This question paper contains 3 printed pages]

Roll No. | | | | | | | | | | | |

S. No. of Question Paper : **1214**

Unique Paper Code : **237604** **E**

Name of the Paper : **Bio-statistics (STH-604)**

Name of the Course : **B.Sc. (Hons.) (Statistics)**

Semester : **VI**

Duration : **Three Hours** Maximum Marks : **75**

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt *Five* questions in all,

selecting *two* questions from each Section and question no. **1** is compulsory.

Attempt *all* parts of questions in continuation.

1. (*a*) Explain type II censored data. Under this population, the times of death follow exponential distribution. Obtain the expression for mean survival time and variance of the estimated mean survival time.

(*b*) Establish the inter-relationship between survival function, death density function and hazard function. Hence, find the survival function and death density function when $h(t) = c + \exp(-ct)$. 9,6

Section A

2. (*a*) Define Bathtub type of survival model. Assuming hazard rate to be a step function and $t_1, t_2, \ldots\ldots\ldots t_{k-1}$ as points of change of the parameter, find its survival probabilities and corresponding death density function.

P.T.O.

(*b*) Suppose that in a study of efficacy of a new drug; 15 patients with tumors are given the drug. The experimenter decides to terminate the study after 10 patients are dead. The survival times (in months) are :

5	8	9	10	12	15	18	20	22	24	24+	24+	24+	24+	24+

Assuming that times of death follow exponential distribution, obtain an expression for the mean survival time and variance of the estimated mean survival time. 8,7

3. (*a*) Define net probability type A of death ($q_{i\delta}$). Establish the relation between $q_{i\delta}$ and crude probability of death $Q_{i\delta}$.

(*b*) Define partially crude probability of death $Q_{i\delta,\epsilon}$. Use the modified Chi-square method to estimate $Q_{i\delta,\epsilon}$. 8,7

4. (*a*) Find the conditional probability of dying due to ith risk, when k risks $R_i (i = 1, 2, ... k)$ of death are operating independently in a population.

(*b*) Estimate crude probability of death when the joint distribution of d_{i1}, d_{i2}, d_{i3}, ..., d_{ik} and $l_i + 1$ given l_i is multinomial. Also obtain $E(Q_{i\delta})$, var $(Q_{i\delta})$, cov$(Q_{i\delta}, Q_{i\epsilon})$ $(\delta \neq \epsilon)$. (Notations have their usual meanings). 7,8

Section B

5. (*a*) Define Simple Stochastic epidemic model. Obtain the probability of no infection upto time τ.

(*b*) Assuming each patient has the same gamma death density function with parameters λ and γ, find $F(t)$, $S(t)$ and $h(t)$. Also, find mean survival time and variance of the mean survival time. 7,8

6. (*a*) Using Kaplan Meier method, estimate survival function and also obtain expression for variance of the estimate.

(*b*) Estimate crude probability of death by applying method of maximum likelihood estimation. 9,6

7. (*a*) Suppose that k risks of death are operating independently in a population. Let λ_i be the hazard rate associated with the ith risk and $\lambda = \sum_{i=1}^{k} \lambda_i$ be the total force of mortality, then show that the probability of dying due to ith cause will be $\frac{\lambda_i}{\lambda}$.

(*b*) Explain different phases of clinical durg trials and write their objectives. 9,6