

**Fourth Semester FYUGP Degree (Reg) Examination April
2026**

**KU4DSCMAT203 - ORDINARY DIFFERENTIAL
EQUATIONS AND LAPLACE TRANSFORMS**

2024 Admission onwards

Time : 2 hours

Maximum Marks : 70

Section A

Answer any 6 questions. Each carry 3 marks.

1. Write the explicit form of first order ordinary differential equation.
2. Solve the ODE: $\frac{dy}{dx} = \frac{1}{1+x^2}$ by integration.
3. State Second Shifting theorem.
4. Find the Laplace transform of $1 * e^{at}$.
5. Write the convolution of two the constant functions $f(t) = 2$ and $g(t) = 3$.
6. Find $(D^2 + 2I) \cosh 2x$.
7. If α and β are the roots of the characteristic equation of a second order linear homogeneous differential equation with constant coefficients, find its general solution.
8. Define the Wronskian of the functions y_1 and y_2 .

Section B

Answer any 4 questions. Each carry 6 marks.

9. Find the inverse transform $f(t)$ of $\frac{e^{-4s}}{s^3}$.
10. Solve the IVP; $y'' + 4y' + 5y = \delta(t-1)$, $y(0) = 0$, $y'(0) = 3$.
11. Find $(f * g)(t)$ when $f(t) = 1$ and $g(t) = \sin \omega t$.
12. Solve $y'' + 9y = \sec 3x$ by variation of parameters.
13. Solve $x^2 y'' + 3xy' + y = 0$.
14. If y_1 is a solution of $y'' + p(x)y' + q(x)y = r(x)$ and y_2 is a solution of $y'' + p(x)y' + q(x)y = 0$, show that $y_1 + y_2$ is a solution of the former.

Section C

1.

Answer any 2 questions. Each carry 14 marks.

15. a) Find the Laplace transform of the following functions:

(i) $\sinh t \cos t$. (ii) $e^{-t}(\cos 3t - \sin 3t)$.

b) Evaluate $\mathcal{L}^{-1} \left[\frac{s^2 + 2s + 3}{(s^2 + 2s + 2)(s^2 + 2s + 5)} \right]$.

16. Solve the following initial value problem by the Laplace transform.

(a) $y'' - 4y' + 4y = 0$, $y(0) = 8.1$, $y'(0) = 3.9$.

(b) $y'' + 9y = 10e^{-t}$, $y(0) = 0$, $y'(0) = 0$.

17. (a) Solve $x(x-y)y' + y^2 = 0$ by the substitution $u = y/x$.

(b) Make the following equation exact and hence solve $(x^2 + y^2)dx - 2xydy = 0$.