

B.Sc.-I (CBCS Pattern) Semester - II
USMT-03 - Mathematics Paper-I
(Ordinary Differential Equations and Difference Equations)

P. Pages : 2

Time : Three Hours



GUG/S/23/11586

Max. Marks : 60

- Notes : 1. Solve all **five** questions.
2. All questions carry equal marks.

UNIT – I

1. a) Show that the DE $(e^y + 1)\cos x dx + e^y \sin x dy = 0$ is exact and solve it. 6
- b) Solve $y' + y = \frac{1}{1 + e^{2x}}$ 6

OR

- c) Solve DE $xy - \frac{dy}{dx} = y^3 e^{-x^2}$ 6
- d) Find the orthogonal trajectories of the family of semicubical parabolas $ay^2 = x^3$. 6

UNIT – II

2. a) Solve $\frac{1}{D^2 + D} \left(\frac{1}{1 + e^x} \right)$ 6
- b) Solve the DE $\frac{d^2y}{dx^2} + \frac{dy}{dx} = x^2 + 2x + 4$ 6

OR

- c) Find the particular integral of $(D^2 + 4D + 3)y = e^{-3x}$ 6
- d) Solve $\frac{dx}{dt} + 4x + 3y = t$ and $\frac{dy}{dt} + 2x + 5y = e^t$ 6

UNIT – III

3. a) Prove that the Wronskian $W(y_1, y_2, x)$ of any two solutions y_1 and y_2 of the DE 6
- $-\int p(t) dt$
- $y'' + py' + qy = 0$, $p, q \in C^0$ satisfies the identity $W(y_1, y_2, x) = W(y_1, y_2, a) e^{\int_a^x p(t) dt}$

b) Solve $(x^2 D^2 - 3xD + 4)y = 2x^2$ 6

OR

c) Solve DE $x^3 \frac{d^3y}{dx^3} + 2x^2 \frac{d^2y}{dx^2} + 2y = 10 \left(x + \frac{1}{x} \right)$ 6

d) Solve $y'' + y = \sec^2 x$ by method of variation of parameters. 6

UNIT – IV

4. a) From the equation $y_n = A.3^n + B.5^n$, derive a difference equation by eliminating arbitrary constants A and B. 6

b) Solve $y_{n+3} - 2y_{n+2} - 5y_{n+1} + 6y_n = 0$. 6

OR

c) Solve $y_{k+1} + \frac{1}{4}y_k = (1/4)^k$, $k \geq 0$, $y(0) = 1$. 6

d) Solve $y_{n+2} - 2\cos \alpha y_{n+1} + y_n = \cos n \alpha$. 6

5. Attempt **any six**.

a) Find integrating factor of $\frac{dy}{dx} + \frac{y}{x} = x^2$ 2

b) Solve $P^2 - 4P + 3 = 0$. 2

c) Solve $(D^3 - 3D^2 + 3D - 1)y = 0$ 2

d) Find P.I of $\frac{1}{D+1} e^{2x}$ 2

e) At y_1 and y_2 be any two solutions of the DE $y'' + py' + qy = 0$ if $W(y_1, y_2, x) = 0$ then prove that y_1 and y_2 are linearly dependent. 2

f) Define Wronskian. 2

g) Write difference equation $\Delta^2 y_n - 3\Delta y_n + 3y_n = 0$ in E – form. 2

h) Define order of a difference equation. 2
