

INDIAN STATISTICAL INSTITUTE  
FOURTH SEMESTER EXAMINATION, 2023/25 SESSION  
**PAPER - 19: GEOGRAPHICAL INFORMATION SCIENCE (ELECTIVE)**  
(MASTER IN LIBRARY INFORMATION SCIENCE)  
28<sup>th</sup> April 2025 (10:00-13:00) (3 Hours)

This Question paper consists of one page and is for **60 Marks**. To score **maximum marks**, attempt the maximum number of questions. Print your answers in the Answer Booklet provided. A Scientific Calculator is allowed.

**QUESTION 1.** Write briefly about

- (i) Geographical Information Science (GISci) [3 marks]
- (ii) Social (Modified) Gravity Model [3 marks]
- (iii) Spatiotemporal modelling of phenomena: use of thematic maps [4 marks]

**QUESTION 2.** Fractal Dimension is a measure to quantify the spatial complexity of features. Explain the (i) Koch curves and the computation of their fractal dimensions, (ii) Box Counting Method, and (iii) Computation of fractal dimension for branched networks. [10 marks]

**QUESTION 3.** Explain the role of Spatial Auto-Correlation computation via Moran's Index in GISci. [10 marks]

**QUESTION 4.** Explain the directional grayscale granulometries in the computation of directional roughness of terrestrial surfaces. [10 marks]

**QUESTION 5.** From a cluster of compact, non-overlapping spatial objects depicting villages, how do you choose a strategically located village where it is easier to reach out to other villages with minimal energy expenditure? Write your arguments to provide a spatial policy. [10 marks]

**QUESTION 6.** Let  $f(x,y)$  and  $g(x,y)$  be two spatial functions, respectively representing the Digital Elevation Models at two-time instants with a time gap of 256 days. The DEMs available at two-time instants are highly discrete. What approach would you follow to show the DEM at one time instant transforming into the DEM at the other instant almost in the near continuum? Explain how grayscale morphological interpolation would help address the required transformation. [10 marks]

**QUESTION 7.** The Digital Elevation Model (DEM), a spatial field depicting elevations above the mean sea level across the spatial positions, is with rich but hidden information of relevance to geometry, morphology, and topology. One of the prominent topological networks conspicuous from the DEMs is valley connectivity network. Explain the morphological skeletonization based spatial algorithm to extract the valley connectivity network from the DEM. [10 marks]

**QUESTION 8.** Write elaborately about the (i) scaling and fractals, (ii) conversion of point-specific data into zonal form via Skeletonization by Influence Zones (SKIZ), and (iii)  $f$ - $\alpha$  spectra. [10 marks]

**END OF PAPER**