KATHMANDU UNIVERSITY
End Semester Examination
July/August 2024

Mark Scored :

Level : B. E.
Year : III

Course : GEOM 317
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 10

05 AUG 2024

Registration No.:

Date :

SECTION "A"
[20 Q. × 0.5 = 10 marks]

Choose the most appropriate answer from the given choices.

1. What is not the criteria for a planet?
   a. It must orbit the Sun
   b. It must be spherical in shape due to its own gravity
   c. It should have its own satellite
   d. It must have "cleared its orbit" of other debris

2. If a is semi major axis, b is semi minor axis, the flattening is given by:
   a. a/(a-b) b. b/(a-b) c. (a-b)/a d. (b-a)/b

3. The angle between the equatorial plane and the straight line passing through a point and the center of the earth is called
   a. Longitude of the point
   b. Latitude of the point
   c. Altitude of the point
   d. Right Ascension of the point

4. The unit of Newton's gravitational constant is
   a. $m^2kg^{-2}s^{-2}$ b. $m^2kg^{-2}s^{-2}$ c. $m^3kg^{-1}s^{-2}$ d. $m^3kg^{-1}s^{-1}$

5. The general solution of Laplace's equation in spherical coordinates is
   a. A function of r only
   b. A function of r and θ
   c. A function of r, θ and λ
   d. A function of t and r

6. The earth's gravitational field is approximately
   a. Uniform and increases with height above the Earth's surface
   b. Uniform and decreases with height above the Earth's surface
   c. Non-uniform and decreases with height above the Earth's surface
   d. Non-uniform and increases with height above the Earth's surface

7. Which of the following statements about solutions to Laplace's equation in a given domain is true?
   a. The solution is always constant within the domain
   b. The solution represents a potential field with no sources or sinks within the domain
   c. The solution can have sources or sinks but must be constant along the boundary
   d. The solution has no relation to boundary conditions

8. In VLBI, the concept of "baseline" refers to
   a. The distance between the observer and the celestial object
   b. The distance between two radio telescopes
   c. The diameter of the individual telescopes
   d. The angle between the two radio telescopes' field of view

9. Satellite Laser Ranging is primarily used to
   a. Measure the distance between ground stations and satellites using laser beams
   b. Track the movement of spacecraft in low Earth orbit using radar
   c. Monitor the atmospheric composition by analyzing satellite data
   d. Observe and map the surface features of Earth from satellite images

10. The semi major axis in WGS84 is
    a. 6378131 m b. 6378137 m c. 6371137 m d. 6371130 m

11. If the distance between two masses is increased by the factor of 5 and one of the mass is increased by a factor of 5 another mass remaining constant, the gravitational force of attraction between them will
    a. Reduced by a factor of 5 b. Reduced by a factor of 25
    c. Remain same d. Increased by a factor of 5

12. The spherical harmonics when order (m) equals to 0 is called
    a. Zonal b. Sectoral c. Tesseral d. Series

13. Orthometric height
    a. Is height along the normal of reference ellipsoid
    b. Is height along the nadir of observer
    c. Is same as dynamic height
    d. Is height along the curved plumb line

14. Which of them is not correct for the property of spherical triangle?
    a. The three sides are all arcs of circles
    b. Any two sides are together greater than the third side
    c. The sum of three angles are greater than 180°
    d. Each spherical angle is less than 180°

15. Which organization is responsible for realization of International Terrestrial Reference Frame?
    a. International Astronomical Union (IAU)
    b. International Association of Geodesy (IAG)
    c. United Nations (UN)
    d. National Aeronautics and Space Administration (NASA)

16. Which of the following best describes the relationship between ITRF and ITRS?
    a. ITRS is a subset of ITRF
    b. ITRF is a realization of the conceptual ITRS
    c. ITRS is updated more frequently than ITRF
    d. ITRF and ITRS are completely independent of each other

17. What does GPS derived height refer to
    a. Orthometric height directly measured using GPS
    b. Ellipsoidal height obtained from GPS
    c. Height above ground as measured by GPS
    d. Normal height measured using GPS

18. Which instrument is commonly used to determine orthometric heights in the field?
    a. Theodolite
    b. GNSS receiver
    c. Leveling instrument
    d. Barometer

19. Relative gravimetry is particularly useful for
    a. Establishing a gravity network over a large area
    b. Measuring the exact gravitational acceleration at a single point
    c. Calibrating absolute gravimeters
    d. Studying the gravitational field of other planets

20. In gravimetry, what is a "free air correction"?
    a. A correction applied for the elevation of the measurement point
    b. A correction applied for mass changes
    c. A correction applied for subsurface density variations
    d. A correction applied for latitude variations

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SECTION "B"
[6 Q. × 4 = 24 marks]

Attempt *ANY SIX* questions.

1. Define gravitational potential. Prove that the gravitational potential is a harmonic function. [1+3]

2. What is gravity reduction? Discuss free air anomaly and Bouguer anomaly. [1+3]

3. Consider two places, London (L) and Cape Town (C). London is at latitude 51°30' N and longitude 0°07' W, and Cape Town is at latitude 33°55' S and longitude 18°25' E. Calculate the distance between London and Cape Town. [4]

4. Show with figure the conversion of rectangular coordinate system (x,y,z) to geodetic coordinate system A (r, θ, λ). [4]

5. Describe working principle of space geodetic techniques VLBI and DORIS. What is co-location sites? [3+1]

6. What is International Terrestrial Reference System and International Terrestrial Reference Frame. Why are they important? [3+1]

7. What is Deflection of Vertical. What is anomalous potential or disturbing potential? Describe both with figure. [2+2]

SECTION "C"
[2Q. × 8 = 16 marks]

Attempt *ALL* questions.

8. Describe Laplace's equation. Derive the solution of Laplace's equation in spherical coordinates. [2+6]

9. Describe different types of height system with net diagram and their relationships. [8]