



CAF-139

Seat No.,

B. Sc. (Sem.- V) Examination

December – 2021

CC MATH-503 : Mathematics

(Differential Equation)

Time Hours] [Total Marks : 70

Instructions : (1) All questions are compulsory.
(2) Figure to the right indicates full mark of the corresponding question.

1 (a) Prove in usual notation 6

$$\frac{1}{D^2 + a^2} \sin ax = \frac{-x}{2a} \cos ax, f(-a^2) = 0$$

OR

(a) Prove in usual notation

$$\frac{1}{f(D)} e^{ax} = \frac{x^r \cdot e^{ax}}{f^{(r)}(a)}, f(a) = 0$$

(b) Attempt any three : 12

(1) Solve $(D^3 + 6D^2 + 11D + 6)y = 0$.

(2) Solve $(D^4 + (m^2 + n^2)D^2 + m^2n^2)y = \cos(m \cdot n) \frac{x}{2} \cos(m \cdot n) \frac{x}{2}$

(3) Solve $D^2y - 5Dy + 6y = x^3 e^x$.

(4) Solve $(D^2 - 2\lambda D + (\lambda^2 + \mu^2))y = 0$.

2 (a) Obtain the first integral of 6

$$x^3 y^{(3)} + 4x^2 y^{(2)} + x(x^2 + 2)y^{(1)} + 3x^2 y = 2x$$

OR

(a) Find the equation of the family of curves which touch the line $y=1$ and are integral curves of the differential equation $y^3(y^{(2)} - y) = 1$

(b) Attempt any three : 12

(1) Solve $x^2 y^{(4)} + 1 = 0$.

(2) Solve $y^{(2)} = \sec^2 y \tan y$ given that $y = 0, y^{(1)} = 1$ when $x = 0$.

(3) Solve equation that do not contain x directly $yy^{(2)} - (y^{(1)})^2 = y^2 \log y$.

(4) $ay^{(2)} = [1 + (y^{(1)})^2]^{\frac{1}{2}}$

3 (a) Method for solving $y^{(2)} + Py^{(1)} + Qy = R$. 5

When an integral included in complementary function is know

OR

(a) Transformation of the equation $y^{(2)} + Py^{(1)} + Qy = R$ by changing the independent variable.

(b) Attempt any three

12

(1) Solve $\sin^2 x \frac{d^2 y}{dx^2} - 2y$ given $y = \cot x$ is a solution

(2) Solve $\frac{d^2 y}{dx^2} + \cot x \frac{dy}{dx} + 4y \operatorname{cosec}^2 x = 0$.

(3) Solve by factorization of $x \frac{d^2 y}{dx^2} + (1-x) \frac{dy}{dx} - y = x^2$.

(4) Solve $y^{(2)} - 2 \tan x y^{(1)} + 5y = e^x \sec x$

4 Attempt any three

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(1) Solve by factorization of

$$x \frac{d^2 y}{dx^2} + (1-x) \frac{dy}{dx} - y = e^x.$$

(2) Solve $\frac{d}{dx} [\cos^2 x y^{(1)}] + \cos^2 x y = 0$

(3) Solve $y^{(2)} = \frac{1}{\sqrt{ay}}$

(4) Solve $(D^2 + D - 2)y = 2(1 + x + x^2)$.