(FOR THE CANDIDATES ADMITTED
DURING THE ACADEMIC YEAR 2024ONLY)

24UCY2A2

REG.NO. :

N.G.M.COLLEGE (AUTONOMOUS) : POLLACHI
END-OF-SEMESTER EXAMINATIONS :MAY-2025
B.Sc.-CHEMISTRY   MAXIMUM MARKS: 75
SEMESTER: II   TIME : 3 HOURS

PART - III

ANCILLARY MATHEMATICS FOR CHEMISTRY - II
SECTION – A
ANSWER THE FOLLOWING QUESTIONS: **(10 X 1 =10 MARKS)**

1. The Value of sin (ix) = -------.   [K1]
       a) i sin hx   b) sin hx   c) sin x   d) none
2. The formula for $L^{-1}\{f(s-a)\}$= -------.

    a) e^{at} f(t)   b) e^{-at} f(t)   c) $\dfrac{1}{e^{at}} f(t)$ d) $-\dfrac{1}{e^{at}} f(t)$

3. ∇c = ------- where c is a constant.
       a) 0   b) 1   c) c   d) none
4. $\nabla X \nabla\phi$ =--------.
     a) ∞ b) ϕ c) 0   d) 1
5. By Gauss Divergence theorem $\iint\limits_{S} \vec{F}.\vec{n}\,dS$ = ----------.

    a) $\iint\limits_{V} \nabla.\vec{F}\,dV$ b) $\iiint\limits_{V} \nabla.\vec{F}\,dV$ c) $\iint\limits_{S} \vec{\phi c}.\vec{n}\,dS$ d) none

ANSWER THE FOLLOWING IN ONE OR TWO SENTENCES.
6. Write the formula for cos hz.   [K2]
7. Find the inverse formula for cos hat.
8. Define irrotational vector.
9. Define line integral.
10. Define harmonic function.

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

11. a) If $\tan\dfrac{x}{2} = \tanh\dfrac{x}{2}$ show that cos x cosh x = 1.

                                (OR)
    b) Find the Laplace transform of $\{\sin^2 3t\}$.

12. a) Find the Laplace inverse of $\dfrac{10}{(s+2)^6}$.

                                (OR)

    b) Find $L^{-1}\left\{\dfrac{s+2}{(s-2)^7}\right\}$.   **(CONTD……….2)**

13. a) If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$ and r $= \left|\vec{r}\right|$ prove that $\nabla r = \dfrac{1}{r}\vec{r}$.

(OR)

b) If $\vec{F} = xz^3\hat{i} - 2xy\hat{j} + xz\hat{k}$ find div $\vec{F}$ and curl $\vec{F}$ at (1, 2, 0).

14. a) If $\vec{F} = yz\vec{i} + zx\vec{j} - xy\vec{k}$, find $\int_C \vec{F}.d\vec{r}$ where C is given by x = t, y = t², z = t³ from

P (0, 0, 0) to Q (2, 4, 8).

(OR)

b) Evaluate $\iint_S \vec{F}.\vec{n}\,ds$ where $\vec{F} = yz\vec{i} + zx\vec{j} + xy\vec{k}$, and S is the part of the surface of the

sphere $x^2 + y^2 + z^2 = 1$ which lies in the first octant.

15. a) Show that the area bounded by a closed curve C is given by $\dfrac{1}{2}\oint_C (xdy - ydx)$.

(OR)

b) Evaluate $\int_S (ax\vec{i} + by\vec{j} + cz\vec{k}).\vec{n}\,dS$ sphere where S is the surface of the sphere

$x^2 + y^2 + z^2 = 1$.

SECTION –C   (5X8 = 40 MARKS)
ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.

16. a) If $\tan\dfrac{x}{2} = \tanh\dfrac{y}{2}$ show that, sinh y = tan x and y = log tan $\left(\dfrac{\pi}{4} + \dfrac{x}{2}\right)$.   [K4]

(OR)

b) Find the Laplace transform of $\{\cos^3 t\}$.

17. a) Find $L^{-1}\left\{\dfrac{7s - 1}{(s+1)(s+2)(s+3)}\right\}$.   [K5]

(OR)

b) Find $L^{-1}\left\{\dfrac{2(s+1)}{(s^2 + 2s + 2)^2}\right\}$.

18. a) Show that $\vec{F} = (y^2 - z^2 + 3yz - 2x)\hat{i} + (3xz + 2xy)\hat{j} + (3xy - 2xz + 2z)\hat{k}$ is irrotational and
    solenoidal.   [K4]

(OR)

b) Prove that $\nabla.\left[\nabla r^n\right] = n(n+1)r^{n-2}$.

19. a) If $\vec{F} = (3x^2 + 6y)\vec{i} - 14yz\vec{j} + 20xz^2\vec{k}$ evaluate $\int \vec{F}.d\vec{r}$ from (0, 0, 0) to (1, 1, 1) along the
    following path x = t, y = t², z = t³.   [K5]

(OR)

b) Show that $\vec{F} = (2xy + z^3)\vec{i} + x^2\vec{j} + 3xz^2\vec{k}$ is a conservative vector field and find a

function ϕ such that $\vec{F} = \nabla\phi$. Also find the work done in moving an object in this field
from (1, -2, 1) to (3, 1, 4).

20. a) Verify Green's theorem in the plane for $\oint_C (xy + y^2)dx + x^2\,dy$ where C is the chord curve

of the region bounded by y = x and y = x².   [K4]

(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.

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