SUB.CODE: 18UPH4A6

REG.NO:

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

(For Candidates admitted from 2019-2020 onwards)

UG DEGREE EXAMINATIONS APRIL - 2021

B.Sc., - PHYSICS

ODE, LAPLACE TRANSFORM AND FOURIER SERIES

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

PART - A

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

1. The complementary function of the equation $(D^2-4D+13)y=0$ is------.

   a) $e^{-2x}(A\cos 3x+B\sin 3x)$ b) $e^{2x}(A\cos 3x+B\sin 3x)$

   c) $e^{2x}(A\cos 3x-B\sin 3x)$ d) e^{2x}

2. The particular integral of $(D^2+16)y=\cos 4x$ is------.

   a) $\frac{x}{4}\sin 4x$ b) $\frac{x}{4}\cos 4x$ c) $\frac{x}{8}\sin 4x$ d) $\frac{x}{4}\cos x$

3. $L(e^{-at})$ is equal to------.

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

4. $L(\sinh at)$ is equal to -------.

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

5. $L^{-1}(\cosh at)$ is equal to -------.

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

6. $L^{-1}\left[\frac{1}{(s-a)^2}\right]$ is equal to -------.

   a) e^{at} b) te^{at} c) te^{-at} d) e^{-at}

7. The Fourier series for the function $f(x)=k,\ 0<x<2\pi$ then the constant a_0 is equal to------.

   a)2k b) 3k c) 2k-1 d) 0

8. The Fourier series expansion of $f(x)=x^3$ in $-\pi<x<\pi$ then the value of a_n is equal to------.

   a) -1 b) -2 c) 0 d) -4

9. The half range sine series in $(0,\pi)$ is-----.

   a) $f(x)=-\sum_{n=1}^{\infty}b_n\sin nx$ b) $f(x)=\sum_{n=1}^{\infty}b_n\sin nx$

   c) $f(x)=\sum_{n=1}^{\infty}a_n\sin nx$ d) $f(x)=\sin nx$

10. The half range sine series $f(x) = x$ in $(0, \pi)$ then b_n is equal to-----.

a) $\frac{2}{n^2}(-1)^{n+1}$ b) $\frac{2}{n}(-1)^n$ c) $\frac{2}{n}(-1)^{n+1}$ d) $\frac{2}{n}$

PART - B

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

11. a) Solve: $(D^2 - 3D - 4)y = e^{3x} + e^{-x}$.

(OR)

b)Solve: $(D^2 + 2D + 2)y = \sinh x$

12. a) Find $L(\sin^2 t \cos^3 t)$.

(OR)

b)Find $L(\cos^4 t)$.

13. a) Find $L^{-1}\left[\frac{5s^2 - 15s - 11}{(s+1)(s-2)^3}\right]$.

(OR)

b) Solve $(D^2 + D)y = t^2 + 2t$ where $y(0) = 4, y'(0) = -2$.

14. a) Express $f(x) = (\pi - x)^2$ as a Fourier series of period 2π in the interval $0 < x < 2\pi$.

(OR)

b) Expand $x(2\pi - x)$ as a Fourier series in $(0,2\pi)$.

15. a) Obtain the Fourier expansion of $x \sin x$ as a cosine series in $(0, \pi)$.

(OR)

b) Find a cosine series for the function $f(x) = \begin{cases} x \ \ in \ \ 0 \le x < \frac{\pi}{2} \\ \pi - x \ \ in \ \ \frac{\pi}{2} \le x < \pi \end{cases}$.

PART - C

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

16. Solve: $(D^2 + 9)y = (x^2 + 1)e^{3x}$.

17. Find the Laplace transform of (i) $t^2 e^{-2t}$ (ii) $e^{-t}(3\sinh t - 5\cosh 2t)$.

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. Find a Fourier series to represent $x - x^2$ in the interval $(0,2\pi)$.

20. Show that in $0 \le x \le \pi$, $x(\pi - x) = \frac{\pi^2}{6} - \left(\frac{\cos 2x}{1^2} + \frac{\cos 4x}{2^2} \frac{\cos 6x}{3^2} + \ldots\right)$.