



K. K. Wagh Institute of Engineering Education & Research, Nashik
(An Autonomous Institute From A.Y. 2022-23)

SUMMER-2024	
Exam Seat No.:	
Academic Year:2023-2024	Semester:III
Class:SY	Program:B.Tech
Branch Code:ETC	Pattern:2022
Name of Course:Applied Mathematics-III	Course Code:SMH222401
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 page(s).
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 and level of Blooms Taxonomy of the Question/sub-question.
6. use of non-Programable calculator is allowed.

Question No. 1 Attempt following Question

- 1a) Solve the Cauchy's Differential Equation: $x^2 \frac{d^2 y}{dx^2} - x \frac{dy}{dx} + y = x \sin(\log x)$ (6) CO2

Question No. 2 Attempt following Question

- 2a) Evaluate: $\int_C \frac{2z + \sin \pi z}{(z-2)(z-1)} dz$, $|z| = 3$ (6) CO2

Question No. 3 Attempt following Question

- 3a) Find Directional derivative of $\phi = x^2 - y^2 - 2z^2$ at (2,-1,3) in the direction of PQ where Q(5,6,4) (5) CO1

OR

- 3b) Find Directional derivative of $\phi = 2x^2 + 3y^2 + z^2$ at (2,1,3) along the line $2(x-2) = y-1 = z-3$ (5) CO1

- 3c) Find the work done Under the force field $\vec{F} = (3x^2 + 6y)\vec{i} - 14yz\vec{j} + 20xz^2\vec{k}$ from (0,0,0) to (1,1,1). (5) CO5

OR

- 3d) Evaluate: $\int_S (\nabla \times \vec{F}) \cdot d\vec{s}$, Where $\vec{F} = (x-y)\vec{i} + (x^2 + yz)\vec{j} - 3xy^2\vec{k}$ and S is the surface of the cone $z = 4 - \sqrt{x^2 + y^2}$ above the XOY plane. (5) CO5

- 3e) Maxwell's equations are given by, $\nabla \cdot \vec{E} = 0, \nabla \cdot \vec{H} = 0, \nabla \times \vec{E} = -\frac{\partial \vec{H}}{\partial t}, \nabla \times \vec{H} = \frac{\partial \vec{E}}{\partial t}$ Show that \vec{E} and \vec{H} satisfy $\nabla^2 \vec{u} = \frac{\partial^2 \vec{u}}{\partial t^2}$ (6) CO5

OR

- 3f) Show that: $\vec{E} = -\nabla \phi - \frac{1}{c} \frac{\partial \vec{A}}{\partial t}$, $\vec{H} = \nabla \times \vec{A}$ are solutions of Maxwell's equations: (5) CO5
 (i) $\nabla \times \vec{H} = \frac{1}{c} \frac{\partial \vec{E}}{\partial t}$, (ii) $\nabla \times \vec{E} = -\frac{1}{c} \frac{\partial \vec{H}}{\partial t}$ if 1) $\nabla \cdot \vec{A} + \frac{1}{c} \frac{\partial \phi}{\partial t} = 0$, 2) $\nabla^2 \vec{A} = \frac{1}{c^2} \frac{\partial^2 \vec{A}}{\partial t^2}$

Question No. 4 Attempt following Question

- 4a) Find Laplace transform of: $f(t) = \int_0^t t e^{-4t} \sin 3t dt$ (5) CO1

OR

- 4b) Find Inverse Laplace Transform of: $F(s) = \frac{2s^2 - 6s + 5}{(s-1)(s-2)(s-3)}$ (5) CO1

- 4c) Find Z-transform of: $f(k) = k^2 5^k$ (5) CO1

OR

- 4d) Find Inverse Z-transform by using inversion integral method: $F(z) = \frac{z^2}{(z - \frac{1}{2})(z - \frac{1}{3})}$ (5) CO1

- 4e) Solve the differential equation by Laplace Transform: $y'' + 4y' + 4y = te^{-2t}$, $y(0) = 0$, $y'(0) = 1$ (6) CO3

OR

- 4f) Find $f(k)$ if $f(k+1) + \frac{1}{2}f(k) = (\frac{1}{2})^k$, $k \geq 0$, $f(0) = 0$ (6) CO3

Question No. 5 Attempt following Question

- 5a) Find fourier sine integral representation of: $f(x) = \begin{cases} 1 & \text{if } 0 \leq x \leq 1 \\ 0 & \text{if } x > 1 \end{cases}$ (5) CO3

OR

- 5b) Find fourier sine integral representation of: $f(x) = \begin{cases} x^2 & \text{if } 0 \leq x \leq 1 \\ 0 & \text{if } x > 1 \end{cases}$ (5) CO3

- 5c) Find Fourier series expansion of $f(x) = e^{-|x|}$ in the interval $-\pi \leq x \leq \pi$ (5) CO5

OR

- 5d) Find Fourier series expansion of $f(x) = \pi^2 - x^2$ in the interval $-\pi \leq x \leq \pi$ also deduce that $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \dots = \frac{\pi^2}{6}$ (5) CO5

- 5e) Find Fourier series expansion of $f(x) = x$ in the interval $0 \leq x \leq 2\pi$ (6) CO1

OR

- 5f) Find Fourier series expansion of $f(x) = x^2$ in the interval $0 \leq x \leq 2\pi$ (6) CO1

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