

KATHMANDU UNIVERSITY
End Semester Examination
February, 2025

Marks Scored:

Level : B.E.

Year : III

Exam Roll No. :

Registration No.:

Time: 30 mins.

Course : GEOM 315

Semester : II

F. M. : 10

Date :

10 FEB 2025

SECTION "A"

[20 Q. × 0.5 = 10 marks]

Choose and encircle the most appropriate option from each set of choices

1. Which of the following is not one of the three pillars of geodesy?
 - a. Geokinematics
 - b. Gravity field
 - c. Earth rotation
 - d. Earth's internal magnetic field
2. Which time period in the development of satellite geodesy is called the 'Phase of scientific projects'?
 - a. 1950s – 1960s
 - b. 1960s – 1970s
 - c. 1970s – 1980s
 - d. 1980s – 1990s
3. Which coordinate system uses longitude, latitude and height above the ellipsoid?
 - a. Earth – centred Earth – fixed coordinate system
 - b. Geographic coordinate system
 - c. Geodetic coordinate system
 - d. Topocentric coordinate system
4. Why does a geostationary satellite appear stationary to an observer on Earth?
 - a. It is stationary in space
 - b. It's orbital period matches the earth's rotation period.
 - c. It is not affected by gravitational force.
 - d. It is located outside Earth's gravity field.
5. The number of orbital planes and satellites in each orbit for a GPS are respectively
 - a. 6,4
 - b. 4,6
 - c. 4,3
 - d. 3,4
6. Selective Availability in GPS is a
 - a. Natural Error
 - b. Systematic error
 - c. Intentional error
 - d. Bias
7. What is the value of argument of periapsis and RAAN when the inclination of orbital plane is 0 degrees?
 - a. 0
 - b. 90
 - c. 360
 - d. undefined
8. Convert Solar Time interval of 4:20:30 into equivalent sidereal time interval.
 - a. 3 hr 12 min 4 sec
 - b. 4 hr 21 min 12 sec
 - c. 4 hr 21 min 00 sec
 - d. 4 hr 13 min 12 sec
9. Which of the following isn't the perturbation on the basis of their periods?
 - a. Secular perturbations
 - b. Long period perturbations
 - c. short period perturbations
 - d. medium period perturbations

10. The drag force acting on the surface of the spacecraft doesn't depend on
 - a. The satellite's velocity
 - b. The geometry of the satellite
 - c. Altitude
 - d. Weight of the satellite
11. What is the principle of satellite laser ranging?
 - a. Time of flight
 - b. Phase difference
 - c. Triangulation
 - d. Trilateration
12. Which of the following isn't the information carried by GNSS satellite signal?
 - a. Navigation message
 - b. Coarse acquisition code (C/A)
 - c. P-code
 - d. L-code
13. One of the carrier frequencies in a GPS is
 - a. L_1 with 1520 MHz
 - b. L_1 with 1575.45 MHz
 - c. L_1 with 1227.60 MHz
 - d. L_1 with 1530.43 MHz
14. Which of the following is not a characteristic of LASER?
 - a. Monochromatic
 - b. Intense
 - c. Coherent
 - d. Divergent
15. Which of the following is the most widely used Laser for SLR?
 - a. Nd:YAG
 - b. Ruby
 - c. He-Ne
 - d. semi-conductor laser
16. Satellites maintain accurate time by the means of
 - a. Quartz clock
 - b. Digital clock
 - c. Atomic clock
 - d. Stop watch
17. Which of the following is an Uplink System?
 - a. GNSS
 - b. DORIS
 - c. SLR
 - d. VLBI
18. What does GGOS stand for?
 - a. Global Geodetic Operational system
 - b. Global Geodetic Observing System
 - c. Geodetic Global Optimization system
 - d. Global Gravity Observing system
19. Which organization oversees GGOS?
 - a. United Nations
 - b. International Astronomical Union
 - c. International Association of Geodesy
 - d. European Space Agency
20. What is the primary law governing orbital motion in astrodynamics?
 - a. Newton's 3rd law of motion
 - b. Kepler's laws of planetary motion
 - c. Einstein's Theory of relativity
 - d. Ohm's law

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SECTION "B"

[6 Q. × 4 = 24 marks]

Attempt ANY SIX questions.

1. What is a satellite geodesy? Explain various coordinate system used in satellite geodesy. (Include figures if needed) [1+3]
2. What is an orbit? What are the various types of satellite orbits? Difference between low earth orbit, medium earth orbit and high earth orbits. [1+1+2]
3. Discuss Kepler's law of planetary motion. Describe the various Keplerian orbital elements along with figures. [1+3]
4. What is DOP? Explain briefly the strategy and focus areas of GGOS? [1+3]
5. What do you mean by orbit perturbation? Explain briefly the major factors causing such perturbation on satellite orbit. [1+3]
6. You are on board a direct straight flight from New Delhi (28°36'N, 77°13'E) to Buenos Aires (34°36'S, 58°22'W). The plane took off from IGI Airport, New Delhi, on 12 February 03:04:00 airport time (not standard time). The average speed of the aircraft during flight is 950 kph. Calculate the local airport time at the instance the aircraft lands in Buenos Aires. Assume the Earth's radius is 6371 km. [4]
7. Write short notes on: [2+2]
 - a. SLR
 - b. DORIS

SECTION "C"

[2 Q. × 8 = 16 marks]

Attempt ANY TWO questions.

8. Radius of Earth = 6371 km; $\mu_{\text{earth}} = GM = 398600.5$; Mass of earth = 5.972×10^{24} kg. Given below are two state vectors, answer the following questions:
Position vector $R^{\vec{}} = 0 \hat{i} + 0 \hat{j} + 10,000 \hat{k}$ km
Velocity vector $V^{\vec{}} = 6 \hat{i} + 0 \hat{j} + 0 \hat{k}$ km/s
 - a. Where is the satellite currently? [1]
 - b. What is the orbit's specific angular momentum? [1]
 - c. What is the orbit's semi-major axis? [1]
 - d. What is the orbit's eccentricity? [1]
 - e. What is its inclination, i ? [1]
 - f. Calculate its RAAN? [1]
 - g. What is its argument of perigee? [1]
 - h. What is the satellite's true anomaly? [1]

P.T.O.

9. State Newton's laws of motion. Using Newtonian Mechanics, derive two body problem along with conservation of angular momentum and specific mechanical energy. [2+6]
10. Explain briefly the various segments of GPS with appropriate sketch. Discuss the various error sources in GNSS. What is CORS? Why is it necessary for Nepal to establish CORS network? [3+2+1+2]

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Course : BIOT 308

Semester : II

F. M. : 20

Date : 10 FEB 2025

SECTION "A"

[20 Q. × 0.5 = 10 marks]

Choose and mark [X] the most appropriate option from each set of choices

1. What is a holoenzyme?
 A cofactor-free enzyme
 An inactive enzyme
 An enzyme bound to its cofactor
 A large protein complex
2. The 'lock and key' hypothesis was proposed by:
 Sumner
 Fischer
 Koshland
 Monod
3. Enzymes with low specificities mostly catalyze:
 Single substrate reactions
 Bonds like peptidases or phosphatases
 Stereospecific reactions
 Synthesis reactions
4. What metal does nitrogenase require for activity?
 Iron
 Copper
 Zinc
 Molybdenum
5. The discovery of RNA catalysis was made by:
 Buchner
 Fischer
 Cech
 Altman
6. In non-competitive inhibition, the inhibitor binds to
 Only the enzyme
 Only the enzyme-substrate complex
 Either the enzyme or enzyme-substrate complex
 The active site of the enzyme
7. At very high substrate concentrations, the reaction velocity shows:
 First-order behavior
 Zero-order behavior
 Second-order behavior
 No behavior
8. When substrate concentration equals K_m , the reaction velocity is:
 V_{max}
 $V_{max}/2$
 Zero
 Infinite
9. The catalytic efficiency of an enzyme is best represented by:
 K_m
 k_{cat}
 k_{cat} / K_m
 V_{max}
10. Which factor does not affect the value of K_m ?
 Substrate structure
 Temperature
 pH
 Product concentration
11. What is the unit of k_{cat} ?
 Molar per second
 Mole per liter per second
 Reciprocal time (s⁻¹)
 Milligrams per minute

12. What is the effect of an uncompetitive inhibitor on V_{max} and K_m ?
 Both V_{max} and K_m decrease
 Both V_{max} and K_m increase
 V_{max} decreases, but K_m remains constant
 V_{max} remains constant, but K_m decreases
13. Which method is commonly used to separate enzymes based on their size?
 Ion-exchange chromatography
 Gel filtration chromatography
 Affinity chromatography
 Centrifugation
14. What is the purpose of dialysis in enzyme purification?
 To denature the enzyme
 To concentrate the enzyme
 To remove small molecules like salts
 To separate enzymes by size
15. During purification, the activity of an enzyme is often measured as
 Specific activity
 Molecular weight
 Purity percentage
 Concentration in moles
16. A successful enzyme purification process typically results in
 Decreased specific activity
 Decreased total activity
 Increased specific activity
 Increased total activity
17. The primary purpose of nuclear magnetic resonance (NMR) spectroscopy is
 To identify molecular weight
 To determine structure of enzymes in solution
 To separate enzyme complexes
 To measure enzyme activity
18. The amino acid commonly involved in general acid-base catalysis is
 Histidine
 Glycine
 Alanine
 Phenylalanine
19. The role of histidine in the chymotrypsin mechanism is primarily to
 Stabilize the transition state
 Donate a proton to the leaving group
 Form a covalent bond with the substrate
 Bind the substrate tightly
20. The gold standard for the measurement of molecular weight of an enzyme is
 Ultracentrifuge
 SDS PAGE
 Gel Filtration
 Mass spectroscopy

SECTION "B"

[10 Q. × 1 = 10 marks]

Fill in the blanks

21. The enzyme class responsible for transfer reactions is called _____.
22. An inactive enzyme without its cofactor is called _____.

10 FEB 2025

23. The induced fit theory was proposed by _____.
24. The first enzyme to be crystallized was _____.
25. Sephadex G100 can fractionate enzymes in the range of _____ KDa.
26. Hexokinase can speed the reaction by _____ fold.
27. The ratio of enzyme activity to the total amount of protein in a sample is called _____.
28. Sensitivity of ninhydrin in acid hydrolysis method is _____.
29. In steady state model of enzyme kinetics, the concentration of _____ complex is constant.
30. In determining kinetic constants, it is best to cover substrate concentrations that yield velocities range of _____ % of V_{max} .