

Assistant Scientist (Land Use)

2023

HPSC

Time : 3 hours]

[Maximum Marks : 150

QUESTION PAPER SPECIFIC INSTRUCTIONS

(Please read each of the following instructions carefully before attempting questions)

- (i) There are **eighteen (18)** questions, all printed in English only.
- (ii) Candidate has to attempt any **fifteen (15)** questions in all.
- (iii) Each question carry **ten** marks.
- (iv) Word limit in questions, wherever specified should be adhered to.
- (v) Attempts of questions shall be counted in sequential order. Unless struck off, attempt of a question will be counted even if attempted partly. Any page or portion of the page left blank in the question-cum-answer booklet must be clearly struck off.
- (vi) Answer to the questions must be confined only to the space provided for each question. No extra/additional sheet will be provided.
- (vii) Answer must be written in the authorized medium. No marks will be given for answers written in a medium other than the authorized one.

1. (a) Explain the concept of image segmentation in digital image processing. Elaborate the importance of thresholding and region growing, used for segmentation. **(Word limit 150)** 5
- (b) Define image classification. Discuss supervised and unsupervised classification techniques, highlighting their differences. **(Word limit 150)** 5
2. (a) Enumerate and explain the components of a GNSS receiver. How does Differential GPS (DGPS) improve the accuracy of position determination? **(Word limit 150)** 5
- (b) Define errors in GNSS observations and discuss various correction techniques used to minimize them. **(Word limit 150)** 5
3. How is GIS used as a tool for spatial analysis? Define the interpolation, buffer, overlay, terrain modelling and network analysis techniques used in GIS. **(Word limit 300)** 10
4. (a) Explain the concept of spectral signature. How can spectral signatures be used in the identification of different materials on the Earth's surface? **(Word limit 150)** 5
- (b) Compare and contrast different resolutions in remote sensing. **(Word limit 150)** 5
5. Explain the principle used in Global Navigation Satellite Systems (GNSS) for positioning and navigation. How does GNSS work and what are the main constellations used? **(Word limit 300)** 10
6. Define map datum and explain the significance of MSL (Mean Sea Level), geoid and WGS-84 (World Geodetic System-1984) in geospatial data. **(Word limit 300)** 10
7. Illustrate various land surveying techniques in detail. **(Word limit 300)** 10
8. Describe stereoscopy and its applications in 3-D modelling and relief displacement analysis in photogrammetry. **(Word limit 300)** 10

9. Explain the concept of aerial photogrammetry. Discuss different types of aerial photographs. How is height determined using parallax bar?
(Word limit 300) 10
10. Elaborate Discriminant Analysis in image processing. How is it used for feature extraction and classification purposes?
(Word limit 300) 10
11. Explain the concepts of variance-covariance matrix and correlation matrix for a digital image. How are these matrices useful in feature extraction and pattern recognition? (Word limit 300) 10
12. Explain the concepts of sampling and quantization theory in digital signal processing. How does the Nyquist-Shannon sampling theorem impact the quality of reconstructed signals? (Word limit 300) 10
13. Describe the electromagnetic spectrum and its significance in remote sensing applications. (Word limit 300) 10
14. (a) What do you understand by Principal Component Analysis (PCA)?
(Word limit 150) 5
- (b) What are vegetation indices? Discuss briefly about the utility of NDVI.
(Word limit 150) 5
15. Compare and contrast various platforms and sensors used in remote sensing.
(Word limit 300) 10
16. Discuss the role of DBMS (Database Management System) in creating spatial and non-spatial databases. (Word limit 300) 10
17. Explain map projections and their significance in representing the Earth's curved surface on a flat map. (Word limit 300) 10
18. How does the Fourier transform aid in analysing the frequency components of a digital image? (Word limit 300) 10

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