

[This question paper contains 2 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : **2008** **L**
Unique Paper Code : 2223010023
Name of the Paper : Research Methodology
Name of the Course : **B.Sc. Hons.-(Physics)_NEP:UGCF-2022**
Semester : VI- Semester (DSE Paper)
Question Paper Set Number : A
Duration: 3 Hours Maximum Marks: 90

Instructions for Candidates

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

Q1 is compulsory. Answer any SIX parts from Q1 and FIVE questions in ALL.

Use of a non-programmable calculator is allowed.

Attempt all the parts of questions together.

Z and T-tables are permitted.

1. (a) Define quantitative research and state any two of its core features that differentiate it from qualitative approaches. 3
(b) What are the important requirements for using the Z-test? 3
(c) What is a predatory journal? State two warning signs a researcher should look for to avoid publishing in one. 3
(d) Define the term plagiarism and distinguish between intentional and accidental plagiarism. 3
(e) Justify why Abstract is the vital component of a research manuscript and what are three key elements it must contain? 3
(f) Discuss how national research funding agencies drive innovation in academic institutions. 3
(g) Explain the difference between probability and non-probability sampling with suitable examples. 3
2. (a) Why is a thorough literature review considered the foundation of any research project? Discuss how it helps in identifying **research gaps** and formulating a valid hypothesis. 9
(b) Define qualitative research and state any two of its basic tenets. Contrast its reliance on statistical generalization with the contextual depth of quantitative research. 3
(c) Explain how the **Discussion section** of a research paper differs from the **Results section**. Why is it crucial to link your findings back to existing literature? 6

3. (a) Fit a straight line of the form

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$$Y = a + bX$$

X	0	1	2	3	4
Y	1	1.8	3.3	4.5	6.3

to the above data by the method of least squares and find the following:

- (i) The sample means $\bar{X}$ and $\bar{Y}$
 - (ii) the least squares estimates of a and b
 - (iii) the line of best fit and estimate Y when $X = 2.5$.
- (b) Define skewness. Explain how Karl Pearson's coefficient of skewness utilizes the distance between the **mean, median, and mode** to quantify the asymmetry of a frequency distribution. 6
4. (a) Name a commonly used database in condensed matter physics. Describe the type of literature, indexing system, and metadata preprints it tracks. 5
- (b) Compare SNIP, SJR, and CiteScore as journal evaluation metrics. Discuss the role of altmetrics in modern research evaluation. 9
- (c) A journal has a Raw Impact per Paper (RIP) of 4.5 and a field citation potential of 0.9. Calculate its Source Normalized Impact per Paper (SNIP) value and deduce whether the journal outperforms the average baseline for its discipline. 5
- 5 (a) What is the primary mandate of the Committee on Publication Ethics (COPE)? Discuss how its flowcharts assist journal editors in handling cases of suspected plagiarism or reviewer bias. 7
- (b) Distinguish between duplicate publication and self-plagiarism. State the rare scenarios where translating or republishing existing work is considered permissible. 6
- (c) Define Research Records under the context of scientific data integrity. Discuss the required retention period for raw laboratory notebooks and data files after a project concludes. 5
- 6 (a) Compare patents, trademarks and copyrights with respect to their scope and duration of protection in India. 6
- (b) Discuss the concept of Design of Experiments (DoE). Distinguish between stochastic and deterministic simulation models. 6
- (c) Discuss the challenges of **overfitting and underfitting** in non-linear regression analysis. How do regularization techniques (like Ridge or Lasso) mitigate these issues? 6