5. (*a*) Briefly explain *two* non-parametric methods for estimating survival function. Using either of the methods estimate the survival function, also compute the variance of the estimated survival function.

(*b*) Find death density function, when competing risks are dependent. Also, obtain the death density function for a bivariate dependent risk model when $\rho\sigma_1=\sigma_2$. 7,8

6. (*a*) Describe Mendel's laws of heredity by giving example of crossing of two traits. Also, obtain the probabilities of dominant and recessive traits in second generation.

(*b*) Write short notes on :

(*i*) Blinding

(*ii*) Phase 1 and Phase 2 of clinical drug trials. 7,8

This question paper contains **4** printed pages]

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

S. No. of Question Paper : **2739** 13/05/2019

Unique Paper Code : **32377910** **IC**

Name of the Paper : **Survival Analysis and Bio-Statistics**

Name of the Course : **B.Sc. (Hons.) Statistics : DSE-3**

Semester : **VI**

Duration : **3 Hours** Maximum Marks : **75**

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

Attempt *five* questions in all.

Question No. **1** is compulsory.

Select *four* questions from the remaining questions.

Use of simple calculator is allowed.

1. (*a*) Describe a survival model whose hazard rate takes the shape of bath tub.

(*b*) Explain random censoring with the help of an example.

(*c*) Suppose that k risks of death are operating independently in a population. Let λ_1 be the hazard rate associated with the ith risk and $\lambda=\sum_{i=1}^{k}\lambda_1$ be the total force of mortality. Show that the probability of dying due to ith cause will be λ_1/λ.

(*d*) What is the importance of chromosomes in Genetics ? What are the different types of phenotypic expressions of a heterozygote with respect to a single loci ? 3,4,4,4

2. (*a*) Under Rayleigh model, find survival function and death density function. Also obtain mean survival time.

(*b*) For the following survival data, compute survival function, probability density function and hazard function :

Year of follow-up	No Alive at the beginning of the interval	No dying in the interval
0—1	1000	245
1—2	755	182
2—3	573	174
3—4	399	128
4—5	271	76
5—6	195	60
6—7	135	43

(*c*) Define crude probability of death due to risk $R_\delta(Q_{i\delta})$. Obtain the expression of $Q_{i\delta}$ stating the assumptions clearly. 3,4,8

3. (*a*) Suppose that in a study of efficacy of a new drug; 12 mice with tumor are given the drug. The experimenter decides to terminate the study after 11 mice are dead. The survival times (in weeks) are 5, 6, 7, 8, 9, 10, 12, 15, 20, 21, 25, 25+

Assuming that time of death of these mice follows exponential distribution, Estimate mean survival time, survival rate and S. E. of mean survival time.

(*b*) Define the duration of an epidemic ? For simple stochastic epidemic model, Obtain the expression for *r*th cumulant of the duration of an epidemic. 7,8

4. (*a*) Describe a method for estimation of mean survival time for a type I censored sample from an Exponential population. If $\hat{\mu}$ is the estimate of mean survival time then obtain Var ($\hat{\mu}$).

(*b*) If $g_i (i = 1, 2, 3, 4)$ is the probability of *i*th gamete (γ_i) then obtain the probability distribution of γ_i's in the *n*th generation under random mating. 7,8

P.T.O.