

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2082 Chaitra

Exam.	Regular	
Level	BE	Full Marks 80
Programme	BCE	Pass Marks 32
Year / Part	IV/ II	Time 3 hrs.

Subject: - GIS Application and Remote Sensing (Elective III)(CE 78501)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.



1. a) Write about the evolution of GIS. How is it different from CAD, cartography, and DBMS? [4]
- b) If a map can show accuracy up to 0.5 mm, what would the positional accuracy be for the map digitized from a 1:25000 scale map? [5]
2. You are asked to prepare an infrastructure development map for Kailali district.
 - a) Which map projection and coordinate system would you select for this? Justify your choice. [4]
 - b) Explain how scale and projection errors may affect area and distance calculations in your analysis. [3]
3. a) A land-use map is to be prepared from satellite imagery and cadastral maps. Which data model (raster/vector) would you use for each dataset? Why? [3]
- b) Explain run length and quadtree compression techniques for raster data. [6]
4. During the field survey, the GPS data showed positional inaccuracies.
 - a) Explain how GPS determines location using satellite signals. [4]
 - b) Identify major sources of GPS errors and explain how DGPS improves accuracy. [4]
5. a) Explain the concept of a Relational Database Management System (RDBMS). Discuss its key characteristics and why it is suitable for managing spatial and non-spatial data in GIS applications. [4]
- b) Explain how proper database structuring and normalization help in minimizing redundancy and maintaining consistency in a GIS database. [3]
6. The department of roads is planning to expand an existing two-lane road of 7m width into a four-lane highway of 20m width. The proposed expansion corridor passes through agricultural land, residential areas, commercial zones, and small forest patches. GIS analysis is required to assess land acquisition and environmental impacts. [5]
 - a) Describe the vector overlay operations you would perform to determine:
 - the total area of agricultural land to be acquired,
 - the number of residential and commercial parcels affected, and
 - the extent of forest land impacted. Explain the GIS tools and steps involved
 - b) Design a buffer analysis to evaluate environmental and social impact zones by creating:
 - A 50 m buffer for direct construction impact, and
 - A 30m buffer for noise and air pollution assessment. Explain how these buffers help in impact mitigation planning

7. A city planning commission is planning to establish a new solid waste landfill site. The selected site must satisfy the following criteria: [10]

- (i) The slope must be less than 8 degrees to ensure stability and reduce construction cost.
- (ii) The site must be located at least 500 meters away from rivers and streams to prevent water contamination
- (iii) The land cover must avoid dense forest and built-up areas to minimize environmental and social impact.
- (iv) The soil type must have low permeability (e.g., clay or silty clay) to reduce leachate infiltration.
- (v) The site should be located at least 1 km away from settlements but within 5 km of main roads for accessibility.

The available raster datasets include:

- DEM
- Soil Type Map
- River Network
- Land Cover Map
- Settlement Map
- Road Network

Using raster data analysis, describe the step-by-step procedure to identify suitable landfill sites. Your explanation must include at least four raster analysis functions and clearly explain how each function contributes to the final suitability map.

8. The following grid represents a LiDAR-derived Digital Elevation Model (DEM) with a 10-meter resolution. Use this data to perform the following tasks:

142	140	138	136	135	133
141	137	136	134	133	132
140	131	134	131	129	131
139	136	132	128	127	129
138	135	131	129	126	128
137	134	130	127	124	126

- a) Identify and fill any sinks in the DEM (show which cells are sinks and the corrected filled values). [2]
 - b) Using the filled DEM, compute flow direction and flow accumulation (show intermediate steps). [3]
 - c) Delineate the watershed(s) and extract the stream network using a minimum catchment area of 1000 m². [3]
9. a) Explain the role of the electromagnetic spectrum and spectral signatures in land cover classification. [4]
- b) Compare spatial, spectral, and temporal resolution and analyze their importance in the case of an urbanization study. [4]
10. Explain the choropleth map. Critically analyze how poor map design can mislead planners and decision-makers. [4]

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2082 Shrawan

Exam.	Back		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - GIS Application and Remote Sensing (*Elective III*) (CE 78501)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt **All** questions.
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1. a) How does GIS work? What are the essential features of GIS? [4]
b) Explain primary and secondary sources of GIS data. Describe some recent developments in data acquisition techniques. [4]
2. a) Map is a 2D model of reality. Explain this with examples. [3]
b) In a Geographic Coordinate System, what is the significance of the Prime Meridian and the Equator? [5]
3. Explain run-length and Quad tree compression techniques. What would be the result of compressing the following data using both of the above techniques? [3+5]

88	88	75	34	9	9	9	9
88	88	33	75	9	9	9	9
88	88	88	34	9	9	9	9
77	77	77	77	9	9	9	9
56	56	56	56	56	56	10	10
56	56	56	56	33	25	10	10
56	56	56	56	33	33	33	9
56	56	56	56	33	33	33	33

4. Explain the concept of RDBMS (Relational Database Management System). How can you join two different tables having one common attribute using a SQL, assuming the following tables with common attribute landuse_id in Table-1 and id in Table-2? [3+5]
Table-1: Vector data of landuse polygons with columns - fid, landuse_id both being integer.
Table-2: Non-spatial table describing the land use with columns – id and, landuse type (such as built-up, farmland etc.).
5. Explain the following vector functions with appropriate examples including effects/changes in the attribute table. [8]
 - (i) Buffer
 - (ii) Dissolve
 - (iii) Union
 - (iv) Intersection

6. Explain the meaning of each of the following terms related to remote sensing. [4×2]
- a) Spectral signature
 - b) Resolution of remote sensing data
 - c) False color image
 - d) Image classification
7. What are the steps involved in generating a river network within a given area (represented by a polygon vector data) assuming that multiple DEMs are available which covers the whole area? Explain steps with sketches. [10]
8. Explain the accuracy of GIS Data in terms of positional, logical, attribute, temporal accuracy and data completeness. What are the significance of data accuracy in GIS analysis? [6+2]
9. a) Explain the meaning of thematic map. [4]
- b) How can colors and sizes of symbols be used to efficiently convey a map to the users? Explain with examples. [5]
10. Discuss the main components of a GPS system. Explain the roles of the space segment, control segment and user segment in GPS system. [5]

TRIBHUVAN UNIVERSITY
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Examination Control Division
2078 Chaitra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - GIS Application and Remote Sensing (*Elective III*) (CE78501)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. a) Explain the development of GIS from cartography, CAD and Database management system. [4]
 - b) What are the major data sources of GIS data? Why data collection is the most important process in GIS analysis? [4]
2. a) What is the allowable RMS error for 1:25000 scale map? [3]
 - b) Why civil engineering projects requires to use projected coordinate system for the analysis. [3]
3. a) Explain different types of data models in GIS. [6]
 - b) Explain run length and quad tree compression technique with clear illustrations. [6]
4. a) How does the GPS works? [4]
 - b) Why do we need DGPS even with the development of sophisticated GPS systems? [3]
5. a) Explain RDBMS. How is the RDBMS used in GIS? [3]
 - b) What is data normalization? Explain 1NF and 2NF. [4]
6. Write about the necessary tools and explain how will you perform following analyses using GIS? Describe the analysis tools along with relevant figures. [10]
 - a) best location for landfill area so that following constraints are fulfilled.

Feature	Distance
Houses	> 1000 m
River	> 1500 m
Road	< 500 m
Water bodies	> 1500 m

Provided data:

Shapefile of river, land use data, point data of the houses, shapefile of roads, polygon Shapefile of the study area.

7. Explain and illustrate with examples the following raster functions. [10]
 - a) Slope and Aspect
 - b) Cost path
 - c) Local and focal and zonal statistics
 - d) Hill shade and view shade
 - e) Euclidean Distance

8. The following grid represents an SRTM DEM data with resolution 100m.

[2+2+2+2]

- a) Find out the sink and fill it.
- b) Show the flow direction Map
- c) Calculate and show the flow accumulation
- d) Delineate the watershed(s) and show the river when stream definition is limited to minimum 5 grids.

1078	1072	1069	1071	1058	1049
1074	1067	1056	1049	1046	1050
1069	1040	1044	1037	1037	1048
1064	1058	1055	1022	1022	1024
1078	1061	1047	1021	1021	1019
1074	1053	1034	1012	1011	1012

9. a) Explain about the spectral signatures in Remote Sensing. Why are they important?

[4]

- b) What is a band combination? Explain the uses of TRUE COLOR, FALSE COLOR and SWIR band combinations with reference to LANDSAT images.

[4]

10. Explain thematic map. Where and why do we design choropleth maps?

[4]

TRIBHUVAN UNIVERSITY
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Examination Control Division
2076 Bhadra

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - GIS Application and Remote Sensing (Elective III) (CE 78501)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt **All** questions.
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1. a. Define GIS. Differentiate GIS from cartography and database management system. [3]
b. What are the basic sources of data for GIS? [3]
2. a. Write the differences between UTM coordinate system and coordinate system(s) used in Nepal? [3]
b. Explain about accuracy and precision. What is the allowable RMS error for 1:25000 scale map? [3]
c. What would be the difference between the distance on earth presented by 1-degree latitude and 1-degree longitude if the radius of the earth at the equator is 6378137m and the radius of earth along poles as 6356752.3142m for WGS1984 system? [3]
3. a. Explain different data models. [3]
b. How will the following land use raster be compressed using quadtree compression technique and run length coding technique? [6]

1	1	1	1	3	3	4	4
1	1	1	1	3	3	4	4
1	1	1	1	3	3	4	4
1	1	1	1	5	5	5	4
2	2	2	2	5	5	5	5
2	2	2	2	5	5	5	5
1	1	1	1	3	3	5	5
1	1	1	1	3	3	5	5

4. a. Explain about the components of GPS. [3]
b. What are the sources of error in GPS measurements? How can the accuracy be increased? [3]
5. a. Describe about RDBMS? Why is it used by GIS instead of other DBMS? [3]
b. What is data Normalization? Explain about 1NF and 2NF. [3]
6. a. Write about the necessary tools and explain how will you perform the vector analysis using GIS to locate the best site for the dumping site area so that the following constraints are fulfilled? Describe the analysis tools along with relevant figures and attribute table data. [10]

Feature	Distance from
Settlement	>1500m.
River	>1000m.
Road	< 400m.
Water bodies	>2000m.

Available data for analysis:

Shapefiles of the river, land use data, point data representing location of the settlements, shapefile of roads, polygon shapefile of the study area

7. a. How do you perform the following analyses using raster data? Illustrate with examples. [8]
- Buffer
 - Intersection
 - Zonal statistics
 - Local operation such as mean, sum etc.
- b. Explain about Slope and Aspect functions with illustrations. [5]
8. The following grid represents a Aster DEM data of certain area whose cell size is 30m. [8]
- Write the flowchart of the watershed delineation.
 - Delineate the watershed(s) and show the river when stream definition is limited to minimum catchment area of 9000m^2 . Show the intermediate steps/calculations.
- | | | | | | |
|-----|-----|-----|-----|-----|-----|
| 278 | 272 | 269 | 271 | 258 | 249 |
| 274 | 267 | 256 | 249 | 246 | 250 |
| 269 | 250 | 244 | 237 | 237 | 248 |
| 264 | 258 | 255 | 222 | 222 | 224 |
| 278 | 261 | 247 | 221 | 221 | 219 |
| 274 | 253 | 234 | 212 | 211 | 212 |
- What are the application of remote sensing? Explain some of the recent developments in the field of remote sensing. [4]
 - Explain about the different types of resolutions in RS. [3]
 - Explain about visual variables in map designing. [3]
 - Explain about the types of maps. [3]

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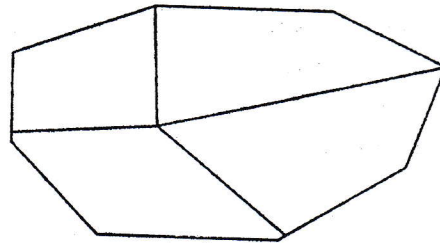
Subject: - GIS Application and Remote Sensing (*Elective III*) (CE78501)

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1. a. Prepare a standard layout of a map with all map elements. [4]
- b. Write down the three raster encoding methods and % decrease in size for following figure [6]

25	25	25	25	25	25
25	25	25	25	25	25
25	25	25	25	25	25
5	5	5	10	10	10
5	5	5	12	12	12
5	5	5	15	12	12

- c. Label vertex, node, arc and polygon for following figure [2]



2. a. Explain how sink is developed in DEM and how it can be removed. [4]
- b. Derive flow direction, flow accumulation and river network from figure below. Consider threshold value as 10 cells. If the cell size is 100m then calculate the catchment area at the lower right cell having value 445. [12]

480	500	490	480	485
505	495	490	475	480
500	485	455	470	475
495	490	480	465	470
490	485	475	455	450
500	490	480	460	445

3. a. Explain different types of interpolation methods in raster GIS and their application in different engineering fields. [4]

- b. Interpolate a value using any one method if the distance from four known values 160, 170, 180 and 90 are 1000, 400, 600 and 120m respectively. [4]

4. Explain clip, merge, union, dissolve and intersection functions in vector GIS with suitable figures and tables for each function.

[16]

5. Explain following raster spatial functions

[16]

- a. Surface
- b. Slope
- c. Aspect
- d. Viewshade
- e. Map Algebra
- f. Summarize Zone
- g. Proximity
- h. Distance

6. Write short notes

[12]

- i. Different types of database management system
- ii. How the time is maintained in GPS
- iii. Different types of attribute variables used in GIS
- iv. UTM and MUTM coordinate system
- v. Active and passive Remote sensing
- vi. Supervised and unsupervised classification

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1. Write down the definition of GIS. Explain Vector model and Raster GIS Model with suitable examples. [10]
2. a. Describe Universal Transverse Mercator and Modified Universal Transverse Mercator projection system for Nepal and write down the parameters used in these projection systems. [5]
b. Explain accuracy and precision in GIS. Calculate the allowable errors for 1:30,000 and 1:5000 scales maps [5]
3. Explain following Geoprocessing tools with suitable spatial map and tables. [12]
 - a) Clip
 - b) Merge
 - c) Union
 - d) Intersection
 - e) Prove that Intersection = Union + Clip [3]
4. Explain [4X4]
 - a. Relational Database Management System.
 - b. Basic Principles of GNNS.
 - c. Active and Passive Remote Sensing.
 - d. Resolutions in Remote Sensing.
5. a. Explain Sink, Flow Direction, Flow Accumulation, River Grid and stream lines. [5]
b. Derive flow direction, flow accumulation, river network and catchment boundary using following Digital Elevation Model and threshold value 4. [10]

109	106	104	103	114	115
107	105	102	100	112	113
105	103	100	95	110	112
106	105	99	90	108	110
107	110	98	94	110	111
108	111	96	95	112	115

6. Grid Code of a raster data with 25m grid resolution is shown below. Derive a suitable map and suitable area for Rice Crop. Suitable parameters on 1 to 10 scale for slope, soil, and landuse are given in Table 1. The weightage for slope, soil, and landuse are 50%, 30%, and 20% respectively. Assume the value greater than 6 is suitable. [14]

1	1	1	2	2	3	4	5
2	2	2	3	3	3	4	4
1	1	2	5	5	5	5	4
3	5	5	4	4	4	4	4
3	5	5	4	4	4	4	4
1	3	3	3	3	3	4	4
1	2	2	2	1	1	1	1

Table 1: Suitable parameters

Grid Code	Suitable Parameters (1-10 scale)		
	Slope	Soil	Landuse
1	10	8	8
2	8	4	1
3	6	10	4
4	4	1	8
5	1	1	10

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Examination Control Division
2073 Bhadra

digitized.

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - GIS Application and Remote Sensing (*Elective III*) (CE78501)

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1. a) Differentiate GIS from cartography, CAD and information system. [3]
b) Explain data feeds of GIS. [3]
2. a) What do you understand by Map projection system? [2]
b) Write about the parameters of coordinate system used in Nepal. [2]
c) Why Nepal's Coordinate system (MUTM) use 3° zone instead of 6° compared to UTM? [2]
3. a) Explain different types of data models. [4]
b) What is topology in TIN data model? [2]
c) Show the encoding of following raster using run length and Quadtree encoding. [6]

12	12	12	12	12	12	12	12
12	12	12	12	12	12	12	12
12	12	12	12	12	12	12	12
12	12	12	12	12	12	12	12
5	5	6	6	9	9	9	9
5	5	61	62	9	6	9	9
7	7	7	7	9	9	9	9
7	7	7	7	9	9	9	9

4. a) Explain the guiding principles of GPS measurement with descriptive figures. [3]
b) Explain the possible errors that might occur while using GPS. How can accuracy of GPS increased? [3]
5. a) Explain about relational database management system. [3]
b) How the relationship is maintained? [3]
6. How will you perform following analyses using GIS? Describe the analysis tools along with relevant figures.

- a) Locate all the settlements that lies within 1 km distance (both side) from rivers.
- b) Flood plain zoning of the selected river according to types of river.
- c) Show the area of agricultural land that lies in that flood plain.

Provided data:

Shapefile of river, land use data, point data of the settlements, Shapefile of flood plain (Polygon)

[10]

7. Explain the following Raster function with relevant example.

[10]

- a) View shade
- b) Euclidean Distance
- c) Reclassify
- d) Slope and aspect
- e) Hillshade

8. The following grid represents a DEM data of certain area whose cell size is 100m. Using this data answer the following questions.

[12]

- a) Show the sink cell.
- b) What will be the value of that cell when the sink is filled?
- c) Calculate flow direction and flow accumulation value for each cell.
- d) What is the area of the largest possible watershed?
- e) Show the river in the raster when stream definition is limited to minimum catchment area of 40000 m²?

78	72	69	71	58	49
74	67	56	49	46	50
69	40	44	37	37	48
64	58	55	22	22	24
78	61	47	21	21	19
74	53	34	12	11	12

9. Explain spectral signature of different land use with example and application of Remote sensing in civil engineering.

[3+3]

10. a) How different symbologies differ according to scaling of data (Nominal, ordinal, interval and ratio)

[3]

b) Explain about visual variables in map designing.

[3]

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Examination Control Division
2073 Magh

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - GIS Application and Remote Sensing (Elective III) (CE78501)

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- What is GIS and its importance in civil engineering. [2+4]
- Why is map projection necessary? State two main differences between a Geographic Coordinate System and Projected Coordinate System. [4]
 - Why Nepal uses a different coordinate system than the UTM? [2]
- How is the following raster encoded using full raster encoding, run length encoding, quad tree encoding and value point encoding? [6]

F	F	F	F	W	W	F	F
F	F	F	F	W	W	F	F
F	F	F	F	O	O	F	F
F	F	F	F	O	O	F	F
F	F	F	F	S	S	S	S
F	F	F	F	S	S	S	S
F	F	F	F	S	S	W	W
F	F	F	F	S	S	W	W

*F= Forest
*W= Water Body
*O= Open Space
*S= Settlement

- What are the main sources of data feed to GIS? What is positional and attribute accuracy? [4+2]
- What is a spatial DBMS? Explain different types of DBMS structures. [2+3]
- Explain following vector function in vector GIS with suitable example. [10]
 - Union
 - Clip
 - Merge
 - Intersect
- Calculate the flow direction and flow accumulation raster from the following DEM. Also, delineate the watershed area if the pour-point reference cell is (4, 4) and cell size is 30×30 meters. [10]

0, 0

118	112	109	111	115
114	107	96	89	92
109	40	84	77	79
104	99	95	62	65
68	68	67	61	64
62	60	58	56	50

8. Illustratively explain how position is determined using GPS. What types of error can occur during a GPS measurement? [6]
9. a) How objects are differentiated in remote sensing by their spectral signatures, explain with illustration? Explain the different types of resolution in remote sensing. [5]
- b) What band combination used in Landsat 8 imagery to represent the natural colour and colour infrared (for vegetation)? [2]
10. Briefly explain the map elements. [6]
11. Explain the following with at least 1 relevant application example in each. [4×3]
- a) Raster algebra
 - b) Zonal statistics
 - c) IDW interpolation
 - d) Reclassification

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INSTITUTE OF ENGINEERING
Examination Control Division
2072 Ashwin

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - GIS Application and Remote Sensing (*Elective III*) (CE78501)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
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1. a) Briefly explain the difference between GIS and cartography. [5]
b) Why map projection is important? Explain which map projection system is used for preparing maps of Nepal? [2+3]
c) How Raster and Vector model are differentiated? Explain TIN Data model. [2+4]
2. a) Write the sources of data feed to GIS and their characteristics. [5]
b) Explain Rational data base system used in GIS. [6]
c) Explain how DEM is created in Raster GIS? [5]
3. a) Differentiate between map overlay and map calculations. Explain how Raster analysis and topological overlay are carries out? [4+6]
b) Explain map elements used in GIS mapping. [6]
4. a) Differentiate between data management functions and data analysis functions in vector GIS. [5]
b) Explain any three vector data management functions. [6]
c) Write down spectral signatures of different land uses. [5]
5. a) Explain sources of errors in GPS and their corrections. [8]
b) Generate flow direction, flow accumulation and river network from following DEM. [8]

100	98	97	98	99
105	103	102	99	100
107	105	95	100	101
109	106	104	102	104
115	112	110	109	108

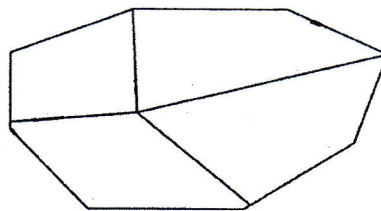
Examination Control Division
2071 Bhadra

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCE	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

Subject: - GIS Application and Remote Sensing (*Elective III*) (CE78501)

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- 1
 - a. Write down the definition of GIS, its components and basic types of spatial data 6
 - b. What is the difference between spatial and none spatial data
 - c. Write down the major functions of GIS
- 2
 - a. Define Projection. 6
 - b. Explain Nepal datum and projection system
 - c. Calculate the allowable RMS error in 1:15,000 & 1:5000 map
- 3
 - a. Explain different types of Raster Models. 12
 - b. Label vertex, node, arc and polygon for following figure and write down different vector models of given figure.



- 4
 - a. Explain different types of database management system 6
 - b. How relationships maintain in Relational Database Management System
- 5 Explain following vector functions with a suitable example (Spatial & Tabular) 10
 - a. Intersection
 - b. Clip
 - c. Dissolve
 - d. Union
- 6 Explain following functions in Raster GIS with a suitable example 10
 - a. Map Algebra
 - b. Interpolation
 - c. Slope
 - d. Aspect
 - e. Hillshade
- 7 Calculate the flow direction, flow accumulation and river network grid from flowing DEM grid. Generate river network with threshold value 5. 12

93	90	89	90	89
91	88	82	79	78
89	71	72	73	74
86	83	82	70	69
86	84	82	75	68

- 8
 - a. Explain different types of errors in GPS 6
 - b. Explain basic principles and basic equation of GPS
 - c. Explain Principal of DGPS
- 9
 - a. Explain sensors and platforms 6
 - b. Explain spectral signature of object
 - c. Write down steps for image processing
- 10 What is scale and write down different types of scales with example 6