

JK Lakshmipat University Jaipur
INSTITUTE OF ENGINEERING AND TECHNOLOGY

End-Term Examination, December 2023
B. Tech., Odd Semester, 2023-24

Roll No.....

AS1405: Ordinary Differential Equations and Laplace Transforms

Time: 2 hours

Max. Marks: 30

Instructions to students:

1. Do not write anything other than your roll number on the question paper.
2. Specify, if you find any ambiguity in the questions. Justify and solve the question after removing that ambiguity.
3. Answer correctly to four decimal places in case of no specific mention of the requirement.
4. Mention the formula for each method you use to solve the problem.

- Q.1. Find the Laplace transforms of the following functions. 8.0
(CO3)
- a) $\cos^2(3t) - \sin^2(3t)$
 - b) $4 \sin(at + b)$
 - c) $4t^3 e^{-2t}$
 - d) $2e^t (\cos 3t - \sin 3t)$
- Q.2. Use the Laplace transform of the second derivative to derive the following 4.0
(CO3)
transform.
- $$\mathcal{L}\{\sin at\} = \frac{a}{s^2 + a^2}$$
- Q.3. Find $\mathcal{L}^{-1} \left\{ \frac{5s^2 + 8s - 1}{(s+3)(s^2+1)} \right\}$. 4.0
(CO3)
- Q.4. Use Laplace transform to solve the differential equation: 7.0
(CO1, 3)
- $$\frac{d^2 y}{dx^2} - 3 \frac{dy}{dx} = 9 \text{ given that when } x = 0, y = 0 \text{ and } \frac{dy}{dx} = 0.$$
- Q.5. Given the initial value problem defined by 7.0
(CO1)
- $$\frac{dy}{dx} = 1 + y^2 \text{ given that when } x = 0, y = 0.$$

Find the values of y for $x = 0.2$ using the Euler, the modified Euler, and the fourth order Runge-Kutta methods. Find the differences in the results from these methods.