# AR20

**CODE: 20BST102** **SET-2**

**ADITYA INSTITUTE OF TECHNOLOGY AND MANAGEMENT, TEKKALI**

**(AUTONOMOUS)**

**I B.Tech II Semester Regular Examinations, October-2021**

**DIFFERENTIAL EQUATIONS**

**(Common to All Branches)**

**Time: 3 Hours** **Max Marks: 60**

Answer ONE Question from each Unit

All Questions Carry Equal Marks

All parts of the Question must be answered at one place

## UNIT-I

1. a) Solve $(1+x^2)dy = (e^{\tan^{-1}x} - y)dx$ 5M

   b) If a substance cools from 370k to 330k in 10minutes, when the temperature of the surrounding air is 290k, find the temperature of the substance after 40minutes. 5M

**(OR)**

2. a) Solve $(1+xy)ydx + (1-xy)xdy = 0$ 5M

   b) Find the orthogonal trajectories of the family of confocal conics $\frac{x^2}{a^2} + \frac{y^2}{b^2+\lambda} = 1$, where $\lambda$ is the parameter 5M

## UNIT-II

3. Solve $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = xe^{3x} + sin2x$ 10M

**(OR)**

4. Solve, by the method of variation parameters, 10M

   $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = e^x logx$

## UNIT-III

5. Find Fourier series for $f(x) = x^2$ in the interval $[-\pi, \pi]$. 10M

   Hence show that $\sum \frac{1}{n^2} = \frac{\pi^2}{6}$

**(OR)**

6. Find a half range cosine series for 10M

$$f(x) = \begin{cases} kx, & 0 \le x \le \frac{L}{2} \\ k(L-x), & \frac{L}{2} \le x \le L \end{cases}$$

## UNIT-IV

7. Find the maximum and minimum values of $x^3 + 3xy^2 - 15x^2 - 15y^2 + 72x$ 10M

**(OR)**

8. a) Find Maclaurin's series expansion for $e^x \log(1+y)$ about (0,0) 5M

b) The temperature T at any point $(x, y, z)$ in space $T(x, y, z) = Kxyz^2$ where K is a constant. Find the highest temperature on the surface $x^2 + y^2 + z^2 = a^2$ 5M

## UNIT-V

9. a) Form the partial differential equation by eliminating the arbitrary constants a and b from $2z = \frac{x^2}{a^2} + \frac{y^2}{b^2}$ 5M

b) Solve $zpq = p + q$ 5M

**(OR)**

10. a) Form the partial differential equation by eliminating the arbitrary function from 5M

$$z = (x+y)\, f(x^2 - y^2)$$

b) Solve $x^2(y-z)p + y^2(z-x)q = z^2(x-y)$ 5M

## UNIT-VI

11. Solve $\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} + u$, where $u(x,0) = 6e^{-3x}$ by the method of separation of variables. 10M

**(OR)**

12. A tightly stretched string of length $l$ with fixed ends is initially in equilibrium position. It is set vibrating by giving each point a velocity $v_0 \sin^3(\pi x/l)$. Find the displacement $y(x, t)$ 10M