

B.SC DEGREE END SEMESTER EXAMINATION OCTOBER 2016
SEMESTER - 5: MATHEMATICS
COURSE: U5CRMAT6, U5CRCMT6 - DIFFERENTIAL EQUATIONS
(Common for BSc. Mathematics and Computer Applications)
 Time: Three Hours Max. Marks: 75

Part - A (Answer **all** questions)

[Each question carries 1mark]

1. Test for the exactness of the differential equation $\frac{y}{x^2} dx + \left(y - \frac{1}{x}\right) dy = 0$
2. Which substitution transforms the differential equation $2x^2 y \frac{dy}{dx} = \tan(x^2 y^2) - 2xy^2$ into a variable separable equation.
3. Find an integrating factor for the differential equation $\sin 2x \frac{dy}{dx} = y + \tan x$
4. Find the wronstian of the solutions $f_1(x) = \cos \omega x, f_2(x) = \sin \omega x$
Of the differential equation $y'' + \omega^2 x = 0$
5. Roots of the auxillary equation corresponding to a third order linear differential equation with constant coefficients are $1, 10i, -10i$ write the general solution.
6. Reduce $x^2 \frac{d^2 y}{dx^2} - 3x \frac{dy}{dx} + 3y = 0$ to a differential equation with constant coefficients.
7. Find the singular points of the differential equation $x^2(x-2)^2 y'' + 2(x-2)y' + (x+1)y = 0$
8. Write the Bessel's equation of order p .
9. Obtain the partial differential equation associated with the family of surfaces $z = (a + by^2) \cos x$
10. Write the two dimensional Laplace's equation.

(1 x 10 = 10)

Part - B (Answer **Eight** questions)

[Each question carries 2 marks]

11. Solve the differential equation $\frac{(2S-1)}{t} ds + \left(\frac{S-S^2}{t^2}\right) dt = 0$
12. Examine whether the differential equation $y + \sqrt{x^2 + y^2} dx - x dy = 0$ is homogeneous or not
13. Solve the differential equation. $\frac{dr}{d\theta} + r \tan \theta = \cos \theta$.
14. Solve the differential equation $\frac{d^2 y}{dx^2} - 3 \frac{dy}{dx} + 3y = 0$
15. Find the general solution of the differential equation

$$\frac{d^2 y}{dx^2} + 2 \frac{dy}{dx} + 4y = \cos 4x$$

16. Solve the differential equation

$$4x^2 \frac{d^2 y}{dx^2} - 4x \frac{dy}{dx} + 3y = 0$$

17. Locate and classify the singular points of the differential equation

$$(x^2 - 3x) \frac{d^2 y}{dx^2} + (x+2) \frac{dy}{dx} + y = 0$$

18. Prove that $\frac{d}{dx}(xJ_1(x)) = xJ_0(x)$

19. Solve $\frac{dx}{x^2} = \frac{dy}{y^2} = \frac{dz}{(x+y)z}$

20. Form the partial differential equation by eliminating the arbitrary function from $z = xy + f(x^2 + y^2)$

(2 x 8 = 16)

Part - C (Answer Five questions)

[Each question carries 5 marks]

21. Solve $2xy \frac{dy}{dx} - y^2 + x^2 = 0$

22. Solve $\frac{dy}{dx} + x \sin 2y = x^3 \cos^2 y$

23. Solve the initial - value problem

$$\frac{d^2 y}{dx^2} - 2 \frac{dy}{dx} - 3y = 2e^x - 10 \sin x, \quad y(0) = 2, \quad y'(0) = 4.$$

24. Find power series solutions in powers of x of the differential equation

$$\frac{d^2 y}{dx^2} + x \frac{dy}{dx} + y = 0$$

25. Use the operator method to solve the following system of equations

$$\frac{dx}{dt} + \frac{dy}{dt} - 2x - 2y = e^t, \quad \frac{dx}{dt} + \frac{dy}{dt} - y = e^{4t}$$

26. Solve the differential equation

$$\frac{d^2 y}{dx^2} + y = \sec x$$

27. Find the general solution of the linear partial differential equation

$$y^2 p - xyq = x(z - 2y)$$

(5 x 5 = 25)

Part - D (Answer any two question)

[Each question carries 12 marks]

28. Solve $\frac{dy}{dx} = \frac{x+2y-3}{2x+y-3}$

29. Find the general solution of the equation

$$y'' + 2y' + y = e^{-x} \log x$$

30. Use method of Frobenius to find the general solution of the differential equation

$$2x^2 \frac{d^2 y}{dx^2} + x \frac{dy}{dx} + (x^2 - 3)y = 0$$

31. (a) Solve the partial differential equation

$$u_{xx} - 4 = 0$$

(b) Find the general integral of the linear partial differential equation

$$(x^2 - yz) p + (y^2 - zx) q = z^2 - xy$$

(12 x 2 = 24)
