(FOR THE CANDIDATES ADMITTED DURING THE ACADEMIC YEAR 2022 ONLY)

22UCY2A2

REG.NO. :

N.G.M.COLLEGE (AUTONOMOUS) : POLLACHI
END-OF-SEMESTER EXAMINATIONS : MAY-2023

COURSE NAME: B.Sc.-CHEMISTRY **MAXIMUM MARKS: 50**
SEMESTER: II **TIME : 3 HOURS**

PART - III
ANCILLARY MATHEMATICS FOR CHEMISTRY - II

SECTION – A (10 X 1 =10 MARKS)

ANSWER THE FOLLOWING QUESTIONS.
MULTIPLE CHOICE QUESTIONS. [K1]

1. $L\{1\} =$ -------

   a) $\frac{1}{s}$ b) $-\frac{1}{s}$ c) s d) s^2

2. $L^{-1}\left(\frac{1}{s^2+a^2}\right) =$ -------

   a) sin at b) $\frac{\sin at}{a}$ c) $\frac{\cos at}{a}$ d) cos at

3. If $\vec{F}$ is solenoidal then $\nabla.\vec{F} =$ ------

   a) zero b) $\nabla^2 c$ c) constant d) one

4. $\nabla X\ \nabla\varphi$ = -------

   a) one b) infinity c) constant d) zero

5. A scalar function φ satisfying the condition $\nabla^2\varphi = 0$ is called the ------ function.

   a) harmonic b) differential c) integral d) Green's

ANSWER THE FOLLOWING IN ONE (OR) TWO SENTENCES. [K2]

6. Define hyperbolic function.
7. Write the Laplace inverse formula for $L^{-1}\left(\frac{s}{s^2-a^2}\right)$.
8. Define irrotational.
9. Define Line integral.
10. State Gauss divergence theorem.

SECTION –B (5 X 3 = 15 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS. [K3]

11. a) If sin $(\theta + i\varphi)$ = tan α + i sec α prove that $\cos 2\theta \cosh 2\phi = 3$.

(OR)

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

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

(OR)

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

(CONTD…..2)

13. a) If $\varphi(x,y,z)=x^2y+y^2x+z^2$ find $\nabla\varphi$ at the point (1, 1, 1).

(OR)

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

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

(OR)

b) Evaluate $\iiint_V \vec{F}\,dv$ where $\vec{F} = 2xz\,\vec{i} - x\,\vec{j} + y^2\,\vec{k}$ and V is the volume of the region enclosed by the cylinder $x^2 + y^2 = a$ between the planes z = 0, z = c.

15. a) Using divergence theorem, evaluate $\int_S \vec{F}\cdot\vec{n}\;dS$ where $\vec{F} = 4xz\,\vec{i} - y^2\,\vec{j} + yz\,\vec{k}$ and S is the Surface of the cube bounded by the planes x =0, x = 2, y = 0, y = 2, z = 0 and z =2.

(OR)

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

SECTION –C (5X5 = 25 MARKS)

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

16. a) Expand $\cosh^8\theta$ in terms of hyperbolic cosines of θ.

(OR) [K4]

b) Find the Laplace transform of the $\sin^3 2t$.

17. a) Using Laplace transform solve $\frac{d^2y}{dt^2}+5\frac{dy}{dt}+6y=e^{-t}$ given y = 0, $\frac{dy}{dt}=1$ when t = 0.

(OR) [K5]

b) Solve $\frac{d^2y}{dt^2}-4\frac{dy}{dt}+5y=4e^{3t}$ given y (0) = 2, y (0) = 7.

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.

(OR) [K4]

b) If $\vec{a}$ is a constant vector prove that div $\left[r^n(\vec{a}\,X\,\vec{r})\right]$=0.

19. a) Find the work done in moving a particle once round the ellipse $\frac{x^2}{25}+\frac{y^2}{16}=1, z=0$ under the field of force given by $\vec{F} = (2x-y+z)\vec{i} + (x+y-z^2)\vec{j} + (3x-2y+4z)\vec{k}$ is the field conservative?

(OR) [K5]

b) Evaluate $\iint_S \vec{F}\cdot\vec{n}\,dS$ where $\vec{F} = 18z\,\vec{i} - 12\,\vec{j} + 3y\,\vec{k}$ and S is the part of the plane 2x +3y + 6z= 12 which is located in the first quadrant.

20. a) Verify Green's theorem in the plane $\oint_C (xy+y^2)dx+x^2dy$ where C is the chord curve of the region bounded by y = x and $y = x^2$. (OR) [K4]

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

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