SUB.CODE: 18UCH2A3A

REG.NO:

DHANALAKSHMI SRINIVASAN COLLEGE OF ARTS & SCIENCE FOR WOMEN (AUTONOMOUS)

(For Candidates admitted from 2020-2021 onwards)

UG DEGREE EXAMINATIONS -APRIL 2021

B.Sc., - CHEMISTRY

DIFFERENTIAL EQUATIONS, LAPLACE TRANSFORM AND VECTOR CALCULUS

Time: 3 Hrs **Max.Marks: 75**

PART - A

CHOOSE THE CORRECT ANSWER **(10X1=10)**

1. If $f(D) = D^2 - 2$, $\frac{1}{f(D)} e^{2x}$ is equal to

   a) $2e^{2x}$ b) e2x c) $\frac{1}{2} e^{2x}$ d) $\frac{1}{2}$

2. The particular integral of $(D^2+a^2)\ y = \sin ax$ is

   a) $\frac{-x}{2a} \cos ax$ b) $\frac{x}{2a} \cos ax$ c) $\frac{-ax}{2} \cos ax$ d) $\frac{ax}{2} \cos ax$

3. $L(f'(t))$ is

   a) S f(S) b) S F(S)-f(0) c) S^2 f(S) d) f(a)

4. Laplace transform of $\sqrt{t}$ is

   a) $\Gamma\frac{3}{2}$ b) $\frac{\Gamma(2/3)}{S^{2/3}}$ c) $\frac{1}{S^{3/2}}$ d) $\frac{\Gamma(3/2)}{S^{3/2}}$

5. Inverse Laplace transform of $(S+2)^{-2}$ is

   a) te^{-2t} b) t c) $t^2 e^{2t}$ d) 2te2t

6. $L^{-1}(\frac{1}{S^n})$ is possible only when n is

   a) Zero b) –ve integer c) +ve integer d) rational

7. A unit normal to $x^2+y^2+z^2 = 5$ at (0,1,2) is

   a) $\frac{1}{\sqrt{5}}(\vec{i}+2\vec{k})$ b) $\frac{2}{\sqrt{5}}(\vec{i}+\vec{j}+\vec{k})$ c) $\frac{1}{\sqrt{5}}(\vec{j}+2\vec{k})$ d) $\underset{2k}{\rightarrow}$

8. If $\vec{F}$ is solemoidal then $\nabla.\vec{F}$ is equal to

   a) Zero b) positive value c) negative value d) all

9. The line integral is along the curve C if C is a _____curve.

   a) Closed b) slide c) open d) slope

10. $\int_0^2 \int_0^x (x+y)dx\,dy =$

    a) 3 b) 2 c) 4 d) 5

PART- B

ANSWER ALL THE QUESTIONS **(5X7=35)**

11. a) Solve the equation $(D^2+2D+1)\, y = e^{-x} + 3$

(OR)

b) Solve $(D^2+9)\, y = (x^2+1)\, e^{3x}$

12. a) Find the Laplace transform of $f(t)$, where $f(t) = \begin{cases} e^t & 0 < t < 1 \\ 0 & t > 1 \end{cases}$

(OR)

b) Find L (sin3t cost)

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

(OR)

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

14. a) Find the directional derivative of $\varphi = xy + yz + zx$ in the direction of the vector $\vec{i} + 2\vec{j} + 2\vec{k}$ at (1,2,0)

(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)

15. a) Let $\vec{F} = (3x^2+6y)\,\vec{i} - 14\,yz\,\vec{j} + 20xz^2\,\vec{k}$. Evaluate $\int \vec{F}.\vec{dr}$ from (0,0,0) to (1,1,1) along the following path $x=t$, $y=t^2$, $z=t^3$

(OR)

b) If $\vec{F} = 2xz\,\vec{i} - x\,\vec{j} + y^2\,\vec{k}$ then evaluate $\iiint_V \vec{F}\,dv$ where V is the region bounded by the surface $x=0$, $y=0$, $y=6$, $z=x^2$ $z=4$.

PART-C

ANSWER ANY THREE QUESTIONS **(3X10=30)**

16. Solve the equation $(D^2+6D+8)\, y = e^{-2x} + \cos^2 x$

17. Find L $(e^{-3t} \sin^2 t + \sin^3 2t)$

18. Solve $\frac{d^2y}{dt^2} + 4\frac{dy}{dt} - 5y = 5$ given that y=0, $\frac{dy}{dt}$ =2 when t=0

19. Prove that $\nabla \times (\nabla \times \vec{F}) = \nabla(\nabla \cdot \vec{F}) - \nabla^2 \vec{F}$ where $\vec{F}$ is a vector point function.

20. Evaluate $\iint_S \varphi.\hat{n}\,ds$ where $\varphi = \frac{3}{8}xyz$ and S is the surface of the cylinder $x2 + y^2 = 16$ included in the first octant between z=0 and z=5.