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

a) TEMED

b) Bromophenol blue

c) Ammonium persulphate

d) all of these.

v) SDS binds strongly to all proteins at the ratio of

a) 1·0 g SDS/g of polypeptide

b) 1·4 g SDS/g of polypeptide

c) 2·4 g SDS/g of polypeptide

d) 3·4 g SDS/g of polypeptide.

vi) Disulphide bonds between polypeptide chains can be broken by

a) SDS

b) 2-mercaptoethanol

c) TEMED

d) Ammonium persulphate.

vii) Which of the following chromatographies uses the isocratic elution ?

a) Ion-exchange chromatography

b) Hydrophobic Interaction Chromatography (HIC)

c) Affinity chromatography

d) Gel filtration.

viii) Which one is the correct composition of mobile phase in paper chromatography ?

a) Water : Butanol : Acetic acid (2 : 5 : 1)

b) Water : Butanol : Acetic acid (4 : 1 : 1)

c) Water : Butanol : Acetic acid (4 : 5 : 1)

d) None of these.

ix) Sensitivity of the Coomassie Brilliant blue R-250 is around

a) 100 microgram of protein

b) 1 microgram

c) 100 ng of protein

d) None of these.

x) High speed centrifuge is generally used for separation of

a) nuclei b) lysosome

c) mitochondria d) all of these.

xi) Optical device is used in

a) analytical ultracentrifuge

b) preparative ultracentrifuge

c) both of these

d) none of these.

xii) Optical is density

a) $In(I_0 / I)$

b) $In(I / I_0)$

c) I_0 / I

d) none of these.

xiii) For CH_3Cl, the possible electronic transition is

a) $n \rightarrow \pi^*$ b) $n \rightarrow \sigma^*$

c) $\sigma \rightarrow \pi^*$ d) $\pi \rightarrow \sigma^*$.

xiv) No. of ^1H NMR peaks for acetic acid is

a) 1 b) 2

c) 3 d) 0.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 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 chromatogrphy ? 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 ? Discus 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