Rev 2019 C scheme

MCQ Answer key

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1) $L(e^{2t} + 4t^3 - 2\sin 3t + 3\cos 3t)$

$= \frac{1}{s-2} + 4 \cdot \frac{3!}{s^4} - \frac{2 \times 3}{s^2+9} + \frac{3 \times s}{s^2+9}$

$= \frac{1}{s-2} + \frac{4 \times 6}{s^4} - \frac{6}{s^2+9} + \frac{3s}{s^2+9}$

$= \frac{1}{s-2} + \frac{24}{s^4} + \frac{3(s-2)}{s^2+9}$

Ans : D

2) $L(f(t)) = \frac{s-3}{(s^2-6s+25)^2}$

$L(f(2t)) = \frac{1}{2} F(s/2)$

$= \frac{1}{2} \times \frac{s/2 - 3}{((s/2)^2 - 6(s/2) + 25)^2}$

$= \frac{1}{2} \frac{\frac{s-6}{2}}{\left(\frac{s^2}{4} - \frac{6 \times s}{2} + 25\right)^2}$

$= \frac{s-6}{4} \times \frac{4^2}{(s^2 - 12s + 25)^2}$

$= \frac{4(s-6)}{(s^2 - 12s + 100)^2}$

Ans : A

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3) $L^{-1}\left(\frac{s}{4s^2-25}\right)$

$= L^{-1}\left(\frac{s}{4\left(s^2-\frac{25}{4}\right)}\right) = \frac{1}{4} L^{-1}\left(\frac{s}{s^2-\left(\frac{5}{2}\right)^2}\right)$

$= \frac{1}{4} \cosh \frac{5}{2} t$

Ans : A

4) $L^{-1}\left(\log \frac{s^2+1}{s^2}\right)$

$= -\frac{1}{t} L^{-1}\left(\frac{d}{ds}\left(\log s^2+1 - \log s^2\right)\right)$

$= -\frac{1}{t} L^{-1}\left(\frac{1}{s^2+1} \times 2s - \frac{1}{s^2} \times 2s\right)$

$= -\frac{1}{t} L^{-1}\left(\frac{2s}{s^2+1} - \frac{2}{s}\right)$

$= -\frac{2}{t}(\cos t - 1) = \frac{2}{t}(1-\cos t)$

Ans : C

5) $f(z) = x^2 - y^2 + i2xy$

$u = x^2 - y^2, \quad v = 2xy$

$u_x = 2x \quad v_x = 2y$

$f'(z) = u_x + iv_x$

$= 2x + i2y \quad = 2(x+iy) = 2z$

Ans : B

6) $y = 2x - x^2 + my^2$

$y_x = 2 - 2x \qquad y_y = 2my$

$y_{xx} = -2 \qquad y_{yy} = 2m$

$y_{xx} + y_{yy} = 0$

$\Rightarrow -2 + 2m = 0 \qquad \Rightarrow 2 = 2m$

$m = 1$

Ans : B

7) $\lambda = 1, 4$

$\lambda = 1 \quad 4A^{-1} + 3A + 2I = 4 \times \frac{1}{1} + 3 \times 1 + 2 \times 1 =$

$= 4 + 3 + 2 = 9$

$\lambda = 4$

$4A^{-1} + 3A + 2I = 4 \times \frac{1}{4} + 3 \times 4 + 2 \times 1$

$= 1 + 12 + 2 = 15$

Ans : A

8) $\lambda_1 = 3$

$\lambda_1 + \lambda_2 + \lambda_3 = 1 + 1 + p$

$= 2 + p$

$\Rightarrow 3 + \lambda_2 + \lambda_3 = 2 + p$

$\Rightarrow \lambda_2 + \lambda_3 = 2 + p - 3$

$= p - 1$

Ans : B

$$f(x) = \frac{a_0}{2} + \sum a_n \cos nx + \sum b_n \sin nx$$

9)

$$a_0 = \frac{1}{\pi}\int_0^{2\pi} x^2\,dx$$

$$= \frac{1}{\pi}\left(x^3/3\right)_0^{2\pi} = \frac{1}{3\pi}\left((2\pi)^3 - 0\right)$$

$$= \frac{1}{3\pi}\left(8\pi^3\right) = \frac{8}{3}\pi^2$$

Ans : D

10) $\vec{u} = (x+3y)\,i + (y-2z)\,j + (x+\lambda z)\,k$

$\nabla \cdot \vec{u} = 0$ (since u is solenoidal)

$$\Rightarrow \frac{\partial}{\partial x}(x+3y) + \frac{\partial}{\partial y}(y-2z) + \frac{\partial}{\partial z}(x+\lambda z) = 0$$

$$\Rightarrow 1 + 1 + \lambda = 0$$

$$\Rightarrow 2 + \lambda = 0$$

$$\Rightarrow \lambda = -2$$

Ans : A

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Q5 → B

Q6 → B

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Q8 → B

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