

Reg. No. :

Name :

PH.D. ENTRANCE EXAMINATION, NOVEMBER 2022

FACULTY OF SCIENCE

STATISTICS

Time : 3 Hours

Max. Marks : 100

Instructions :

- 1) Answer **any ten** questions each from Section **A** and **B**.
- 2) Each question carries **5** marks.
- 3) No additional Answer sheets will be provided.
- 4) Candidates should clearly indicate the section, Question number in the answer booklet.

SECTION – A

Research Methodology

Answer any **ten** questions. All questions carry equal marks.

1. Distinguish between Research methods and Research methodology.
2. Explain the importance of literature review in defining a research problem.
3. Make a comparison between applied research and Fundamental Research.
4. Describe qualitative research and quantitative research.
5. What are the steps in formulating a research problem?
6. Explain the meaning and significance of a research design.
7. What are the features of a good research design?

8. How will you develop a research plan? Explain.
9. Distinguish between
 - (a) Restricted and unrestricted sampling
 - (b) Cluster and area sampling
10. Explain
 - (a) Nominal scale
 - (b) Ordinal scale and
 - (c) Ratio scale
11. What are the different steps in writing research reports?
12. Mention different types of report, particularly pointing out the difference between a technical report and a popular report.
13. Enlist the differences between thesis writing and research paper writing.
14. Write a short note on "Research as knowledge Discovery".
15. What is a Journal? Bring out the significance of few journals of international repute in statistics.

2+2+1

(10 × 5 = 50 Marks)

SECTION – B

Statistics

Answer any **ten** questions. All questions carry equal marks.

1. Define linear independent set of vectors. Prove or disprove "the vectors $(1, 3, -1, 2)$, $(2, 4, 3, -2)$, $(1, -2, -3, 2)$ and $(8, 10, -2, 6)$ are linearly independent.
2. Explain Gram-Schmidt orthogonalization process.
3. Let A be an $n \times n$ independent matrix. What are the ch.roots of A ? What about $|A|$?
4. Define transient state and recurrent state of a Markov chains. Examine whether all states of an irreducible Markov chains are positive recurrent.

5. The consumption of electricity every day in a small town is having a probability function $f(x, \theta) = \frac{1}{\theta} e^{-x/\theta}$, $x > 0, \theta > 0$. Determine the significance level and power if $H_0 = \theta = 2000 \text{ Kw}$ is repeated against $H_1 = \theta = 2800 \text{ Kw}$ if the consumption of a randomly selected day is greater than 2650 Kw.
6. Show that MLE's of μ and Σ in $N_p(\mu, \Sigma)$ are independent.
7. If T is a constant estimator of θ , show that $1 + 2e^T$ is a consistent estimator of $1 + 2e^\theta$.
8. Distinguish between fixed effect and random effect models.
9. Define empirical distribution function. Obtain its distribution and hence find its mean and variance.
10. Let $X \sim \text{Binomial}\left(n, \frac{1}{2}\right)$ and $Y \sim \text{Binomial}\left(m, \frac{1}{2}\right)$, be independent random variables. Find the p.m.f. of $X - Y + m$.
11. Stating the basic idea behind, elaborate the procedure of stratified sampling and indicate how it differs from cluster sampling scheme.
12. If x and y are i.i.d. random variables, prove that $x - y$ is a symmetric random variable.
13. Let (x, y) be jointly distributed with p.d.f. $f(x, y) = \begin{cases} 2 & 0 < x < y < 1 \\ 0, & \text{otherwise} \end{cases}$

Find correlation between x and y .
14. Let $x_{(1)}, x_{(2)}, x_{(3)}$ be the order statistics based of a random sample x_1, x_2, x_3 from the exponential distribution with p.d.f. $f(x, \theta) = \frac{1}{\theta} e^{-x/\theta}$, $x > 0, \theta > 0$. Find $E(X_{(1)})$.
15. Define tail event. Give an example of the same. State Borel-Cantelli lemma.

(10 × 5 = 50 Marks)