Total No. of Questions : 8]

SEAT No. : ____

PC-3759

[Total No. of Pages : 4

[6336]-101
M.Sc.
PHYSICAL CHEMISTRY - I
CHP-110 : Fundamentals of Physical Chemistry
(2019 Pattern) (Semester - I)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates :

1) ***Answers to the two sections should be written in separate answer books.***
2) ***Question 1 and 5 are compulsory.***
3) ***Answer any 2 Questions out of Q2, Q3 & Q4 and any 2 questions out of Q6, Q7 & Q8.***
4) ***Figures to the right side indicates full marks.***
5) ***Use of logarithmic table, calculator is allowed.***
6) ***Neat diagrams must be drawn wherever necessary.***

Physico - Chemical Constants

1.	Avogadro Number	N	$= 6.023 \times 10^{23}$ mol^{-1}
2.	Boltzmann Constant	k	$= 1.38 \times 10^{-16}$ erg K^{-1} molecule^{-1}
			$= 1.38 \times 10^{-23}$ J K^{-1} molecule^{-1}
3.	Planck Constant	h	$= 6.626 \times 10^{-16}$ erg s
			$= 6.626 \times 10^{-34}$ Js
4.	Electronic Charge	e	$= 4.803 \times 10^{-10}$ esu
			$= 1.602 \times 10^{-19}$ C
5.	1 eV		$= 23.06$ kcal mol^{-1}
			$= 1.602 \times 10^{-12}$ erg
			$= 1.602 \times 10^{-19}$ J
			$= 8065.5$ cm^{-1}
6.	Gas Constant	R	$= 8.314 \times 10^{7}$ erg K^{-1} mol^{-1}
			$= 8.314$ J K^{-1} mol^{-1}
			$= 1.987$ cal K^{-1} mol^{-1}
7.	Faraday Constant	F	$= 96487$ C equivalent^{-1}
8.	Speed of light	c	$= 2.997 \times 10^{10}$ cm s^{-1}
			$= 2.997 \times 10^{8}$ m s^{-1}
9.	1 cal		$= 4.187 \times 10^{7}$ erg
			$= 4.187$ J
10.	1 amu		$= 1.673 \times 10^{-27}$ kg
11.	Bohr magneton	β_e	$= -9.274 \times 10^{-24}$ J T^{-1}
12.	Nuclear magneton	β_n	$= 5.051 \times 10^{-27}$ J T^{-1}
13.	Mass of an electron	m_e	$= 9.11 \times 10^{-31}$ kg

P.T.O.

SECTION - I

Q1) a) Attempt any four of the following : **[8]**

i) Differentiate between state function and path function.

ii) What is Henry's law? Show its deviation from ideal behaviour with suitable diagram.

iii) explain UV - catastrophe with suitable diagram.

iv) Explain sp^3 hybridisation with suitable example.

v) Write an equation for the photoelectric effect and explain the terms in it.

b) An electron moving in an atomic nucleus has a speed of $6 \times 10^6 \pm 1\%$ ms^{-1}. What is the uncertainty in its position? **[3]**

Q2) a) Explain in detail : **[6]**

i) Explain well- behaved function with one example.

ii) With the help of valence bond theory, show that XF_6 has octahedral structure and $sp^3 d^3$ hybridization.

b) Solve the following : **[6]**

i) Calculate the kinetic energy of a photoelectron when UV light of 350nm falls on a metal surface having work function of 2ev.

ii) Calculate de- Broglie wavelength from the following data

$m = 9.1 \times 10^{-27}$ g, $h = 6.626 \times 10^{-27}$ ergs $V = 7.2 \times 10^4$ $m.s^{-1}$

Q3) a) Explain any two failures of classical mechanics in detail. **[6]**

b) Solve the following : **[6]**

i) The vapour pressure of an aqueous solution is 24.90 mm at 25°C. What is the mole fraction of solvent if the vapour pressure of pure water is 25.75 mm at 25°C.

ii) Explain Mo diagram of N_2 and find its bond order.

Q4) a) Answer the following : **[6]**

i) Explain the stability of 1,3 - Butadiene with the help of Hückel theory.

ii) What is operator? Write any one linear operator.

b) Solve the following : **[6]**

i) Calculate entropy of mixing when 16 grams of O_2 and 28 grams of N_2 are mixed at 300k

ii) Explain Clausious in equality.

SECTION - II

Q5) a) Attempt any four of the following : **[8]**

i) What are consecutive reactions?

ii) Give advantages of stoppered-flow technique.

iii) State the Eyring equation and explain the terms involved in it.

iv) Explain the effect of pH on enzyme catalysed reactions.

v) What is meant by Bose - Einstein statistics?

b) Show that in cases of first order reaction the time required for 99.9% completion of the reaction to takes place is 10 times required for half life of the reaction. **[3]**

Q6) a) Answer the following : **[6]**

i) Discuss the flash photolysis technique to study the fast reaction.

ii) Explain Lineweaver and Eadie plot for enzyme uncompitative inhibition.

b) Answer the following : **[6]**

i) Write a note on 'absolute reaction rate theory'.

ii) The enzyme catalysed conversion of a substance at 25°C has Michaelis constant 0.035 mole lit^{-1}. The rate of reaction is 1.15×10^{-5} mole $lit^{-1}s^{-1}$, when the substrate concentration is 0.11M. Calculate the maximum velocity of the enzymolysis?

Q7) a) Answer the following : **[6]**

i) Discuss the Lindemann's theory for unimolecular reaction.

ii) State and explain the Boltzmann distribution law.

b) What are diffusion controlled limits? Derive the equation for diffusion controlled reaction. **[6]**

Q8) a) Define partition function. Derive an expression for rotational partition function. **[6]**

b) Answer the following : **[6]**

i) State the limitations of collision theory.

ii) The vibrational frequency of iodine molecule is 208 cm^{-1}. What is the probability of iodine molecule populating the second excited vibrational state at 25°C?

Total No. of Questions : 6]

SEAT No. :

PC3760

[Total No. of Pages : 4

[6336]-102
M.Sc. - I
CHEMISTRY
CHI - 130 : Molecular symmetry and Chemistry of P - Block Elements
(2019 Pattern) (Semester - I)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Answer to the two sections should be written in seperate book.***
3) ***Figures to the right indicate full marks.***
4) ***Use of log tables, character tables and calculator is allowed.***

SECTION - I

Q1) a) Answer the following. **[8]**

i) Sketch horizontal plane in trans-$[CoCNH_3)_4Cl_2]^+$.

ii) List out symmetry element and point group for PCl_5.

iii) Find out the product of $C_2^{(y)} \times C_2^{(x)}$ using matrix multiplication method.

iv) Find the order of group and number of classes in 1,2 dichlorobenzene.

b) Assign the correct mulliken symbol for

$\Gamma_1, \Gamma_2, \Gamma_3, \Gamma_4$ with their justification. **[3]**

	E	C_2	i	σ_h
Γ_1	1	1	1	1
Γ_2	1	–1	1	–1
Γ_3	1	1	–1	–1
Γ_4	1	–1	–1	1

P.T.O.

Q2) a) Answer any one of the following. **[6]**

i) Derive character table for C_4V point group using orthogonality theorem.

ii) Draw all symmetry operation and assign the proper point group giving reason for following molecule.

1) $[Ni(CN)_4]^{2-}$ 2) CO_3^{2-}

b) Answer any two of the following. **[6]**

i) Define symmetry element and explain C_2h point group using suitable example.

ii) Write all associate operation with S_3 axis.

iii) Show the improper axis of rotation in trans H_2O_2

Q3) a) Answer any one of the following. **[6]**

i) Find the reducible representation for $[(Pt(Cl)_4]^{2-}$ with D_4h point group considering σ-bond as a basis of representation and thus find out the orbitals offered to σ-bond formation in the molecule.

[Given: Character table for D_4h point group].

ii) Find out the irreducible representation component for the following.

C_2v	E	$C_2^{(Z)}$	$\sigma_v^{(xz)}$	$\sigma_v^{(yz)}$
Γ_{RR}	15	-1	5	5

[Given: Character table for C_2v point group]

b) Answer any two of the following. **[6]**

i) Classify the following molecule into oppropriate point group.

1) $Ni(CO)_4$ 2) Pyridine 3) $SOCl_2$

ii) Find whether the following operation is commputative on non-commutative for $C_3' \times \sigma_v''$ in NH_3

iii) Explain with the help of example secondary rotational axis.

Character tables.

D_4h	E	$2C_4$	C_2	$2C_2'$	$2C_2''$	i	$2S_4$	σ_h	$2\sigma_v$	$2\sigma_d$		
A_1g	1	1	1	1	1	1	1	1	1	1		x^2+y^2,z^2
A_2g	1	1	1	–1	–1	1	1	1	–1	–1	R_z	
B_1g	1	–1	1	1	–1	1	–1	1	1	–1		x^2-y^2
B_2g	1	–1	1	–1	1	1	–1	1	–1	1		
Eg	2	0	–2	0	0	2	0	–2	0	0	(R_x,R_y)	(xz,yz)
A_1u	1	1	1	1	1	–1	–1	–1	–1	–1		
A_2u	1	1	1	–1	–1	–1	–1	–1	1	1	z	
B_1u	1	–1	1	1	–1	–1	1	–1	–1	1		
B_2u	1	–1	1	–1	1	–1	1	–1	1	–1		
Eu	2	0	–2	0	0	–2	0	2	0	0	(x,y)	

C_2v	E	C_2	$\sigma_v^{(xz)}$	$\sigma_v^{(yz)}$
A_1	1	1	1	1
A_2	1	1	–1	–1
B_1	1	–1	1	–1
B_2	1	–1	–1	1

SECTION-II

Q4) a) Answer the following. **[8]**

i) Give the chemical reactions for the synthesis of dihydrogen.

ii) What are crown ethers? Give their examples.

iii) Borazine is called inorganic benzene, explain.

iv) What are chalcogens? Give their examples.

b) What are intercalation compounds of graphite? Give their examples. **[3]**

Q5) a) Answer any one of the following: **[6]**

i) Explain the structure and bonding in:

1) B_2H_6 b) IF_7

ii) Write a note on: Carbon nonotubes.

b) Answer any two of the following. **[6]**

i) Give an account of phosphonitrilic compounds.

ii) Write a note on : Zeolites as molecular sieves.

iii) Classify the given compounds into closo/nido/arachno, borane/ carboranes.

1) $C_2B_4H_8$ 2) B_5H_{11} c) B_4H_{10}

Q6) a) Answer any one of the following: **[6]**

i) Give an account of oxoanions of nitrogen.

ii) Draw the structures of following.

1) $[B_6N_6]^{2-}$
2) N_2O_3
3) dibenzo-18-crown-6
4) $(Si_3O_9)^{6-}$
5) $[Cl_2PN]_4$
6) X_eF_6

b) Answer any two of the following. **[6]**

i) Write a note on electron precise hydrides.

ii) Give an account of phosphorous oxoanions.

iii) Write a note on organolithium compounds.

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Total No. of Questions : 8]

SEAT No. :

PC3761

[Total No. of Pages : 5

[6336]-103

M.Sc. - I

CHEMISTRY

CCTP-3-CHO-150 : Basic Organic Chemistry

(2019 Pattern) (Semester-I)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Question 1 and Q.5 are compulsory and carry equal marks.***
2) ***Attempt any two questions from 2 to 4 and any two questions from Q.6 to Q.8.***
3) ***Answers to the two sections should be written in separate answer books.***
4) ***Figures to the right indicate full marks.***

SECTION-I

Q1) a) Attempt the following. **[9]**

i) Comment on Aromaticity.

ii) Write Paal-Knorr Thiophene synthesis.

iii) Pyrrole undergoes polymerization reaction in strong acidic condition, explain.

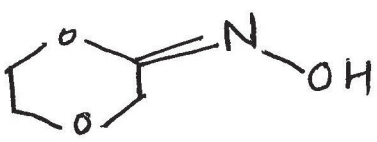
b) Define stereospecific reaction with suitable example. **[2]**

Q2) Attempt any four of the following. **[12]**

a) Draw all possible conformational isomers of 1,2-dimethyl cyclohexane.

b) Explain Huckel's rule for Benzenoid and Heterocyclic compounds.

c) Assign E/Z



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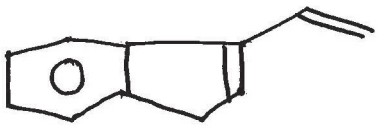
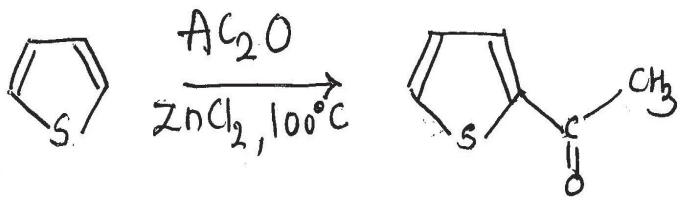


P.T.O.

d) Assign Re and Si face labels.

e) Write the mechanism for the following reaction and justify your answer.

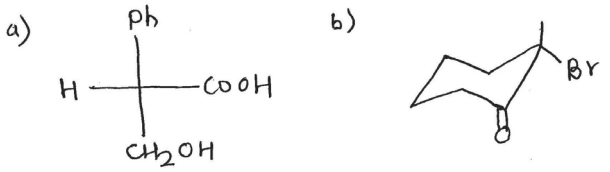


Q3) Attempt any four of the following. **[12]**

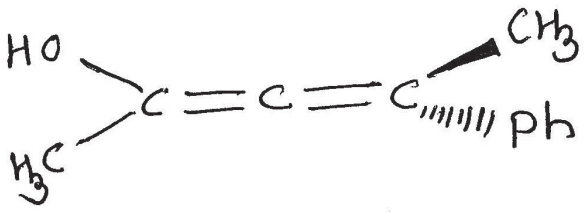
a) Comment on the optical activity of Biphenyls.

b) Electrophic substitution on Furan takes place at second position. Explain.

c) Assign R/S configuration to the following and justify your answers.



d) Comment on optical activity of the following. Justify.



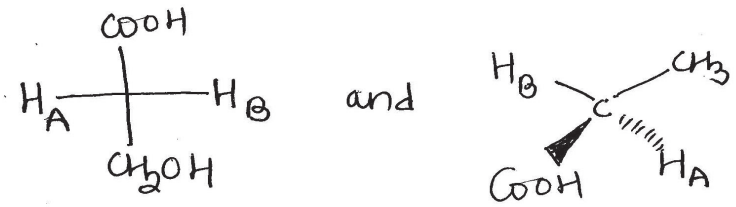
e) Comment on aromaticity of the following.

Q4) Attempt any four of the following. **[12]**

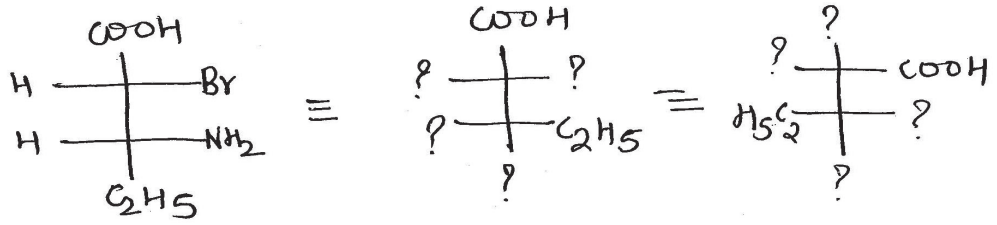
a) Write a note on chichibabin reaction.

b) Write a note on stability of annulenes.

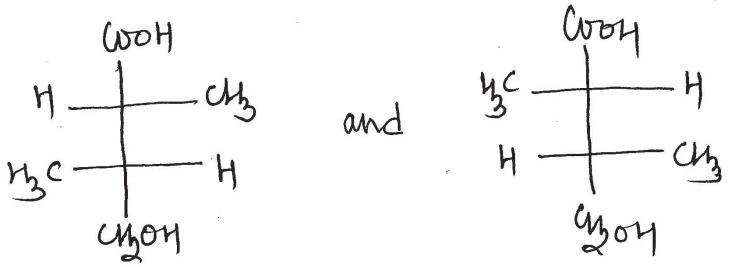
c) Assign Pro-R and Pro-S to H_A and H_B.



d) Write the equivalent structures.



e) What is the stereochemical relationship between the following compounds? Justify.



SECTION-II

Q5) a) Attempt the following. **[9]**

i) Explain structure and stability of carbene.

ii) Explain the use of Hoffmann in organic synthesis.

iii) Write the applications of phosphorus ylide.

b) Write any two applications of **[2]**

i) SeO_2

ii) DIBAL

Q6) Attempt any four of the following **[12]**

a) Write a note on Beckmann rearrangement.

b) Write a note on Birch reduction.

c) Predict the product and justify the answer.

d) Predict the product and justify the answer

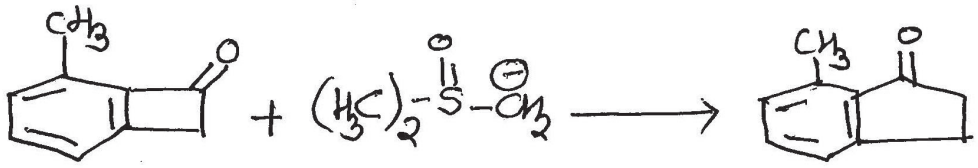
e) Explain NGP for ring expansion.

Q7) Attempt any four of the following. **[12]**

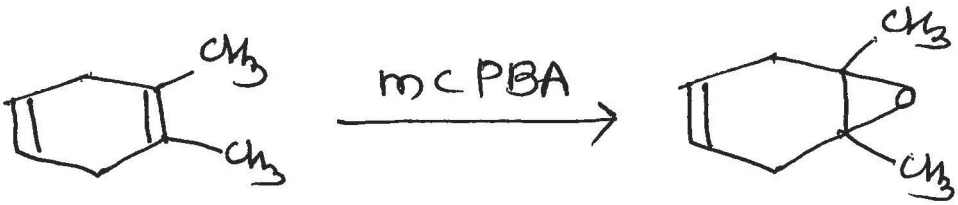
a) Explain syn diol formation.

b) Explain structure, stability and any one reaction of carbanion intermediate.

c) Write the mechanism and justify answer.



d) Write the mechanism and justify answer.



e) Applications of Hydroboration reaction in organic synthesis.

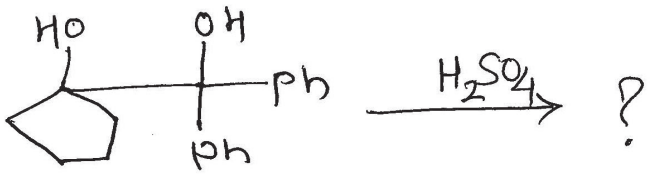
Q8) Attempt any four of the following. **[12]**

a) Describe Schmidt rearrangement with suitable example.

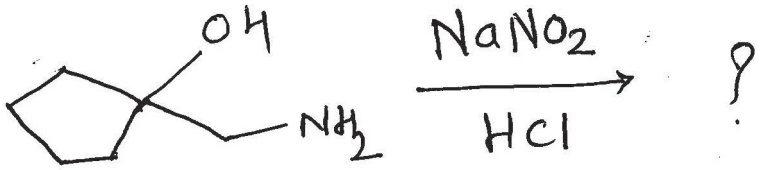
b) Explain any one method for the synthesis of alpha hydroxy carboxylic acids.

c) Factors affecting the stability of carbocation.

d) Predict the products and suggest mechanism.



e) Predict the products and suggest mechanism.



Total No. of Questions : 4]

SEAT No. : ____

PC3762

[Total No. of Pages : 6

[6336]-104

M.Sc. - I

CHEMISTRY

CBOP-1-CHG-190(A) : Introduction to Solid State of Matter

(2019 Pattern) (Semester - I)

Time : 2 Hours] ***[Max. Marks : 35***

Instructions to the candidates:

1) ***Solve any one section from three.***
2) ***Question 1 is compulsory.***
3) ***Questions 2-4 carry equal marks.***
4) ***Solve any two questions from 2 to 4.***
5) ***Figures to the right indicate full marks.***

Q1) a) Solve any four of the following : **[8]**

i) What are intrinsic & extrinsic semiconductors?

ii) NaCl show schottky defect. Explain.

iii) What is decomposition reaction for the preparation of solid? Give an example.

iv) Define superconductors.

v) What is band gap for semiconductors?

b) Solve the following : **[3]**

The band gap of TiO_2, ZnO, Cu_2O and Cds are 3.31, 3.26, 2.45 and 2.7 ev. Which of these will act as photoconductor in visible radiations? Why?

Q2) a) Solve the following : **[6]**

i) Explain synthesis of Ag nanoparticles.

ii) Explain coprecipitation method for the synthesis of solids.

b) Explain bond structure of Metals, Semi conductors and insulator with suitable example. **[6]**

P.T.O.

Q3) a) Solve the following : **[6]**

i) What is gas sensor? Explain O_2 sensor.

ii) Write note on BCS theory of superconductivity.

b) Solve the following : **[6]**

i) Differenciate between Frankel and schottky defects with examples.

ii) Explain Hydrothermal method for synthesis of solids.

Q4) a) What are stoichiometric and non-stoichiometric compounds? Explain non stoichiometry in FeO in detail. **[6]**

b) Solve the following : **[6]**

i) Write note on Fast ion conductors.

ii) What is doping in semiconductors? Explain B-doped si as P type of Semiconductor.

x x x

Total No. of Questions : 4]

PC3762

[6336]-104

M.Sc. - I

CHEMISTRY

CBOP-1-CHG-190(B) : Introduction to Chemical Mathematics

(2019 Pattern) (Semester - I)

Time : 2 Hours] ***[Max. Marks : 35***

Instructions to the candidates:

1) ***Question 1 is compulsory.***
2) ***Questions 2 to 4 carry equal marks.***
3) ***Solve any two questions from 2 to 4.***
4) ***Figures to the right indicate full marks.***
5) ***Use of log tables or non programmable calculator is allowed.***

Q1) a) Solve any four of the following : **[8]**

i) Give the derivative of

1) cosec x

2) tan x

ii) Define

1) Node

2) Cusp

iii) Give the quotient rule of differentiation.

iv) State whether following differential equation is exactor inexact $xy^3\,dx + (x^2\,y^2 + 1)\,dy = 0$

v) Find the order of the following determinant $\begin{bmatrix} 1 & 3 & 2 \\ 3 & -2 & 6 \\ 5 & 9 & 8 \end{bmatrix}$

b) Derive Maclaurin Theorem. **[3]**

Q2) a) Solve the following : **[6]**

i) Differentiate the following w.r.t. x

$5x^4 + 3x^3 + 2x$

ii) Integrate the following w.r.t. independent variable

$\int x^4 + 5x^3 + 3x + 9dx$

b) Solve the following : **[6]**

i) Find the determinant of $\begin{bmatrix} 9 & 8 & 3 \\ 4 & 5 & 2 \\ 1 & 8 & 1 \end{bmatrix}$

ii) Give any two differential equations used in Physical Chemistry.

Q3) a) Solve the following : **[6]**

i) Differentiate the following w.r.t. x $(x)\log x$.

ii) Evaluate the following integral by substitution method $\int e^{12x} dx$

b) Solve the following **[6]**

i) Find the cofactor of $\begin{bmatrix} 3 & 2 & 1 \\ 1 & 5 & 6 \\ 2 & 3 & 4 \end{bmatrix}$

ii) Find out whether following equation exhibits maxima or minima $y = 3x^3 + 9x^2 - 5x + 14$.

Q4) a) Solve the following : **[6]**

i) If $x = at^2$ $y = 2at$ find dy/dx

ii) Integrate $\int_0^3 (x+1)(x+2)$.

b) Solve the following : **[6]**

i) If $A = \begin{bmatrix} 2 & 6 & 2 \\ 1 & 8 & 2 \end{bmatrix}$ $B = \begin{bmatrix} 3 & 9 \\ 8 & 4 \\ 3 & 2 \end{bmatrix}$ find AB

ii) Give rules for partial derivatives with suitable examples.

Total No. of Questions : 4]

PC3762

[6336]-104

M.Sc. - I

CHEMISTRY

CBOP-1-CHG-190(C) : Introduction to Chemical Biology - I

(2019 Pattern) (Semester - I)

Time : 2 Hours] ***[Max. Marks : 35***

Instructions to the candidates:

1) ***Question 1 is compulsory.***
2) ***Questions 2 to 4 carry equal marks.***
3) ***Solve any two questions from 2 to 4.***
4) ***Draw diagrams wherever necessary.***

Q1) a) Solve any four of the following : **[8]**

i) What is iodine value of fat?

ii) Draw the structure of lactose.

iii) What are amphipathic lipids? How do they behave in water?

iv) What do you mean by denaturation of proteins?

v) Draw the structure of any two aromatic amino acids.

b) Define polysaccharides and describe the structure of any two homopolysaccharide. **[3]**

Q2) Attempt the following questions :

a) What are standard amino acids? Classify them based on their R group or side chain. **[6]**

b) Comment on uniport, symport and antiport transport system. **[3]**

c) Give a short account on sugar derivatives. **[3]**

Q3) Answer the following questions :

a) Define and classify lipids with suitable examples. **[6]**

b) Write a note on Quaternary structure of proteins. **[3]**

c) Comment on acid base property of amino acids. **[3]**

Q4) Solve the following questions :

a) What is meant by active transport? How do Na^+ K^+ pump operate in membrane? **[6]**

b) Discuss in brief structure and function of any three organelles of prokaryotic cell. **[3]**

c) Describe the structure of α-helix. **[3]**

Total No. of Questions : 8]

SEAT No. : ____

PC3763

[Total No. of Pages : 4

[6336]-201
First Year M.Sc.
PHYSICAL CHEMISTRY - II
CHP-210-CCTP-4 : Molecular Spectroscopy & Nuclear Chemistry
(2019 Pattern) (Semester - II)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer to the two sections should be written in separate answer books.***
2) ***Question 1 and 5 are compulsory.***
3) ***Answer any 2 questions out of Q2, Q3 and Q4 and any 2 questions out of Q6, Q7 and Q8.***
4) ***Figures to right side indicate full marks.***
5) ***Use of logarithmic table, calculator is allowed.***
6) ***Neat diagrams must be drawn wherever necessary.***

Physico - Chemical Constants

1.	Avogadro Number	N	$= 6.022 \times 10^{23}$ mol^{-1}
2.	Boltzmann Constant	k	$= 1.38 \times 10^{-16}$ erg K^{-1} molecule^{-}
			$= 1.38 \times 10^{-23}$ J K^{-1} molecule^{-1}
3.	Planck Constant	h	$= 6.626 \times 10^{-27}$ erg s
			$= 6.626 \times 10^{-34}$ J s
4.	Electronic Charge	e	$= 4.803 \times 10^{-10}$ esu
			$= 1.602 \times 10^{-19}$ C
5.	1 eV		$= 23.06$ kcal mol^{-1}
			$= 1.602 \times 10^{-12}$ erg
			$= 1.602 \times 10^{-19}$ J
			$= 8065.5$ cm^{-1}
6.	Gas Constant	R	$= 8.314 \times 10^{7}$ erg K^{-1} mol^{-1}
			$= 8.314$ J K^{-1} mol^{-1}
			$= 1.987$ cal K^{-1} mol^{-1}
7.	Faraday Constant	F	96487 C equiv^{-1}
8.	Speed of light	c	$= 2.997 \times 10^{10}$ cm s^{-1}
			$= 2.997 \times 10^{8}$ m s^{-1}
9.	1 cal		$= 4.184 \times 10^{7}$ erg
			$= 4.184$ J
10.	1 amu		$= 1.673 \times 10^{-27}$kg
11.	Bohr magneton	β_e	$= - 9.274 \times 10^{-24}$ J T^{-1}
12.	Nuclear magneton	β_n	$= 5.051 \times 10^{-27}$ J T^{-1}
13.	Mass of an electron	m_e	$= 9.11 \times 10^{-31}$ kg

P.T.O.

SECTION - I

Q1) a) Attempt any four of the following : **[8]**

i) Classify the molecules on the basis of moment of inertia.

SO_2, NO_2, $CHCl_3$ and H_2O

ii) What is zero point energy?

iii) Write down selection rule for pure rotational Raman activity in linear molecules.

iv) Calculate the number of fundamental modes of vibrations in

C_2H_2, C_2H_6, SO_3 & C_6H_6

v) Why are stoke's lines more intense than the anti-stokes lines?

b) For J = 0 to J = 1 transition in case of $^{12}C^{16}O$ take place at 115.4 GHz. While in case of $^{*}C^{16}O$ take place at 110.2 GHz. Calculate the mass number of unknown isotope of carbon. **[3]**

Q2) a) Answer the following : **[6]**

i) Write the equation for rotational constant of a molecule. How will its value change with the equillibrium bond length and reduced mass?

ii) What are hot bands? Derive the expression for the hot band.

b) Solve the following : **[6]**

i) If vibrational frequency of $^{1}H^{35}Cl$ is 1900 cm^{-1}. Calculate the vibrational frequency of $^{1}H^{37}Cl$. Assuming that the force constant does not change.

ii) What is predissociation? Explain it by using suitable diagram.

Q3) a) Answer the following : **[6]**

i) Deduce $V_{max} = \frac{1}{2x_e} - 1$ for electronic spectroscopy.

ii) In the pure rotational Raman spectrum of XY molecule, the adjacent stokes lines are separated by 4 cm^{-1}, the molecule is irradiated by a radiation of 30,000 cm^{-1}. What is the wave number of first stokes lines?

b) Solve the following: **[6]**

i) Explain the number of Mössbauer peaks observed in $Na_3[Fe(CN)_5NH_3]$ & $Na_3[Fe(CN)_6]$.

ii) Explain the Quantum theory of Raman effect.

Q4) a) Answer the following: **[6]**

i) Explain the variation of intensities of spectral transitions in vibrational-electronic spectra of diatomic molecule.

ii) The IR spectrum of a diatomic molecule exhibit transitions at 2143.0 cm^{-1} & 4260.0 cm^{-1}, corresponding excitations from ground state to first and second vibrational state respectively. What is the value of fundamental frequency?

b) Solve the following : **[6]**

i) Explain any two applications of Mössbauer spectroscopy.

ii) In CO_2 no vibration is simultaneously active in both Raman & IR, while in H_2O molecule the vibrations are active both in Raman & IR Spectra. Explain it.

SECTION - II

Q5) a) Attempt any four of the following : **[8]**

i) What is the Auger effect?

ii) What do you mean by stopping power in radiation chemistry?

iii) What is spallation in nuclear fission?

iv) Write the equation for the preparation of ^{131}I.

v) Define curie (ci).

b) To Assess the volume of blood in a patient, one cm^3 of his blood was withdraw, lebelled with ^{32}P and reinjected into his body. After adequate time for homogenization, one cm^3 of his blood was again withdrawn and the sample showed a total activity of 250 net counts in 10 min. Find the volume of blood in the patient, given that 0.1 cm^3 of the lebelled blood before injection corresponded to an activity of 14,000 counts per min.**[3]**

Q6) a) Answer the following : **[6]**

i) What are prompt and delayed neutrons in nuclear fission?

ii) What are the various units for measurement of radiation energy? How they related with each other?

b) Solve the following : **[6]**

i) Find out the Molecular absorption coefficient of methanol.

[Given : $e\mu$ = 0.211 b/electron, density of methanol is 0.713 g/cc, z of c = 6, H = 1, O = 8, and A of c = 12, H = 1, O = 16]

ii) Explain the application of radioisotope in structure investigation.

Q7) a) Answer the following : **[6]**

i) Discuss the principle of Isotope dilution analysis. How it is used to determine the volume of blood in patient?

ii) How does the process of nuclear fission occur & what are the steps involved?

b) Solve the following : **[6]**

i) Calculate the mass and the number of atoms in a mci of ^{24}Na.

[Given : $t_{½}$ = 15 hr]

ii) What is compton scattering? Explain in details.

Q8) a) Answer the following : **[6]**

i) Explain the radiometric titration with suitable example.

ii) Explain the products of radiolysis of water.

b) Solve the following: **[6]**

i) Half life of ^{64}Cu is 12.8 hrs. To determine the time required to reduce to 60% of its initial activity.

ii) What is the Gray, the Rem & the Rad? How it is related to each other?

Total No. of Questions : 5]

SEAT No. :

PC3764

[Total No. of Pages : 5

[6336]-202

M.Sc. - I

CHEMISTRY

CHI-230 : Coordination and Bioinorganic Chemistry

(2019 Pattern) (Semester - II) (4 Credits)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Answer to the two sections should be written in separate answer book.***
3) ***Neat and labeled diagram must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of calculators is allowed.***

SECTION - I

Q1) a) Explain the following : **[8]**

i) Calculate the total degeneracy for the following term and configuration :

1) ^3D

2) $(t_{2g})^3 (eg)^2$

ii) Assign the J values and work out possible R.S term symbols from the following data :

1) L = 1, S = ½

2) L = 2, S = 2

iii) Arrange the following terms in increasing order of energy and justify your answer.

1) $^1P^2D^3F^4S^2G$

2) $^3S^4P^2I^1G^3F$

iv) State and explain : curie-weiss law

b) State and explain the selection rules in d-d transition. **[3]**

P.T.O.

Q2) a) Answer any one of the following : **[6]**

i) Prepare a table of microstates and obtain allowed R.S term symbols for the d^2 configuration.

ii) Classify the following transitions in a octahedral complex as orbitally allowed, vibronically allowed and Forbidden transitions.

1) $A_{2g} \rightarrow A_{1g}$

2) $A_{2u} \rightarrow T_{2g}$

3) $A_{1g} \rightarrow T_{2u}$

b) Answer any two of the following : **[6]**

i) Determine the ground state term symbol for :

1) $[Co(NH_3)_5Cl]Cl_2$ (Z = 27)

2) Fe^{3+} (Z = 26)

ii) Calculate crystal field splitting parameter (10Dq) for $[Cr(H_2O)_6]SO_4$. (Given : μ_{obs} = 4.82 B.M. and λ = + 58cm^{-1})

c) Write a note on fluorescence and phosphorescence.

Q3) a) Answer any one of the following : **[6]**

i) Write a note on : Quenching of orbital angular momentum.

ii) An octahedral complex records three spin allowed transitions at 7728cm^{-1}, 12970cm^{-1} and 24038cm^{-1}. Calculate Δo, Racah parameter, nephelauxetic ratio and comment on nature of M-L bond. (Given : B_0 = 970 cm^{-1}).

b) Answer any two of the following : **[6]**

i) Give the splitting of ^3F term in weak cubic field using character table for pure rotational point group(O) and reduction formula.

ii) How would you account for the magnetic moment listed against the following complex.

$[Ni(NH_3)_6]SO_4$ μ_{obs} = 2.84 B.M.

iii) Explain the possible allowed transitions in $[Co(H_2O)_6]^{2+}$. Complex ion and correlate them in terms of crystal field splitting parameter (10Dq) and Racah parameter (B).

SECTION - II

Q4) a) Answer the following : **[8]**

i) What are the functions of Mg in biological system?

ii) Explain the Irving-Williams series.

iii) What are the common oxidation state of Cu and Zn found in biological system?

iv) What are the two pair electron transfer metalloenzyme?

b) What is hydrolytic enzyme? Explain the types of hydrolytic enzyme with its reaction. **[3]**

Q5) a) Answer any one of the following : **[6]**

i) What is hard-soft acid base concept? Explain the binding preferences of metal ion's with ligand.

ii) Explain with the help of scheme ATP-dependent export of $3Na^+$ and $2K^+$ ion's by Na^+–K^+–ATPase.

b) Write a note on any two of the following. **[6]**

i) Ferritin

ii) Metals in medicine

iii) Manganese in photosystem - II

Q6) a) Answer any one of the following : **[6]**

i) Draw and discuss the structure of iron-sulfur cluster.

ii) What is model complex? Explain the concept with suitable example of spontaneous self assembly.

b) Answer any two of the following : **[6]**

i) Explain in detail multipair electron transfer metalloenzyme.

ii) Explain Hard-Soft acid base concept with suitable example.

iii) With the help of reaction explain how metal ion's affect the reactions of coordinated liganel.

Direct Product

1. **Group of the form G x i or G x σh**
   The g, u, or "," additions to the IR symbol in this group satisfy
   g x g = u x u = g, g x u = u, 'x' = "x"=
2. **Product of the form A x A, B x B, A x B**
   For all groups:
   Letter Symbol: A x A =A, B x B = A , A x B = B
   Subscript: 1 x 1 = 1, 2 x 2 = 1, 1 x 2 = 2
   Except for the B representations of D_2 and D_2 where
   B x B = B, and 1 x 2 = 3, 2 x 3 = 1, 3 x 1 = 2
3. **Products of the forms: A x E, B x E:**
   (a) For all groups A X E_k = E_k irrespective of the suffix on A.
   (b) For all groups except D_4h, D_4d, S_8:
   B x E_1= E_2, B x E_2 = E_1
   irrespective of the suffix on B (If the group has only one B representative put E_1=E_2=E)
   (c) For D_4h:
   B X E_1 = E_3, E x E_2 = E_3, B x E_3 =E_3, B x E_2 = E_2, B x E_3 = E_1
   Irrespective of the suffix on B:
   (d) For D_4d, S_8:
   B x E_1= E_3, B x E_2 =E_2, B x E_3 = E_1
   Irrespective of the suffix on B:
4. **Products of the form E x E:**
   (For groups which have A, B, or E symbols without suffixes put A_1 = A_2 = A, etc in the equation below)
   (a) For Oh, O, T_3, D_6h, D_2, C_6v, C_6h, C_6, S_6, D_2d, D_2h, D_3, C_2, C_3h, C_3:
   E_1 x E_1 =E_2 x E_2= A_1+ A_2+ B_2; B_1 x E_2 – B_1 + B_2+ E_1
   (b) For D_4h, D_4, C_4v,C_4h,C_4,S_4,D_2d:
   E x E = A_1 + A_2 + B_1 + B_2.
   (c) For D_6d:
   E_1 x E_1 = E_3 x E_3 = A_1 + A_2+ Eg
   E_2 x E_2 = E_4 x E_4 = A_1 + A_2+ Eg
   E_3 x E_3= A_1 + A_1+ B_1 + B_2
   E_1+ E_2= E_4 + E_3 =E_1+E_3,E_1 x E_3 = E_3 x E_1= E_2+ E_1,
   E_1+ E_4= E_2 + E_3 =E_3+E_3,E_2 x E_3 = E_3 x E_4= E_1+ E_3,
   E_1+ E_3= B_4 +B_2+E4, E_2 x E_4 = B_1+ B_2 + E_2,
   (d) D_5d, D_2h, D_3, C_3v, C_3h, C_3
   E_1 x E_1 = A_1 + A_2 + E_2 , E_2 x E_2 = A_1 + A_2 + E_1
   E_1 x E_2 = E_1 + E_2
   (e) For D_4d,S_8
   E_1x E_1= E_3 x E_3 = A_1 + A_2 + E_2
   E_2 x E_2 = A_1 + A_2 + B_1+ B_2
   E_1 xE_2 = E_2 x E_3= E_1 + E_3, E_1 x E_3 = B_1 + B_2 + E_2
5. **Product involving the T (or F) representation of Oh, O, Td:**
   A_1 x T_1= T_1, A_1 x T_2= T_2, A_2 x T_1 = T_2, A_2 x T_2= T_1'
   E x T_1= E x T_2= T_1 + T_2,
   T_1 x T_1 = T_2 x T_2 = A1+ B + T_1 + T_2
   T_1 x T_2 = A_2 + E+ T_1+ T_2

6. **To Complete result for O are**

O	A_1	A_2	E	T_1	T_2
A_1	A_1	A_2	E	T_1	T_2
A_2	A_2	A_1	E	T_2	T_1
E	E	E	$A_1 + A_2 + E$	$T_1 + T_2$	$T_1 + T_2$
T_1	T_1	T_2	$T_1 + T_2$	$A_1 + E + T_1 + T_2$	$A_2 + E + T_1 + T_2$
T_2	T_2	T_1	$T_1 + T_2$	$A_2 + E + T_1 + T_2$	$A_1 + E + T_1 + T_2$

Character Table for O rotational group

O	E	$6C_4$	$3C_2(=C_4^2)$	$8C_3$	$6C_2$		
A_1	1	1	1	1	1		$x^2+y^2+z^2$
A_2	1	-1	1	1	-1		$(2z^2-x^2-y^2,$
E	2	0	2	-1	0		$x^2-y^2)$
T_1	3	1	-1	0	-1	$(R_x,R_y,R_z);(x,y,z)$	(xy,xz,yz)
T_2	3	-1	-1	0	1		

Correlation table for group Oh

Oh	O	Td	D_4h	D_2d	C_{4V}	C_2v	D_3d	D_3	C_2h
A_1g	A_1	A_1	A_1g	A_1	A_1	A_1	A_1g	A_1	Ag
A_2g	A_2	A_2	B_1g	B_1	B_1	A_2	A_2g	A_2	Bg
Eg	E	E	A_1g+B_1g	A_1+B_1	A_1+B_1	A_1+A_2	Eg	E	Ag+ Bg
T_1g	T_1	T_1	A_2g+E_g	A_2+E	A_2+E	$A_2+B_1+B_2$	A_2g+Eg	A_2+E	Ag+ 2Bg
T_2g	T_2	T_2	B_2g+Eg	B_2+E	B_2+E	$A_1+B_1+B_2$	A_1g+Eg	A_1+E	2Ag+Bg
A_1u	A_1	A_1	A_1u	B_1	A_2	A_2	A_1u	A_1	Au
A_2u	A_2	A_1	B_1u	A_1	B_2	A_1	A_2u	A_2	Bu
Eu	E	E	A_1u+B_1u	A_1+B_1	A_2+B_2	A_1+A_2	Eu	E	Au+ Bu
T_1u	T_1	T_2	A_2u+Eu	B_2+E	A_1+E	$A_1+B_1+B_2$	A_2u+Eu	A_1+E	Au+ 2Bu
T_2u	T_2	T_1	B_2u+Eu	A_2+E	B_1+E	$A_2+B_1+B_2$	A_1u+Eu	A_1+E	2Au+Bu

Total No. of Questions : 8]

SEAT No. : ____

PC3765

[Total No. of Pages : 7

[6336]-203
M.Sc. - I
ORGANIC CHEMISTRY
CCTP- 6 - CHO - 250 : Photochemistry, Pericyclic and Organic Spectroscopy
(2019 Pattern) (Semester - II)

Time : 3 Hours] ***[Max. Marks : 70***

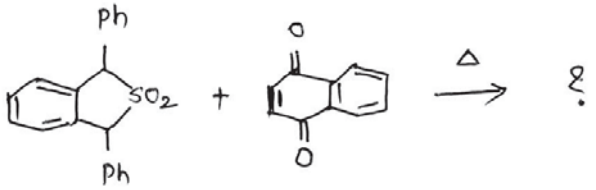
Instructions to the candidates:

1) ***Q.1 and Q.5 are compulsory and carry 11 marks each.***
2) ***Attempt any two question from Q.2 to Q.4 and two questions from Q.6 to Q.8.***
3) ***Answers to the two sections should be written in separate answer books.***
4) ***Figures to the right indicate full marks.***

SECTION - A

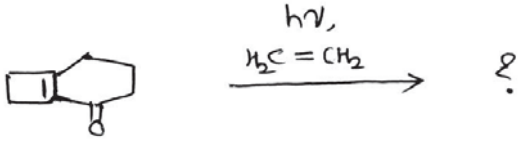
Q1) A) Predict the products with exact stereochemistry. Justify your answer. **[8]**

a)



b)

c)



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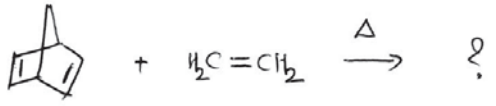
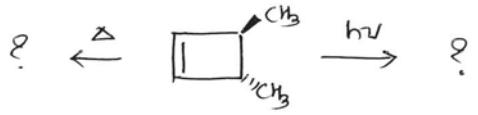
d) 

B) Write a note on 'Mclafferty Reaction'. **[3]**

Q2) A) Attempt any three of the following. **[9]**

a) Explain Jablonski diagram.

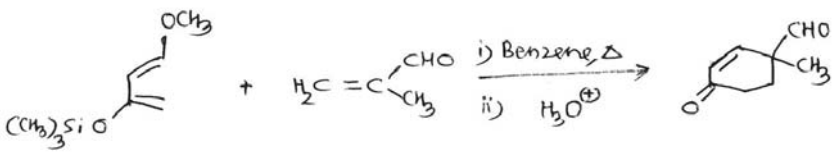
b) Predict the products with exact stereochemistry. Justify your answer.



c) Explain the following conversion.

d) Explain chetetropic reactions with suitable examples.

B) Suggest the suitable mechanism for following reaction. Justify your answer. **[3]**

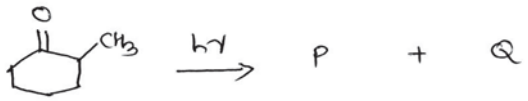


Q3) A) Attempt any three of the following. **[9]**

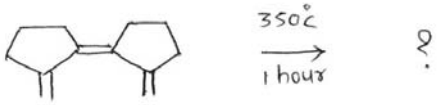
a) What are cycloaddition reactions? Explain with any two suitable examples.

b) Using FMO approach predict whether [4+2] cycloaddition reaction is thermally or photochemically allowed. Explain.

c) Write the structures P and Q in following reaction.



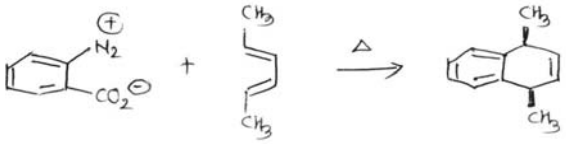
d) Predict the product/s in following reaction.



B) Explain Norrish - II reaction with suitable examples. **[3]**

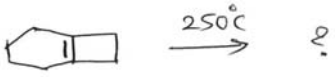
Q4) A) Attempt any three of the following. **[9]**

a) Explain the following conversion.

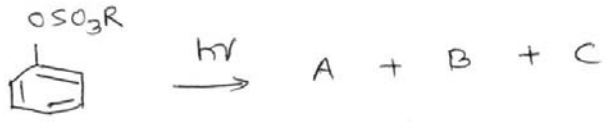


b) Write a note on Barton reaction.

c) Predict the product/s in following reaction.



d) Write the structures of A, B and C in following reaction.

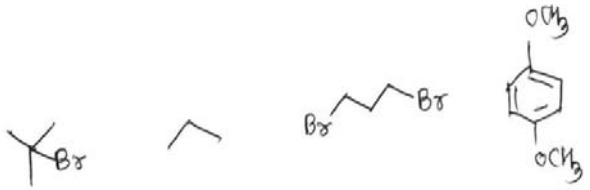


B) Explain cope rearrangment with suitable examples. **[3]**

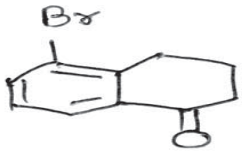
SECTION - B

Q5) A) Attempt the following. **[8]**

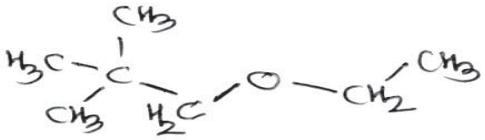
a) Which of the following compound give 1:3 ratio in ^{1}H-NMR spectrum?



b) Calculate λmax for following compound.



c) Explain the genesis of peaks in following compound.

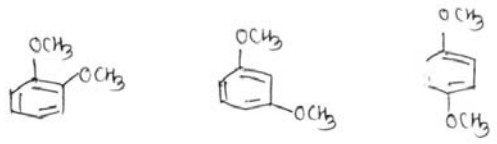


d) Compound with molecular formula C_4H_8O shows IR at 1700 cm^{-1}, three signals in ^{1}H-NMR and one signal > 160 ppm in ^{13}C-NMR. What may be the probable structure?

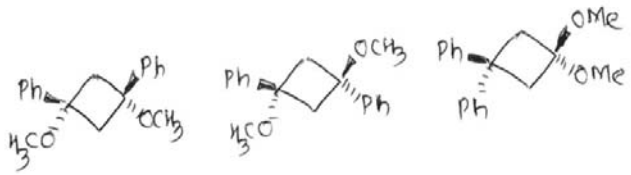
B) Write note on 'Spin-spin splitting'? **[3]**

Q6) A) Attempt any three of the following. **[9]**

a) How many signals do you expect for following compounds in ^{13}C-NMR?



b) How could you use ^{13}C-and ^{1}H-NMR to distinguish following isomers? Explain.



c) Deduce the structures of following isomers

i) M.F : $C_9H_{10}O$

IR : 1712 cm^{-1}

PMR: 2.15 (S, 3H), 3.07(S, 2H), 7.01 (bs, 5H) (ppm)

ii) M.F : $C_9H_{10}O$

IR : 1688 cm^{-1}

PMR: 1.22(t, 3H), 2.98 (q, 2H), 7.28-7.95 (m, 5H) (ppm)

d) Assign the structure.

M.F : $C_9H_{10}O_2$

IR : 1680 cm^{-1}

PMR: 2.5(s, 3H)

3.8 (s, 3H)

6.9 (d, J = 8Hz, 2H)

7.9 (d, J = 8 Hz, 2H)

B) Three isomeric compounds A, B, C with M.F. C_3H_6O shows the following mass spectral data. the underlined peaks are the base peaks. assign the structures to the isomers. **[3]**

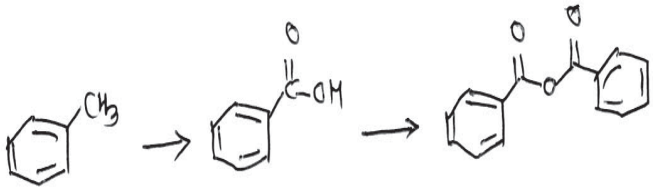
M/Z : (A) 58,<u>43</u> (B) : 58, <u>29</u>,28,27 (C) : 58,<u>57</u>,29,28

Q7) A) Attempt any three of the following. **[9]**

a) What are metastable ions? Give one example.

b) Why we do not count integration in ^{13}C-NMR? explain.

c) How will you follow following reaction using IR?



d) How will you use UV. spectroscopy to distinguish geometric isomers? Explain with suitable example.

B) Explain anisotropic effects in acetaldehyde in ^1H-NMR spectroscopy.**[3]**

Q8) A) Attempt any three of the following. **[9]**

a) What is Hooke's law? explain its significance in IR.

b) Propose the structure consistent with following data

Molecular Ion : 72

IR : 1710 cm^{-1}

PMR : 1.00 (t, 3H)

2.1 (s, 3H)

2.4 (q, 2H)

c) Compound A exhibits two signals in it's PMR at 2.64 and 3.69 ppm with ratio of 2:3 compound B exhibits two signals in PMR at 2.09 and 4.27 ppm with ratio of 3:2. Which compound corresponds to dimethyl succinate and which compound corresponds to ethylene diacetate? Explain.

d) Assign the structure.

M.F : $C_8H_8O_2$

UV : 260nm

IR : 2700-3000 (bs), 1700, 1600, 1500, 920 (cm^{-1})

^{1}H.NMR : 3.5 (s 12mm), 7.2 (s, 30mm), 12.3(s, 6mm)

B) Assign the structure. **[3]**

M.F : $C_5H_{11}Br$

PMR: 1.02 (d, J = $6H_2$, 24 mm)

1.66 (m, 4mm)

1.85 (q, 8mm)

3.40 (t, J = $6H_2$, 8mm)

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Total No. of Questions : 4]

SEAT No. :

PC3766

[Total No. of Pages : 6

[6336]-204
M.Sc. - I
CHEMISTRY
CBOP-2 : CHG-290 : Material Characterization Technique
(2019 Pattern) (Semester-II) (Elective Option-A) (2 Credit)

Time : 2 Hours] *[Max. Marks : 35*

Instructions to the candidates:

1) ***Question 1 is compulsory.***
2) ***Solve any two questions from 2 to 4.***
3) ***Question 2 to 4 carry equal marks.***
4) ***Figures to the right indicate full marks.***

Q1) a) Solve any four of the following: **[8]**

i) What is absorption edge in X Ray radiation?

ii) Give the condition for emission of fluorescence X ray and Auger electron.

iii) Calculate the acceleration voltage of electrons produced in X ray tube having wavelength 0.15406nm.

iv) Give any two limitations of EDS.

v) Name the types of Electron guns used in TEM.

b) Answer the following **[3]**

In a XRD spectrum of Ag metal a peak at $\theta=19.1^{o}$ was observed for $|\,|\,|$ plane of FCC crystal using incident wavelength of 1.5406 Å. Calculate the 'a' and 'd' value.

Q2) a) Answer the following: **[6]**

i) Derive the Bragg's equation.

ii) Differentiate between light and transmission microscope.

b) Answer the following: **[6]**

i) Explain sample preparation in XRF.

ii) Write a note on Astigmatism

P.T.O.

Q3) a) Answer the following: **[6]**

i) Explain construction and working of X ray tube in XRD.

ii) Compare SEM and TEM.

b) Answer the following: **[6]**

i) Explain the Si(Li) detector in EDS

ii) Explain specimen preparation in SEM

Q4) a) Answer the following: **[6]**

i) Write a note on Reciprocal lattice

ii) Sketch a neat labelled diagram of the structure of a transmission electron microscope.

b) Answer the following: **[6]**

i) Write a note on qualitative analysis by EDS and WDS

ii) Describe mass density contrast in SEM with the help of a neat labeled diagram.

Total No. of Questions : 4]

PC3766

[6336]-204
M.Sc. - I
CHEMISTRY
CHG-290 : Organometallic & Inorganic Reaction Mechanism
(2019 Pattern) (Semester-II) (Elective Option-B) (2 Credit)

Time : 2 Hours] ***[Max. Marks : 35***

Instructions to the candidates:

1) ***Question 1 is compulsory.***
2) ***Solve any two questions from 2 to 4.***
3) ***Question 2 to 4 carry equal marks.***
4) ***Figures to the right indicate full marks.***

Q1) a) Solve any four of the following: **[8]**

i) Determine valence electron counts for the following complexes:

1) $[(\eta^3- C_5H_5)\ (\eta^5- C_5H_5)Fe(CO)]$

2) $[Re(pph_3)_2Cl_2N]$

ii) Identify the second-row transition metal for the following $18e^-$ species

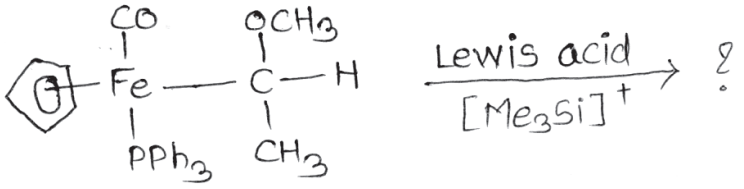
1) $[(\eta^4–C_8H_8)\ M(CO)_3]$

2) $HM\ (CO)_5$

iii) Predict the product and give the type for the following reaction:

1) $(CO)_5\,Mn - CH_3 + SO_2 \rightarrow ?$

2)



iv) Define oxidative addition with suitable example.

v) Give the rate law for dissociative reaction.

b) Discuss the any two methods for synthesis of binary carbonyl complexes. **[3]**

Q2) a) Explain in detail bonding in ferrocene **[6]**

b) i) Give an account of pd-catalyzed cross-coupling cycle. **[3]**

ii) Write a short note on kinetic chelate effect with suitable examples. **[3]**

Q3) a) Explain with the help of suitable example insertion reaction. **[6]**

b) i) Give the role of IR technique in structure predication of organometallic compounds. **[3]**

ii) Define inert and labile complexes. Classify following complexes into inert and labile. **[3]**

$[Cr(H_2O)_6]^{2+}$; $[V(H_2O)_6]^{3+}$; $[Cr(CN)_6]^{3-}$

Q4) a) Explain the stereochemistry of substitution reaction in square planar complexes. **[6]**

b) i) Draw π orbitals for linear system C_5H_7 **[3]**

ii) Give an account of polymerization using Zeiglar-Natta catalyst. **[3]**

Total No. of Questions : 4]

PC3766

[6336]-204

M.Sc. - I

CHEMISTRY

CHG-290 : Introduction to Chemical Biology-II

(2019 Pattern) (Semester-II) (Elective Option-C) (2 Credit)

Time : 2 Hours] ***[Max. Marks : 35***

Instructions to the candidates:

1) ***Question No.1 is compulsory.***
2) ***Solve any two questions from 2 to 4.***
3) ***Question 2 to 4 carry equal marks.***
4) ***Figures to the right indicate full marks.***
5) ***Draw daigram wherever necessary.***

Q1) a) Solve any four of the following: **[8]**

i) What is Gene therapy?

ii) What is promoter sequence? Give its significance for initiation of transcription process.

iii) What is the difference between deamination and transamination of amino acids?

iv) What is the effect of pH on enzyme activity?

v) What do you mean by central dogma of molecular biology?

b) Comment on Urea cycle. **[3]**

Q2) Attempt the following questions.

a) Discss the reactions of TCA cycle. **[6]**

b) Give the differences between DNA and RNA. **[3]**

c) Write in brief : Industrial applications of enzymes. **[3]**

Q3) Answer the following questions.

a) Describe the principle and procedure of SDS-PAGE **[6]**

b) Explain the salient features of DNA replication. **[3]**

c) Comment on allosteric enzymes with suitable example. **[3]**

Q4) Solve the following questions.

a) Describe in detail steps leading to formation of initiation complex in protein synthesis. State the function of peptidyl transferase and translocase enzyme. **[6]**

b) Write a note on irreversible inhibition of enzyme. **[3]**

c) Comment on applications of Gene cloning. **[3]**

Total No. of Questions : 6]

SEAT No. :

PC-5199

[Total No. of Pages : 2

[6336]-205

M.Sc. (Part - I)

GENERAL CHEMISTRY

CHA - 290 : Analytical Chemistry

(Revised 2014) (Semseter - II) (New) (4 Credits) (33214)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***All questions of respective section are compulsory.***
2) ***Figures to the right hand side indicate marks.***
3) ***Write the answers of the two parts in separate answer books.***

PART - A

Modern Separation Methods and Hyphenated Techniques

Q1) **Attempt the following :** **[10]**

a) Explain parent ion and meta stable ion in mass spectrometry.

b) Give any two significant applications of gas chromatography.

c) Give any two applications of ion exchange resins used in chromatography.

d) Give the fragmentation pattern of m-anisidine and chlropropane.

e) Give the principle of ICPMS.

Q2) **Answer any Two of the following :** **[10]**

a) Explain magnetic analyzers in mass spectrometry.

b) Explain chromatographic band broadening and efficiency of chromatographic column.

c) Describe size exclusion chromatography.

d) Explain the detectors used in mass spectrometry.

Q3) **Answer any One of the following :** **[5]**

a) Explain the construction of different components and their working.

b) A mass spectral peak centred at m/z of 352 and had a peak width at 5 percent of the peak height of 0.41. Determine the resolution of the mass spectrometer.

P.T.O.

PART - C

Concept of Analytical Chemistry

Q4) **Answer the following :** **[10]**

a) What is student T-test?

b) With suitable example explain term precision.

c) What is separation by precipitation?

d) How column performance can be improved in chromatography?

e) Give procedure for sampling of metals and alloys.

Q5) **Attempt any Two of the following :** **[10]**

a) What are different separation methods? Explain separation by extraction.

b) Write a note on automated sample handling.

c) Explain the term propagation of error with suitable example.

d) Write a note on ion exchange chromatography.

Q6) **Attempt any One of the following :** **[5]**

a) What is confidence limit? Explain in detail test of significance.

b) Explain mean deviation, average deviation, standard deviation with example.

▽▽▽▽

Total No. of Questions : 8]

SEAT No. : ____

PC-3767

[Total No. of Pages : 4

[6336]-301
M.Sc. - II
PHYSICAL CHEMISTRY
CHP - 310 : Quantum and Solid State Chemistry
(2019 Pattern) (Semester - III) (Credit-4)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates :

1) ***Answers to the two sections should be written in separate answer books.***
2) ***Question 1 and 5 are compulsory.***
3) ***Answer any 2 Questions out of Q2, Q3 & Q4 and any 2 questions out of Q6, Q7 & Q8.***
4) ***Figures to the right indicate full marks.***
5) ***Use of logarithmic table, calculator is allowed.***
6) ***Neat diagrams must be drawn wherever necessary.***

Physico - Chemical Constants

1.	Avogadro Number	N	$= 6.022 \times 10^{23}$ mol^{-1}
2.	Boltzmann Constant	k	$= 1.38 \times 10^{-16}$ erg K^{-1} molecule^{-1}
			$= 1.38 \times 10^{-23}$ J K^{-1} molecule^{-1}
3.	Planck Constant	h	$= 6.626 \times 10^{-27}$ erg s
			$= 6.626 \times 10^{-34}$ Js
4.	Electronic Charge	e	$= 4.803 \times 10^{-10}$ esu
			$= 1.602 \times 10^{-19}$ C
5.	1 eV		= 23.06 kcal mol^{-1}
			$= 1.602 \times 10^{-12}$ erg
			$= 1.602^{-} \times 10^{-19}$ J = 1.602^{-}
			= 8065.5 cm^{-1}
6.	Gas Constant	R	$= 8.314 \times 10^{7}$ erg K^{-1} mol^{-1}
			= 8.314 J K^{-1} mol^{-1}
			= 1.987 cal K^{-1} mol^{-1}
7.	Faraday Constant	F	= 96487 C equiv^{-1}
8.	Speed of light	c	$= 2.997 \times 10^{10}$ cm s^{-1}
			$= 2.997 \times 10^{8}$ m s^{-1}
9.	1 cal		$= 4.184 \times 10^{7}$ erg
			= 4.184 J
10.	1 amu		$= 1.673 \times 10^{-27}$ kg
11.	Bohr magneton	β_e	$= -9.274 \times 10^{-24}$ J T^{-1}
12.	Nuclear magneton	β_n	$= 5.051 \times 10^{-27}$ J T^{-1}
13.	Mass of an electron	m_e	$= 9.11 \times 10^{-31}$ kg

P.T.O.

SECTION - I

Q1) a) Attempt any four of the following : **[8]**

i) Find the term symbol for L = 2, S = ½

ii) State the conditions for the operator to be linear.

iii) Give the statement of Pauli's exclusion principle.

iv) Write any two properties of quantum mechanical operator.

v) Define Ladder operator and give its properties.

b) Formulate the Hamiltonian operator for Be^{+2} ion and H_2 molecule. **[3]**

Q2) a) Attempt the following : **[6]**

i) Discuss the various step involved in the application of the variation method.

ii) Derive the equation for linear momentum operator (Px).

b) Attempt the following : **[6]**

i) Which of the following are eigen Functions of $\frac{d^2}{dx^2}$? Give eigen value

A) sinx and B) $3e^x$

ii) Write the Schrodiger time independent equation and give the significance of the terms in it.

Q3) a) Derive the expression for first order correction to energy of non-degenerate unperturbed level. **[6]**

b) Attempt the following : **[6]**

i) Compare perturbation method with the variation method.

ii) Evaluate $\left[x^3, \frac{d}{dx}\right]$

Q4) a) Write a note on Hartree - fock self consistent method. **[6]**

b) Attempt the following : **[6]**

i) What are the properties of commutators?

ii) Define symmetric and antisymmetric wave function.

SECTION - II

Q5) a) Attempt any four of the following : **[8]**

i) Define screw and edge dislocations.

ii) What is van Arkel process.

iii) Give the factor affecting rates of solid -solid reaction.

iv) What is piezoelectricity?

v) Define elastic and plastic deformation.

b) What is lattice imperfection? Give its classification. **[3]**

Q6) a) Attempt the following : **[6]**

i) Discuss the growth of crystal from vapour phase.

ii) Explain the mechanism of the following solid - solid reaction.

$AgCl_{(s)} + NaI_{(s)} \rightarrow AgI(s) + NaCl_{(s)}$.

b) Attempt the following **[6]**

i) Explain the thermal properties of crystal

ii) Discuss the kinetic rate laws for deceleratory solid phase decomposition reaction.

Q7) a) What is a colour centre? Explain the origin of colour centres in halide crystals. **[6]**

b) Attempt the following : **[6]**

i) Explain photoconductivity in ionic crystals.

ii) The diffusion coefficient of Li in Ge at 500°C is 10^{-6} cm^2 /s . What is the distance penetrated in one and half hour?

Q8) a) Write note on intrinsic and extrinsic semiconductor **[6]**

b) Attempt the following. **[6]**

i) If 1eV energy is required to move an atom from the crystal's interior to the surface, what is the proportion of vacancies present in the crystal at 1000 k? At 500 k?

ii) Define climb, jog and kink.

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Total No. of Questions : 8]

SEAT No. : [ ]

PC3768

[Total No. of Pages : 3

[6336]-302
M.Sc. - II
PHYSICAL CHEMISTRY
CHP-311 : CCTP-8 : Nuclear, Radiation and Polymer Chemistry
(2019 Pattern) (Semester - III) (4 Credits)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer to the two sections should be written in separate answer books.***
2) ***Questions 1 and 5 are compulsory.***
3) ***Answer any 2 questions out of Q2, Q3 and Q4 and any 2 questions out of Q6, Q7 and Q8.***
4) ***Figures to the right indicate full marks.***
5) ***Use of logarithmic table, calculator is allowed.***
6) ***Neat diagrams must be drawn wherever necessary.***

Physico - Chemical Constants

1.	Avogadro Number	N	$= 6.023 \times 10^{23}$ mol^{-1}
2.	Boltzmann Constant	k	$= 1.38 \times 10^{-16}$ erg K^{-1} molecule^{-1}
			$= 1.38 \times 10^{-23}$ J K^{-1} molecule^{-1}
3.	Planck Constant	h	$= 6.626 \times 10^{-16}$ erg s
			$= 6.626 \times 10^{-34}$ J/s
4.	Electronic Charge	e	$= 4.803 \times 10^{-10}$ esu
			$= 1.602 \times 10^{-19}$ C
5.	1 eV		$= 23.06$ k cal mol^{-1}
			$= 1.602 \times 10^{-12}$ erg
			$= 1.602 \times 10^{-19}$ J
			$= 8065.5$ cm^{-1}
6.	Gas Constant	R	$= 8.314 \times 10^{7}$ erg K^{-1} mol^{-1}
			$= 8.314$ J K^{-1} mol^{-1}
			$= 1.987$ cal K^{-1} mol^{-1}
7.	Faraday Constant	F	$= 96487$ C equivalent^{-1}
8.	Speed of light	c	$= 2.997 \times 10^{10}$ cm s^{-1}
			$= 2.997 \times 10^{8}$ m s^{-1}
9.	1 cal		$= 4.187 \times 10^{3}$ erg
			$= 4.187$ J
10.	1 amu		$= 1.673 \times 10^{-22}$ kg
11.	Bohr magneton	β_e	$= -9.274 \times 10^{-24}$ J T^{-1}
12.	Nuclear magneton	β_n	$= 5.051 \times 10^{-27}$ J T^{-1}
13.	Mass of an electron	m_e	$= 9.11 \times 10^{-31}$ kg

P.T.O.

SECTION - I

Q1) a) Attempt any four of the following : **[8]**

i) Distinguish between fissile and fissinable nucleids.

ii) Enlist special nuclear reactions.

iii) Describe the applications of PIXE.

iv) Explain the properties of scintillators.

v) Write different types of nuclear reactions.

b) Discuss the merits and demerits of liquid drop model. **[3]**

Q2) a) Attempt the following : **[6]**

i) Explain conservation in nuclear reactions.

ii) Describe projective accelerator and target preparation in PIXE.

b) Attempt the following : **[6]**

i) Discuss discontinuties in nuclear properties with reference to magic number.

ii) Explain schematic diagram of RBS experiment.

Q3) a) Explain the working of surface barrier semiconductor detector **[6]**

b) Attempt the following. **[6]**

i) Discuss the compound nucleus theory.

ii) Write a note on thermonuclear reactions.

Q4) a) Describe the working of Li-drifted detector with schematic diagram. **[6]**

b) Attempt the following. **[6]**

i) Distinguish thermal, fast & Intermediate reactors.

ii) Describe channeling effects of RBS.

SECTION - II

Q5) a) Attempt any four of the following : **[8]**

i) Distinguish between Homopolymer and co-polymer.

ii) Define regular and strictly regular solutions.

iii) Explain degree of polymerisation.

iv) Write co-polymer equation & explain terms.

v) Define number and weight average molecular weight.

b) Describe secondary bond forces of the polymers **[3]**

Q6) a) Answer the following : **[6]**

i) Describe membrane osmometry.

ii) Discuss the classification of polymers.

b) Answer the following : **[6]**

i) Explain end group analysis method to determine molecular weight.

ii) Explain instantaneous composition of polymer.

Q7) a) Explain light scattering method for determination of molecular weight of polymer. **[6]**

b) Answer the following. **[6]**

i) Distinguish between thermoplastic and thermosetting polymers.

ii) What is monomer reactivity ratios?

Q8) a) Explain cryoscopic method to determine molecular weight of polymer. **[6]**

b) Answer the the following: **[6]**

i) Discuss ultra centrifugation.

ii) Describe molecular weight distribution.

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Total No. of Questions : 8]

SEAT No. :

PC3769

[Total No. of Pages : 4

[6336]-303
S.Y. M.Sc.
PHYSICAL CHEMISTRY
CHP-312: Physicochemical Methods of Analysis
(2019 Pattern) (Semester III)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer the two sections should be written in Separate answer book.***
2) ***Question 1 and 5 are compulsory.***
3) ***Answer any 2 questions out of Q2. Q3 and Q4 and any 2 questions out of Q6. Q7 and Q.8.***
4) ***Figures to the right side indicate full marks.***
5) ***Use of logarithmic table, calculator is allowed.***
6) ***Neat diagrams must be drawn wheever necessary.***

Physico - Chemical Constants

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			$= 1.38 \times 10^{-23}$ J K^{-1} molecule^{-1}
3)	Planck Constant	h	$= 6.626 \times 10^{-27}$ erg s
			$= 6.626 \times 10^{-34}$ J s
4)	Electronic Charge	e	$= 4.803 \times 10^{-10}$ esu
			$= 1.602 \times 10^{-19}$ C
5)	1 eV		$= 23.06$ k cal mol^{-1}
			$= 1.602 \times 10^{-12}$ erg
			$= 1.602 \times 10^{-19}$ J
			$= 8065.5$ cm^{-1}
6)	Gas Constant	R	$= 8.314 \times 10^{7}$ ergK^{-1} mol^{-1}
			$= 8.314$ J K^{-1} mol^{-1}
			$= 1.987$ cal K^{-1} mol^{-1}
7)	Faraday Constant	F	$= 96487$ C equiv^{-1}
8)	Speed of light	c	$= 2.997 \times 10^{10}$ cm s^{-1}
			$= 2.997 \times 10^{8}$ m s^{-1}
9)	1 cal		$= 4.184 \times 10^{7}$ erg
			$= 4.184$ J
10)	1 amu		$= 1.673 \times 10^{-27}$ kg
11)	Bohr magneton	β_e	$= -9.274 \times 10^{-24}$ J T^{-1}
12)	Nuclear magneton	β_n	$= 5.051 \times 10^{-27}$ J T^{-1}
13)	Mass of an electron	m_e	$= 9.11 \times 10^{-31}$ kg

P.T.O.

SECTION - I

Q1) a) Attempt any four of the following : **[8]**

i) What is meant by short wavelength cutoff?

ii) Define the term binding energy and work function used in ESCA.

iii) Why does weight of energy crucible change when it is heated upto 1000ºC in TGA technique.

iv) Give two application of X-ray absorption.

v) Explain the term thermal analysis.

b) Discuss the application of TGA technique. **[3]**

Q2) a) Answer the following. **[6]**

i) What are the advantages of X-ray radioactive source.

ii) Explain chemical shift observed in ESCA technique.

b) Answer the following. **[6]**

i) Describe with an example neutralization thermometric titration.

ii) The work function of a spectrometer is 35ev. The binding energy of the emitted electrons is 1.050 ev. If the kinetic energy of the electrons is 1.75 ev. Find the wavelength of X-ray.

Q3) a) Explain with a neat labelled diagram electron microprobe used in electron probe X-ray microanalysis techniques. **[6]**

b) Answer the following. **[6]**

i) Explain spectral splitting observed in ESCA technique.

ii) Explain how DTA peaks are helpful to analyse the test sample.

Q4) a) State the principle of thermometric titration. Explain thermometric titration curve for exothermic and endothermic reaction. **[6]**

b) Answer the following. **[6]**

i) Explain the chemical analysis of X-ray absorption.

ii) 120 mg sample containg a mixture of Nacl (mol.wt.58.5) and $CaC_2O_4 \cdot H_2O$ (mol.wt.146) showed a loss of 7.00 mg at 140ºC on TG curve. Determine the percentage of calcium oxalate in the sample.

SECTION - II

Q5) a) Attempt any four of the following : **[8]**

i) What is plasma? State it's types?

ii) What is controlled potential coulometry?

iii) Differentiate between fluorescence and phosphorescence.

iv) What is principle of amperometric titration?

v) Define the term potentistat

b) Explain 'T' route mechanism for electro chemiluminescence. **[3]**

Q6) a) Answer the following. **[6]**

i) Write the application of potential coulometry.

ii) What are the advantages of amperometric titration.

b) Answer the following. **[6]**

i) Describe briefly the technique of pulse voltametry.

ii) The intial current is go mA and decrease exponentially with k=0.0058 sec^{-1} the titration time is 714 sec. How many milligram of uranium(vi) are reduced to uranium (iv)

Q7) a) Explain the sample intruduction in ICP spectrometer . **[6]**

b) Attempt the following. **[6]**

i) Explain the 'S' route mechanism for electro chemiluminescence.

ii) Define the terms:

1) Voltagram

2) Single, doublet and triplet states.

Q8) a) Write a note on cyclic voltametry. **[6]**

b) Attempt the following. **[6]**

i) Discuss the applications of cyclic voltametry.

ii) A sample of Ni are weighing 3.18g is dissolved in acidic and the Ni is electrolysed using constant current of 2.5 ua for 10 minutes. Calculate the percentage of Ni in the ore.

Total No. of Questions : 8]

SEAT No. : ____

PC3770

[Total No. of Pages : 6

[6336]-304

M.Sc. - II (Physical Chemistry)

CBOP-3 : CHP-313(A) : PHOTOCHEMISTRY AND TECHNIQUES IN POLYMER CHEMISTRY

(2019 Pattern) (Semester - III) (Elective) (Option - A)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer to the Two sections should be written in separate answer books.***
2) ***Question 1 and 5 compulsory.***
3) ***Answer any 2 questions out of Q2, Q3 and Q4 and any 2 questions out of Q6, Q7 and Q8.***
4) ***Figures to the right indicate full marks.***
5) ***Use of logarithmic table, calculator is allowed.***
6) ***Neat diagrams must be drawn wherever necessary.***

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5.	1eV		$= 23.06$ k cal mol^{-1}
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			$= 8.314$ J K^{-1} mol^{-1}
			$= 1.987$ cal K^{-1} mol^{-1}
7.	Faraday Constant	F	$= 96487$ C equavalent^{-1}
8.	Speed of light	c	$= 2.997 \times 10^{10}$ cm s^{-1}
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9.	1 cal		$= 4.187 \times 10^{7}$ erg
			$= 4.187$ J
10.	1 amu		$= 1.673 \times 10^{-27}$ kg
11.	Bohr Magneton	β_e	$= -9.274 \times 10^{-24}$ J T^{-1}
12.	Nuclear Magneton	β_n	$= 5.051 \times 10^{-27}$ J T^{-1}
13.	Mass of an electron	m_e	$= 9.11 \times 10^{-31}$ kg

P.T.O.

SECTION - I

Q1) a) Solve any 4 of the following : **[8]**

i) Explain the photochemical equivalance.

ii) What is selection rules?

iii) Explain four level lasers.

iv) Discuss single photon counting.

v) What is Femtosecond Flash Photolysis.

b) Discuss the term photoluminescence. **[3]**

Q2) a) Explain in details. **[6]**

i) Explain self-phase modulation.

ii) What are application of solar energy.

b) Answer the following :

i) Write a short note on photosynthesis. **[3]**

ii) Discuss kinetics of collision quenching. **[3]**

Q3) a) Explain the Jablonski diagram depicting photophysical process. **[6]**

b) Answer the following :

i) State Grothhus - Draper's law. **[3]**

ii) What are general Features of Photochemical process. **[3]**

Q4) a) Derive the stern-volmer equation for kinetics of collison quenching. **[6]**

b) Answer the following :

i) Discuss interaction of light with matter. **[3]**

ii) Explain photophysical kinetics of bimolecular process. **[3]**

SECTION - II

Q5) a) Solve any 4 of the following : **[8]**

i) What is random degradation?

ii) Explain singlet & triplet state.

iii) What is Rubber elasticity.

iv) What is carbon blocks?

v) Explain the term crystalline melting point.

b) Write a note on plastic technology. **[3]**

Q6) a) Explain in details. **[6]**

i) Discuss the Mechanical properties of crystalline polymer.

ii) Write note on re-inforcement.

b) Answer the following :

i) What are application of conducting polymer. **[3]**

ii) Describe the crosslinking of Polymer. **[3]**

Q7) a) What is Morphology? Explain polymer requirements and polymer utilization. **[6]**

b) Answer the following :

i) Describe the Voiget model of viscoelastic behaviour. **[3]**

ii) Define calendering, dry spinning, wet-spinning. **[3]**

Q8) a) Derive the stress-strain equation for simple stretching of an elastomer. **[6]**

b) Answer the following :

i) Describe injection moulding with neat diagram. **[3]**

ii) How IR spectra useful in Polymer Analysis. **[3]**

Total No. of Questions : 8]

PC3770

[6336]-304

M.Sc. - II (Physical Chemistry)

CBOP-3 : CHP-313(B) : SPECIAL TOPICS IN PHYSICAL CHEMISTRY

(2019 Pattern) (Semester - III)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer to the Two sections should be written in separate answer books.***
2) ***Question 1 and 5 compulsory.***
3) ***Answer any 2 questions out of Q2, Q3 and Q4 and any 2 questions out of Q6, Q7 and Q8.***
4) ***Figures to the right indicate full marks.***
5) ***Use of logarithmic table, calculator is allowed.***
6) ***Neat diagrams must be drawn wherever necessary.***

Physico - Chemical Constants

1.	Avogadro Number	N	$= 6.023 \times 10^{23}$ mol^{-1}
2.	Boltzmann Constant	k	$= 1.38 \times 10^{-16}$ erg K^{-1} molecule^{-1}
			$= 1.38 \times 10^{-23}$ J K^{-1} molecule^{-1}
3.	Planck Constant	h	$= 6.626 \times 10^{-16}$ erg s
			$= 6.626 \times 10^{-34}$ J s
4.	Electronic Charge	e	$= 4.803 \times 10^{-10}$ esu
			$= 1.602 \times 10^{-19}$ C
5.	1eV		$= 23.06$ k cal mol^{-1}
			$= 1.602 \times 10^{-12}$ erg
			$= 1.602 \times 10^{-19}$ J
			$= 8065.5$ cm^{-1}
6.	Gas Constant	R	$= 8.314 \times 10^{7}$ erg K^{-1} mol^{-1}
			$= 8.314$ J K^{-1} mol^{-1}
			$= 1.987$ cal K^{-1} mol^{-1}
7.	Faraday Constant	F	$= 96487$ C equavalent^{-1}
8.	Speed of light	c	$= 2.997 \times 10^{10}$ cm s^{-1}
			$= 2.997 \times 10^{8}$ m s^{-1}
9.	1 cal		$= 4.187 \times 10^{7}$ erg
			$= 4.187$ J
10.	1 amu		$= 1.673 \times 10^{-27}$ kg
11.	Bohr Magneton	β_e	$= -9.274 \times 10^{-24}$ J T^{-1}
12.	Nuclear Magneton	β_n	$= 5.051 \times 10^{-27}$ J T^{-1}
13.	Mass of an electron	m_e	$= 9.11 \times 10^{-31}$ kg

SECTION - I

Q1) a) Attempt any four of the following : **[8]**

i) Explain the difference between mean and meridian.

ii) Define the terms determinate and indeterminate errors.

iii) Write the difference between turbidimetry and colorimetry.

iv) State the combination and give its formula.

v) Define pH and pOH. How they are inter-related?

b) Explain the principle of nephelometry with a neat labelled diagram. **[3]**

Q2) a) Attempt the following : **[6]**

i) Explain the term 'significant figures' with suitable example for numerical products and quotients.

ii) Explain proton condition for 0.1M $NaHCO_3$.

b) Calculate the pH and concentration of all species for 0.01 M CH_3 COONa. (Given : $K_a = 1.8 \times 10^5$] **[6]**

Q3) a) Attempt the following : **[6]**

i) Explain the method of least square analysis.

ii) Write mass balance and charge balance for 0.1M H_3PO_4.

b) Attempt the following : **[6]**

i) What is regression analysis? Explain the method of linear regression analysis.

ii) Turbidimetry was used to examine a sample. The transmittance of the sample was 0.368, the cell path length was 1.00 cm and the concentration was 112 mg/L. Determine the turbidity coefficient of the sample.

Q4) a) What is charge balance equation? Explain how charge balance equation be used for equilibrium calculations with suitable example. **[6]**

b) Attempt the following : **[6]**

i) Take four alphabets K, L, M and N. How many combinations and permutations are possible? All four at a time.

ii) What is the role of conditioning reagent? Explain the method of turbidimetric determination of sulphate in water.

SECTION - II

Q5) a) Attempt any four of the following : **[8]**

i) What are carbon nanotubes?

ii) What is nano aerogel? Give its two applications.

iii) Explain. Why chemisorption is not useful for the particle storage of Hydrogen?

iv) Write the influence of temperature and pressure on storage of Hydrogen.

v) What is electrochemical adsorption of Hydrogen storage?

b) Give an account of semiconductor nanocrystals. **[3]**

Q6) a) Attempt the following: **[6]**

i) Explain the Hydrogen storage capability of buckyball.

ii) Explain the piezoelectric materials with suitable examples.

b) Attempt the following : **[6]**

i) What are different methods of preparation of nanoparticles?

ii) Write a note on smart ceramics.

Q7) a) Attempt the following: **[6]**

i) Write short note on smart polymers.

ii) What are shape memory alloy? Give their applications.

b) Explain in detail the applications of nanoparticles with examples. **[6]**

Q8) a) Attempt the following: **[6]**

i) What are the uses of smart windows and smart glasses?

ii) Explain electric double layer in metal nanoparticles.

b) Explain the role of physisorption in the storage of Hydrogen. **[6]**

Total No. of Questions : 6]

SEAT No. : ____

PC-3771

[Total No. of Pages : 3

[6336]-305

M.Sc. (Part - II)

INORGANIC CHEMISTRY

CCTP - 7 CHI - 330 : Organometallic and Homogeneous Catalysis

(2019 Pattern) (CBCS) (Semseter - III) (4 Credits)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Answer to the two sections should be written in separate answer books.***
3) ***Figures to the right indicate full marks.***
4) ***Neat diagram must be clean wherever necessary.***

SECTION - I

Q1) a) Answer the following : **[8]**

i) Which of the following complexes obey EAN rule?

I) $Fe_2(CO)_9$

II) $CO_2(CO)_8$

(Atomic No. of Fe = 26, CO = 27)

ii) What is Mond's Process?

iii) Give the properties of cyclobutadines.

iv) What heplacities are possible for following ligands?

I) Cyclooctatetraene

II) C_6H_6

b) Explain with the help of suitable example the role of organometallic compound as a protecting agent. **[3]**

Q2) a) Answer any One of the following : **[6]**

i) Give an account of synthesis and bonding properties and applications of phosphine compounds.

ii) Give the typical reactions of (η^6-arene) metal derivatives.

b) Answer any two of the following. **[6]**

i) Write a note on schrock curbene.

ii) Explain the organometallic compound as a electrophiles and nucleophiles.

iii) Write short note on triphenyl phosphine.

P.T.O.

Q3) a) Answer any one of the following : **[6]**

i) For the following molecules give the oxidation state of metal, Total Valence Electron (TVE) and No of M-M bonds if any.

I) $Mn_2(CO)_{10}$

II) $CpMn(CO)_3$

III) $CO_2(CO)_8$

ii) Explain the interdependence of inorganic and organometallic material's in the environment.

b) Answer any two of the following. **[6]**

i) What is synergic bonding? Explain with example.

ii) Give Industrial applications of organometallic compounds.

iii) Write short note on bonding in metallic carbonyls.

SECTION - II

Q4) a) Answer the following : **[8]**

i) What is asymmetric catalysis? Explain with suitable example.

ii) Give the basic steps involved in polymerization reaction.

iii) Define chemo selectivity with suitable example.

iv) Give the catalyst used for sharpless & Jacobson epoxitation.

b) Differentiate between Homogeneous and heterogeneous catalysis. **[3]**

Q5) a) Answer any one of the following: : **[6]**

i) What do you mean by C-C bond formation reaction? Discuss mechanism of Heck reaction with the help of catalytic cycle.

ii) Give the limitation of Homogeneous catalysis. Discuss the various attempt made for catalyst-product seperation in Homogeneous catalysis.

b) Answer any two of the following : **[6]**

i) How IR spectroscopy is used for studying Homogeneous catalytic reactions with suitable example.

ii) Metallocene based catalyst are superior for polymerization of olefms. Explain.

iii) Give the importance of 16-18 electron rule in homogeneous catalytic cycle.

Q6) a) Answer any one of the following **[6]**

i) What is metathesis reaction? Discuss different types of metathesis reactions giving suitable example.

ii) Give an account of homogeneous catalysis for synthesis of high value chemicals.

b) Answer any two of the following. **[6]**

i) Discuss oxidative addition reaction with suitable example.

ii) Write a note on influence of attached ligand on catalysts activity and selectivity.

iii) Discuss the catalyst used for liquid phase oxidation reactions.

▽▽▽▽

Total No. of Questions : 6] **SEAT No. :**

PC3772 **[Total No. of Pages : 3**

[6336]-306
M.Sc.- II
INORGANIC CHEMISTRY
CHI-331: Inorganic Reaction Mechanism
(2019 Pattern) (Semester - III)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***All question are compulsory.***
2) ***Neat diagram must be drawn whenever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Answers in the two section should be written in separate answer book.***

SECTION - A

Q1) a) Answer the following. **[8]**

i) Give the main types of inorganic reactions.

ii) Arrange the following complexes according to their increasity order of rate equation. trans $[Co(en)_2Cl_2]^+$ trans $[Co(en)(NH_3)_4Cl_2]^+$, trans $[Co(NH_3)Cl_2]$.

iii) Four coordinated Td or square planar complexes faster than six coordinated oh complexes why?

iv) What are the main characteristics of outersphere electron transfer reactions?

b) Explain in detail the reactions of coordinated ligands. **[3]**

Q2) a) Answer any one of the following.

i) What is base hydrolysis? Explain with suitable example. **[6]**

ii) How isotope labelling technique is useful in studying the mechanism of the reaction? Explain?

b) Attempt the following. **[6]**

i) Describe mercus equaltion in detail.

ii) Polarisation theory of trans-effect.

iii) Discuss SN^2-mechanism in brief.

P.T.O.

Q3) a) Attempt any one of the following. **[6]**

i) Discuss the extent of exchange interaction in the Cu_2O_2 ring system is greater than that in Cr_2O_2 ring system explain.

ii) What is exciated state outersphere reactions & Give their applications?

b) Write a note on (any two) **[6]**

i) HSAB principle

ii) Racemization in coordination compounds.

iii) Electrophillic behaviour of the complex.

SECTION -B

Q4) a) Answer the following. **[8]**

i) What do you mean by quanturm yeild in photochemical reaction?

ii) What is phosphorescence?

iii) What is photochemical reaction? Give example.

iv) What is anation reaction?

b) Attempt the following **[3]**

Describe the phenomenon of fluoresence.

Q5) a) Answer any one of the following. **[6]**

i) Discuss the role of spector ligand in substitution of square planer complexes.

ii) Explain in detail methyl migration reaction.

b) Answer any two of the following. **[6]**

i) Explain Substitution by reversible oxidative addition.

ii) Give an account on non chalant ring forming reaction of coordinated ligands.

iii) Draw and discuss the experimental set up for study of photochemical reaction.

Q6) a) Attempt any one of the following. **[6]**

i) Give an overview about solvolysis of coordinated phosphorous atoms.

ii) Discuss in brief kinetic template effect involving reaction between one donor atom and one non donor atom.

b) Write a short note on any two of the following. **[6]**

i) Chalant ring modifying reactions.

ii) Reductive elimination Reactions.

iii) Halogenation of coordinated nitrogen atom.

❋ ❋ ❋

Total No. of Questions : 6]

SEAT No. :

PC3773

[Total No. of Pages : 3

[6336]-307

M.Sc. - II (Chemistry)

INORGANIC CHEMISTRY

CHI-332 : Bioinorganic and Medicinal Inorganic Chemistry

(2019 Pattern) (Semester-III)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicates full marks.***
3) ***Draw neat diagram wherever necessary.***
4) ***Answer to the two sections should be written in separate answer books.***

SECTION-I

Q1) a) Answer the following. **[8]**

i) Why Mn^{++} is biologically important?

ii) What are Reiske protein?

iii) Explain the structurally important components of Mo containing enzymes.

iv) Why type-I cu-protein are blue in colour?

b) Why transition metals are involved in enzymatic reaction? **[3]**

Q2) a) Attempt any one of the following. **[6]**

i) What are oxidase? Explain it with suitable example.

ii) Give the overall reaction catalysed by molybdenum dependent nitrogenase.

b) Attempt any two of the following. **[6]**

i) Write a note on Adenosylconalamine as a coenzyme.

ii) Draw the structure of vit. B_{12} with its role.

iii) Give the names & functions of any three zinc proteins.

P.T.O.

Q3) a) Attempt any one of the following. **[6]**

i) Give an account of metal clusters in nitrogenase.

ii) Explain the structure & functions of Tyrosinase in detail.

b) Write note on any two. **[6]**

i) Explain Vanadium's Insulin mimetic effect.

ii) Explain O_2 production at four Mn cluster.

iii) Multisite redox enzymes are known in biology. Comment on the hydrogenases in Nickel.

SECTION-II

Q4) a) Attempt the following. **[8]**

i) What are the biological function of four inorganic elements?

ii) Explain the general route to develop the inorganic complex.

iii) Explain the role of ^{89}Sr-chloride as a therapeutic agent for bone cancer treatment.

iv) Enlist platinum based Antitumor agents.

b) Explain the biochemistry & pharmacology of gold complex. **[3]**

Q5) a) Attempt any one of the following. **[6]**

i) What is Intra-cavity & Intra-arterial radiopharmaceuticals.

ii) Why is Tc considered as best nucleous in radiopharmaceuticals?

b) Attempt any two of the following. **[6]**

i) Biological oxidation of phenylalanine in presence of Dopamine-β-mono oxygenase.

ii) What do you mean "metallofoot printing agents". Explain with the help of suitable examples?

iii) Explain the model pathway for reduction and accumulation of vanadium.

Q6) a) Attempt any one of the following. **[6]**

i) Explain with mechanism the reaction catalysed by amine oxidase enzyme.

ii) Explain with the help of suitable diagram the nuclease activity of $[Cu(phen)_2]^+$ complex.

b) Write notes on any two. **[6]**

i) Heart & Brain imaging agents.

ii) A mavandin

iii) Role of lithium isotope in precise localization of lithium on cells/ lithium isotope.

Total No. of Questions : 6]

SEAT No. : ____

PC3774

[Total No. of Pages : 6

[6336]-308

M.Sc. - II

INORGANIC CHEMISTRY

CHI-333(A) : Modern Instrumental Methods in Inorganic Chemistry

(2019 Pattern) (Semester - III)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer to the two sections should be written in two answer books.***
2) ***All questions are compulsory.***
3) ***Figures to the right indicate full marks.***
4) ***Use of logarithm table and calculator is allowed.***

SECTION - I

(Thermal and Spectroscopic Techniques)

Q1) a) Attempt the following : **[8]**

i) Define isothermal TGA

ii) Which electromagnetic radiation used in NMR spectroscopy? Write the frequence range of that electromagnetic radiation.

iii) Write the condition for scaning sample in Auger electron spectroscopy.

iv) What is T.P.D.? Give the applications of T.P.D.

b) Explain ESR spectrum of H-atom. Write the intensity ratio of ESR-spectrum of H-atom. **[3]**

Q2) a) Attempt any one of the following : **[6]**

i) Explain in detail typical thermogram of TGA.

ii) What is miller indices? Draw the miller indices for (100), (101).

b) Attempt any two of the following : **[6]**

i) What is DSC? Explain the working of DSC with suitable example.

ii) Explain the principle of FTIR spectroscopy.

iii) Draw the block diagram of D.T.A.

P.T.O.

Q3) a) Attempt any one of the following : **[6]**

i) Describe the Jablonski diagram and its significance in understanding fluorescence.

ii) Describe the principle of operation of a scientillation counter.

b) Attmept any two of the following : **[6]**

i) State Bragg's equation and explain its significance in X-ray diffraction.

ii) How does T.P.D. differ from other thermal analysis techniques.

iii) What is ESR? Which standard compound used in ESR? What is the g-value for Free electron.

SECTION - II

(Imaging and Analytical Techniques)

Q4) a) Attempt the following : **[8]**

i) What is SEM? Name the detector used in SEM.

ii) What is the primary purpose of cyclic voltammetry?

iii) Write the unit of magnetic moment measurement? Write spin only formulae.

iv) What is Bathochromic shift? Write the range of wavelength used in UV-visible spectroscopy.

b) What is TEM? Draw the schematic diagram of TEM. **[3]**

Q5) a) Attempt any one of the following : **[6]**

i) Why UV-visible spectra is broad? Explain the used of UV-visible spectroscopy toward co-ordination complet (T : $(H_2O)_r]^{3+}$.

ii) Draw the cyclic voltammogram of $k_3[Fe(CN)_6]$ in 0.1m kcl electrolytic solution.

b) Attempt any two of the following : **[6]**

i) How will you differentiate cis-$[Ptcl_2(NH_3)_2]$ and trans - [Pt Cl_2 $(NH_3)_2$] by using 'H-NMR-Spectroscopy.

ii) Explain the applications of flame photometry.

iii) Explain the application of ^{13}C - NMR spectroscopy.

Q6) a) Attempt any one of the following : **[6]**

i) Define magnetic susceptibility? Explain typical hysteresis curve for Ferromagnetic materials.

ii) Write the difference between soft and hard magnets.

b) Attempt any two of the following : **[6]**

i) Write shorts notes on photodegration of dye.

ii) Explain the principle, working and application of flame photometry.

iii) Write the application & uses of XPS.

Total No. of Questions : 6]

PC3774

[6336]-308

M.Sc. - II

INORGANIC CHEMISTRY

CHI-333(B) : Inorganic Magneto and Polymer Chemistry

(2019 Pattern) (Semester - III)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Use of calculator is allowed.***
4) ***Neat diagrams must be drawn wherever necessary.***

SECTION - I

(Inorganic Magneto Chemistry)

Q1) a) Answer the following : **[8]**

i) What is Neel temperature? Give its example.

ii) Give significance of magnetic materials.

iii) Define magnetic susceptibility. Give its unit.

iv) Explain solute-solute magnetic interactions.

b) Explain experimental magnetic moment of the following : **[3]**

i) Mn^{2+} $\mu_{expt.}$ = 4.9 BM At. No. Mn = 25

ii) Fe^{2+} $\mu_{expt.}$ = ~ 5.5 BM At. No. Fe = 26

Q2) a) Answer any one of the following : **[6]**

i) Explain potential energy for high spin cross over complex.

ii) Explain temperature independent paramagnetism.

b) Answer any two of the following : **[6]**

i) Discuss structure and magnetic interactions in spinel.

ii) Explain applications of magnetic materials.

iii) Describe in detail metal - metal exchange interactions.

Q3) a) Attempt any one of the following : **[6]**

i) What do you meant by hard and soft ferrites. Explain interactions in spinels.

ii) Describe experimental set-up for Faraday's method & write advantages & disadvantages of this method.

b) Answer any two of the following : **[6]**

i) Discuss magnetic properties of lanthanides & actinides.

ii) What are mixed valence compounds? Comment on their mangetic behaviour.

iii) What is spin canting? Give it's suitable examples.

SECTION - II

(Inorganic Polymers)

Q4) a) Answer the following : **[8]**

i) Draw the structure of Borazole.

ii) Explain classification of polymers.

iii) Give brief account of silicon rubber.

iv) Explain homopolar inorganic polymer with example.

b) Explain polymeric compounds of nitrogen. **[3]**

Q5) a) Attempt any one of the following : **[6]**

i) Explain catalytic role of inorganic polymers.

ii) Explain preparation, properties & applications of aluminium nitride.

b) Answer any two of the following : **[6]**

i) Write a note on polythiazoles.

ii) Explain in brief boron nitrides.

iii) Discuss about polysiloxanes.

Q6) a) Attempt any one of the following : **[6]**

i) Discuss various applications of inorganic polymers.

ii) Explain steps involved in polymerization process.

b) Answer any two of the following : **[6]**

i) Discuss synthesis & reactions of coordination polymers.

ii) Write a note on SN compounds.

iii) Explain synthesis of vulcanised rubber. Write its applications in different field.

Total No. of Questions : 8]

SEAT No. :

PC-3775

[Total No. of Pages : 5

[6336]-309
M.Sc. - II
ORGANIC CHEMISTRY
CCTP-7 CHO - 350 : Organic Reaction Mechanism and Biogenesis
(2019 Pattern) (Semester - III)

Time : 3 Hours] *[Max. Marks : 70*

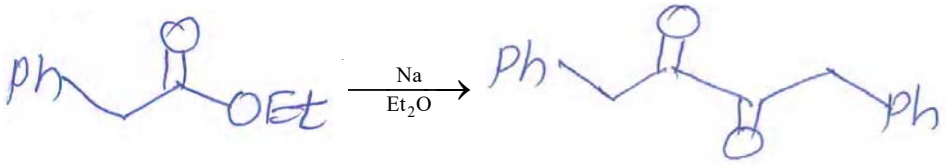
Instructions to the candidates:

1) ***Question 1 and 5 are compulsory and carry 11 marks each.***
2) ***Attempt any two questions from question 2 to 4 and two questions from questions 6-8.***
3) ***Answer to the two sections should be written in separate answer books.***
4) ***Figures to the right indicate full marks.***

SECTION - I

Q1) Attempt the following:

a) Suggest the mechanism for the following. **[5]**

i) 

ii) $CH_3CH = C(CH_3)_2 \xrightarrow[H_2O_2]{HBr} CH_3 - \underset{Br}{CH} - CH(CH_3)_2$

b) Suggest the reagents and explain the mechanism for the following conversions. **[6]**

i) $CH_2 = CH - CH_2 - Br \rightarrow H_2\underset{Br}{C} - CH_2 - \underset{Br}{C}H_2$

ii) 

P.T.O.

Q2) Write short note on <u>any three.</u> **[12]**

a) Isotope Labeling.

b) Taft equation.

c) Factors affecting stability of free radical.

d) Mcmurry coupling.

Q3) Attempt <u>any four</u> of the following. **[12]**

a) Predict the sign of Hammett sigma (σ) constant for the following substituents.

i) P – CH_3

ii) P – CN

iii) P – OH

b) What is autoxidation? Explain with suitable example.

c) The pKa of P - methoxy benzoic acid is 4.49 and benzoic acid is 4.19. Calculate σ for P-MeO.

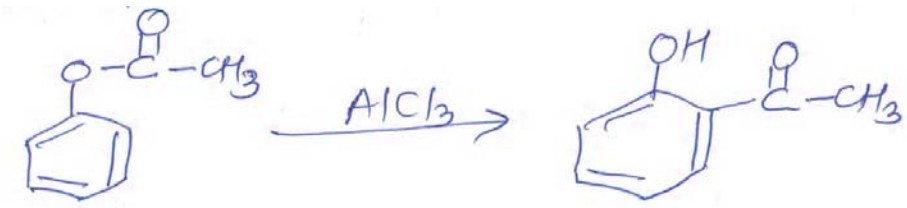
d) What are persistent radicals? Explain with suitable example.

e) What are free radicals? Comment on their stability.

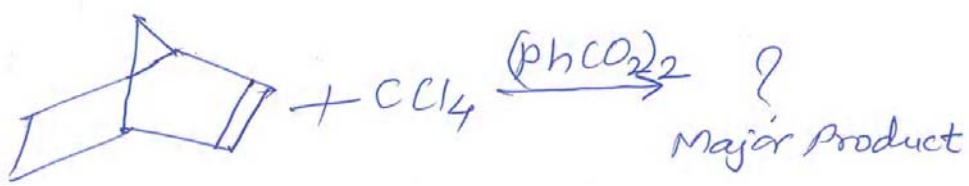
Q4) Attempt any four of the following. **[12]**

a) Explain the significance of σ –(sigma) and ρ (rho).

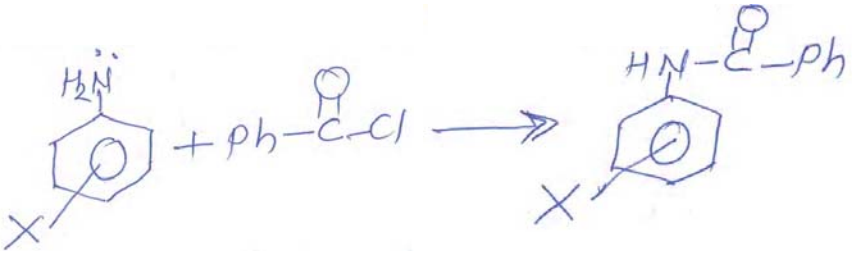
b) Demonstrate the utility of cross over experiment in the investigation of reaction mechanism for the following reaction.



c) Predict the product with mechanism.



d) The benzoylation of m - and p- substituted aniline has ρ = – 2.69. Justify your answer.



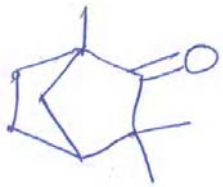
e) Predict the product and explain the mechanism.

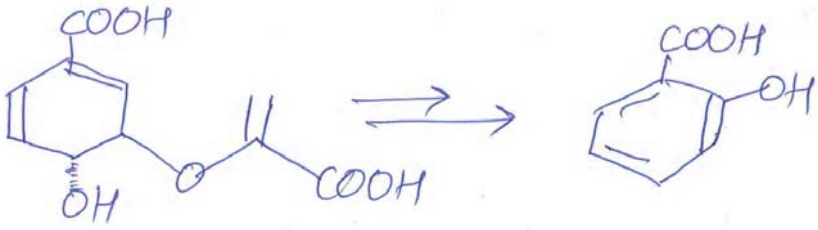
Br CCl_3 + H_2C = CEt_2 $\xrightarrow{hv}$?

SECTION - II

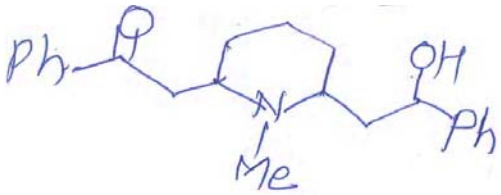
Q5) Attempt the following.

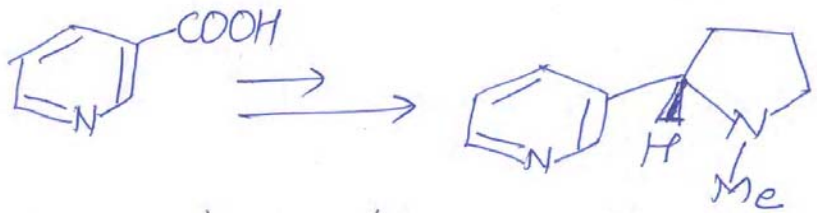
a) Suggest the biogenesis for the following natural products. **[5]**

i) G P P $\longrightarrow$ 

ii) 

b) Complete the given biogenetic conversions. **[6]**

i) L – Lysine $\longrightarrow$ 

ii) 

Q6) Write a short note on <u>any three</u> of the following. **[12]**

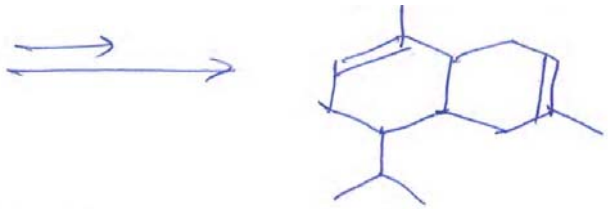
a) Importance of Mannich reaction in the biosynthesis of alkaloids.

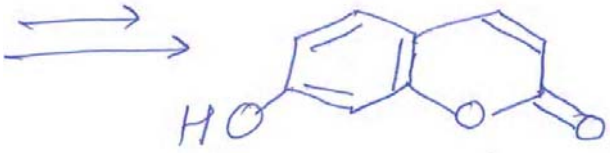
b) Role of 'SAM' in natural product synthesis.

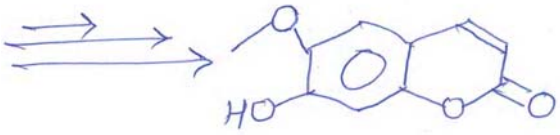
c) Steps involved in the conversion of acetyl CoA to Mevalonic acid.

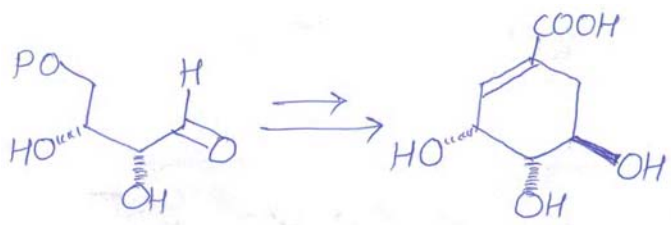
d) Irregular monoterpenoides

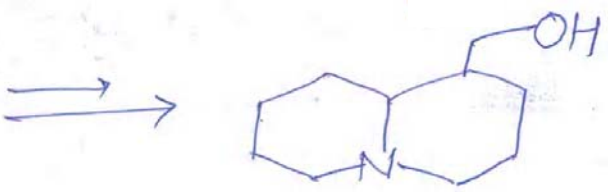
Q7) Complete the following biogenesis (any four) **[12]**

a) F P P 

b) Phenyl alanine 

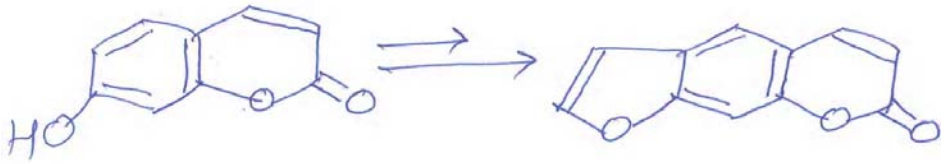
c) Cinnamic acid 

d) 

e) L-Lysine 

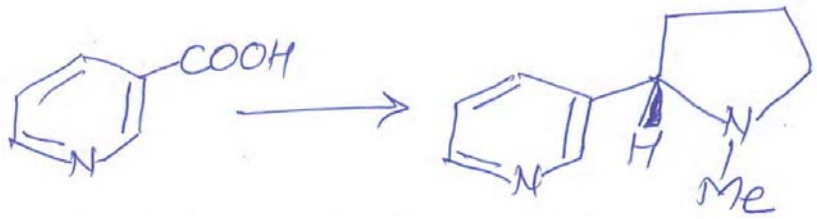
Q8) Attempt <u>any four</u> of the following. **[12]**

a) Complete the following biogenesis.



b) Write a short note on 'Cyclo addition reaction in piperine'

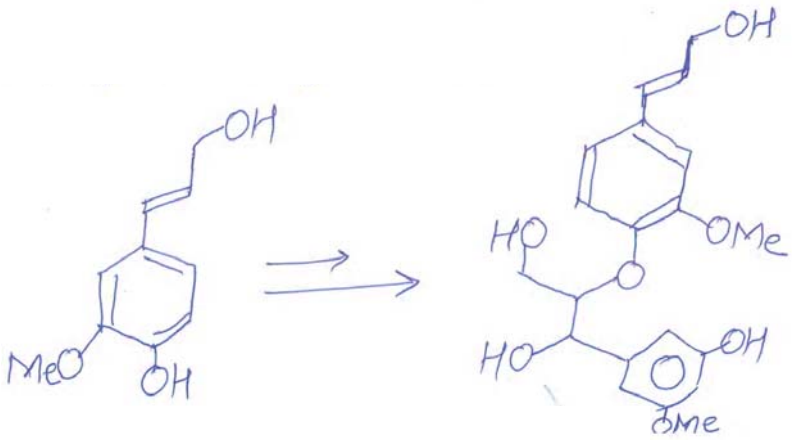
c) Complete the given biogenesis.



d) Indicate the position of lable in each step and in the final product.

$$CH_3-\overset{O}{\overset{\|}{C}}-SCoA \xrightarrow{\rightarrow} NPP$$

e) Complete the give biogenesis.



Total No. of Questions : 8]

SEAT No. : ____

PC3776

[Total No. of Pages : 9

[6336]-310
M.Sc. - II
ORGANIC CHEMISTRY
CCTP - 8, CHO - 351 : Structure Determination of Organic Compounds by Spectroscopic Methods
(2019 Pattern) (Semester - III)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Q.1 and Q.5 are compulsory and carry 11 marks each.***
2) ***Attempt any two questions from Q.2 to Q.4 and any two questions from Q.6 to Q.8.***
3) ***Answers to the two sections should be written in separate answer books.***
4) ***Figures to the right indicate full marks.***

SECTION - I

Q1) a) Discuss advantages of 2d spectroscopic techniques. **[3]**

b) Deduce the structure of the following compound from the data given. Justify your assignment. **[4]**

MF : $C_5H_{10}O$

CMR	DEPT-I	DEPT-II
18	up	-
41	up	up
67	up	-
116	down	-
141	up	up

c) Analyse the following spectral data and arrive to a correct structure. **[4]**

Molecular Ion peak = M^+ (m/e = 130); Base peak = 115

CMR : 20^o (s); 75 (s); 54(t); 50 (q); 33(q); 25(q) str.

PMR : 1.3(s) 30mm; 2.2 (s)15mm; 2.5(s) 10mm 3.6(s) 15mm

P.T.O.

Q2) Write a short note. (Any three) **[12]**

a) Concept of NOE

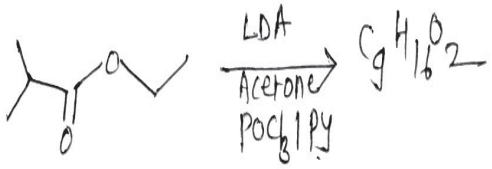
b) DEPT and APT

c) Lanthanide shift reagents

d) Factors affecting spin-spin coupling

Q3) Attempt any three of the following. **[12]**

a) Deduce the structure and Justify.



CMR : 13.9 (Q) str. 19.8 (Q), 24.4 Q), 47.5(s), 60.1(t) 110.2(t), 147.7(s); 176.3(s)

PMR : 1.12(s)6H, 1.2(t)7.4Hz3H, 1.62(s)3H 4.07(Q)7.4Hz2H, 4.76(s)2H

b) MF : $C_6H_8Cl_2O_2$

PMR : 1.45 (d) 12Hz 1H, 1.60(s)3H, 2.29 (d) 12Hz 1H 3.77 (s)3H

CMR : 18, 31, 35, 53, 63, 170

DEPT 90 : No peak

DEPT 135 : 18 & 53 (up), 31 (down)

Deduce the structure from given data

c) M.F. : $C_5H_{10}O_3$

IR : 1728 cm^{-1}

^1H NMR : 2.1 (s) 3H, 3.35 (s) 6H, 4.6 (s) 1H

CMR	DEPT 90	DEPT 135
25	ab	up
55	ab	up
104	up	up
204	ab	ab

Deduce the structure from given data.

d) The COSY and HETCOR spectra of the compound z(C_4H_8O) exhibit the following data.

Its CMR (DEPT-135) show -ve peaks.

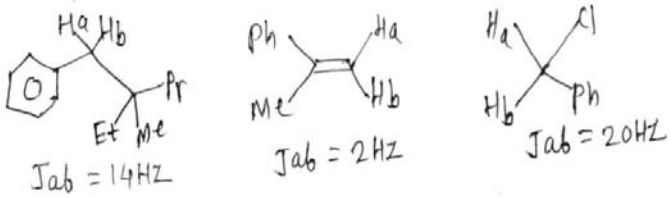
Analyse the data and arrive at correct structure.

COSY : $3.8 \rightarrow 1.7$ HETCOR : $3.8 \rightarrow 64$

$1.7 \rightarrow 3.8$ $1.7 \rightarrow 32$

Q4) Attempt any four of the following. **[12]**

a) Explain Jab for the following compounds.

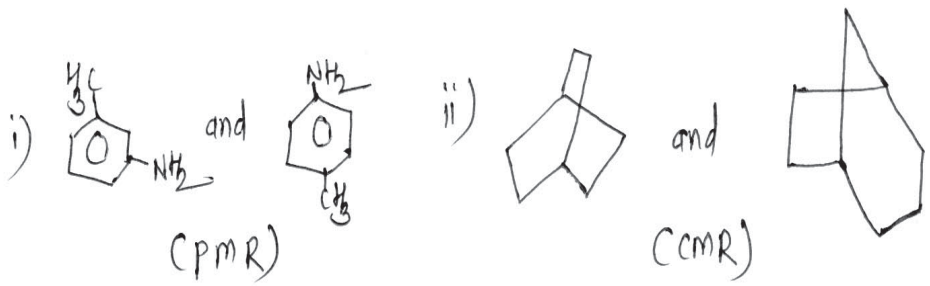


b) $(CD_3)_2SO$ shows five lines in ^{13}CMR at 40.1 ppm : Explain.

c) Why the PMR spectrum of EtoH Shows broad singlet for OH.

d) However the signal disappears on addition of D_2O. Write note on types of coupling.

e) How will you distinguish between following pairs by using indicated spectral technique.

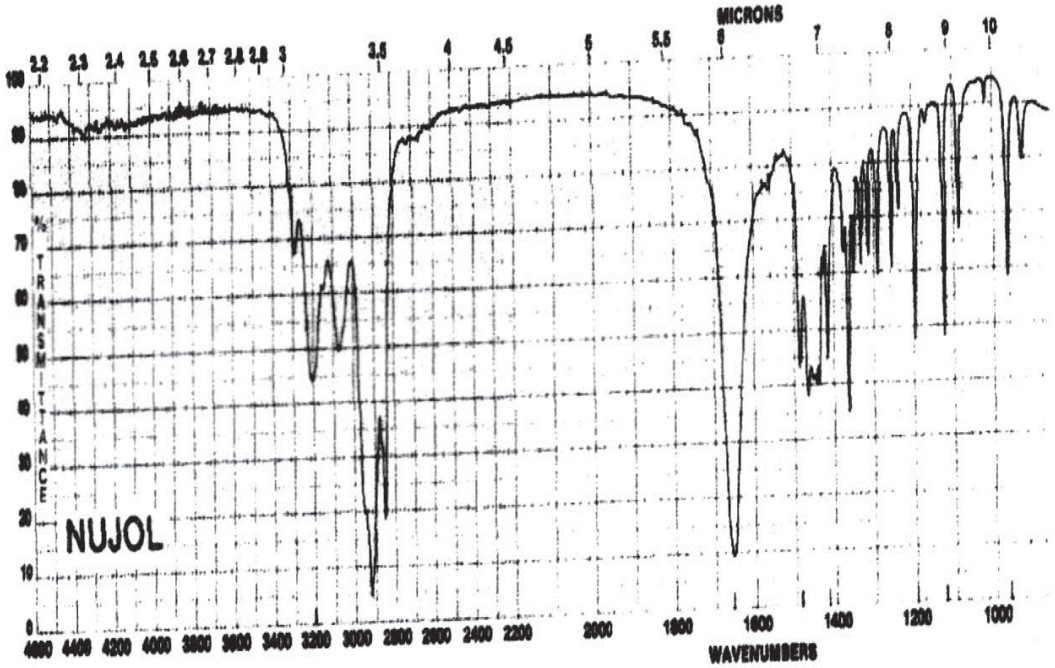


SECTION - II

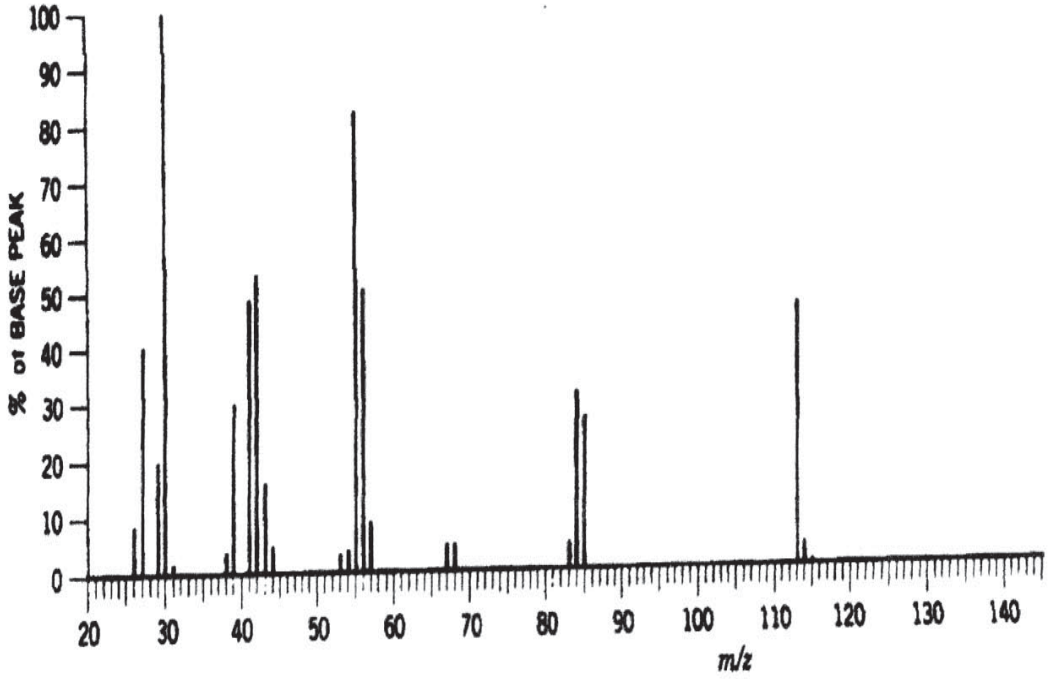
Q5) The spectra of unknown compound are given below. Analyse the spectra and use the data to arrive at a structure. **[11]**

Note :- students are instructed to interpet and attach the extra copy of spectra provided with question paper with answer sheet.

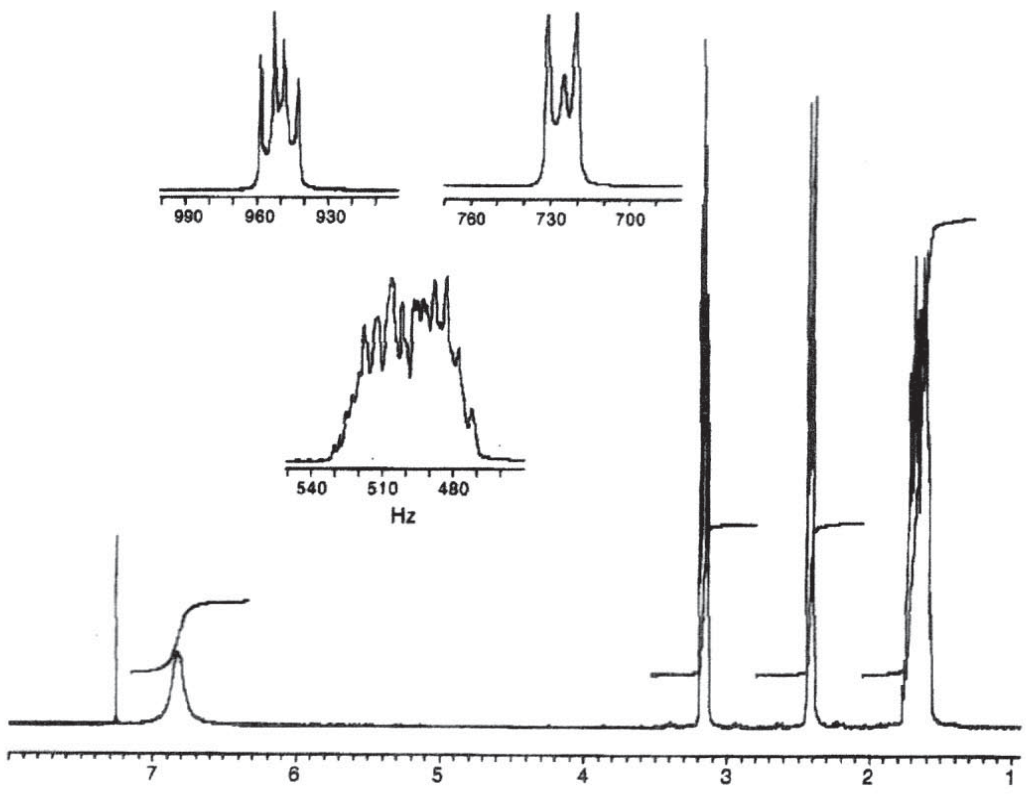
IR


MICRONS
2.2 2.3 2.4 2.5 2.6 2.7 2.8 2.9 3 3.5 4 4.5 5 5.5 6 7 8 9 10
% TRANSMITTANCE
NUJOL
4800 4400 4200 4000 3800 3600 3400 3200 3000 2800 2600 2400 2200 2000 1800 1600 1400 1200 1000
WAVENUMBERS

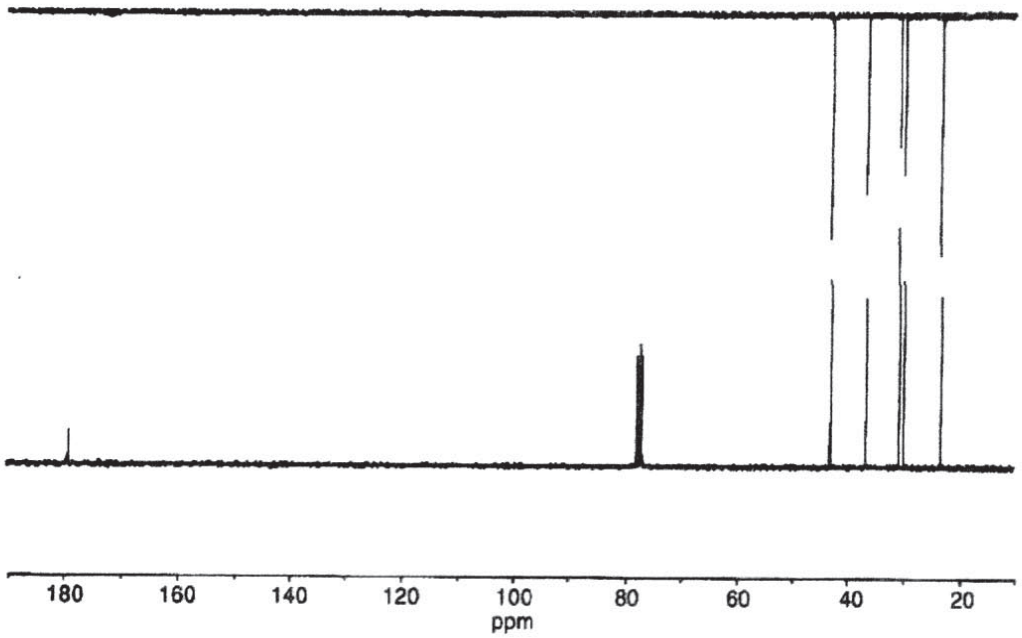
MASS


% of BASE PEAK
100 90 80 70 60 50 40 30 20 10 0
20 30 40 50 60 70 80 90 100 110 120 130 140
m/z

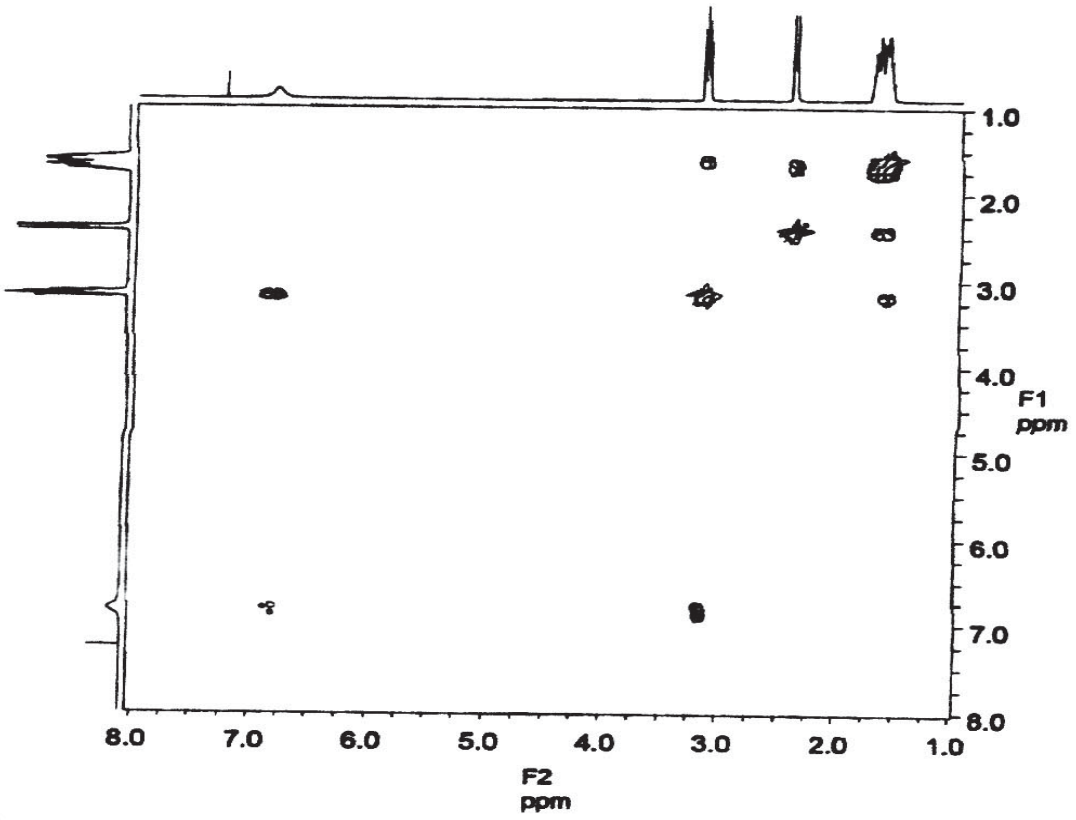
^{1}H NMR



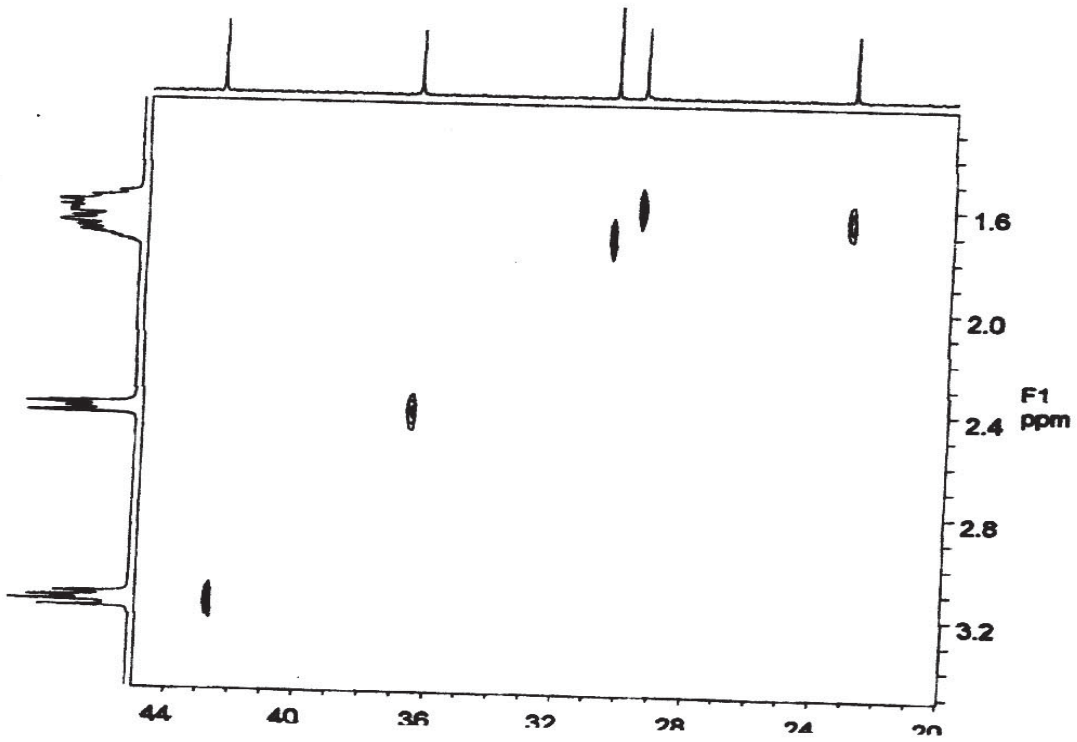
^{13}C/DEPT



COSY

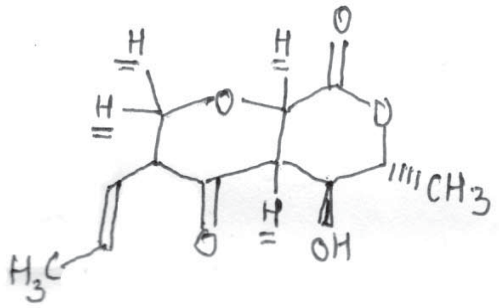

1.0
2.0
3.0
4.0
F1
ppm
5.0
6.0
7.0
8.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
F2
ppm

HETCOR


1.6
2.0
F1
ppm
2.4
2.8
3.2
44
40
36
32
28
24
20

Q6) a) The PMR of compound A shows following signals. Assign signals to different protons using decoupling experiment. Justify your answer. **[6]**

[Note -underlined protons are not given]



1.65 (3H, d, J = 7Hz)

1.97 (3H, dd, J = 1.5 and 7Hz)

3.86 (1H, bs, exch)

3.92 (1H, d, J = 5 Hz)

4.32 (1H, dq, J = 5 and 7 Hz)

5.87 (1H, d, J = 2Hz)

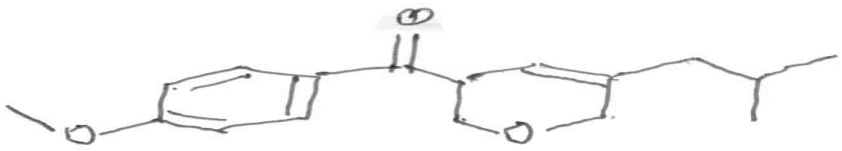
6.06 (1H, ddq, J = 1,1.5 and 16 Hz)

6.99 (1H, dq, J = 6 and 16 Hz)

Spin decoupling experiment-

	Irradiation at	change at
i)	6.06	5.87(s)
		1.97 (d, J = 7Hz)
		6.99 (q, J = 6Hz)
ii)	3.92	4.32 (q, J = 7Hz)

b) Assign the given chemical shift to various carbon of the following structure. **[6]**



23.6 (q), 28.5 (d), 42.9 (t), 47.4 (d)

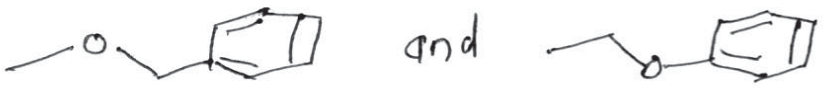
55.9 (q), 70.8 (t), 71.2 (t), 114.2 (d)

119.8 (d), 129.1 (s), 129.8 (d), 133.4 (s)

165.1 (s), 195.3 (s)

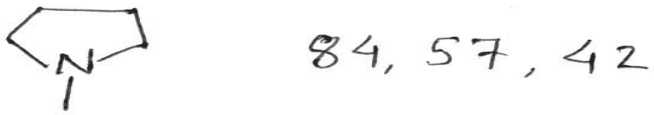
Q7) Attempt any four of the following. **[12]**

a) Differentiate the following by mass spectrometry.

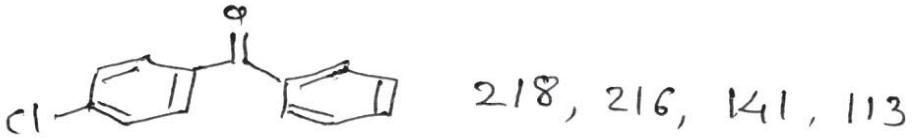


b) Differentiate the following by mass spectrometry.

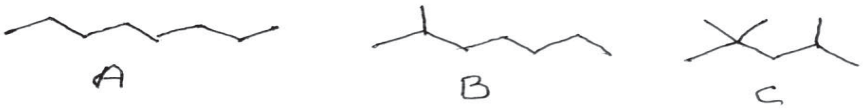
c) Write the genesis of the ions given below.



d) Write the genesis of the ions given below.



e) Mass spectral data for one of the three structures A, B and C is given below. Identify the structure consistent with given mass spectral data.



mass (m/2) = 114, 99,71,70, 57, 43 (100%)

Q8) Attempt any three of the following. **[12]**

a) M^+ intensity decreases in order of cyclic > acyclic > branch

Explain.

b) Write short note on Time of flight mass analyser.

c) Mass spectroscopy can be used to determine number of chlorine and bromine atom in organic compounds. Explain.

d) Suggest the structure of the compound based on following data and explain genesis of ions.

M.F. : $C_9H_{10}O_2$

Mass m/2 : 150, 108 (100%), 91,77,73

❋ ❋ ❋

Total No. of Questions : 8]

SEAT No. :

PC3777

[Total No. of Pages : 5

[6336]-311

M.Sc. - II

ORGANIC CHEMISTRY

CHO-352 : Stereochemistry and Asymmetric Synthesis of Organic Compounds

(2019 Pattern) (Semester-III)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Question 1 and Q.5 are compulsory.***
2) ***Attempt any two questions from 2 to 4.***
3) ***Attempt any two questions from Q.6 to Q.8.***
4) ***Answers to the two sections should be written in separate answer books.***
5) ***Figures to the right indicate full marks.***

SECTION-I

Q1) a) Answer the following. **[5]**

i) Draw the correct stereostructures of Cis and Trans decalin. Comment on their stability.

ii) Reduction of cyclobutanone by $NaBH_4$ is much easier than cyclooctanone. Explain.

b) Write a note on Felkin-Anh model. **[3]**

c) Draw the stable conformation of stereostructure of ψ tropine and 1, 4 ditert-butyl cyclohexane. **[3]**

Q2) Attempt any three of the following. **[12]**

a) Discuss the stereochemistry of hydrindane comment on its conformational flexibility, stability and optical activity.

b) Write a short notes on tacticity.

c) What is racemization and racemic resolution? Explain with suitable examples.

d) Draw planar and perspective structures of Cis-Syn-Cis (Meso) perhydrophenanthrene.

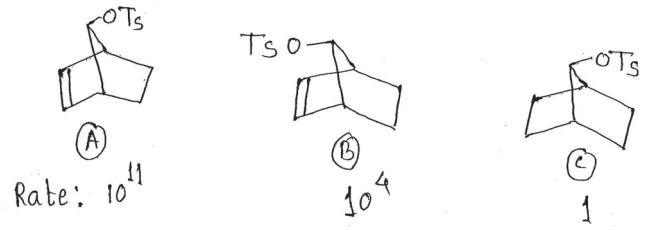
P.T.O.

Q3) Give reasons. (any four) **[12]**

a) Trans (e,e)-2-amino cyclohexanol undergoning compression to give cyclopentane carboxyaldehyde on reaction with HNO_2 while Cis(a,e) forms cyclohexanone.

b) In 6-membered ring usually the reactions involving change in hybridization from SP^2 to SP^3 are more favoured than SP^3 to SP^2.

c) The observed rate of solvolysis for Ⓐ,Ⓑ, &Ⓒis as follows. Explain and justify your answer.

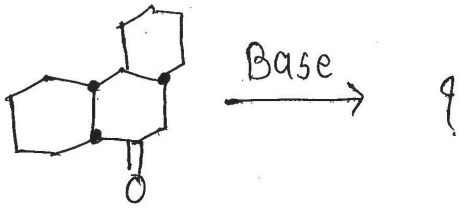


d) Neomenthyl chloride undergoes base catalysed elimiantion abour 200 time faster than menthyl chloride.

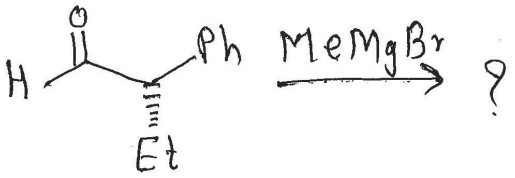
e) Twistane has four stereocentres but it only exists as two enantiomers.

Q4) Predict the product/s. Justify your answer by giving mechanism and stereochemical principles involved in it. (any four) **[12]**

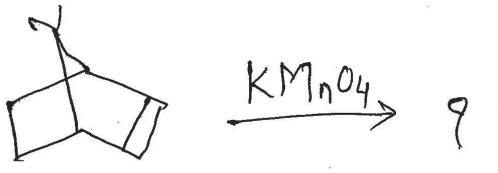
a)



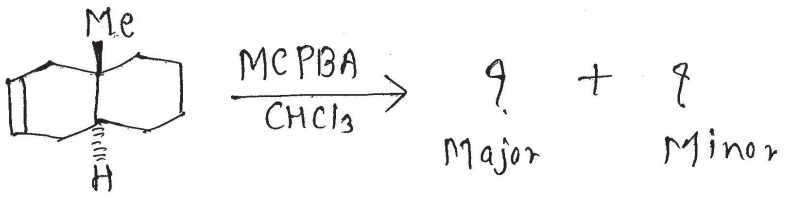
b)



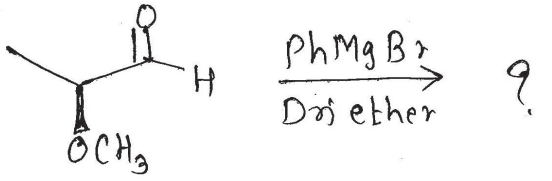
c)



d)



e)



SECTION-II

Q5) a) Answer the following. **[8]**

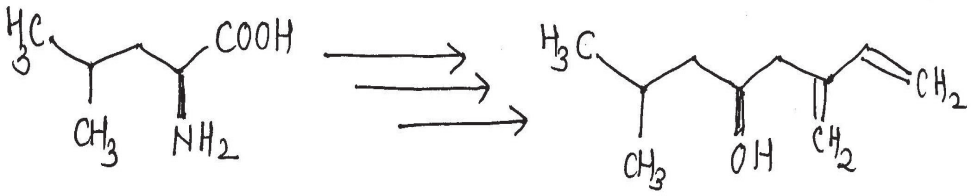
i) With the help of suitable example, explain the term 'Diastereoselectivity'.

ii) Explain the steps involved in the asymmetric synthesis using chiral auxiliary.

iii) With the help of suitable example, explain the condition for formation of E-enolate.

iv) Give any two applications of Chiral Borane in asymmetric reduction reactions.

b) Complete the following conversion. **[3]**



Q6) a) Answer the following (any two) **[6]**

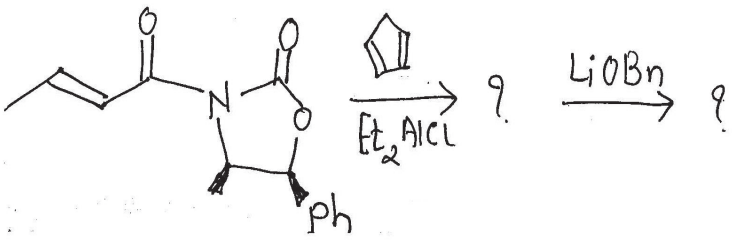
i) Explain the selectivity involved in asymmetric reduction of ketone by using CBS reagent.

ii) Explain the selectivity involved in sharpless asymmetric dihydroxylation reactions.

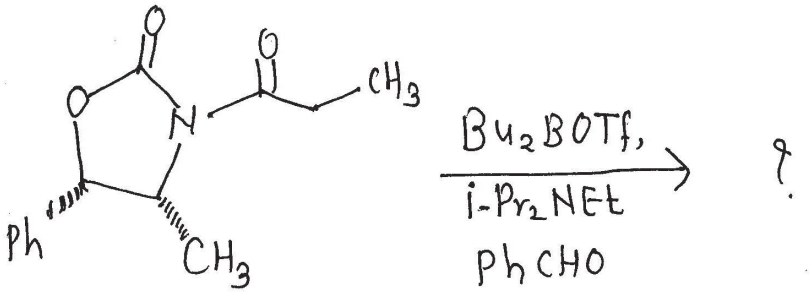
iii) With the help of suitable example, explain the Jacobsen-Katsuki epoxidation.

b) Predict the product (s) and justify the mechanism. **[6]**

i)



ii)



Q7) a) Answer the following. (Any two) **[6]**

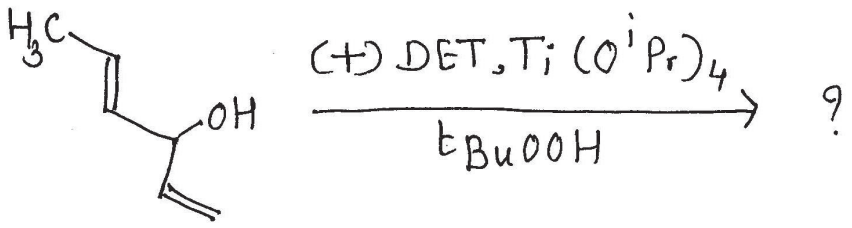
i) Explain the term Enantiometic excess and diastereometic excess with suitable examples.

ii) What is 'Chiral pool' approach in asymmetric synthesis? Explain with suitable example.

iii) Explain any two applications of BINAL-H in asymmetric reduction reactions.

b) Predict the product (s) and justify the mechanism. **[6]**

i)



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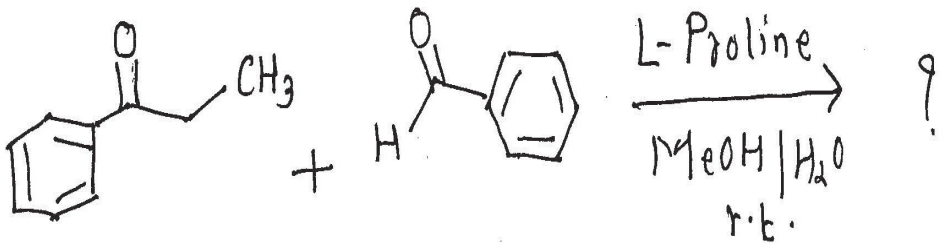


Q8) a) Answer the following. (Any two) **[6]**

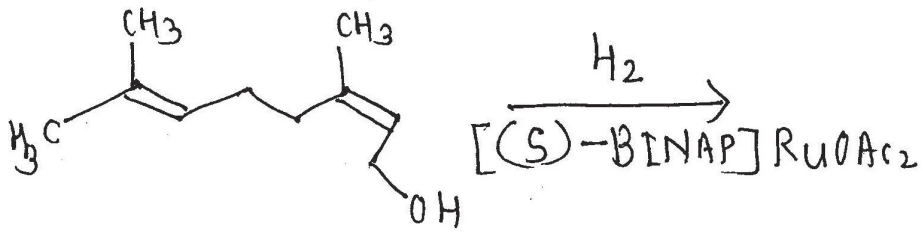
i) Explain the terms:

1) Stereotopic faces

2) Stereotopic ligands

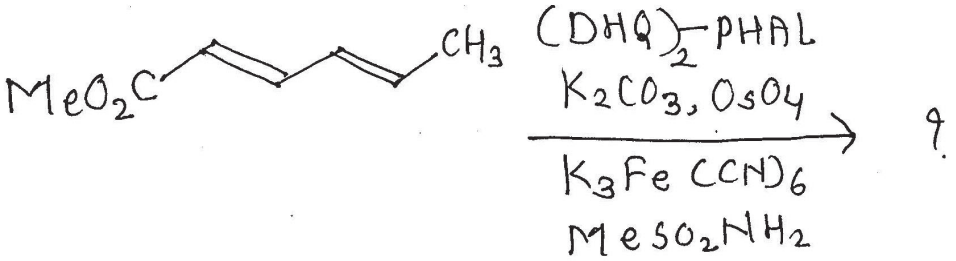
ii) Explain the Zimmerman-Traxler transition state structures for the aldol reaction of transenolate with achiral aldehyde.

iii) Predict the product in the following conversion and explain the stereochemistry.



b) Predict the product (s) and justify the mechanism. **[6]**

i)



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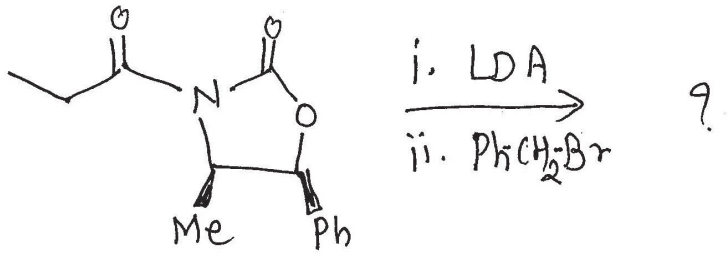

Total No. of Questions : 8]

SEAT No. :

PC3778

[Total No. of Pages : 9

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M.Sc. - II

ORGANIC CHEMISTRY

CHO-353(A) : Protection - Deprotection Chiron Approach and Carbohydrate Chemistry

(2019 Pattern) (Semester - III)

Time : 3 Hours] *[Max. Marks : 70*

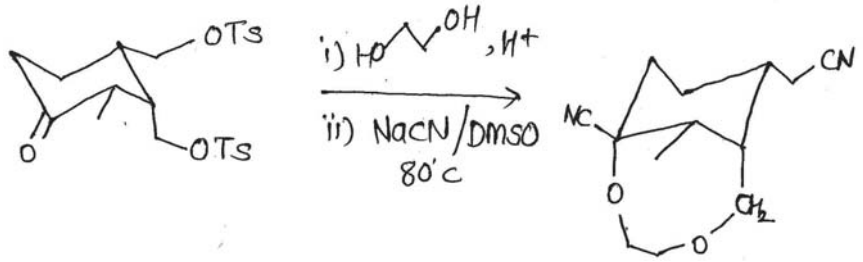
Instructions to the candidates:

1) ***Q.1 & Q.5 are compulsory and carry 11 marks each.***
2) ***Attempt any two questions from Q.2 to Q.4 and two questions form Q.6 to Q.8.***
3) ***Answer to the two sections should be written in separate answer books.***
4) ***Figures to the right indicate full marks.***

SECTION - I

Q1) a) Suggest the mechanism **[6]**

i)



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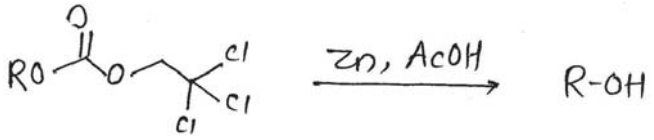


b) Explain in details the synthesis of (R) and (S). Epichlorohydrin using chiron approach concept. **[5]**

Q2) Attempt any three of the following : **[12]**

a) Explain role of protection deprotection in solid phase peptide synthesis.

b) Write a note on MOM and MEM protection in organic synthesis.

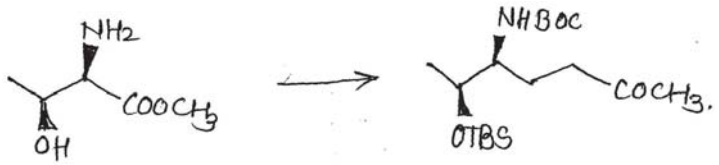
c) Write importance of chiral precursors for organic synthesis with examples.

d) What is amino-sugar? Enlist the protection methods for formation of amino-sugar.

P.T.O.

Q3) Attempt the following : **[12]**

a) Arrange the reagents sequentially with all intermediate in the following conversions.

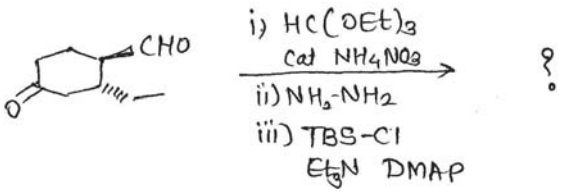


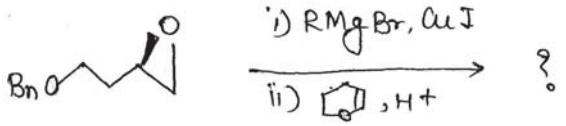
$Ph_3PCHCO_2CH_3$; TBSCl; Swern oxidation ; H_2 Pd/c ; $(BOC)_2O$, $NaHCO_3$; $LiBH_4$, EtOH.

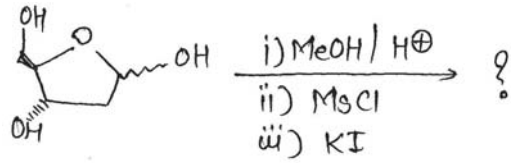
b) Outline the following synthesis with mechanism

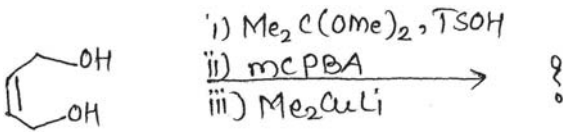
c) Explain the synthesis of (S) - propenedial from D-mannitol.

Q4) Prdict the product/s with mechanism. **[12]**

a) 

b) 

c) 

d) 

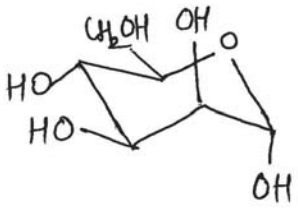
SECTION - II

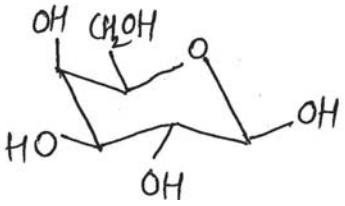
Carbohydrate Chemistry

Q5) a) Attempt the following : **[6]**

i) Draw open structure and hemiacetal structure of D-fibose.

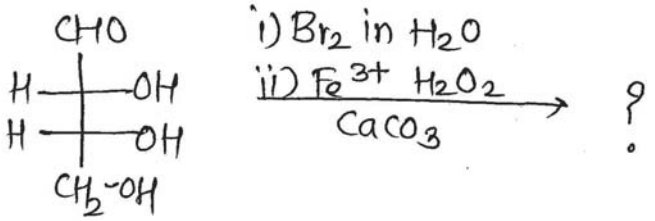
ii) Identify the following Hexoses.





b) Predit the products/s **[5]**

i)



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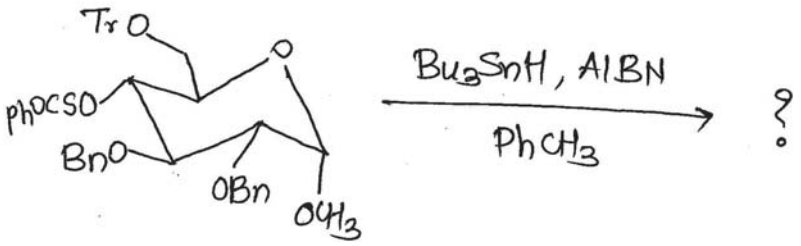


Q6) Write a short note (Any three) **[12]**

a) Glycosylation in carbohydrate chemistry.

b) Step up synthesis of monosaccharides.

c) Alkylation of reducing sugars.

d) Synthesis of polysaccharides.

Q7) Attempt the following : **[12]**

a) Specific rotation of D-glucose changes over several hours until reaching +52.5°, explain.

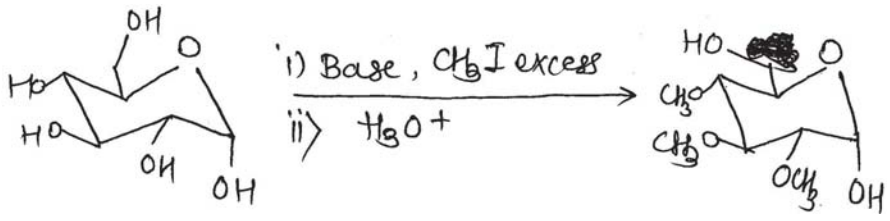
b) Explain reactivities of hydroxy group in glucose with examples.

c) Explain the participation of group at C_2 in formation of 1, 2 - trans and cis glycoside bond.

d) What is glucoconjugates? Explain one method for synthesis of glucoconjugate.

Q8) Suggest the mechanism. **[12]**

a)



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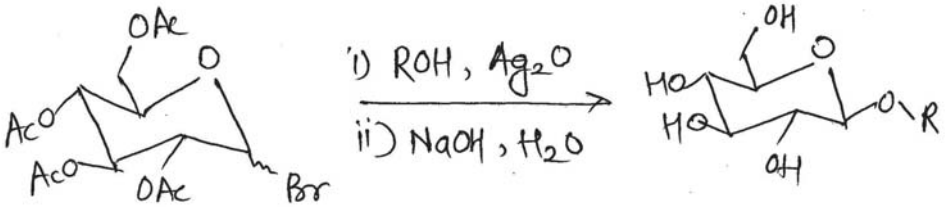

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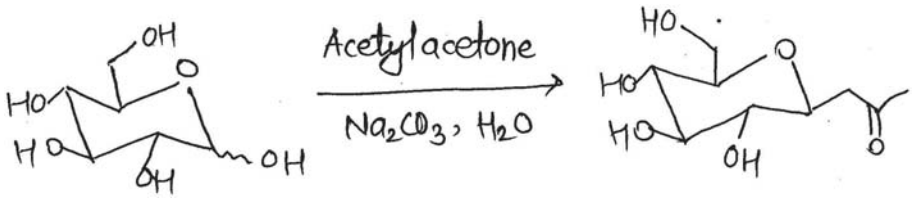

Total No. of Questions : 8]

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M.Sc. - II

ORGANIC CHEMISTRY

CHO-353(B) : Designing Organic Synthesis and Heterocyclic Chemistry

(2019 Pattern) (Semester - III)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Q.1 & Q.5 are compulsory and carry 11 marks each.***
2) ***Attempt any two questions from Q.2 to Q.4 and two questions form Q.6 to Q.8.***
3) ***Answer to the two sections should be written on separate answer books.***
4) ***Figures to the right indicate full marks.***

SECTION - I

Q1) a) Answer the following (Any two) **[6]**

i) Write the synthetic equivalent for following synthons with suitable examples.

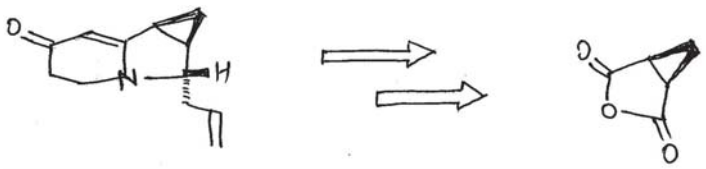
$\overset{\ominus}{C}OOH$ & $\overset{\oplus}{C}H_2 - CH_2 - OH$

ii) Explain reversal of carbonyl group polarity with example.

iii) Write disconnection methods for 3, and 4-membered rings.

b) Suggest the retrosynthetic analysis & strategy for following intermediates. **[5]**

i)



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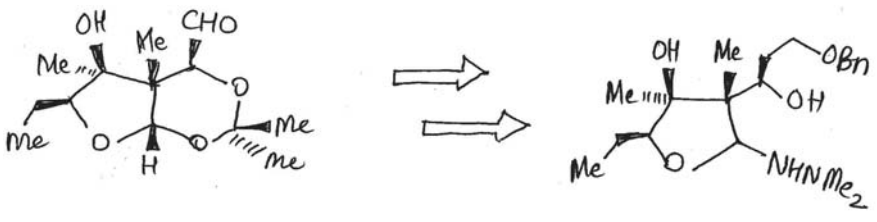
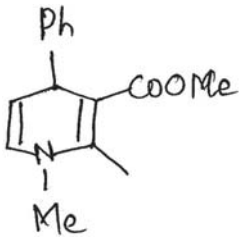
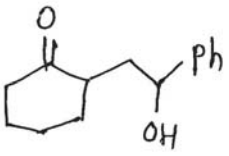
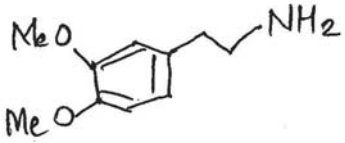
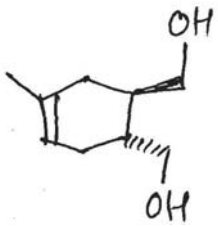


Q2) Using retrosynthetic analysis, suggest suitable method for the synthesis of following compounds (Any three) **[12]**

a) 

b) 

c) 

d) 

Q3) Attempt the following : **[12]**

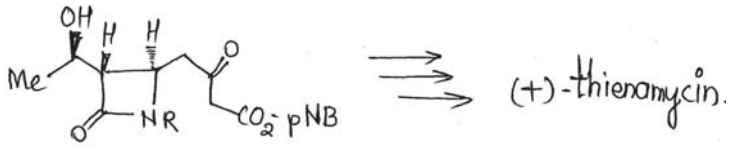
a) Explain the used of FGI in disconnection approach with two functional groups.

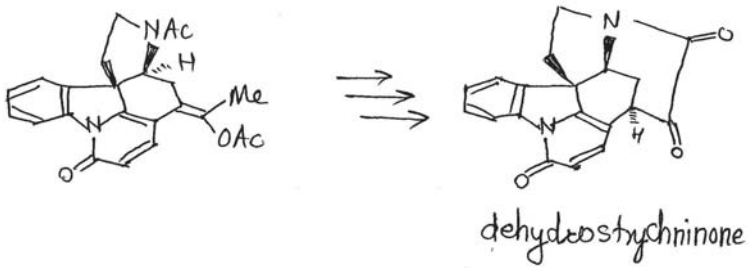
b) Explain illogical disconnection in α-hydroxy carbony compounds.

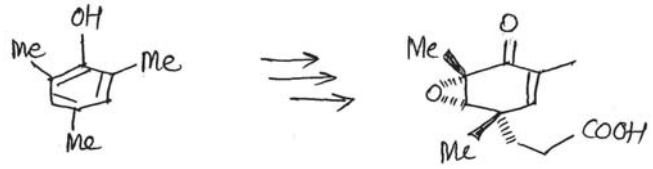
c) Draw the structure of (±) reserpic acid lactone and (–) reserpine.

d) Explain stereoselective functionalizations of furan - aldehyde photoadducts in synthesis of Asteltoxin.

Q4) Outline the steps involved in the following synthetic sequences. Indicate the reagents used and discuss the stereochemistry involved. **[12]**

a) 

b) 

c) 

SECTION - II

Q5) a) Answer the following : **[6]**

i) How are 1, 3 dicarbonyl compound used for synthesis of isoxazole and pyrazole.

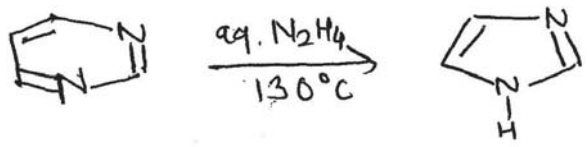
ii) Name the following heterocycles using

1) Recognized trivial names.

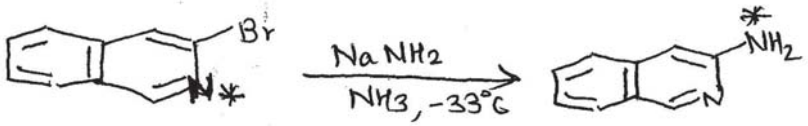
2) By systematic Hantzsch - widman nomen clature.

b) Suggest a suitable mechanism for the following : **[5]**

i)

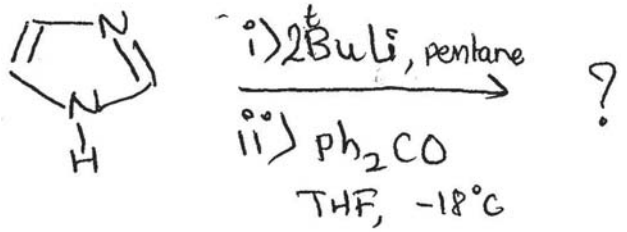


ii)



Q6) Predit the product with a mechanism. **[12]**

a)



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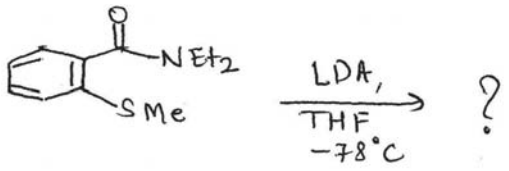

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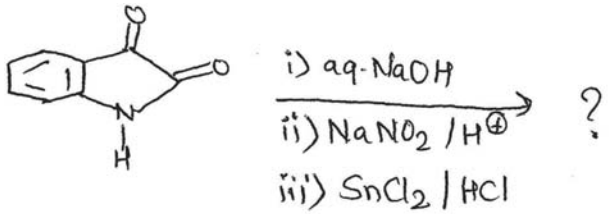

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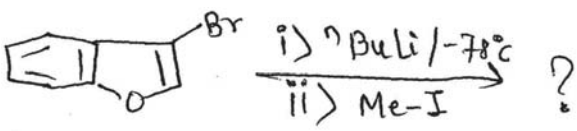


Q7) Answer the following : **[12]**

a) Explain Fischer synthesis with a suitable example.

b) Give any one method for the preparation of isoxazole and pyrimidine.

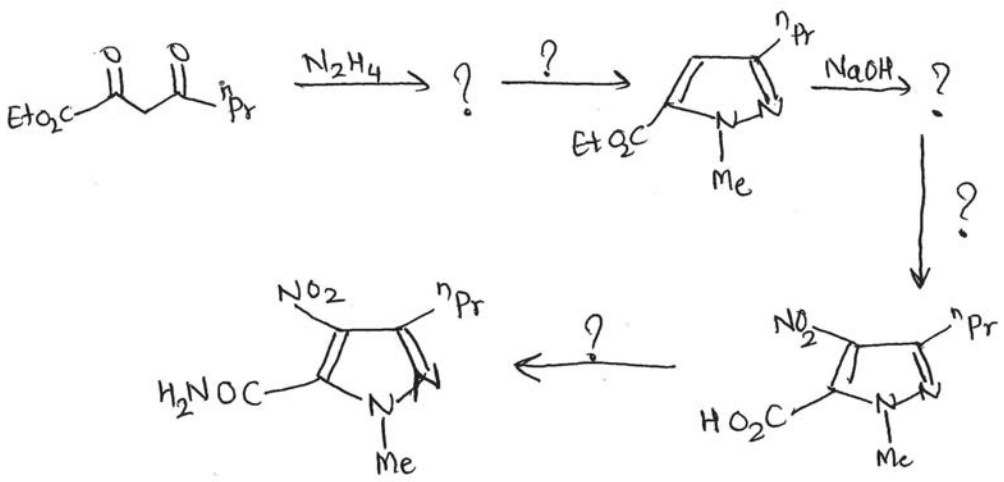
c) Explain two different types of reactions in benzothiazoles.

Q8) a) Answer the following : **[6]**

i) Why isoxazole is less basic thanoxazole.

ii) Write the structure & uses of Omeprazole, Nicotin & Cilostazol.

b) Complete the following reaction sequence and write the structure & reagents. **[6]**



Total No. of Questions : 8]

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PC-3779

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M.Sc. - II

ANALYTICAL CHEMISTRY

CHA - 390 : Electrochemical and Thermogravimetric Methods of Chemical Analysis

(Revised 2019) (Semseter - III) (4 Credits)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Question 1 and 5 are compulsory.***
2) ***Question 2 to 4 and question 6 to 8 carry equal marks.***
3) ***Solve any two questions from 2 to 4 and any two from 6 to 8.***
4) ***Figures to the right indicate full marks.***
5) ***Use of log table and calculator are allowed.***
6) ***Answers to two sections should be written on separate answer sheet.***

SECTION - I

Q1) a) Solve any four of the following : **[8]**

i) Give the analytical principle of polarography?

ii) State and explain the Faraday's second law of electrolysis?

iii) Explain the analytical significance of half wave potential and diffusion current using polarogram.

iv) Differentiate between cathodic peak potential and anodic peak potential in cyclic voltammetry.

v) The pulse voltammetric techniques are more sensitive than classical DC polarography? Explain.

b) In a polarographic analysis, a 2.0×10^{-3} M of zinc chloride in a 0.1m KCl solution shows the diffusion current of 45.0 μA at –0.4 V versus SCE. The mercury is dropping at a rate of 80 drops per 5.0 minute. The 100 drops of mercury are collected and found weight 0.379 grams. Calculate the diffusion coefficient at Zinc ion. **[3]**

P.T.O.

Q2) a) Attempt the following : **[6]**

i) Draw the ideal cyclic voltamogram for reduction oxidation of ferric-ferrous system in a 0.1m KCl solution, and explain why cathodic peak current and anodic peak current are equal for this redox reaction.

ii) Explain the different analytical applications of cyclic voltammetry.

b) Attempt the following : **[6]**

i) Distinguish between controlled-potential coulometry and controlled current coulometry.

ii) A nicotinamide adenine dinucleotide (NAD^+) was assayed by coulometry by reduction to its dimer $(NAD)_2$

$2NAD^+ + 2e \rightarrow (NAD)_2$

The area under the current-time curve for reduction of 25.0 ml aqueous solution of NAD^+ is 84.3 m A.min. Calculate the concentration of NAD^+ in the sample (1F = 96500C).

Q3) a) Attempt the following : **[6]**

i) What is hydrodynamic voltammetry? What are the differential ways of performing the hydrodynamic voltammetry.

ii) Explain the polorographic method of determination of dissolved oxygen in sample solution.

b) Attempt the following : **[6]**

i) What is pulse voltammetry? Explain the potential sweep program applied in differential pulse voltammetry.

ii) What is coulometry? Explain the applications of potentiostatic coulometry.

Q4) a) Attempt the following : **[6]**

i) Give the analytical applications of anodic stripping voltammetry.

ii) What is polarogram? Explain its use for qualitative and quantitative analysis in polarography.

b) Attempt the following :

i) Give construction and working of 'Clark Oxygen Sensor'. **[6]**

ii) A 5.0 ml sample solution of Zn (II) ion produces 15.6 μA diffusion current on DC polarogram. By adding 3.5ml of 1.00×10^{-3}M Zn (II) solution to above solution, the new diffusion current is 38.4 μA. Calculate the concentration of Zn (II) ion in sample solution.

SECTION - II

Q5) a) Solve any four of the following : **[8]**

i) What DSC can measure.

ii) What this Symbol Signifies Tg?

iii) Define thermomechanical analysis.

iv) Write various changes conclude from peaks observed in DTA.

v) Explain term polymer blends.

b) A thermogram of a magnesium compound shows a loss of 89.0 mg from a total of 180.0 mg used for analyse. Identify the compound either as MgO, $MgCO_3$ or MgC_2O_4. **[3]**

Q6) a) Attempt the following : **[6]**

i) Write a note on 'Heat flux DSC'.

ii) Write a note on 'TG-MS'.

b) Explain any three factors affecting results of thermal methods. **[6]**

Q7) a) What is thermogravimetry? Explain instrumentation of thermogram. **[6]**

b) Answer the following : **[6]**

i) A sample of 6.68mg of high purity Indium gave a peak of area 21.94 cm^3. Calculate calorimetric sensitivity constant at 150°C.

ii) Write a note on dielectric thermal analysis.

Q8) a) Attempt the following : **[6]**

i) Explain study of high alumina cement by DTA method.

ii) Explain detection and identification of evolved gas by EGA.

b) Answer the following : **[6]**

i) Write a note on thermomicroscopy

ii) Explain Power compensate DSC system.

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Total No. of Questions : 8]

SEAT No. :

PC3780

[Total No. of Pages : 3

[6336]-314
S.Y.M.Sc.
ANALYTICAL CHEMISTRY
CHA - 391 : Analytical Method Development and Extraction Techniques
(Revised 2019 Pattern) (Semester - III)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Question 1 and 5 are compulsory.***
2) ***Questions 2 to 4 carry equal marks.***
3) ***Solve any 2 questions from 2 to 4 and solve 2 questions from 6 to 8.***
4) ***Figures to the right indicate full marks.***
5) ***Use of logarithmic tables and scientific calculator is allowed.***

SECTION - I

Q1) a) Solve any four of the following. **[8]**

i) Define precision.

ii) What is random error?

iii) What is revalidation?

iv) What is single point calibration.

v) What is slope and intercept.

b) With a suitable diagram describe the USP Type III dissolution apparatus. **[3]**

Q2) a) Explain in detail:- **[6]**

i) Robustness and ruggedness.

ii) Explain the role of documentation and communication in method transfer.

b) i) Write a note on interlaboratory qualification process. **[6]**

ii) In an analysis of a sample of Pronze the expected percentage of Tin is 11% The values obtained by three analysis are 10.5% 12.1% and 12.5% Estimate the absolute error, relative error and percentage error.

P.T.O.

Q3) a) Discuss the factors affecting the dissoution process. **[6]**

b) What is an error? Discuss in detail the types of errors. **[6]**

Q4) a) Give an account of ICH guidelines and their categories. **[6]**

b) i) Who are the members (Cosponsors) of ICH? **[3]**

ii) A standard containing 1-6 ppm of nitrate nitrogen was treated with colorizing agents to give an absorbance of 0.22 at 507nm. A sample treated in the same manner gave an absorbance of 0.16 at the same wavelength. Determine the concentration of nitrate nitrogen in this sample. **[3]**

SECTION - II

Q5) a) Attempt the following any four. **[8]**

i) What are the function of the SPME holder.

ii) Enlist factors affecting SPE

iii) What are the important variables in SPE?

iv) Give conditions for selection of an organic solvent for MAE.

v) Draw a schematic of the layout of a typical pressurized fluid extraction system.

b) For a given system, calculate the percent extracted for a volume ratio $\frac{V_a}{V_o}$ of (i) 1 and (ii) $\frac{1}{10}$ for a single extraction. [Given :- D = 10] **[3]**

Q6) a) Attempt the following. **[6]**

i) Explain in detail determination of copper as the diethyl dithio carbamate complex.

ii) Explain in detail:

1) Batch extractions and

2) Continuous extractions

b) Attempt the following. **[6]**

i) Calculate the milligrams of Fe^{3+} left unextracted from 100ml of a solution having 200 milligrams of Fe^{3+} and in 6m HCL after three extractions with 25ml ethyl ether. The value of D for this extraction is 150.

ii) Give any one applications of Ion exchange SPE.

Q7) a) Attempt the following. **[6]**

i) Draw a schematic diagram of pressurised MAE and explain its working.

ii) Give factors affecting on SPE.

b) Attempt the following. **[6]**

i) Draw a schematic diagram of soxhlet extraction processes & explain its principle of operation.

ii) Discuss the stages of SPE technique.

Q8) a) Attempt the following. **[6]**

i) Explain in detail headspace SPME.

ii) Describe stir-bar sorptive extraction.

b) Attempt the following. **[6]**

i) Describe practical aspects of sampling water.

ii) Describe SPME-GC applications in the analysis of pesticides in aqueous sample.

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Total No. of Questions : 8]

SEAT No. :

PC3781

[Total No. of Pages : 3

[6336]-315

M.Sc. - II

ANALYTICAL CHEMISTRY

CHA-392 : Advanced Chromatographic Methods of Chemical Analysis

(Revised 2019 Pattern) (Semester-III)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Write answers of two sections on two separate answer books.***
2) ***Q. 1 and Q.5 are compulsory. Solve two questions from 2 to 4 and two questions from Q.6 to Q.8.***
3) ***Use of log table and calculator is allowed.***
4) ***Figures to the right indicate full marks.***

SECTION-I

Q1) a) Solve any four of the following. **[8]**

i) What is HETP? Give equation for calculation of HETP.

ii) What is probability based matching in GC-MS?

iii) What do you mean by retention factor.

iv) What are supercritical fluids?

v) What is selective ion monitoring in GC-MS?

b) Gas chromatographic analysis of hydrocarbons was carried out using 20 m length column at gas velocity 37 cms^{-1}. Retention times for octane and decane are observed at 2.53 and 4.75 min, having $W_{½}$ 0.28 and 0.55 min respectively. Then calculate retention factor for both and selectivity factor. **[3]**

Q2) a) Explain in detail. **[6]**

i) Steps in interpretation of mass spectra

ii) Chemical ionization in MS.

b) Answer the following. **[6]**

i) Write a note on selected ion monitoring.

ii) Give application of GC-MS.

P.T.O.

Q3) a) Draw the schematic diagram of gas chromatograph and explain function of each component in detail. **[6]**

b) Answer the following. **[6]**

i) What is m/z ratio? What is the use of m/z ratio in interpretation of ms with suitable example.

ii) Explain the term deactivation of surfaces.

Q4) a) Explain estimation of phenols and organochlorine pesticides by LLC-GC method. **[6]**

b) Answer the following. **[6]**

i) Write note on kinetic theory of chromatography.

ii) Explain any one mass analyser in detail.

SECTION-II

Q5) a) Answer any four of the following. **[8]**

i) What is the principle of siz exclusion chromatography?

ii) What is the role of Guard column in HPLC.

iii) If a sample containing mixture of polar and non-polar substances is passed through a reverse phase column, which component will elute first? Justify your answer.

iv) What is the function of interface in LC-MS instrument?

v) Draw a neat labelled diagram of UV-detector.

b) A standard solution of caffeine of 5gl lit is prepared. It gives a peak area of 6000. The sample containing caffeine gives a peak of 3700. Calculate calibration factor and amount of caffeine in given sample. **[3]**

Q6) a) i) What is derivatization? Describe pre and post derivatisation in HPLC. **[3]**

ii) Explain refractive index detector in HPLC. **[3]**

b) Discuss the following. **[6]**

i) Preparation of mobile phase in HPLC.

ii) Chemically modified silica phases in HPLC.

Q7) a) Describe working of short strok piston pumps. How quantitative analysis is done using HPLC? **[6]**

b) Write a short note on following. **[6]**

i) Super critical fluid chromatography

ii) Applications of LC-MS

Q8) a) Explain principle of ion exchange chromatography. What are different types of ion exchangers. **[6]**

b) Discuss the following.

i) Chiral chromatography **[3]**

ii) Thermospray interface **[3]**

Total No. of Questions : 8]

SEAT No. : ____

PC3782

[Total No. of Pages : 7

[6336]-316

M.Sc. - II

ANALYTICAL CHEMISTRY

CHA-393(A) : Bioanalytical Chemistry

(Revised 2019 Pattern) (Semester - III)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Question No. 1 and Question No. 5 are compulsory.***
2) ***Answer to two sections should be written on separate answer sheets.***
3) ***Solve any two questions from Q.2 to Q.4 and any two questions from Q.6 to Q.8.***
4) ***Figures to right indicate full marks.***
5) ***Use of log tables and calculator is allowed.***

SECTION - I

Q1) a) Solve any four from the following : **[8]**

i) Write the characteristics of electrophoretic system.

ii) What is zone electrophoresis?

iii) Write principle of TLC.

iv) Give general aspects of Injection system.

v) State the Lambert - Beer law.

b) Write a note on UV-visible absorbance detection in capillary electrophoresis. **[3]**

Q2) a) Attempt the following : **[6]**

i) What is isoelectric Focus?

ii) Write a note on electroosmosis.

b) Discuss fluorescence detection in capillary electrophoresis and spectral distribution in HPTLC plate. **[6]**

P.T.O.

Q3) a) Answer the following : **[6]**

i) Write a short note on planar chromatography.

ii) Derive equation for electrophoretic mobility.

b) Explain in detail fluorescence detection. **[6]**

Q4) a) Answer the following : **[6]**

i) Write a note on cellulose acetate as support media in electrophoresis.

ii) Explain general aspects of quantitative and qualitative analysis.

b) Explain in detail factors affecting on electrophoretic mobility. **[6]**

SECTION - II

Q5) a) Attempt any four of the following : **[8]**

i) What is preservative? Enlist blood preservatives.

ii) Draw the structure of vitamin B.

iii) Define antigen.

iv) Why 24hr urine is collected for clinical Analysis?

v) What are water insoluble vitamins? Give two examples.

b) Unknown blood sample of patient were analysed for urea content by DAM method; the absorbance of sample is 0.110 and absorbance of standard is 0.115. Calculate the concentration of urea in sample.

[Given : - Conc. of standard urea is 50 μg/mL] **[3]**

Q6) a) Discuss the following : **[6]**

i) Oral glucose tolerance test.

ii) Serum urea determination by urease method.

b) Answer the following : **[6]**

i) Explain in detail determination of glucose by glucose oxidase method.

ii) Explain the determination of Riboflavin from biological sample by photofluorometric method.

Q7) a) Explain the following : **[6]**

i) Explain colorimetric method for the determination of serum phosphate level.

ii) What is the function of immune system? Explain innate and adaptive immunity in detail.

b) Answer the following : **[6]**

i) Explain in detail collection of Blood sample.

ii) State the principle and explain the procedure for determination of Ketone bodies in blood sample.

Q8) a) Explain in detail the various steps involved in solid phase of ELISA technique. **[6]**

b) Answer the following : **[6]**

i) Explain in detail the Fluorimetric method for determination of Xanthuric acid.

ii) Blood glucose level was analysed by enzymatic method. 100µlit. 1.8g/l glucose standard is treated with colouring agent displayed absorbance of 0.260. Similarly 100µlit. blood sample is treated, displayed 0.180. Calculate Conc. of glucose in g/l.

Total No. of Questions : 8]

PC3782

[6336]-316

M.Sc. - II

ANALYTICAL CHEMISTRY

CHA-393(B) : Analytical Methods of Food and Controlled Substances

(Revised 2019 Pattern) (Semester - III)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Q.1 & Q.5 are compulsory.***
2) ***Solve any two questions from Q.2 to Q.4 and any two questions from Q.6 to Q.8.***
3) ***Figures to the right indicate full marks.***
4) ***Answers to both sections should be written on separate answer book.***
5) ***Use of scientific calculator is allowed.***

SECTION - I

Q1) a) Attempt any four of the following : **[8]**

i) What factors affect the selection of a specific sampling plan in food analysis.

ii) What are the reasons for determining the ash content in food?

iii) What are monosaccharides?

iv) When is it essential to conduct protein analysis?

v) Write the principal involved in the determination of benzoic acid from food.

b) Analysis of FAME by GC gave the following areas for identified peaks

FAME	peak area (AU)
A	1182738
B	2853369
C	14344172

Calculate the % composition of each fatty acid. **[3]**

Q2) a) Outline an analytical method for the determination of saponification value of oil. A 1.5gm oil sample of saponification value 300 mg KOH was Saponified using 0.5N KOH. The blank titration reading was 25ml of 0.5N HCl. Find the quantity of alcoholic KOH consumed by the oil per gm. **[6]**

b) i) Define Ash value. Give the method for the determination of sulphated ash. **[3]**

ii) Explain phenol - sulphuric acid method. **[3]**

Q3) a) What are food preservatives? Discuss the classification of food preservatives with example. A food sample containing sulphite as preservative (25 gm) was subjected to Tanner method and the titre value obtained with 0.01m NaOH was 8.5 ml. Calculate the amount of SO_2 present in the sample. **[6]**

b) i) What is moisture assay? Discuss the importance of moisture assay. **[3]**

ii) What are proteins? Write the principal of Dumas method for proteins. **[3]**

Q4) a) Explain the terms -

i) Essential Amino acid Index

ii) Lysin Availability.

If nitrogen retained, nitrogen absorbed and nitrogen intake by the rat was 2.84 mg, 2.22mg and 9.30mg respectively. Calculate NPU, Digestibility and BV. **[6]**

b) i) Explain the selection of sampling procedure in food analysis. **[3]**

ii) Discuss the importance of dietary fibre. **[3]**

SECTION - II

Q5) a) Attempt any four of the following : **[8]**

i) Write the structure of cathinone and cathine.

ii) What are glandular trichomes?

iii) Write the Gold Chloride Test.

iv) What is LSD?

v) Define

1) Addict

2) Opium poppy

b) TLC was used to separate components in a drug sample. The distances travelled by the solvents and the samples B_1, B_2 and B_3 were 9cm, 2.5cm, 3.9cm and 6.5cm respectively. Calculate the R_f value of each sample.**[3]**

Q6) a) Discuss any one presumptive test for diacetylmorphine. A sample of diacetylmorphine was analysed by LC method. It gave following observations -

C_s = 4.3µg/ml P_x = 6.4, A_x = 4.7, P_s = 4.3, A_s = 7.6 calculate C_x of diacetylmorphine. **[6]**

b) i) Discuss the general procedure for chemical colour tests. What are its limitations. **[3]**

ii) Explain - Dille - Koppanyi's test. **[3]**

Q7) a) Discuss the quantification of cocain by GCMS. **[6]**

b) i) Discuss the origin, sources and manufacture of cannabis. **[3]**

ii) A drug sample of LSD was extracted with $CHCl_3$. The $CHCl_3$ extract was analysed for its LSD content using GCMS and the observations are as follow -

LSD (μg/ml)	Peak area ratio (AU)
50	1101
100	1210
150	1333
200	1445
250	1562
Sample	1225

Determine the amount of LSD in the sample. **[3]**

Q8) a) Discuss the Marqui's Test for amphetamines. An amphetamine is estimated by using GC and the sample shows a peak height of 50 mAUmin. while the peak height of the standard solution having concentration of 4.5μg/ml is 65 mAUmin. Calculate the concentration of amphetamine in the sample. **[6]**

b) i) Write a note on TLC analysis of mescaline. **[3]**

ii) What are benzodiazepines? Write the structure of alprazolam and clorazepate. **[3]**

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Total No. of Questions : 8]

SEAT No. : ____

PC3783

[Total No. of Pages : 4

[6336]-401
M.Sc. (Part - II)
PHYSICAL CHEMISTRY
CCTP-10, CHP-410 : Molecular Structure & Spectroscopy
(2019 Pattern) (Semester - IV) (Credit - 4)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer to the two sections should be written in separate answer books.***
2) ***Question 1 and 5 are compulsory.***
3) ***Answer any 2 questions out of Q2, Q3 and Q4 and any 2 questions out of Q6, Q7 and Q8.***
4) ***Figures to right side indicate full marks.***
5) ***Use of logarithmic table, calculator is allowed.***
6) ***Neat diagrams must be drawn wherever necessary.***

Physico - Chemical Constants

1.	Avogadro Number	N	$= 6.023 \times 10^{23}$ mol^{-1}
2.	Boltzmann Constant	k	$= 1.38 \times 10^{-16}$ erg K^{-1} molecule^{-1}
			$= 1.38 \times 10^{23}$ J K^{-1} molecule^{-1}
3.	Planck Constant	h	$= 6.626 \times 10^{16}$ erg s
			$= 6.626 \times 10^{-34}$ Js
4.	Electronic Charge	e	$= 4.803 \times 10^{-10}$ esu
			$= 1.602 \times 10^{-19}$ C
5.	1eV		$= 23.06$ k cal mol^{-1}
			$= 1.602 \times 10^{-12}$ erg
			$= 1.602 \times 10^{-19}$ J
			$= 8065.5$ cm^{-1}
6.	Gas Constant	R	$= 8.314 \times 10^{7}$ erg K^{-1} mol^{-1}
			$= 8.314$ J K^{-1} mol^{-1}
			$= 1.987$ cal K^{-1} mol^{-1}
7.	Faraday Constant	F	$= 96487$ C equavalent^{-1}
8.	Speed of light	c	$= 2.997 \times 10^{10}$ cm s^{-1}
			$= 2.997 \times 10^{8}$ m s^{-1}
9.	1 cal		$= 4.187 \times 10^{7}$ erg
			$= 4.187$ J
10.	1 amu		$= 1.673 \times 10^{-24}$ kg
11.	Bohr Magneton	β_e	$= -9.274 \times 10^{-24}$ J T^{-1}
12.	Nuclear Magneton	β_n	$= 5.051 \times 10^{-27}$ J T^{-1}
13.	Mass of an electron	m_e	$= 9.11 \times 10^{-31}$ kg

P.T.O.

SECTION - I

Q1) a) Attempt any four of the following : **[8]**

i) Distinguish betwen δ and τ chemical shift scales.

ii) What is spin coupling?

iii) Define Kramer's degeneracy.

iv) Discuss the factor affecting 'g' value.

v) What is quadrupole moment?

b) Predict the nature of esr spectra of $^{14}NH_3$ and $^{15}NH_3$. **[3]**

Q2) a) Attempt the following : **[6]**

i) Explain the advantages of TMS.

ii) State the principle of esr and explain it.

b) Attempt the following : **[6]**

i) Discuss the term spin Hamiltonian in esr spectroscopy.

ii) Give the application of NQR.

Q3) a) Describe the instrumentation used in NQR spectroscopy with suitable diagram. **[6]**

b) Attempt the following: **[6]**

i) Write a note on ^{19}F Spectroscopy.

ii) Explain the concept of electric field gradient.

Q4) a) Explain the application of NMR in various fields with example. **[6]**

b) Attempt the following : **[6]**

i) Distinguish between ^{13}C NMR and ESR spectroscopy.

ii) Calculate the frequency separation of nuclear spin state in ^{13}C nucleus with magnetic field 14.4 T. The magnetogyric ratio is $6.73\times10^7\ T^{-1}S^{-1}$. (I = ½ for ^{13}C)

SECTION - II

Q5) a) Attempt any four of the following : **[8]**

i) State and explain Langevin equation.

ii) Explain the term paramagnetic susceptibility.

iii) What is XRD pattern for a FCC unit cell.

iv) What is scattering intensity in electron diffraction?

v) Give the two major limitation of electron diffraction technique.

b) Calculate the typical wavelength of neutron that have reached thermal equillibrium with their surrounding at 373K (Given : mass of neutron = 1.675×10^{-27} kg). **[3]**

Q6) a) Attempt the following : **[6]**

i) Describe the phase problem in XRD and explain how it may be overcome.

ii) Discuss any three applications of x-ray diffraction technique.

b) Attempt the following : **[6]**

i) Discuss how you would use the systematic absence of reflection in the diffraction pattern to distinguish between the three type of cubic Bravais lattices.

ii) At 25°C, the molar magnetic susceptibility of water is -13×10^{-6} $cm^3\ mol^{-1}$ and its density is 0.9970 gcm^{-3}. Calculate the specific magnetic susceptibility of water at this temperature.

Q7) a) Attempt the following : **[6]**

i) Write a note on Ferro and Antiferromagnetism.

ii) Explain neutron diffraction analysis method for structure elucidation of magnetically order unit cell with suitable example.

b) Attempt the following : **[6]**

i) What is mean by structure factor? How it is related to intensity of diffracted radiation?

ii) Explain low energy electron diffraction technique.

Q8) a) Attempt the following : **[6]**

i) Write note on elastic scattering of neutron.

ii) Describe Gouy method for the measurement of magnetic susceptibility.

b) Attempt the following: **[6]**

i) State the principle of neutron diffraction. Explain, how neutron diffraction differs from x-ray diffraction.

ii) The x-ray diffraction of silver, known to crystallize in the cubic system, was obtained using x-ray with wavelength 154.1 Pm. The first six lines occured at the following angles : 19.08°, 22.17°, 32.36°, 38.74°, 40.82° and 49.00°. Determine the type of cubic system.

Total No. of Questions : 5]

SEAT No. :

PC3784

[Total No. of Pages : 3

[6336]-402

M.Sc. - II

PHYSICAL CHEMISTRY

CHP-411 : Surface Chemistry and Electrochemistry

(2019 Pattern) (Semester - IV)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) *Answer to the two section should be written in separate answerbook.*
2) *Questions 1 and 5 are compulsory.*
3) *Answer any 2 questions out of Q.2, Q.3 and Q.4 adn any 2 questions out of Q.6, Q.7 and Q.8.*
4) *Figures to the right indicate full marks.*
5) *Use of logarithmic table, calculator is allowed.*
6) *Neat diagram must be drawn wherever necessary.*

Physico-Chemical Constants

1) Avogadro Number	$N = 6.023 \times 10^{23}$ mol^{-1}
2) Boltzmann Constant	$k = 1.38 \times 10^{-16}$ erg K^{-1} molecule^{-1}
	$= 1.38 \times 10^{-23}$ J K^{-1} molecule^{-1}
3) Planck Constant	$h = 6.626 \times 10^{-16}$ erg s
	$= 6.626 \times 10^{-34}$ J s
4) Electronic Charge	$e = 4.803 \times 10^{-10}$ esu
	$= 1.602 \times 10^{-19}$ C
5) 1 eV	$= 23.06$ k cal mol^{-1}
	$= 1.602 \times 10^{-12}$ erg
	$= 1.602 \times 10^{-19}$ J
	$= 8065.5$ cm^{-1}
6) Gas Constant	$R = 8.314 \times 10^{7}$ erg K^{-1} mol^{-1}
	$= 8.314$ J K^{-1} mol^{-1}
	$= 1.987$ cal K^{-1} mol^{-1}
7) Faraday Constant	$F = 96487$ C equivalent^{-1}
8) Speed of light	$c = 2.997 \times 10^{10}$ cm s^{-1}
	$= 2.997 \times 10^{8}$ m s^{-1}
9) 1 cal	$= 4.187 \times 10^{7}$ erg
	$= 4.187$ J
10) 1 amu	$= 1.673 \times 10^{-27}$ kg
11) Bohr Magneton	$\beta_e = -9.274 \times 10^{-24}$ J T^{-1}
12) Nuclear Magneton	$\beta_n = 5.051 \times 10^{-27}$ J T^{-1}
13) Mass of an electron	$m_e = 9.11 \times 10^{-31}$ Kg

P.T.O.

SECTION - I

Q1) a) Attempt any four of the following : **[8]**

i) Draw the different types of hysteresis loop.

ii) Define the term emulsification.

iii) What is porous solids? Give its examples.

iv) What is capillary condensation?

v) Define adsorption isotherm and explain the terms involved init.

b) Explain the mechanism of chemisorption on metal oxide and semi conductor. **[3]**

Q2) a) Answer the following : **[6]**

i) Explain the volumetric method for measurement of Adsorption.

ii) Discuss the forth flotation technique.

b) Answer the following : **[6]**

i) Describe the porosity meter method of determination of poresize.

ii) Distinguish between physisorption and chemisorption.

Q3) a) Derive and explain Gibb's absorption equation. **[6]**

b) Answer the following : **[6]**

i) Explain tracer method for verification of Gibb's equation.

ii) Describe in detail wetting phenomenon.

Q4) a) Derive the equation for isosteric heat of adsorption. **[6]**

b) Answer the following : **[6]**

i) Explain adsorption behaviour of porous material.

ii) How is Hurkin's Jura equation used to determine the surface area of solid.

SECTION - II

Q5) a) Attempt any four of the following : **[8]**

i) Write a types of electrode.

ii) What is liquid junction potential?

iii) What is electro kinetic phenomenon?

iv) Why does Debye-Huckel limiting law referred as limiting law.

v) Write the Nerst equation and explain the terms in it.

b) What are the advantages of fuel cell. **[3]**

Q6) a) Attempt the following : **[6]**

i) Deduce Debye-Huckel limiting law.

ii) Describe the lithium ion battery.

b) Attempt the following : **[6]**

i) Write a note on tafel plot

ii) Discuss the electrical double layer in detail.

Q7) a) Attempt the following : **[6]**

i) If the tafel constant a and b have values 1.54V and 0.119.V respective for the reduction of hydrogen ion at lead cathod. Calculate the transfer coefficient and exchange current density io at 298K.

ii) Describe lead acid storage battery.

b) Attempt the following : **[6]**

i) Derive the equation for mean activity coefficient for finite size ion.

ii) What is zeta potential?

Q8) a) Attempt the following : **[6]**

i) Calculate the ionic strength of 100ml 0.1m $CuSO_4$ and 200ml of 0.2m NH_4OH solution assuming the complete dissociation takes place.

ii) Derive the tafel equation.

b) Attempt the following : **[6]**

i) Describe the Hydrogen Oxygen cell.

ii) Write Butler-volmers equation and explain the terms involved in it.

Total No. of Questions : 8]

SEAT No. : ____

PC3785

[Total No. of Pages : 7

[6336]-403
M.Sc. - II
PHYSICAL CHEMISTRY
CHP-412 (A) CBOP - 4 : Material Chemistry and Catalysis
(2019 Pattern) (Semester - IV)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer to the two sections should be written in separate answer books.***
2) ***Question 1 and 5 are compulsory.***
3) ***Answer any 2 questions out of Q2, Q3 and Q4 and any 2 questions out of Q6, Q7 and Q8.***
4) ***Figures to the right indicate full marks.***
5) ***Use of logarithmic table, calculator is allowed.***
6) ***Neat diagrams must be drawn wherever necessary.***

Physico - Chemical Constants

1.	Avogadro Number	N	$= 6.023 \times 10^{23}$ mol^{-1}
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3.	Planck Constant	h	$= 6.626 \times 10^{-27}$ erg s
			$= 6.626 \times 10^{-34}$ J s
4.	Electronic Charge	e	$= 4.803 \times 10^{-10}$ esu
			$= 1.602 \times 10^{-19}$ C
5.	1 eV		$= 23.06$ kcal mol^{-1}
			$= 1.602 \times 10^{-12}$ erg
			$= 1.602 \times 10^{-19}$ J
			$= 8065.5$ cm^{-1}
6.	Gas Constant	R	$= 8.314 \times 10^{7}$ erg K^{-1} mol^{-1}
			$= 8.314$ J K^{-} mol^{-1}
			$= 1.987$ cal K^{-1} mol^{-1}
7.	Faraday Constant	F	96487 C equiv^{-1}
8.	Speed of light	c	$= 2.997 \times 10^{10}$ cm s^{-1}
			$= 2.997 \times 10^{8}$ m s^{-1}
9.	1 cal		$= 4.184 \times 10^{7}$ erg
			$= 4.184$ J
10.	1 amu		$= 1.673 \times 10^{-27}$kg
11.	Bohr magneton	β_e	$= - 9.274 \times 10^{-24}$ J T^{-1}
12.	Nuclear magneton	β_n	$= 5.051 \times 10^{-27}$ J T^{-1}
13.	Mass of an electron	m_e	$= 9.11 \times 10^{-31}$ kg

P.T.O.

SECTION - I

Q1) a) Attempt any four of the following : **[8]**

i) What is perovskite ? Give its general stoichiometric formula.

ii) Draw the unit cell diagram of LSCO super conducting cuprate.

iii) Explain the principle of sputtering system.

iv) Which are the steps involve in zone reaction of MOCVD?

v) Write any two advantages of full wave rectifier.

b) Explain the steps involve in preparation of Langmuir-Blodgett films. **[3]**

Q2) a) Attempt the following : **[6]**

i) Explain normal state properties of super conducting cuprate.

ii) Describe IV-V compounds of low dimensional quantum structure.

b) Attempt the following : **[6]**

i) Explain the preparation method of 2-1-4 super conducting cuprate material.

ii) What are the aduantages of sol-gel method for preparation of thin films.

Q3) a) Explain the steps involve in photolithography with the help of suitable diagram. **[6]**

b) Attempt the following. **[6]**

i) State and explain meissner effect.

ii) Draw the coupling modes in hitech materials.

Q4) a) What is elastic constant? Explain different types of elastic constant. **[6]**

b) Attempt the following. **[6]**

i) Distinguish between LTSC and HTSC.

ii) What are the applications of L-B film technique.

SECTION - II

Catalysis

Q5) a) Attempt any four of the following : **[8]**

i) Define autocatalysis.

ii) Write any four characteristics of catalytic reactions.

iii) Explain catalytic poisoning.

iv) Give any Four principles of green chemistry.

v) Write the principle of X-ray photoelectron spectroscopy.

b) Explain the mechanism of photo catalysis on semiconductor. **[3]**

Q6) a) Answer the following : **[6]**

i) Write a note on intermediate compound formation theory of catalysis.

ii) Explain the hydrothermal method of preparation of catalyst.

b) Answer the following : **[6]**

i) State and explain the principle of photocatalysis.

ii) Write a note on catalytic decomposition of ozone.

Q7) a) Answer the following : **[6]**

i) Explain the factors which affects the activity of catalyst.

ii) How is the characterization of catalyst done by using XPS technique?

b) Explain the impregnation method used for preparation of catalyst. **[6]**

Q8) a) Explain the mechanism of heterogenous catalysis proposed by Langmuir and Hinshelwood. **[6]**

b) Answer the the following: **[6]**

i) Write a note on auto-exhaust catalyst.

ii) Discuss the gravimetric method to determine size of the catalyst pore.

* * *

Total No. of Questions : 8]

PC3785

[6336]-403
M.Sc.-II
PHYSICAL CHEMISTRY
CHP-412 (B) CBOP - 4 : Biophysical Chemistry, Special Topics in Nuclear & Radiation Chemistry
(2019 Pattern) (Semester - IV)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer to the two sections should be written in separate answer books.***
2) ***Question 1 and 5 are compulsory.***
3) ***Answer any 2 questions out of Q2, Q3 and Q4 and any 2 questions out of Q6, Q7 and Q8.***
4) ***Figures to the right indicate full marks.***
5) ***Use of logarithmic table/calculator is allowed.***
6) ***Neat diagrams must be drawn wherever necessary.***

Physico - Chemical Constants

1.	Avogadro Number	N	$= 6.022 \times 10^{23}$ mol^{-1}
2.	Boltzmann Constant	k	$= 1.38 \times 10^{-16}$ erg K^{-1} molecule^{-}
			$= 1.38 \times 10^{-23}$ J K^{-1} molecule^{-1}
3.	Planck Constant	h	$= 6.626 \times 10^{-27}$ erg s
			$= 6.626 \times 10^{-34}$ J s
4.	Electronic Charge	e	$= 4.803 \times 10^{-10}$ esu
			$= 1.602 \times 10^{-19}$ C
5.	1 eV		$= 23.06$ k cal mol^{-1}
			$= 1.602 \times 10^{-12}$ erg
			$= 1.602 \times 10^{-19}$ J
			$= 8065.5$ cm^{-1}
6.	Gas Constant	R	$= 8.314 \times 10^{7}$ erg K^{-1} mol^{-1}
			$= 8.314$ J K^{-1} mol^{-1}
			$= 1.987$ cal K^{-1} mol^{-1}
7.	Faraday Constant	F	96487 C equiv^{-1}
8.	Speed of light	c	$= 2.997 \times 10^{10}$ cm s^{-1}
			$= 2.997 \times 10^{8}$ m s^{-1}
9.	1 cal		$= 4.184 \times 10^{7}$ erg
			$= 4.184$ J
10.	1 amu		$= 1.673 \times 10^{-27}$kg
11.	Bohr magneton	β_e	$= - 9.274 \times 10^{-24}$ J T^{-1}
12.	Nuclear magneton	β_n	$= 5.051 \times 10^{-27}$ J T^{-1}
13.	Mass of an electron	m_e	$= 9.11 \times 10^{-31}$ kg

SECTION - I

Q1) a) Attempt any four of the following : **[8]**

i) State any explain Bragg's law.

ii) Distinguish between active and passive transport.

iii) Define electrophoresis and give its application.

iv) Give two functions of proteins.

v) Write Henderson's eq^{n} and explain the terms in it.

b) Calculate Rrms and Rg for a linear polymetric chain containing 250 monomeric units, each being 45^{o}A long. **[3]**

Q2) a) Attempt the following : **[6]**

i) Explain the difference between RNA & DNA.

ii) What are biopolymer? State and explain their characteristics and applications.

b) Attempt the following : **[6]**

i) Derive the Michaelis-Menten equation.

ii) Calculate the pH of a 2L solution containing 10 mL of 5M acetic acid and 10 mL of 1m sodium acetate .

Q3) a) Discuss the methods to determine molecular weight of a protein. **[6]**

b) Attemp the following: **[6]**

i) Define and explain circular dichroism.

ii) Evaluate Rmp for freely jointed randomly coiled polymer chain if the number of bonds is 4000 and the bond distance 154×10^{-12}m

Q4) a) Discuss nerve impulse and its conduction. **[6]**

b) Attemp the following : **[6]**

i) Explain role of Na^{+}/K^{+} pump.

ii) A polymer sample contain equal no of molecules with molecular weight 15000 and 25000. calculate $\overline{Mn}$ and $\overline{Mw}$.

SECTION - II

Q5) a) Attempt any four of the following : **[8]**

i) Explain the term hot atom and recoil atom.

ii) Write products formed in radiolysis of water.

iii) Explain Bethe's notation with example.

iv) Enlist manmade sources of radio active radiation.

v) Explain the term nuclear star.

b) Half life period of a radio active-element is 74.5 min. How much it would be left after 30 min, if initial amount of radiactive element is 1g? **[3]**

Q6) a) Attempt the following : **[6]**

i) What is difference between somatic and genetic effect of radiation?

ii) Write a note on radiation protection.

b) Attempt the following : **[6]**

i) State possible radiolysis reaction for organic compounds.

ii) Solve the following:

1) ${}^{40}_{20}\mathrm{Ca}(n,\alpha)$ _____

2) ${}^{197}_{79}\mathrm{Au}(n,\gamma)$ _____

3) ${}^{27}_{13}\mathrm{Al}(\gamma, n)$ _____

Q7) a) Explain construction and working of Van de Graff accelerator. **[6]**

b) Attempt the following : **[6]**

i) Write a note on solar nutrino problem.

ii) Evaluate Q value for the reaction.

$${}^{7}_{3}\mathrm{Li} + {}^{1}_{1}\mathrm{H} \rightarrow {}^{4}_{2}\mathrm{He} + \alpha$$

[Given : ${}^{7}\mathrm{Li} = 7.01822u$, ${}^{1}_{1}\mathrm{H}$=1.00814u, α=4.00387u

Q8) a) What is condition required for choosing a radioactive nuclide as indicator for radiometric titration? **[6]**

b) Attempt the following: **[6]**

i) Draw and explain linear accelerator.

ii) Calculate resolving-time if system in microsecond from following data.

sample	A	B	A+B
Count Rate	3600 for 3 min	2400 for 5 min	9900 for 6 min

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Total No. of Questions : 6]

SEAT No. : ____

PC3786

[6336]-404

[Total No. of Pages :2

M.Sc. - II (Inorganic Chemistry)

INORGANIC CHEMISTRY AND IT'S APPLICATIONS

CHI-430 : Heterogeneous Catalysis and it's Applications

(2019 Pattern) (Semester- IV)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Draw neat diagrams wherever necessary.***
4) ***Write each section in separate answer book.***

SECTION - I
(Heterogeneous Catalysis)

Q1) a) Answer the following: **[8]**

i) What is turn-over frequency? Give it's significance.
ii) Define Physisorption and Chemisorption.
iii) Define promotor and poison.
iv) What is solid catalyst? Give any one example of it.

b) What are zeolites? Discuss the nomenclature of zeolite. **[3]**

Q2) a) Attempt any one of the following. **[6]**

i) "Organic templates are structural directing agent in zeolite synthesis". Explain.
ii) Discuss the post synthetic treatments in heterogeneous catalysis.

b) Attempt any Two of the following: **[6]**

i) Discuss the classification of heterogeneous catalysts.
ii) What is adsorption isotherms? Discuss their applications.
iii) Discuss the role of support in supported metal catalyst.

Q3) a) Answer any one of the following: **[6]**

i) Discuss zeolite characterization by powder XRD method.
ii) Describe the preparation of solid catalysts by precipitation method. Give it's advantages and disadvantages.

b) Answer any Two of the following: **[6]**

i) Discuss hydrothermal synthesis of ZSM-5.
ii) Write a note on phase transfer catalysis.
iii) Discuss fixed bed reactor.

P.T.O.

SECTION - II

(Applications of Heterogeneous Catalysis in Organic Synthesis)

Q4) a) Answer the following: **[8]**

i) What is water-gas shift reaction? Which catalyst is used in it?

ii) What is F.C. Alkylation? Give it's example.

iii) Whta is hydrocracking? Where it is used?

iv) What is MCM-41? Give it's application.

b) Why TiO_2 is considered as a good photocatalyst? **[3]**

Q5) a) Answer any one of the following. **[6]**

i) Discuss the use of $BiMoO_4$ as an oxidation and Ammoxidation catalyst.

ii) Discuss the conversion of biomass on solid catalysts.

b) Answer any Two of the following: **[6]**

i) What is Fischer-Tropsch synthesis? Discuss the limitations of Fischer-Tropsch synthesis.

ii) Write a note on Industrial Electrocatalysis.

iii) Discuss selective hydrogenation of hydrocarbons.

Q6) a) Answer any one of the following: **[6]**

i) What are perovskite? Explain their uses as a catalyst for pollution control.

ii) What is shape selective catalysis? Discuss shape selective catalysis with suitable example.

b) Answer any Two of the following: **[6]**

i) Discuss the synthesis of methanol by heterogeneous catalysis.

ii) What is catalytic converter? Discuss it's advantages.

iii) Write a note on Clays and Interculated Clays as a catalyst.

Total No. of Questions : 6]

SEAT No. :

PC3787

[Total No. of Pages : 3

[6336]-405

Second Year M.Sc.

INORGANIC CHEMISTRY

CHI-431: Inorganic Nanomaterials: Properties, Applications & Toxicity

(2019 Pattern) (Semester - IV)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Answer to the two sections should be written in separate answer books.***

SECTION - I
(Nano-structural Materials and its applications)

Q1) a) Answer the following. **[8]**

i) What is nanoparticle?

ii) What are quantum sheet.

iii) Write the properties of natural nanoparticle.

iv) Write Moore's law.

b) Explain in detail optical properties of nanostructured materials. **[3]**

Q2) a) Answer any one of the following. **[6]**

i) What is carbon nanotube? Explain in detail types of carbon nanotube.

ii) Explain the classification of nanomaterial synthesis methods.

b) Answer any two of the following. **[6]**

i) Explain biological applications of nanoparticle with suitable example.

ii) What is nanophotonic? Explain in detail use of nanophotonic in solar cell.

iii) What is polymer nanotechnology? Give the applications of polymer nanotechnology.

P.T.O.

Q3) a) Answer Any one of the following. **[6]**

i) Discuss top-down approach for synthesis of nanomaterials.

ii) What is nanobiotechnology? Explain the application of nanobiotechnology in healthcare field.

b) Answer Any Two of the following. **[6]**

i) Explain the computational nanotechnology in communication sector.

ii) Explain the melting point of nanomaterials changes with respect to size of nanoparticle.

iii) Explain the laser ablation methods for synthesis of carbon nanotube.

SECTION - II

(Nanotoxicology and Biosafety)

Q4) a) Answer the following. **[8]**

i) What is biosafety?

ii) What is nanotoxicology? Write the factors affecting on it.

iii) What is the etymology.

iv) Write the difference between vivo-toxicily & vitro toxicity.

b) Explain the bio-mimetic technology with suitable example. **[3]**

Q5) a) Answer any one of the following. **[6]**

i) Explain the mechanism of nanotoxicity on cell.

ii) Explain any two physicochemical properties affect on human health that causes nanotoxicity.

b) Answer Any Two of the following. **[6]**

i) What is on cytotoxicity. Explain the cytotoxicity mechanism of nanoparticle with suitable example.

ii) Explain the size dependent toxicity of silver nanoparticle.

iii) Explain biodistribution of nano materials.

Q6) a) Answer Any one of the following. **[6]**

i) Explain toxic effect of gold-nanoparticle.

ii) Explain the challenges of nanotoxicology.

b) Answer any two of the following. **[6]**

i) Explain the necrosis assay of in vitro assement.

ii) Explain apoptosis assay of nanotoxicology.

iii) Write short note on epidemiological evidences of nanotoxicology.

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Total No. of Questions : 6]

SEAT No. : ____

PC3788

[Total No. of Pages : 6

[6336]-406
M.Sc. - II
INORGANIC CHEMISTRY
CHI-432 (A) : Material Science
(2019 Pattern) (Semester - IV)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Use of logarithmic table & calculator is allowed.***
5) ***Write the two sections on separate answerbook.***

SECTION - I

(Defects, Magnetic & Super conducting materials)

Q1) a) Answer the following : **[8]**

i) What is plane defect? Explain it's types.

ii) What is paramagnetism? Explain with example.

iii) Explain the classification of super conductors.

iv) What is diffusion? List the different types of diffusion in solids.

b) Draw the structure of BCC and calculate the no. of atoms per unit cell of BCC. **[3]**

Q2) a) Answer Any ONE of the following : **[6]**

i) State and Explain Fick's Law of diffusion.

ii) What is hystersis loop? Explain detail B-H curve.

b) Answer Any TWO of the following. **[6]**

i) Explain the application of superconductors.

ii) Write note on 'Perovskite'.

iii) Give the important application of magnetic materials.

P.T.O.

Q3) a) Answer Any ONE of the following. **[6]**

i) Explain the Meissner effect. Explain what are type I & type II superconductors.

ii) Calculate the net magnetic moment per iron atom in crystal structure from following data:

1) Iron has FCC structure

2) Lattice parameter = 2.87Å

3) IBM = 9.273×10^{-24} A/m^2

4) Saturation magnetisation = 1750 KA/m^2

b) Answer Any TWO of the following. **[6]**

i) Write a short note on 'Fullerence'.

ii) Difference between Soft and Hard magnetic materials.

iii) Explain the 'Josephen effect' of superconductivity.

SECTION - II

(Ceramic, Composite, Cementitious and Biomaterial)

Q4) Answer the following. **[8]**

a) i) What is pyroelectric effect? Explain with example.

ii) What are glass fibres? Explain with example.

iii) What is blended cement?

iv) Write a full form of C_3S & C_3 AF.

b) Define the terms. **[3]**

i) Ageing

ii) Set retarder

iii) Asphalt

Q5) a) Answer Any ONE of the following : **[6]**

i) What are Ceramics materials? How they are classified?

ii) What is composite materials? Explain different parts of wood with it's function.

b) Answer Any TWO of the following. **[6]**

i) What are Biomaterials? Give it's Orthopedic application.

ii) A piece of wood containing moisture weighed 200 gm and after oven drying showed constant weight is 182 gm. Calculate % moisture content.

iii) What is Bioceramic material?

Q6) a) Answer Any ONE of the following : **[6]**

i) Explain Sol-gel process for manufacture of Ceramic materials.

ii) What is Cement? Explain monufacturing of cement.

b) Write a note on (ANY TWO) : **[6]**

i) Oil well cement

ii) Wood

iii) Portland cement

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Total No. of Questions : 6]

PC3788

[6336]-406
M.Sc.-II
INORGANIC CHEMISTRY
CBOP - 4 - CHI-432 (B) : Inorganic Chemistry; Applications in Industry
(2019 Pattern) (Semester - IV)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicates full marks.***
3) ***Neat diagram must be drawn wherever necessary.***
4) ***Answers to the two sections should be written in separate answer books.***
5) ***Use of logarithmic table, calculator is allowed.***

SECTION - I

(Inorganic Chemistry ; Application in Industry)

Q1) a) Answer the following. **[8]**

i) What is meant by anticorrosive agent? Name the types of corrosion inhibitors.

ii) Explain the electroplating of gold.

iii) What are the types of explosives? Which chemicals are used in explosive.

iv) SO_2 is hazardus to vegetation as well as animal comment.

b) Attempt the following. **[3]**

Explain in detail properties of explosive and mention its uses.

Q2) a) Attempt any ONE of the following : **[6]**

i) Define green chemistry. How green chemistry differs from cleaning up pollution.

ii) What is metal finishing? Which chemicals are used in metal finishing. Explain in detail electroless deposition of copper.

b) Attempt Any TWO of the following : **[6]**

i) Mention the most explosive chemicals. Why chemical safety is important? Which safety measures are followed in chemical industry?

ii) What is meant by electrodeposition? Explain electrodeposition of silver. Give its applications.

iii) Where should explosive be stored? What are the hazards of explosives? How can we prevent explosions?

Q3) a) Attempt Any ONE of the following. **[6]**

i) Mention harmful industrial gases. Mention its sources. For what purpose they are used?

ii) Which chemicals are used in metal finishing? Explain the effect of electrodeposition on environment. Explain electrodeposition of tin.

b) Write note on Any Two **[6]**

i) Handling and use of chemicals.

ii) Advantages and disadvantages of green chemistry.

iii) Distruptive explosives for military use.

SECTION - II

(Inorganic Chemistry : Applications in Environment)

Q4) a) Answer the following. **[8]**

i) Explain primary and secondary sludge process.

ii) Write a note on Tidal power.

iii) What are the types of water pollutants?

iv) List the five provisions of clean water act (CWA).

b) Attempt the following : **[3]**

Explain electroplating. How can electroplating be done?

Q5) a) Attempt Any ONE of the following : **[6]**

i) How biogas is produced? Explain.

ii) Explain in detail activated sludge process.

b) Attempt Any TWO of the following. **[6]**

i) Discuss some of the advantages of Physico-Chemical treatment of sewage as opposed of biological waste.

ii) What are the maximum cantaminant level (MCL) of the safe drinking water act?

iii) Compare aerobic treatment process with an anerobic treatment process.

Q6) a) Attempt Any ONE of the following: **[6]**

i) Draw a schematic diagram of a molten carbonate fuel cell (MCFC). Write the reaction that occure at the cathode and anode. Show overall reaction. Describe the molten electrolyte used in this fuel cell.

ii) Draw a schematic diagram that shows all the components of an AAS. How is an aqueous sample introduced into AAS. How is an equeous sample introduced into AAS. And the metal ion analyte has a positive charge. How does it become a neutral atom.

b) Write a note on Any TWO of the following. **[6]**

i) Electricity from photovoltaic cells.

ii) Phenol and cyanide removal from waste water.

iii) Stabilisation pond and Areated lagoon.

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Total No. of Questions : 8]

SEAT No. : ____

PC3789

[Total No. of Pages :4

[6336]-407

M.Sc. - II

ORGANIC CHEMISTRY

CHO-450 : Chemistry of Natural Products

(2019 Pattern) (Semester- IV)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Question 1 and 5 are compulsory and carry 11 marks each.***
2) ***Attempt any two questions from Q.2 to Q.4 and two questions from Q.6 to Q.8.***
3) ***Answer to the two sections should be written in separate answer books.***
4) ***Figures to the right indicate full marks.***

SECTION - I

Q1) a) Solve any four of the following: **[8]**

i) Write two protecting reagents for hydroxyl group with suitable example.

ii) Write the structure and role of following reagents in the synthesis.

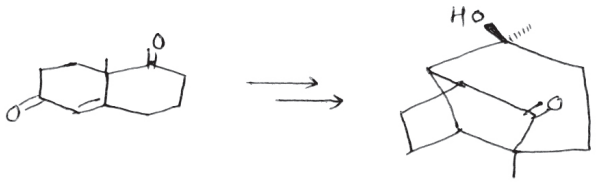
1) LDA
2) BoC

iii) Write retrosynthesis of longifolene by E.J. Corey approach.

iv) Write the structure of (-) - Ribisin A with correct stereochemistry.

v) Give the application of Hirsutellone B.

b) Write the correct sequence of reagents for the following conversion. **[3]**



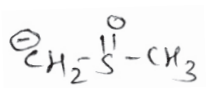
i) CH_3MgI

ii) $ArCO_3H$

iii) H^+

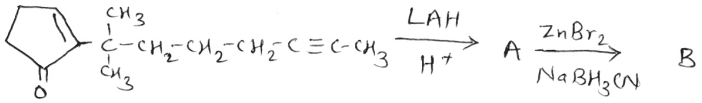
iv) H_2, pd

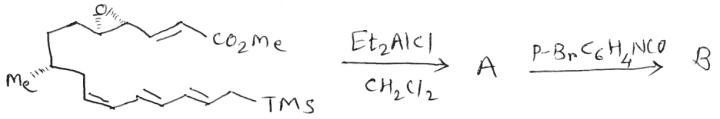
v) $(HOCH_2)_2$

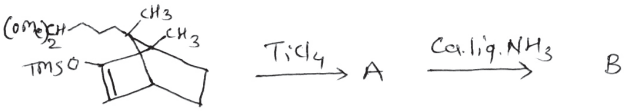
vi) 

P.T.O.

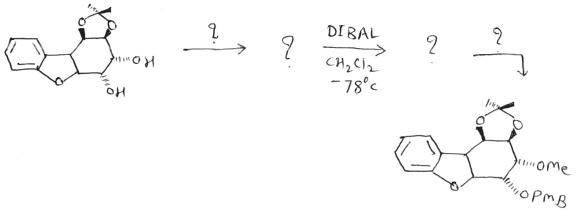
Q2) Predict the products with mechanism. **[12]**

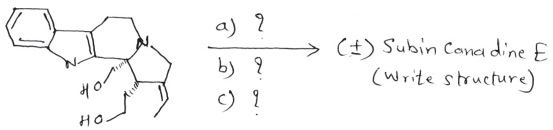
a) 

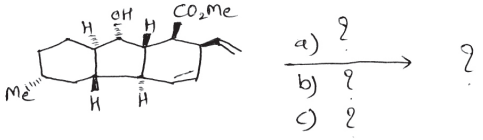
b) 

c) 

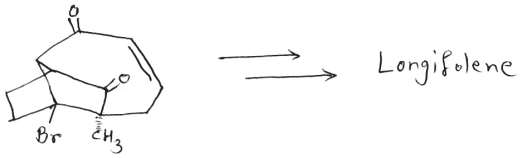
Q3) Write the missing reagents and intermediates for the following conversion. **[12]**

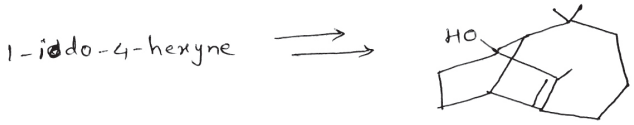
a) 

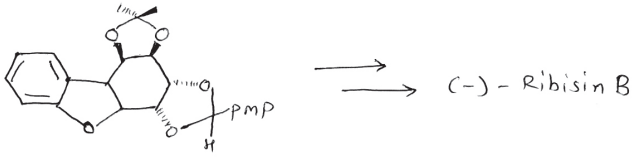
b) 

c) 

Q4) Outline the steps involved in the following synthetic sequence. **[12]**

a) 

b) 

c) 

SECTION - II

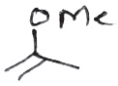
Q5) a) Solve any 4 of the following. **[8]**

i) Draw the structure of Revised vannusal B with correct stereochemistry.

ii) Write a note on Mitsunobu reaction with reference to synthesis of originally assigned vannusal B.

iii) Draw structure and show key proton NMR coupling constants and NOES exhibited by both originally assigned an natural vannusal B.

iv) Write the role of following reagents with mechanism

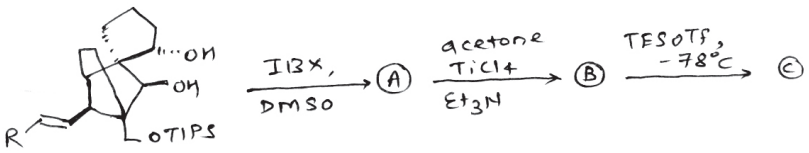
1) CSA; 

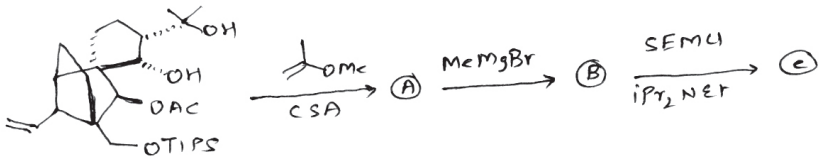
2) POC_{l3}; Pyridine

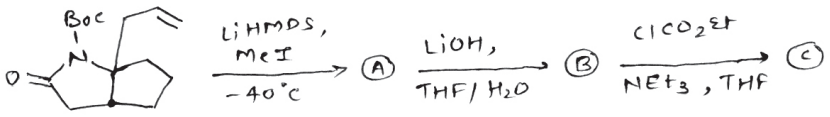
v) What is SMI_2 mediated cyclisation strategy for the synthesis of Vannusal B? Explain.

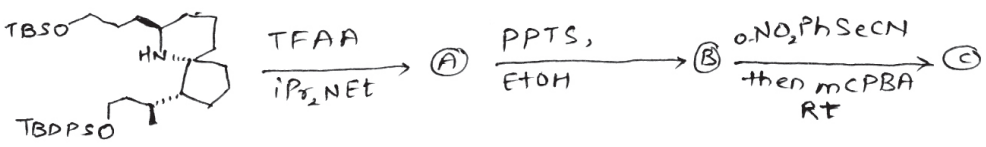
b) Give the method to determine the configuration at c-17 of Pinnaic acid.**[3]**

Q6) Predict the products. **[12]**

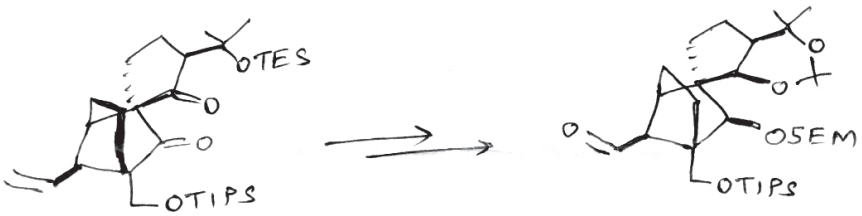
a) 

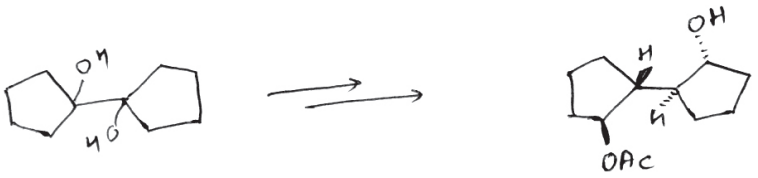
b) 

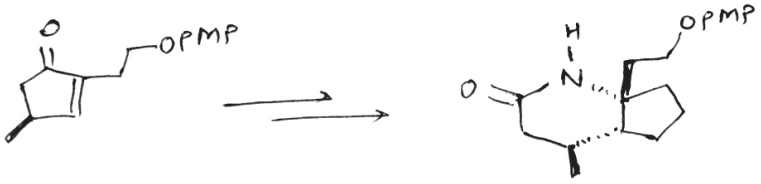
c) 

d) 

Q7) Write the correct reagents and detailed steps involved in the following conversions. **[12]**

a) 

b) 

c) 

Q8) Answer the following. **[12]**

a) Explain the initially proposed biosynthetic hypotheses for vannusal B.

b) Write the synthetic plan for Pinnaic acid mentioning all the key intermediates.

c) What were the observations when ^{1}H-NMR of originally assigned (synthetic) vannusal B was compared with natural isomer? Explain with Diagram and Spectra.

Total No. of Questions : 5]

SEAT No. :

PC3790

[Total No. of Pages : 4

[6336]-408

M.Sc. - II

ORGANIC CHEMISTRY

CCTP-II, CHO-451 : Organometallic Reagents In Organic Synthesis

(2019 Pattern) (Semester - IV)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Question Nos.1 and 5 are compulsory and carry 11 marks each.***
2) ***Write any 2 questions from Q.2 to Q.4 from sections-1 and 2 questions from Q.6 to Q.8 from section-II.***
3) ***Answer to the two sections should be written in seperate books.***
4) ***Figures to the right indicate full marks.***

SECTION - I

Q1) a) Explain the following (any 4) : **[8]**

i) In Shapiro reaction, excess n-Butyl Lithium is used for olefination reaction.

ii) In Hiyama coupling reaction, KF is used as activator.

iii) Tertiary amines resist to undergo Büchiwald Hartwig amination reaction.

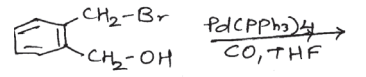
iv) Higher oxidation state Ti complexes are used in Mc-Murray coupling reaction.

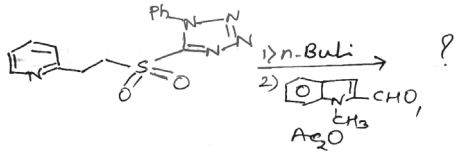
v) Role of $CaCl_2$ in wacker's process.

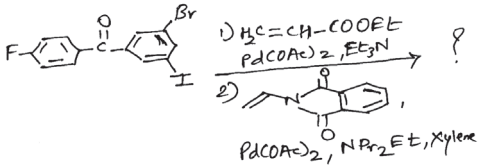
b) Write a catalytic cycle of stille coupling reaction. **[3]**

P.T.O.

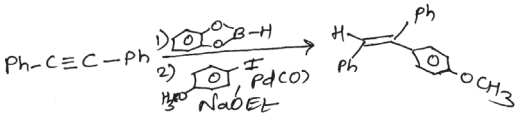
Q2) a) Predict the product for the following reactions. **[6]**

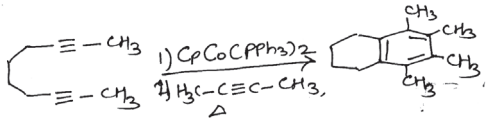
i) 

ii) 

iii) 

b) Suggest the mechanism. **[6]**

i) 

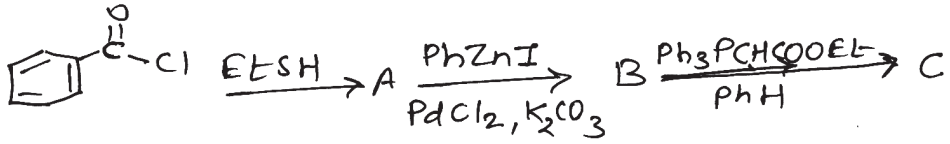
ii) 

Q3) a) Answer the following. **[8]**

i) Fe is a versatile catalyst in advance organic synthesis. Explain.

ii) Discuss the use of Iridium complexes in organic synthesis.

b) Complete the following reaction sequence with mechanism. **[4]**



Q4) a) Write a note on : **[6]**

i) Sonogshira coupling reaction

ii) Peterson olefination

b) Attempt the following : **[6]**

i) What are the differences and similarities between Suzuki and Heck coupling reaction?

ii) Discuss Wadsworth-Emmons modification reaction.

SECTION - II

Q5) a) Answer any four of the following : **[8]**

i) Silicon forms strong bond with Fluorine. Explain with suitable example.

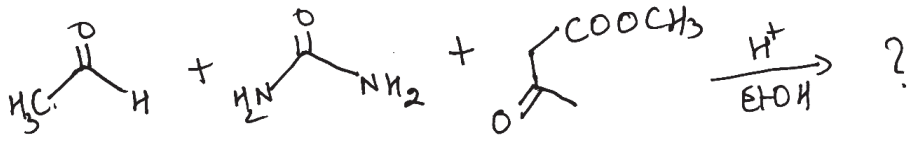
ii) How 3, 3-dimethyl-1-butanol can be synthesized using hydroboration approach.

iii) Compare the thermal and copper catalyzed 1, 3 dipolar cyclo addition of azides and alkynes.

iv) Why trimethyl amine can not be used in Mannich reaction?

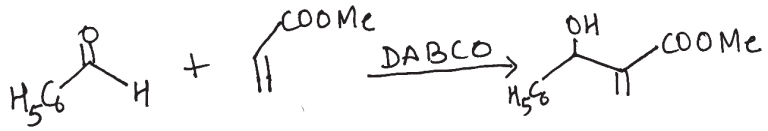
v) What is the difference between ring opening metathesis and ring opening metathesis polymerization. Under which condition ring opening metathesis polymerization proceeds?

b) Predict the product and suggest the mechanism for the following reaction. **[3]**



Q6) a) Suggest the mechanism for the following reactions. **[6]**

i)



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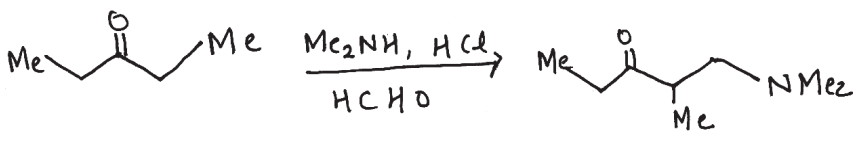
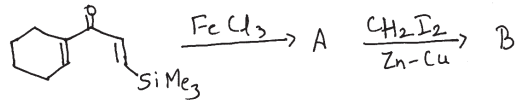
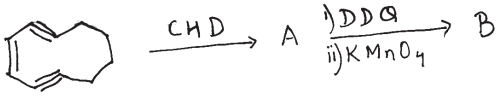
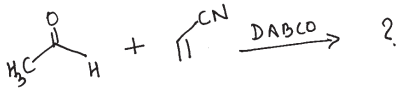


b) Predict the product/s of the following reaction. **[6]**

i) 

ii) 

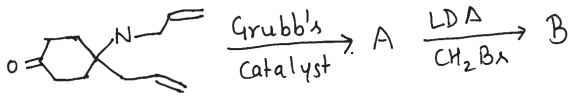
iii) 

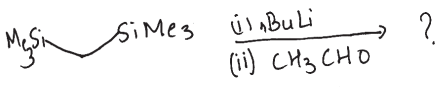
Q7) a) Write short notes on **[6]**

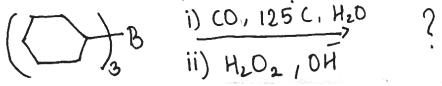
i) Enyne metathesis

ii) Eschenmoser Tanahe Fragmentation

b) Predict the product for the following reactions. **[6]**

i) 

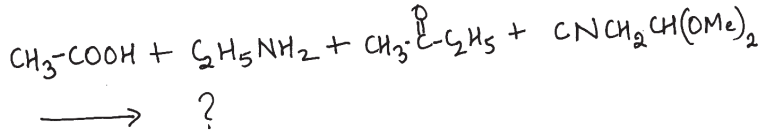
ii) 

iii) 

Q8) a) Solve the following : **[6]**

i) Carry out the following conversion using organo silicon.

ii) Predict the product and suggest the mechanism for the following reaction.



b) Write short notes on : **[6]**

i) Disimyl borane

ii) Grubb's first generation catalyst

iii) Mitsunobu reaction

Total No. of Questions : 8]

SEAT No. : ____

PC3791

[Total No. of Pages : 5

[6336]-409
M.Sc. - II
ORGANIC CHEMISTRY
CBOP - 4 - CHO 452 (A) : Concepts and Applications of Medicinal Chemistry
(2019 Pattern) (Semester - IV)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Q.1 & Q.5 are compulsory carry 11 marks.***
2) ***Attempt any two question from Q.2 to Q.4 and Q.6 to Q.8.***
3) ***Answer to the two sections should be written in seperate answerbook.***
4) ***Figures to the right side indicate full marks.***

SECTION - I

Q1) a) Answer the following : **[8]**

i) What are cofactors?

ii) What is solid phase peptide synthesis.

iii) Enlist stages of modern drug discovery process.

iv) Write Hansch equation and write terms involved in it.

b) What are proton pump inhibitors? **[3]**

Q2) Answer the following : (Any three) **[12]**

a) What are peptides? Explain their use in therapeutics.

b) Write note on enzymes as drug targets.

c) Explain drug metabolism process.

d) Explain the use of NMR in drug design.

Q3) Answer the following. (Any three) **[12]**

a) Explain historical development of medicinal chemistry.

b) Explain biological significance of folic acid.

c) Explain drug-receptor interactions in brief.

d) Write note on protein as biocatalyst.

P.T.O.

Q4) Answer the following (any three) **[12]**

a) Write biological functions of TPP.

b) Explain pharmacokinetics of drugs.

c) Explain drug optimization strategies.

d) Write note on solution phase peptide synthesis.

SECTION - II

Q5) a) Answer the following : **[8]**

i) Discuss the mode of action of macrolides.

ii) Write SAR of tetracyclins.

iii) What is partition coefficient?

iv) Explain the term prodrug with an example.

b) Answer the following. **[3]**

What is QSAR? Give its importance in drug design.

Q6) Answer Any Four of the following : **[12]**

a) Discuss antifungal agents with an example.

b) What are β-lactam antibiotics? Explain their mode of action.

c) Explain the term pharmacophore with an example.

d) Discuss : Quinine as antimalarial agent.

e) What is bioisoster? Explain with an example.

Q7) Answer Any Four of the following : **[12]**

a) Write note on: protein synthesis inhibitors.

b) Discuss problems associated with penicillin - G.

c) What are statins? Discuss their general mode of action.

d) Explain medicinal applications of quinolones & fluoroquinolones.

e) Discuss metabolic stability of drug with an example.

Q8) Answer Any Four of the following : **[12]**

a) Write note on : QSAR

b) Discuss Rifamycins as antibacterial agents.

c) Discuss the role of lipophilicity in drug design.

d) Explain broad and narrow spectrum antibiotics with an example each.

e) Give an account of sulphonamides as antibacterial agents.

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Total No. of Questions : 8]

PC3791

[6336]-409
M.Sc.-II
ORGANIC CHEMISTRY
CBOP - 4 - CHO-452 (B) : Applied Organic Chemistry
(2019 Pattern) (Semester - IV)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Q.1 & Q.5 are compulsory.***
2) ***Attempt any two questions from Q.2 to Q.4.***
3) ***Attempt any two questions from Q.6 to Q.8.***
4) ***Answer to the two sections should be written in seperate answerbook.***
5) ***Figures to right indicate full marks.***

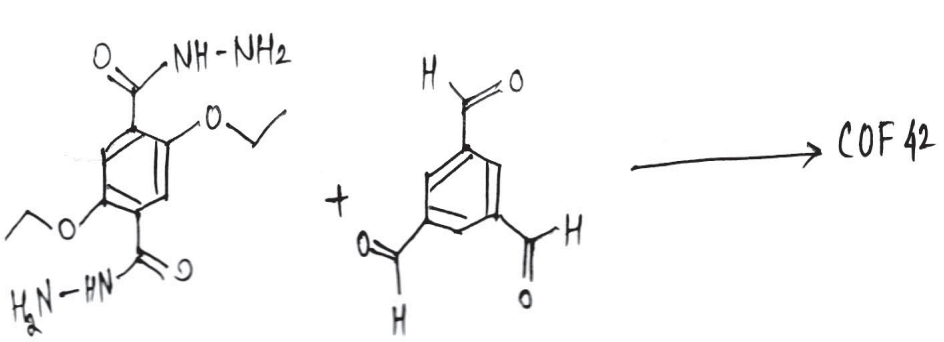
SECTION - I

Q1) a) Draw the topology diagrams representing a general basis for COF design by using following symmetry in their monomers. **[4]**

i) C_2 linear + C_3 planer symmetry

ii) Td + C_4 planer symmetry

b) Explain the COF structure of hydrozone linked COFs formed by following starting compounds. **[4]**



c) Explain Schematic illustration of thermally activated delayed fluorescence (TADF). **[3]**

Q2) Attempt the following : **[12]**

a) Give the typical examples of Td, C_4, C_6 and C_2 symmetric monomers with amine functional groups for synthesis of COFs.

b) Explain multicomponent (MC) design stratergy for hexagonal and tetragonal COFs.

c) Explain Different types of OLEDs.

Q3) Attempt the following. **[12]**

a) Write a note on applications of OLEDs.

b) Write a note on EL process with schematic diagram.

c) Write a note on covalent organic frameworks.

Q4) Attempt the following. **[12]**

a) Give the advantages & disadvantages of OLEDs.

b) What is OLEDs? Enlist the molecules commonly used in OLEDs.

c) Explain the structures of boron containing COFs.

SECTION - II

Q5) a) Explain Two and Three dimensional Assemblies of molecules in supramolecular chemistry. **[4]**

b) Write a note on Electric field induced & temperature induced switching in molecule switches. **[4]**

c) Explain molecular tweezer and clip models in molecular machines. **[3]**

Q6) Attempt the following: **[12]**

a) Discuss the superstructural Hierachy.

b) Explain a reversible single-molecule switch based on activated anti aromaticity.

c) Write a note on self propelled nanostructures.

Q7) Attempt the following: **[12]**

a) Explain the Host-guest complex within another host.

b) Draw schematic representation of a robust single molecule-switch.

c) Write a note on molecular machines.

Q8) Attempt the following: **[12]**

a) Explain the Threading and stoppering in supramolecular chemistry.

b) Describe mechanically-interlocked molecular swithches.

c) Draw chemical structure of a synthetic molecular crank with its schematic representation.

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Total No. of Questions : 8]

SEAT No. : ____

PC3792

[Total No. of Pages :3

[6336]-410

M.Sc. - II (Analytical Chemistry)

CCTP-10-CHA-490 : ADVANCED ANALYTICAL SPECTROSCOPIC TECHNIQUES

(Revised 2019 Pattern) (Semester- IV)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answers of two sections should be written on separate answer books.***
2) ***Use of logtable and calculator is allowed.***
3) ***Figures to right indicate full marks.***

SECTION - I

Question 1 is compulsory. Solve any two questions from 2 to 4.

Q1) a) Answer any four of the following. **[8]**

i) What do you meant by atomization in AAS?

ii) Explain the principle of FES.

iii) Write Boltzmann equation to explain relationship bet ground and excited state populations of atoms in AAS and meaning of the terms involved in it.

iv) Define the term atomic fluorescence.

v) What is the function of interface in ICP-MS?

b) K^+ in soil sample was analysed by FES method. 15 ppm standard of K^+ showed flame intensity 71. Soil sample (10 g) was extracted with water (250 ml) and aspirated in flame. It showed flame intensity 65.

Calculate mg of K^+ in 100 g soil sample. **[3]**

Q2) a) Explain the following. **[6]**

i) Construction and working of ICP torch.

ii) Construction and working of premix burner (flame atomizer).

b) Answer the following. **[6]**

i) Explain the origin of atomic spectral.

ii) Sample of water was analysed by ICP-AES. 50 ppb standard of Pb(II) showed flame intensity 35 while water sample showed intensity 28. Calculate micrograms of Pb(II) in 1000 ml water sample.

P.T.O.

Q3) a) Discuss the following: **[6]**

i) Chemical and spectral interferances in AAS.

ii) Microwave digestion method for the sample preparation in Atomic spectroscopy.

b) With suitable example explain calibration curve method for AAS. Give details of the calculation by this method. **[6]**

Q4) a) Write note on **[6]**

i) Hydride and cold vapour technique for atomization.

ii) Quadra pole mass analyser.

b) Solve the following. **[6]**

i) What is LEIS? Explain different types of excitations in LEIS.

ii) What is elemental analyser? Explain total carbon analyser.

SECTION - II

Question 5 is compulsory. Solve any two questions from 6 to 8.

Q5) a) Answer any four of the following. **[8]**

i) What is the difference between Photoelectron and Auger electron?

ii) Define the term chemiluminescence.

iii) Fluorescence intensity of 8 - hydroxy quinoline is much less than Zn - 8 hydroxy quinoline complex. Why?

iv) What is the ratio of lines in ESR spectra of methyl free radical?

v) With help of electron spin diagram show excited singlet and excited triplet state.

b) With the help of pascal triangle calculate the ratio of lines in ESR spectra of cyclopentadienyl free radical and draw the hyperfine ESR spectral of the same radical. **[3]**

Q6) a) Answer the following. **[6]**

i) What is internal and external conversion? Explain internal conversion in detail.

ii) Explain applications of the fluorescence determination.

b) Discuss the following. **[6]**

i) What is hyperfine splitting in ESR spectrum? Why hyperfine splitting occurs in ESR spectrum? What is the relationship between number of lines and nuclear spin?

ii) Construction and working of x - ray gun in for XPS analysis.

Q7) a) Answer the following: **[6]**

i) Differentiate between fluorescence and phosphorescence.

ii) Write note on ESR transitions.

b) Solve the following: **[6]**

i) P-benzosemiquinone free radical shows lines of intensity 1:4:6:4:1. Why?

ii) Quinine sulphate in tablet was analysed by photoflurometric method. The standard quinine sulphate of conc 0.005 mg/ml showed intensity 96 units. 15 mg tablet was dissolved in 1000 ml 0.01 m H_2SO_4. It showed fluorescence intensity 212 units. If wt of one tablet is 450 mg calculate amount of quinine sulphate in one tablet.

Q8) a) Draw block diagram of fluorometer or spectro fluorometer and explain function of each component in it. **[6]**

b) Write notes on: **[6]**

i) Quenching of fluorescence

ii) Auger electron spectra

Total No. of Questions : 8]

SEAT No. :

PC3793

[Total No. of Pages : 4

[6336]-411

M.Sc. -II

ANALYTICAL CHEMISTRY

CCTP-11, CHA - 491 : Chemical Methods of Pharmaceutical Analysis

(Revised 2019 Pattern) (Semester - IV)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Questions 1 & 5 is compulsory.***
2) ***Question 6 to 8 carry equal marks and solve any two question from 6 to 8.***
3) ***Figures to right indicate full marks.***
4) ***Answers to the two sections must be written on separate.***
5) ***Use of logotable and calculators is allowed.***

SECTION - I

Q1) a) Solve any four of the following. **[8]**

i) Define oral liquid. Enlist the types of oral liquid.

ii) Peroxide value.

iii) Explain ophthalmic preparation.

iv) Define limit test. What are the importance of limit test.

v) Enteric coated tablet.

b) A sample of oil weighing 0.25 gm was treated with 25 ml of w_{ij} solution after allowed to stand for 30min. It was treated with 10% KI and the Iodine librated titrated against 0.1 $Na_2s_2o_3$ and it required 9.3 ml of it. If the blank titre value was 25ml. Calculate the Iodine value of oil. **[3]**

P.T.O.

Q2) a) Attempt the following. **[6]**

i) Write a note on particle size by microscopy.

ii) Explain limit test to chloride.

b) Attempt the following. **[6]**

i) Write a note on determination of water by Karl Fischer method.

ii) Differentiate between dissolution test and disintegration test.

Q3) a) Explain in detail agar diffusion assay. **[6]**

b) Attempt the following. **[6]**

i) Write a limit test for lead.

ii) Write critical factors in the assay of growth promoting substances.

Q4) a) Attempt the following. **[6]**

i) Write a note on particulate contamination.

ii) A sample of oil weighing 4.7 gm was subjected to saponification with 50 ml of alcoholic KOH. It was later titran against 0.5N HCl and it required 13.5ml of titrant. If the blank reading was 50ml calculate the sap value of oil.

b) Explain indetail the aspects of techniques for microbial assay. **[5]**

SECTION - II

Q5) a) Solve any four of the following. **[8]**

i) What is specific absorbance?

ii) What is the importance of limit test of ash and sulfated ash?

iii) How melting point of substance help in identification of pharmaceutical pure compound?

iv) Give two identification test of paracetamol.

v) What is non aqueous titration?

b) 0. 2019 sample of lignocaine (234. 3 g/mol) was dissolved in acetic acid and titrated with 0.097m perchloric acid. End point was observed at 8.1ml. Expected percent purity is 98.5 to 100.5%. Explain sample posses or fail assay. **[3]**

Q6) a) Give the principle of quantitative analysis of substances by LC method. Explain assay of simvostatin by LC method. **[6]**

b) Write notes on the following. **[6]**

i) Redox titration method for the assay of ferrous fumarate.

ii) Identification of pharmaceutical ingredient by UV spectroscopy.

Q7) a) Answer the following. **[6]**

i) Give method for the determination of uniformity in content of dosage form with suitable example.

ii) What is the principle of IR spectroscopy? Explain identification of asprin tablet by IR spectroscopy.

b) Explain the following. **[6]**

i) Identification of chloride in chlorcyclizine hydrochloride.

ii) Fentanyl in fentanyl citrate is analysed by LC method. 81.0 mg fentanyl citrate was dissolved in 100 ml and 10 ml of this solution was diluted to 100 ml. The peak area for this standard was found to be 100763. The direct injection of the fentanyl citrate solution showed the peak of area 99753. Calculate mg of fentanyl citrate and fentanyl in 1ml solution (Mol. Wt. Fentanyl citrate=528.59 and fentanyl = 336.48 9 per mol).

Q8) Answer the following. **[12]**

a) Explain the importance of determination of pH and alkalinity of API. How this test is performed?

b) Why dissolution test is performed on tablet? Explain tablet dissolution test for paracetamol tablet.

c) What is iodine value ? Explain method for the determination of iodine value.

d) 0. 252 g of amitriptyline hydrochloride sample was titrated against 0.1 M NaoH and end point was observed at 8.0 ml. mol. wt. of the substance in test is 313.9 gram. Calculate percent purity. If expected purity is 99 to 101% then comment on the assay of the substance.

■■■■

Total No. of Questions : 8]

SEAT No. : ____

PC3794

[Total No. of Pages : 6

[6336]-412
M.Sc. - II
ANALYTICAL CHEMISTRY
CBOP - 4 - CHA-492 (B) : Analytical Chemistry of agriculture, Polymer and Detergent
(Revised 2019 Pattern) (Semester - IV)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Question 1 and 5 are compulsory.***
2) ***Solve any two questions from section- I Q.2 to Q.4 and any two question from section-II Q.6 to Q.8***
3) ***Answer to the two sections must be written on separate answerbook.***
4) ***Figures to right side indicate full marks.***
5) ***Use of logtable and calculator is allowed.***

SECTION - I

Q1) a) Attempt any four of the following. **[8]**

i) Enlist redusing agents used for reduction of nitrogen.

ii) Give importance of ion exchange - in soil.

iii) Define pesticides, Herbicides and fungicides.

iv) Define fertilizer and give its advantages.

v) What precaustions should taken while sampling of soil.

b) 0.48 gm of soil was analysed for nitrogen content by kjeldhal's method. The evolved amonia was absorbed in 55 ml of 0.15N HCL, The remaining acid was back titrated with 0.15N NaOH gave burette reading of 16.4 ml. then calculate the percentage of nitrogen in the given sample of soil.**[3]**

Q2) a) Attempt the following : **[6]**

i) Explain various methods used for acid digestion of soil and explain any one in detail.

ii) Give method for determination of ammonium oxalate soluble potassium fertilizer.

b) Give genral scheme for analysis of pesticides. **[6]**

P.T.O.

Q3) a) Attempt the following. **[6]**

i) Explain determination of total nitrogen in presence of nitrate and organic nitrogen by distillation.

ii) Explain in detail analysis of calcium and magnesium by AAS.

b) Calculate the percentage of nitrogen in amononium nitrate sample having weight 0.25 gm which contains 43.8 mg of NO_3 - N. Sample titration is required 12.69 ml of 0.01 M H_2SO_4. and blank required 0.20ml of 0.01M H_2SO_4. **[6]**

Q4) a) Attempt the following. **[6]**

i) Explain analytical procedure for extractable boron.

ii) Give the tinsley's wet combustion method for determination of organic matter in soil

b) Give analytical procedure for estimation of dithiocarbamate in fungicides. **[6]**

SECTION - II

Q5) a) Attempt the any four of following : **[8]**

i) Distingwish between thermosetting and thermoplastic polymer.

ii) Define degree of polymerisation.

iii) Define cationic surfactant.

iv) Define saponification value.

v) What is meant by polymer blends.

b) 0.846g. CTPB sample was dissolved in mixture of ethanol & xylene solution. and was titrated with 0.295N alcoholic KOH solution. The burette reading was 5.1ml calculate $\overline{Mn}$ of polymer.

(Given functionality = 02) **[3]**

Q6) a) Attempt the following : **[6]**

i) Give analytical procedure for determination of iodine value.

ii) Explain following terms-

Hardness, Impact test, abrasion resistance.

b) Explain the two phase titration of ionic surfactant with surfactants of opposite charge. **[6]**

Q7) a) Attempt the following : **[6]**

i) Explain with neat labeled diagram ebuloscopic method.

ii) Give analytical method for determination of alkali content and free fatty acids.

b) A polymeric material has a relaxation time of 100 days at 27ºC when a stress of 4.0 MPa is applied. **[6]**

i) What is, the relaxation time at 40º C if the activation energy for this process in 20kJ mol^{-1}.

ii) How many days will be required to decrease the stress.

Q8) a) Attempt the following : **[6]**

i) Explain optical properties of polymer.

ii) Give the method for determination of total alkane sulphonate.

b) Write a note on viscoelasticity with respect to creep model. **[6]**

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Total No. of Questions : 8]

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M.Sc.-II
ANALYTICAL CHEMISTRY
CBOP - 4 - CHA-492 (A) : Laboratory Automation and Environmental Analytical Chemistry
(Revised 2019 Pattern) (Semester - IV)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Questions 1 and 5 are compulsory.***
2) ***Solve any two questions from Scetion - I Q.2 to Q.4 and any two question from section-II Q.6 to Q.8.***
3) ***Answer to the two sections should be written on seperate answerbook.***
4) ***Use of logtable and calculator is allowed.***
5) ***Figures to right side indicate full marks.***

SECTION - I

Q1) a) Solve any four of the following. **[8]**

i) Give any two benefits of lab Information management system (LIMS)

ii) What is continuous flow Analysis?

iii) What is serial integration?

iv) State the four criterias for sensors.

v) Give any two achievements of Biotransduction

b) What are the objectives of automation in analytical chemistry. **[3]**

Q2) a) Explain the following : **[6]**

i) Batch and continuous flow Analysis.

ii) What is biosensor? Explain methods of immobilization.

b) Define microfabrication. Explain silicon and glass micro-matching. **[6]**

Q3) a) Discuss the following **[6]**

i) Optical sensors.

ii) Serial and parallel integration.

b) Explain the following. **[6]**

i) Flow injection analysis for reproducible sampling.

ii) Electrochemical sensors and give its applications.

Q4) a) Explain the following. **[6]**

i) How would you design an optical Biosensor to mesure cholesterol

ii) Flow Injection-Hydride Generation scheme.

b) Give classification of analyser and explain discrete sample analyser in detail. **[6]**

SECTION - II

Q5) a) Solve any four of the following : **[8]**

i) Define acidity.

ii) What is Threshold odour Test?

iii) Explain what is calcium carbonate saturation.

iv) What are sources and hazards of carbon monoxide?

v) Define TOC.

b) Solve the following:- **[3]**

75 ml of standard hard water required 42ml of EDTA solution for titration upto end point. 75ml of hard water sample requred 28ml of same EDTA solution. calculate hardness if |m| standard hard water = 1.2mg of $CaCo_3$ equivalent.

Q6) a) Explain in detail : **[6]**

i) Describe the technique of Direct spectrophotometric analysis of gaseous air pollutants.

ii) Explain the preliminary treatment of samples for dissolved and suspended metals.

b) Solve the following: **[6]**

i) Discuss the Batch method for ozone demand.

ii) 75ml of an alkaline water sample requred 9.2ml of 0.02N HCl upto phenolphthalein end point and total 14.0ml of same acid for complete neutralisation. Find the types and amount of allcalimities in the water sample.

Q7) a) Give an account of organic pollutants in air. **[6]**

b) i) Write a short note on detergents and detergent builders in waste water. **[3]**

ii) Discuss estimation of metalions by ICPAES. **[3]**

Q8) a) What are the methods used to estimate dissolved oxygen? Explain in detail. **[6]**

b) i) Discuss analysis of particulate matter from air samples. **[3]**

ii) A 30ml of sew age water sample was refluxed with 20ml of 0.25N $K_2Cr_2O_7$ solution. The unreacted dictrromate required 7.2ml of 0.1N FAS, 10 ml of dictrromate solution and 25ml of distilled work water under same condition as sample required 28ml of 0.1N FAS. calculate the COD of sewage water sample. **[3]**

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