

N.G.M COLLEGE (AUTONOMOUS): POLLACHI
END-OF -SEMESTER EXAMINATIONS: APRIL 2026

B.Sc.- PHYSICS
SEMESTER: II

MAXIMUM. MARKS: 75
TIME: 3 HOURS

PART - III
ANCILLARY MATHEMATICS FOR PHYSICS - II

SECTION - A

(10 X 1 =10 MARKS)

ANSWER THE FOLLOWING QUESTIONS:
MULTIPLE CHOICE QUESTIONS.

K1

- e^z is a periodic function of period-----.
a) 2π b) -2π c) $2\pi i$ d) none
- $L^{-1}\left[\frac{1}{s}\right] =$ -----.
a) 0 b) 1 c) 2 d) ∞
- $\nabla c =$ -----.
a) 0 b) $-\infty$ c) 1 d) ∞
- $\nabla x \nabla \phi =$ -----.
a) $-\infty$ b) $+\infty$ c) 0 d) 1
- $\iint_S \vec{F} \cdot \vec{n} dS =$ -----.
a) $\iint_V \vec{F} \cdot dV$ b) $\iint_V \vec{n} \cdot dV$ c) $\iiint_V \nabla \cdot \vec{F} dV$ d) none

ANSWER THE FOLLOWING IN ONE OR TWO SENTENCES.

K2

- Write the formula for cos hz.
- Write the formula for $L^{-1}[\cos at]$.
- Define irrotational.
- Define conservative force.
- Define harmonic function.

SECTION- B (5X5=25 MARKS)

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

K3

11. a) Prove Euler's formula.

[OR]

b) Prove that $\cosh 2x = \frac{1 + \tanh^2 x}{1 - \tanh^2 x}$.

12. a) Prove that $L\{f'(t)\} = s\bar{f}(s) - f(0)$.

[OR]

b) Find the Laplace transform of $\{2t^2 e^{-t} - t + \cos 4t\}$.

(CONTD.....2)

13. a) Show that the vector $3x^2y\bar{i} - 4xy^2\bar{j} + 2xyz\bar{k}$ is solenoidal.

[OR]

b) Prove that $\text{div } \bar{r} = 3$ and $\text{curl } \bar{r} = 0$ where \bar{r} is the position vector of the point (x, y, z) .

14. a) If $\bar{F} = 3xy\bar{i} - y^2\bar{j}$, evaluate $\int_c \bar{F} \cdot d\bar{r}$ where c is the curve on the xy plane $y = 2x^2$ from $(0, 0)$ to $(1, 2)$.

[OR]

b) If $\bar{F} = yz\bar{i} + zx\bar{j} - xy\bar{k}$, find $\int_c \bar{F} \cdot d\bar{r}$ where c is given by $x = t, y = t^2, z = t^3$ from $P(0, 0, 0)$ to $Q(2, 4, 8)$.

15. a) Find the area of the ellipse $x = a \cos \theta, y = b \sin \theta$.

[OR]

b) Find the area between the parabola $y^2 = 4x$ and $x^2 = 4y$.

SECTION- C (5X8=40 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS. K4 & K5

16. a) Prove that $\cosh 2x + \sinh 2x = \frac{1 + \tanh x}{1 - \tanh x}$.

[OR]

b) If $\sin(A+iB) = x+iy$ prove that i) $\frac{x^2}{\cosh^2 x} + \frac{y^2}{\sinh^2 x} = 1$, ii) $\frac{x^2}{\sin^2 A} - \frac{y^2}{\cos^2 A} = 1$.

17. a) Find $L\left\{\frac{\sin^2 t}{t}\right\}$.

[OR]

b) Find the Laplace transform of $\left\{\frac{e^{3t} - e^{-2t}}{t}\right\}$.

18. a) If $\bar{r} = x\bar{i} + y\bar{j} + z\bar{k}$ show that $\nabla \times (r^n \bar{r}) = 0$.

[OR]

b) Prove that $\text{div } \frac{\bar{r}}{r} = \frac{2}{r}$.

19. a) If $\bar{F} = (3x^2+6y)\bar{i} - 14yz\bar{j} + 20xz\bar{k}$, find $\int_c \bar{F} \cdot d\bar{r}$ from $(0, 0, 0)$ to $Q(1, 1, 1)$ along with the path $x = t, y = t^2, z = t^3$.

[OR]

b) For the vector function $\bar{F} = 2xy\bar{i} + (x^2+2yz)\bar{j} + (y^2+1)\bar{k}$, determine the value of the integral $\int_c \bar{F} \cdot d\bar{r}$ around the unit circle with centre at the origin in the xy plane.

20. a) Find the area of the four leafed rose $r = 3 \sin 2\theta$.

[OR]

b) Compute $\int_c (xy - x^2) dx + x^2 y dy$ over the triangle bounded by the lines $y = 0, x = 1, y = x$ and verify Green's theorem.