

Modern Education Society's College Of Engineering, Pune-01
Department Of Mathematics
Multiple choice questions on Linear Differential Equations
Engineering Maths III

1 Homogeneous LDE

1. If the roots $m_1, m_2, m_3 \cdots m_n$ of auxillary equation $\phi(D) = 0$ are real and distinct, then distinct, then solution of $\phi(D)y = 0$ is (1)
- A. $c_1 e^{m_1 x} + c_2 e^{m_2 x} + \cdots + c_n e^{m_n x}$
 - B. $c_1 \cos m_1 x + c_2 \cos m_2 x + \cdots + c_n \cos m_n x$
 - C. $m_1 e^{c_1 x} + m_2 e^{c_2 x} + \cdots + m_n e^{c_n x}$
 - D. $c_1 \sin m_1 x + c_2 \sin m_2 x + \cdots + c_n \sin m_n x$

Solution:

2. If the roots $m_1, m_2, m_3 \cdots m_n$ of auxillary equation $\phi(D) = 0$ are real. If two of these roots are repeated say $m_1 = m_2$ and the remaining roots $m_3, m_4, \cdots m_n$ are distinct then solution of $\phi(D)y = 0$ is (1)
- A. $c_1 e^{m_1 x} + c_2 e^{m_2 x} + \cdots + c_n e^{m_n x}$
 - B. $c_1 \cos m_1 x + c_2 \cos m_2 x + \cdots + c_n \cos m_n x$
 - C. $(c_1 x + c_2) e^{m_1 x} + c_3 e^{m_3 x} + \cdots + c_n e^{m_n x}$
 - D. $c_1 \sin m_1 x + c_2 \sin m_2 x + \cdots + c_n \sin m_n x$

Solution:

3. If the roots $m_1, m_2, m_3 \cdots m_n$ of auxillary equation $\phi(D) = 0$ are real. If two of these roots are repeated say $m_1 = m_2 = m_3$ and the remaining roots $m_4, m_5, \cdots m_n$ are distinct then solution of $\phi(D)y = 0$ is (1)
- A. $c_1 e^{m_1 x} + c_2 e^{m_2 x} + \cdots + c_n e^{m_n x}$
 - B. $c_1 \cos m_1 x + c_2 \cos m_2 x + \cdots + c_n \cos m_n x$
 - C. $(c_1 x^2 + c_2 x + c_3) e^{m_1 x} + c_4 e^{m_4 x} + \cdots + c_n e^{m_n x}$
 - D. $c_1 \sin m_1 x + c_2 \sin m_2 x + \cdots + c_n \sin m_n x$

Solution:

4. If $m_1 = \alpha + i\beta$ and $m_2 = \alpha - i\beta$ are two complex roots of auxiliary equation of second order DE $\phi(D)y = 0$ then it's solution is, (1)
- A. $e^{\beta x}[c_1 \cos \alpha x + c_2 \sin \alpha x]$
 - B. $e^{\alpha x}[c_1 \cos \beta x + c_2 \sin \beta x]$
 - C. $c_1 e^{\alpha x} + c_2 e^{\beta x}$
 - D. $e^{\alpha x}[(c_1 x + c_2) \cos \beta x + (c_3 x + c_4) \sin \beta x]$

Solution:

5. The solution of differential equation $\frac{d^2 y}{dx^2} - 5 \frac{dy}{dx} + 6y = 0$ is, (1)
- A. $c_1 e^{2x} + c_2 e^{3x}$
 - B. $c_1 e^{-2x} + c_2 e^{3x}$
 - C. $c_1 e^{2x} + c_2 e^{-3x}$
 - D. $c_1 e^{-2x} + c_2 e^{-3x}$

Solution:

6. The solution of differential equation $\frac{d^2 y}{dx^2} - 5 \frac{dy}{dx} - 6y = 0$ is, (1)
- A. $c_1 e^{-x} + c_2 e^{6x}$
 - B. $c_1 e^x + c_2 e^{-6x}$
 - C. $c_1 e^{2x} + c_2 e^{-3x}$
 - D. $c_1 e^{-2x} + c_2 e^{-3x}$

Solution:

7. The solution of differential equation $2 \frac{d^2 y}{dx^2} - \frac{dy}{dx} - 10y = 0$ is, (1)
- A. $c_1 e^{2x} + c_2 e^{\frac{5x}{2}}$
 - B. $c_1 e^{-2x} + c_2 e^{\frac{5x}{2}}$
 - C. $c_1 e^{2x} + c_2 e^{-\frac{5x}{2}}$

D. $c_1e^{-2x} + c_2e^{\frac{-5x}{2}}$

Solution:

8. The solution of differential equation $\frac{d^2y}{dx^2} - 4y = 0$ is, (1)
- A. $(c_1x + c_2)e^{2x}$
 - B. $c_1e^{-4x} + c_2e^{4x}$
 - C. $c_1 \cos 2x + c_2 \sin 2x$
 - D. $c_1e^{-2x} + c_2e^{2x}$

Solution:

9. The solution of differential equation $\frac{d^2y}{dx^2} - \frac{dy}{dx} - 2y = 0$ is, (1)
- A. $c_1e^{2x} + c_2e^x$
 - B. $c_1e^{-2x} + c_2e^x$
 - C. $c_1e^{2x} + c_2e^{-x}$
 - D. $c_1e^{-2x} + c_2e^{-x}$

Solution:

10. The solution of differential equation $2\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 3y = 0$ is, (1)
- A. $c_1e^x + c_2e^{\frac{3x}{2}}$
 - B. $c_1e^{-2x} + c_2e^{-3x}$
 - C. $c_1e^x + c_2e^{-\frac{3x}{2}}$
 - D. $c_1e^{\frac{x}{2}} + c_2e^{\frac{3x}{2}}$

Solution:

11. The solution of differential equation $4\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + y = 0$ is, (1)
- A. $c_1e^{\frac{x}{2}} + c_2e^{-\frac{x}{2}}$
 - B. $(c_1x + c_2)e^{-2x}$

C. $c_1 \cos 2x + c_2 \sin 2x$

D. $(c_1x + c_2)e^{\frac{x}{2}}$

Solution:

12. The solution of differential equation $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = 0$ is, (1)

A. $c_1e^{\frac{x}{2}} + c_2e^{-\frac{x}{2}}$

B. $(c_1x + c_2)e^{-2x}$

C. $c_1 \cos 2x + c_2 \sin 2x$

D. $(c_1x + c_2)e^{\frac{x}{2}}$

Solution:

13. The solution of differential equation $\frac{d^3y}{dx^3} - 7\frac{dy}{dx} - 6y = 0$ is, (1)

A. $c_1e^x + c_2e^{2x} + c_3e^{3x}$

B. $c_1e^{-x} + c_2e^{-2x} + c_3e^{6x}$

C. $c_1e^{-x} + c_2e^{2x} + c_3e^x$

D. $c_1e^{-x} + c_2e^{-2x} + c_3e^{3x}$

Solution:

14. The solution of differential equation $\frac{d^3y}{dx^3} + 2\frac{d^2y}{dx^2} + \frac{dy}{dx} = 0$ is, (1)

A. $c_1e^x + (c_2x + c_3)e^{2x}$

B. $c_1e^x + c_2e^{2x} + c_3e^{3x}$

C. $(c_2x + c_3)e^{-x}$

D. $c_1e^{-x} + (c_2x + c_3)e^{-2x}$

Solution:

15. The solution of differential equation $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = 0$ is, (1)

A. $c_1e^{2x} + c_2e^x$

- B. $c_1e^x + c_2e^{-x}$
- C. $(c_1x + c_2)e^{-x}$
- D. $(c_1x + c_2)e^x$

Solution:

16. The solution of differential equation $\frac{d^2y}{dx^2} + 6\frac{dy}{dx} + 9y = 0$ is, (1)

- A. $c_1e^{-6x} + c_2e^{-9x}$
- B. $(c_1x + c_2)e^{-3x}$
- C. $(c_1x + c_2)e^{3x}$
- D. $c_1e^{3x} + c_2e^{2x}$

Solution:

17. The solution of differential equation $\frac{d^2y}{dx^2} + y = 0$ is, (1)

- A. $c_1e^x + c_2e^{-x}$
- B. $(c_1x + c_2)e^{-x}$
- C. $c_1 \cos x + c_2 \sin x$
- D. $e^x(c_1 \cos x + c_2 \sin x)$

Solution:

18. The solution of differential equation $\frac{d^2y}{dx^2} + 6\frac{dy}{dx}y + 10y = 0$ is, (1)

- A. $e^{-3x}(c_1 \cos x + c_2 \sin x)$
- B. $e^x(c_1 \cos 3x + c_2 \sin 3x)$
- C. $c_1e^{5x} + c_2e^{2x}$
- D. $e^x(c_1 \cos x + c_2 \sin x)$

Solution:

19. The solution of differential equation $\frac{d^2y}{dx^2} + \frac{dy}{dx}y + y = 0$ is, (1)

- A. $e^x(c_1 \cos x + c_2 \sin x)$
- B. $e^{x/2} \left(c_1 \cos\left(\frac{3x}{2}\right) + c_2 \sin\left(\frac{3x}{2}\right) \right)$
- C. $e^{-x/2} \left(c_1 \cos\left(\frac{\sqrt{3}}{2}x\right) + c_2 \sin\left(\frac{\sqrt{3}}{2}x\right) \right)$
- D. $e^x(c_1 \cos x + c_2 \sin x)$

Solution:

20. The solution of differential equation $\frac{d^3y}{dx^3} + 6\frac{d^2y}{dx^2} + 11\frac{dy}{dx} + 6y = 0$ (1)
- A. $c_1e^x + c_2e^{2x} + c_3e^{3x}$
 - B. $c_1e^{-x} + c_2e^{-2x} + c_3e^{-3x}$
 - C. $c_1e^{-x} + c_2e^{2x} + c_3e^{3x}$
 - D. $c_1e^{-x} + c_2e^{-2x} + c_3e^{3x}$

Solution:

21. The solution of differential equation $\frac{d^3y}{dx^3} + 5\frac{d^2y}{dx^2} + 8\frac{dy}{dx} - 4y = 0$ (1)
- A. $c_1e^x + (c_2x + c_3)e^{2x}$
 - B. $c_1e^{-x} + c_2e^{-2x} + c_3e^{-3x}$
 - C. $c_1e^{-x} + c_2e^{2x} + c_3e^{3x}$
 - D. $c_1e^{-x} + (c_2x + c_3)e^{-2x}$

Solution:

22. The solution of differential equation $\frac{d^3y}{dx^3} + 2\frac{d^2y}{dx^2} + \frac{dy}{dx} = 0$ (1)
- A. $c_1 + (c_2x + c_3)e^x$
 - B. $c_1 + (c_2x + c_3)e^{-x}$
 - C. $(c_2x + c_3)e^{-x}$
 - D. $c_1 + c_2e^x + c_3e^{-x}$

Solution:

23. The solution of differential equation $\frac{d^3y}{dx^3} + 2\frac{d^2y}{dx^2} + \frac{dy}{dx} = 0$ (1)
- A. $c_1 + (c_2x + c_3)e^x$
 - B. $c_1 + (c_2x + c_3)e^{-x}$
 - C. $(c_2x + c_3)e^{-x}$
 - D. $c_1 + c_2e^x + c_3e^{-x}$

Solution:

24. The solution of differential equation $\frac{d^3y}{dx^3} - 4\frac{dy}{dx} = 0$ (1)
- A. $c_1e^{2x} + c_2e^{-2x}$
 - B. $c_1e^x + c_2e^{-2x} + c_3e^{-3x}$
 - C. $c_1 + c_2e^{2x} + c_3e^{2x}$
 - D. $c_1 + c_2 \cos 2x + c_3 \sin 2x$

Solution:

25. The solution of differential equation $\frac{d^3y}{dx^3} + y = 0$ (1)
- A. $c_1e^x + e^x \left(c_2 \cos\left(\frac{3x}{2}\right) + c_3 \sin\left(\frac{3x}{2}\right) \right)$
 - B. $c_1e^x + e^{x/2} \left(c_2 \cos\left(\frac{x}{2}\right) + c_3 \sin\left(\frac{x}{2}\right) \right)$
 - C. $c_1e^x + e^{-x/2} \left(c_2 \cos\left(\frac{x}{2}\right) + c_3 \sin\left(\frac{x}{2}\right) \right)$
 - D. $c_1e^{-x} + e^{x/2} \left(c_2 \cos\left(\frac{x}{2}\right) + c_3 \sin\left(\frac{x}{2}\right) \right)$

Solution:

26. The solution of differential equation $\frac{d^3y}{dx^3} + \frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 12y = 0$ (1)
- A. $c_1e^{-3x} + e^x \left(c_2 \cos(\sqrt{3}x) + c_3 \sin(\sqrt{3}x) \right)$

- B. $c_1 e^{-3x} + (c_2 \cos(\sqrt{3}x) + c_3 \sin(\sqrt{3}x))$
 C. $c_1 e^{3x} + e^{-x} (c_2 \cos(\sqrt{3}x) + c_3 \sin(\sqrt{3}x))$
 D. $c_1 e^{-x} + c_2 e^{-\sqrt{3}x} + c_3 e^{\sqrt{3}x}$

Solution:

27. The solution of differential equation $(D^3 - D^2 + 3D + 5)y = 0$ where $D \equiv \frac{d}{dx}$ is, (1)
- A. $c_1 e^{-x} + e^x (c_2 \cos(2x) + c_3 \sin(2x))$
 B. $c_1 e^{-x} + (c_2 \cos(2x) + c_3 \sin(2x))$
 C. $c_1 e^x + e^{-x} (c_2 \cos(2x) + c_3 \sin(2x))$
 D. $c_1 e^{-x} + c_2 e^{2x} + c_3 e^{-3x}$

Solution:

28. The solution of differential equation $(D^3 - D^2 + 4D - 4)y = 0$ where $D \equiv \frac{d}{dx}$ is (1)
- A. $(c_1 + c_2 x)e^{-2x} + c_3 e^{-x}$
 B. $c_1 e^x + c_2 \cos 4x + c_3 \sin 4x$
 C. $c_1 e^x + c_2 \cos 2x + c_3 \sin 2x$
 D. $c_1 e^x + c_2 e^{2x} + c_3 e^{-2x}$

Solution:

29. The solution of differential equation $(D^4 - 1)y = 0$ where $D \equiv \frac{d}{dx}$ is (1)
- A. $(c_1 + c_2 x)e^{-x} + c_3 \cos x + c_4 \sin x$
 B. $(c_1 + c_2 x + c_3 x^2 + c_4 x^3)e^x$
 C. $c_1 e^x + c_2 e^{-x} + c_3 \cos x + c_4 \sin x$
 D. $(c_1 x + c_2) \cos x + (c_3 x + c_4) \sin x$

Solution:

30. The solution of differential equation $(D^4 + 2D^2 + 1)y = 0$, where $D \equiv \frac{d}{dx}$ is (1)
- A. $(c_1 + c_2 x)e^{-x} + c_3 \cos x + c_4 \sin x$

- B. $(c_1 + c_2x + c_3x^2 + c_4x^3)e^x$
- C. $c_1e^x + c_2e^{-x} + c_3 \cos x + c_4 \sin x$
- D. $(c_1x + c_2) \cos x + (c_3x + c_4) \sin x$

Solution:

31. The solution of differential equation $(D^2 + 9)^2y = 0$, where $D \equiv \frac{d}{dx}$ is (1)
- A. $(c_1 + c_2x)e^{-x} + c_3 \cos x + c_4 \sin x$
 - B. $(c_1 + c_2x + c_3x^2 + c_4x^3)e^{3x}$
 - C. $(c_1x + c_2) \cos 9x + (c_3x + c_4) \sin 9x$
 - D. $(c_1x + c_2) \cos 3x + (c_3x + c_4) \sin 3x$

Solution:

32. The solution of differential equation $(D^4 + 8D^2 + 16)y = 0$, where $D \equiv \frac{d}{dx}$ is (1)
- A. $c_1e^{2x} + c_2e^{-x} + c_3e^x + c_4e^{-2x}$
 - B. $(c_1x + c_2)e^{2x} + (c_3x + c_4)e^{-2x}$
 - C. $(c_1x + c_2) \cos 4x + (c_3x + c_4) \sin 4x$
 - D. $(c_1x + c_2) \cos 2x + (c_3x + c_4) \sin 2x$

Solution:

33. The solution of differential equation $(D^6 + 6D^4 + 9D^2)y = 0$, where $D \equiv \frac{d}{dx}$ is (1)
- A. $c_1x + c_2 + (c_3x + c_4) \cos(\sqrt{3}x) + (c_5x + c_6) \sin(\sqrt{3}x)$
 - B. $c_1x + c_2 + (c_3x + c_4) \cos 3x + (c_5x + c_6) \sin 3x$
 - C. $(c_1x + c_2) \cos 4x + (c_3x + c_4) \sin 4x$
 - D. $c_1x + c_2 + (c_3x + c_4)e^{[\sqrt{3}x]}$

Solution:

34. The solution of differential equation $\frac{d^3y}{dx^3} - 7\frac{dy}{dx} - 6y = 0$ (1)
- A. $c_1e^x + c_2e^{2x} + c_3e^{3x}$

B. $c_1e^{-x} + c_2e^{-2x} + c_3e^{-3x}$

C. $c_1e^{-x} + c_2e^{2x} + c_3e^{3x}$

D. $c_1e^{-x} + c_2e^{-2x} + c_3e^{3x}$

Solution:

35. The solution of differential equation $\frac{d^3y}{dx^3} + 2\frac{d^2y}{dx^2} + \frac{dy}{dx} = 0$ (1)

A. $c_1 + (c_2x + c_3)e^x$

B. $c_1 + (c_2x + c_3)e^{-x}$

C. $(c_2x + c_3)e^{-x}$

D. $c_1 + c_2e^x + c_3e^{-x}$

Solution:

36. The solution of differential equation $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = 0$ (1)

A. $c_1e^x + c_2e^{2x}$

B. $c_1e^{-x} + c_2e^{-x}$

C. $(c_1x + c_2)e^x$

D. $(c_1x + c_2)e^{-x}$

Solution:

37. The solution of differential equation $\frac{d^2y}{dx^2} + 9y = 0$ (1)

A. $c_1 \cos 3x + c_2 \sin 3x$

B. $c_1e^{-3x} + c_2e^{3x}$

C. $(c_1x + c_2)e^{-3x}$

D. $c_1 \cos 2x + c_2 \sin 2x$

Solution:

38. If $m_1 = \alpha + i\beta$ and $m_2 = \alpha - i\beta$ of auxiliary equation of fourth order DE $\phi(D)y = 0$ are repeated twice then it's solution is, (1)

- A. $e^{\beta x}[c_1 \cos \alpha x + c_2 \sin \alpha x]$
- B. $e^{\alpha x}[(c_1 x + c_2) \cos \beta x + (c_3 x + c_4) \sin \beta x]$
- C. $(c_1 x + c_2)e^{\alpha x} + (c_3 x + c_4)e^{\beta x}$
- D. $e^{\alpha x}[c_1 \cos \beta x + c_2 \sin \beta x]$

Solution:

2 Short Cut Method for Nonhomogeneous LDE

39. Particular integral of linear differential equation with constant coefficient $\phi(D)y = f(x)$ is given by, (1)

- A. $\frac{1}{\phi(D)}f(x)$
- B. $\frac{1}{\phi(D)f(x)}$
- C. $\phi(D)\frac{1}{f(x)}$
- D. $\frac{1}{\phi(D^2)}f(x)$

Solution:

40. $\frac{1}{D+m}f(x)$, where $D \equiv \frac{d}{dx}$ and m is constant, is equal to (1)

- A. $e^{-mx} \int e^{mx} dx$
- B. $\int e^{mx} f(x) dx$
- C. $e^{mx} \int e^{-mx} f(x) dx$
- D. $e^{-mx} \int e^{mx} f(x) dx$

Solution:

41. $\frac{1}{D-m}f(x)$, where $D \equiv \frac{d}{dx}$ and m is constant, is equal to (1)

- A. $e^{mx} \int e^{-mx} dx$
- B. $\int e^{mx} f(x) dx$
- C. $e^{mx} \int e^{-mx} f(x) dx$
- D. $e^{-mx} \int e^{mx} f(x) dx$

Solution:

42. Particular integral $\frac{1}{\phi(D)}e^{ax}$, where $D \equiv \frac{d}{dx}$ and $\phi(a) \neq 0$ is, (1)

A. $\frac{1}{\phi(-a)}e^{ax}$

B. $x\frac{1}{\phi(a)}e^{ax}$

C. $\frac{1}{\phi(a^2)}e^{ax}$

D. $\frac{1}{\phi(a)}e^{ax}$

Solution:

43. Particular integral $\frac{1}{\phi(D-a)^r}e^{ax}$, where $D \equiv \frac{d}{dx}$ is, (1)

A. $\frac{1}{r!}e^{ax}$

B. $\frac{x^r}{r}e^{ax}$

C. $\frac{x^r}{r!}e^{ax}$

D. $x^r e^{ax}$

Solution:

44. Particular integral $\frac{1}{\phi(D^2)}\sin(ax+b)$, where $D \equiv \frac{d}{dx}$ and $\phi(-a^2) \neq 0$ is, (1)

A. $\frac{1}{\phi(-a^2)}\cos(ax+b)$

B. $\frac{1}{\phi(-a^2)}\sin(ax+b)$

C. $x\frac{1}{\phi(-a^2)}\sin(ax+b)$

D. $\frac{1}{\phi(a^2)}\sin(ax+b)$

Solution:

45. Particular integral $\frac{1}{\phi(D^2)} \sin(ax + b)$, where $D \equiv \frac{d}{dx}$ and $\phi(-a^2) = 0, \phi'(-a^2) \neq 0$ is, (1)

A. $x \frac{1}{\phi'(-a^2)} \cos(ax + b)$

B. $x \frac{1}{\phi'(-a^2)} \sin(ax + b)$

C. $\frac{1}{\phi(-a^2)} \sin(ax + b)$

D. $\frac{1}{\phi'(-a^2)} \sin(ax + b)$

Solution:

46. Particular integral $\frac{1}{\phi(D^2)} \cos(ax + b)$, where, $D \equiv \frac{d}{dx}$ and $\phi(-a^2) \neq 0$ is, (1)

A. $\frac{1}{\phi(-a^2)} \cos(ax + b)$

B. $\frac{1}{\phi(-a^2)} \sin(ax + b)$

C. $x \frac{1}{\phi(-a^2)} \cos(ax + b)$

D. $\frac{1}{\phi(a^2)} \cos(ax + b)$

Solution:

47. Particular integral $\frac{1}{\phi(D^2)} \cos(ax + b)$, where, $D \equiv \frac{d}{dx}$ and $\phi(-a^2) = 0, \phi'(-a^2) \neq 0$ is, (1)

A. $x \frac{1}{\phi'(-a^2)} \cos(ax + b)$

B. $x \frac{1}{\phi'(-a^2)} \sin(ax + b)$

C. $\frac{1}{\phi(-a^2)} \cos(ax + b)$

D. $\frac{1}{\phi'(-a^2)} \cos(ax + b)$

Solution:

48. Particular integral $\frac{1}{\phi(D^2)} \sinh(ax + b)$, where, $D \equiv \frac{d}{dx}$ and $\phi(-a^2) \neq 0$ is, (1)

A. $\frac{1}{\phi(-a^2)} \cosh(ax + b)$

B. $\frac{1}{\phi(-a^2)} \sinh(ax + b)$

C. $x \frac{1}{\phi(-a^2)} \sinh(ax + b)$

D. $\frac{1}{\phi(a^2)} \sinh(ax + b)$

Solution:

49. Particular integral $\frac{1}{\phi(D^2)} \cosh(ax + b)$, where, $D \equiv \frac{d}{dx}$ and $\phi(-a^2) \neq 0$ is, (1)

A. $\frac{1}{\phi(-a^2)} \cosh(ax + b)$

B. $\frac{1}{\phi(-a^2)} \sinh(ax + b)$

C. $x \frac{1}{\phi(-a^2)} \sinh(ax + b)$

D. $\frac{1}{\phi(a^2)} \cosh(ax + b)$

Solution:

50. Particular integral $\frac{1}{\phi(D^2)} e^{ax} V$, where V ia any function of x and $D \equiv \frac{d}{dx}$ is, (1)

A. $e^{ax} \frac{1}{\phi(D - a)} V$

B. $e^{ax} \frac{1}{\phi(a)} V$

C. $e^{ax} \frac{1}{\phi(D + a)} V$

D. $\frac{1}{\phi(D + a)} V$

Solution:

51. Particular integral $\frac{1}{D+1}e^{e^x}$, where $D \equiv \frac{d}{dx}$ is, (1)
- A. $e^{-x}e^{e^x}$
 - B. e^{e^x}
 - C. $e^xe^{e^x}$
 - D. $e^{-2x}e^{e^x}$

Solution:

52. Particular integral $\frac{1}{D+1}\sin e^x$, where $D \equiv \frac{d}{dx}$ is, (1)
- A. $-e^{-x}\sin e^x$
 - B. $e^{-x}\cos e^x$
 - C. $e^x\cos e^x$
 - D. $-e^{-x}\cos e^x$

Solution:

53. Particular integral $\frac{1}{D+2}e^{-x}\cos e^x$, where $D \equiv \frac{d}{dx}$ is, (1)
- A. $e^{-x}\cos e^x$
 - B. $e^{-x}\sin e^x$
 - C. $e^{-2x}\cos e^x$
 - D. $e^{-2x}\sin e^x$

Solution:

54. Particular integral $\frac{1}{D+2}e^{-2x}\sec^2 x(1+2\tan x)$, where (use $\tan x = t$) and $(D \equiv \frac{d}{dx})$ is, (1)
- A. $e^{-2x}(1+\tan^2 x)$
 - B. $e^{-2x}(\tan x + \tan^2 x)$
 - C. $e^{2x}(\tan x + 2\tan^2 x)$
 - D. $e^{-2x}(\tan x + \sec x)$

Solution:

55. Particular integral $\frac{1}{D+1}\left(\frac{1}{1+e^x}\right)$, where $D \equiv \frac{d}{dx}$ is, (1)
- A. $e^x \log(1 - e^x)$
 - B. $\log(1 + e^x)$
 - C. $e^x \log(1 + e^x)$
 - D. $e^{-x} \log(1 + e^x)$

Solution:

56. Particular integral of differential equation $\frac{d^2y}{dx^2} - 7\frac{dy}{dx} + 6y = e^{2x}$ is (1)
- A. $-\frac{xe^{2x}}{3}$
 - B. $\frac{e^{2x}}{4}$
 - C. $-\frac{e^{2x}}{4}$
 - D. $\frac{e^{2x}}{24}$

Solution:

57. Particular integral $(D^2 + 4D + 3)y = e^{-3x}$, where $D \equiv \frac{d}{dx}$ is, (1)
- A. xe^{-3x}
 - B. $-\frac{1}{2}e^{-3x}$
 - C. $-\frac{x}{2}e^{-3x}$
 - D. $-\frac{x}{10}e^{-3x}$

Solution:

58. Particular integral $(D^2 - 5D + 6)y = 3e^{5x}$ is, (1)

- A. $\frac{e^{5x}}{2}$
- B. $\frac{e^{5x}}{6}$
- C. $-\frac{e^{5x}}{14}$
- D. $-\frac{e^{2x}}{2}$

Solution:

59. Particular integral of differential equation $(D^3 + D)y = \cos x$ is, (1)

- A. $-\frac{x}{2} \sin x$
- B. $\frac{x}{4} \cos x$
- C. $-\frac{1}{2} \cos x$
- D. $-\frac{x}{2} \cos x$

Solution:

60. Particular integral of differential equation $(D^2 + 1)y = \sin x$ is, (1)

- A. $-\frac{x}{2} \cos x$
- B. $-\frac{x}{4} \cos x$
- C. $-\frac{x}{2} \sin x$
- D. $-\frac{1}{2} \cos x$

Solution:

61. Particular integral of differential equation $(D^3 + 9D)y = \sin 3x$ is, (1)

- A. $-\frac{x}{18} \cos 3x$
- B. $-\frac{x}{18} \sin 3x$
- C. $-x \sin 3x$

D. $-\frac{1}{18} \sin 3x$

Solution:

62. Particular integral of differential equation $(D^4 + 10D^2 + 9)y = \sin 2x + \cos 4x$ is, (1)

A. $-\frac{1}{23} \sin 2x - \frac{1}{105} \cos 4x$

B. $\frac{1}{15} \sin 2x + \cos 4x$

C. $-\frac{1}{15} \sin 2x + \frac{1}{105} \cos 4x$

D. $-\frac{1}{15} \sin 2x + \frac{1}{87} \cos 4x$

Solution:

63. Particular integral of differential equation $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 5y = 10 \sin x$ is, (1)

A. $\frac{8}{3} \sin x$

B. $\sin x - 2 \cos x$

C. $4 \sin x + 2 \cos x$

D. $2 \sin x + \cos x$

Solution:

64. Particular integral of differential equation $\frac{d^3y}{dx^3} - 4\frac{dy}{dx} = 2 \cosh 2x$ is, (1)

A. $\frac{1}{4} \cosh 2x$

B. $\frac{x}{8} \cosh 2x$

C. $\frac{x}{4} \cosh 2x$

D. $\frac{x}{4} \sinh 2x$

Solution:

65. Particular integral of differential equation $(D^2 + 6D - 9)y = 2 \sinh 3x$ is, (1)
- A. $\frac{1}{18} \cosh 3x$
 - B. $\frac{1}{2} \cosh 3x$
 - C. $\frac{1}{18} \sinh 3x$
 - D. $-\frac{1}{18} \cosh 3x$

Solution:

66. Particular integral of differential equation $(D^4 + D^2 + 1)y = 53x^2 + 17$ is, (1)
- A. $53x^2 + 17$
 - B. $53x^2 - 89$
 - C. $53x^2 + 113$
 - D. $3x^2 - 17$

Solution:

67. Particular integral of differential equation $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = e^{-x} \cos x$ is, (1)
- A. $e^x \cos x$
 - B. $-e^{-x} \sin x$
 - C. $-e^{-x} \cos x$
 - D. $(c_1x + c_2)e^{-x}$

Solution:

68. Particular integral of differential equation $(D^2 - D + 1)y = 3x^2 - 1$ is, (1)
- A. $3x^2 + 6x + 5$
 - B. $x^2 - 6x + 1$
 - C. $3x^2 + 6x - 1$

D. $x^2 + 18x - 11$

Solution:

69. Particular integral of differential equation $(D^2 + 2D + 1)y = e^{-x}(1 + x^2)$ is, (1)

A. $e^{-x}\left(\frac{x^2}{2} - \frac{x^4}{12}\right)$

B. $e^{-x}\left(x + \frac{x^3}{3}\right)$

C. $e^{-x}\left(\frac{x^2}{2} + \frac{x^4}{12}\right)$

D. $\left(\frac{x^2}{2} + \frac{x^4}{12}\right)$

Solution:

70. Solution of differential equation $(D^2 + 1)y = x$ is, (1)

A. $c_1 \cos x + c_2 \sin x - x$

B. $c_1 \cos x + c_2 \sin x + x$

C. $c_1 \cos x + c_2 \sin x + 2x$

D. $c_1 \cos x + c_2 \sin x - 2x$

Solution:

71. Particular integral of differential equation $(D^2 - 1)y = x^3$ is, (1)

A. $-x^3 + 6x$

B. $x^2 + 6$

C. $x^3 + 6x$

D. $-x^3 - 6x$

Solution:

72. Particular integral of differential equation $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = xe^x \sin x$ is, (1)

A. $-e^x(x \sin x + 2 \cos x)$

- B. $e^x(x \sin x - 2 \cos x)$
- C. $(x \sin x + 2 \cos x)$
- D. $-e^x(x \sin x + 2 \cos x)$

Solution:

73. Solution of differential equation $\frac{d^2y}{dx^2} + \frac{dy}{dx} + y = e^{2x}$ is, (1)

- A. $e^x(c_1 \cos \frac{\sqrt{3}}{2}x + c_2 \sin \frac{\sqrt{3}}{2}x) - \frac{1}{7}e^{2x}$
- B. $e^{\frac{x}{2}}(c_1 \cos \frac{\sqrt{3}}{2}x + c_2 \sin \frac{\sqrt{3}}{2}x) + \frac{1}{5}e^{2x}$
- C. $e^{-\frac{x}{2}}(c_1 \cos \frac{1}{2}x + c_2 \sin \frac{1}{2}x) + \frac{1}{7}e^{2x}$
- D. $e^{-\frac{x}{2}}(c_1 \cos \frac{\sqrt{3}}{2}x + c_2 \sin \frac{\sqrt{3}}{2}x) + \frac{1}{7}e^{2x}$

Solution:

74. Particular integral $(D^4 + 25)y = x^4 + x^2 + 1$, where $D \equiv \frac{d}{dx}$ is, (1)

- A. $x^4 + x^2 - \frac{1}{25}$
- B. $x^4 + x^2 + \frac{49}{25}$
- C. $\frac{1}{25}(x^4 + x^2 + 24x + 1)$
- D. $\frac{1}{25} \left(x^4 + x^2 + \frac{1}{25} \right)$

Solution:

75. Particular integral $(D^2 + 6D + 9)y = e^{-3x}x^{-3}$, where $D \equiv \frac{d}{dx}$ is, (1)

- A. $\frac{e^{-3x}}{2x}$
- B. $e^{-3x}x$
- C. $\frac{e^{-3x}}{12x}$

D. $(c_1x + c_2)e^{-3x}$

Solution:

76. Particular integral $(D^3 + 8)y = x^4 + 2x + 1$, where $D \equiv \frac{d}{dx}$ is, (1)

- A. $\frac{1}{8}(x^4 + 5x + 1)$
- B. $\frac{1}{8}(x^3 - 3x^2 + 1)$
- C. $x^4 - x + 1$
- D. $\frac{1}{8}(x^4 - x + 1)$

Solution:

77. Particular integral $(D^3 + 3D^2 - 4)y = x^2$, where $D \equiv \frac{d}{dx}$ is, (1)

- A. $-\frac{1}{4}\left(x^2 + \frac{3}{2}\right)$
- B. $\frac{1}{4}\left(x^2 + \frac{3}{2}x\right)$
- C. $\left(x^2 + \frac{3}{2}\right)$
- D. $-\frac{1}{4}\left(x^2 - \frac{3}{2}\right)$

Solution:

78. Particular integral $(D^4 - m^4)y = \cos mx$, where $D \equiv \frac{d}{dx}$ is, (1)

- A. $-\frac{x}{4m^3} \cos mx$
- B. $\frac{x}{m^3} \sin mx$
- C. $-x \sin mx$
- D. $-\frac{x}{4m^3} \sin mx$

Solution:

79. Particular integral $(D^3 - 4D)y = 2 \cosh 2x$, where $D \equiv \frac{d}{dx}$ is, (1)

- A. $\frac{1}{4} \cosh 2x$
- B. $\frac{x}{8} \cosh 2x$
- C. $\frac{x}{4} \cosh 2x$
- D. $\frac{x}{4} \sinh 2x$

Solution:

80. Particular integral $(D^3 - 4D)y = 2 \sinh 2x$, where $D \equiv \frac{d}{dx}$ is, (1)

- A. $\frac{1}{4} \cosh 2x$
- B. $\frac{x}{8} \cosh 2x$
- C. $\frac{x}{4} \cosh 2x$
- D. $\frac{x}{4} \sinh 2x$

Solution:

81. For $(D^2 - 6D + 8)y = 5e^{4x}$ particular integral is, (1)

- A. 0
- B. $\frac{5}{2}e^{4x}$
- C. $\frac{5}{2}xe^{4x}$
- D. $\frac{5}{2}$

Solution:

82. For $(D^2 + 9)y = \sin 2x$ particular integral is, (1)

- A. $\frac{1}{13} \sin 2x$
- B. $\frac{1}{13} \cos 2x$
- C. $\frac{1}{5} \sin 2x$
- D. $-4 \sin 2x$

Solution:

83. For $(D^2 + D + 1)y = \cos 2x$ particular integral is, (1)

- A. $\frac{1}{13}(3 \cos 2x - 2 \sin 2x)$
- B. $-\frac{1}{13}(3 \cos 2x + 2 \sin 2x)$
- C. $-\frac{1}{13}(3 \cos 2x - 2 \sin 2x)$
- D. $\frac{1}{13}(3 \cos 2x + 2 \sin 2x)$

Solution:

84. For $(D^2 - 2D + 1)y = e^x$ particular integral is, (1)

- A. $\frac{x^2}{2}e^x$
- B. $\frac{x}{2}e^x$
- C. $\frac{x}{4}e^{x^2}$
- D. $\frac{x^2}{5}e^{2x}$

Solution:

3 Variation of Parameter Method

85. Complementary function of differential equation $a_0 \frac{d^2y}{dx^2} + a_1 \frac{dy}{dx} + a_2y = f(x)$ is $c_1y_1 + c_2y_2$. Then by method of variation of parameters, particular integral is $u(x,y)y_1 + v(x,y)y_2$ where u is obtained from \dots (1)

A. $\int \frac{f(x)}{y_1y_2' + y_2y_1'} dx$

B. $\int \frac{y_2f(x)}{y_1y_2' - y_2y_1'} dx$

C. $\int \frac{y_1f(x)}{y_1y_2' - y_2y_1'} dx$

D. $\int \frac{-y_2f(x)}{y_1y_2' - y_2y_1'} dx$

Solution:

86. Complementary function of differential equation $a_0 \frac{d^2y}{dx^2} + a_1 \frac{dy}{dx} + a_2y = f(x)$ is $c_1y_1 + c_2y_2$. Then by method of variation of parameters, particular integral is $u(x,y)y_1 + v(x,y)y_2$ where v is obtained from \dots (1)

A. $\int \frac{f(x)}{y_1y_2' + y_2y_1'} dx$

B. $\int \frac{y_2f(x)}{y_1y_2' - y_2y_1'} dx$

C. $\int \frac{y_1f(x)}{y_1y_2' - y_2y_1'} dx$

D. $\int \frac{-y_2f(x)}{y_1y_2' - y_2y_1'} dx$

Solution:

87. In solving differential equation $\frac{d^2y}{dx^2} + y = \operatorname{cosec} x$ by method of variation of parameters, complementary function = $c_1 \cos x + c_2 \sin x$, Particular Integral = $u \cos x + v \sin x$, then u is equal to, (1)

A. $-\log \sin x$

B. x

C. $-x$

D. $\log \sin x$

Solution:

88. In solving differential equation $\frac{d^2y}{dx^2} - y = \frac{2}{1+e^x}$ by method of variation of parameters, complementary function = $c_1e^x + c_2e^{-x}$, Particular Integral = $ue^x + ve^{-x}$, then v is equal to, (1)
- A. $e^{-x} - \log(1 + e^{-x})$
 - B. $-\log(1 + e^x)$
 - C. $\log(1 + e^x)$
 - D. $e^{-x} + \log(1 + e^{-x})$

Solution:

89. In solving differential equation $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = e^{e^x}$ by method of variation of parameters, complementary function = $c_1e^{-2x} + c_2e^{-x}$, Particular Integral = $ue^{-2x} + ve^{-x}$, then v is equal to, (1)
- A. $-e^{e^x}$
 - B. $e^{-2x}e^{e^x}$
 - C. $e^xe^{e^x}$
 - D. e^{e^x}

Solution:

90. In solving differential equation $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = e^{e^x}$ by method of variation of parameters, complementary function = $c_1e^{-2x} + c_2e^{-x}$, Particular Integral = $ue^{-2x} + ve^{-x}$ then v is equal to, (1)
- A. $-e^{e^x}$
 - B. $e^{-2x}e^{e^x}$
 - C. $e^xe^{e^x}$
 - D. e^{e^x}

Solution:

91. In solving differential equation $\frac{d^2y}{dx^2} + 4y = 4\sec^2 2x$ by method of variation of parameters, complementary function = $c_1 \cos 2x + c_2 \sin 2x$, Particular Integral = $u \cos 2x + v \sin 2x$ then u is equal to, (1)

- A. $\log(\sec 2x + \tan 2x)$
- B. $-\sec 2x$
- C. $\sec 2x + \tan 2x$
- D. $\log(\tan 2x)$

Solution:

92. In solving differential equation $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 9y = \frac{e^{3x}}{x^2}$ by method of variation of parameters, complementary function = $c_1xe^{3x} + c_2e^{3x}$, Particular Integral = $uxe^{3x} + ve^{3x}$, then u is equal to, (1)

- A. $-e^x \cos(e^x) + \sin(e^x)$
- B. $-\cos(e^x)$
- C. $\cos(e^x)$
- D. $e^x \sin(e^x) + \cos(e^x)$

Solution:

93. In solving differential equation $\frac{d^2y}{dx^2} + 4y = \sec 2x$ by method of variation of parameters, complementary function = $c_1 \cos 2x + c_2 \sin 2x$, Particular Integral = $u \cos 2x + v \sin 2x$, then u is equal to, (1)

- A. $-\frac{1}{2}x$
- B. $\frac{1}{4} \log(\cos 2x)$
- C. $-\frac{1}{4} \log(\cos 2x)$
- D. $\frac{1}{2}x$

Solution:

94. In solving differential equation $\frac{d^2y}{dx^2} + y = \tan x$ by method of variation of parameters, complementary function = $c_1 \cos x + c_2 \sin x$, Particular Integral = $u \cos x + v \sin x$, then v is equal to, (1)

- A. $-\cos x$
- B. $[\log(\sec x + \tan x)] - \sin x$

- C. $-\log(\sec x + \tan x) - \sin x$
 D. $\cos x$

Solution:

95. In solving differential equation $\frac{d^2y}{dx^2} + 9y = \frac{1}{1+\sin 3x}$ by method of variation of parameters, complementary function = $c_1 \cos 3x + c_2 \sin 3x$, Particular Integral = $u \cos 3x + v \sin 3x$ then v is equal to, (1)

- A. $-\frac{1}{3}(-\frac{1}{3} \sec 3x + \frac{1}{3} \tan 3x - x)$
 B. $-\frac{1}{9} \log(1 + \sin 3x)$
 C. $\frac{1}{9} \log(1 + \sin 3x)$
 D. $\frac{1}{3} \log \cos x$

Solution:

4 Simultaneous LDE and Symmetrical LDE

96. Solution of symmetric simultaneous differential equation (1)

$$\frac{dx}{x} = \frac{dy}{y} = \frac{dz}{z}$$

is

- A. $x = c_1y, y = c_2z$
 B. $xy = c_1z, yz = c_2x$
 C. $x + y = c_1, y + z = c_2$
 D. $x + y = c_1, y - z = c_2$

Solution:

97. Using a set of multipliers as 1, 1, 1 the solution of differential equation (1)

$$\frac{dx}{y-z} = \frac{dy}{z-x} = \frac{dz}{x-y}$$

is

- A. $x^2 + y^2 + z^2 = c$
- B. $x - y - z = c$
- C. $x + y + z = c$
- D. $-x + y - z = c$

Solution:

98. Considering the first two ratio of the symmetrical simultaneous DE

(1)

$$\frac{dx}{y^2} = \frac{dy}{x^2} = \frac{dz}{x^2y^2z^2},$$

one of the relation in the solution is DE is

- A. $x^2 + y^2 + z^2 = c$
- B. $x - y - z = c$
- C. $x + y + z = c$
- D. $-x + y - z = c$

Solution:

99. For the simultaneous Linear DE $\frac{du}{dx} + v = \sin x$, $\frac{dv}{dx} + u = \cos x$, solution of u using

(1)

where $D \equiv \frac{d}{dx}$ is obtain from,

- A. $(D^2 + 1)v = 0$
- B. $(D^2 - 1)u = 0$
- C. $(D^2 - 1)v = -2 \sin x$
- D. $(D^2 + 1)v = \sin x + \cos x$

Solution:

100. For the simultaneous Linear DE $\frac{du}{dx} + v = \sin x$, $\frac{dv}{dx} + u = \cos x$, solution of v using

(1)

$D \equiv \frac{d}{dx}$ is obtain from,

- A. $(D^2 + 1)v = 0$
- B. $(D^2 - 1)u = 0$

- C. $(D^2 - 1)v = -2 \sin x$
 D. $(D^2 + 1)v = \sin x + \cos x$

Solution:

101. Solution of symmetric simultaneous differential equation

(1)

$$\frac{dx}{1} = \frac{dy}{1} = \frac{dz}{1}$$

is

- A. $x + y = 0, y + z = 0$
 B. $x - y = c_1, y + z = c_2$
 C. $x + y = c_1, y - z = c_2$
 D. $x - z = c_1, y - z = c_2$

Solution:

5 Cauchy's and Legendre's LDE

102. To reduce the differential equation

(1)

$$(x + 2)^2 \frac{d^2 y}{dx^2} - 4(x + 2) \frac{dy}{dx} + 6y = 4x + 7$$

to linear differential equation with constant coefficients, substitution is

- A. $x + 2 = e^{-z}$
 B. $x = z + 1$
 C. $x + 2 = e^z$
 D. $x + 2 = \log z$

Solution:

103. The differential equation

(1)

$$x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} - y = \frac{x^3}{1 + x^3}$$

, on putting $x = e^z$ and using $D = \frac{d}{dz}$ is transformed into....

- A. $x + y = 0, y + z = 0$
- B. $x - y = c_1, y + z = c_2$
- C. $x + y = c_1, y - z = c_2$
- D. $x - z = c_1, y - z = c_2$

Solution:

104. Solution of differential equation

(1)

$$x \frac{d^2y}{dx^2} + \frac{dy}{dx} = x,$$

is

- A. $(c_1x + c_2) - \frac{x^2}{4}$
- B. $(c_1x^2 + c_2) + \frac{x^2}{4}$
- C. $c_1 + c_2 \frac{1}{x} + \frac{1}{2x^2}$
- D. $(c_1 \log x + c_2) + \frac{x^2}{4}$

Solution: