ROYAL CIVIL SERVICE COMMISSION
BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2020
EXAMINATION CATEGORY: <u>TECHNICAL</u>

PAPER III: SUBJECT SPECIALISATION PAPER FOR GEOGRAPHIC INFORMATION SYSTEM

Date	: February 27, 2021
Total Marks	: 100
Writing Time	: 150 minutes (2.5 hours)
Reading Time	: 15 minutes (prior to writing time)

GENERAL INSTRUCTIONS:

1. Write your Registration Number clearly and correctly on the Answer Booklet.

2. The first 15 minutes is to check the number of pages of the Question Paper, printing errors, clarify doubts and to read the instructions. You are NOT permitted to write during this time.

3. This paper consists of **TWO SECTIONS**, namely SECTION A & SECTION B:

   - **SECTION A** has two parts: Part I - 30 Multiple Choice Questions

                                     Part II - 4 Short Answer Questions

     All questions under SECTION A are COMPULSORY.

   - **SECTION B** consists of two Case Studies. Choose only **ONE** case study and answer the questions of your choice.

4. All answers should be written on the Answer Booklet provided to you. Candidates are not allowed to write anything on the question paper. If required, ask for additional Answer Booklet.

5. All answers should be written with correct numbering of Section, Part and Question Number in the Answer Booklet provided to you. Note that any answer written without indicating the Section, Part and Question Number will NOT be evaluated and no marks will be awarded.

6. Begin each Section and Part on a fresh page of the Answer Booklet.

7. You are not permitted to tear off any sheet(s) of the Answer Booklet as well as the Question Paper.

8. Use of any other paper including paper for rough work is not permitted.

9. **You must hand over the Answer Booklet to the Invigilator before leaving the examination hall.**

10. This paper has **7 printed pages**, including this instruction page.

GOOD LUCK!

SECTION A

PART I: Multiple Choice Questions (30 marks)

Choose the correct answer and write down the letter of your chosen answer in the Answer Booklet against the question number e.g. 31 (d). Each question carries ONE mark. Any double writing, smudgy answers or writing more than one choice shall not be evaluated.

1. All of the following are the major ways to represent the world or geographic phenomena in ArcGIS EXCEPT
   a) Features (collection of lines, points and polygons).
   b) Attributes (associated features).
   c) Spreadsheet without coordinates attached to the data.
   d) Remotely sensed data or imagery.

2. Spatial data describe
   a) what geographical features are.
   b) where geographical features are located.
   c) geometry of geographical features.
   d) both location and attribute of geographical features.

3. In the context of query in GIS, we use a number of logical operators. Which one or more of the following statements is/are TRUE about logical operators?
   a) AND operator returns TRUE if both expressions a and b are true.
   b) NOT operator returns TRUE if expression is false.
   c) OR operator returns TRUE if one or both of the expressions a and b are true.
   d) All of the above.

4. The principal of GPS surveying is similar to
   a) Rectangulation
   b) Triangulation
   c) Traverse
   d) Resection

5. All of the following are true regarding the differences between the raster and vector models of a GIS EXCEPT
   a) The raster model is more akin to an "object" view while the vector model is more akin to a "field" view.
   b) Data can be stored more precisely in a vector model.
   c) Grid resolution is important for a raster model, but does not apply to a vector Database.
   d) The raster model is more focused on the continuous fields whereas the vector model is more focused on the discrete fields.

6. A mathematical model representing terrain without structures and vegetation is a

   a) DHM
   b) DSM
   c) DTM
   d) DEM

7. A satellite image has 0.50 m ground sampling distance. Tt refers to
   a) Spatial resolution
   b) Spectral resolution
   c) Radiometric resolution
   d) Temporal resolution

8. The DRUKREF 03, the National Geodetic Reference Datum in Bhutan is equivalent to
   a) New Everest
   b) Transverse Mercator
   c) WGS84
   d) Lambert Conformal Conic

9. The Geoid Model used in Bhutan for height conversion to MSL is
   a) EG2008
   b) Bessel
   c) Clarke 1858
   d) Everest

10. Geo-referencing refers to
    a) relating spatial with non-spatial data.
    a) geodetic network adjustment.
    b) linking spatial information to a coordinate system.
    c) defining four corners of a map.

11. Which one of the following is not a type of image resolution that is very important in image analysis?
    a) Temporal
    b) Reflectance
    c) Spatial
    d) Spectral

12. The Worldview-1 satellite imagery has a panchromatic image resolution of
    a) 1 meter
    b) 85 centimeter
    c) 2 meters
    d) 46 centimeter

13. Which one of the following is not a high-resolution satellite imagery?
    a) GeoEye-1
    b) IKONOS
    c) Landsat
    d) Quick bird

14. The minimum number of satellite constellation required to make a GPS observation are
    a) Two
    b) Three
    c) Four
    d) None of the above

15. To derive continuous surface as a raster DEM from point data, which one of the following method can be used?

a) Binary polygons
b) IDW interpolation
c) Contour tool in ArcGIS to produce isolines
d) None of the above

16. The standard generic term for GNSS is

a) Medium Earth Orbit (MEO) Satellite System
b) Satellite Navigation Systems (SAT NAV)
c) Global Positioning System (GPS)
d) Satellite Based Augmentation Systems (SBAS)

17. Which one of the following characteristics of a satellite imagery is most relevant for studying change detection over a period of time?

a) Spatial resolution
b) Spectral resolution
c) Temporal resolution
d) All of the above

18. The mathematical process used for generation of contour maps using a set of spot heights is

a) Interpolation
b) Extrapolation
c) Linearization
d) Adjustment

19. Which one of the following is TRUE?

a) While the contour map has height information, the DEM provides elevation information.
b) Contour map represents height information discretely, while DEM provides it continuously.
c) Contour is a raster dataset and DEM is a vector dataset.
d) A contour map is more precise than a DEM.

20. Key requirement for integration of various GIS datasets existing in different agencies is that

a) the datasets must have compatible accuracy standard.
b) the datasets must have compatible coordinate system.
c) the datasets must have compatible symbolization standards.
d) All of the above.

21. The map projection used in Drukref03 grid is

a) Polyconic
b) Transverse mercator
c) Lamberts conformal conic
d) Conic

22. What does NSDI stand for?
    a) National Spatial Data Interface
    b) National Spatial Data Information
    c) National Spatial Data Infrastructure
    d) National Spatial Data Integration

23. The best approach for storing a large quantity of GIS dataset that need to be constantly revised, accessed, manipulated and updated by multiple user would be
    a) Shape files
    b) Personal geodatabase
    c) Raster files
    d) Enterprise geodatabase

24. The process of using known values of a point to estimate the value of unknown points in the same or nearby region is called
    a) Spatial interpolation
    b) Spatial prediction
    c) Spatial adjustment
    d) Spatial estimation

25. The geometric transformation of a remote sensing image to a map projection plane is best described by
    a) Resampling
    b) Image rectification
    c) Georeferencing
    d) Image calibration

26. It is easy to integrate GIS, Remote Sensing and GPS technologies because these are
    a) digital, special and generic
    b) digital, analogue and manual
    c) digital, spatial and generic
    d) negative, positive and neutral

27. A satellite image with 1m spatial resolution covers an area of $1m^2$, whereas a pixel with 0.1m spatial resolution covers an area of
    a) $0.1 \, m^2$
    b) $0.001 m^2$
    c) $10 \, cm^2$
    d) $100 \, cm^2$

28. Resampling of a raster image
    a) increases the accuracy.
    b) increases the precision.
    c) decreases data details.
    d) increases data details.

29. A 1:50,000 Scale map can be compared to which one of the following spatial resolution?
    a) 50000m
    b) 50m
    c) 1/50000m
    d) Not possible to compare

30. To examine which crops grow on which types of soil based on an agricultural land use and a soil map, you should apply
    a) polygon on polygon overlay.
    b) point in polygon overlay.
    c) completely contain.
    d) line in polygon overlay.

PART II – Short Answer Questions [20 marks]

This part has 4 Short Answer Questions. Answer ALL the questions. Each question carries 5 marks.

1. What are the different basic resources that you would need if you were to start up a GIS consultancy firm?

2. Suppose you have downloaded a vegetation map from the Internet. However, the map is much larger than your study area. Describe the steps you will follow to extract the vegetation map within the boundary for your study area.

3. What kinds of information should a text file, containing point data have so that the text file can be imported in ArcGIS to map correctly?

4. What is the difference between raster and vector data structures? Explain how geospatial data is collected and stored in the different structures. What are the main processes that can be applied to vector data? Give an example of vector and raster data each.

SECTION B: CASE STUDY [50 marks]

Choose either CASE I or CASE II from this section. Each case study carries 50 marks.

CASE I

The Ministry of Education wants to establish a new school in one of the Dzongkhags in Bhutan. However, the Ministry has no idea where should the school be suitably located. Describe how you would use the application of GIS to do a suitability analysis to determine the best sites for a new school. Describe and explain necessary steps and the methodology or framework that you would like to adopt to produce the desired output.

CASE II

The year of 2020 began with a huge challenge called Covid-19 across the world including Bhutan. Although there was just one casualty in Bhutan until now, the number of Covid-19 cases detected has kept on increasing daily. Due to its impact, Bhutan is losing its economic strength and its GDP has dropped to negative value.

Describe how you would use GIS and Remote Sensing Technology to help the government in managing Covid-19 pandemic.

TASHI DELEK