1/EH–28 (i) (Syllabus–2019)

2022

(February)

STATISTICS

(Elective/Honours)

(Descriptive Statistics, Numerical Analysis, Probability)

[STEH–1 (TH)]

Marks : 56

Time : 3 hours

The figures in the margin indicate full marks for the questions

Answer **five** questions, selecting **one** from each Unit

UNIT—I

1. *(a)* State various methods of collecting primary data and comment on their relative merits. 6

(b) Show that mean deviation is the least when calculated about median. 6

2. *(a)* What do you mean by the term 'central tendency'? Compare the merits and demerits of arithmetic mean, the median and the mode. 2+4=6

(b) Define moments. Establish the relationship between the moments about mean in terms of moments about any arbitrary point. 1+5=6

UNIT—II

3. *(a)* Explain the concepts of correlation (r). Can it be used to measure any relationship between two variables? Show that $|r|$ 1. 2+1+3=6

(b) Explain the method of least squares as applied to regression analysis. 5

4. *(a)* Explain multiple and partial correlation coefficients with examples. 2+2=4

(b) Why are there in general two lines of regression? 2

(c) Write a note on intra-class correlation. 5

UNIT—III

5. *(a)* Define the terms 'argument' and 'entry' involved in a difference table. 2

(b) Explain the difference between

$$\frac{{}^{2}}{E}\, U_x \text{ and } \frac{{}^{2}U_x}{EU_x}$$

and find the values of these functions when $U_x \quad x^2$. 2+2+2=6

(c) Show that

$$\log f(x) \quad \log 1 \quad \frac{f(x)}{f(x)}$$ 3

6. (a) Define divided differences and show that the *r*th order divided difference is a symmetric function of argument. 1+5=6

(b) State and prove Simpson's three-eighth rule for approximate integration. 5

UNIT—IV

7. (a) State and prove multiplicative law of probability. 1+3=4

(b) If $P(\overline{A})$ and $P(\overline{B})$, then prove that $P(A \quad B) \quad 1$. 3

(c) Show that for any two arbitrary events A and B

$$P(A \quad B) \quad P(A) \quad P(A \quad B) \quad P(A) \quad P(B)$$ 4

8. (a) State and prove Bayes' theorem of probability. 5

(b) Let A and B be two events such that $P(A) \quad \frac{3}{4}$ and $P(B) \quad \frac{5}{8}$. Show that

$$\frac{3}{8} \quad P(A \quad B) \quad \frac{5}{8}$$ 2

(c) Two urns, similar in appearance, certain following numbers of white and black balls are as follows :

Urn I : 6 white and 4 black balls

Urn II : 5 white and 5 black balls

One urn is selected at random and a ball is drawn from it. It happens to be white. What is the probability that it has come from the urn I ? 4

UNIT—V

9. (a) Define probability distribution function. 2

(b) Let X be a continuous random variable with p.d.f.

$$f(x) \quad \begin{matrix} ax & , & 0 \quad x \quad 1 \\ a & , & 1 \quad x \quad 2 \\ ax \quad 3a, & & 2 \quad x \quad 3 \\ 0 & , & \text{otherwise} \end{matrix}$$

Determine the constant a and compute $P \; X \quad 2\;5$. 4

(c) Define moment-generating function (m.g.f.) and cumulant-generating function of a random variable. Also, find the m.g.f. of the random variable whose moments are

$$\mu_r' = (r+1)!\,2^r$$

2+3=5

10. *(a)* If X is a discrete random variable, then prove that

$$E(X) = \sum_{r=1}^{\infty} P(X \ge r)$$

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(b) Two random variables X and Y have the following joint probability function :

$$f(x, y) = \begin{cases} 2 - x - y; & 0 \le x \le 1,\ 0 \le y \le 1 \\ 0 \quad ; & \text{otherwise} \end{cases}$$

Find the following : 2+2+2+2=8

(i) Marginal probability density functions of X and Y

(ii) Conditional density functions

(iii) Var(X) and Var(Y)

(iv) Covariance between X and Y

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