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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: V - THEORY EXAMINATION (2024 - 2025)

Subject: Analytical Technique

Time: 3 Hours

Max. Marks: 100

General Instructions:*IMP: Verify that you have received the question paper with the correct course, code, branch etc.**1. This Question paper comprises of three Sections -A, B, & C. It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.**2. Maximum marks for each question are indicated on right -hand side of each question.**3. Illustrate your answers with neat sketches wherever necessary.**4. Assume suitable data if necessary.**5. Preferably, write the answers in sequential order.**6. No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.***SECTION-A**

20

1. Attempt all parts:-

1-a. Glutaraldehyde is a (CO1, K1)

1

- (a) metal
- (b) fixative
- (c) non-metal
- (d) atomic specie

1-b. Shadow casting is a technique of visualizing (CO1, K1)

1

- (a) isolated particles
- (b) mounts
- (c) shoot tips
- (d) root tips

1-c. Which force is at work in chromatography? (CO2, K1)

1

- (a) Hydrogen bonding
- (b) London force
- (c) Electric static force
- (d) All of the above

1-d. Chromatography with a solid stationary phase is referred to as (CO2, K1)

1

- (a) Circle chromatography
- (b) Square chromatography
- (c) Solid chromatography

- (d) Adsorption chromatography
- 1-e. Which among the following has the maximum penetrating power? (CO3, K1) 1
- (a) Radio waves
 - (b) Microwaves
 - (c) Ultraviolet radiation
 - (d) Gamma rays
- 1-f. In atomic emission spectroscopy the emission due to the electronic transition of (CO3, K1) 1
- (a) Singlet ground state to singlet excited state
 - (b) Singlet excited state to singlet ground state.
 - (c) Singlet ground state to triplet excited state
 - (d) Triplet excited state to singlet ground state.
- 1-g. What is rate-zonal centrifugation? (CO4, K1) 1
- (a) Based on separation of particles by mass
 - (b) Based on separation of particles by density
 - (c) Based on separation of particles on solubility
 - (d) Based on separation of particles on size
- 1-h. Who invented centrifugation? (CO4, K1) 1
- (a) Newton
 - (b) G.G. Stokes
 - (c) Antonin Prandtl
 - (d) Al-Kindi
- 1-i. In centrifugation, which of the following force is not used? (CO5, K1) 1
- (a) Electrostatic force
 - (b) Gravitational force
 - (c) Centripetal force
 - (d) Centrifugal force
- 1-j. Which of the following is not a type of centrifugation? (CO5, K1) 1
- (a) Hydro cyclone
 - (b) Tubular centrifuge
 - (c) Microfiltration
 - (d) Disk stack separator
2. Attempt all parts:-
- 2.a. How are samples prepared for a light microscope? (CO1, K2) 2
- 2.b. How does pressure affect chromatography? (CO2, K2) 2
- 2.c. What solvents are used in LC-MS? (CO3, K2) 2
- 2.d. Where is sedimentation used in everyday life? (CO4, K2) 2

2.e.	What are the properties of an ideal density gradient media? (CO5, K2)	2
SECTION-B		30
3. Answer any <u>five</u> of the following:-		
3-a.	How an object can be viewed in dark field microscopy without staining? (CO1, K3)	6
3-b.	How does temperature affect fluorescence? (CO1, K3)	6
3-c.	Why does boiling point affect retention time? (CO2, K3)	6
3-d.	Why do compounds elute faster at higher temperatures? Explain in details. (CO2, K3)	6
3.e.	Why is positron emission tomography considered a useful research tool? (CO3, K3)	6
3.f.	What is the most common error when using a centrifuge? How we correct the error? (CO4, K3)	6
3.g.	Discuss in brief the various types of analytical techniques used in research. (CO5, K3)	6
SECTION-C		50
4. Answer any <u>one</u> of the following:-		
4-a.	How can the advantages and disadvantages of Transmission Electron Microscopy (TEM) be utilized to determine its suitability for different types of scientific research? (CO1, K3)	10
4-b.	In what ways would you utilize the strengths and limitations of Atomic Force Microscopy (AFM) to decide its application in different types of scientific research? (CO1, K3)	10
5. Answer any <u>one</u> of the following:-		
5-a.	Draw a labelled diagram of High-Performance Liquid Chromatography (HPLC). How is it used to separate and analyze complex mixtures in a laboratory setting? (CO2, K3)	10
5-b.	How would you use the properties of a protein exploited by hydrophobic interaction chromatography to achieve purification in a laboratory setting? (CO2, K3)	10
6. Answer any <u>one</u> of the following:-		
6-a.	Describe the principle and technique of gas chromatography considering the factors such as the type of column used, the choice of carrier gas, and the method of detection in your approach. (CO3, K4)	10
6-b.	How would you apply the principles and techniques of Liquid Chromatography-Mass Spectrometry (LC-MS) to identify and quantify the components of a complex biological sample in a research laboratory? (CO3, K4)	10
7. Answer any <u>one</u> of the following:-		
7-a.	On what basis the different types of centrifugation are selected to separate and analyze cellular components in a research laboratory? Discuss key factors like	10

rotor designs, speed, and temperature settings to optimize your experimental approach. (CO4, K3)

7-b. Explain the principles of density gradient centrifugation. Discuss the preparation of the gradient, the choice of centrifuge, and the interpretation of the results in your approach. (CO4, K3) 10

8. Answer any one of the following:-

8-a. Explain the primary benefits of analytical centrifugation versus preparative centrifugation within a laboratory context? Highlighting the unique purposes each method serves, and the advantages they offer in scientific research.(CO5, K3) 10

8-b. How can the principles and techniques of ultracentrifugation be employed to isolate and characterize macromolecules such as proteins, nucleic acids, or organelles in a research laboratory? (CO5, K3) 10

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