

(i) Printed Pages: 2

Roll No.

(ii) Questions : 8 Sub. Code :

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Exam. Code :

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B.A./B.Sc. (General) 4th Semester
(2055)

MATHEMATICS

Paper—II : Differential Equations—II

Time Allowed : Three Hours]

[Maximum Marks : 30

Note :—Attempt **FIVE** questions, selecting at least **TWO** questions from each Unit. All questions carry equal marks.

UNIT—I

1. Solve the differential equation $x^2 \frac{d^2y}{dx^2} + x \frac{dy}{dx} + (x^2 - 4)y = 0$

in series.

2. (a) Prove that $J_n(-x) = (-1)^n J_n(x)$, where n is any integer.

(b) Show that $2\pi J_n(x) = \int_0^{2\pi} \cos(x \sin \theta - n\theta) d\theta$.

3. (a) Show that $\int_{-1}^1 x^K P_n(x) dx = 0$, where K is an integer less than n .

(b) Prove that $\int_{-1}^1 x P_{n-1}(x) P_n(x) dx = \frac{2n}{4n^2 - 1}$.

4. (a) Form partial differential equation by eliminating arbitrary function from the following relation : $xy - z^2 = f\left(\frac{x}{y}\right)$.
- (b) Find the equation of integral surface of $(y - z)p + (z - x)q = x - y$, which passes through $y = 2x, z = 0$.

UNIT—II

5. (a) Find Laplace transform of $|t - 1| + |t + 1|, t \geq 0$.
- (b) Find Laplace transform of $t^2 e^t \sin 4t, t \geq 0$.
6. (a) Find inverse Laplace transform of $\frac{e^{-1/s}}{s}$.
- (b) Apply Convolution theorem to find inverse transform of $\frac{s}{(s^2 + \alpha^2)^3}$.
7. (a) Using Laplace transform, solve the following differential equation : $\frac{d^2 y}{dt^2} + y = e^{-2t} \sin t$, when $y(0) = 0, y'(0) = 0$.
- (b) Using Laplace transform, solve :
- $$\frac{dx}{dt} - 2y = t; \frac{dy}{dt} - 4x + 2y = 0,$$
- when $x(0) = 3, y(0) = 0$.
8. (a) Find Laplace transform of $\frac{1 - \cos 3t}{t}, t > 0$.
- (b) Find the inverse Laplace transform of $\frac{1}{s^2 + 5s}$.