



UNIVERSITY OF THE PUNJAB

Roll No.

Third Prof. A/2015

Examination: Doctor of Pharmacy (Pharm.D.)

Subject: Pharmaceutical Chemistry-II (Instrumentation) TIME ALLOWED: 20 min.

PAPER: 5

MAX. MARKS: 20

Attempt this Paper on this Question Sheet only.

Note: This paper comprises of TWO Parts, Part – I (MCQs) and Part – II (descriptive). Part – I is compulsory, whereas attempt any FOUR questions from Part – II. Each question carries equal marks.

Part – I Multiple Choice Questions (MCQs). Please encircle the correct statement, each MCQ carries 2 marks, total Marks. 20.

Q.1	<p>1- Which one of the following is true for constant flow pump?</p> <ul style="list-style-type: none">a- Used for analytical purposesb- Used for preparative purposesc- Used for column packingd- Used for gradient purposes <p>2- Which of the following is correct for HETP and N (number of plates)?</p> <ul style="list-style-type: none">a- Inverse relationb- Direct relationc- Longitudinal relationd- Vertical relation <p>3- Which one of the following is true for mid IR range?</p> <ul style="list-style-type: none">a- 0.7-300 cm⁻¹b- 180-380 cmc- 180-380 μmd- 4000-600 cm⁻¹ <p>4- What will be the order of elution in normal phase chromatography?</p> <ul style="list-style-type: none">a- non polar elute firstb- Polar elute firstc- Polar and non polar co-eluted- None of a, b, c <p>5- Precision stands for which of the following?</p> <ul style="list-style-type: none">a- Degree of scatter of valuesb- Closeness of true value and value foundc- Degree of selectivityd- Degree of sensitivity <p>6- Which of the following is be used for a non-ionic compound having MW>2000?</p> <ul style="list-style-type: none">a- Adsorption chromatographyb- Affinity chromatographyc- Ion pair chromatography	20	
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PTO

	<p>d- Size exclusion chromatography</p> <p>7- Which of the following is correct for capacity factor?</p> <ul style="list-style-type: none"> a- $(TR-TM)/TM$ b- $(TM-TR)/TM$ c- $(TR-TM)/TR$ d- $(TR-TM)$ <p>8- Van Deemter plot is used for which of the following?</p> <ul style="list-style-type: none"> a- Determine optimum velocity of the mobile phase and minimum plate height b- Determine optimum plate height and maximum velocity of the mobile phase c- Determine HETP and number of plates d- HETP and column efficiency <p>9- Chemical shift is used to describe signals of NMR on a scale, which one of the following will be true for it?</p> <ul style="list-style-type: none"> a- Measured in ppm b- Ratio of shift downfield from TMS (Hz) to total spectrometer frequency (MHz). c- Same value for 60, 100, or 300 MHz machine. d- a, b, c <p>10- There are two basic types of DSC instruments called power compensation and heat-flux. Which of the following is true for power compensation instrument?</p> <ul style="list-style-type: none"> a- Separate blocks for sample and reference cells b- Same block for sample and reference cells c- Different coils for heating for sample and reference pans d- a and c 		
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Roll No.

Subject: Pharmaceutical Chemistry-II (Instrumentation)

TIME ALLOWED: 2 hrs. & 40 min.

PAPER: 5

MAX. MARKS: 80

Attempt this Paper on Separate Answer Sheet provided.

NOTE: Attempt any 4 questions. All questions carry equal marks.

Q.1	a- Write note on electronic transitions in UV-Visible region. (5 marks) b- Write note on theory and applications of atomic absorption spectroscopy. (10 marks) c- Describe the different parts of gas chromatography. (5 marks)	20	
Q.2	a- Differentiate between selectivity (α) and resolution (R_s). (5 marks) b- Describe the relationship between R_f and partition coefficient (K). (5 marks) c- Describe the methods for the determination of lowest limit of detection. (10 marks)	20	
Q.3	a- Define chromatographic developments and describe the methods used for this process (10 marks) b- Describe the principle of mass spectrometry and its application in pharmacy (10 marks)	20	
Q-4	a- Write down the applications of DSC and DTA. (10 marks) b- Describe excitation and relaxation of nuclei in NMR spectroscopy. (5 marks) c-Describe N+1 rule in spin-spin splitting. (5 marks)	20	
Q.5	a- Describe working of loop injector by illustration. (5 marks) b- Draw diagrammatic illustration of gas chromatography instrument. (5 marks) c- Describe three types of packing materials for columns based on physical nature. (5 marks) d- Define partition coefficient, capacity factor, retention time, selectivity factor and dead time. (5 marks)	20	
Q. 6	a- Describe Nernst Equation. (10 marks) b- Describe polarography and its applications. (10 marks)	20	



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 Part – I is compulsory, whereas attempt any FOUR questions from Part – II. Each question carries equal marks.

Part – I Multiple Choice Questions (MCQs). Please encircle the correct statement, each MCQ carries 2 marks, total Marks. 20.

No. of question	Question	Marks
Q.1	<p>1- Which one of the following is true for constant flow pump?</p> <p>a- Pressure depends on flow resistance b- Pressure depends on speed of the pump c- Pressure does not depends on flow resistance d- Pressure depends the type of column</p> <p>2- Witch of the following is correct for packing diameter and number of plates?</p> <p>a- Number of plates increase with decrease in diameter b- Number of plates decrease with decrease in diameter c- Number of plates remains constant d- Number of plates decrease from 15 to 10 and the remain unchanged</p> <p>3- The electrode solution within the glass electrode (ref) of the pH-meter is which of the following?</p> <p>a- Concentrated KCl b- Dilute KCl c- Dilute HCl d- Saturated KCl</p> <p>4- What will be the order of elution if stationary phase is polar, mobile phase is non polar and separation mechanism is polar adsorption?</p> <p>a- non polar elute first b- Polar elute first c- Polar and non polar co-elute d- None of a, b, c</p> <p>5- Precision stands for which of the following?</p>	20

P.T.O.

- a- Degree of scatter of values
- b- Closeness of true value and value found
- c- Degree of selectivity
- d- Degree of sensitivity

6- The EMF of the sample is determined by which of the following?

- a- $E_{\text{cell}} = E_{\text{cathode}} + E_{\text{Ij}} - E_{\text{anode}}$
- b- $E_{\text{cell}} = E_{\text{anode}} - E_{\text{Ij}} - E_{\text{cathode}}$
- c- $E_{\text{cell}} = E_{\text{cathode}} - E_{\text{Ij}} - E_{\text{anode}}$
- d- $E_{\text{cell}} = E_{\text{anode}} + E_{\text{Ij}} - E_{\text{cathode}}$

7- Which of the following is correct for UV/VIS spectroscopy?

- a- Generate colored spectrums
- b- Determine the concentration
- c- Used to make light visible
- d- used to bend and rotate bonds

8- Which one of the following will be true for partition coefficient (K) if concentration of analyte in stationary phase is 3 mg and mobile phase is 2 mg?

- a- 1.5
- b- 1.25
- c- 1.90
- d- 1.45

9- A CH₂ group generates which of the following in a ¹H NMR at a neighbouring C-Atom?

- a- Singlet
- b- Doublet
- c- Triplet
- d- Quadruplet

10- Differential scanning calorimetry (DSC) is a technique useful in determining which of the following?

- a- Glass transition temperatures
- b- Softening points of amorphous polymers and glasses
- c- Melting point of a crystalline polymer
- d- all of the above



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PAPER: 5

MAX. MARKS: 80

Attempt this Paper on Separate Answer Sheet provided.

NOTE: Attempt any 4 questions. All questions carry equal marks.

No. of question	Question	Marks
Q.1	a- Write note on stretching and bending vibrations of organic molecules in mid-infrared region. (5 marks) b- Write note on theory and applications of atomic absorption spectroscopy. (10 marks) c- describe electronic transitions in UV/Visible spectroscopy (5 marks)	20
Q.2	a- Describe the different parts of a modular HPLC system and describe the qualitative use of HPLC. (10 marks) b- Describe the types of adsorption isotherms and their role in peak shape (10 marks)	20
Q.3	a- Describe the process or methodology of column chromatography (10 marks) b- Differentiate between normal phase and reverse phase chromatography and their orders of elution (5 marks) c- Describe isocratic and gradient elution (5 marks)	20
Q.4	a- What are the basic types of a DSC instrument and describe different phase transitions occurring in a polymer in DSC analysis. (10 marks) b- Define chemical shift, delta scale, internal standard, role of $\frac{1}{2}$ spin in NMR and N+1 rule in spin-spin splitting. (10 marks)	20
Q.5	a- Define capacity factor and describe relationship of R_f and partition coefficient (5 marks) b- Draw diagrammatic illustration of gas chromatography instrument and working of different parts. (5 marks) c- Describe different types and procedure for developments of planer chromatography (5 marks)	20
Q. 6	Write note on the following a- Plastic membrane electrodes (10 marks) b- Potentiometric electrodes (10 marks)	20



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Third Prof. 2nd A/2016

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PAPER: 5 MAX. MARKS: 20

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Part – I is compulsory, whereas attempt any FOUR questions from Part – II. Each question carries equal marks.

Part – I Multiple Choice Questions (MCQs). Please encircle the correct statement, each MCQ carries 2 marks, total Marks. 20.

No. of question	Question	Marks
Q.1	1- Average rate of migration of a solute (V) in column depends on which of the following? a- Carrier velocity b- V_s/V_m c- Distribution coefficient (K) d- All a, b and c 2- Which of the following is incorrect for chromatographic development? a- Frontal analysis b- Simple filtration c- Displacement analysis d- Elution 3- The function of the salt bridge is: a- to maintain electrical neutrality of the solution in two half cells b- to provide link between two half cells c- to allow ions to go from one cell to another d- to keep the emf of the cell positive	20
	4- Limit of detection is expressed by an equation ($LOD = 3.3\sigma/S$). In this equation S stands for which one of the following? e- Slope of the standard curve f- Solubility constant g- Standard deviation h- Intercept of the standard curve	

P.T.O.

5- Half-wave potential of the polarogram determines which of the following?

- e- Semi quantitative information
- f- Qualitative and quantitative information
- g- Quantitative information
- h- Qualitative information

6- Which of the following is true for bulk property detector?

- e- UV detector
- f- Florescent light detector
- g- Refractive index detector
- h- Photo diode array detector

7- Which of the following is true for a primary standard?

- e- Oxalic acid rehydrate
- f- Oxalic acid dihydrate
- g- Oxalic acid dehydrate
- h- Oxalic acid monohydrate

8- A solvent has retention time of 30 min and aspirin 75 min with peak width 6.5 min. What will be the capacity factor for aspirin?

- a- 1.5
- b- 2.6
- c- 1.9
- d- 1.02

9- Tetramethylsilane (TMS) is used as an internal standard in NMR due to which one of the following?

- a- Silicone is less electronegativity than carbon
- b- All the 12 protons are highly shielded
- c- Its signal is defined as zero
- d- a, b, c

10- Which of the following is true for a DSC calibrant?

- e- high purity
- f- accurately known enthalpies
- g- thermally stable
- h- a,b,c



UNIVERSITY OF THE PUNJAB

Roll No.

Third Prof: Annual - 2017

Examination: Doctor of Pharmacy (Pharm.D.)

Subject: Pharmaceutical Chemistry-II (Instrumentation) (Old Course) TIME ALLOWED: 20 min.
Pharmaceutical Chemistry-III (Pharmaceutical Analysis) (New Course) MAX. MARKS: 20

PAPER: 5

Attempt this paper on this question sheet only

Note: This paper comprises of two parts, Part-1 (MCQs) and part-2 (descriptive). Part-1 is compulsory, whereas attempt any 4 questions from part-2. Each question carries equal marks. Part-1 Multiple Choice Questions (MCQs). Please encircle the correct statement, each MCQ carries 2 marks, total marks 20.

No. of question	Question	Marks
Q.1	<p>1- Which of the following is correct statement?</p> <ul style="list-style-type: none">a. Resolution is proportional to the square root of the number of theoretical plates in a columnb. Resolution is inverse proportional to the square root of the number of theoretical plates in a columnc. Resolution is proportional to the square of the number of theoretical plates in a columnd. Resolution is proportional to the number of theoretical plates in a column <p>2- What useful information can be found from a Van Deemter plot?</p> <ul style="list-style-type: none">a. The selectivity factorb. Optimum mobile phase flow ratec. Optimum column temperatured. The capacity factor <p>3- Sieving is the mechanism of separation in</p> <ul style="list-style-type: none">a. Cause exclusion chromatographyb. CECc. Size fractional chromatography (SFC)d. Size exclusion chromatography (SEC)e. Internal exclusion fractional chromatography (IEFC) <p>4- Retention factor, k', describes</p> <ul style="list-style-type: none">a. The distribution of an analyte between the stationary and the mobile phaseb. The migration rate of an analyte through a columnc. The velocity of the mobile phased. a and c <p>5- Which of the following techniques does <i>not</i> use the mass spectrometer as a detector?</p> <ul style="list-style-type: none">a. Gas chromatographyb. High performance liquid chromatographyc. Nuclear magnetic resonance spectroscopyd. Atomic absorption spectroscopy	20

PTO

	<p>6- Which of the following techniques is least useful for structural determination of small organic compounds?</p> <ol style="list-style-type: none"> UV spectroscopy NMR GC-MS FT-IR <p>7- In general the lamp used in variable wavelength detector for UV in HPLC is which of the following?</p> <ol style="list-style-type: none"> Deuterium Tungsten Carbon arc Xenon <p>8- UV-Vis. Spectroscopy of organic compounds is usually concerned with which electronic transition(s)?</p> <ol style="list-style-type: none"> $\sigma \rightarrow \sigma^*$ $n \rightarrow \pi^*$ $n \rightarrow \pi^*$ and $\pi \rightarrow \pi^*$ a and b <p>9- Which of the following wavelength ranges is associated with UV spectroscopy?</p> <ol style="list-style-type: none"> 0.8 - 500μm 400 - 100nm 380 - 750nm 0.01 - 10nm <p>10- The electrolyte solution within the glass electrode (ref) of the pH meter is:</p> <ol style="list-style-type: none"> Saturated KCl Concentrated HCl Dilute KCl Dilute HCl 	
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Third Prof: Annual - 2017

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Roll No.

Subject: Pharmaceutical Chemistry-II (Instrumentation) (Old Course)

Pharmaceutical Chemistry-III (Pharmaceutical Analysis) (New Course)

TIME ALLOWED: 2 hrs. & 40 min.

MAX. MARKS: 80

PAPER: 5

Attempt this Paper on Separate Answer Sheet provided.

Part-II: Attempt any 4 questions. Each questions carry equal marks.

No. of question	Question	Marks
Q.1	a- Describe chromatographic development. (10 marks) b- Describe adsorption isotherms and their role in peak shape. (5 marks) c- Describe electronic transitions in UV/Visible spectroscopy (5 marks)	20
Q.2	a-Describe the construction and working of loop injector in HPLC. (5 marks) b- Describe the Jabalonski Diagram (5 marks) c- Describe the relationship of Retardation factor (R _f) and partition coefficient (5 marks) d- Describe properties, preparation and applications of Silver Nitrate (5 marks)	20
Q.3	a- Differentiate between accuracy and precision (5 marks) b- How LOD and LOQ is determined? (5 marks) c- Describe factors described in the Rate Theory of chromatography (10 marks)	20
Q-4	a- What are the basic types of a DSC instrument and describe different phase transitions occurring in a polymer in DSC analysis. (10 marks) b- Define chemical shift, delta scale, internal standard, role of $\frac{1}{2}$ spin in NMR and N+1 rule in spin-spin splitting. (10 marks)	20
Q.5	a- Write down the different methods for ion production in mass spectrometry. (10 marks) b- Write down the principle and applications of Atomic Absorption Spectrometry. (5 marks) c- Write down the vibrational modes and applications of IR (5 marks)	20
Q. 6	a- What is electrode potential and how it can be determined with Nernst Equation? (10 marks) b- Describe non-aqueous titrations and their applications (10 marks)	20



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Third Prof: 2nd Annual - 2017

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Subject: Pharmaceutical Chemistry-II (Instrumentation) (Old Course) TIME ALLOWED: 20 min.
Pharmaceutical Chemistry-III (Pharmaceutical Analysis) (New Course) MAX. MARKS: 20

PAPER: 5

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Note: This paper comprises of TWO Parts, Part – I (MCQs) and Part – II (descriptive).
Part – I is compulsory, whereas attempt any FOUR questions from Part – II. Each question carries equal marks.

Part – I Multiple Choice Questions (MCQs). Please encircle the correct statement.

Each MCQ carries 2 marks, total Marks. 20.

No. of question	Question	Marks
Q.1	<p>1- In an electrolytic cell, which of the following is the half-cell where reduction takes place?</p> <ul style="list-style-type: none">a. Anodeb. Cathodec. Combination electroded. Electrode response <p>2-Mercury covered by a layer of mercurous chloride in contact with saturated potassium chloride solution is a description of which of the following types of electrodes?</p> <ul style="list-style-type: none">a. Sodiumb. Calciumc. Silver/silver chlorided. Calomel <p>3- The ¹³C NMR spectrum of a compound A contains two signals and in the ¹H NMR spectrum there is a singlet. Which compound is consistent with these data?</p> <ul style="list-style-type: none">a. Acetoneb. Dichloromethanec. Ethanold. Bromoethane <p>4- Vicinal coupling is:</p> <ul style="list-style-type: none">a. coupling between ¹H nuclei in an alkaneb. coupling between ¹H nuclei attached to the same C atomc. coupling between ¹H nuclei in an alkened. coupling between ¹H nuclei attached to adjacent C atoms <p>5- Which of the following techniques would be most useful to identify and quantify the presence of a known impurity in a drug substance?</p> <ul style="list-style-type: none">a. NMRb. MSc. IRd. HPLC	20

PTO

6- Which of the following assays could not be performed by gas chromatography?

- a. Characterisation of volatile oils
- b. Measurement of drugs and metabolites in biological fluids
- c. Analysis of intravenous sodium chloride infusion
- d. Characterisation of raw materials for drug synthesis

7- Which of the following compounds does not absorb light in the UV/visible spectrum?

- a. Chloral hydrate
- b. Aspirin
- c. Paracetamol
- d. Phenobarbitone

8- In infrared spectroscopy which frequency range is known as the fingerprint region?

- a. $400 - 1400\text{cm}^{-1}$
- b. $1400 - 900\text{cm}^{-1}$
- c. $900 - 600\text{cm}^{-1}$
- d. $600 - 250\text{cm}^{-1}$

9- The compound eluted last and retained more in Normal and Reversed phase are

- a. Polar and Non-polar
- b. Non-polar and Polar
- c. Both are in Polar
- d. Both are in Non-polar

10- Which of the following is true for a DSC calibrant?

- a- high purity
- b- accurately known enthalpies
- c- thermally stable
- d- a,b,c



UNIVERSITY OF THE PUNJAB

Third Prof: Annual – 2018

Examination: Doctor of Pharmacy (Pharm.D.)

Roll No.

Subject: Pharmaceutical Chemistry-III (Pharmaceutical Analysis) (New Course) TIME ALLOWED: 2 Hrs. & 30 min.
PAPER: 5 Part – II MAX. MARKS: 80

Attempt this Paper on Separate Answer Sheet provided.

Attempt any 4 questions. Each questions carry equal marks.

Q. 2	a- Describe the peak-dispersion processes involved in the rate theory of chromatography. (10 marks) b- Define chromatographic development and types of chromatographic developments. (10 marks)	20
Q. 3	a- Describe system suitability parameters such as Number of theoretical plates (N), Height equivalent to theoretical plates (HETP), Capacity factor (K'), Resolution (R) and Selectivity factor (α). (10 marks) b- Describe the steps involved in liquid column chromatography. (10 marks)	20
Q. 4	a- Describe the relationship of average linear rate of migration of a solute (V) and capacity factor K'. (10 marks) b- Describe the function, characteristics and types of HPLC pump (10 marks)	20
Q. 5	a- Describe the basic principle of DSC and DTA (10 marks) b- Describe precipitation and argentometric Titration (10 marks)	20
Q. 6	a) Write down the working with instrumentation of mass spectrometry (10 marks) b) Write down the modes of vibrations of IR spectroscopy (10 marks)	20
Q. 7	A)- Describe chemical shift and properties of tetra methyl silane (TMS) (10 marks) B)- Describe the quantitative use of the Nernst Equation (10 marks)	20



UNIVERSITY OF THE PUNJAB

Third Prof: Annual – 2018

Examination: Doctor of Pharmacy (Pharm.D.)

Roll No.

Subject: Pharmaceutical Chemistry-III (Pharmaceutical Analysis) (New Course) TIME ALLOWED: 30 min.
PAPER: 5 Part – I (Compulsory) MAX. MARKS: 20

Attempt this Paper on this Question Sheet only.

Please encircle the correct statement. Each MCQ carries 2 Marks. This Paper will be collected back after expiry of time limit mentioned above.

Q.1 Multiple Choice Questions (MCQs). Please encircle the correct statement (1X20=20)

1- There are two types of pumps for HPLC, constant pressure pump and constant flow pump.

Which of the following is true for constant flow pump?

- a- Pressure depends on flow resistance
- b- Pressure depends on speed of the pump
- c- Pressure does not depend on flow resistance
- d- Pressure depends the type of column

2- Infrared (IR) radiation is used for determination of functional groups in organic molecules.

Which one of the following is true for IR range?

- a- 180-380 nm
- b- 180-380 cm
- c- 180-380 μm
- d- 180-380 cm^{-1}

3- In validation of an assay precision stands for which of the following?

- a- Degree of scatter of values
- b- Closeness of true value and value found
- c- Degree of selectivity
- d- Degree of sensitivity

4- Sample preparation is an important step in HPLC. What will be true if sample is not dissolved in mobile phase?

- a- Loss of efficiency
- b- Poor peak resolution
- c- Spreading or splitting of peaks
- d- (a), (b), (c)

5- Chemical shift is used to describe signals of NMR on a scale, which one of the following will be true for it?

- a- Measure in ppm
- b- Ratio of shift downfield from TMS (Hz) to total spectrometer frequency (MHz)
- c- Same value for 60, 100, or 300 MHz machine
- d- a, b, c

6- Which of the following is true for accuracy?

- a- A measure of how often an experimental value can be repeated
- b- The closeness of a measured value to the real value
- c- The number of significant figures used in a measurement
- d- None of these

7- What is the molarity of a 500 mL solution of NaOH containing 80 g NaOH?

- a- 2M
- b- 4M
- c- 3 M
- d- 0.4 M

8- In the expression of limit of detection S/N stands for which one of the following?

- a- Signal to normality
- b- Solubility to normality
- c- Standard deviation to normal distribution
- d- Signal to noise

9- Which one of the following is true for solute property detector?

- a- Depends on solute
- b- Depends on mobile phase
- c- Depends on solute and mobile phase
- d- Depends on volume of mobile phase

- 10- The retention time of mobile phase (t_M) is 20 min and retention time of aspirin (t_R) is 60 min with peak width 3 min. Then which of the following is true for capacity factor for aspirin?
 - a- 2.0
 - b- 2.6
 - c- 1.9
 - d- 1.02
- 11- Which one of the following is true for constant flow pump?
 - a- Used for analytical purposes
 - b- Used for preparative purposes
 - c- Used for column packing
 - d- Used for gradient purposes
- 12- Which one of the following is true for mid IR range?
 - a- 0.7-300 cm^{-1}
 - b- 180-380 cm^{-1}
 - c- 180-380 μm
 - d- 4000-600 cm^{-1}
- 13- Precision stands for which of the following?
 - a- Degree of scatter of values
 - b- Closeness of true value and value found
 - c- Degree of selectivity
 - d- Degree of sensitivity
- 14- Which of the following is correct for capacity factor?
 - a- $(T_R - T_M)/T_M$
 - b- $(T_M - T_R)/T_M$
 - c- $(T_R - T_M)/T_R$
 - d- $(T_R - T_M)$
- 15- Chemical shift is used to describe signals of NMR on a scale, which one of the following will be true for it?
 - a- Measured in ppm
 - b- Ratio of shift downfield from TMS (Hz) to total spectrometer frequency (MHz)
 - c- Same value for 60, 100, or 300 MHz machine
 - d- a, b, c
- 16- In voltammetry which of the following is correct for half wave potential?
 - a. Independent of concentration
 - b. Dependent on concentration
 - c. Dependent on current
 - d. Independent of current
- 17- Which of the following is correct potentiometry?
 - a. Galvanic cell
 - b. Electrolytic cell
 - c. Half-cell
 - d. Auxiliary cell
- 18- Which of the following is correct for potential sweep in voltammetry?
 - a. Working and auxiliary electrodes
 - b. Working and standard electrodes
 - c. Standard and auxiliary electrodes
 - d. Standard electrode and salt-bridge
- 19- Which equation is used for quantitative purpose in potentiometry?
 - a. The Henderson-Hasselbalch equation
 - b. The Nernst equation
 - c. The Regression equation
 - d. The Ilkovic equation
- 20- Mass spectrum is the graphical representation of mass to charge ratio versus which of the following?
 - a- Relative intensity
 - b- Relative abundance
 - c- Percentage
 - d- All of above



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Third Prof: 2nd Annual – 2018

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Roll No.

Subject: Pharmaceutical Chemistry-II (Instrumentation)
PAPER : 5 Part – II (Old Course)

MAX. TIME: 2 Hrs. 30 Min.
MAX. MARKS: 80

ATTEMPT THIS (SUBJECTIVE) ON THE SEPARATE ANSWER SHEET PROVIDED

NOTE: ATTEMPT ANY FOUR QUESTIONS. EACH QUESTION CARRIES EQUAL MARKS.

Q.2	a- Describe chromatographic development. (10 marks) b- Describe the Rate Theory of chromatography. (10 marks)	20
Q.3	a- Describe the principal and pharmaceutical applications of mass spectrometry (10 marks) b- Describe electromagnetic spectrum and qualitative and quantitative applications of UV/Visible spectroscopy. (10 marks)	20
Q.4	a-Describe Retention Time, Capacity Factor, Retention Volume, Selectivity Factor and Resolution. (10 marks) b- Draw schematic diagram of a basic HPLC system, and describe pumps and loop injector. (10 marks)	20
Q.5	a- Write the names of 5 solvents used to prepare samples for NMR spectroscopy and draw flow diagram of NMR system. (10 marks) b- Write note on Magnetic shielding and Spin-spin splitting. (10 marks)	20
Q.6	a- What is the basic principle of DSC and how heat capacity of a substance is determined by DSC? (10 marks) b- Give the characteristics of the compound determining suitability to be analyzed by gas chromatography, and describe the instrumentation and applications of infrared spectroscopy (10 marks)	20
Q.7	A)- Describe the use, types and characteristics of Salt Bridge (10 marks) B)- Describe briefly Radiochemical methods of analysis with one example (10 marks)	20



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Roll No.

Subject: Pharmaceutical Chemistry-III (Pharmaceutical Analysis)
PAPER : 5 Part – II (New Course)

MAX. TIME: 2 Hrs. 30 Min.
MAX. MARKS: 80

ATTEMPT THIS (SUBJECTIVE) ON THE SEPARATE ANSWER SHEET PROVIDED

NOTE: ATTEMPT ANY FOUR QUESTIONS. EACH QUESTION CARRIES EQUAL MARKS.

Q.2	a- Describe the plate theory of chromatography and its importance. (10 marks) b- Describe guard column, analytical column and loop injector. (3+3+4=10 marks)	20
Q.3	a- Classify the chromatography based on the mechanism of separation and describe the difference between normal phase and reverse phase chromatography. (10 marks) b- Describe sensitivity of a method and how it is determined? (10 marks)	20
Q.4	a- Define chromatographic developments and describe the methods used for this process (10 marks) b- Describe the principle of mass spectrometry and its application in pharmacy (10 marks)	20
Q.5	a- Write down the applications of DSC and DTA. (10 marks) b- Describe complexometric titrations. (10 marks)	20
Q.6	a- Describe schematic diagram of HPLC system and gas chromatography system (10 marks) b- Write down the different methods of ion production in mass spectrometry (10 marks)	20
Q.7	a- Describe Nernst Equation (10 marks) b- Describe voltammetry and its applications (10 marks)	20



UNIVERSITY OF THE PUNJAB

Third Prof: 2nd Annual – 2018

Examination: Doctor of Pharmacy (Pharm.D.)

Roll No. in Fig.

Roll No. in Words.

Subject: Pharmaceutical Chemistry-III (Pharmaceutical Analysis)

MAX. TIME: 30 Min.

PAPER : 5 Part – I (Compulsory) (New Course)

MAX. MARKS: 20

Signature of Supdt.:

Attempt this Paper on this Question Sheet only.

Please encircle the correct option. Division of marks is given in front of each question.

This Paper will be collected back after expiry of time limit mentioned above.

Q.1. Encircle the right answer cutting and overwriting is not allowed.

(20x1=20)

- 1- What will be the effect packing diameter on the number of plates when columns of same dimensions were packed with material having diameter 15, 10, 5 and 3 μ ?
 - a- Number of plates increase with decrease in diameter
 - b- Number of plates decrease with decrease in diameter
 - c- Number of plates remains constant
 - d- Number of plates decrease from 15 to 10 and the remain unchanged
- 2- What will be the order of elution if stationary phase is polar, mobile phase is non-polar and separation mechanism is polar adsorption?
 - a- non polar elute first
 - b- Polar elute first
 - c- Polar and non-polar co-elute
 - d- None of a, b, c
- 3- Which of the following is a type of chromatography for non-ionic compound having MW> 2000?
 - a- Adsorption chromatography
 - b- Affinity chromatography
 - c- Ion pair chromatography
 - d- Size exclusion chromatography
- 4- Which one of the following will be true for partition coefficient (K) if concentration of analyte in stationary phase is 3 mg and mobile phase is 2 mg?
 - a- 1.5
 - b- 1.25
 - c- 1.90
 - d- 1.45
- 5- There are two basic types of DSC instruments called power compensation and heat-flux. Which of the following is true for power compensation instrument?
 - a- Separate blocks for sample and reference cells
 - b- Same block for sample and reference cells
 - c- Different coils for heating for sample and reference cells
 - d- a & c
- 6- In analysis where sample is continuously passed through the column is known by which of the following?
 - a- Gradient analysis
 - b- Elution analysis
 - c- Displacement analysis
 - d- Frontal analysis
- 7- Which of the following is true for UV-Visible spectroscopy?
 - a- Florescence
 - b- Electronic transition
 - c- Phosphorescence
 - d- Angle transitions
- 8- Which of the following is true for ppm of an aqueous solution?
 - a- 100 μ g/100 mL
 - b- 10 μ g/10 mL
 - c- 1 mg/L
 - d- All a, b and c
- 9- Deuterated solvents are used for which one of the following?
 - a- NMR
 - b- FTIR
 - c- GC-TOFMS
 - d- Tandem Mass Spectroscopy

P.T.O.

- 10- Which of the following is true for a DSC calibrant?
 - a- high purity
 - b- accurately known enthalpies
 - c- thermally stable
 - d- a,b,c
- 11- Which of the following is correct for HETP and N (number of plates)?
 - a- Inverse relation
 - b- Direct relation
 - c- Longitudinal relation
 - d- Vertical relation
- 12- What will be the order of elution in normal phase chromatography?
 - a- non polar elute first
 - b- Polar elute first
 - c- Polar and non-polar co-elute
 - d- None of a, b, c
- 13- Which of the following is used for a non-ionic compound having MW>2000?
 - a- Adsorption chromatography
 - b- Affinity chromatography
 - c- Ion pair chromatography
 - d- Size exclusion chromatography
- 14- Van Deemter plot is used for which of the following?
 - a- Determine optimum velocity of the mobile phase and minimum plate height
 - b- Determine optimum plate height and maximum velocity of the mobile phase
 - c- Determine HETP and number of plates
 - d- HETP and column efficiency
- 15- There are two basic types of DSC instruments called power compensation and heat-flux. Which of the following is true for power compensation instrument?
 - a- Separate blocks for sample and reference cells
 - b- Same block for sample and reference cells
 - c- Different coils for heating for sample and reference pans
 - d- a and c
- 16- Which type of electrochemical cell is used in voltammetry?
 - a. Galvanic cell
 - b. Electrolytic cell
 - c. Half-cell
 - d. Auxiliary cell
- 17- In galvanic cell which of the following reaction produces current?
 - a. Non-spontaneous
 - b. Spontaneous
 - c. Non-redox
 - d. Heat-dependent
- 18- In voltammetry concentration of the sample is not effected due to which of the following?
 - a. Microelectrode
 - b. Dropping mercury electrode
 - c. SHE
 - d. SCE
- 19- FID is the example of detector of which of the following?
 - a. GC
 - b. MS
 - c. IR
 - d. HPLC
- 20- Total energy for ionization and fragmentation in MS is which of the following?
 - a. 70ev
 - b. 80ev
 - c. 90ev
 - d. 100ev



UNIVERSITY OF THE PUNJAB

Doctor of Pharmacy (Pharm.D.) Third Prof: Annual-2019

Subject: Pharmaceutical Chemistry-II (Instrumentation) (Old Course)

Paper: 5 Part - I (Compulsory)

Time: 30 Min. Marks: 20

Roll No. in Fig.

Roll No. in Words.

Signature of Supdt.:

ATTEMPT THIS PAPER ON THIS QUESTION SHEET ONLY.

Division of marks is given in front of each question.

This Paper will be collected back after expiry of time limit mentioned above.

Q.1. Encircle the correct option.

(20x1=20)

1. Total energy for ionization and fragmentation in MS is which of the following?
 - a. 70ev
 - b. 80ev
 - c. 90ev
 - d. 100ev
2. In field ionization the electric field is given by which of the following?
 - a. 10^{10} V/m
 - b. 10^{11} V/m
 - c. 10^{12} V/m
 - d. 10^{13} V/m
3. Electron multiplier detector is the example of which of the following?
 - a. GC detector
 - b. MS detector
 - c. IR detector
 - d. None of above
4. Which of the following is not true about the galvanic method of oxygen analysis?
 - a. Electrodes are composed of noble and base metals.
 - b. Electrodes composed acid and base
 - c. Its principle is based on electrolysis
 - d. Its utilizes an electronic cell
5. Which of the following methods is widely used for trace gas analysis?
 - a. Galvanic Methods
 - b. Conductometric methods
 - c. polarographic cells
 - d. thermal conductivity method
6. Pure water is known to be which of the following?
 - a. weak electrolyte
 - b. strong electrolyte
 - c. Neither weak nor strong
 - d. Non an electrolyte
7. Beer's Law states that which of the following?
 - a. Absorbance is proportional to both the path length and concentration of the absorbing species
 - b. Absorbance is proportional to the log of the concentration of the absorbing species
 - c. Absorbance is equal to P_0 / P
 - d. None of these
8. Which of following is not true about absorption spectroscopy?
 - a. Involves transmission
 - b. Scattering is kept minimum
 - c. Reflection is kept maximum
 - d. Intensity of radiation leaving substance is an indication of conc.
9. Which of following detector does not require a battery and is also known as barrier layer cell?
 - a. Photomultiplier tube
 - b. Photovoltaic cell
 - c. Photoemissive tube
 - d. Photo reflector
10. What will be the order of elution if stationary phase is polar, mobile phase is non polar and separation mechanism is polar adsorption?
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P.T.O.

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 - c- Polar and non-polar co-elute
 - d- None of a, b, c



UNIVERSITY OF THE PUNJAB

Doctor of Pharmacy (Pharm.D.) Third Prof: Annual-2019

Roll No.

Subject: Pharmaceutical Chemistry-III (Pharmaceutical Analysis)

Paper: 5 Part - I (Compulsory) (New Course)

Time: 2 Hrs. 30 Min. Marks: 80

ATTEMPT THIS (SUBJECTIVE) ON THE SEPARATE ANSWER SHEET PROVIDED

Note: Attempt any *FOUR* questions. Each question carries equal marks.

No. of question	Question	Marks
Q.2	a) Write down the different methods of ion production in mass spectrometry (10 marks) b) Draw and label the internal diagram of gas chromatography and explain the working of gas chromatography system (10 marks)	20
Q.3	a- Define Number of theoretical plates (N), Height equivalent to theoretical plates (HETP), Capacity factor (K'), Resolution (R) and Selectivity factor (α). (10 marks) b- Describe the chromatographic development. (10 marks)	20
Q.4	a- Describe the relationship of average linear rate of migration of a solute (V) and capacity factor K'. (10 marks) b- Draw the schematic diagram of a basic HPLC system and the functioning of loop injector. (10 marks)	20
Q.5	a. Describe different types of DSC instruments and measurement of heat capacity using DSC curve b. Define the Beer-Lambert's Law and explain its used in UV/Visible spectroscopy	20
Q.6	Write note in the following a. Dropping mercury electrodes (5 marks) b. Applications of Polarography (5 marks) c. Electrode Potential (5 marks) d. PII (5 marks)	20
Q.7	a. Describe chemical shift and use and properties of tetra methyl silane (TMS) (10 marks) b. Differentiate between normal phase and reverse phase chromatography, and write a note on affinity chromatography (10 marks)	20



UNIVERSITY OF THE PUNJAB

Doctor of Pharmacy (Pharm.D.) Third Prof: Annual-2019

Roll No.

Subject: Pharmaceutical Chemistry-II (Instrumentation) (Old Course)

Paper: 5 Part - I (Compulsory)

Time: 2 Hrs. 30 Min. Marks: 80

ATTEMPT THIS (SUBJECTIVE) ON THE SEPARATE ANSWER SHEET PROVIDED

Note: Attempt any *FOUR* questions. Each question carries equal marks.

No. of question	Question	Marks
Q.2	a. Write down the modes of vibrations of IR spectroscopy (10 marks) b. Draw and label the internal diagram of mass spectrometry (5 marks) c. Write and explain the types of gas chromatography (5 marks)	20
Q.3	a- Classify the chromatography based on the mechanism of separation and size exclusion chromatography. (10 marks) b- How sensitivity of a method is determined? (10 marks)	20
Q.4	a- Describe factors involved in the rate theory of chromatography. (10 marks) b- Describe the principle of mass spectrometry and its application in pharmacy (10 marks)	20
Q-5	a- Describe measurement of heat capacity and glass transition using DSC curve b. Describe the basic principle and theory of atomic absorption spectroscopy	20
Q.6	a- Describe schematic diagram of HPLC system and gas chromatography system (10 marks) b- Write down characteristics and functions of HPLC pumps (10 marks)	20
Q. 7	a- Describe Nernst Equation (10 marks) b- Describe Ion-Selective Electrodes (10 marks)	20



UNIVERSITY OF THE PUNJAB

Doctor of Pharmacy (Pharm.D.) Third Prof: Annual-2021

Subject: Pharmaceutical Chemistry-III (Pharmaceutical Analysis)

Paper: 5 Part – I (Compulsory)

(New Course)

Time: 30 Min. Marks: 20

Roll No. in Fig.

Roll No. in Words.

Signature of Supdt.:

ATTEMPT THIS PAPER ON THIS QUESTION SHEET ONLY.

Division of marks is given in front of each question.

This Paper will be collected back after expiry of time limit mentioned above.

Q.1. Encircle the correct option.

(20x1=20)

1. Phenolphthalein changes from colorless to pink in which of the following?
 - a) Acid
 - b) Alkali
 - c) Water
 - d) Neutral solutions
2. A thermal analysis during which mass of analyte changes as a function of temperature is known by which of the following?
 - a) DSC
 - b) DTA
 - c) TGA
 - d) TMA
3. The radioactivity per unit volume is known by which of the following?
 - a) Specific activity
 - b) Radioactive concentration
 - c) Curie
 - d) Baquerel
4. Which of the followings is used as a primary reference electrode?
 - a) Ag-AgCl Electrode
 - b) Calomel Electrode
 - c) Glass Electrode
 - d) Standard Hydrogen Electrode
5. EDTA stands for which of the following?
 - a) Ethylene diamino tetra acetic acid
 - b) Ethyl dichromate trichloro acid
 - c) Ethyl dibromo tetra acetic acid
 - d) Ethylene difloro tetra trichloro acid
6. How many types of bending vibrations take place in IR spectroscopy?
 - a. 2
 - b. 3
 - c. 4
 - d. 5
7. Faraday cup is the example of detector of which of the following?
 - a. Gas chromatography
 - b. UV visible spectroscopy
 - c. IR spectroscopy
 - d. Mass spectrometry
8. Golay cell is the example of detector of which of the following?
 - a. Gas chromatography
 - b. UV visible spectroscopy
 - c. IR spectroscopy
 - d. Mass spectrometry
9. Flame ionization detector is the example of detector of which of the following?
 - a. Gas chromatography
 - b. UV visible spectroscopy
 - c. IR spectroscopy
 - d. Mass spectrometry
10. In electron ionization the pressure range to which of the following?
 - a. $10^{-4} - 10^{-5}$
 - b. $10^{-4} - 10^{-6}$
 - c. $10^{-4} - 10^{-7}$
 - d. $10^{-4} - 10^{-8}$
11. Which of the following component of a spectrophotometer collect the diverging light from a source and pass as parallel beams?
 - a. Collimeter
 - b. Amplifier
 - c. Monochromator
 - d. Detector

12. Functional groups having lone pair electrons to form pi-bond with chromophore ($n-\pi$ conjugation) are known by which of the following?
- Auxochrome
 - Chromogen
 - Fluorescent
 - Luminescent
13. Deuterated solvents are used in which of the following?
- IR
 - NMR
 - Visible spectroscopy
 - TGA
14. Resolution is calculated by which of the following?
- W average/dTR
 - dTR/W average
 - TR2-TR1/TM
 - TR-TM/TM
15. What will be correct for HPLC peak if $K=1$?
- Leading edge
 - Tailing
 - Symmetrical
 - Asymmetrical
16. Which of the following is based on molecular size?
- Ion exchange chromatography
 - Partition Chromatography
 - Adsorption Chromatograph
 - Gel permeation chromatography
17. Which of the following pump cannot be used for gradient elution?
- Binary channel
 - Single channel
 - Ternary channel
 - Quaternary channel
18. Stationary phase for affinity chromatography needs which of the following?
- Reference node
 - Displacer
 - Spacer
 - Partition
19. Increase in number of plates results in which of the following?
- Decrease in plate height
 - Increase in plate height
 - No effect in plate height
 - Surge in plate height
20. Which of the following is correct for TLC plate rotation in 2 D?
- 70 degree
 - 90 degree
 - 120 degree
 - 180 degree



UNIVERSITY OF THE PUNJAB

Doctor of Pharmacy (Pharm.D.) Third Prof: Annual-2021

Roll No.

Subject: Pharmaceutical Chemistry-III (Pharmaceutical Analysis)

Paper: 5 Part - II

(New Course)

Time: 2 Hrs. 30 Min. Marks: 80

ATTEMPT THIS (SUBJECTIVE) ON THE SEPARATE ANSWER SHEET PROVIDED

Note: Attempt any *FOUR* questions. Each question carries equal marks.

Q.2	a) Differentiate between the following; (5*2=10) 1. Atomic and molecular spectroscopy 2. Bathochromic and hypsochromic shift 3. Single beam and double beam spectrophotometer 4. Line and band spectrum 5. Fluorescence and phosphorescence b) Write a detailed note on the components of an atomic absorption spectrophotometer. (10)	20
Q.3	a) Write a note on application of UV/Visible spectrophotometer. (10) b) What are the factors that affect the fluorimetric measurements? (10)	20
Q.4	a) Write a note on the detectors of gas chromatography (10) b) Describe HPLC pumps and loop injector (10)	20
Q-5	a) Draw and label the internal diagram of IR spectrometer (10) b) Describe the rate theory of chromatography (10)	20
Q.6	a) Highlight advantages and disadvantages of titrimetric analysis as a quantitative analytical technique (10) b) Define differential scanning calorimetry (DSC) and describe its instrumentation and applications (10)	20
Q. 7	a) Draw and describe working of dropping mercury electrode (5) b) Describe the steps involved in liquid column chromatography (10) c) Describe the relationship between average rate of migration of solute and capacity factor (5)	20