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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 (2022 - 2023)

Subject: Analytical Techniques

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

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## 1. Attempt all parts:-

- 1-a. Resolving power of a microscope is a function of \_\_\_\_\_(CO1) 1
- (a) Wavelength of light used
  - (b) Numerical aperture of lens system
  - (c) Refractive index
  - (d) Wavelength of light used and numerical aperture of lens system
- 1-b. Q1: What is the ratio of resolving power of an optical microscope for wavelengths  $\lambda_1 = 4000 \text{ \AA}$  and  $\lambda_2 = 6000 \text{ \AA}$ ? (CO1) 1
- (a) 2:3
  - (b) 0.126388888888889
  - (c) 6
  - (d) 16
- 1-c. Which of the following can be used as mobile phase in chromatography? (CO2) 1
- (a) Solid or liquid

- (b) Liquid or gas
- (c) Gas only
- (d) Liquid only
- 1-d. In reverse phase chromatography, the stationary phase is made up of.....(CO2) 1
- (a) Non-polar
- (b) Polar
- (c) Either non-polar or polar
- (d) None of these
- 1-e. Q10: Which of the following electromagnetic waves is used in medicine to destroy cancer cells? (CO3) 1
- (a) IR-rays
- (b) Visible rays
- (c) Gamma rays
- (d) Ultraviolet rays
- 1-f. Chemical vaporization is carried out by the treatment of element with.....(CO3) 1
- (a) Potassium chloride
- (b) Teflon
- (c) Aloxite
- (d) Sodium borohydrate
- 1-g. For the separation of DNA by electrophoresis, which of the following method is commonly used? (CO4) 1
- (a) Agarose – vertical
- (b) Agarose – horizontal
- (c) PAGE – vertical
- (d) PAGE – horizontal
- 1-h. In isoelectric focusing, proteins are separated on the basis of their.....(CO4) 1
- (a) relative content of positively charged residue only
- (b) relative content of negatively charged residue only
- (c) size
- (d) relative content of positively and negatively charged residue
- 1-i. The particle sedimentation velocity increases with.....(CO5) 1
- (a) Increasing viscosity

	(b) Decreasing difference in density between the two phases	
	(c) Increasing diameter	
	(d) All of the above	
1-j.	Which of the following method used for sedimentation of red blood cells? (CO5)	1
	(a) High speed centrifuge	
	(b) Low speed centrifuge	
	(c) Ultra centrifuge	
	(d) Vacuum centrifuge	
2.	Attempt all parts:-	
2.a.	Write down the five applications of microscope. (CO1)	2
2.b.	What is Rf value? (CO2)	2
2.c.	What are the applications of UV visible spectroscopy? (CO3)	2
2.d.	What is the basic principle of electrophoresis? (CO4)	2
2.e.	How can we prevent sedimentation? (CO5)	2
SECTION B		30
3.	Answer any <u>five</u> of the following:-	
3-a.	What are the different ways one can maximize the quality of an image under bright field microscopy? (CO1)	6
3-b.	Describe the various components of fluorescence microscope and its applications. (CO1)	6
3-c.	What are the differences between affinity and gel filtration chromatography? (CO2)	6
3-d.	Define the concept of retention time and factor. What is the relationship between retention time and retention factor? (CO2)	6
3.e.	Explain in detail the two basic approaches for the synthesis of nanomaterials. (CO3)	6
3.f.	Define the basic principle of electrophoresis. What are different types of factors that could affect migration of molecules in the gel electrophoresis? (CO4)	6
3.g.	What do you understand by analytical techniques? Discuss in detail various types of analytical techniques used in research. (CO5)	6
SECTION C		50
4.	Answer any <u>one</u> of the following:-	
4-a.	Describe in detail the principle and components of different types of microscopy. (CO1)	10
4-b.	Describe the basic principle and applications of phase contrast microscopy. What is the	10

relationship between phase contrast microscopy and fluorescence microscopy? (CO1)

5. Answer any one of the following:-

5-a. What is chromatography? Explain the working principle, components and applications of HPLC. (CO2) 10

5-b. Define size exclusion chromatography. Describe the principle, components and applications of size exclusion chromatography. (CO2) 10

6. Answer any one of the following:-

6-a. Define spectroscopy. Explain the principle and components of NMR and FTIR spectroscopy in detail. (CO3) 10

6-b. Define atomic absorption spectroscopy. Discuss the basic principle and applications of atomic absorption spectroscopy in detail. (CO3) 10

7. Answer any one of the following:-

7-a. Define gel electrophoresis and its applications. What aspects of native proteins affect their rate of migration during gel electrophoresis? (CO4) 10

7-b. Discuss the complete procedure and instrumentation used in agarose gel electrophoresis and SDS-PAGE electrophoresis for purification of biomolecules. (CO4) 10

8. Answer any one of the following:-

8-a. What is centrifugation? Explain in detail different types of centrifuge. (CO5) 10

8-b. Define the process and principle of sedimentation. Elaborate the four types of sedimentation process in detail. (CO5) 10