

**B. Tech. Third Semester**  
**Engineering 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-Analyze) the significance of chi-square test, F-test, t-test, ANOVA as well as control charts.

M. M. 100

Time: 3 Hrs.

**Section A**

(2X10 = 20 Marks)

**Q1. Attempt all questions:**

- Find the solution of  $4r - 12s + 9t = 0$ .
- Find the solution of  $r + 2s + t + 2p + 2q + z = 0$ .
- Find the Classification of the partial differential equation  $5u_{xx} - 9u_{xy} + 4u_{yy} = 0$ .
- Discuss the Telegraph equations in transmission line.
- The mean of 200 items was 50. Later on it was discovered that two items were misread as 92 and 8 instead of 192 and 108. Find out the correct mean.
- Discuss the normal equations of  $y = ax + \frac{b}{x}$ .
- Find p and q of the Binomial distribution whose mean is 9 and variance is  $\frac{9}{4}$ .
- Find the probability  $P(X \geq 4)$  for the Poisson distribution whose variance is 2.
- Define Null hypothesis and Level of significance.
- Discuss Statistical Quality Control (S.Q.C.).

CO1  
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CO2

**Section B**

(10X3 = 30 Marks)

**Q2. Attempt all questions. Question No. 2(a) is compulsory:**

- Solve the partial differential equation

$$x^2 \frac{\partial^2 z}{\partial x^2} - 4xy \frac{\partial^2 z}{\partial x \partial y} + 4y^2 \frac{\partial^2 z}{\partial y^2} + 6y \frac{\partial z}{\partial y} = x^3 y^4$$

CO4

- b i) Use one dimensional wave equation for a tightly stretched string with fixed end points  $x = 0$  and  $x = l$  is initially at rest in its equilibrium position. If it is set vibrating by giving to each of its points an initial velocity  $\lambda x(1-x)$ , find the displacement of the string at any distance  $x$  from one end at time  $t$ . CO3

OR

- ii) Compute the variance, third and fourth central moment (moment about mean) for the following data: CO3

x	0	1	2	3	4	5	6	7
y	1	8	28	56	70	56	28	8

- c i) In a certain factory turning out of razor blades, there is small chance of 0.002 for any blade to be defective. The blades are supplied in a packet of 10. Calculate the approximate number of packets containing no defective, one defective and two defective blades in a consignment of 10000 packets. CO2

OR

- ii) A bag X contains 2 white and 3 red balls and a bag Y contains 4 white and 5 red balls. One ball is drawn at random from one of the bags and is found to be red. Calculate the probability that it was drawn from bag Y. CO2

### Section C

#### 3. Attempt all questions:

(10X5 = 50 Marks)

- a i) Solve by Charpit's method  $2zx - px^2 - 2qxy + pq = 0$ . CO4

OR

- ii) Solve the partial differential equation  $(y + zx)p - (x + yz)q = x^2 - y^2$ . CO4

- b i) Apply two dimensional heat equation in steady state to  $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$  subject to condition  $u(0, y) = 0, u(l, y) = 0, u(x, 0) = 0$  and  $u(x, l) = 100 \sin \frac{n\pi x}{l}$ . CO3

OR

- ii) In a sample of 1000 cases, the mean of a certain test is 14 and S.D. is 2.5. Using normal distribution, find (a) how many students score between 12 and 15 (b) how many score above 18 (c) how many score below 8 (d) how many score 16? CO3  
[Given that  $P(0 \leq z \leq 0.4) = 0.1554, P(0 \leq z \leq 0.6) = 0.2257, P(0 \leq z \leq 0.8) = 0.2881, P(0 \leq z \leq 1) = 0.3413, P(0 \leq z \leq 1.6) = 0.4452, P(0 \leq z \leq 2.4) = 0.4918$ ]

- c i) Calculate the correlation coefficient and lines of regression from the given data: CO2

x	5	7	8	10	11	13	16
y	33	30	28	20	18	16	9

OR

- ii) Calculate mean, standard deviation and variance of the discrete Poisson distribution CO2

$f(x) = \frac{e^{-m} \cdot m^x}{x!}$ , with the help of moment generating function.

- d i) Calculate the correlation coefficient and lines of regression from the given data:

x	5	7	8	10	11	13	16
y	33	30	28	20	18	16	9

CO2

OR

- ii) Out of 8000 families with 4 children each, calculate how many families would be expected to have (i) 2 boys and 2 girls (ii) at least one boy (iii) no girl (iv) at most two girls ? Assume equal probabilities for boys and girls.

CO2

- e i) The two random samples reveal the following data:

Sample No.	Size	Mean	Variance
I	16	440	40
II	25	460	42

CO4

Test whether the samples come from the same normal population.

[Given that for  $\vartheta = 39$ ,  $t_{0.05} = 1.96$  and for  $\vartheta_1 = 14$ ,  $\vartheta_2 = 24$ ,  $F_{0.05} = 2.11$ ]

OR

- ii) Construct the np-chart for the following data of defectives of 10 samples of size 100 each and examine that the process is under control?

CO4

Sample No.	1	2	3	4	5	6	7	8	9	10
No. of defectives	6	9	12	5	12	8	8	16	13	7