5. Define segregation matrix. Prove that probability of genes remains invariant over generations under random mating if generations are non-overlapping. (15)

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

(b) Distinguish between :

(i) Coupling and Repulsion,

(ii) Genotype and Phenotype,

(iii) Simple Epidemic model and General Epidemic model and

(iv) Single, double and triple blinding (7,8)

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1232 **A**

Unique Paper Code : 32377910

Name of the Paper : Survival Analysis and Bio-Statistics

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

Semester : VI

Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt **five** questions in all.
3. Question no. **1** is compulsory
4. Select **four** questions from the remaining questions.
5. Use of simple calculator is allowed.

1. Answer any **three** parts :

(a) Define death density function, survival function and hazard function, when T follows Weibull

distribution. Obtain mean survival time and variation in survival time when scale parameter is 0.5 and shape parameter is 1.5. Also, comment on the nature of hazard function for given parameters.

(b) Suppose that two risks R_δ. and R_ε $(\delta \neq \varepsilon)$ are operating in the population s.t. $Q_{i\delta} > Q_{i\varepsilon}$ then show that $q_{i\delta} > q_{i\varepsilon}$.

(c) Explain all the phases of clinical drug trials.

(d) Obtain death density function and survival function for bath tub type of survival model. (5×3)

2. (a) Explain Kaplan Meier method for defining survival function. Using this method obtain the survival function. Also, compute the variance of the estimated survival function.

(b) Suppose that in a study to compare the efficacy of two drugs A and B; 14 patients with swine flu are given the drug A and 15 patients with swine flu are given the drug B. The experimenter (under both cases) decides to terminate the study after the recovery of 8 patients. The survival times (in days) are :

Drug A	6	8	11	12	14	16	18	20
Drug B	6	7	10	13	15	17	19	20

If times of remission follow exponential distribution, obtain and compare the mean survival time of drug A and drug B. Also, find the variance of the estimated mean survival time. (8,7)

3. (a) Define Competing Risk Theory. State Chiang's proportionality assumptions and obtain the crude probability of death due to risk R_δ.

(b) Using Neyman's modified Chi square method, obtain the estimator for partially crude probability of death $(Q_{i\delta.1})$ and its variance. (7,8)

4. (a) What is the duration of an epidemic? Obtain the expression for the r^{th} cumulant of the distribution of the duration of an epidemic under simple stochastic epidemic model, given that initially there are n susceptible and one infective at t=0.

(b) Define type-II random censoring. Under this censoring, estimate mean survival time assuming that duration of disease follows exponential distribution. (8,7)

P.T.O.