JHARKHAND Rai University RANCHI

End Semester /Reappear (Semester II) Examination May 2025

Programme: B.Tech (CSE) **Full Marks: 70**
Course: Mathematics –II **Time: 3 Hrs.**
Course Code: 3BSC104
Enrolment no. ___________________

Section I

1. **Short Answer type questions.** **4 x 5 = 20**

a. Solve the given differential equation $(x+1)\frac{dy}{dx} - y = e^{3x}(x+1)^2$ CO1 (Understand)

or

The equation $(\alpha xy^3 + y\cos x)dx + (x^2y^2 + \beta \sin x)dy = 0$ is exact. Find the value of α and β.

CO1 (Understand)

b. Solve $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} - 4y = 0$ CO2 (Understand)

or

Solve $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} - 21y = 0$ CO2 (Understand)

c. Determine whether x = 0 is an ordinary or singular point of the differential equation

$x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + (x^2 - \frac{1}{4})y = 0$ CO5 (Understand)

or

Find regular singular point of the differential equation $2x^2\frac{d^2y}{dx^2} + 3x\frac{dy}{dx} + (x^2 - 4)y = 0$

CO5 (Understand)

d. Discuss steps for finding complementary function of general linear homogeneous partial differential equation of second order. CO 4 (Remember)

or

Solve the partial differential equation $\frac{\partial^2 z}{\partial x^2} - 2\frac{\partial^2 z}{\partial x \partial y} + \frac{\partial^2 z}{\partial y^2} = 0$ CO 4 (Understand)

Section II

Long Answer type questions. **3 x 10 = 30**

2. Find solution of $\frac{d^2y}{dx^2} + 4y = 8\cos 2x$, given that y = 0and $\frac{dy}{dx} = 0$ when x = 0. CO2 (Evaluate)

or

Solve $x^2\frac{d^2y}{dx^2} - 3x\frac{dy}{dx} + 5y = \sin(\log x)$ CO2 (Evaluate)

3. Solve the partial differential equation $(D^3 - 7DD'^2 - 6D'^3)z = \sin(x+2y) + e^{2x+y}$

CO 4 (Evaluate)

or

Solve the partial differential equation $(p^2 + q^2)y = qz$ CO 4 (Evaluate)

4. Solve in series form of given differential equation at x = 0, $(x^2+2)\frac{d^2y}{dx^2} + x\frac{dy}{dx} - (1+x)y = 0$

CO5 (Evaluate)

or

Prove that $J_{\frac{1}{2}}(x) = \sqrt{(\frac{2}{\pi x})}\sin x$ and $J_{-\frac{1}{2}}(x) = \sqrt{(\frac{2}{\pi x})}\cos x$ CO5 (Apply)

Application based questions. **1 x 20 = 20**

5. **a.** In a certain city the population gets doubled in 2 years and after 3 years the population is 20, 000. Find the number of people initially being living in the city.

b. The number of bacteria in a yeast culture grows at rate which is proportional to the number present. If the population of a colony of yeast bacteria triples in 1 hour, find the number of bacteria which will be present at the end of 5 hours. CO1 (Apply)

or

a. The current in a circuit containing an inductance L, resistance R and voltage E sinωt is given by $L\frac{di}{dt} + Ri = Esin\omega t$.If initially there is no current in the circuit show that $i = \frac{E}{\sqrt{R^2+\omega^2 L^2}}[sin(\omega t - \varphi) + sin\varphi . e^{-\ (R/L)t})]$ where tan $\varphi = \omega l/R$ CO1 (Apply)

b. If the population of a country doubles in 50 years, in how many years will it triple under the assumption that the rate of increase is proportional to the number of inhabitants? CO1 (Apply)

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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.