniform (d) Conditional event

CO:4 K:1 8. The binomial distribution contains how many independent constants

(a) 2 (b) 1

(c) 0 (d) 3

CO:5 K:1 9. The Legendre polynomial $P_n(x)$ has

(a) N real zero between 0 and 1 (b) N is real

(c) N is imaginary (d) N is real and imaginery

CO:5 K:1 10. The value of $\Gamma 1/2$ is

(a) $\sqrt{\pi}$ (b) 0

(c) -1 (d) 1

PART – B (5 X 5 = 25 Marks)

Answer ALL Questions choosing either (a) or (b).
Answer should not exceed 250 words.

CO:1 K:3 11. (a) State and prove Gauss divergence theorem.

(OR)

(b) State and prove Stoke's divergence theorem.

CO:2 K:3 12. (a) Evaluate the inverse of matrix $A=\begin{bmatrix} 1 & -1 & 3 \\ -1 & 1 & 2 \\ 3 & 2 & -1 \end{bmatrix}$

(OR)

(b) Show that the given matrix $\begin{bmatrix} 1/\sqrt{2} & i/\sqrt{2} \\ -i/\sqrt{2} & -1/\sqrt{2} \end{bmatrix}$ is unitary.

CO:3 K:3 13. (a) Prove that $|z|$ is analytic or not.

(OR)

(b) State and prove Morera's theorem.

CO:4 K:4 14. (a) The probability of horse A winning the race is 1/5 and the probability of horse B winning the race is 1/6. What is the probability that one of the horse wins?

(OR)

(b) A box contains one pink and seven red pens. A pen is drawn from the box and after noting its colour, is put back into the box. Then the contents of the box are thoroughly mixed. Using the Poisson approximation, determine the probability that such drawings a pink pen is selected exactly 3 times.

CO:5 K:3 15. (a) Write the recurrence relation of Rodrigue's formula.

(OR)

(b) Obtain the generation function of Laugerre's polynomial.

PART – C (5 X 8 = 40 Marks)

Answer ALL Questions choosing either (a) or (b).
Answer should not exceed 600 words.

CO:1 K:3 16. (a) Prove that div (AXB) = B.curl A - A.curl B

(OR)

(b) State and prove Green's theorem.

CO:2 K:3 17. (a) Find the eigen values of the matrix $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \\ 0 & 1 & 0 \end{bmatrix}$.

(OR)

(b) Find the characteristic equation of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 2 & -1 & 4 \\ 3 & 1 & 1 \end{bmatrix}$ and verify the Cayley-Hamilton theorem

CO:3 K:3 18. (a) State and prove Laurent's theorem.

(OR)

(b) State and prove Taylor's theorem.

CO:4 K:4 19. (a) An experiment succeeds twice as often as it fails. Find the chance that in the next 6 trials there will be at least 4 successes.

(OR)

(b) The radius of a wire is measured in cm as 0.17, 0.15,0.18,0.19, 0.16, 0.15. Find the mean radius and the standard deviation.

CO:5 20. (a) Write any two orthogonal properties of Rodrigue's function.

K:4

(OR)

(b) Using gamma function, show that $\int_0^1 \frac{35x^2}{32\sqrt{1-x}}\, dx = 1$.