Reg. No.: ...........................

Name : ........................

### B. Sc. DEGREE (C.B.C.S.S.) EXAMINATION, OCTOBER 2018
#### (2016 Admission Regular & 2015 Admission Supplementary)
#### SEMESTER V- CORE COURSE (MATHEMATICS)
#### MT5B06B – DIFFERENTIAL EQUATIONS

**Time: Three Hours**                                                    **Maximum Marks: 80**

### PART A

**I. Answer all questions. Each question carries 1 mark.**

1. Define an exact differential equation.

2. Find the order and degree of the differential equation $\frac{d^2y}{dx^2} + xy\left(\frac{dy}{dx}\right)^2 = 0$.

3. Find the general solution of $\frac{d^2y}{dx^2} + 4y = 0$.

4. Find the Wronskian of $(x^3, x^5)$.

5. Define ordinary point of a second order homogeneous differential equation.

6. What is Lagrange's partial differential equation?

                                                        **(6×1=6)**

### PART B

**II. Answer any seven questions. Each question carries 2 marks.**

7. Solve $4xy\,dx + (x^2 + 1)dy = 0$.

8. Show that $e^x$, $e^{2x}$ are lineary independent solution of the differential equation $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = 0$.

9. Find the integrating factor of the differential equation $(2x + \tan y)dx + (x - x^2\tan y)dy = 0$.

10. Solve $\frac{d^3y}{dx^3} - 5\frac{d^2y}{dx^2} + 7\frac{dy}{dx} - 3y = 0$.

11. The roots of the auxiliary equation, corresponding to a certain $10^{th}$ order homogeneous linear differential equation with constant coefficients are $4, 4, 4, 4, 2 + 3i, 2 - 3i, 2 + 3i, 2 - 3i, 1 + 2i,$
    $1 - 2i$.

12. Solve $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + 4y = 0$.

13. Solve $\frac{d^2y}{dx^2} - \frac{dy}{dx} + 25y = 0$.

14. Find the indicial equation and its roots for the equation $x^3y'' + (\cos 2x - 1)y' 2xy = 0$.

15. Find the integral curves of the equation $\frac{dx}{x} = \frac{dy}{y} = \frac{dz}{z}$.

16. Form the parital differential equation of the sphere whose centre lies on the $z$ −axis.

                                                        **(7×2=14)**

### PART C

**III. Answer any five questions. Each question carries 6 marks.**

17. Solve $(3x + 8)(y^2 + 4)dx - 4y(x^2 + 5x + 6)dy = 0$.

                                                        **(P.T.O)**

18. Solve $\frac{dy}{dx} - \frac{y}{x} = \frac{-y^2}{x}$.

19. Given that $y = x$ is a solution of $(x^2 - x + 1)\frac{d^2y}{dx^2} + (x^2 + x)\frac{dy}{dx} + (x + 1)y = 0$. Find a linearly independent solution by reducing the order. Write the general solution.

20. Solve $\frac{d^2y}{dx^2} + y = x \sin x$.

21. Solve $x^3 \frac{d^3y}{dx^3} - x^2 \frac{d^2y}{dx^2} + 2x \frac{dy}{dx} - 2y = 4 \ln x$.

22. Find the power series solution of differential equation $\frac{d^2y}{dx^2} + x \frac{dy}{dx} + (x^2 + 2) = 0$.

23. $J_p(x)$ is the solution of the Bessel's equation of order $p$. Then show that :

i) $\frac{d}{dx}(J_p(x)) = \frac{1}{2}[J_{p-1}(x) - J_{p+1}(x)]$

ii) $J_p(x = \frac{x}{2p}[J_{p-1}(x) + J_{p+1}(x)]$.

24. Find the general integral of .

$$(5 \times 6 = 30)$$

## PART D

**IV. Answer any two questions. Each question carries 15 marks.**

25. Solve:

a) $(y + \sqrt{x^2 + y^2})dx - xdy = 0$

b) $(2xy^2 + y)dx + (2y^3 - x)dy = 0$

26. Solve the initial valued problem $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 3y = 9x^2 + 4, y(0) = 6, y'(0) = 8$.

27. Find the general solution of the differential equation
$$\sin^2 x \frac{d^2y}{dx^2} - 2 \sin x \cos x \frac{dy}{dx} + (\cos^2 x + 1)y = \sin^3 x.$$

28. Solve completely in series, the equation $(2x + x^3)y'' - y' - 6xy = 0$.

$$(2 \times 15 = 30)$$