

End Semester /Reappear (Semester II) Examination May 2025

Programme: B.Tech (MiE)

Full Marks: 70

Course: Mathematics –II

Time: 3 Hrs.

Course Code: 8BSC104

Enrolment no. _____

Section I

1. Short Answer type questions.

4 x 5 = 20

- a. Check the differential equation $(xy^2 + 2x^2y^3)dx + (x^2y - x^3y)dy = 0$ is exact or not. If not, find integrating factor which makes it exact. **(CO1) Apply**

or

Solve $(x^2 - ay)dx - (ax - y^2)dy = 0$ **(CO1) Apply**

- b. Solve the equation $(D^3 + 6D^2 + 11D + 6)y = 0$ **(CO2) Apply**

or

Evaluate $(D^3 + 1)y = x^2$ **(CO2) Evaluate**

- c. Define regular and irregular singular point of second order differential equation. **(CO3), Remember**

or

Check whether $x=1$ is ordinary point or regular singular point $(x^2 - 1)y'' + xy' - y = 0$.

(CO3). Apply

- d. Define classification of parabolic, hyperbolic and elliptic partial differential equation.

(CO4) Understand

or

Solve $(D^2 + D'^2)Z = 0$ **(CO4) Analyze**

Section II

Long Answer type questions.

3 x 10 = 30

2. Prove that $\frac{d}{dx}[x^n J_n(x)] = x^n J_{n-1}(x)$. **(CO3) Analyze**

or

Find the series solution of the differential equation $3x \frac{d^2y}{dx^2} + 2 \frac{dy}{dx} + y = 0$ about $x = 0$

(CO3) Analyze

3. Solve $\frac{\partial^3 z}{\partial x^3} - 3 \frac{\partial^3 z}{\partial x^2 \partial y} + 4 \frac{\partial^3 z}{\partial y^3} = e^{x+2y}$ **(CO4) Apply**

or

Evaluate $y^2 p^2 + y^2 q^2 = z^2$ **(CO4) Evaluate**

4. Prove that the vector $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$ is irrotational. **(CO5) Analyze**

or

Find directional derivatives of $f = x^2yz + 4xz^2$ at the point $(1, -2, -1)$ in the direction of the vector $2\hat{i} - \hat{j} - 2\hat{k}$. **(CO5) Apply**

Section III

Application based questions.

1 x 20 = 20

5. Solve $(x + 1) \frac{d^2y}{dx^2} - 2(x + 3) \frac{dy}{dx} + (x + 5)y = e^x$ **(CO2) Analyze**

or

Solve using variation of parameters $x^2y'' + xy' - y = x^2e^x$.

(CO2) Analyze

Course Outcomes

CO1 To introduce the basic concepts required to understand, construct, solve and interpret ordinary differential equations.

CO2 To teach methods to solve differential equations of various types.

CO3 To give an idea about Power series solutions; Legendre polynomials, Bessel functions.

CO4 To give an ability to apply knowledge of Partial Differential equation on engineering problems.

CO5 Formulate and solve problems related to vector calculus in the field of Industrial Organization Engineering.