TB205150V **Reg. No :.....**

Name :.....

B. Sc. DEGREE (C.B.C.S.) EXAMINATION, NOVEMBER 2022

(2020 Admission Regular and 2019, 2018 Admission Supplementary)

SEMESTER V - CORE COURSE (MATHEMATICS)

(Common for Mathematics and Computer Applications)

MT5B07B18 - DIFFERENTIAL EQUATIONS

Time : 3 Hours **Maximum Marks : 80**

Part A

I. Answer any Ten questions. Each question carries 2 marks **(10x2=20)**

1. **Write the formula to find the oblique trajectories intersecting a given family of curves at an angle α.**
2. **Identify the linearity of the differential equation** $y^2\frac{d^2y}{dx^2}+5y=0$ **and illustrate the reasons.**
3. **Recall on what factor does the number of arbitrary constants in the general solution of a differential equation depend.**
4. Evaluate the wronskian and check whether e^x and e^{2x} are linearly independent.
5. Solve $\frac{d^2y}{dx^2}-6\frac{dy}{dx}+9y=0.$
6. Solve $\frac{d^2y}{dx^2}-5\frac{dy}{dx}+6y=0.$.
7. Evaluate the general solution $4\frac{d^2y}{dx^2}+4\frac{dy}{dx}+y=0.$
8. State the two conditions to check the regularity of singular points
9. Define regular singular points.
10. Determine the nature of the point x= 0 of the equation $\frac{d^2y}{dx^2}+ysinx=0$.
11. Write the partial differential equation $ax^2+by^2+z^2=1$.
12. Write the partial differential equation $z=(x+a)(y+b)$.

Part B

II. Answer any Six questions. Each question carries 5 marks **(6x5=30)**

13. Solve $xsinydx+\left(x^2+1\right)cosydy=0.$
14. Determine the oblique trajectories that intersect the family of straight lines y = cx at an angle 45^0.
15. Solve $\frac{d^2y}{dx^2}-4\frac{dy}{dx}+3y=9x^4+4$.
16. Solve $x^3\frac{d^3y}{dx^3}-4x^2\frac{d^2y}{dx^2}+8x\frac{dy}{dx}-8y=4lnx$
17. Classify the singular points of $\left(x^5+x^4-6x^3\right)\frac{d^2y}{dx^2}+x^2\frac{dy}{dx}+(x-2)y=0.$
18. Compute the power series solution of $\frac{d^2y}{dx^2}+8x\frac{dy}{dx}-4y=0.$

19. Compute the power series solution in powers of x of the differential equation $\frac{d^2y}{dx^2} - x\frac{dy}{dx} - y = 0.$

20. Solve the partial differential equation $p\sqrt{x} + q\sqrt{y} = \sqrt{z}$

21. If $z = f\left(x^2 - y\right) + g\left(x^2 + y\right)$ .Show that $\frac{\partial^2 z}{\partial x^2} - \frac{1}{x}\frac{\partial z}{\partial x} = 4x^2\frac{\partial^2 z}{\partial y^2}$.

Part C

III. Answer any Two questions. Each question carries 15 marks **(2x15=30)**

22. **a) Solve** $\frac{dy}{dx} + \left(\frac{2x+1}{x}\right)y = e^{-2x}.$

b) Solve $y^2dx + (3xy - 1)\,dy = 0$.

23. **a) Determine the general solution of the differential equation** $x^2\frac{d^2y}{dx^2} - 5x\frac{dy}{dx} + 8y = 2x^3.$

b) Solve the differential equation $\frac{d^2y}{dx^2} + 4y = sec^2 2x$ **by the method of variation of parameters.**

24. **Solve** $2x\frac{d^2y}{dx^2} + \frac{dy}{dx} + 2y = 0$ **using the method of Frobenius.**

25. **Solve a)** $x^2(y-z)p + y^2(z-x)q = z^2(x-y)$

b) $(x^2 - y^2 - z^2)p + 2xyq = 2xz$.