End Exam

INTERNATIONAL INSTITUTE OF INFORMATION TECHNOLOGY
GS0.301 Introduction to Spatial Science and Technology

Total Marks: 45

Time: 90 minutes

- Answer the questions section-wise
- If you make any assumptions, state that clearly while answering.

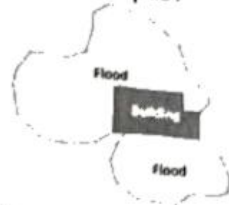## Section: I Answer all of the following questions (1mark x 5 = 5 Marks)

1. List a manmade disaster in which you think Spatial sciences can help better prepare for its prevention. Briefly support your answer.

2. Indicate the type of attributes these data fall in –
   - (a) Land use class
   - (b) Road Map of India having roads as NH, SH, District Roads, etc.

3. State True / False
   - (a) a. when doing an image stretch, pixel value of the original image also changed.
   - (b) b. Light is absorbed by the atmosphere on the path from the sun to the surface, but not on the path from the surface to the satellite

4. Select spatio-temporal queries that are more appropriate during the flood "response" phase? (Multi select question)
   - (a) How many buildings in the area are strongly flooded?
   - (b) How many buildings in the area are not accessible via road as roads are submerged in the water?
   - (c) How many buildings in the area were flooded for more than 5 days?
   - (d) Which roads were completely submerged during time T1 and T2"

5. Image tiling decomposes a large image-scene (say 10K*10K pixels) into small image patches (say of size 128*128 pixels). Why would you perform image tiling in the image information mining pipeline? (Multi select question)
   - (a) To make process computationally less intensive and manageable
   - (b) It is a better to break the relationships between adjacent image objects belonging to the two adjacent image-tiles
   - (c) Most of the time a user is interested in querying a small part of a big RS image scene
   - (d) More fine details of image objects will emerge in the image-tiles as opposed to the whole scene

Section: II Answer any 7 of the following questions (2mark x 7 = 14 Marks)

6. You were tasked with making a Map of the IIITH Campus and a map of India, as a Large poster on an A0 sized paper, which property of projection will you preserve and why in each of these maps?

7. Between the 'reflectance' and 'emittance (thermal)' bands, which one is your choice for delineating burned area / burn scar? Explain briefly.

8. Explain in brief about the spatial scale of a water resources system.

9. Explain PCA based image fusion technique.

10. (A) Which wavelength region is used in detection of vegetation fires from satellite data (B) Which bands are used to get the normalized burn ratio and what is the formula?

11. How do you characterise the water (Quantity and Quality) taking appropriate examples.

12. Which index (along with formula) would you use to extract water bodies in a forest area, and why?

13. What is GNSS? Name the Indian GNSS system and how is it different?

Section-III Answer all the questions (4mark x 4 = 16 Marks)

14. How do we spatially model the surface runoff (flooding)? Briefly explain the 'Bucket Model' as discussed in the class, with the spatial data model, the parameters used and how it helps get a first estimate of runoff.

15. You are tasked with making a map of the IIITH campus that captures all the facilities, environmental aspects, and travel-related information on the campus. (A) List all the data layers you will capture with one key attribute and its type (B) Which of these layers will you use, and how will you report that all facilities can be reached within 10 minutes on campus?

16. Describe the hypothetical scene shown in the figure by identifying spatial relations (topological and directional) and represent the scene in terms of graph where each node represents land use/land cover type and edge between nodes represent spatial relationships. (Note: Define your spatial relation clearly)

17. Soil properties like soil water holding capacity, percentage of sand, etc., vary gradually over large spatial distances. Which model of spatial data will you use to capture and store this data? Support your answer including comparing why the other data model does not work?

Section: IV Answer the following (5mark x 2 = 10 Marks). Make sure to present a step by step approach or a flow chart depicting the steps you will employ for these questions.

18. Assume a crop type classification has been performed using the Landsat-TM satellite. Subsequently, the classification result is being evaluated by means of a field survey. The result is as follows: (i) Of the 25,000 potato pixels, 15,000 were classified correctly as potatoes, 1,250 as wheat and 8,750 as sugarbeet. (ii) Of the 50,000 wheat pixels, 40,000 were classified correctly as wheat, 5,000 as potatoes and 5,000 as sugarbeet. (iii) Of the 25,000 sugarbeet pixels, 16,500 were classified correctly as sugarbeet, 6,000 were classified as potatoes and 2,500 as wheat.

Based on these results, perform the following tasks/calculations:

(a) Show how you will calculate for each class the classification producers' and users' accuracy and the Kappa coefficient

(b) Assuming this crop classified map is accurate enough and this imagery covers 5 districts, briefly state the steps you will employ to generate the district-level crop statistics (i.e., how much area in each district grows which crop).

19. An environmental group collected more than 100 samples of air pollution data (say PM10) at different distances from a major Highway in the city. And a group of doctors studying the incidence of respiratory cases, recorded the location of these houses and the case count. Given that both the above is from the same region, you embarked on making a spatial model to explain the relationship between these to identify zones around the road that are (a) safe; (b) of concern and needs to be monitored; and (c) should not live in (maybe make a green zone). Based on this,

(a) Which type of data collection methods that each of the above two teams employ?

(b) How will you analyse these data sets to create a well-defined spatial question to be answered? State the spatial question.

(c) Which spatial function will you use to spatially model the above relationship and create the zones?