MANAV RACHNA UNIVERSITY

DEPARTMENT OF SCIENCES

"End Term Examination, Jan-June-2023"

SEMESTER	**II**	**DATE OF EXAM**	25.05.2023
SUBJECT NAME	**Physical Chemistry-I**	**SUBJECT CODE**	**CHH102-T**
BRANCH	**Chemistry**	**SESSION**	II
DURATION	**3 hrs (01:00 – 04:00PM)**	**MAX. MARKS**	**100**
PROGRAM	**B.Sc (Hons.)**	**CREDITS**	**4**
NAME OF FACULTY	**Dr. Harsha Devnani**	**NAME OF COURSE COORDINATOR**	**Dr. Harsha Devnani** Arpit Sanad

Note: Part-A: Attempt all questions.
Part-B: Attempt any four questions.

Q.NO.		QUESTIONS	MARKS	CO ADDRESSED	BLOOM'S LEVEL	PI
PART-A	1(A)	Define the terms refractive index and molar refraction.	4	CO2	BT2	
	1(B)	What is meant by Reynold's number? Discuss its significance.	4	CO2	BT2	
	1(C)	How is optical activity related to refractive index?	4	CO2	BT3	
	1(D)	Calculate the degrees of freedom of following molecules: a. H_2O b. C_2H_2	4	CO1	BT3	
	1(E)	Explain the terms collision number and collision diameter.	4	CO1	BT1	
PART-B	Q2(A)	Calculate the interplanar spacing for a cubic system between the following sets of planes: (a) 110 (b) 111 (c) 222. Assume a is the edge length of the unit cell.	10	CO3	BT3	
	2(B)	Define the terms solubility and solubility product of a substance. Explain any 2 applications of the concept of solubility product.	10	CO4	BT2,4	
	Q3(A)	Explain why does a solution of a weak acid and its salt behave as a buffer? Derive the relation between the pH of the solution and the relative	10	CO4	BT4	

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		amounts of the acid and the salt present in it. Explain why a solution containing a strong acid and its salt does not behave as a buffer?				
	3(B)	What is lattice energy? Derive Born-Lande equation for the lattice energy of an ionic solid.	10	CO3	BT1,2	
	Q4(A)	Discuss in detail the phenomenon of hydrolysis of salts. Illustrate your answer taking example of a mixture of a weak acid and strong base.	10	CO4	BT2	
	4(B)	Derive the Bragg equation for X-ray crystallography.	10	CO3	BT2,4	
	Q5(A)	a. Calculate pH of a solution prepared by mixing 50 mL of 0.1 M NaOH and 50 mL of 0.2 M CH_3COOH. $K_a = 1.8 \times 10^{-5}$ b. Calculate the pH of 1.0×10^{-3} M solution of HCl	10	CO4	BT3	
	5(B)	Discuss briefly following types of defects: a. Frenkel Defect b. Metal excess defect	10	CO3	BT2	
	Q6(A)	Discuss the proton transfer theory of acids and bases. What is meant by a conjugate pair?	10	CO4	BT1	
	6(B)	Sketch the seven crystal systems giving their dimensions.	10	CO3	BT3	

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DEPARTMENT OF SCIENCES

"End Term Examination, June-2023"

SEMESTER	**II**	**DATE OF EXAM**	29.05.2023
SUBJECT NAME	**Inorganic Chemistry-I**	**SUBJECT CODE**	**CHH103B-T**
BRANCH	**Chemistry**	**SESSION**	II
TIME	**180 Min** (01:00 – 04:00PM)	**MAX. MARKS**	**100**
PROGRAM	**BSc(H) Chemistry**	**CREDITS**	**4**
NAME OF FACULTY	**Dr. A Jayamani**	**NAME OF COURSE COORDINATOR**	**Dr. A Jayamani** A.JayaMani Arpit Sonal

Note: All questions are compulsory.

Q.NO.		QUESTIONS	MARKS	CO ADDRESSED	BLOOM'S LEVEL	PI
PART-A	1(A)	Describe in detail the shapes of s, p, and d orbitals with diagrams.	5	CO1	BT3, BT4	
	1(B)	Write short notes on radial and angular distribution functions	5	CO2	BT3	
	1(C)	Explain how the periodic trends vary for electron gain enthalpy in comparison to ionization enthalpy	5	CO3	BT2, BT3	
	1(D)	Define electronegativity and explain the following (i) On the Pauling scale the electronegativities of nitrogen and oxygen are respectively 3.0 and 3.5. Why is oxygen more electronegative than nitrogen? b) On the same scale, the electronegativity of Sulphur is 2.5. Why is Sulphur less electronegative than oxygen?	5	CO3	BT4	
PAR	Q2(A)	Explain the concept of the radius ratio rule and mention its limitations	4	CO4	BT2	

	2(B)	Compare the hcp and ccp in ionic crystals	6	CO4	BT4	
	2(C)	Explain the Born Haber Cycle with an example.	10	CO4	BT1, BT3	
	Q3(A)	Draw the Lewis structure of sulphate ion (SO_4^{2-}) in which four O atoms are bonded to S atoms.	4	CO4	BT4	
	3(B)	Write short notes on equivalent and non-equivalent hybrid orbitals	4	CO4	BT3	
	3(C)	No compound in nature is 100 % Ionic or 100 % covalent, Justify this statement with the help of Fajan's rule. Also, mention which is more ionic in NaCl or KCl and NaF or NaBr with reasons.	6	CO4	BT4	
	3(D)	The dipole moment of KCl is 3.336×10^{-29} coulomb metre which indicates that it is a highly polar molecule. The interatomic distance between k^+ and Cl^- is 2.6×10^{-10} m. Calculate the dipole moment of the KCl molecule if there were opposite charges of one fundamental unit located at each nucleus and calculate the percentage ionic character of KCl. ($e=1.602 \times 10^{-19}$ C).	6	CO4	BT3	
PART -C	Q4(A)	How the percentage ionic character can be calculated from the electronegativity difference?	4	CO5	BT3	
	4(B)	What are band theories of solids? Explain how it supports differentiating conductors, semiconductors and insulators	8	CO5	BT2	
	4(C)	Explain elaborately various defects in solids	8	CO5	BT2, BT6	
	Q5(A)	Draw a flowchart for identifying the type of intermolecular forces present in a molecule and mention which of the following can form hydrogen bonding with water dimethyl ether, methane, formic acid and Fluoride ions, and give a reason.	10	CO5	BT5, BT6	
	5(B)	(i) Which substance in each of the following pairs would you expect to have the higher boiling point? Explain why. (a) Ne or Xe, (b) CO_2 or CS_2, (c) CH_4 or Cl_2, (d) F_2 or LiF, (e) NH_3 or PH_3 and (f) NH_3 and CH_4 (ii) Mention the types of intermolecular forces that exist between molecules (or basic units) in each of the following species: (a) benzene, (b)	6+4	CO5	BT2, BT4	

		chloroform (c) PF_3 and (d) CS_2.				

PART -B **************** END ********************

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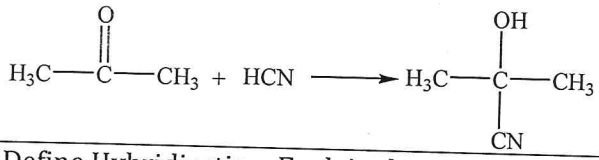
"End term Examination,May-June 2023"

SEMESTER	**II**	**DATE OF EXAM**	02.06.2023
SUBJECT NAME	**Organic Chemistry-I**	**SUBJECT CODE**	CHH 104 B-T
BRANCH	**Chemistry**	**SESSION**	II
TIME	**3.0 hrs (01:00 – 04:00)**	**MAX. MARKS**	**100**
PROGRAM	**BSc(H) Chemistry**	**CREDITS**	**4**
NAME OF FACULTY	**Dr. S.K. Shukla**	**NAME OF COURSE COORDINATOR**	**Dr. S.K. Shukla** Aapit Sam d

Note: All questions are compulsory.

Q.NO.		QUESTIONS	MARKS	CO ADDRESSED	BLOOM'S LEVEL	PI
PART-A	1	Explain the optical isomerism in tartaric acid acid	6 marks	CO2	BT2	
	2	Explain the conformations of ethane with detailed digramatic representations	4 marks	CO2	BT3	
	3	Write the mechanism of the following reaction 	6 marks	CO1	BT4	
	4	Define Hybridization. Explain the energy level diagram of the sp^3 hybridization in nitrogen	4 marks	CO1	BT1	
PART-B	5	What happens when: (a) Sodium acetate reacts with sodium hydroxide. (b) Alkyne reacts with Lindlar's catalyst. (c) Propylene reacts with any hypohalous acid (d) 1,2-dibromopropane heated with sodamide. (e) 1-butyne react with silver nitrate in presence of ammonium hydroxide.	10 marks	CO3	BT4	
	6	Complete the following reactions and give their detailed mechanism: (a) $H_2C{=}CH_2 + Br_2 \xrightarrow{\text{Inert Solvent}} ?$ (b) $H_3C{-}C(H){=}CH_2 + Cl_2 \xrightarrow{500^\circ C} ?$	6+6 marks	CO3	BT3	

16 ɔ

	7	Explain the following in detail: (a) Mechanism of bromination & how it is different from chlorination (b) Difference between combustion and pyrolysis. What will be the products of methane in presence of sufficient and insufficient supply of oxygen	5+5 marks	CO3	BT2	
	8	How to convert: (a) How to convert acetylene into 1-Butyne (b) Alkyne in to alkane through the formation of alkene.	4+4 marks	CO3	BT1	
PART-C	9	What happens when (a) Benzene undergoes ozonolysis and the product formed further treated with Zn/H_2O (b) Benzene reacted with hydrogen in presence of nickel or platinum at 150°C under pressure (c) Chlorobenzene reacts with magnesium followed by dilute hydrochloric acid	6 marks	CO4	BT4	
	10	Explain the aromatic character of Pyrrole	4 marks	CO4	BT1	
	11	Give the detailed mechanism of Friedel-Crafts Acylation of benzene. What will be the final product when it follows the Clemmensen reduction. Explain with chemical reaction.	10 marks	CO4	BT3	
	12	How to convert: (a) Benzene into nitrobenzene. Give detailed mechanism (b) Benzene into benzene sulphonic acid. Give detailed mechanism.	5+5marks	CO4	BT2	
	13	Explain the following in detail: (a) Toluene do not have any lone pair of electron to share with benzene ring but still shows ortho para directing behavior, why? Show the chemical representation to explain. (b) Substitution in disubstituted benzenes with suitable examples.	6+4 marks	CO4	BT4	

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161

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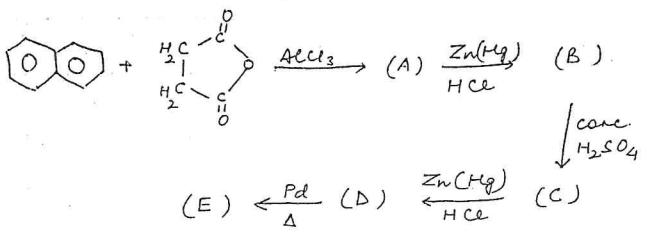
DEPARTMENT OF SCIENCES
"End-Term Examination, June-2023"

SEMESTER	**IV**	**DATE OF EXAM**	19.05.2023
SUBJECT NAME	**ORGANIC CHEMISTRY-III**	**SUBJECT CODE**	**CHH207B-T**
BRANCH	**Chemistry**	**SESSION**	**I**
TIME	09:00 AM-12:00PM	**MAX. MARKS**	**100**
PROGRAM	**B.Sc. (H) Chemistry**	**CREDITS**	**4**
NAME OF FACULTY	**Dr. Jaya Tuteja**	**NAME OF COURSE COORDINATOR**	**Dr. Jaya Tuteja**

Arpit Sood

Note: All questions are compulsory.

	Q. No.	Questions	Marks	Co Addressed	Bloom's Level	PI
PART-A	1(A)	What happens when nitrile is boiled with an aqueous strong acid or alkali? Give the mechanism of acid hydrolysis of nitriles?	5	CO1	L2	1.1
	1(B)	Explain the reason why secondary amines are more basic than primary amine but less basic than tertiary amines?	5	CO1	L3	1.1
	1(C)	Write down the preparation and properties of chloramine T?	5	CO2	L3	1.2
	1(D)	Discuss the chemical properties of thioethers?	5	CO2	L3	1.2
PART-B	Q2(A)	Write a note on Haworth's synthesis of naphthalene.	7	CO3	L4	5.2
	2 (B)	1-naphthyl amine is a weaker base than aniline. Explain	3	CO3	L4	5.2
	2(C)	What happens when: (i) Phenanthrene undergoes oxidation with potassium dichromate and sulphuric acid or chromium trioxide in acetic acid (ii) Phenanthrene reacts with concentrated sulphuric acid at 120^0C	5	CO3	L2	4.1
	2(D)	Complete the following reaction by writing suitable reaction conditions in each step and name of all intermediates:  	5	CO3	L3	4.1

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	Q3(A)	Discuss the suitable mechanism for the nitration of naphthalene.	5	CO3	L3	7.2.
	3(B)	Anthracene undergoes addition and electrophilic substitution reactions at C-9 and C-10 positions. Justify it with the help of intermediate carbonium ion. Why addition and substitution is less favoured at C-1 and C-2 positions.	5	CO3	L4	7.2.
	3 (C)	How will you synthesize the following: a. Naphthylamine from naphthalene b. Anthraquinone from anthracene c. B-naphthol from naphthalene d. 1,4-naphthaquinone from naphthalene e. Diphenic acid from phenanthrene	10	CO3	L3	5.2.
PART C	Q4(A)	Represent the structure of furan by resonance, and explain why the dipole moment of furan is smaller than that of its saturated analogue, tetrahydrofuran.	5	CO4	L3	4.1.
	4 (B)	What happens when (i) Thiophene reacts with conc. H_2SO_4 and iscetin (ii) Thiophene reacts with Conc. HNO_3 at different temperatures	5	CO4	L4	7.2.
	4 (C)	Describe one method of preparation and one property (physical and chemical) of the following: a) Furan b) thiophene c) pyrrole	10	CO4	L3	7.2.
	Q5(A)	Compare the reactivity's of Furan, pyrrole and thiophene.	5	CO4	L4	5.2.
	5(B)	Discuss electrophilic substitution in Pyridine.	5	CO4	L4	4.1.
	5(C)	Compare the basicity and reactivity of pyrrole and pyridine.	10	CO4	L4	7.2.

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DEPARTMENT OF SCIENCES (Program-Chemistry)

"End Term Examination, Jan-June-2023"

SEMESTER	IV	DATE OF EXAM	22.05.2023
SUBJECT NAME	INORGANIC CHEMISTRY-III	SUBJECT CODE	CHH206B-T
BRANCH	CHEMISTRY	SESSION	I
DURATION	3 HOURS (9-12:00PM)	MAX. MARKS	100
PROGRAM	B.Sc. (H) CHEMISTRY	CREDITS	4
NAME OF FACULTY	DR. EKTA RAWAT	NAME OF COURSE COORDINATOR	DR. EKTA RAWAT Arpit Sand

Note: All questions are compulsory.

	Q.NO.	QUESTIONS	MARKS	CO ADDRESSED	BLOOM'S LEVEL
PART-A	1(a)	Draw a well labeled diagram of MOT of O_2 molecule. Calculate bond order and mentions the number of unpaired electrons.	5	CO1	BT3
	1(b)	"The molecules namely CH_4, NH_3 and H_2O molecules contain the same number of electrons but their geometries are different". Explain?	5	CO1	BT2, BT3
	2(a)	How ionization energy vary in transition metals along the period and down the group?	7	CO2	BT4
	2(b)	Discuss the chemistry separation of lanthanides by fractional crystallization method.	3	CO2	BT3
PART-B	3(a)	Using IUPAC norms write the formulas for the following: (i) Tetrahydroxozincate(II) (ii) Potassium tetrachloridopalladate(II)	2+2=4	CO3	BT2, BT3
	3(b)	What is chelate effect? How does it enhance the stability of the complexes?	6	CO3	
	3(c)	On the basis of VBT, answer the following questions for the 6-coordinated complex ion/compounds: $[V(H_2O)_6]^{3+}$ and $[Fe(CN)_6]^{3-}$ (i) What type of hybridization is involved? (ii) Whether the given complex ion is inner orbital complex or outer orbital complex? (iii) What is the magnetic behavior of the complexes? Give the value of magnetic moment of each.	5+5=10	CO3	BT3, BT4
	4(a)	Represent schematically the splitting of d-orbitals in tetrahedral fields.	4	CO3	
	4(b)	How does nature of central metal atom of a complex affect magnitude of CFSE?	6	CO3	BT3
	4(c)	Calculate the value of number of unpaired electrons, magnetic moment and CFSE in terms of Δ_o/Δ_t of the following systems: (i)d^4 in weak field octahedral complex (ii) d^7 in tetrahedral complex	5+5=10	CO3	BT3, BT4

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PART-C	5(a)	Explain the following on the basis of HAB principle: (i) Occurrence of metals in nature. (ii) AgI_2^- is stable while AgF_2^- does not exist.	4+4=8	CO4	BT3, BT4
	5(b)	How do you classify bases as hard and soft according to Pearson's rule?	6+4=10	CO4	BT3
	5(c)	Give limitations of HSAB principle.	2	CO4	BT2, BT3
	6(a)	On the basis of Lewis concept of acid and base, explain the relative order of the basic strength of NH_3, PH_3, AsH_3, SbH_3 and BiH_3.	5	CO4	BT3, BT4
	6(b)	Discuss the Bronsted-Lowry concept of acid and base. What do you understand by conjugated acid and base? Explain with examples.	8	CO4	BT2, BT3
	6(c)	What is leveling and differentiating solvents? Explain with examples.	7	CO4	BT3, BT4

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DEPARTMENT OF SCIENCES

"End Term Examination, June-2023"

SEMESTER	**IV**	**DATE OF EXAM**	26.05.2023
SUBJECT NAME	**Polymer Chemistry**	**SUBJECT CODE**	**CHH208B**
BRANCH	**Chemistry**	**SESSION**	II I
DURATION	**180 Minutes**	**MAX. MARKS**	**100**
PROGRAM	**B.Sc. (H) Chemistry**	**CREDITS**	**4**
NAME OF FACULTY	**Dr. Arpit Sand**	**NAME OF COURSE COORDINATOR**	**Dr. Arpit Sand** Arpit Sand

Note: Note: Part-A&B: All questions are compulsory.

	Q.NO.	QUESTIONS	MARKS	CO ADDRESSED	BLOOM'S LEVEL	PI
PART-A	1	What do you mean by secondary structure of the polymers on the basis of configuration and confirmation	5	CO1	BT2	
	2	Write the short note Elastomers and liquid resins	5	CO1	BT3	
	3	derive equation for radical polymerization	5	CO2	BT3	
	4	Discuss Helix structures of the polymers	5	CO2	BT3	
PART-B	5	Discuss concepts of sedimentation and viscosity average molecular weight of the polymers	5+5	CO3	BT3	
	6	Discuss PDI and its effect molecular weight distribution in the polymers	5	CO4	BT4	
	7	Explain the mechanism of cyclization in natural rubber	5	CO4 CO3	BT4	
	8	Staring from Boltzmann equation derive the formulation of Flory Huggins theory	10	CO4	BT2	
	9	Discuss effect viscosity of dilute polymer solutions	5	CO4	BT2 BT3	
	10	Discuss bulk polymerization of styrene with chemical reactions only	5	CO5	BT4	

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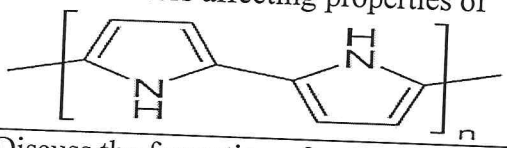
PART-C	11	In the basis of molecular orbital theory discuss Band theory of conducting polymers	10	CO5	BT3 BT4	
	12	Discuss the formation use and application of following polymers 1. PVC 2. Polysulphides	10	CO4 CO5	BT3	
	13	Electrochemical preparation of polypropylenes by chemical reactions.	5	CO5	BT4	
	14	Write a short note on Supercapacitors	5	CO5	BT5	
	15	Discuss factors affecting properties of 	5	CO5	BT4	
	16	Discuss the formation of polysuphone and uses.	5	CO5	BT3	

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DEPARTMENT OF SCIENCES

"End Term Examination-June 2023"

SEMESTER	**4TH**	**DATE OF EXAM**	30.05.2023
SUBJECT NAME	**PHYSICAL CHEMISTRY-III**	**SUBJECT CODE**	**CHH205B-T**
BRANCH	**CHEMISTRY**	**SESSION**	I
TIME	**3hrs (9:00AM-12:00PM)**	**MAX. MARKS**	**100**
PROGRAM	**B.Sc.(H)**	**CREDITS**	**4**
NAME OF FACULTY	**DR. PRITI GUPTA**	**NAME OF COURSE COORDINATOR**	**DR. PRITI GUPTA** Arpit Sand

Note: All Questions are compulsory.

Q.NO.		QUESTIONS	MARKS	CO ADDRESSED	BLOOM'S LEVEL
PART-A	1(A)	Write the reduced phase rule equation for condensed systems.	2	CO1	BT1
	1(B)	Explain why in a phase diagram of water, solid - liquid line is almost vertical and slightly tilted towards left?	2	CO1	BT3
	1(C)	Determine the no. of Degrees of freedom in Liquid water and water vapor in equilibrium at a pressure of 1 atmosphere.	2	CO2	BT3
	1(D)	Explain: a) Metastable Equilibrium b) Critical point	4	CO2	BT2
	1(E)	Define the various curves, points and areas involved in two component system with incongruent melting point with the help of phase diagram.	5	CO2	BT3
	1(F)	State the law of Chemical Equilibrium. How can it be derived on thermodynamic considerations	5	CO2	BT4
PART-B	Q2(A)	The specific conductance of an electrolyte decreases but the equivalent conductance and molar conductance increases with dilution. Justify why?	7	CO3	BT3

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	2(B)	Discuss Faraday's Laws of electrolysis with their importance.	8	CO3	BT1
	2 (C)	What do you understand by cell constant? How is it determined experimentally ?The specific conductance of N/50 KCl solution is $0.002765 ohm^{-1}cm^{-1}$ at 25^0C.If the resistance of the solution contained in the cell is 100 ohms, calculate the cell constant.	9	CO3	BT4
	2(D)	Describe the Hittorf's method of for determining the transport no. of Ag+ and NO^{3-} ions in solution of silver nitrate .	8	CO3	BT3
	2(E)	Discuss Freundlich adsorption isotherm of a gas on a solid surface. How will you prove that Langmuir adsorption isotherm is superior to Freundlich adsorption isotherm?	8	CO3	
PART-C	3(A)	What do you understand by Liquid Junction Potential? Calculate the liquid junction potential at 25^0C between two solutions of HCl having mean ionic activities of 0.01 and 0.001, respectively. The transference no. of H+ ions in HCl may be taken as 0.83.	8	CO4	BT2
	3(B)	Write short notes on: a)Potentiometric Titration b)Concentration cell without transference	8	CO4	BT3
	3(C)	What is meant by activity coefficient of an electrolyte? How would you determine the mean ionic activity coefficient of HCl in a given solution of acid.	7	CO4	BT2
	3(D)	Derive Nernst equation showing effect of electrolyte concentration on the potential of an oxidation reduction electrode.	8	CO4	BT3
	3(E)	Describe various types of electrodes which can be used for determining pH of the solution.	9	CO4	BT4

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DEPARTMENT OF SCIENCES
"End Term Examination, Jan-June2023"

SEMESTER	**6th**	**DATE OF EXAM**	**25.05.2023**
SUBJECT NAME	**Statistics - II**	**SUBJECT CODE**	**MAH205B**
BRANCH	**Chemistry**	**SESSION**	**II**
DURATION	**3 Hours**	**MAX. MARKS**	**100**
PROGRAM	**B.Sc. (Hons.)**	**CREDITS**	**4**
NAME OF FACULTY	**Ms. Savitta Saini**	**NAME OF COURSE COORDINATOR**	**Ms. Savitta Saini**

Note: *All questions are compulsory.*

Q.NO.		QUESTIONS	MARKS	CO ADDRESSED	BLOOM'S LEVEL	PI
PART-A	1	An Analysis of production rejects resulted in the following figures: No of rejects per operator: 21-25, 26-30, 31-35, 36-40, 41-45, 46-50, 51-55 No. of operators: 120, 125, 280, 260, 155, 184, 162 Calculate *Mean*.	10	CO1	BT3	
PART-B	2	The following table gives the marks obtained by a group of 80 students in the examination. Calculate the variance. Marks obtained: 10-14, 14-18, 18-22, 22-26, 26-30, 30-34, 34-38, 38-42, 42-46, 46-50 No. of students: 5, 8, 12, 15, 20, 14, 12, 6, 4, 6	10	CO2	BT3	

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PART-C

3(a)	Two random samples X and Y were drawn from normal population and their values are X: 20, 16, 26, 27, 23, 22, 18, 24, 25, 19 Y: 27, 3, 42, 35, 32, 34, 38, 28, 41, 43 Test whether the two populations have the same variance at 5% level of significance? ($v_1 = 9, v_2 = 11$ $F - value\ is$ 4.63)	10	CO3	BT4
3(b)	Ten workers were given a training programme with a view to shorten their assembly time for a certain mechanism. The results of the time and motion studies before and after the training programme are given below: Worker: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 First Study (in minutes): 15, 18, 20, 17, 16, 14, 21, 19, 13, 22 Second Study (in minutes): 14, 16, 21, 10, 15, 18, 19, 16, 14, 20 On the basis of this data, can it be concluded that the training program has shortened the average assembly time?	10	CO3	BT4
4(a)	A set of 5 coins is tossed 3200 times and the number of heads appearing each time is noted. The results are as below: No. of heads: 0, 1, 2, 3, 4, 5 Frequency: 80, 570, 1100, 900, 500, 50 Test the hypothesis that the coins are unbiased.	10	CO3	BT4
4(b)	Memory capacity of 9 students was tested before and after a course for a month. State whether the course was effective or not from the data below (in same units) Before: 10, 15, 9, 3, 7, 12, 16, 17, 4 After: 12, 17, 8, 5, 6, 11, 18, 20, 3	10	CO3	BT4

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PART-D

5 (a)	Two different types of drugs A and B were tried on certain patients for increasing weight, 5 persons were given drug A and 7 persons were given drug B . The increase in weight (in pounds) is given below: Drug A: 8, 12, 13, 9, 3, , Drug B: 10, 8, 12, 15, 6, 8, 11 Do the two drugs differ significantly with regard to their effect in increasing weight?	10	CO4	BT4
5(b)	Two random samples drawn from normal populations are: Sample A: 20, 16, 26, 27, 23, 22, 18, 24, 25, 19, , Sample B: 27, 33, 42, 35, 32, 34, 38, 28, 41, 43, 30, 37 Obtain estimates of the variances of the population and test whether two populations have the same variance.	10	CO4	BT4
6(a)	A survey of 320 families with 5 children each revealed the following information: No. of boys: 5, 4, 3, 2, 1, 0 No. of girls: 0, 1, 2, 3, 4, 5 No. of families: 14, 56, 110, 88, 40, 12 Is the result consistent with the hypothesis that male and female birth are equally probable?	12	CO4	BT4
6(b)	The height of 6 randomly chosen sailors in inches are 63, 65, 68, 69, 71 and 72. Those of 9 randomly chosen soldiers are 61, 62, 65, 66, 69, 70, 71, 72 and 73. Test whether the sailors are on the average taller than soldiers.	8	CO4	BT4

** ********** END **********

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Table 3: CHI-SQUARE (χ^2)

Significant Values χ^2 (α) of χ^2 Distribution Right Tail Areas for Given Probability α,

$P = P_r(\chi^2 > \chi^2(\alpha)) = \alpha$

And is Degrees of Freedom (d.f.)

Degree of freedom (ν)	*Probability (Level of Significance)*						
	0 = .99	*0.95*	*0.50*	*0.10*	*0.05*	*0.02*	*0.01*
1	.000157	.00393	.455	2.706	3.841	5.214	6.635
2	.0201	.103	1.386	4.605	5.991	7.824	9.210
3	.115	.352	2.366	6.251	7.815	9.837	11.341
4	.297	.711	3.357	7.779	9.488	11.668	13.277
5	.554	1.145	4.351	9.236	11.070	13.388	15.086
6	.872	2.635	5.348	10.645	12.592	15.033	16.812
7	1.239	2.167	6.346	12.017	14.067	16.622	18.475
8	1.646	2.733	7.344	13.362	15.507	18.168	20.090
9	2.088	3.325	8.343	14.684	16.919	19.679	21.669
10	2.558	3.940	9.340	15.987	18.307	21.161	23.209
11	3.053	4.575	10.341	17.275	19.675	22.618	24.725
12	3.571	5.226	11.340	18.549	21.026	24.054	26.217
13	4.107	5.892	12.340	19.812	22.362	25.472	27.688
14	4.660	6.571	13.339	21.064	23.685	26.873	29.141
15	4.229	7.261	14.339	22.307	24.996	28.259	30.578
16	5.812	7.962	15.338	23.542	26.296	29.633	32.000
17	6.408	8.672	15.338	24.769	27.587	30.995	33.409
18	7.015	9.390	17.338	25.989	28.869	32.346	34.805
19	7.633	10.117	18.338	27.204	30.144	33.687	36.191
20	8.260	10.851	19.337	28.412	31.410	35.020	37.566
21	8.897	11.591	20.337	29.615	32.671	36.343	38.932
22	9.542	12.338	21.337	30.813	33.924	37.659	40.289
23	10.196	13.091	22.337	32.007	35.172	38.968	41.638
24	10.856	13.848	23.337	32.196	36.415	40.270	42.980
25	11.524	14.611	24.337	34.382	37.65	41.566	44.314
26	12.198	15.379	25.336	35.363	38.885	41.856	45.642
27	12.879	16.151	26.336	36.741	40.113	41.140	46.963
28	13.565	16.928	27.336	37.916	41.337	45.419	48.278
29	14.256	17.708	28.336	39.087	42.557	46.693	49.588
30	14.933	18.493	29.336	40.256	43.773	47.962	50.892

Note. For degrees of freedom (ν) greater than 30, the quantity $\sqrt{2\chi^2} - \sqrt{2\nu - 1}$ may be used as a normal variate with unit variance.

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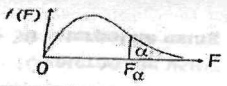

X. 5% POINTS OF FISHER'S F-DISTRIBUTION

n \ m	1	2	3	4	5	6	7	8	9	10	12	15	20	30	60	α
1	161.45	199.50	215.71	224.58	230.16	233.99	236.77	238.88	240.54	241.88	243.91	245.95	248.01	250.09	252.20	254.32
2	18.513	19.000	19.164	19.247	19.296	19.330	19.353	19.371	19.385	19.396	19.413	19.420	19.446	19.462	19.479	19.496
3	10.128	9.5521	9.2766	9.1172	9.0135	8.9406	8.8868	8.8452	8.8123	8.7855	8.7446	8.7029	8.6602	8.6166	8.5720	8.5265
4	7.7086	6.9443	6.5914	6.3883	6.2560	6.1631	6.0942	6.0410	5.9988	5.9644	5.9117	5.8578	5.8025	5.7459	5.6878	5.0281
5	6.6079	5.7861	5.4095	5.1922	5.0503	4.9503	4.8753	4.8183	4.7725	4.7351	4.6777	4.6188	4.5581	4.4957	4.4314	4.3650
6	5.9874	5.1433	4.7571	4.5337	4.3874	4.2839	4.2066	4.1468	4.0990	4.0600	3.9999	3.9381	3.8742	3.8082	3.7398	3.6688
7	5.5914	4.7374	4.3468	4.1203	3.9715	3.8660	3.7870	3.7257	3.6767	3.6365	3.5747	3.5108	3.4445	3.3758	3.3043	3.2298
8	5.3177	4.4590	4.0662	3.8378	3.6875	3.5806	3.5005	3.4381	3.3881	3.3472	3.2840	3.2184	3.1503	3.0794	3.0053	2.9276
9	5.1174	4.2565	3.8626	3.6331	3.4817	3.3738	3.2927	3.2296	3.1789	3.1373	3.0729	3.0001	2.9365	2.8637	2.7872	2.7007
10	4.9646	4.1028	3.7083	3.4780	3.3258	3.2172	3.1355	3.0717	3.0204	2.9782	2.9130	2.8450	2.7740	2.6996	2.6211	2.5379
11	4.8443	3.9823	3.5874	3.3567	3.2039	3.0946	3.0123	2.9480	2.8962	2.8536	2.7876	2.7186	2.6464	2.5705	2.4901	2.4045
12	4.7272	3.8853	3.4903	3.2502	3.1059	2.9961	2.9134	2.8486	2.7964	2.7534	2.6866	2.6169	2.5436	2.4663	2.3842	2.2962
13	4.6672	3.8056	3.4105	3.1791	3.0254	2.9153	2.8321	2.7669	2.7144	2.6710	2.6037	2.5331	2.4589	2.3803	2.2966	2.2064
14	4.6001	3.7389	3.3439	3.1122	2.9582	2.8477	2.7642	2.6987	2.6458	2.6021	2.5342	2.4630	2.3879	2.3082	2.2230	2.1307
15	4.5431	3.6823	3.2874	3.0556	2.9013	2.7905	2.7066	2.6408	2.5876	2.5437	2.4753	2.4035	2.3275	2.2468	2.1601	2.0658
16	4.4940	3.6337	3.2389	3.0069	2.8524	2.7413	2.6572	2.5911	2.5377	2.4935	2.4247	2.3522	2.2756	2.1938	2.1058	2.0096
17	4.4513	3.5915	3.1968	2.9647	2.8100	2.6987	2.6143	2.5480	2.4943	2.4499	2.3807	2.3077	2.2304	2.1477	2.0584	1.9604
18	4.4139	3.5546	3.1599	2.9277	2.7729	2.6613	2.5767	2.5102	2.4563	2.4117	2.3421	2.2686	2.1906	2.1071	2.0166	1.9168
19	4.3808	3.5219	3.1274	2.8951	2.7401	2.6283	2.5435	2.4768	2.4227	2.3779	2.3080	2.2341	2.1555	2.0712	1.9796	1.8780
20	4.3513	3.4928	3.0984	2.8661	2.7100	2.5990	2.5140	2.4471	2.3928	2.3479	2.2776	2.2033	2.1242	2.0391	1.9464	1.8432
21	4.3248	3.4668	3.0725	2.8401	2.6848	2.5727	2.4876	2.4205	2.3661	2.3210	2.2504	2.1757	2.0960	2.0102	1.9165	1.8117
22	4.3009	3.4434	3.0491	2.8167	2.6613	2.5491	2.4638	2.3965	2.3419	2.2967	2.2258	2.1508	2.0707	1.9842	1.8895	1.7831
23	4.2793	3.4221	3.0280	2.7955	2.6500	2.5277	2.4422	2.3748	2.3201	2.2747	2.2036	2.1282	2.0476	1.9605	1.8649	1.7570
24	4.2597	3.4028	3.0088	2.7763	2.6207	2.5082	2.4226	2.3551	2.3002	2.2547	2.1834	2.1077	2.0267	1.9390	1.8424	1.7331
25	4.2417	3.3852	2.9912	2.7587	2.6030	2.4904	2.4047	2.3371	2.2821	2.2365	2.1649	2.0889	2.0075	1.9192	1.8217	1.7110
26	4.2252	3.3690	2.9751	2.7426	2.5868	2.4741	2.3883	2.3205	2.2655	2.2197	2.1479	2.0716	1.9898	1.9010	1.8027	1.6906
27	4.2100	3.3541	2.9604	2.7278	2.5719	2.4591	2.3732	2.3053	2.2501	2.2043	2.1323	2.0558	1.9736	1.8842	1.7851	1.6717
28	4.1960	3.3404	2.9467	2.7141	2.5581	2.4453	2.3593	2.2913	2.2360	2.1900	2.1179	2.0411	1.9586	1.8687	1.7689	1.6541
29	4.1830	3.3277	2.9340	2.7014	2.5454	2.4324	2.3463	2.2782	2.2229	2.1768	2.1045	2.0275	1.9446	1.8543	1.7537	1.6377
30	4.1709	3.3158	2.9223	2.6896	2.5336	2.4205	2.3343	2.2662	2.2107	2.1646	2.0921	2.0148	1.9317	1.8409	1.7396	1.6223
40	4.0848	3.2317	2.8387	2.6060	2.4495	2.3359	2.2490	2.1802	2.1240	2.0772	2.0035	1.9245	1.8389	1.7444	1.6373	1.5089
60	4.0012	3.1504	2.7581	2.5252	2.3688	2.2540	2.1665	2.0970	2.0401	1.9926	1.9174	1.8364	1.7480	1.6491	1.5343	1.3893
120	3.9201	3.0718	2.6802	2.4472	2.2900	2.1750	2.0867	2.0164	1.9588	1.9105	1.8337	1.7505	1.6587	1.5543	1.4290	1.2539
∞	3.8415	2.9957	2.6049	2.3719	2.2141	2.0986	2.0096	1.9384	1.8799	1.8307	1.7522	1.6664	1.5705	1.4591	1.3180	1.0000

Table 2 : SIGNIFICANT VALUES $t_\nu(\alpha)$ OF t-DISTRIBUTION (TWO TAIL AREAS) $[|t| > t_\nu(\alpha)] = \alpha$

d.f.	*Probability (Level of Significance)*					
(ν)	*0.50*	*0.10*	*0.05*	*0.02*	*0.01*	*0.001*
1	1.00	6.31	12.71	31.82	63.66	636.62
2	0.82	0.92	4.30	6.97	6.93	31.60
3	0.77	2.32	3.18	4.54	5.84	12.94
4	0.74	2.13	2.78	3.75	4.60	8.61
5	0.73	2.02	2.57	3.37	4.03	6.86
6	0.72	1.94	2.45	3.14	3.71	5.96
7	0.71	1.90	2.37	3.00	3.50	5.41
8	0.71	1.80	2.31	2.90	3.36	5.04
9	0.70	1.83	2.26	2.82	3.25	4.78
10	0.70	1.81	2.23	2.76	3.17	4.59
11	0.70	1.80	2.20	2.72	3.11	4.44
12	0.70	1.78	2.18	2.68	3.06	4.32
13	0.69	1.77	2.16	2.05	3.01	4.22
14	0.69	1.76	2.15	2.62	2.98	4.14
15	0.69	1.75	2.13	2.60	2.95	4.07
16	0.69	1.75	2.12	2.58	2.92	4.02
17	0.69	1.74	2.11	2.57	2.90	3.97
18	0.69	1.73	2.10	2.55	2.88	3.92
19	0.69	1.73	2.09	2.54	2.86	3.88
20	0.69	1.73	2.09	2.53	2.85	3.85
21	0.69	1.72	2.08	2.52	2.83	3.83
22	0.69	1.72	2.07	2.51	2.42	3.79
23	0.69	1.71	2.07	2.50	2.81	3.77
24	0.69	1.71	2.06	2.49	2.80	3.75
25	0.68	1.71	2.06	2.49	2.79	3.73
26	0.68	1.71	2.06	2.48	2.78	3.71
27	0.68	1.70	2.05	2.47	2.77	3.69
28	0.68	1.70	2.05	2.47	2.76	3.67
29	0.68	1.70	2.05	2.46	2.76	3.66
30	0.68	1.70	2.04	2.46	2.75	3.65
∞	0.67	1.65	1.96	2.33	2.58	3.29

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MANAV RACHNA UNIVERSITY

DEPARTMENT OF SCIENCES

"End Term Examination, Jan-June-2023"

SEMESTER	**VI**	**DATE OF EXAM**	29.05.2023
SUBJECT NAME	**Chemicals and Environment**	**SUBJECT CODE**	**CHH 310B**
BRANCH	**Chemistry**	**SESSION**	**End Sem**
DURATION	**3 hrs**	**MAX. MARKS**	**100**
PROGRAM	**B.Sc. (Hons) Chemistry**	**CREDITS**	**4**
NAME OF FACULTY	**Dr. Pradeep K. Varshney**	**NAME OF COURSE COORDINATOR**	**Dr. Pradeep K. Varshney**

***Note**: Attempt all questions. All are Compulsory.*

Q.NO.		QUESTIONS	MARKS	CO ADDRESSED	BLOOM'S LEVEL	PI
PART-A	1(A)	What is the Chemical formula of boric acid? Is it different from Borax? Justify your answer.	2	1	2	
	1(B)	Explain the concept of nuclear fusion and fission.	2	3	2	
	1(C)	Write the name given to bases that are highly soluble in water. Give an example.	2	1	1	
	1(D)	How air pollution is destroying our health. Explain.	2	3	1	
	1(E)	What is potassium alum? Where it is used in homes?	2	1	1	
	1(F)	Why ferrous alloys are used extensively. Explain.	2	2	3	
	1(G)	Write a short note on incineration of hazardous waste?	2	2	3	
	1(H)	Why we call steel as "stainless"? Explain.	2	2	1	
	1(I)	"Determination of Biological Oxygen Demand (BOD) can help in suggesting the quality of a water body." Explain.	2	4	3	
	1(J)	How will you introduce metallurgy? Write two differences between Ores and Minerals.	2	4	1	
PART-B	Q2(A)	Do you feel that the knowledge of chemicals is important as a science student to protect environment. Discuss your answer with justifications.	5	3	2	
	Q2(B)	Phosgene was used during the World War I as a poisonous gas. How it can be prepared in lab and industrial scale. How people can protect themselves and what they should do if they are exposed to phosgene.	5	3	4	

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PART-C	Q3(A)	As an environmentalist, what efforts would you make about the production of industrial products and their effects on environment and human health?	5	2	4	
	Q3(B)	What is the future of nuclear energy? What kind of measures you should take to manage nuclear disaster.	5	3	4	
PART-D	Q4(A)	Explain the concept of "Greenhouse effect" and "Global warming" using diagram. What is the importance of Ozone layer? What could be done to prevent ozone layer depletion?	10	3	3	
	Q4(B)	Discuss methods of estimation of CO, NOx, SOx and their control procedures.	10	1	3	
	Q4(C)	If you are working in a textile Industry, what kind of effluents is released by the industry? How will you manage industrial wastes/effluents as a Sr. Chemist?	10	4	4	
PART-E	Q5(A)	What is meant by Desalination of brackish water? How it is carried out by Electro dialysis.	10	4	3	
	Q5(B)	What is the composition of photochemical smog? What are the effects of photochemical smog and it can be controlled.	10	3	3	
	Q5(C)	As a chemist how can you treat effluent at primary, secondary and tertiary level? Explain with the help of case study.	10	4	4	

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MANAV RACHNA UNIVERSITY
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DEPARTMENT OF SCIENCES

"End Term Examination, June- 2023"

SEMESTER	6TH	DATE OF EXAM	19.05.2023
SUBJECT NAME	INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS	SUBJECT CODE	CHH309BT
BRANCH	CHEMISTRY	SESSION	II
TIME	3hrs (01:00 – 04:00PM)	MAX. MARKS	100
PROGRAM	B.Sc.(H)	CREDITS	4
NAME OF FACULTY	DR.PRITI GUPTA	NAME OF COURSE COORDINATOR	DR.PRITI GUPTA

Note: All Questions are compulsory.

	Q.NO.	QUESTIONS	MARKS	CO ADDRESSED	BLOOM'S LEVEL
PART-A	1(A)	Below are some examples of errors produced during experimentation. Identify the type of error? i)Improper washing of a precipitate ii)use of improper calibrated weights iii)Occurrence of induced and side reactions iv)introduction of foreign material in a sample v)wrong selection of method	2.5	CO1	BT2
	1(B)	Define Chemical and matrix interference? How are they can be corrected in Atomic Absorption determination?	3.5	CO2,CO1	BT3
	1(C)	How many fundamental vibrational frequencies would you expect to observe in the infrared absorption spectrum of CO_2?	3	CO1	BT2
	1(D)	Discuss the relationship between Fluorescence and phosphorescence process. What are the factors affecting these processes?	5	CO2	BT3
	1(E)	How does photoacoustic spectroscopy works? Draw a neat Schematic diagram of Photoacoustic spectrometer.	6	CO2	BT4

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178

PART-B	Q2(A)	For selecting a carrier gas what considerations should be taken into account? Also describe two important applications of Gas chromatography in Qualitative analysis.	7	CO3	BT3
	2(B)	Justify how HPLC is more efficient to solve some of the shortcomings of standard /classical liquid chromatography? Also describe in brief the working and types of pumping systems used in HPLC.	8	CO3	BT1
	2 (C)	Give details about the following terms: 1) Number of Theoretical Plates (N) 2) Resolution 3) Retention Factor	9	CO3	BT4
	2(D)	With aspect of Gel electrophoresis technique explain how DNA fragments /RNA or proteins get separated based on their size and charge	8	CO3	BT3
	2(E)	What are Supercritical Fluids, discuss the phase behavior of SCFs along with two properties: Density & Diffusivity.	8	CO3	BT2
PART-C	3(A)	Discuss about the following components of Mass spectrometer: 1) Ion Source 2) Vacuum system	7	CO4	BT2
	3(B)	How Mass spectroscopy is useful in isotopic dilution method, Quantitative analysis of mixtures and impurity detection	8	CO4	BT3
	3(C)	Describe the principle of Fast Atom Bombardment (FAB).Give reason why these techniques are considered unique techniques for solid analysis.	8	CO4	BT2
	3(D)	Differentiate between chemical ionization and Electron Ionization techniques.	8	CO4	BT3
	3(E)	Write short notes on: 1)Time of Flight 2)Electric Quadrupole	9	CO4	BT4

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MANAV RACHNA UNIVERSITY

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DEPARTMENT OF SCIENCES

"End Term Examination, June-2023"

SEMESTER	**II**	**DATE OF EXAM**	25.05.2023
SUBJECT NAME	**Physical Chemistry-II**	**SUBJECT CODE**	**CHH506B**
BRANCH	**Chemistry**	**SESSION**	II
DURATION	**180 Minutes**	**MAX. MARKS**	**100**
PROGRAM	**M.Sc. Chemistry**	**CREDITS**	**4**
NAME OF FACULTY	**Dr. Arpit Sand**	**NAME OF COURSE COORDINATOR**	**Dr. Arpit Sand** Arpit Sand

Note: Note: Part-A&B: All questions are compulsory.

Q.NO.		QUESTIONS	MARKS	CO ADDRESSED	BLOOM'S LEVEL	PI
PART-A	1	Calculate the number of ways of distributing distinguishable molecules a,b,c, between three energy levels so as to obtain the following set of occupation number $N_0=1$ $N_1=1$ $N_2=1$, that is each energy level is occupied by one molecules	6	CO1	BT3	1.3.1
	2	Write the sterling's approximation. Calculate the value of 9 ! and 49 !.	4	CO1	BT3 BT4	1.3.1
	3	Write the Boltzmann distribution equation and the equation of molecular partition function. From these written equations shows that $E=nkT^2(\partial \ln q/ \partial T)_v$	5	CO2	BT3	1.3.2
	4	Derive the relationship chemical potential and partition function.	5	CO2	BT4	1.3.3
PART-B	5	Explain Bravais lattice and deduce expression for Bragg equation	5	CO3	BT3	1.3.2
	6	Write a short note on Reciprocal lattice and draw the graph reciprocal lattice point	5	CO4	BT4	1.3.3
	7	Differentiate X-ray and ~~electron~~ neu tron diffractions (up to 10)	10	CO4 CO3	BT4	1.3.1

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	8	Discuss Patterson synthesis with the help of Potassium Nitrate crystal	10	CO4	BT3 BT4	1.3.1
	9	Discuss crystal space with diagram	5	CO4	BT2 BT3	1.3.2
	10	Define Space groups, Glide planes, screw axes and structure factor	5	CO5	BT4	1.3.3
PART C	11	Discuss the collision theory of bimolecular reactions	6	CO5	BT3 BT4	1.3.1
	12	For the first order isomerization of an organic compound at 130°C. The activation energy is $108.4JK^{-1}$ mol^{-1} and the rate constant is 9.12×10^{-4} S^{-1}. Calculate the standard entropy of activation	4	CO4 CO5	BT3	1.3.1
	13	Show that for a gaseous molecular reaction $A(g)+B(g) \longrightarrow (AB)^{\#} \longrightarrow P$ $Ea=\Delta H^{\#}_m+2RT$ Where the subscript m stand for the molar.	5	CO5	BT4	1.3.2
	14	What are the shortcomings of Hinshelwood Theory? How are they overcome by RRK theory of unimolecular reaction?	5	CO5	BT5	1.3.3
	15	In the temperature range of 250 to 450K,the pre exponential factor A, for the reaction $Cl(g)+H_2(g) \longrightarrow HCl(g)+H(g)$ is found to be equal to 1.20×10^{10} dm^3 mol^{-1} S^{-1}. If M (Cl) =35.453 g mol^{-1} M (H_2) =35.453 g mol^{-1} d (Cl) =200 pm d(H_2)=150 pm, determine the value of steric factor	10	CO5	BT3 BT4	1.3.2
	16	Discuss statistical mechanical derivation of the rate constant of gaseous bimolecular reactions	10	CO5	BT5	1.3.3

********** END **********

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DEPARTMENT OF SCIENCES

"End Term Examination, June-2023"

SEMESTER	II	DATE OF EXAM	29.05.2023
SUBJECT NAME	**Inorganic Chemistry II**	SUBJECT CODE	**CHH507B**
BRANCH	**M.Sc. Chemistry**	SESSION	II
TIME	**180 minutes**	MAX. MARKS	**100**
PROGRAM	**M.Sc. Chemistry**	CREDITS	**4**
NAME OF FACULTY	**Dr. Roopa Rani**	NAME OF COURSE COORDINATOR	**Dr. Roopa Rani**

***Note**: Attempt all questions*

Arpit Saini

Q.NO.		QUESTIONS	MARKS	CO ADDRESSED	BLOOM'S LEVEL	PI
Part A						
	1	Explain the concept of lability and inertness as per VBT with suitable example.	5	CO1	3	
	2	Explain the mechanism of substitution reaction of coordination complexes suggested by Eigen-Winkins.	5	CO1	4	
	3	Justify the importance of nitrogen fixation in ecosystem with suitable examples.	4	CO1	5	
	4	How does trans effect helpful in synthesizing few useful coordination complexes? Write atleast two examples and their synthesis.	6	CO2	4	
PART B						
	5	What do you mean by outer sphere electron transfer reactions? Explain its mechanism with a suitable example and draw their reaction coordinate curves.	10	CO3	5	
	6	Write short notes on the following a) Nature of bridging ligand b) Two electron transfer reactions c) Chemical activation d) Internal electron transfer reaction	5 5 5 5	CO3	3	
	7	Justify the statement "The mixed valance complexes can initiate internal electron transfer reactions"? Explain using suitable example.	10	CO3	6	

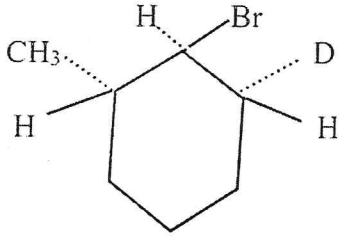
	8	Explain the correlation between thermal and optical ETR.	10	CO4	5	
	9	"Life time of excited state can decide the mode of occurrence of Electron Transfer Reaction". State the reason.	10	CO3	5	
	10	Write the mechanism of excited state electron transfer reaction using $[Ru(bpy)_3]^{2+}$ complex	10	CO4, CO5	4	
	11	Define the role of spin-spin coupling in governing the intensity of transition in an ETR?	5	CO5	3	
	12	Why Orbital coupling for ETR is important? Explain using an example.	5	CO5	4	
		.....END.....				

MANAV RACHNA UNIVERSITY
SCHOOL OF SCIENCES

"End Term Examination, June-2023"

SEMESTER	**II**	**DATE OF EXAM**	**31.05.2023**
SUBJECT NAME	**ORGANIC CHEMISTRY II**	**SUBJECT CODE**	**CHH508B**
BRANCH	**CHEMISTRY**	**SESSION**	**II**
DURATION	**3h**	**MAX. MARKS**	**100**
PROGRAM	**MSc**	**CREDITS**	**3**
NAME OF FACULTY	**Prof. Sangeeta Banga/ Dr. Shilpa Sharma**	**NAME OF COURSE COORDINATOR**	**Prof. Sangeeta Banga/ Dr. Shilpa Sharma**

Note: Part-A: All questions are compulsory
Part-B: All questions are compulsory

Q.NO.		QUESTIONS	MARKS	CO ADDRESSED	BLOOM'S LEVEL	PI
PART-A	1(A)	What is Chugaev reaction, Explain its mechanism and mention its synthetic importance.	3	CO1	BT2	
	1(B)	Both Hydroboration and Oxymercuration-demercuration reactions of alkene results in the formation of alcohol. How two reactions differ from each other, explain with the support of proper example.	3	CO1	BT2	
	1(C)	When the deuterium labeled compound given below is subjected to dehydrohalogenation using Sod. Ethoxide in ethanol, the only product is 3-methylcyclohexene. This product does not contain deuterium. Provide an explanation for this result. 	4	CO1	BT2	

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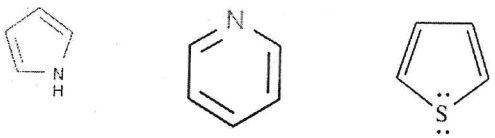
PART -B	2(A)	2-bromobutane reacts with sodium hydroxide solution under suitable conditions to give a mixture of but-1-ene and but-2-ene. (i) Write the mechanism for the formation of but-1-ene and but-2-ene (ii)In fact, the reaction gives a mixture of two different but-2-enes. Explain, with the help of a Sawhorse diagram, how it is possible to have two different but-2-enes.	4	CO2	BT2	
	2(B)	Illustrate Mechanism for the Pyrolytic Elimination (with example)	3	CO2	BT2	
	2(C)	When 3-iodo-3-ethylpentane is treated with sodium methoxide in methanol, the major organic product is an _____ that is generated through an _____ mechanism. Justify it by drawing mechanism	3	CO2	BT3	
PART - C	3(A)	Show electron distribution in MO's of the following and explain its aromaticity on the basis of its frost circle: (a) Cyclopentadienyl cation and anion (b) Cycloheptatriene cation (c) Cyclopropenyl cation and anion	2.5+2+2.5 =7	CO3	BT2	
	3(B)	Explain the basis on which the molecules given below are aromatic. Discuss whether the lone pair of electron participating in aromaticity or not, if not then why?  Pyrrole Pyridine Thiophene	6	CO3	BT3	
	3(C)	Discuss the Perturbation Theory Approach in detail. Also, Explain the formation of Molecular orbital of 1,3-butadiene from the interaction of the molecular orbitals of two ethylene molecules.	3+5=8	CO3	BT3	
	3 (D)	(a) What is the physical significance of sigma and rho in Hammett equation for linear free energy relationship? (b) Why ortho isomers and aliphatic compounds do not exhibit the straight-line relationship? (c) The pKa Value for m-Chlorobenzoic acid is 2.83 while that of benzoic acid is 3.61. Calculate ρ-Cl. Substituent constant σ for Chloro at meta position is = 0.37	3+2+3=8	CO3	BT3	

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	3 (E)	Explain why a substituent such as nitro bonded to ortho and para position has a much greater effect on the acidity of phenol than a benzoic acid?	5	CO3	BT3	
	3 (F)	How many nodes are there in the molecular orbitals present at ψ1, ψ2, ψ3*, & ψ4*level of 1,3 butadiene and arrange these orbitals in the order of increasing energy.	6	CO3	BT2	
PART-D	4(A)	Give one important method for the synthesis of Isoxazole and explain at which position does it undergo electrophilic substitution reaction.	6	CO4	BT2	
	4(B)	Explain the electrophilic substitution of Pyrazole. At which Carbon the electrophilic substitution is easily feasible and why?	5	CO4	BT3	
	4(C)	Write short note on synthesis and reactions of Benzoxazole. Also discuss why the nitration occurs here at 6th position and amination at 2nd position?	7	CO4	BT2	
	4(D)	Give reason for your answer on the basis of structure: (i) Imidazole is more basic than Pyrazole (ii) Pyridazine is more basic than Pyridine	3+3=6	CO4	BT3	
	4(E)	Discuss the medicinal properties of the following compounds: (a) Pyridizine (b) Benzimidazone (c) Indole (d) Pyrimidine	8	CO4	BT2	
	4(F)	Explain the aromaticity of the following heterocyclic compounds: Pyrazole, Oxazole, Pyrazine, Benzithiazone,	8	CO4	BT3	

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MANAV RACHNA UNIVERSITY
DEPARTMENT OF SCIENCES (Program-Chemistry)
"End-Term Examination, June-2023 Set B"

SEMESTER	II	DATE OF EXAM	02.06.2023
SUBJECT NAME	Molecular Spectroscopy	SUBJECT CODE	CHH 509B
BRANCH	Chemistry	SESSION	2022-2023 (II)
TIME	01:00PM – 04:00PM	MAX. MARKS	100
PROGRAM	M.Sc Chemistry	CREDITS	4
NAME OF FACULTY	Dr. Jaya Tuteja	NAME OF COURSE COORDINATOR	Dr. Jaya Tuteja Arpit Saini

Note: All Questions are compulsory

Q.NO.		QUESTIONS	MARKS	CO ADDRESSED	BLOOM'S LEVEL
PART-A	Q1(a)	Which solvents are generally used in UV-VIS spectroscopy and why?	3	CO1	BT2
	Q1(b)	Explain the electronic factor which influences the absorption frequency in IR spectroscopy?	3	CO1	BT3
	Q1(c)	Name the different types of lines present in Raman spectroscopy and explain the reason for observing these lines?	4	CO1	BT2
PART-B	Q2(a)	What do you mean by shielding and deshielding of nucleus in ^{1}H-NMR spectroscopy?	3	CO2	BT3
	Q2(b)	What is the effect of hydrogen bonding and rapid exchange in ^{1}H-NMR spectroscopy?	3	CO2	BT2
	Q2(c)	Explain the term "splitting of signals" with suitable examples?	4	CO2	BT5
PART-C	Q3(a)	Why it is not possible to determine relative ratio of carbon atoms in a compound by integration of peak areas in ^{13}C-NMR as PMR?	3	CO3	BT3
	Q3(b)	What are the advantages of gated-decoupling? Discuss in detail.	4	CO3	BT4
	Q3(c)	How many sets of non-equivalent carbons are there in: a. toluene b. 2-pentanone c. para-xylene	3	CO3	BT5
	Q4(a)	What is DEPT in ^{13}C-NMR spectrum?	5	CO3	BT4
	Q4(b)	What is the difference between COSY and HETCOR techniques?	5	CO3	BT5
	Q5(a)	Distinguish among carbonyl isomers pertaining to the molecular formula C_4H_8O on the basis of CMR spectroscopy?	5	CO3	BT6
	Q5(b)	What are the four stages of a mass spectrometry?	5	CO3	BT4

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	Q6(a)	How Atmospheric Pressure Chemical Ionization (APCI) technique is different from Matrix Assisted Laser Desorption Ionization (MALDI) techniques in Mass Spectroscopy?	5	CO4	BT3
	Q6(b)	Explain the below terms in respect of Mass spectrometry (i) Fragmentation (ii)Mass analyzers	5	CO4	BT5
	Q7	An organic compound gives the following spectral data: UV: λ_{max} 257 nm and 340 nm IR: significant absorption bands at 3040, 2950, 1740, 1480, 1220, 750 and 700 cm^{-1} PMR: δ 1.96 (3H, s); 5.00 (2H, s); 7.22 (5H, s) CMR (off-resonance decoupled): two singlets, one triplet, one quartet, and three doublets. One of the singlets at δ 171 and other is at δ 136. Mass: Prominent peaks at m/e 150 (M+), 108, 91, 79, 78 and 77.	15	CO1, CO2, CO3, CO4	BT6
	Q8	Provide a structure of the compounds consistent with the following spectra. Show your work and assign all relevant peaks in ^{1}H-NMR spectra, 13C-NMR spectra. Interpret functionality from IR and show the fragmentation of Mass wherever possible?	15	CO1, CO2, CO3, CO4	BT6
	Q9	Provide a structure of the compounds with Molecular formula of $\mathbf{C_{10}H_{12}O}$ consistent with the following spectra. Show your work and assign all relevant peaks in ^{1}H-NMR spectra, ^{13}C-NMR spectra. Interpret functionality from IR spectroscopy?	10	CO1, CO2, CO3, CO4	BT6

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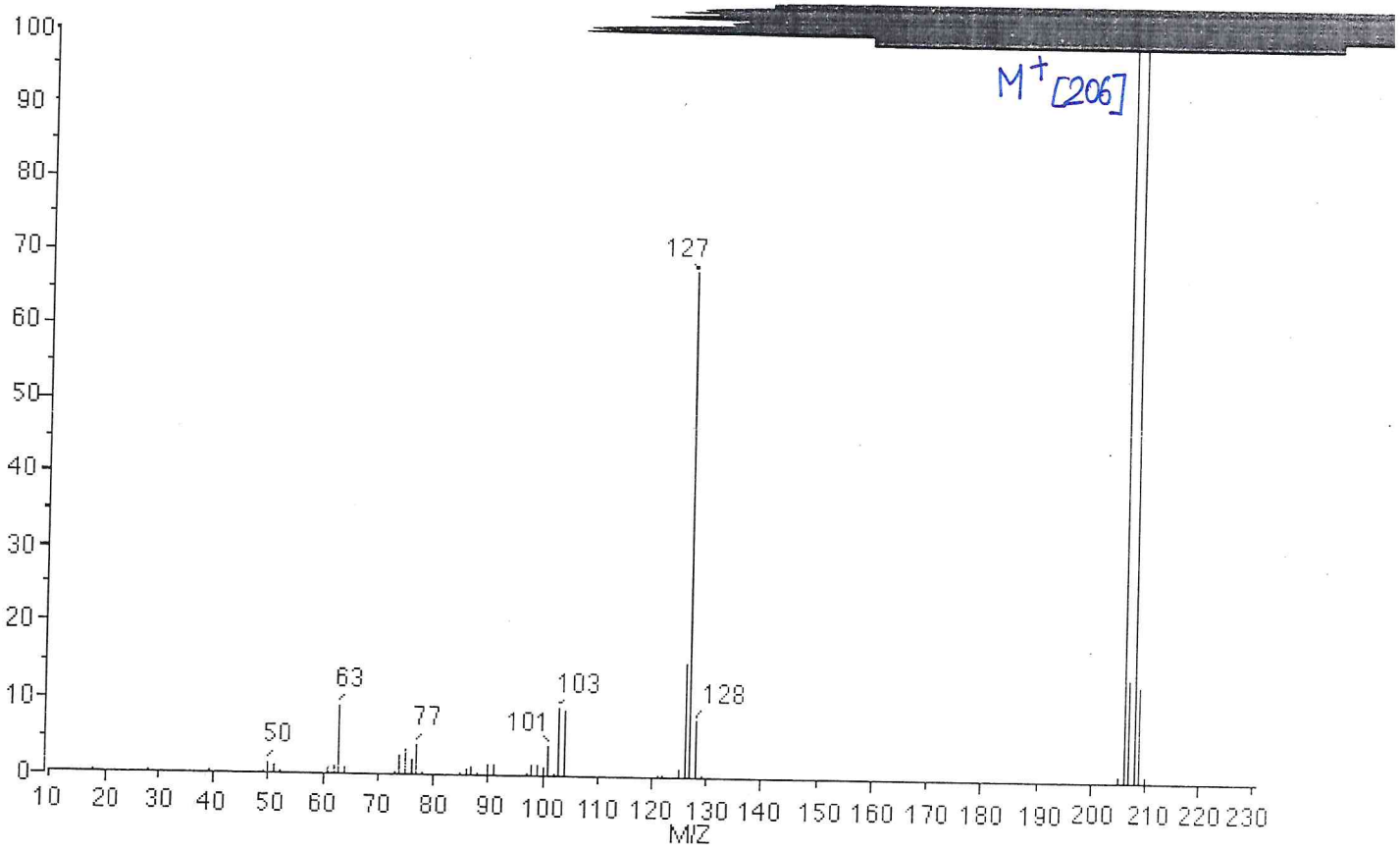
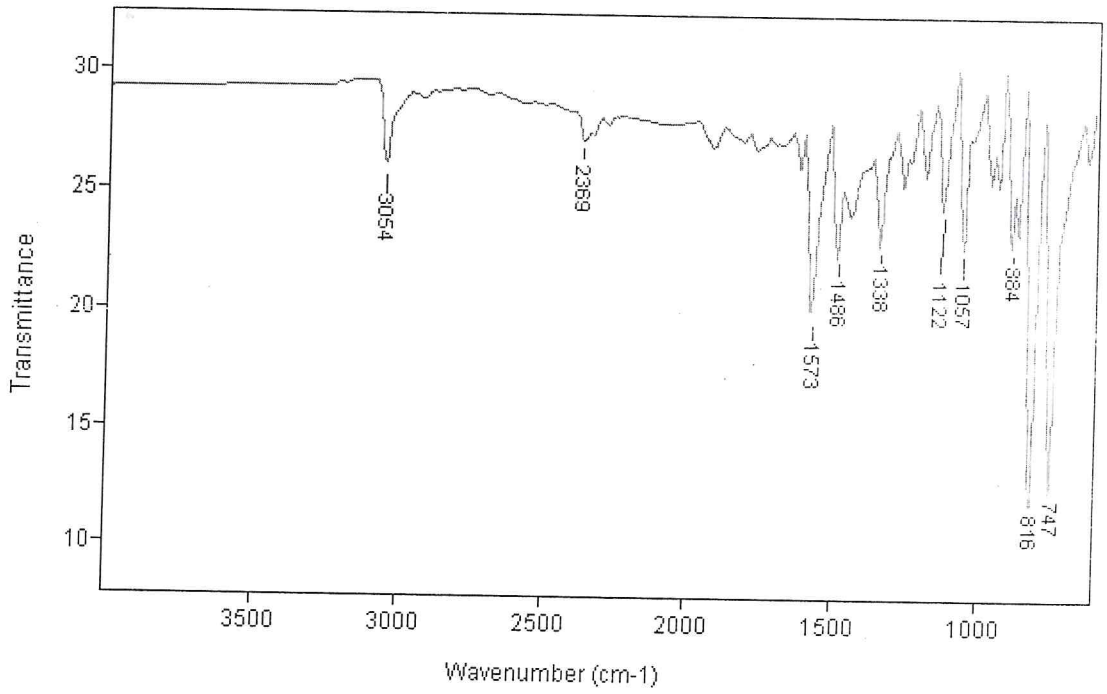
Q 8 Spectral Data





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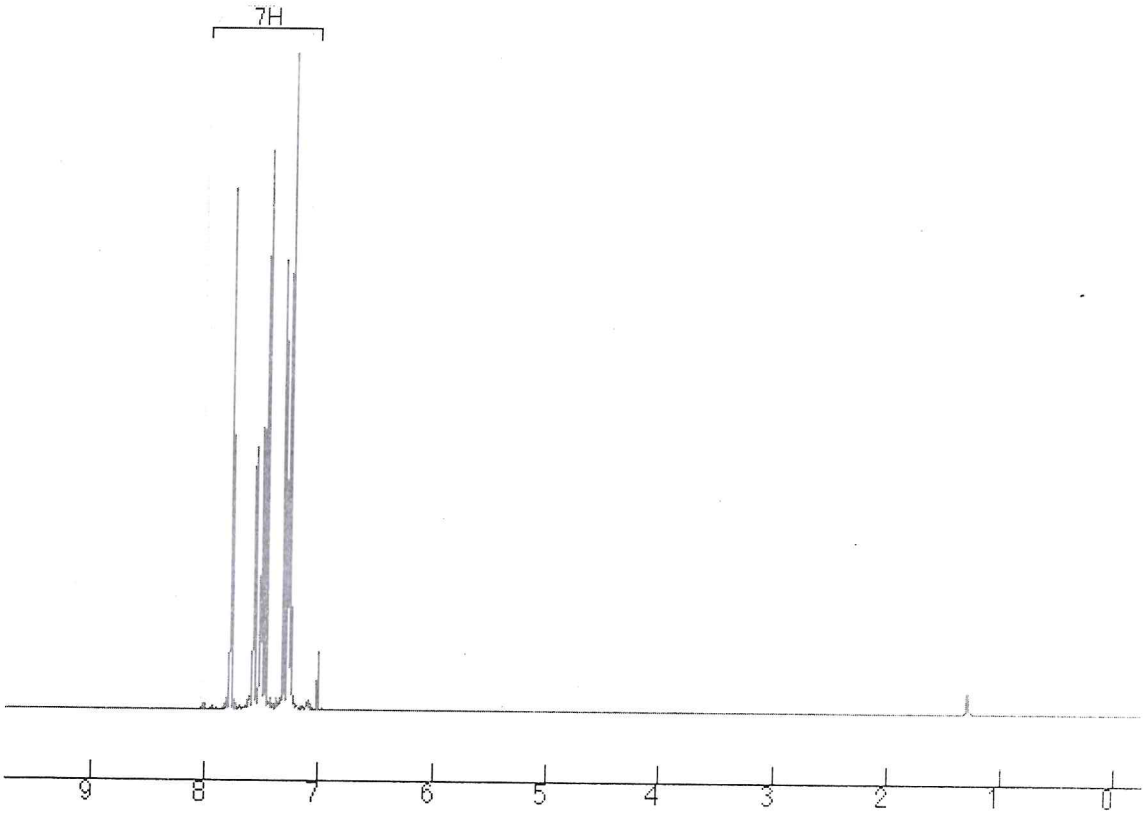
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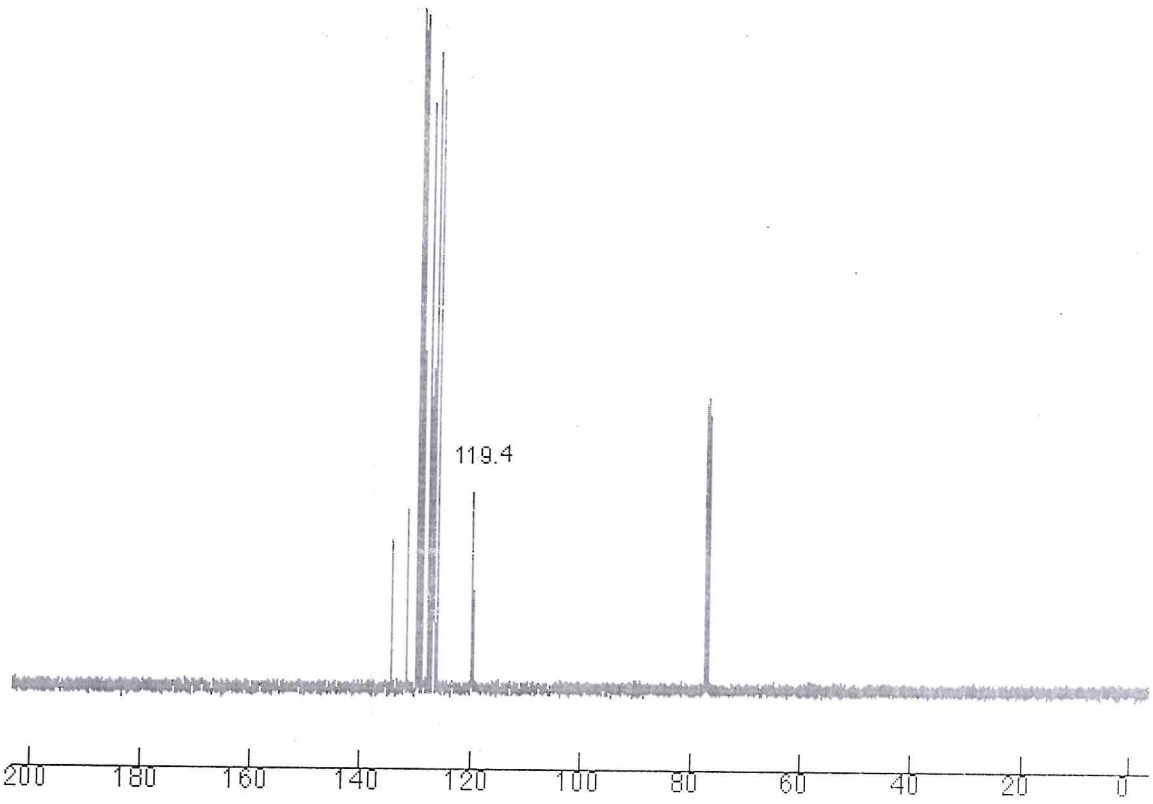
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Q 9 Spectral Data

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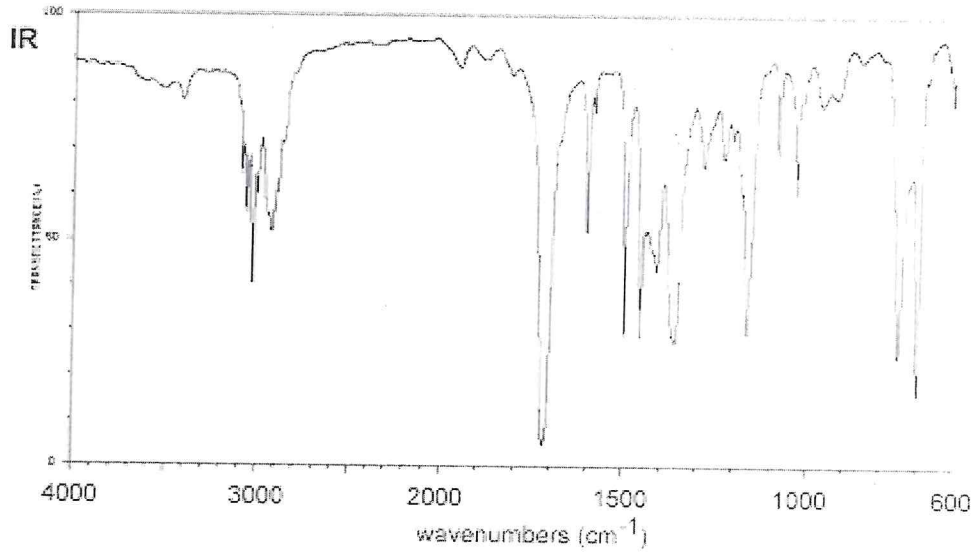
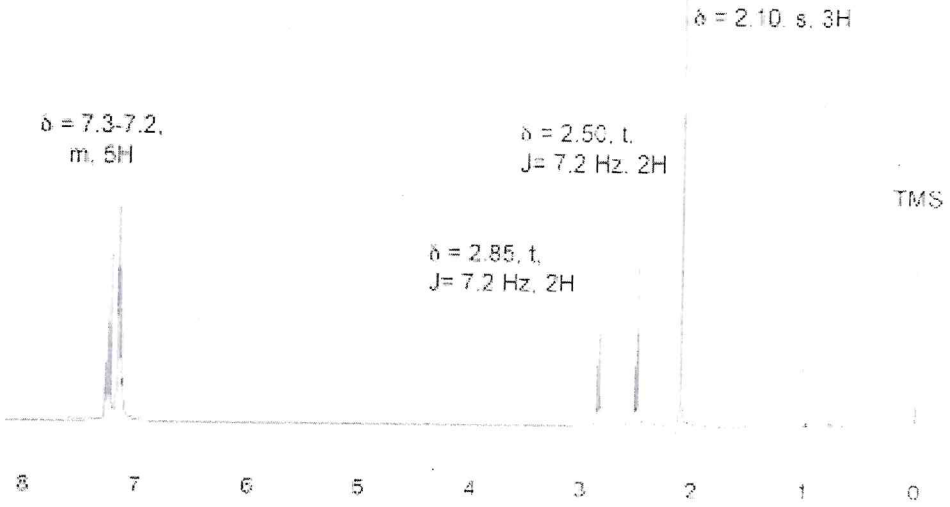


^{1}H NMR



^{13}C NMR: δ **207, 141, 128, 126, 124, 45, 29, 27**

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MANAV RACHNA UNIVERSITY
SCHOOL OF SCIENCES

"End Term Examination, June-2023"

SEMESTER	**II**	**DATE OF EXAM**	05.06.2023
SUBJECT NAME	**COMPUTATIONAL CHEMISTRY**	**SUBJECT CODE**	**CHS620B**
BRANCH	**CHEMISTRY**	**SESSION**	II
DURATION	**1.5h** 01:00PM-02:30PM	**MAX. MARKS**	**40**
PROGRAM	**MSc**	**CREDITS**	**2**
NAME OF FACULTY	**Dr. Shilpa Sharma**	**NAME OF COURSE COORDINATOR**	**Dr. Shilpa Sharma** Arpit Sand

Note: Part-A: All questions are compulsory
Part-B: All questions are compulsory

Q.NO.		QUESTIONS	MARKS	CO ADDRESSED	BLOOM'S LEVEL	PI
PART-A	1(A)	What are different phases in drug discovery and drug development	3	CO1	BT2	
	1(B)	If I have a transgenic mouse whose tumour is growing fast. What type of drugs can be tested with that mouse.	1.5	CO1	BT2	
	1(C)	Explain the mechanism of action of anti-inflammatory drugs with suitable example.	3	CO1	BT2	
	1(D)	Give two examples of anti-protozoan's drug. How mosquito can spread the protozoans in the host body	2.5	CO1	BT2	
PART-B	2(A)	Explain the Abbreviation ADME. Drug metabolism take place in which organ?	2	CO2	BT2	
	2(B)	What is Lipinki's rule of five. What is it used for?	3	CO2	BT2	
	2(C)	Dissolution of a drug follows a first order process. Which is a first order relations (C0= initial drug concentration and C and t are the time and concentration at different times). If 50% drug dissolves in 12 mins how long will it take to dissolve 80% of the drug?	4	CO2	BT3	
	2(D)	Does this molecule follow Opera – rule of 3. How many violations.	4	CO3	BT3	

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		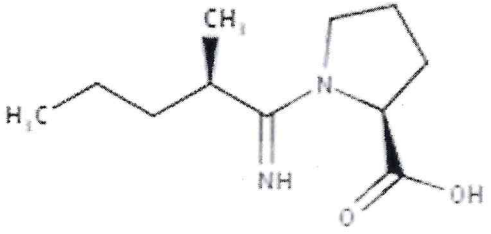				
PART-C	3(A)	How ab-initio method in quantum mechanics is different from semi-empirical method.	3	CO3	BT2	
	3(B)	Describe the role of QSAR using drug as example.	2	CO3	BT2	
	3(C)	Pharmacodynamics and pharmacokinetics play an important role in Drug discovery. How are they different and similar to each other.	4	CO3	BT2	
PART-D	4(A)	In a protein sequence A and B, Sequence A has 320 amino acids and Sequence B has 450 amino acids. Among them 100 amino acids were similar and 23 were different by conservation substitution. Using Blast pair wise alignment, calculate identity (%) and similarity (%).	3	CO4	BT2	
	4(B)	Name different softwares used for analyzing the biological systems	2	CO4	BT1	
	4(C)	What are the applications of Computational Biology	3	CO4	BT2	

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