B.Sc. (CBCS New Pattern) Semester-II

USMT-03 - Mathematics Paper-I - Ordinary Differential Equations and Difference Equations

P. Pages : 2 **GUG/W/24/11586(S)**

Time : Three Hours * 7 6 4 0 * Max. Marks : 60

Notes : 1. Solve all five questions.
2. Each question carries equal marks.

UNIT-I

1. a) Show that, **6**
$\cos x(\cos x - \sin\alpha \sin y)dx + \cos y(\cos y - \sin\alpha \sin x)dy = 0$ is exact and solve.

b) Solve the differential equation **6**
$\frac{dy}{dx} + \frac{y}{x} = x^2$, given $y = 1$ when $x = 1$.

OR

c) Solve the differential equation **6**
$\cos x\, dy = y(\sin x - y)\, dx$

d) Find the orthogonal trajectory of **6**
$r^n = a^n \cos n\theta$

UNIT-II

2. a) Solve the differential equation **6**
$\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = e^{-5x}$

b) Solve the differential equation **6**
$\frac{d^2y}{dx^2} + \frac{dy}{dx} = x^2 + 2x + 4$

OR

c) Solve the differential equation **6**
$(D^3 - 7D - 6)\, y = e^{2x}(1 + x)$

d) Solve the differential equations **6**
$\frac{dx}{dt} + 7x - y = 0,\ \frac{dy}{dt} + 2x + 5y = 0$

UNIT-III

3. a) Solve the differential equation **6**
$x^2 \frac{d^2y}{dx^2} - 8x\frac{dy}{dx} + 8y = \log x$

b) Solve the differential equation **6**

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

OR

c) Find a general solution of $\frac{d^2y}{dx^2}+y=\operatorname{cosec} x$ by the method of variation. **6**

d) Prove that Wronskian of two linearly independent solutions of $y''+py'+qy=0$ never vanishes. **6**

UNIT-IV

4. a) From the equation, $y_n=(A+Bn)3^n$ **6**

Derive a difference equation by eliminating arbitrary constant A and B.

b) Solve the difference equation **6**

$y_{n+2}+4y_{n+1}+3y_n=2^n$ given $y_0=0,\ y_1=1$.

OR

c) Solve difference equation **6**

$y_{n+2}-2\cos\alpha.y_{n+1}+y_n=\cos n\alpha$

d) Solve difference equation **6**

$y_{n+2}-2y_{n+1}+y_n=n^2\cdot 2^n$

5. Solve **any six.**

a) Solve the equation **2**

$p^2-4p+3=0$ where $p=\frac{dy}{dx}$

b) Solve the equation **2**

$p=\log(px-y)$

c) Solve the equation **2**

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

d) Solve the equation **2**

$(D-2)^4y=0$

e) If y_1 and y_2 are linearly dependent differentiable functions then prove that their Wronskian vanishes identically. **2**

f) Define the Wronskian for two function y_1 and y_2. **2**

g) Solve the difference equation **2**

$4y_{n+2}-4y_{n+1}+y_n=0$

h) Solve the difference equation **2**

$y_{n+2}-3y_{n+1}+2y_n=0$

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