

M.C.S.E. FIRST YEAR FIRST SEMESTER EXAMINATION-2025
RESEARCH METHODOLOGY, ETHICS AND IPR

Time: 3 hours

Full Marks: 100

1. Consider the following abstract:

“The accurate prediction of climate patterns is crucial for effective environmental management and strategic planning, particularly in the face of increasing climate variability and extreme weather events. This study focuses on enhancing the predictive accuracy of global climate models by integrating a random forest algorithm with seasonal bias correction, which is aimed at forecasting changes in precipitation and temperature across various climate scenarios. Our approach significantly improves the precision of climate forecasts by using a comprehensive dataset that includes historical climate data and future projections under Representative Concentration Pathways. For precipitation, after implementing seasonal bias correction, the Correlation Coefficient improved from 0.826 to 0.860, and the Nash–Nash-Sutcliffe efficiency increased from 0.633 to 0.735. In addition, the Mean Absolute and Root Mean Square Error decreased, enhancing the model’s reliability in predicting extreme precipitation events. Temperature forecasts also benefited from the Random Forest model, achieving a correlation Coefficient of up to 0.987, indicating a strong predictive performance. These improvements highlight the potential of machine learning methods in refining climate models, thus providing more accurate tools for policymakers and planners to manage climate risks. Furthermore, the successful application of these advanced statistical techniques underscores the importance of continuous innovation in climate science, ensuring that climate projections remain relevant and reliable in informing global climate resilience and adaptation strategies.”

- a) Design an appropriate problem statement for the given abstract
- b) Discuss data needed for this work and its collection process
- c) Explain the methods or techniques used here as far as possible
- d) Explain various terms used in this abstract

5 × 4

2. Compare

- a) Research methods and research methodology.
- b) Descriptive and Analytical research
- c) Researchable Problem and Problematic Situation
- d) Topical and Chronological organization of papers
- e) Census and Sampling
- f) Dissertation and Thesis
- g) Writing a paper and writing a project proposal
- h) Trademark and Copyright
- i) Ghost authorship and Honorary authorship
- j) Antithesis and Synthesis

2 × 10

3.A) How does a clearly defined research problem impact the study? Explain the role of literature review in defining a research problem. How does reviewing existing literature help formulate a research problem?

2 + 5 + 3

OR

[Turn over

3.B) Discuss the criteria researchers should consider when selecting an appropriate research method. How do the research problem, objectives, and available resources influence the choice of research methodology? **4 + 6**

4.A) What is the importance of a literature review in research? How does it guide the formulation of hypotheses and research questions? **3 + 7**

OR

4.B) What key steps are involved in a literature review? What are the common challenges researchers face when conducting a literature review, and how can these challenges be overcome? **4 + 6**

5.A) Explain the differences between probability and non-probability sampling techniques. What is simple random sampling? How is it conducted, and what are its strengths and weaknesses? **10**

OR

5.B) Describe stratified sampling with the steps involved in implementing stratified sampling. What is sampling error? How can researchers minimize sampling error through appropriate sampling techniques? **5 + 2 + 3**

6.A) Examine the ethical issues surrounding the publication of research findings. How should researchers address concerns related to plagiarism, authorship, and the responsible dissemination of their results? **3 + 7**

OR

6.B) Critically evaluate the key ethical issues in Computer science research. How can researchers address informed consent, confidentiality, and privacy concerns while conducting their studies? **3 + 7**

7.A) Critically analyze the different types of intellectual property (IP) rights—patents, copyrights, trademarks, and trade secrets. How does each IP type provide protection, and what are the mechanisms for enforcing these protections? **5 + 5**

OR

7.B) Analyze the impact of emerging technologies like artificial intelligence (AI) on intellectual property protection. What new mechanisms can be devised to protect IP rights in this rapidly evolving technological landscape? **5 + 5**

8.A) Analyze the role of writing style in writing grant proposals. How should researchers adjust their writing to meet the specific expectations of funding bodies while ensuring their findings are communicated effectively? **4 + 6**

OR

8.B) What role do bibliometrics and citation analysis play in academic publishing? Explain how these metrics are used to evaluate the impact and relevance of a published paper. Discuss the differences between academic journals, conferences, and books as outlets for publishing research. **3 + 4 + 3**