



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:II
Class:FY	Program:B.Tech
Branch Code:FYE	Pattern:2023
Name of Course:Differential Equations and Integral Calculus	Course Code:2300102A
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. Use of non-programmable pocket calculator is allowed.
5. Draw the neat labelled diagrams, wherever necessary.
6. The last columns indicates the Course Outcome and level of Blooms Taxonomy of the Question/sub-question.

Question No. 1 Attempt following Question

- 1 Solve $(\frac{e^{-2\sqrt{x}}}{\sqrt{x}} - \frac{y}{\sqrt{x}})\frac{dx}{dy} = 1$ (6) CO2

Question No. 2 Attempt following Question

- 2 A resistance of 250 ohms, an inductance of 640 H are connected in series with a battery of 500V. Find the current in the circuit as a function of time. (6) CO5

Question No. 3 Attempt following Question

- 3.a) The temperature distribution along a metal rod as it undergoes a heating process over time is shown in the table below. Estimate the temperature when the time elapsed is 3 hours using Newton's forward difference interpolation formula. (5) CO3

x(time elapsed in hours)	0	2	4	6	8
y(temperature in Celsius)	5	29	125	341	725

OR

- 3.b) In designing a control system for a robotic arm, the angle of rotation of the robotic arm changes with the time, as shown in the table below. Estimate the angle of rotation when the time elapsed is 48 seconds using Newton's backward difference interpolation formula. (5) CO3

x(time elapsed in seconds)	30	35	40	45	50
y(angle of rotation in radians)	0.5	0.5736	0.6428	0.7071	0.7660

- 3.c) 1. Prove that, $E\nabla = \delta E^{1/2}$ (5) CO1
 2. Evaluate, $\Delta = E - 1$

OR

- 3.d) 1. Prove that, $\mu^2 f(x) = \frac{1}{4}[f(x+h) + 2f(x) + f(x-h)]$ (5) CO1
 2. Evaluate, $\Delta f(x)$ where $f(x) = x^2$, $h=1$

- 3.e) Find Lagrange's interpolating polynomial passing through set of points (6) CO3

x	0	2	3
y	2	-2	-1

Use it to find $\frac{dy}{dx}$ at $x=2$

OR

- 3.f) Use Stirling's formula to find $f(28)$ from the following data (6) CO3

x	20	25	30	35	40
f(x)	49225	48316	47236	45926	44036

Question No. 4 Attempt following Question

- 4.a) Use Euler's method to solve the equation $\frac{dy}{dx} = 1 - y$, subject to the condition $y(0)=0$, with step size 0.1 and find y at $x=0.5$ (5) CO3

OR

- 4.b) Using modified Euler's method solve the equation $\frac{dy}{dx} = x^2 + y$, subject to the condition $y(0)=1$, with step size 0.05 and find y at $x=0.05$ (5) CO3

- 4.c) Using fourth order Runge-Kutta method, solve the equation $\frac{dy}{dx} = xy + x^2$, subject to the condition $y(0.1)=1.1169$ and find $y(0.2)$ taking $h=0.1$ (6) CO3

OR

- 4.d) Numerical solution of the differential equation $\frac{dy}{dx} = 2e^x - y$ is tabulated as (6) CO3

x	0.1	0.2	0.3	0.4
y	2.0	2.0310	2.0825	2.1548

Find y at $x=0.5$ by Milne's predictor-corrector method.

- 4.e) A river is 80m wide. The depth d in meters at a distance x meters from one bank is given by the following table: (5) CO3

x	0	10	20	30	40	50	60	70	80
y	0	4	7	9	12	15	14	8	3

Find approximately the area of the cross section using Trapezoidal rule.

OR

- 4.f) The velocity $v(\text{km/min})$ of a moped which starts from rest, is given at fixed intervals of a time $t(\text{min})$ as follows: (5) CO3

t	0	2	4	6	8	10	12	14	16	18	20
v	0	10	18	25	29	32	20	11	5	2	0

Estimate approximately the distance covered in 20 minutes using Simpson's 1/3 rule.

Question No. 5 Attempt following Question

- 5.a) Evaluate, $\iint xy \, dx \, dy$ over the region bounded by $y = x^2$, $y^2 = -x$ (6) CO2

OR

- 5.b) Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} \frac{dx \, dy}{1 + e^{y(\sqrt{1-x^2}-y^2)}}$. (6) CO3

- 5.c) Find the area bounded by the curves $y^2=4x$ and $2x-3y+4=0$ (5) CO5

OR

- 5.d) Find the center of gravity of the area bounded by the lines $y=x$, $y=-x$ and $x=2$. (5) CO5

- 5.e) Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} \frac{dz \, dy \, dx}{\sqrt{1-x^2-y^2-z^2}}$. (5) CO3

OR

- 5.f) Find the volume of the region bounded below by the X-Y plane and above by paraboloid $x^2+y^2=2z$ and lying inside the cylinder $x^2+y^2=4$. (5) CO3

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