

**BACHELOR'S DEGREE EXAMINATION, OCTOBER 2025
2024 ADMISSIONS REGULAR
SEMESTER III - MAJOR (MATHEMATICS)
MT3DSEA01B24 - Differential Equations- I**

Time : 2 Hours

Maximum Marks : 70

Part A

Answer all questions from the bunch of CO1. Each question carries 2 mark. (2x3=6)

1. Solve $ydx + xdy = 0$. [CO1,Remember]

2. Identify whether the differential equation $y^2 \frac{d^2y}{dx^2} - 5y = 0$ is linear or non-linear linear and illustrate the reasons. [CO1,Remember]

3. Recall on what factor does the number of arbitrary constants in the general solution of a differential equation depend. [CO1,Remember]

Part A

Answer all questions from the bunch of CO2. Each question carries 2 mark. (2x3=6)

4. Express the equation of a family of circles whose origin lies on the x-axis with radius 3. [CO2,Understand]

5. Determine the integrating factor of $-ydx + xdy = 0$, as a function in x. [CO2,Understand]

6. Given family of straight lines $y = cx$, determine the orthogonal trajectories. [CO2,Understand]

Part A

Answer all questions from the bunch of CO3. Each question carries 2 mark. (2x3=6)

7. Evaluate the Wronskian and check whether the functions $\sin x$ and $\cos x$ are linearly independent. [CO3,Apply]

8. Solve $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} - 6y = 0$. [CO3,Understand]

9. List the UC set of the function x^3e^{2x} . [CO3,Apply]

Part A

Answer all questions from the bunch of CO4. Each question carries 2 mark. (2x3=6)

10. Write the partial differential equation of all spheres of radius r whose centers lie on the z axis. [CO4,Understand]

11. Write the partial differential equation $\phi = x + y + f(xy)$. [CO4,Understand]

12. Write the partial differential equation $ax^2 + by^2 + z^2 = 1$. [CO4,Understand]

Part B

Answer any 2 questions from the bunch of CO1. Each question carries 6 mark. (6x2=12)

13. Solve the exact equation $(6x+4y+1)dx+(4x+2y+2)dy=0$. [CO1,Apply]

14. $\frac{dy}{dx} + \frac{x}{t^2} = \frac{1}{t^2}$. [CO1,Apply]

15. Solve the Bernoulli's equation $\frac{dy}{dx} - \frac{y}{x} = -\frac{y^2}{x}$. [CO1,Apply]

Part B

Answer any 2 questions from the bunch of CO2. Each question carries 6 mark. (6x2=12)

16. Determine the integrating factor of the form $x^p y^q$ of the equation $(4xy^2 + 6y)dx + (5x^2y + 8x)dy = 0$. [CO2,Apply]
17. Solve the Clairaut's equation $y = px + p^2$, where $p = dy/dx$. [CO2,Apply]
18. Determine the orthogonal trajectory of $y = cx^3$. [CO2,Apply]

Part B

Answer any 2 questions from the bunch of CO3. Each question carries 6 mark.

(6x2=12)

19. Determine the complementary function of $\frac{d^2 y}{dx^2} - 3\frac{dy}{dx} + 2y = 4x^2$. [CO3,Apply]
20. Solve $\frac{d^2 y}{dx^2} + 7\frac{dy}{dx} + 10y = 0$, $y(0) = -4$; $y'(0) = 2$. [CO3,Apply]
21. Determine the complimentary function of $x^3 \frac{d^3 y}{dx^3} - 4x^2 \frac{d^2 y}{dx^2} + 8x \frac{dy}{dx} - 8y = 4 \ln x$. [CO3,Apply]

Part C

Answer any 1 question from the bunch of CO4. Each question carries 10 mark.

(10x1=10)

22. a) Solve the partial differential equation $x(y-z)p + y(z-x)q = z(x-y)$.
 b) Solve the partial differential equation $p\sqrt{x} + q\sqrt{y} = \sqrt{z}$. [CO4,Apply]
23. Solve the following partial differential equations
 a) $x(x+y)p - y(x+y)q = y^2 - x^2$
 b) $(y-z)p + (z-x)q = x - y$. [CO4,Apply]