December 2024

B. Tech (ME) - III 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.   *Required z- Table, T-Table, Chi-Square Table*

PART –A

Q1 (a)   Define Kurtosis and its types .   (1.5)

(b)   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 the ace appears.

(c)   The probability density function   (1.5)

$$f(x) = \begin{cases} kx^3, & 0 \le x \le 3 \\ 0, & Otherwise \end{cases}$$

Find the value of k and the probability between $x = \frac{1}{2}$ and $x = \frac{3}{2}$.

(d)   If X and Y are two random variables having joint density function   (1.5)

$$f(x) = \begin{cases} \frac{1}{8}(6 - x - y), & 0 < x < 2 < y < 4 \\ 0 & , & Otherwise \end{cases}$$

Find 1. $P[X < 1 \cap Y < 3]$

2. $P[X + Y < 3]$

(e)   From the data given below, calculate the coefficient of Rank Correlation between   (1.5)

X and Y.

X	78	89	97	69	59	79	68	57
Y	125	137	156	112	107	136	123	108

(1.5)

(f)

Compute the coefficient of Skewness from the following data:

$$25, 15, 23, 40, 27. 25, 23, 25, 20$$

(g) Explain Normal Distribution . (1.5)

(h) Solve (1.5)

$$p - x^2 = q + y^2$$

(i) Form the partial differential equation from (1.5)

$$z = f\,(x^2 - y^2)$$

(j) Solve (1.5)

$$(D^3 - 3D^2D' + 4D'^3)z = 0.$$

PART –B

Q2 (a) Using least square method, fit a second degree parabola to the following data (8)

$$y = a + bx + cx^2$$

X	0	1	2		4
Y	1	1.8	1.3	2.5	6.3

(b) Calculate Karl Pearson's Coefficient of Correlation from the following data: (7)

X	24	27	28	28	29	30	32	33	35
Y	18	20	22	25	22	28	30	27	30

Q3 (a) In an antimalarial campaign in a certain area Quinine was administered to 1624 persons (8)
out of a total population of 6496. The number of fever cases is shown below:

Treatment	Fever	No Fever	Total
Quinine	40	1584	1624
No Quinine	440	4432	4872
Total	480	6016	6496

Discuss the usefulness of Quinine in checking Malaria.

(Given Chi-Square at 5% level of significance is 3.84)

(b) Calculate the first four moments about the mean and also the value of β_1 and β_2 from the
following data:

(7) .

X	2	3	4	5	6
F	1	3	7	3	1

Comment on the skewness and kurtosis of the distribution.

Q4 (a) In a normal Distribution, 31% of the items are under 45 and 8% are over 64. Find the mean and standard Deviation of the distribution. (8)

(b) Out of 800 families with 4 children each, how many families would be expected to have i) 2 Boys 2 girls ii) atleast 1 Boy iii) No Girl iv) at most 2 Girls .Assume equal probabilities for boys and girls. (7)

Q5 (a) The contents of urn I, II and III are as follows: (8)

- One white, 2 black and three red balls
- Two white, one black and one red ball
- Four white, five black and three red balls

One urn is chosen at random and two balls are drawn, they happen to be white and red. What is the probability that they come from

(i) Urn I

(ii) Urn III

(b) Data was collected over a period of 10 years , showing number of deaths from horse kicks in each of the 200 army corps. The distribution of deaths was as follows: (7)

No of Deaths:	0	1	2	3	4	Total
Frequency :	109	65	22	3	1	200

Fit a poission distribution to the data and calculate the theoretical frequencies.

Q6 (a) Drive the expression of solution of Wave equation by D'Almbert's Method. (8)

(b) Solve (7)

$$[D^2 + DD' - 6D'^2] \, z = x^2 \, Sin \, (x + y)$$

Q7 (a) Solve by using Charpit Method, $2xz - px^2 - 2qxy + pq = 0$. (8)

(b) A manufacturer claims that only 4 % of its products supplied by him are defective. A random sample of 600 products contained 36 defective . Test the claim of the manufacturer. (7)