

Errata for ESE-2018 Prelims Test Series (Test-10) (held on 02nd December 2017)

8. $(D^4 - D^3 - 9D^2 - 11D - 4)y = 0$, where $D \equiv \frac{d}{dx}$. Then the solution of the given differential equation is, where C_i , $i = 1, 2, 3, 4$ are the constants,

(a) $y(x) = (c_1 + c_2x)e^x + c_3e^{-x} + c_4e^{4x}$

(b) $y(x) = c_1e^x + c_2e^{-x} + c_3e^{2x} + c_4e^{4x}$

(c) $y(x) = c_1e^x + c_2e^{2x} + c_3e^{3x} + c_4e^{4x}$

(d) $y(x) = e^{-x}(c_1 + c_2x + c_3x^2) + c_4e^{4x}$

8. (d)

The auxillary equation is

$$D^4 - D^3 - 9D^2 - 11D - 4 = 0$$

$$\Rightarrow D^3(D + 1) - 2D^2(D + 1) - 7D(D + 1) - 4(D + 1) = 0$$

$$\Rightarrow (D + 1)(D^3 - 2D^2 - 7D - 4) = 0$$

$$\Rightarrow (D + 1)[D^2(D + 1) - 3D(D + 1) - 4(D + 1)] = 0$$

$$\Rightarrow (D + 1)^2 [D^2 - 3D - 4] = 0$$

$$\Rightarrow (D + 1)^2 [D^2 - 4D + D - 4] = 0$$

$$\Rightarrow (D + 1)^2 (D - 4) (D + 1) = 0$$

$$\Rightarrow (D + 1)^3 (D - 4) = 0$$

Hence its characteristic roots are $-1, -1, -1, 4$.

Thus solution is

$$y(x) = e^{-x} (C_1 + C_2x + C_3x^2) + C_4e^{4x}$$

10. The unit normal to the surface $2x^2 + 4yz - 5z^2 = -10$ at the point P $(3, -1, +2)$,

(a) $\frac{-3\hat{i} - 2\hat{j} + 6\hat{k}}{7}$

(b) $\frac{3\hat{i} + 2\hat{j} + 6\hat{k}}{7}$

(c) $\frac{3\hat{i} - 2\hat{j} + 6\hat{k}}{7}$

(d) $\frac{-3\hat{i} + 2\hat{j} + 6\hat{k}}{7}$

10. (a)

A vector normal to the surface is given by

$$\nabla(2x^2 + 4yz - 5z^2 + 10) =$$

$$4x\hat{i} + 4z\hat{j} + (4y - 10z)\hat{k}$$

so at the normal to the surface is

$$12\hat{i} + 8\hat{j} - 24\hat{k}.$$

Thus a unit normal to the surface at P is

$$\frac{12\hat{i} + 8\hat{j} - 24\hat{k}}{\sqrt{12^2 + 8^2 + (-24)^2}} = \frac{12\hat{i} + 8\hat{j} - 24\hat{k}}{28}$$

$$= \frac{3\hat{i} + 2\hat{j} - 6\hat{k}}{7}$$

And the another unit normal to the surface

at P is $\frac{-3\hat{i} - 2\hat{j} + 6\hat{k}}{7}$

