**R18**

## PROBABILITY AND STATISTICS & COMPLEX VARIABLES
(Common to ME, MCT, MMT, AE, MIE, PTM)

Time: 3 Hours

Max. Marks: 75

**Answer any five questions**
**All questions carry equal marks**
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1.a) In a bolt factory machines A, B, C manufacture 20%, 30% and 50% of the total of their output and 6%, 3% and 2% are defective. A bolt is drawn at random and found to be defective. Find the probabilities that it is manufactured form i) Machine A ii) Machine C

b) A random variable x has the following probability distribution.

| $X = x$ | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---------|---|----|----|----|----|----|----|----|
| $P(X = x)$ | k | 2k | 3k | 4k | 5k | 6k | 7k | 8k |

Find the value of  i) $k$   ii) $p(2 \le x \le 5)$. [7+8]

2.a) In a factory machine A produces 40% of the output and machine B produces 60% on the average 9 items in 1000 produced by A are defective and 1 item in 250 produced by B is defective. An item drawn at random from a day's output is defective. What is the probability that it was produced by A.

b) A sample of 3 items is selected at random from a box containing 10 items of which 4 are defective. Find the expected number of defective items. [10+5]

3.a) Fit a Binomial distribution to the following data.

| x | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|----|----|----|----|---|
| f | 2 | 14 | 20 | 34 | 22 | 8 |

b) A manufacturer of cotter pins knows that 5% of his product is defective. Pins are sold in boxes of 100. He guarantees that not more than 10 pins will be defective. What is the approximate probability that a box will fail to meet the guaranteed quality? [8+7]

4.a) Prove that mean, median and mode of a Normal distribution are equal.

b) If X is a poisson variate such that $P(x=2) = P(x=3)$, then find the mean of the poisson distribution. [10+5]

5.a) A coin was tossed 400 times and returned heads 216 times. Test the hypothesis that the coin is unbiased. Use a 0.05 level of significance.

b) 20 people were attacked by a disease and only 18 survived. Will you reject the hypothesis that the survival rate if attacked by this disease is 85% in favor of the hypothesis that is more at 5% level? [7+8]

6.a) A population consists of five numbers 2,3, 6, 8 and 11. Consider all possible samples of two numbers with replacement from this population. Find:
i) The mean of population
ii) The standard deviation of population.
iii) The mean of sampling distribution of means.
iv) The standard deviation of sampling distribution of means.

b) A sample of size 300 was taken whose variance is 225 and mean 54. Construct 95% confidence interval limits for the mean $\mu$. [10+5]

7.a) Discuss the continuity of $f(x,y) = \begin{cases} \dfrac{2xy(x+y)}{x^2+y^2}, & (x,y) \neq (0,0) \\ 0, & (x,y) = (0,0) \end{cases}$

b) Construct the analytic function whose real part is $e^x \cos y$.          [7+8]

8.a) Find the Laurent's series of $\dfrac{z}{(z-1)(z-2)}$ about $z = -2$, in all possible regions.

b) Find the bilinear transformation that maps the points 1, i, -1 into the points 2, i, -2 respectively.          [7+8]

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