K. K. Wagh Institute of Engineering Education & Research, Nashik

(An Autonomous Institute From A.Y. 2022-23)

WINTER-2025	
Exam Seat No.:	
Academic Year:2025-2026	Semester:III
Class:SY	Program:B.Tech
Branch Code:ELE	Pattern:2022
Name of Course:Applied Mathematics-III	Course Code:SMH222601
Max. Marks:60	Duration:2.30 Hrs.

Instructions: Candidates should read carefully the instructions printed on the Question Paper and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains 2 pages.
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. Draw the neat labelled diagrams, wherever necessary.
5. The last columns indicates the Course Outcome of the Question/sub-question.
6. Use of non-programmable scientific calculator is allowed

Marks CO

Question No. 1

1a) An e.m.f. Esinpt is applied at t=0 to a circuit containing a condenser C and inductance L in series the current I satisfies the equation: $L\left(\frac{-d^2q}{dt^2}\right)+\frac{1}{C}\left(-q\right)=E\sin pt$, If $I=-\frac{dq}{dt}$, $p^2=\frac{1}{LC}$ and initially the current and the charge are zero, find current at any time t. (6) CO4

Question No. 2

2a) The electric flux density in free space is given by $\bar{D}=x^3yz\bar{\imath}+x^2y^2z^2\bar{\jmath}+x^4y\bar{k}$ find the total electric flux passing through the surface $x=2,\quad 0\le y\le 2,\quad 0\le z\le 1$ in the direction away from the origin. (6) CO4

Question No. 3

3a) Find Laplace transform of $\int_0^t e^{4t}\left(\frac{1-\cos 3t}{t}\right)dt$. (5) CO2

OR

3b) Find Laplace transform of $t^2\sin 3t$. (5) CO2

3c) Find inverse Laplace transform of $\frac{7s-23}{(s-2)(s-5)}$ by using partial fraction. (5) CO2

OR

3d) Find inverse Laplace transform of $\frac{4}{(s-2)(s+2)^2}$ by using Convolution theorem. (5) CO2

3e) Solve by Laplace transform method, (6) CO4

$y''-2y'-8y=0;\quad y(0)=3, y'(0)=6.$

OR

3f) Solve by Laplace transform method, (6) CO4

$y'' - 2y' + y = e^{-2t}; \quad y(0) = y'(0) = 0.$

Question No. 4

4a) Find the Fourier cosine Transform of, (5) CO2

$$f(x) = \begin{cases} x, & 0 < x < \frac{1}{2} \\ 1 - x, & \frac{1}{2} < x < 1 \\ 0, & x > 1 \end{cases}$$

OR

4b) Find the Fourier transform of, (5) CO2

$$f(x) = \begin{cases} x^2, -1 \le x \le 1 \\ 0, & |x| > 1 \end{cases}$$

4c) Find the Fourier sine integral representation of the function $f(x) = \frac{\pi}{2} e^{-mx}, \quad m > 0, \quad x > 0.$ (5) CO3

OR

4d) Find the Fourier sine integral representation of the function (5) CO3

$$f(x) = \begin{cases} \frac{\pi}{4}, 0 < x < \pi \\ 0, & x > \pi \end{cases}$$

4e) Obtain the Fourier series to represent $f(x) = x^2 + 4$ in the interval $-\pi \le x \le \pi$. (6) CO4

OR

4f) Obtain the Fourier series to represent $f(x) = e^{-x}$ in the interval $0 \le x \le 2\pi$. (6) CO4

Question No. 5

5a) Find the Z-transform of $f(k) = (k^2 + 2k)5^k, \quad k \ge 0.$ (5) CO2

OR

5b) Find the Z-transform of $f(k) = 2^k \sin\left(\frac{k\pi}{4} + \alpha\right), \quad k \ge 0, \quad \alpha \quad is \quad constant.$ (5) CO2

5c) Find the inverse Z-transform of $\frac{5z^2}{(z-1)(z-2)}$ using integral inversion method. (5) CO3

OR

5d) Find the inverse Z-transform of $\frac{z(z+1)}{z^2 - 5z + 6}; \quad 2 < |z| < 3$ using partial fraction method. (5) CO3

5e) Solve the difference equation, (6) CO4

$f(k+2) - 4f(k) = 0; \quad f(0) = 0, \quad f(1) = 2.$

OR

5f) Solve the difference equation, (6) CO4

$f(k+2) - 5f(k+1) + 6f(k) = 18; \quad f(0) = f(1) = 0.$

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