PRANVEER SINGH INSTITUTE OF TECHNOLOGY KANPUR

Odd Semester | Session 2023-24 | CT -I

B. Tech.- 3rd Semester

Mathematics-IV (BAS-303)

CO Number	Course Outcome
CO1	Define/State/Find (L1-Remember) various fundamental concepts of partial differential equations (PDE), fourier transform and probability.
CO2	Explain/Discuss/Show (L2-Understand) the process involved various engineering problems to calculate (L2-Understand) various value of dependent variables. Partial differential equations are used in heat equation, wave equation, curve fitting, correlation, regression and other statistical techniques.
CO3	Apply/use (L3-Apply) the concepts of PDE, Fourier transform, probability and statistics to compute (L3-Apply) the engineering problems.
CO4	Solve/Examine (L4-Analyze) moments, skewness and kurtosis, coefficient of correlation, probability and various dependent variables in PDE. Test (L4-Analyse) the significance of chi-square test, Z-test, t-test as well as control charts.

Time: 1.5 Hrs. M. M. 20

Section A

(1X5 = 5 Marks)

Q1. Attempt all questions:

a) Define partial differential equation by eliminating the arbitrary constant from $z = (a + x)(y + b)$ — CO1

b) Find the singular integral of $z = px + qy + pq$ — CO1

c) Find the C.F. of the PDE $(D^2 - D'^2 - 3D + 3D')z = 0$ — CO1

d) Find the classification of the differential equation — CO1

$$t\frac{\partial^2 u}{\partial t^2} + 3\frac{\partial^2 u}{\partial x \partial t} + x\frac{\partial^2 u}{\partial x^2} + 17\frac{\partial u}{\partial t} = 0$$

e) Define non-linear partial differential equation of first order with an example. — CO1

Section B

(2.5X4 = 10 Marks)

Q2. Attempt all questions:

a i) Solve the PDE $(x^2 - yz)\,p + (y^2 - zx)q = z^2 - xy$ — CO4

Or

ii) Solve the PDE $(D^2 - 2D'^2)z = sinx\,cos2y$ — CO4

b i) Calculate the complete solution of following PDE — CO2

$$x^2\frac{\partial^2 z}{\partial x^2} - y^2\frac{\partial^2 z}{\partial y^2} = xy$$

Or

ii) Calculate the complete solution of the PDE CO2

$$\frac{\partial^2 z}{\partial x^2} - 3\frac{\partial^2 z}{\partial x \partial y} + 2\frac{\partial^2 z}{\partial y^2} = e^{2x+3y} + \sin(x - 2y)$$

c i) Use the method of separation of variables to solve the equation CO3

$$\frac{\partial u}{\partial x} = 4\frac{\partial u}{\partial y} \quad ; \quad u(0, y) = 8\, e^{-y}$$

Or

ii) Apply the concept of partial differential equation to solve $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ with boundary conditions $u(0, t) = 0$, $u(l, t) = 0$ and $u(x, 0) = 3 \sin n\pi x$ CO3

d i) Use the concept of PDE to solve$(D + 3D' - 2)^2 z = 2\, e^{2x} \tan(y + 3x)$ CO3

Or

ii) Apply the concept of non-linear PDE to solve CO3

$$p + q = sinx + siny$$

Section C

(5X1 = 5 Marks)

Q3

i) Solve the equationby Charpit's method$x^2p^2 + y^2q^2 = 4$CO4

Or

ii) A string is stretched and fastened to two points l apart. Motion is started by displacing the string in the form $y = A\, sin\frac{\pi x}{l}$ from which it is released at time $t = 0$. Examine the concept one dimensional wave equation to show that the displacement of any point at distance x the string from one end at time t is given by CO4

$$y = A\, sin\frac{\pi x}{l}\, cos\frac{\pi ct}{l}$$