

GS2.401 Spatial Informatics**Time: 90minutes****Total Marks: 40**

Note: Make Suitable assumptions wherever needed and state it clearly when answering. No doubts will be clarified during the exams.

Part I.

5x2=10

1. What do we mean by a Geoid and where is it used?
2. To survey the boundary and get the locations of IIITH buildings, a DGPS survey was carried out. What does one mean by a DGPS survey? And why is it needed while taking the coordinates using a GNSS?
3. For the following regions, indicate which projection plane & type you will use and which property you are trying to preserve
 - a. State of Telangana, that lies between 15.666° and 19.900° North and 78.233° and 81.65° East
 - b. Chile is located as a long coastal country on the West South America Continent. South half of the country spreads from 37°30' to 57° S and 64°36' and 73°54' W
4. You are given a satellite imagery dataset for a region that shows predominantly vegetation types and has data containing SWIR, NIR, and Red and Green Bands. And you have an option to save it in one of the primary raw raster formats - BIP or BSQ. State which of them will you choose and why if you have to compute vegetation index over the region.
[Hint: Vegetation Index NDVI = $(\text{NIR} - \text{Red}) / (\text{NIR} + \text{Red})$]
5. For the spatial components of an object that are captured and stored in a GIS, what are the different types of data models available? And how do you decide on which data model to use for a given data? [Hint: use an example to answer]

Part II. Answer the following questions

6x3=18

6. What type of coordinate system does geographic coordinates use? Do you agree with the statement that 'it is not a good CRS for measuring distances across the globe'? Briefly discuss why.
7. There are 5 geo-tagged municipal road cleaning vehicles that can clean about 50Kms each day. A small town has only 200Kms of roads that need to be cleaned. But, at the end of the day, there are some roads that are not cleaned at all, while some are cleaned more than once. Explain, using a flowchart, how you can identify this and help improve the road-cleaning coverage to more than 95% of the roads.
8. What are the errors that occur in manual digitization of maps? List and briefly explain in one or two sentences.
9. I have a dataset that contains the location of Bank branches in a region covering 500sqkm. I want to make sure that no two branches are within 10KM of each other so that they do not service the same population. Show how you can help the Bank to identify which ones to move and where?
10. In developing an Urban growth model, the study uses nearness to an existing urban area and the closeness to road infrastructure as two key parameters to identify new area that will Urbanise. Which mode of analysis will you employ

for finding out the potential areas that will Urbanise. Briefly state and explain them.

11. Give two examples of how Spatial approach can help in Computer based (Video) Games. Explain how it can aid in any one of them.

Part III. Answer any One question by detailing out your answers well

1x12=12

12. Recently in Hyderabad, a Govt. body called HYDRA (Hyderabad Disaster Response and Assets Monitoring and Protection) has been setup and it is clearing the areas where constructions have encroached or changed the boundaries of a water body (like lakes) or within its Buffer zone. The buffer zone is an area of 9m around the water bodies with a spread area less than 10Ha and 30m for above 10 Ha spread. The water spread is given as the maximum area of its FTL(Full tank level) or MWS (Maximum water spread area). (A) To help the public know whether a land parcel or plot lies within the prohibited buffer or water body area, you need to develop a map based information system. (B) Also, you want to count the number of buildings that already exist within this area.

Given the following datasets, Explain step-by-step how you will do the 2 above tasks.

- (a) Paper maps of Survey of India Topographic map sheets at 1:25,000 showing the water bodies and its FTL. All data is in geographic coordinates.
 - (b) Satellite image @10m resolution, in UTM projection for the last 3 recent highest rainfall years of 2020, 2019 and 2017. Assume that a satellite image classification algorithm is available to you that gives the water and land mask.
13. Water supply pipelines are to be installed in a city in India on the left border (along E to W and N to S directions) of the roads at an offset of 1m from the road boundary. The planner also wants to use the intersections and parallels to design the network. The surveyed data contains a bunch of start and end points of the centerline of the road segments; with road width (8m to 48m) and road name as its attributes in two separate files. Many road segments have the same road names too. The final map you generate will be (A) A pipeline vector dataset consisting of straight lines with the diameter of the pipe as an attribute with clear locations of its start and end coordinates. (B) Another vector dataset of all junctions and turns that are part of the network with attributes capturing the type of the junction/turn so that appropriate pipe components can be sourced.

Explain in detail how you will generate the 2 vector datasets.

While answering also state the data storage model the data was given in and the data model it should be converted to, so that it can be used in the analysis.

Hint: Show it using a flowchart and figure.