



Name : .....

Roll No. : .....

Invigilator's Signature : .....

**CS/M.Sc. (BT)/SEM-1/MSBT-104/2012-13**

**2012**

**ANALYTICAL TECHNIQUES**

Time Allotted : 3 Hours

Full Marks : 70

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words as far as practicable.*

**GROUP – A**

**( Multiple Choice Type Questions )**

1. Choose the correct alternatives for any *ten* of the following :  
 $10 \times 1 = 10$ 
  - i) Unwanted fragmentation of molecule is prevented in
    - a) MALDI-TOF
    - b) Tandem MS
    - c) ESI
    - d) None of these.
  - ii) Trypsin
    - a) cleaves at arginine and lysine residues
    - b) cleaves at proline and lysine residues
    - c) cleaves hydrophobic residues
    - d) cleaves between any residues.
  - iii) Analyser used in Tandem Mass can be
    - a) TOF
    - b) Magnetic analyzer
    - c) Quadrupole
    - d) All of these.



- iv) For gel polymerization in SDS-PAGE, free radicals are generated by
- TEMED
  - Bromophenol blue
  - Ammonium persulphate
  - all of these.
- v) SDS binds strongly to all proteins at the ratio of
- 1.0 g SDS/g of polypeptide
  - 1.4 g SDS/g of polypeptide
  - 2.4 g SDS/g of polypeptide
  - 3.4 g SDS/g of polypeptide.
- vi) Disulphide bonds between polypeptide chains can be broken by
- SDS
  - 2-mercaptoethanol
  - TEMED
  - Ammonium persulphate.
- vii) Which of the following chromatographies uses the isocratic elution ?
- Ion-exchange chromatography
  - Hydrophobic Interaction Chromatography (HIC)
  - Affinity chromatography
  - Gel filtration.
- viii) Which one is the correct composition of mobile phase in paper chromatography ?
- Water : Butanol : Acetic acid ( 2 : 5 : 1)
  - Water : Butanol : Acetic acid ( 4 : 1 : 1)
  - Water : Butanol : Acetic acid ( 4 : 5 : 1)
  - None of these.



- ix) Sensitivity of the Coomassie Brilliant blue R-250 is around
- 100 microgram of protein
  - 1 microgram
  - 100 ng of protein
  - None of these.
- x) High speed centrifuge is generally used for separation of
- nuclei
  - lysosome
  - mitochondria
  - all of these.
- xi) Optical device is used in
- analytical ultracentrifuge
  - preparative ultracentrifuge
  - both of these
  - none of these.
- xii) Optical is density
- $\ln(I_0 / I)$
  - $\ln(I / I_0)$
  - $I_0 / I$
  - none of these.
- xiii) For  $\text{CH}_3\text{Cl}$ , the possible electronic transition is
- $n \rightarrow \pi^*$
  - $n \rightarrow \sigma^*$
  - $\sigma \rightarrow \pi^*$
  - $\pi \rightarrow \sigma^*$ .
- xiv) No. of  $^1\text{H}$  NMR peaks for acetic acid is
- 1
  - 2
  - 3
  - 0.

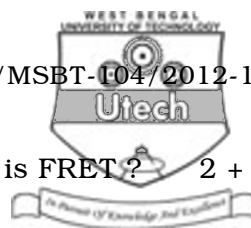


**GROUP – B**

**( Short Answer Type Questions )**

Answer any *three* of the following.  $3 \times 5 = 15$

2. What is MALDI-TOF ? Draw the block diagram of mass spectroscopy and explain the phenomenon briefly.  $1 + 4$
3. Discuss how separation of molecules from a mixture can be achieved by gel filtration technique.
4. What is reverse phase chromatography ? Why is it so named ? What kind of constituents makes the stationary phase in this chromatography ? How does it differ from hydrophobic interaction chromatography ?  $1 + 1 + 2 + 1$
5. Discuss the principle of molecules separation by HPLC.
6. Write a short note on Ultracentrifugation.
7. What is sedimentation equilibrium ? Apply it to calculate molecular weight.  $3 + 2$
8. Discuss how differential centrifugation separate cell materials.
9. Describe how absorption spectroscopy determines structure of protein and nucleic acids.



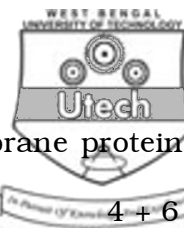
10. What do you mean by fluorescence ? What is FRET ? 2 + 3
11. Optical density is additive. Justify. What is hyperchromic shift ? 3 + 2
12. Describe Raman effect. What is polarisability ? What is the necessary condition for Raman effect ? 2 + 2 + 1
13. Write a short note on ESI. 5

**GROUP – C**

**( Long Answer Type Questions )**

Answer any *three* of the following. 3 × 15 = 45

14. What do you mean by chromatography ? What are the modes of chromatography ? Discuss the principle and method of separation of molecules by paper chromatography. 2 + 4 + 2 + 7
15. What are cation and anion exchangers ? Discuss the methods of biomolecule separation by ion exchange and hydrophobic interaction chromatography. 3 + 6 + 6
16. What is electrophoresis ? Discuss the principle and method of protein separation by SDS-PAGE. 1 + 4 + 10



17. Discuss about buffer action. How can membrane protein be isolated ? How is RBC hexokinase assayed ?  $4 + 6 + 5$

18. Discuss how tracer technique helps to study biological processes. Write the principle of radioimmunoassay. What is Cerenkov radiation ? What is its advantage ? Why soft beta cannot be detected by gas ionization method ?

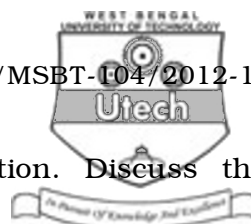
$5 + 3 + 3 + 1 + 3$

19. Discuss the principle of Scintillation detection. What is its advantage over Geiger-Müller counter? What is the role of photomultiplier tube ? How isotopes are identified in scintillation counter ? Why detection of gamma ray is done by solid scintillation ?

$3 + 3 + 3 + 3 + 3$

20. What is the basic principle of density gradient centrifugation ? Compare between rate zonal and isopycnic centrifugation. What is sedimentation coefficient ? Discuss briefly instrumental details of a preparative centrifuge. Write different types of optical device used in analytical centrifuge.

$3 + 5 + 1 + 5 + 1$



21. Write the basic principle of centrifugation. Discuss the factors on which centrifugation depends. What are the different kinds of rotor used ? What is wall effect ? How is this removed ?

3 + 3 + 4 + 3 + 2

22. What do you mean by circular dichroism ? Give basic principle of plasma emission spectroscopy. Discuss how this identifies biomolecules. What is the difference between NMR and PMR ? What kind of transition occurs in ESR ?

3 + 3 + 4 + 3 + 2

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