Odd Semester

SINGH INSTITUTE OF TECHNOLOGY, KANPUR

Session 2022-23

CT - I

B. Tech. III[rd] Semester

Mathematics IV (KAS-302)

CO Number	Course Outcome
CO1	**Define/State/Find (L1-Remember)** various fundamental concepts of partial differential equations (PDE), probability.
CO2	**Explain/Discuss/Show (L2-Understand)** the process involved various engineering problems to **calculate (L2-Understand)** various value of dependent variables. Partial differential equation are used in heat equation, wave equation, curve fitting, correlation, regression and other statistical techniques.
CO3	**Apply/use (L3-Apply)** the concepts of PDE, 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, F-test, t-test, ANOVA as well as control charts.

Time: 1.5 Hrs.

M. M. 15

Section A

Q1. Attempt all questions: **(1X3 = 3 Marks)**

a) Find the partial differential equation by eliminating the arbitrary constant from $z = ax + a^2x^2 + b$. CO1

b) Find P.I. of the partial differential equations $(D^2 - DD' - 2D)z = \sin(3x + 4y)$. CO1

c) Find the classification of the differential equation $x^2\frac{\partial^2 u}{\partial t^2} - \frac{\partial^2 u}{\partial x^2} + u = 0$. CO1

Section B

Q2. Attempt all questions: **(2X4 = 8 Marks)**

a i) Discuss the process to solve the PDE CO2

$$x^2(y - z)p + y^2(z - x)q = (x - y)z^2.$$

OR

ii) Explain the complete solution of the PDE CO2

$$\frac{\partial^3 z}{\partial x^3} - 7\frac{\partial^3 z}{\partial x \partial y^2} - 6\frac{\partial^3 z}{\partial y^3} = e^{3x+y} + \sin(x + 2y).$$

$m^3 - 7m - 6$

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

$$\frac{\partial u}{\partial t} = \frac{\partial u}{\partial x} - 2u \,. \qquad u(x,0) = 10\, e^{-x} - 6e^{-4x}$$

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

c i) Solve the equation CO4

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

OR

ii) Solve the partial differential equation CO4

$$(D + D' - 1)^2 z = xy.$$

d i) Solve the PDE by method of Cauchy characteristics CO4

$$u_x + u_y = 1 + cosy\,; \qquad u(0,y) = siny$$

OR

ii) Solve the non-linear PDE $z^2(p^2 + q^2) = x^2 + y^2$. CO4

Section C

Q3.

i) Use Charpit's method to solve the equation $px + qy = pq$. **(4X1 = 4 Marks)** CO3

OR

(ii) Compute the deflection of the vibrating string which is fixed at the ends $x = 0$ and $x = 2$. The motion is started by displacing the string into the form $sin^3\left(\frac{\pi x}{2}\right)$ and releasing it with zero initial velocity at $t = 0$. CO3