

**B. Sc. DEGREE (C.B.C.S.S.) EXAMINATION, JANUARY 2019**  
**(2016 Admission Supplementary)**  
**SEMESTER V- CORE COURSE (MATHEMATICS)**  
**MT5B06B – DIFFERENTIAL EQUATIONS**

Time: Three Hours

Maximum Marks: 80

**PART A****I. Answer all. Each one carries 1 mark.**

1. Define Bernoulli differential equation.
2. Find the integrating factor of the equation  $\frac{dx}{dy} + \frac{2}{y}x = y^2$ .
3. Write the UC set of the function  $x^2 e^{4x} \sin x$ .
4. Solve  $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = 0$ .
5. Define ordinary point of a second order differential equation.
6. The direction cosines of the normal to the surface  $z = f(x, y)$  at the point  $(x, y, z)$  are

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(6×1=6)

**PART B****II. Answer any seven questions. Each one carries 2 marks.**

7. Solve  $(3x + 2y)dx + (2x + y)dy = 0$ .
8. Solve  $\frac{dy}{dx} + \frac{y}{x} = x^2$ .
9. Write the UC set of the functions  $x^3 e^{5x} \sin x, x^5 e^{2x}$ .
10. Show that  $e^{-x}, e^{3x}, e^{4x}$  are linearly independent solution of the differential equation  $\frac{d^3y}{dx^3} - 6\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 12y = 0$ .
11. Solve  $\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 13y = 0$ .
12. Locate and classify the singular points of  $(x^3 + x^2)\frac{d^2y}{dx^2} + (x^2 - 2x)\frac{dy}{dx} + 4y = 0$ .
13. Show that  $J_{-p}(x) = (-1)^p J_p(x)$ , if  $p$  is an integer.
14. Evaluate :  
 i)  $(D - 1)(D - 2)(t^2 + e^t)$ .  
 ii)  $(D^2 + 3D)(e^{3t} + \cos t)$ .
15. Form the partial differential equation  $F(x^2 y^2 z^2, xyz) = 0$ .
16. Find the equation of the tangent plane to the surface  $x^2 + y^2 + z^2 = 1$  at the point  $(\frac{1}{\sqrt{14}}, \frac{2}{\sqrt{14}}, \frac{-1}{\sqrt{14}})$ .

(7×2=14)

**PART C****III. Answer any five questions. Each one carries 6 marks.**

17. Solve  $(x + 2y + 3)dx + (2x + 4y - 1)dy = 0$ .
18. Solve  $\frac{dy}{dx} + y = xy^3$ .

19. Solve  $\frac{d^2y}{dx^2} + 4y = \sec^2 2x$ .
20. Given that  $y = x$  is a solution of  $(x^3 - x + 1) \frac{d^2y}{dx^2} + (x^2 + x) \frac{dy}{dx} + (x + 1)y = 0$ . Find a linearly independent solution by reducing the order. Find the general solution.
21. Solve  $x^2 \frac{d^2y}{dx^2} - 4x \frac{dy}{dx} + 4y = 4x^2 - 6x^3$ .
22. Find the power series solution of the differential equation  $\frac{d^2y}{dx^2} + x \frac{dy}{dx} + y = 0$ .
23.  $J_p(x)$  is the solution of the Bessel's equation of order  $p$ . Then show that :
- i)  $\frac{d}{dx}(x^p J_p(x)) = x^p J_{p-1}(x)$
- ii)  $\frac{d}{dx}(x^{-p} J_p(x)) = x^{-p} J_{p+1}(x)$
24. Find the general integral of  $y^2 p - xyq = x(z - 2y)$ .

(5×6=30)

### PART D

IV. Answer any two questions. Each one carries 15 marks.

25. Solve the differential equation  $(x - 2y - 3)dx + (2x + y - 1)dy = 0$ .
26. Solve  $\frac{d^2y}{dx^2} - 3 \frac{dy}{dx} + 2y = x^2 e^x$ .
27. Find the general solution of  $(x^2 - 1)y'' - 2xy' + 2y = (x^2 - 1)^2$ .
28. Find the general solution of the linear system of equations:

$$2 \frac{dx}{dt} - 2 \frac{dy}{dt} - 3x = t$$

$$2 \frac{dx}{dt} + 2 \frac{dy}{dt} + 3x + 8y = 2$$

(2×15=30)