(FOR THE CANDIDATES ADMITTED

DURING THE ACADEMIC YEAR 2023 ONLY)

23UPS2A2

REG.NO. :

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

END-OF-SEMESTER EXAMINATIONS : MAY-2024

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

SEMESTER: II **TIME : 3 HOURS**

PART - III

ANCILLARY MATHEMATICS FOR PHYSICS – II

SECTION – A **(10 X 1 =10 MARKS)**

ANSWER ALL THE FOLLOWING QUESTIONS: [K1]

MULTIPLE CHOICE QUESTIONS.

1. cos ix = -----------.
   a) cos h x b) icoshx c) – coshx d) none
2. $L^{-1}\{\frac{1}{s}\}$= --------.
   a) 0 b) 1 c) $\frac{1}{s}$ d) none
3. If $\vec{A} X \vec{B}$ are irrotational then $\vec{A} X \vec{B}$ is ---------.
   a)irrational b) rational c) solenoidal d) none
4. If $\int_A^B \vec{F}.\vec{dr}$ =0 is independent of path then $\vec{F}$ is called------------.
   a)irrational b) solenoidal c)conservative d) none
5. In Green's theorem the function 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 function.
7. Write formula for L^{-1}\{cos at\}.
8. Define solenoidal.
9. Define line 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) If $\tan\frac{x}{2} = \tanh\frac{y}{2}$ prove that, sinh y = tan x and y = log tan $\left(\frac{\pi}{4}+\frac{x}{2}\right)$.

(OR)

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

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

(OR)

b) Find $L^{-1}\left\{\frac{s^2}{(s^2+4)(s^2+9)}\right\}$.

(CONTD…..2)

13. a) Find the value of a so that the vector $\vec{F}$ = (z+3y)$\vec{i}$ +(x-2z)$\vec{j}$ +(x+az)$\vec{k}$ is solenoidal.

(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) Evaluate $\iiint_v \nabla.\vec{F}\, dv$ if $\vec{F} = x^2\vec{i} + y^2\vec{j} + z^2\vec{k}$ and if v is the volume of the region enclosed by the cube $0 \le x \le 1, 0 \le y \le 1, 0 \le z \le 1$.

(OR)

b) 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).

15. a) 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.

(OR)

b) Show that $\iint_S \vec{r}.\vec{n}\, dS = 3V$ where V is the volume enclosed by the closed surface S.

SECTION –C (5X8 = 40 MARKS)

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

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

[OR] [K4]

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

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

[OR] **[**K5]

b) Show that $\bar{F} = (y^2 - z^2 + 3yz - 2x)\bar{i} + (3xz + 2xy)\bar{j} + (3xy - 2xz + 2z)\bar{k}$ is irrotational and solenoidal.

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

[OR] [K5]

b) Evaluate $\iint (y^2z\vec{i} + z^2x\vec{j} + x^2y\vec{k}).d\vec{S}$ where S is the surface of the sphere $x^2 + y^2 + z^2 = a^2$ lying in the positive octant.

20.a) Evaluate $\iint_S (y^2z^2\vec{i} + z^2x^2\vec{j} + z^2y^2\vec{k}).\vec{n}\, dS$ where S is the part of the sphere $x^2 + y^2 + z^2 = 1$ above the xy plane and bounded by the plane.

[OR] **[**K4]

b) Find $\iint_S \vec{F}.\vec{n}\, dS$ for the vector $\vec{F} = x\vec{i} - y\vec{j} + 2z\vec{k}$ over the sphere $x^2 + y^2 + (z-1)^2 = 1$.

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