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6) $(D^2 - 5D + 6)y = 0.$

$\rightarrow$ Compare above equation with $\phi(D)y = 0$, we get

$\phi(D) = D^2 - 5D + 6 = (D-2)(D-3)$

$\therefore$ roots are 2 and 3 $\rightarrow$ Real and distinct.

$$\therefore \boxed{y_c = C_1 e^{2x} + C_2 e^{3x}} \rightarrow \text{D}.$$

7) $(D^2 - 5D - 6)y = 0.$

$\rightarrow$ Compare above equation with $\phi(D)y = 0$, we get.

$\phi(D) = D^2 - 5D - 6 = (D-6)(D+1)$

$\therefore$ roots are -1 and 6 $\rightarrow$ Real and distinct.

$$\therefore \boxed{y_c = C_1 e^{-x} + C_2 e^{6x}} - \text{A}$$

8) $(2D^2 - D - 10)y = 0.$

$\rightarrow$ Compare above equation with $\phi(D)y = 0$, we get.

$\phi(D) = 2D^2 - D - 10$, roots are $\dfrac{1 \pm \sqrt{1^2 - 4 \times 2 \times (-10)}}{4} = \dfrac{1 \pm 9}{4} = \dfrac{5}{2}$ or -2.

Roots are -2 and $5/2$ $\rightarrow$ Real and distinct.

$$\therefore \boxed{y_c = C_1 e^{-2x} + C_2 e^{\frac{5x}{2}}} \rightarrow \text{C}.$$

9) $(D^2-4)y = 0$

$\rightarrow$ Compare above equation with $\phi(D)y=0$, we get

$$\phi(D) = D^2-4 = (D-2)(D+2)$$

$\therefore$ Roots are -2 and 2 $\rightarrow$ Real and distinct.

$$\therefore \boxed{y_c = C_1 e^{-2x} + C_2 e^{2x}} \rightarrow \text{(D)}$$

10) $(D^2-D-2)y=0$.

$\rightarrow$ Compare above equation with $\phi(D)y=0$, we get.

$$\phi(D) = D^2-D-2 = (D-2)(D+1)$$

$\therefore$ Roots are -1 and 2 $\rightarrow$ Real and distinct

$$\therefore \boxed{y_c = C_1 e^{-x} + C_2 e^{2x}} \rightarrow \text{(B)}.$$

11) $(2D^2-5D+3)y=0$

$\rightarrow$ Compare above equation with $\phi(D)\ y=0$, we get.

$$\phi(D) = 2D^2-5D+3 \rightarrow \frac{5 \pm \sqrt{25-4\times2\times3}}{4} = \frac{5\pm1}{4} = \frac{3}{2} \text{ or } 1.$$

Roots are $\frac{3}{2}$ and 1 $\rightarrow$ Real and distinct.

$$\therefore \boxed{y_c = C_1 e^{x} + C_2 e^{3x/2}} \rightarrow \text{(A)}.$$

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12) $(D^2+2D+1)y=0$.

→ Compare above equation with $\phi(D)y=0$, we get

$\phi(D) = D^2+2D+1. = \frac{-2 \pm \sqrt{4-4}}{2} = -1$ ↳ Real and Reapeating.

$\therefore \boxed{y_c = (C_1 + xC_2)e^{-x}}$ → © and Ⓓ.

13) $(4D^2-4D+1)y=0$.

→ Compare above equation with $\phi(D)y=0$, we get.

$\phi(D) = 4D^2-4D+1 \Rightarrow \frac{4 \pm \sqrt{16-4\times4\times1}}{2\times4} = \frac{1}{2}$.
↳ Real and Repeated.

$\therefore \boxed{y_c = (C_1 + xC_2)e^{x/2}}$ → Ⓓ.

14) $(D^2-4D+4)y=0$.

→ Compare above equation with $\phi(D)y=0$, we get

$\phi(D) = D^2-4D+4 \Rightarrow \frac{4 \pm \sqrt{16-4\times4\times1}}{2} = 2$
↳ real and repeated.

$\therefore \boxed{y_c = (C_1 + xC_2)e^{2x}}$ → Ⓐ

16) $(D^2+6D+9)y=0$.

→ Compare above equation with $\phi(D)y=0$, we get

$\phi(D) = D^2+6D+9 = (D+3)(D+3)$ → Real and repeated.

$\therefore \boxed{y_c = (C_1 + xC_2)e^{-3x}}$ → Ⓑ

16) $(D^2+1)y=0.$

$\rightarrow$ Compare above equation with $\phi(D)y=0$, we get.

$$\phi(D) = D^2+1 \rightarrow \pm i$$
$$\therefore \alpha = 0, \ \beta = 1$$
$$\therefore \boxed{y_c = (C_1 \cos x + C_2 \sin x)} \rightarrow C$$

17) $(D^2+9)y=0.$

$\rightarrow$ Compare above equation with $\phi(D)y=0$, we get.

$$\phi(D) = D^2+9 \Rightarrow \pm 3i$$
$$\therefore \alpha = 0, \ \beta = 3$$
$$\therefore \boxed{y_c = (C_1 \cos 3x + C_2 \sin 3x)} \rightarrow D$$

18) $(D^2+6D+10)y=0.$

$\rightarrow$ Compare above equation with $\phi(D)y=0$, we get.

$$\phi(D) = D^2+6D+10 \Rightarrow \frac{-6 \pm \sqrt{36-40}}{2} = -3 \pm 2i$$
$$\therefore \alpha = -3, \ \beta = 2$$
$$\therefore \boxed{y_c = e^{-3x}(C_1 \cos 2x + C_2 \sin 2x)} \rightarrow A$$

19) $(D^2+D+1)y=0$

$\rightarrow$ Compare above equation with $\phi(D)y=0$, we get

$$\phi(D) = D^2+D+1 \Rightarrow \frac{-1 \pm \sqrt{1-4}}{2} = \frac{-1}{2} \pm \frac{\sqrt{3}}{2} i$$
$$\therefore \alpha = -1/2, \ \beta = \sqrt{3}/2.$$
$$\therefore \boxed{y_c = e^{-x/2}\left[C_1 \cos\left(\frac{\sqrt{3}x}{2}\right) + C_2 \sin\left(\frac{\sqrt{3}x}{2}\right)\right]} \rightarrow C$$

20) $(4D^2+4D+5)y=0$.

→ Compare above equation with $\phi(D)y=0$, we get.

$$\phi(D)=4D^2+4D+5 \Rightarrow \frac{-4\pm\sqrt{16-80}}{2\times 4} = \frac{-1}{2} \pm i.$$

$\therefore \alpha = -1/2, \quad \beta = 1$

$\therefore \boxed{y_c = e^{-x/2}[C_1 \cos x + C_2 \sin x]} \to$ B.

21) $(D^3+6D^2+11D+6)y=0$.

→ Compare above equation with $\phi(D)y=0$, we get.

$\phi(D) = D^3+6D^2+11D+6 \Rightarrow -1, -2, -3.$

↳ Real and distinct.

$\therefore \boxed{y_c = C_1 e^{-x} + C_2 e^{-2x} + C_3 e^{-3x}} \to$ C.

22) $(D^3-7D-6)y=0$.

→ Compare above equation with $\phi(D)y=0$, we get.

$\phi(D) = D^3 - 7D - 6 \to -1, -2, +3$

↳ Real and distinct

$\therefore \boxed{y_c = C_1 e^{-x} + C_2 e^{-2x} + C_3 e^{3x}} \to$ D

23) $(D^3+2D^2+D)=0$.

→ Compare above equation with $\phi(D)y=0$, we get

$\phi(D) = D^3+2D^2+D \to D(D^2+2D+1) \to \frac{-2\pm\sqrt{4-4}}{2} \quad -1.$

$\therefore \boxed{y_c = C_1 + (C_2 + xC_3)e^{-x}} \to$ B.

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24) $(D^3 - 5D^2 + 8D - 4)\,y = 0$.

→ Compare above equation with $\phi(D)\,y = 0$, we get

$$\phi(D) = D^3 - 5D^2 + 8D - 4 \rightarrow (D-2)^2 (D-1)$$

$$\therefore \boxed{y_c = C_1 e^{x} + (C_2 + x C_3) e^{2x}} \rightarrow A$$

25) $(D^3 - 4D)\,y = 0$.

→ Compare above equation with $\phi(D)\,y = 0$, we get.

$$\phi(D) = D^3 - 4D = D(D^2 - 4) \Rightarrow D(D+2)(D-2)$$

$$\therefore \boxed{y_c = C_1 + C_2 e^{-2x} + C_3 e^{2x}} \rightarrow D$$

26) $(D^3 + 1)\,y = 0$.

→ Compare above equation with $\phi(D)\,y = 0$, we get.

$$\phi(D) = D^3 + 1 = (D+1)(D^2 - D + 1) \Rightarrow -1, \frac{1}{2} \pm \frac{\sqrt{3}i}{2}$$

$$\therefore \boxed{y_c = e^{x/2}\left[C_1 \cos\left(\frac{\sqrt{3}x}{2}\right) + C_2 \sin\left(\frac{\sqrt{3}x}{2}\right)\right] + C_3 e^{-x}} \rightarrow C.$$

27) $(D^3 + 3D)\,y = 0$.

→ Compare above equation with $\phi(D)\,y = 0$, we get.

$$\phi(D) = D^3 + 3D = D(D^2 + 3) \rightarrow 0, \pm\sqrt{3}i.$$

$$\therefore \boxed{y_c = C_1 \cos(\sqrt{3}x) + C_2 \sin(\sqrt{3}x) + C_3} \rightarrow B$$

28) $(D^3+D^2-2D+12)y=0.$

$\rightarrow$ Compare above equation with $\phi(D)y=0$, we get.

$$\phi(D) = D^3+D^2-2D+12 = (D+3)(D^2-2D+4)$$

$$\frac{+2 \pm \sqrt{4-16}}{2}$$

$$\therefore \boxed{y_c = C_1 e^{-3x} + e^{x}\left(C_2\cos(\sqrt{3}x) + C_3\sin(\sqrt{3}x)\right)}$$

$\alpha = 1,\ \beta = \sqrt{3}$

$\hookrightarrow$ (A)

29) $(D^3-D^2+3D+5)y=0.$

$\rightarrow$ Compare above equation with $\phi(D)y=0$, we get.

$$\phi(D) = D^3-D^2+3D+5 = (D+1)(D^2-2D+5) \qquad \frac{+2 \pm \sqrt{4-20}}{2} = \frac{2 \pm 4i}{2}$$

$\hookrightarrow -1,\ 1 \pm 2i \Rightarrow \alpha = 1,\ \beta = 2$

$$\therefore \boxed{y_c = C_1 e^{-x} + e^{x}\left[C_2\cos(2x) + C_3\sin(2x)\right]}$$

$\hookrightarrow$ (A)

30) $(D^3-D^2+4D-4)y=0.$

$\rightarrow$ Compare above equation with $\phi(D)y=0$, we get

$$\phi(D) = D^3-D^2+4D-4 = (D-1)(D^2+4)$$

$\hookrightarrow 1,\ \pm 2i$

$\therefore \alpha = 0,\ \beta = 2.$

$$\therefore \boxed{y_c = C_1 e^{x} + C_2\cos(2x) + C_3\sin(2x)} \rightarrow \text{(C)}$$

31) $(D^4-1)y=0.$

$\rightarrow$ Compare above equation with $\phi(D)y=0$, we get.

$$\phi(D) = D^4 - 1 \rightarrow (D+1)(D+i)(D-i)(D-1) \rightarrow +1,\ -1,\ \pm i$$

$$\therefore \cancel{y_c = (C_1+xC_2)e^{-x} + (C_3+xC_4)e^{+x}}$$

$$\boxed{y_c = C_1 e^{x} + C_2 e^{-x} + C_3\cos x + C_4\sin x}$$

$\hookrightarrow$ (D)

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32) $(D^4+2D^2+1)y=0$.

$\rightarrow$ Compare above equation with $\phi(D)y=0$, we get

$$\phi(D) = D^4+2D^2+1 = (D^2)^2+2(D^2)+1$$
$$= (D^2+1)^2$$
$$\rightarrow +i, +i, -i, -i.$$
$$\alpha = 0,\ \beta = 1 \quad , \alpha =$$

$$\boxed{y_c = (c_1+xc_2)\cos x + (c_3+xc_4)\sin x} \rightarrow (B)$$

33) $(D^2+9)^2 y = 0$.

$\rightarrow$ Compare above equation with $\phi(D)y=0$, we get.

$$\phi(D) = (D^2+9)^2 \rightarrow +3i, -3i, +3i, -3i.$$
$$\alpha = 0,\ \beta = 3.$$

$$\therefore \boxed{y_c = (c_1+xc_2)\cos 3x + (c_3+xc_4)\sin 3x}$$

$\hookrightarrow$ (B)

34) $(D^4+8D^2+16)y=0$.

$\rightarrow$ Compare above equation with $\phi(D)y=0$, we get.

$$\phi(D) = D^4+8D^2+16.$$
$$= (D^2)^2+8D^2+16 = (D^2+4)^2.$$
$$\therefore +2i, -2i, +2i, -2i.$$
$$\alpha = 0,\ \beta = 2.$$

$$\therefore \boxed{y_c = (c_1+xc_2)\cos 2x + (c_3+xc_4)\sin 2x}$$

$\hookrightarrow$ (D).

35). $(D^6 + 6D^4 + 9D^2)y = 0.$

$\rightarrow$ Compare above equation with $\phi(D)y = 0$, we get

$$\phi(D) = D^6 + 6D^4 + 9D^2 = D^2((D)^2 + 6D^2 + 9)$$

$$= D^2(D^2 + 3)^2$$

$$\Rightarrow 0, 0, +\sqrt{3}i, -\sqrt{3}i, +\sqrt{3}i, -\sqrt{3}i.$$

$\therefore$

$$\boxed{y_c = e^{0x}(c_1 + xc_2) + (c_3 + xc_4)\cos(\sqrt{3}x) + (c_5 + xc_6)\sin(\sqrt{3}x).}$$

$\hookrightarrow$ A.

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Tutorial 2 for SE COMP batch S4

Total points 56/60

Solve the following

Q6 * 2/2

- A
- B
- C
- D

Q7 * 2/2

- A
- B