



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:CIV	Pattern:2022
Name of Course:Applied Mathematics-III	Course Code:SMH222301
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 3 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. Use of non programmable calculator is allowed.
6. The last columns indicates the Course Outcome and level of Blooms Taxonomy of the Question/sub-question.

Question No. 1 Attempt following Question

- 1a) Solve by method of variation of parameter: $(D^2 + 1)y = \operatorname{cosec} x$ (6) CO2

Question No. 2 Attempt following Question

- 2a) A tightly stretched string with fixed end points $x=0$ and $x=l$ is initially in a position given by $y(x, 0) = y_0 \sin^3 \left(\frac{\pi x}{l} \right)$. If it is released from rest from this position. Find the displacement y at any distance x from one end and at any time t . (6) CO4

Question No. 3 Attempt following Question

- 3a) The first four moments of a frequency distribution about the value 4 are 2, 20, 40 and 100 respectively. Obtain moments about mean, mean and standard deviation, coefficient of skewness and kurtosis. (5) CO3

OR

- 3b) The first four moments of a distribution about the value 2 are 1, 2.5, 5.5 and 16 respectively. determine the moments about mean, mean and standard deviation, coefficient of skewness and kurtosis. (5) CO3
- 3c) Obtain correlation coefficient between population density (per square miles) and death rate (per thousand persons) from data related to 5 cities. (5) CO3

Population density	200	500	400	700	800
Death rate	12	18	16	21	10

OR

3d) Obtain regression lines from the following data:

(5) CO3

X	6	2	10	4	8
Y	9	11	5	8	7

3e) Number of road accidents on a highway during a month follows Poisson distribution with mean 5. Find the probability that in a certain month number of accidents on the highway will be (6) CO5

i) Less than 3

ii) Between 3 and 5

iii) More than 3.

OR

3f) In a certain city 4000 tubelights are installed. If the lamps have average life of 1500 burning hours with standard deviation 100 hours. Assuming normal distribution (6) CO5

i) How many lamps will fail in first 1400 hours.

ii) How many lamps will last beyond 1600 hours. $[A(z=1)=0.3413]$

Question No. 4 Attempt following Question

4a) Find the directional derivative of $\phi = 4xz^3 - 3x^2y^2z$ at $(2, -1, 2)$ in the direction of tangent to the curve $x = e^t \cos t, y = e^t \sin t, z = e^t$ at $t=0$ (5) CO1

OR

4b) Find the directional derivative of $\phi = 3\log(x + y + z)$ at $(1, 1, 1)$ in the direction of tangent to the curve $x = b \sin t, y = b \cos t, z = bt$ at $t=0$ (5) CO1

4c) Show that the vector field $\vec{F} = (x + 2y + 4z)\vec{i} + (2x - 3y - z)\vec{j} + (4x - y + 2z)\vec{k}$ is irrotational Find scalar potential ϕ such that $\vec{F} = \nabla\phi$ (5) CO1

OR

4d) Show that the vector field $\vec{F} = (y^2 \cos x + z^2)\vec{i} + (2y \sin x)\vec{j} + 2xz\vec{k}$ is irrotational and also find its scalar potential. (5) CO1

4e) Find the work done in moving a particle once round the ellipse $\frac{x^2}{25} + \frac{y^2}{16} = 1, z = 0$ under the field of force given by $\vec{F} = (2x - y + z)\vec{i} + (x + y - z)\vec{j} + (3x - 2y + 4z)\vec{k}$ (6) CO4

OR

4f) Evaluate $\int_C \vec{F} \cdot d\vec{r}$ using Stoke's theorem $\vec{F} = x^2\vec{i} + (xy)\vec{j}$ and C is bounded by the rectangle $x=0, y=0, x=1, y=2$. (6) CO4

Question No. 5 Attempt following Question

5a) Find a real root of the equation $x^3 + 2x - 5 = 0$ by applying Newton Raphson method at the end of fifth iteration. (5) CO3

OR

5b) Find a positive real root of $x \log_{10} x = 1.2$ using Bisection method at the end of fifth iteration. (5) CO3

5c) Solve the following system of equations by Gauss elimination method: (5) CO3

$$x + 4y - z = -5, x + y - 6z = -12, 3x - y - z = 4$$

OR

- 5d) Apply Gauss elimination method to solve the equations. (5) CO3

$$2x + y + z = 10, 3x + 2y + 3z = 18, x + 4y + 9z = 16$$

- 5e) Solve the following system of equations by Gauss Seidel method. (6) CO5

$$5x + 2y + z = 12, x + 4y + 2z = 15, x + 2y + 5z = 20$$

OR

- 5f) Solve the following system of equations by Gauss Seidel method (6) CO5

$$10x + y + z = 12, 2x + 10y + z = 13, 2x + 2y + 10z = 14$$

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