

**2021****STATISTICS — HONOURS****Paper : DSE-A-2****(Survival Analysis)****Full Marks : 50***The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words  
as far as practicable.*

1. Answer **any five** of the following questions : 2×5
- (a) Which is the outcome variable in the context of survival analysis?
  - (b) Define empirical survival function.
  - (c) Show that the hazard function is constant for all  $t$  if the lifetime probability density function is  $f(t) = e^{-t}; t > 0$ .
  - (d) State the causes of censoring.
  - (e) Establish the relation between mean remaining life function and survival function for a continuous failure time variable.
  - (f) What is the competing risk?
  - (g) Distinguish between Type-1 censoring and random censoring.
  - (h) When Log Rank Test is used?
2. Answer **any two** of the following questions: 5×2
- (a) State the important properties of the survival function. Give a real life situation where survival analysis is useful.
  - (b) Obtain uniformly minimum variance unbiased estimator of the survival function of  $X$ , distributed as exponential with mean  $\theta$ .
  - (c) Find the life estimate of survival function for a cohort study with censoring and derive the Greenwood formula in this context.
3. Answer **any three** of the following questions : 10×3
- (a) Find the estimate of survivor function, hazard rate and their confidence intervals by maximum likelihood method for Type-II censored data following the exponential lifetime distribution.
  - (b) Derive the expression for estimation of survival function using actuarial method. Also obtain the variance of the proposed estimator.

**Please Turn Over**

- (c) Discuss bathtub curve for hazard rate analysis with illustration.
  - (d) (i) Define multiple decrement function in the context of competing risk theory and explain the problem of identifiability in such situation.  
(ii) Derive the Kaplan-Meier estimate of the survival function for censored data.
  - (e) Discuss hazard rate function for a Weibull distributed lifetime. How will you estimate survival function in this situation?
-