MBR-003-010301 Seat No. _____

M. Sc. (Sem. III) (Chemistry) (CBCS) Examination

December - 2016

C - 301 : Separation Techniques

(New Course)

Faculty Code : 003

Subject Code : 010301

Time : $2\frac{1}{2}$ Hours] [Total Marks : **70**

Instructions : (1) All questions are **compulsory**.
(2) All questions carry **equal** marks.

1 Answer the following : (any **seven**)

(a) Differentiate TLC and HPTLC.

(b) What is meant by bulk property and solute property detectors ? List the detectors based on this property of HPLC and GC.

(c) What is temperature programming analysis and how does this differ from isothermal analysis ?

(d) Give the name of columns used in HPLC and GC.

The $-\overset{|}{\underset{|}{Si}}-C_{18}H_{37}$ group name as..... column and this packing materials abbreviated as.....

(e) Give the principle of ion exchange chromatography.

(f) What is silulation ? Why it is necessary ?

(g) Give the name of separation techniques. Define chromatography and classify them.

(h) What are hyphenated techniques ? Give their name and advantages.

(i) A chromatogram with ideal band has a retention time of 9.0 minutes and $W_{1/2}$ = 2.0 minutes. How many theoretical plates are their ?

Edited By..Kishan Bheda

(j) Define :

(i) Normal phase chromatography.

(ii) Reverse phase chromatography

(iii) Mobile phase and stationary share.

2 Answer the following : (any three)

(a) Draw the block diagram of GLC and labelled each component of it. Differentiate packed and capillary GC columns. Why column conditioning is required in GC ?

(b) How will you manage the gas supply in GC ? Explain GC inlet system, what is split and splitless system ? Give their importance.

(c) Give the principle of FID, TCD and ECD.

(d) Differentiate :

(i) GSC and GLC

(ii) GLC and HPLC.

3 Answer the following :

(a) Give an account of rate theory.

(b) Determine :

(i) k, N and HETP for tolune in the following analysis.

(ii) Resolution between benzene and tolune peaks.

Solute	$t_{R,\ min}$	$W_{1/2}$min
Air	1.5	-
Benzene	7.45	1.05
Tolune	10.6	1.45

Column length = 10 meters

Flow rate = 30 ml/min

Isothermal condition.

OR

3 (a) What is supercritical fluid chromatography ? Give the characteristics of supercritical fluid. Discuss with diagram the instrumentation of SFC.

(b) Compounds A and B have retention times of 16.40 and 17.63 min. respectively, on a 30.0 cm column. An unretained species passes through the column in 1.30 min. The peak width (at base) for A and B are 1.11 and 1.21 min.

Calculate :

(i) Column resolution

(ii) Plate height

(iii) Average number of plates in column

(iv) Length of column required to achieve a resolution of 1.5.

4 Answer the following : (any two)

(a) Write note on ion-exchangers.

(b) What are the difficulties arise when LC coupled with MS ? Discuss the interface system of LC-MS and give the list of applications of LC-MS.

(c) Draw the hypothetical chromatogram and explain each term involved in its interpretation.

5 Answer the following : (any two)

(a) List the criteria for mobile phase selection in HPLC. Why it is necessary the filter and degassing the mobile phase ? Explain the role of guard column and give the name of sample introduction system in HPLC.

(b) Define the following :

(i) Capacity factor

(ii) Resolution

(iii) HETP

(iv) Number of theoretical plates

(v) Van Deemter equation

(vi) Gradient elution and isocratic elution.

(c) Answer in brief :

(i) Explain : Noise, drift, S/N ratio and quantification techniques used in HPLC.

(ii) Give the concept of selectivity, sensitivity, LOD and LOQ for detectors.

(d) Draw the labelled diagram of HPLC. Give the principle of UV-Visible, fluorescence and diode array detectors and discuss any one in detail.

BBG-003-0010301 Seat No. _____

M. Sc. (Chemistry) (Sem. III) (CBCS) Examination

December - 2015

CPA - 301 : Separation Techniques

(Common to All Branch) (New Course)

Faculty Code : 003
Subject Code : 0010301

Time : $2\frac{1}{2}$ Hours] [Total Marks : **70**

Instructions : (1) All questions are compulsory.
(2) All questions carry equal marks.

1 Answer the following : (any seven) **14**

(a) Give the name of separation techniques and principle of chromatography.

(b) What is gradient elution and how does this differ from an isocratic one ?

(c) What is meant by a bulk property detector ? Give an example of an HPLC and GC that is based on bulk properties.

(d) Classify the chromatographic techniques. Explain normal phase and reverse phase chromatography.

(e) What are hyphenated techniques ? Give their name and advantages.

(f) Briefly explain the mechanism of ion exchange chromatography.

(g) What type of detector will you suggest for the analysis of the following by GC ?

(i) Organophosphorous pesticides
(ii) Hydrocarbons
(iii) Organochlorine pesticides
(iv) Inorganic gaseous pollutant

(h) Differentiate TLC and HPTLC. What does spotting and development the plate mean for TLC ?

(i) What is silytation ? Why it is necessary ?

(j) A chromatogram with an ideal bond has a retention time of 9.0 minutes and $W_{1/2}$ = 2.0 minutes.

(i) How many theoretical plates are there ?

(ii) Find the plate height if the column is 10.0 cm long.

2 Answer the following : (any three) 14

(a) What is electron capture detector ? Explain its basis for operation, why is nitrogen necessary ? What types of species are detected with ECD ?

(b) (i) Why do capillary columns predominate in analytical GC ?

(ii) What is temperature programming in GC ? How does it gain advantage over single temperature separation ?

(c) Draw the labelled diagram of GC and differentiate open tubular and capillary column used in GC.

(d) Why high purity gas is required in GC ? What are the impurities present in gases ? How will you remove it ?

3 Answer the following : 14

(a) (i) Draw the hypothetical chromatogram and explain the various terminology.

(ii) Define the following :

(i) Capacity factor

(ii) Separation factor

(iii) Number of theoretical plates

(iv) HETP

(b) What is Van Deemter equation ? Define terms and explain how the 'A' term of equation contributes to band broadening.

OR

(b) (i) Ethanol and methanol are separated in column with retention times of 370 and 385 seconds respectively and band width (wb) of 16.0 and 17.0 seconds. An unretained peak occurs at 10.9 sec. Calculate the separation factor and resolution.

(ii) On a chromatographic column L=25 cm compounds elute in 10 min with a $W_{1/2}$=5 sec. What's a number of theoretical plates and plate height ?

4 Answer the following : (any two) 14

(a) (i) What are the difficulties arises when GC coupled with MS and LC is coupled with MS ? How these difficulties resolved ?

(ii) Discuss the principle of MS and give the name of ionization techniques.

(b) Write note on cationic and anionic exchangers.

(c) Describe the steps involved in chromatographic development of HPTLC in detail. Give the features of HPTLC.

5 Answer the following : (any two) 14

(a) Draw the labelled diagram of HPLC. Describe how HPLC differs from conventional chromatography and GLC.

(b) What is super critical fluid chromatography ? Give the characteristics of super critical fluid and discuss with diagram instrumentation of it.

(c) (i) What is guard column and why is it used ?

(ii) Why degassing is required for mobile phase ?

(iii) What is C_8 and C_{18} column ? Why they commonly used in HPLC ?

(d) Discuss the type of matrix of ion exchangers used in ion exchange chromatography.

---

cellulose — OH + Cl - CH_2 - COOH

for acid

cellulose - OH +

WL-146

003-010301

M.Sc. (CBCS) (Sem.-III) Examination

November-2014

C-OP-301 : Common for all branch

(Separation Technique)

Faculty Code : 003
Subject Code : 010301

Time : 2½ Hours] **[Total Marks : 70**

Instructions : (1) **All** questions are compulsory.
(2) **All** questions carry equal marks.

1. Answer the following : (any **seven**)
   - (a) Express resolution Rs.
   - (b) What is degassing ? Name the methods used for it and briefly explain any one.
   - (c) Define elution, isocratic and gradient elution.
   - (d) Differentiate TLC and HPTLC. Give the advantages of HPTLC.
   - (e) Explain the use of peak height or area in quantitative calculations and to investigate integration of chromatographic peak.
   - (f) Write the mechanism of ion exchange.
   - (g) What is the basic requirements of liquid to be used as stationary phase in GC ?
   - (h) Mention the difficulties arise when LC coupled with MS.
   - (i) Express the numbers of theoretical plates "N".
   - (j) Define hyphenated techniques. Give their name and mention advantages of them.

2. Answer the following : (any **two**)
   - (a) (i) What is super critical fluid chromatography ? Give the characteristics of super critical fluids.
     - (ii) Differentiate GLC and HPLC. Why HPLC is superior to GLC ?
     - (iii) Give the principle of UV, RI and DAD detectors.
   - (b) (i) Differentiate Packed and Capillary column. What are the stationary phase for packed and capillary columns ? Explain importance of deactivation of column.
     - (ii) Give Van Deemter equation and explain each terms involved in it and also give graphical representation of the contributing terms.
     - (iii) Explain GC inlet system. What is split and splitless system ? Give their importance.
   - (c) (i) Give the principle of NPD, ECD and FID detectors.
     - (ii) Give the comparison of SFC with HPLC and GLC.
     - (iii) Write the name of materials used for normal, reverse and chiral phases. Explain silylation with reaction and give the advantages and disadvantages of it.

3. Answer the following :

(a) The following data were obtained for three compounds separated on a 20 metre column :

Compounds	t_r (min)	W (min)
A	8.04	0.15
B	8.26	0.15
C	8.43	0.16

(i) Calculate the number of theoretical plates for each compound and average number of theoretical plates for the column.

(ii) Calculate the average height of theoretical plates.

(iii) In chromatographic analysis for organic compounds give a peak with retention time of 8.66 min and base line of 0.29 min., how many theoretical plates are involved in this separation ? If the column length is 2.0 meters long what is the height of theoretical plates ?

(b) Define the following terms :

(i) Gradient elution

(ii) Isocratic elution

(iii) Reversed phase packing

(iv) Sample loop

(v) Bonded phase packing

(vi) Chromatogram

4. Answer the following : (any **two**)

(a) Write a note on cationic and anionic exchangers.

(b) Describe various types of matrix of the ion exchanger.

(c) Discuss spot Vs band applications in HPTLC. Draw the block diagram of HPTLC and write the functioning.

5. Answer the following : (any **two**)

(a) Enlist the interfaces of LC-MS and give brief account on Particle beam.

(b) Write note on Watson-Biemann effusion separator.

(c) What are mass analysers ? Discuss TOF mass analyser.

(d) Give a brief account on Atmospheric pressure chemical ionization.

119A

003-010301

M.Sc. (CHE) (CBCS) (Sem.-III) Examination

November-2013

(CPA)-301 : Separation Techniques

Faculty Code : 003

Subject Code : 010301

Time : 2½ Hours] [Total Marks : 70

Instructions : (1) All questions are compulsory.
(2) All questions carry equal marks.

1. Answer the following (any seven) :
   (a) List the detectors used in HPLC and explain LOQ and LOD.
   (b) (i) In LSC the separation takes place due to difference in _____ and in LCC due to _____
   (ii) Enantiomers separated on _____ and is based on the formation of _____
   (c) (i) Which detector is not used in GC ?
   (a) FED (b) ECD
   (c) TCD (d) PDA
   (ii) Which ionization technique is used in GC-MS and LC-MS ?
   (a) MALDI (b) EI
   (c) CI (d) All above
   (d) Differentiate TLC and HPTLC, why HPTLC is superior ?
   (e) Why guard column and mobile phase degassing is necessary in HPLC ?
   (f) Give the principle of ion exchange chromatography and classify ion exchangers with examples.
   (g) Mention the name of hyphenated techniques. Give the applications and advantages of it.
   (h) Give the characteristics of the detectors used in chromatographic techniques and explain sensitivity and signal to noise ratio.
   (i) Define Van-Deemter equation and explain the terms of the equation.
   (j) Briefly discuss the silylation process and its importance.

2. Answer the following (any three) :
   (a) Draw the labelled diagram of GLC. Outline the separation process in GSC and GLC and also give the characteristics of carrier gas.
   (b) Explain the working principle of FID and TCD in GC. Briefly give operating procedure for any one.
   (c) Differentiate the following :
   (i) GC and HPLC
   (ii) GLC and GSC
   (iii) LLC and LSC
   (d) Give the differences between packed column and capillary column. Mention the name of stationary phases used in it.

3. Answer the following :
   (a) What is GC-MS ? What are the difficulties in coupling GC with MS ? Describe interface system and any one mass analyzer technique.
   (b) In liquid chromatographic column following data are found :
   Length of column 24.7 cm.
   Flow rate 0.313 ml/min.
   V_M = 1.37 ml and
   V_S = 0.164 ml
   A chromatogram of natural product mixture of species A, B, C and D provide following data :

	Retention time minute	Width of peak base (w) in minute
Non-retained	3.1	-
A	5.4	0.41
B	13.3	1.07
C	14.1	1.16
D	21.8	1.72

   Calculate :
   (i) The number of plates from each peak.
   (ii) The plate height for the column.
   (iii) The capacity factor for A, B, C and D.

OR

(a) Demonstrate the effects of eddy diffusion, longitudinal diffusion and mass transfer on the efficiency and chromatographic peaks.

(b) In a HPLC separation of two drugs X and Y the following data were recorded :

(i) The length of column packing = 25.7 cm

(ii) Flow rate = 0.313 ml/min

(iii) V_M = 1.37 ml

(iv) V_S = 0.164 ml

The retention time and peak width data for X and Y are as under :

	Retention time in (minute)	Peak width (second)
Non retained	3.1	–
X	5.4	24.6
Y	14.1	69.6

Calculate :

(i) Number of plate from each peak

(ii) Plate height for column

(iii) Retention factor for X and Y

4. Answer the following (any three) :

(a) List the ionization techniques used in hyphenated instruments and describe any one in detail with advantages and disadvantages.

(b) Explain the difficulties arises when LC coupled with MS. Give the name of ionization techniques used in it and discuss any one.

(c) Write the cationic and anionic exchange reactions. Describe the role of anion exchanger.

(d) Discuss the ion exchanger matrices.

5. Answer the following (any two) :

(a) (i) Explain the functioning of HPTLC with diagram and give the list of applications.

(ii) Define :

(a) Number of theoretical plates

(b) HETP

(c) Resolution

(d) Capacity factor

(b) Give the principle of chromatography and classify them. Explain chromatogram with terminology.

(c) Describe each components of HPLC with diagram.

(d) Give reasons :

(i) Derivatization of organic compounds are generally required in GLC.

(ii) Temperature programming is useful for analysis of a mixture of close boiling range.

(iii) Outline various injector categories for sample introduction in GC column.

292

Yogesh sangh

003-010301

M.Sc. (CBCS) (Sem-III) Examination

November-2012

(CPA) – 301 : Separation Techniques

(Common to all branches)

Faculty Code : 003

Subject Code : 010301

Time : 2½ Hours] [Total Marks :

Instructions : (1) All questions are compulsory.

(2) All questions carry equal marks.

1. Answer the following (any seven) :

(a) Complete the following sentence :

(i) Silylation is a process where _____ .

(ii) Chiral stationary phase is used for the separation of _____ and is based on the formation of _____ .

(b) Why small particle size is required in HPLC ?

(c) (1) What type of detector will you suggest for the analysis of following by GC :

(i) Organochlorine compounds

(ii) Inorganic gaseous pollutants in air

(iii) Organophosphorous pesticides

(2) True or False :

(i) Column efficiency is improved by increasing larger particle size packing.

(ii) For a high efficiency a high molecular weight carrier gas should be used.

(d) Give the general protocol of HPTLC analysis.

(e) What is C_8 and C_{18} columns ? Why they used commonly in HPLC ?

(f) What is anion exchanger ? Give its role in ion exchange chromatography.

(g) List the applications of LC-MS and discuss any one.

(h) Complete the sentence :

(i) Solvent is delivered to the column through _____.

(ii) Chiral stationary phase is used for the separation of _____ and is based on formation of _____.

(i) Select correct one

(i) Which one is not hyphenated technique ?

(a) GC-MS

(b) LC-NMR

(c) GC-IR

(d) HPTLC

(ii) Inert solid support used in GC column chromosorb-P is

(a) Diatomaceous earth phosphate

(b) Diatomaceous earth pink

(c) Diatornaceous earth phosphorous

(d) None of these

(iii) Which one is isonization techniques in GC-MS and LC-MS ?

(a) MALDI

(b) EI

(c) APCI

(d) All

(iv) Which column is used in GC ?

(a) C_8

(b) Chiral

(c) Capillary

(d) All above

(j) List the sample introduction system used in HPLC. Which one is generally used ? Why ?

2. Answer the following (any three) :

(a) (i) Name the stationary phase used in GC column. What is porapak ? What is the advantage of its used in the column ?

(ii) Draw the block diagram of GLC. How will you remove impurities from carrier gas ?

(b) What is the minimum detectable quantity of detector ? Explain the principle of TCD and FID.

(c) Give the name of methods for evaluation of GC chromatogram and briefly discuss any one.

(d) How will you separate compounds with low volatility and thermally instable ? What is the advantages of temperature programming GC analysis ?

Answer the following :

(a) What are the difficulties arises in coupling GC with MS ? Discuss interface system of GC-MS.

(b) In a liquid column chromatographic separation of two components X and Y the following data were recorded :

(i) Length of column = 25.7 cm

(ii) Flow rate = 0.313 ml/min

(iii) V_m = 1.37 ml

(iv) V_s = 0.164 ml

(v) Retention time and peak width data are as under :

	Residence time (min.)	Peak width (sec.)
Unretained	3.1	–
X	5.4	24.6
Y	14.1	69.6

Calculate :

(a) Number of plate from each peak.

(b) Plate height for column.

(c) Retention factor for X and Y.

OR

(a) Draw the schematic diagram of HPLC. Give the comparison of HPLC with GLC. Enlist the detectors and columns used in HPLC.

(b) In a analysis two substances A and B were found to have retention time 9.25 and 9.90 minutes on 16 cm column. An unretained species passed through the column in 0.55 minutes. The peak width (at base) for A and B were 0.60 and 0.65 minutes. Calculate :

(1) Column resolution

(2) Plate height

(3) Average No. of plates in column

4. Answer the following (any two) :

(a) What is the role of mass analyzers in hyphenated techniques ? Give their name and discuss any one in detail with merits of it.

(b) What is HPTLC ? Write a note on fingerprint region in HPTLC.

(c) What is ion exchange ? Describe ion exchangers in detail.

5. Answer the following (any three) :

(a) Define and explain :

(i) HETP

(ii) Number of theoretical plate

(iii) Van Deemter equation

(b) Explain the term chromatography. Give its classification and also explain reverse phase and normal phase chromatography.

(c) Outline the band broadening phenomena.

(d) Explain :

(i) Guard column

(ii) Mobile phase degassing, and

(iii) Gradient elution in HPLC

2011 Yogesh Sanghan

003-010301

M. Sc. (Sem. III) (CBCS) (Chemistry) Examination

December - 2011

C - 301 : Separation Techniques

(Common For All Branches)

2011

Faculty Code : 003

Subject Code : 010301

Time : 2.30 Hours] [Total Marks : 70

Q.1: Answer the followings (Any Seven) 14

a. Write the name of various separation techniques with basis of separation phenomena.

b. Give the principle of ion-exchange chromatography and list the application of it.

c. Explain the sample application in HPTLC.

d. A peak is observed on a column 360 nm long where V_R = 10.2 ml and W= 2.60 ml. calculate the number of theoretical plates and HETP.

$N = 16 \cdot \left(\frac{V_R}{W}\right)^2$; $H = \frac{L}{N}$

e. Explain reverse phase and normal phase chromatography.

f. Give the principle of thermal conductivity detector.

g. What is hyphenated technique? List the name of techniques.

h. Answer the correct one:

i. (i)In HPLC generally pressure requires about :(a)500 PSi (b) 50,000 PSi (c) 50PSi (d) 5000PSi.

(ii) Generally pesticides analyze by GC using :FID (b) TCD (c) ECD (d) FPD

i. Fill in the blanks:

(I) In the separation of series of hydrocarbons by GLC———liquid phase is used.

(II) Hydrogen and helium gas have very high thermal conductivity due to———.

j. Give the characteristic of detectors used in GC.

Q.2: Answer the following: (Any Three) 14

a. Draw the schematic diagram of GC-MS. Briefly explain the component of it.

b. Define: resolution, theoretical plates, capacity factor.

c. Explain the difficulties arise in coupling LC with Ms. Name the Mass analyzer used in LC-Ms and discuss any one in detail.

d. Discuss the role of HPTLC in chiral compound analysis.

Q.3 Answer the following 14

a. Draw the schematic diagram of GLC and give the name of components it. Briefly discuss column used in GC.

b. Answer the following :

(i)Differentiate GLC and GSC; GC and HPLC. (ii) Write a note on Kovats indices.

OR

Q.3: Answer the following:

a. Draw the schematic diagram of HPTLC. Explain its component and function of it. 14

b. Describe band broadening phenomena briefly.

Q.4: Answer the following: (Any Three)

a. Explain Plainimetry, Triangulation and integration technique for quantitative analysis of Gas chromatography. 14

b. Draw the diagram of Flame-ionization detector; give its advantage s and limitation. FID

c. Write Van-Demeter equation. Explain the term involved in it and give its practical effect.

d. Give the mechanism of chiral columns used in separation of chiral compound in HPLC.

Q.5: Answer the following: (Any Two)

a. Draw the labeled diagram of HPLC and give the principle and the function of "RI" and "PDA" detector. 14

b. Draw the chromatogram and explain the terms related to chromatography.

c. Enumerate the difficulties arise in coupling GC with Ms. Give the name of interface system. Explain any one analyzing system.

d. Why solvent degassing is required in HPLC? What is Guard Column? Give the characteristics of detectors used in HPLC and principle of UV detector.

2010

Yogesh Sanghani

AO-10650 Seat No. _____

M. Sc. (Sem. III) Examination

November / December – 2010

C - 301 : Chemistry

(Separation Techniques)

Time : 3 Hours] [Total Marks : 70

Instructions : (1) All questions are compulsory.
(2) Q.1 carries 10 marks.
(3) Q. 2 to 5 carry 15 marks each.

1 Answer the following : (any four)

(a) Classify and explain the mechanism of ion exchanger.

(b) Give the principle of chromatography. Explain reverse phase and normal phase.

(c) Explain the principle and role of solid carrier in affinity chromatography.

(d) Describe argented TLC and its importance.

(e) Name the hyphanated techniques. What are the problems arising with coupling of LC with MS ?

(f) Give the principle of paper chromatography and role of paper.

(g) Give any five applications of HPTLC in brief.

2 Answer the following : (any three)

(a) (i) Van-Deempter equation and its practical effect.

(ii) Guard Column is required in HPLC. Why?

(b) Name the detectors used in HPLC. Give characteristics of detectors. Discuss PDA and UV detectors.

(c) Draw the schematic diagram of HPLC with labelling each component Why degassing of mobile phase in HPLC is necessary?

(d) Explain : Gradient elution, Isocratic elution. Give the difference between modern and classical LC.

3 Answer the following :

(a) Classify the chromatography. Define HETP, number of theoretical plates, resolution and capacity factor.

(b) Explain GC-MS. Enumerate the difficulties encountered in coupling GC-MS.

(c) Draw the chromatogram and explain in detail various terms.

4 Answer the followings : (any three)

(a) What is HPTLC? Compare with TLC and briefly explain instrumentation.

(b) What is mass-analyzer? Name the analyzer used in LC-MS. Which one is the most commonly used? Discuss with principle.

(c) Describe a model practical of an affinity chromatography.

(d) (i) Calculate the resolution for the compound A and B when n = 1550 plate and t_A = 7.8 minutes and t_B = 8.9 mts.

(ii) Why temperature programming in GC is required?

5 Answer the following : (any three)

(a) Give the characteristics of detectors used in GC. Give the principle of FID and TCD and explain any one in detail.

(b) Give the principle of GLC. What type of column used in GC? Give the importance of silanization of support in stationary phases used in GC ?

(c) What is band broadening? Describe it with limitations.

(d) Why derivatization of organic compounds in GLC is required?

Differentiate between GLC and HPLC.

KK-10650 Seat No. 3105

M. Sc. (Sem. III) Examination

October / November -- 2009

C - 301 : Chemistry

(Separation Techniques)

Time : 3 Hours] [Total Marks : 70

Instructions : (1) All questions are compulsory.
(2) Question 1 carries 10 marks.
(3) Question 2 to 5 carry 15 marks each.

1 Answer the following : (any four)

(a) Explain isocratic and gradient elution technique in liquid chromatography.

(b) What is hyphanated technique? What are the difficulties arising when GC and HPLC coupled with mass spectrometer?

(c) Why TLC is superior to PC?

(d) Define ion exchange chromatography. Classify ion exchanger with examples.

(e) Discuss the columns used in GC. Why guard column necessary to use in GC?

(f) What is the role of carrier gas in GC? Give the characteristics of it.

2 Answer the following : (any three)

(a) What is mass analyzer? Name the analyzers used in LC-MS. Which one is most commonly used? Discuss with principle.

(b) Explain GC-MS interface system. Give applications of GC-MS and GC-MS/MS.

(c) What is HPTLC? Compare with TLC and briefly explain instrumentation of HPTLC.

(d) Describe a model practical of affinity chromatography.

3 Answer the following :

(a) What is band broadening phenomena? Describe it with limitations.

(b) Classify the chromatography. Explain chromatogram in detail.

(c) Define number of theoretical plate HETP and resolution. Determine the number of theoretical plates for a compound with V=4.92, and W = 0.43 ml what is the HETP if the column is 150 cm long ?

4 Answer the following : (any three)

(a) Give the principle of GC. What type of column used in GC? Give the importance of silanization of support in stationary phase in GC.

(b) Name the detectors used in GC with its characteristics. Explain in detail with diagram the functioning of FID.

(c) Describe with diagram the functioning of GLC.

(d) Differentiate between HPLC and GLC. Why derivatization of organic compounds in GLC require?

5 Answer the following : (any three)

(a) What is HPLC? Explain the normal phase and reverse phase technique. Give the name of columns used in HPLC.

(b) Discuss with diagram the functioning of HPLC instrument.

(c) Discuss the characteristics of detectors used in HPLC. Explain PDA and chiral detector in detail.

(d) Give the difference between modern LC and traditional LC. Why degassing is required in HPLC?
