(NO. OF PAGES: 2)

(FOR THE CANDIDATES ADMITTED

DURING THE ACADEMIC YEAR 2023 ONLY)

23UCY2A2

REG.NO. :

N.G.M.COLLEGE (AUTONOMOUS) : POLLACHI

END-OF-SEMESTER EXAMINATIONS : MAY-2024

COURSE NAME: B.Sc.- CHEMISTRY **MAXIMUM MARKS: 75**

SEMESTER: II **TIME : 3 HOURS**

PART - III

ANCILLARY MATHEMATICS FOR CHEMISTRY - II

SECTION – A (10 X 1 =10 MARKS)

ANSWER ALL THE FOLLOWING QUESTIONS. [K1]

MULTIPLE CHOICE QUESTIONS.

1. tan ix = -----------.
   a) tanhx b) i tan hx c) – tan hx d) none
2. L{e^{-4t}}= --------.
   a) $\frac{1}{s+a}$ b) $\frac{1}{s-a}$ c) $\frac{a}{s-1}$ d) none
3. $\vec{F}.curl\vec{F}$ =---------.
   a) 0 b) 1 c) ∞ d) none
4. $\nabla X \nabla \phi$ --------.
   a) ∞ b) 1 c) 0 d) none
5. In Green's theorem the functions M and N are ----------.
   a) contant b) zero c) continuous d) none

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

6. Define inverse hyperbolic fucntion.
7. Write the formula for L^{-1} {cosh at}.
8. Define irotational.
9. Define surface integral.
10. State Green's theorem.

SECTION –B (5 X 5 = 25 MARKS)

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

11. a) Separate into real and imaginary parts of tan (x + iy).

(OR)

b) If tan $(\alpha+i\beta)$= $(x+iy)$ show that $x^2+y^2+ 2x \cot 2\alpha =1$.

12. a) Find $L^{-1}\left\{\frac{10}{(s+2)^6}\right\}$.

(OR)

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

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

(OR)

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

(CONTD……2)

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

(OR)

b) If $\vec{F} = yz\vec{i} + zx^2\vec{j} - zxy\vec{k}$ find $\int_C \vec{F}.\vec{dr}$ 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) Evaluate $\int_S (ax\vec{i} + by\vec{j} + cz\vec{k})\vec{n}\, dS$ where S is the surface of the sphere $x^2 + y^2 + z^2 = 1$.

(OR)

b) Using divergence theorem, evaluate $\int_S \vec{F}.\vec{n}\, dS$ 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, z = 2.

SECTION –C (5X8 = 40 MARKS)

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

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

[OR] [K5]

b) If tan y = tan αtanhβ, tan z = cot α tan h β, prove that tan (y + z) = sinh 2β cosec 2α.

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

[OR] [K4]

b) Find the Laplace transform of the $L\left\{\frac{s^2+9s+2}{(s-1)^2(s+2)}\right\}$..

18. a) If $\vec{F} = (xy^2)\hat{i} + (2x^2yz)\hat{j} - 3yz^2\hat{k}$ find div $\vec{F}$ and culr $\vec{F}$. What are these values at the point (1, -1, 1)?

[OR] [K5]

b) Find the value of 'a' such that $\overline{F} = (axy - z^2)\overline{i} + (x^2 + 2yz)\overline{j} + (y^2 - axz)\overline{k}$ is irrotational.

19. a) Find the circulation of $\vec{F}$ round the curve C where $\vec{F} = y\vec{i} + z\vec{j} + x\vec{k}$ and C is the circle $x^2 + y^2 = 1$ and z = 0.

[OR] [K5]

b) 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.

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 $y = x^2$.

[OR] [K4]

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

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