(6 pages)

MAY 2013

P/ID 17456/RCF/ PCAB

Time : Three hours Maximum : 75 marks

PART A — ($5 \times 5 = 25$ marks)

Answer ALL questions.

All questions carry equal marks.

1. (a) If $P(A \cup B) = \frac{5}{6}$, $P(A \cap B) = \frac{1}{3}$ and $P(\overline{A}) = \frac{1}{2}$, find $P(A)$ and $P(B)$. Also, examine the independence of A and B.

Or

(b) Define probability density function. Verify whether the following function is the probability density function a random variable $f(x) = \begin{cases} \frac{3+2x}{18}, & \text{if } 2 < x \leq 4 \\ 0, & \text{otherwise} \end{cases}$

2. (a) What is the probability mass function of Poisson(5) distribution? Also, obtain its mean and variance.

Or

(b) If a random variable X is distributed according to Gamma (2,3) distribution, find its moment generating function.

3. (a) Ten competitors in an elocution competition were ranked by two judges as follows :

Judge 1 :	1	6	5	10	3	2	4	9	7	8
Judge 2 :	6	4	9	8	1	2	3	10	5	7

Calculate the coefficient of correlation between the rankings using Spearman's formula.

Or

(b) Describe the method of fitting a parabola.

4. (a) What is stratified random sample? Describe the method of drawing such a random sample.

Or

(b) Determine 95% confidence interval for the mean of the normal population from which the following random sample has been obtained :

10 12 10 14 9 8 10.

5. (a) What is meant by randomization? Explain its purpose in scientific experiments.

Or

(b) Describe long term fluctuation with a suitable example.

PART B — ($5 \times 10 = 50$ marks)

Answer any FIVE questions.

All questions carry equal marks.

6. In a bolt factory, machines A, B and C manufacture bolts respectively 25%, 35% and 40% of the total production. Of their products, 5%, 4% and 2% are defectives. A bolt is drawn randomly from the total production and it was found defective. What is the probability that the bolt was manufactured by machine

(a) A (b) B?

7. Obtain the probability density function, mean and variance of a continuous random variable, if its cumulative distribution function if given by

$$F_x(x)=\begin{cases}0, & \text{if} \quad x<-a \\ \frac{1}{2}\left(\frac{x}{a}+1\right), & \text{if} \quad -a\le x<a \\ 1, & \text{if} \quad x\ge a\end{cases}$$

8. The joint probability distribution of the random variables X and Y is given by $P(X=0,Y=1)=\frac{1}{3}$ $=P(X=1,Y=-1)=\frac{1}{3}=P(X=1,Y=1)$. Obtain the conditional distribution of X given Y =1. Also, Calculate Var (X) and Covariance (X, Y).

9. Define normal distribution. Also, determine its coefficient of skewness.

10. If the coefficients of correlation among the variables X, Y and Z are $r_{XY}=0.91$, $r_{YZ}=0.33$ and $r_{ZX}=0.81$, calculate the values of

(a) $r_{YZ\cdot X}$ (b) $R^2{}_{Z\cdot XY}$.

11. Number of units of an item produced per shift by two workers A and B during randomly selected days are given below :

A : 25 23 19 24 27 18 19 22

B : 26 37 30 35 45 26 22 27 31 33

Test whether the worker A is more stable compared to the worker B? Examine carrying out the F-test at 5% level of significance.

12. Five hundred students at college level are graded according to their intelligence quotient (IQ) and their economic conditions. Find out whether there is any association between economic conditions and the IQ level of college students.

Economic Conditions	IQ level			Total
	High	Medium	Low	
Rich	80	150	70	300
Poor	70	50	80	200
Total	150	200	150	500

13. Perform a two-way analysis of variance at 5% level of significance to the following data :

Plots of Land	Treatment			
	A	B	C	D
1	38	40	41	39
2	45	42	49	36
3	40	38	42	42