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

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

| WINTER-2025 | |
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| Exam Seat No.: | |
| Academic Year:2025-2026 | Semester:III |
| Class:SY | Program:B.Tech |
| Branch Code:ELE/ETC | Pattern:2023 |
| Name of Course:Advanced Calculus and Transform Techniques | Course Code:2300201E |
| 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 inductor of 0.25 henries is connected in series with negligible resistance and a capacitor of 0.04 farads, a generator having alternative voltage given by 12sin10t(t>0). Find charge and current if the differential equation is given by $L\left(\frac{d^2q}{dt^2}\right)+\frac{q}{C}=E$. | | (6) | CO4 |
| **Question No. 2** | | | | |
| 2a) | The electric flux density in free space is given by $\bar{D}=xy^2z^3\bar{\imath}+2xyz^3\bar{\jmath}+3xy^2z^2\bar{k}$ find the total electric flux passing through the surface $0\le x\le 3,\quad 0\le y\le 2,\quad z=4$ in the direction away from the origin. | | (6) | CO4 |
| **Question No. 3** | | | | |
| 3a) | Find Laplace transform of $e^{-2t}\int_0^t \frac{\sin 5t}{t}dt$. | | (5) | CO2 |
| | | **OR** | | |
| 3b) | Find Laplace transform of $t^2\cos 2t$. | | (5) | CO2 |
| 3c) | Find inverse Laplace transform of $\frac{3s+7}{s^2-2s-3}$ by using partial fraction. | | (5) | CO2 |
| | | **OR** | | |
| 3d) | Find inverse Laplace transform of $\frac{5}{(s-3)^2(s+2)}$ by using Convolution theorem. | | (5) | CO2 |
| 3e) | Solve by Laplace transform method, $y''-2y'-24y=0;\quad y(0)=y'(0)=1$. | | (6) | CO4 |
| | | **OR** | | |
| 3f) | Solve by Laplace transform method, | | (6) | CO4 |

$y'' - y' = 5; \quad y(0) = y'(0) = 0.$

**Question No. 4**

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

$$f(x) = \begin{cases} \sin x, 0 \le x \le a \\ 0, \quad x > a \end{cases}$$

**OR**

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

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

4c) Find the Fourier cosine integral representation of the function $f(x) = \frac{\pi}{3} e^{-3x}, \quad x > 0.$ (5) CO3

**OR**

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

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

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

**OR**

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

**Question No. 5**

5a) Find the Z-transform of $f(k) = (k+1)^2 2^k, \quad k \ge 0.$ (5) CO2

**OR**

5b) Find the Z-transform of $f(k) = 3^k \cos\left(\frac{k\pi}{2} + \alpha\right), \quad k \ge 0, \quad \alpha \ \ is \ \ constant.$ (5) CO2

5c) Find the inverse Z-transform of $\frac{z}{\left(z - \frac{1}{3}\right)\left(z + \frac{1}{3}\right)}$ using integral inversion method. (5) CO3

**OR**

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

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

$f(k+2) + 3f(k+1) + 2f(k) = 0; \quad f(0) = 0, \quad f(1) = 1.$

**OR**

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

$f(k+1) + \frac{1}{5} f(k) = \left(\frac{1}{5}\right)^k; \quad f(0) = 0, k \ge 0$

**····· End of question paper·····**