May 2023

B.Tech (CIVIL) - IV SEMESTER

MATHEMATICS-III (BSC-201)

Time: 3 Hours   **Max. Marks:75**

Instructions: 1. *It is compulsory to answer all the questions (1.5 marks each) of Part -A in short.*

2. *Answer any four questions from Part -B in detail.*

3. *Different sub-parts of a question are to be attempted adjacent to each other.*

4. *Use of calculator is allowed.*

PART -A

Q1 (a) Solve   (1.5)

$$(D^2 - 2DD')z = 0$$

(b) Differentiate between one dimensional and two dimensional Heat equation.   (1.5)

(c) Find particular Integral of   (1.5)

$$(D^2 + DD')z = Sin(x+y)$$

(d) Differentiate between Multinomial distribution and Baye's rule.   (1.5)

(e) Cards are dealt one by one from a well shuffled pack of playing cards until an ace   (1.5)
appears. Find the probability that exactly " n " cards are dealt before an ace appears.

(f) A random variable X has the following distribution: (1.5)

X	-2	-1	0	1	2	3
P(X)	0.1	K	0.2	2K	0.3	K

Find the expected value.

(g) Define the following terms: (1.5)
1. Positive correlation
2. Partial correlation
3. Non-linear correlation

(h) Differentiate between correlation analysis and regression analysis.   (1.5)

(i) Explain Rank Correlation with example.   (1.5)

(j) Explain " Test of significance for a single mean".   (1.5)

PART -B

Q2 (a) Solve   (8)

$$(4D^2 - 4DD' + D'^2)z = e^{3x-2y} + Sin\, x$$

(b) Find the general solution of one dimensional wave equation: (7)

$$\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2} \quad ; \quad 0 < x < \infty, \quad t > 0$$

$$u(x,0) = Cos\left(\frac{\pi x}{2}\right) \quad ; \quad 0 \le x < \infty$$

$$\frac{\partial u}{\partial t}(x,0) = 0 \quad ; \quad 0 \le x < \infty$$

Q3 (a) Fit a binomial distribution to following data, when tossing 5 coins: (8)

X	0	1	2	3	4	5
f	2	14	20	34	22	8

(b) A pair of dice is thrown together, find the expected value and variance. (7)

Q4 (a) Fit a Poisson distribution on the following data: (8)

X	0	1	2	3	4
f	192	100	24	3	1

(Given: $e^{-0.5} = 0.6065$)

(b) If the probability density function of a random variable is given by: (7)

$$f(x) = \begin{cases} K(1 - x^2) & , & 0 \leq x \leq 1 \\ 0 & , & elsewhere \end{cases}$$

Find the value of K and hence calculate mean and variance.

Q5 (a) Find the solution of (8)

$$\frac{\partial^2 u}{\partial x^2} = \frac{1}{c^2} \cdot \frac{\partial u}{\partial t} \qquad ; \qquad 0 < x < 1, \quad t > 0$$

for which $u(0, t) = u(1, t) = 0$ and $u(x, 0) = k \, Sin \, 2\pi x$

(b) Solve (7)

$$y z p + z x q = x y$$

Q6 (a) Calculate Karl Pearson's coefficient of correlation between x and y for the following data: (8)

x	65	66	67	67	68	69	70	72
y	67	68	65	68	72	72	69	71

(b) 1. Define Null and Alternative Hypothesis. (7)
2. A random sample of 200 villages was taken from a certain district and the average population per village was found to be 485 with standard deviation of 50. Another random sample of 200 villages from the same district gave an average population of 510 per village with standard deviation of 40. Is the difference between the averages of two samples significant? Justify your answer. (Significant value of Z at 5% level of significance = 1.96)

Q7 (a) From the given data obtain two regression equations using the following data: (8)

X	2	4	6	8	10
y	5	7	9	8	11

(b) Fit a second degree parabola in the following data: (7)

X	0	1	2	3	4
y	1	4	10	17	30

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