Year - April 2024

MSC - chemistry

SEM - IV

No of pages - 22

MSC = Sem IV - Chemistry

Duration: 2 ½ hrs. **Total Marks: 60**

Instructions:
(1) All questions are compulsory.
(2) Figures to the right indicate full marks.

Q. 1 (a) Attempt any **two** of the following: 08
(i) Explain quantitative structure activity relationship for *p*-substituted 2-aryl-2-chloropropanes with electron donating groups during their solvolysis in water.
(ii) "The shifts in rate limiting step within the same overall reaction pathway can be explained by using Hammett's equation." Justify with suitable example.
(iii) How are E_s and σ^* parameters are determined? Discuss their physical significance.
(iv) Give an account of Grunwald-Winstein equation.

(b) Attempt any **one** of the following: 04
(i) "The change in the reaction mechanism can be explained by the Hammett's equation". Explain with suitable example.
(ii) Explain Swain-Scott equation used for determination of nucleophilicity scale.

Q. 2 (a) Attempt any **two** of the following: 08
(i) Discuss any one example of a receptor with multiple hydrogen bonding sites?
(ii) What are rotaxanes? Discuss their structure.
(iii) What are Cryptands? Discuss their structural features and give any one method of synthesis of Cryptands?
(iv) What is molecular self-assembly? Explain with a suitable example.

(b) Attempt any **one** of the following: 04
(i) What are molecular tweezers? Write detailed notes on tweezers?
(ii) Discuss the structural features of molecular cleft derived from Kemp's triacid for their applications as synthetic receptors?

Q. 3 (a) Attempt any **two** of the following: 08
(i) What is absolute and relative configuration? How to determine a configuration of an enantiomer based on a comparison of Optical Rotation.
(ii) What is resolution of enantiomers? Explain the following chemical methods of resolution of enantiomers:
a. esterification
b. by forming diastereomeric Salt
(iii) The specific rotation of (*S*)-2-iodobutane is +15.90°. Determine the % composition of a mixture of (*R*)- and (*S*)-2-iodobutane if the specific rotation of the mixture is -3.18°.
(iv) What is optical rotatory dispersion & how is it useful in the characterization of substances?

X51Y3A3806X51Y3A3806X51Y3A3806X51Y3A3806

(b) Attempt any **one** of the following: 04

(i) What do you mean by Racemization? Explain the mechanism of racemization involving

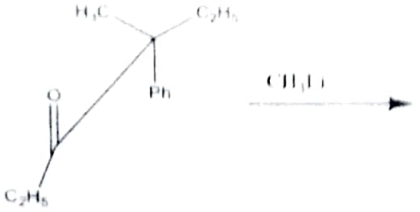
a stable Symmetrical intermediate

b Racemization through rotation around bonds

(ii) Explain the use of Lanthanide Shift Reagents in chiral discrimination.

Q. 4 (a) Attempt any **two** of the following: 08

(i) State Cram's rule. Illustrate the same for the following reaction.



(ii) Discuss the asymmetric aminohydoxylation.

(iii) Explain 'Asymmetric amplification' with example.

(iv) How will you achieve stereoselectivity in Diel's Alder reaction? Illustrate with the examples.

(b) Attempt any **one** of the following: 04

(i) How will you achieve distereoselectivity in aldol reaction.

(ii) Discuss chiral pool strategy in asymmetric synthesis.

Q. 5 Attempt any **four** of the following: 12

(a) Explain Dimmorth's E_T parameter.

(b) Explain Edward-Ritchie equation.

(c) What are Calixarenes? Give any one method of their synthesis?

(d) What are crown ethers? Give method of preparation of crown ethers.

(e) Give the applications of alpha-haloketone rule.

(f) Differentiate between ORD and CD curves.

(g) Give synthesis of L-DOPA by Knowles's Mosanto method.

(h) Explain three methods of asymmetric induction.

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Msc (Research) P Semester IV (3)

Total Marks: 60

(2 ½ hours)

N.B. (1) All questions are **compulsory.**
(2) **Figures** to the **right** indicate **full** marks.

Q.1 A Answer **any Two** of the following questions: **08**

a. Discuss the occurrence, biological role and structural features of steroidal alkaloids.

b. Explain eight chiral centers involved in the synthesis of Progestrone from 16-DPA.

c. Explain the following:
i) Structural and stereochemical features of corticosteroids.
ii) Oestrone is derivative of saturated hydrocarbon.

d. How is Oestradiol synthesized from 16-DPA?

Q.1 B Answer **any One** of the following questions: **04**

a. Give the characteristics features and synthesis of Jasmalone.

b. Write structural & stereochemical features and applications of sterols and bile acids.

Q.2 A Answer **any Two** of the following: **08**

a. How are vitamins classified? Give synthesis of vitamin K1 and state its biological importance.

b. How will you prepare vitamin B6 from ethoxy acetyl acetone and cyano acetamide? Explain biological importance of vitamin B6.

c. How are antibiotics classified based on their activity?
Outline the steps involved in the synthesis of phenoxy methyl Penicillin.

d. Give synthesis and biological importance of vitamin B12.

Q.2 B Answer **any One** of the following: **04**

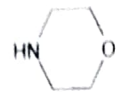
a. Give the spectral data to establish the structure of Chloramphenicol and give synthesis of Chloramphenicol from benzaldehyde and β-nitro ethanol.

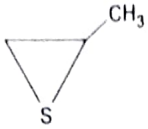
b. How will you prove the presence of following in the structure of zingiberene
i) Monocyclic ring
ii) homoannular conjugate bond.
Discuss the stereochemistry of zingiberene.

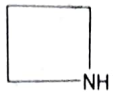
Q.3 A Answer **any Two** of the following: **8**

a. Name the following compounds according to the system of nomenclature mentioned alongside the structure.

X51YC8260AX51YC8260AX51YC8260AX51YC8260A

i  Common name system

ii  Hantzsch-Widman system

iii  Hantzsch-Widman system

iv  Replacement

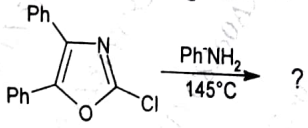
b. Write the synthesis of:

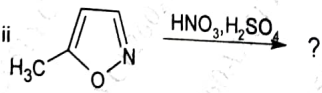
i) 3,5-dimethyl pyrazole from dicarbonyl compound.

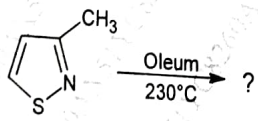
ii) Pyrazine from 1,2-dicarbonyl compound and 1,2-diamine.

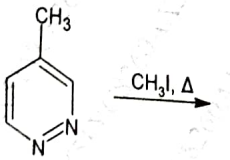
c. Explain on the basis of stability of intermediate, the electrophilic attack tales place at the 4(5) position in imidazole.

d. Complete the following reactions:

i 

ii 

iii 

iv 

Q.3 B. Answer **any One** of the following: 4

a. Draw structures for the following:

i) 2H-1,3-Thiazine

ii) 4H-Pyran

iii) 1-Oxa-4-aza-2,5-cyclohexadiene

X51YC8260AX51YC8260AX51YC8260AX51YC8260A

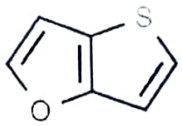
iv) Piperazine

b. Explain the following reactions with one suitable example.
   i) Cycloaddition reaction of oxazole
   ii) Electrophilic substitution reaction of thiazole.

Q.4 A Answer **any Two** of the following: **8**

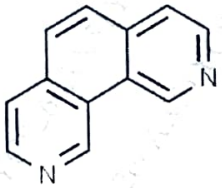
a. Name the following compounds according to the system of nomenclature mentioned under the structure.

(i)



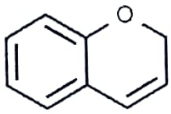
Hantzsch-Widman system

(ii)



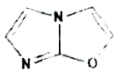
Replacement nomenclature

(iii)



Common name

(iv)

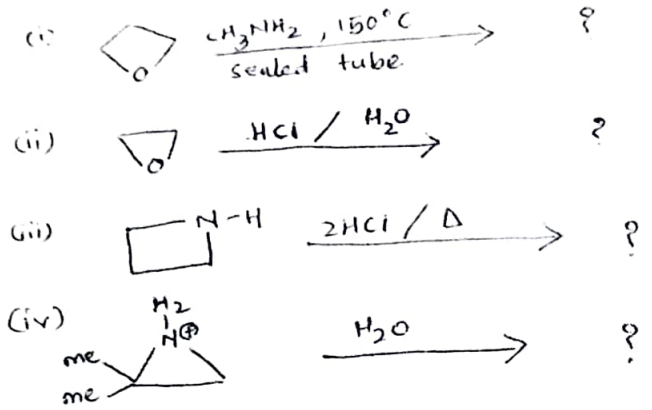


Hantzsch-Widman system

b. Give the following synthesis:
   i) Benzothiazole from *o*-heteroatom substituted arenes
   ii) Reissert synthesis of Indole

X51YC8260AX51YC8260AX51YC8260AX51YC8260A

c. Complete the following reactions:



d. Explain: (i) 2-methyl indole is nitrated in the six membered ring at the C-5 rather than C-3 by conc. HNO_3 and conc. H_2SO_4.

(ii) Purines can undergo both electrophilic and nucleophilic reactions at carbon in five membered ring and nucleophilic reactions mainly in the six membered ring.

Q.4 B. Answer **any One** of the following: **4**

a. Draw the structures of the following compounds:

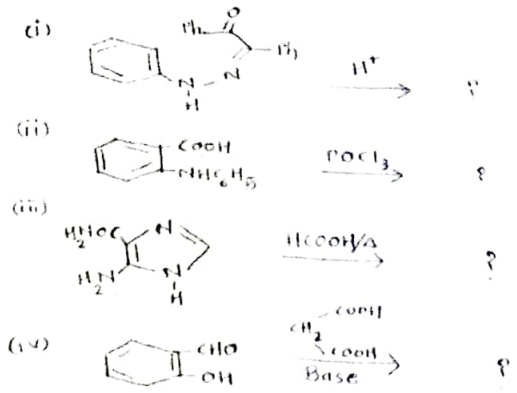
i) Phenazine

ii) carbazole

iii) 4H-1,4-benzothiazine

iv) 1-thia-3a,6-diazapentalene

b. Complete the following reactions:



Q.5 Answer **any Four** of the following: **12**

a. Give synthesis of 16-DPA from cholesterol.

b. Give the biochemical method for synthesis of testosterone.

c. Give synthesis of Penicillin-G.

X51YC8260AX51YC8260AX51YC8260AX51YC8260A

d. State sources and biological properties of rotenoids.
Draw the structure of Vitamin E.

e. State whether following statements are True or False and justify your answer.

i) Imidazole is stronger base than thiazole.

ii) Pyrimidine is weakly basic.

iii) Pyrazole has higher boiling point than isothiazole.

f. Draw the structure of pyridazine and explain that it undergoes electrophilic substitution only under drastic conditions.

g. Select the correct option:

(i) Which of the following is not a purine derivative?

a) Guanine b) Adenine

c) Azathioprine d) Cytosine

(ii) _____ group reduces the basicity of amino purines.

a) ester b) oxo

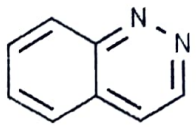
c) hydroxy d) cyano

(iii) Which of the following is not a benzodiazine?

a) Cinnoline b) Quinoxaline

c) Quinazoline d) Quinolizine

h. Name the following compound by



i) Recognized common name

ii) Systematic Hantzsch Widman system

iii) Replacement nomenclature

X51YC8260AX51YC8260AX51YC8260AX51YC8260A

MSc - Sem IV - Chem

Duration: 2½ Hours **Max Marks: 60**

N.B. **i)** **All Questions are compulsory**
ii) **Figures to the right indicates full marks**

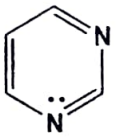
1. A. Attempt **any two** of the following: **8**
i) How will you synthesize androsterone from 16-DPA?
ii) Give the synthesis of Oestrone from 16-DPA.
iii) Discuss the occurrence, biological role and structural features of bile acids.
iv) How is cholesterol converted to 16-DPA?

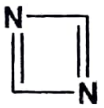
B Attempt **any one** of the following: **4**
i) Write a note on corticosteroids.
ii) How is Cinerolone synthesized?

2. A Attempt **any two** of the following: **8**
i) Write the biological importance and synthesis of vitamin B_2.
ii) Briefly describe the sources, biological importance and synthesis of vitamin B_6 using ethoxy acetylacetone and cynoacetamide.
iii) Give classification of antibiotics on the basis of activity. Give synthesis of Pyrethrin-I.
iv Write the structure elucidation of Chloramphenicol.

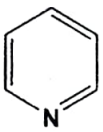
B Attempt **any one** of the following: **4**
i) Give an account of acid hydrolysis of Cephalosporin- C.
ii) Write structure elucidation of Zingiberene.

3. A Attempt **any two** of the following: **8**
i Name the following compounds according to the system of nomenclature mentioned alongside the structure

i  **Common name**

ii  **Hantzsch-Widman system**

iii  **Hantzsch-Widman system**

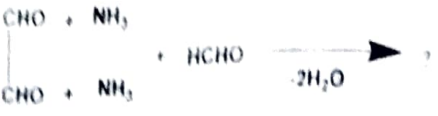
iv  **Replacement**

ii Explain:
a) Why pka value of Imidazole is more than other five membered azoles?
b) Complete the following reactions.

i. $CH_3COCH_2COCH_3 \xrightarrow[-H_2O]{NH_2NH_2}$?

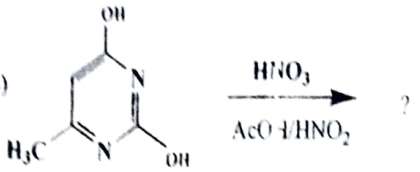
Acetyl Acetone

X51YE8D7D7X51YE8D7D7X51YE8D7D7X51YE8D7D7

ii. 

iii Complete the following reactions

a) 

b) 

iv a) Explain: electrophilic substitution in Imidazole at 2-position is unfavorable attack at C-5.

b) Explain with suitable examples the reactivity of oxazoles towards electrophiles.

B Attempt **any one** of the following:

i Give any two methods of preparation of pyrazole. 4

ii a) Draw resonance structures of pyridazine.

b) Why pyridazine is weaker base than Pyrazine.

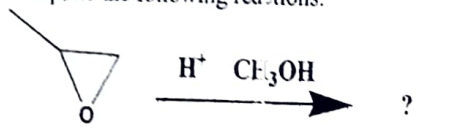
4. A Attempt **any two** of the following:

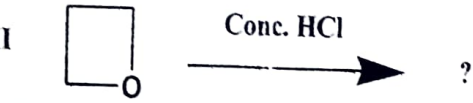
i Draw the structures of the following: 8

a) Pyrazino[2,3-d] pyridazine b) Phenoxathiine

c) 10-azaanthracene d) 1,3-diazabenzene

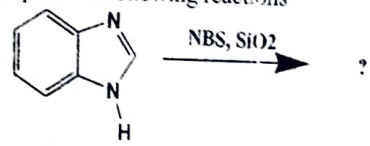
ii a) Complete the following reactions.

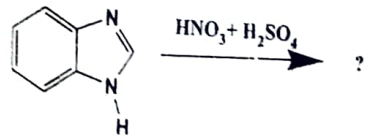
I 

II 

b) Give one synthetic method of Benzothiazoles.

ii Complete the following reactions

a) 

b) 

v Give the synthesis of indole by (I) Fischer-Indole synthesis (II) Bischler synthesis.

B Attempt **any one** of the following: 4

Gives any two synthetic methods of benzimidazoles.

i Gives two methods of synthes s of acridines.

X51YE8D7D7X51YE8D7D7X51YE8D7D7X51YE8D7D7

5 Attempt **any four** of the following: 12

a) Give the synthesis of progesterone from 16-DPA.

b) Give the synthesis of muscone.

c) Give classification of Vitamins. Give synthesis of vit-E.

d) State the biological importance and give the synthesis of vit-K_1.

e) Explain: Electrophilic attack in 1, 2-diazoles takes place at position-4

f) Give two examples of nucleophilic substitution in iso-thiazoles

g) Draw the structure of Coumarin. Give anyone synthetic method of Coumarin.

h) Draw structure of 1, 2-dihydro Azete. What is action of HCl on Azetidine?

X51YE8D7D7X51YE8D7D7X51YE8D7D7X51YE8D7D7

M sc - Sem - IV

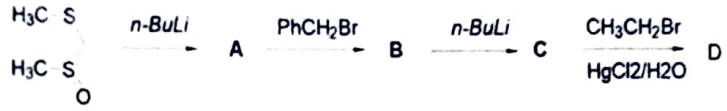
Duration: 2.5 hours **Max. Marks.60**

N.B. i) All questions are compulsory.
ii) Figures to the right indicate full marks.

1. A. Attempt **any two** of the following: **8**

i) Give the equations involved in the protection and deprotection of following functional groups. I) -NH2 II) -COOH

ii) Complete the following reaction sequence by identifying A-D.



iii) Describe the term Synthons and Synthetic equivalents. What are the synthetic equivalents for the following.

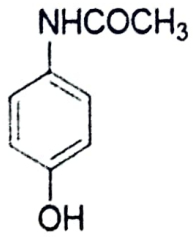


iv) Suggest the synthesis of the following using protection deprotection protocol.



B Attempt **any one** of the following: **4**

i) Provide a retro-synthesis of the following compound.

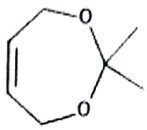


X51YA6077DX51YA6077DX51YA6077DX51YA6077D

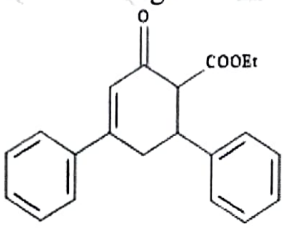
ii) Explain the terms Linear synthesis and Convergent synthesis using one example each and its Significance.

2. A Attempt **any two** of the following: **8**

i) For the following molecule, suggest a retrosynthetic pathway. Also write its synthesis, as per the pathway suggested by you.

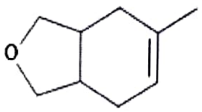


ii) The following molecule can be synthesised by a reaction sequence involving Michael reaction followed by cyclisation.



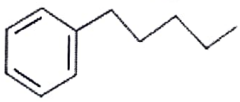
Using this sequence, write the synthesis. What is this reaction called?

iii) Write the retrosynthetic analysis of the following molecule and name the diene from which it can be synthesised.



Write the complete synthesis of this molecule.

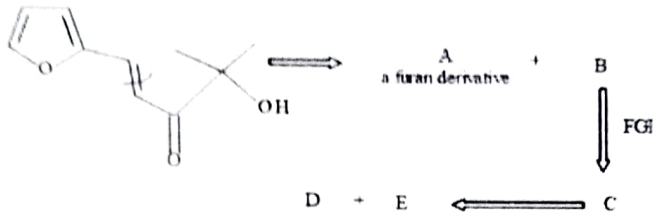
iv For the following molecule, show a retrosynthetic analysis using a Wittig reaction. Write the corresponding synthesis. **4**



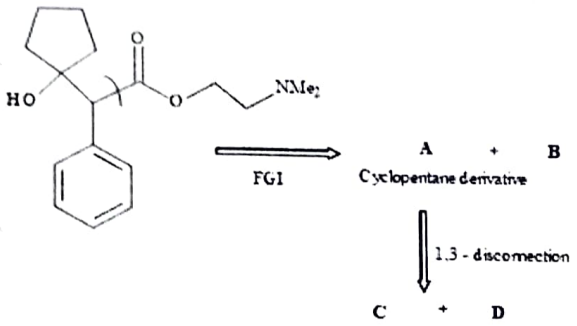
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B Attempt **any one** of the following:

i) Complete the following retrosynthetic analysis by drawing structures for A, B, C and D.

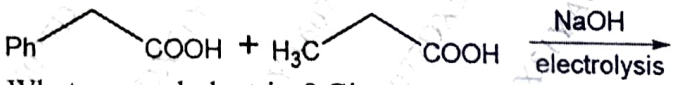


ii) Complete the following retrosynthetic pathway by drawing structures for **A, B, C and D**.



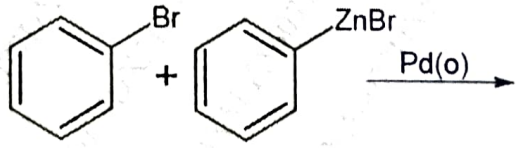
3. A Attempt **any two** of the following: **8**

i) Give the product, name and mechanism of the following reaction.



ii) What are cyclodextrins? Give structure of α-cyclodextrin. How does it help in selective chlorination of anisole using HOCl?

iii) Give the product, name and mechanism of the following reaction.



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iv) Give applications of $Yb(OTf)_3$ as a water tolerant Lewis acid catalyst in the following reactions:
Diels Alder reaction
Michael reaction
Aldol condensation
Friedel Crafts reaction

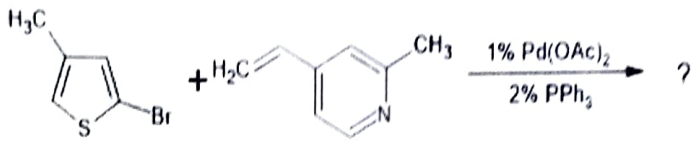
B Attempt **any one** of the following: **4**

i) What are crown ethers? Explain the selectivity of crown ethers towards alkali metal ions and give their applications in organic synthesis.

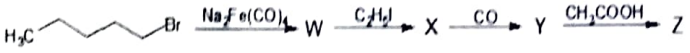
ii) What are organocatalysts? Explain the use of imidazolidinone in organic synthesis with suitable examples.

4. A Attempt **any two** of the following: **8**

i) Give name, product and mechanism of the following reaction.

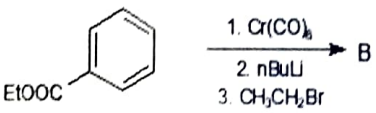


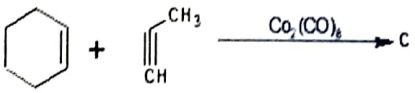
ii) Complete the following reaction and identify W, X, Y and Z.

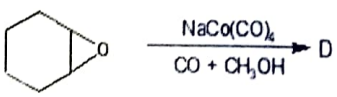


iii) Complete the following reactions by identifying A, B, C and D.







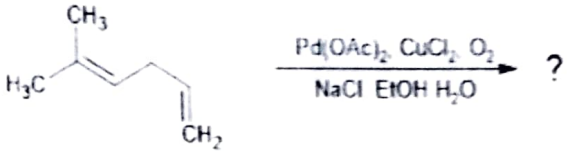


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iv) What is the action of SmI_2 on the following compounds - aldehydes, nitro compounds, alkyl halides and α-functionalized carbonyls?

B Attempt **any one** of the following: 4

i) Give the product, name and mechanism of the following reaction.



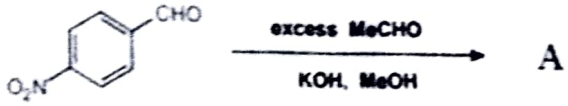
ii) Explain the terms oxidative addition and reductive elimination with suitable examples.

5. Answer **any four** of the following: 1 2

(a) Explain the term Functional Group Interconversions (FGI) and Functional Group Additions (FGA) with suitable examples.

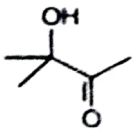
(b) Using the umpolung concept, write the conversion of Benzaldehyde to acetophenone.

(c)



Draw the structure of A and show its disconnection to the given starting material.

(d) How will you synthesise the following molecule from acetylene?



(e) What are micelles? Explain their role as phase transfer catalyst in organic synthesis giving suitable examples.

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(f) Discuss with examples cathodic reduction of carbonyl compounds.

(g) Explain the 18-electron rule. Using this rule, determine the value of n for $[Cl_2Cr(CO)_n]$ (At. no. of Cr = 24).

(h) Give the applications of Ce(IV) in i) synthesis of quinoxaline ii) as a deprotection agent.

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istry : Paper IV - Inorganic Chemistry Or Organic Chemistry Or Analytical Chemistry Or Physical Chemistry:

MSC- chemistry. sem IV.

Duration : 2 ½ Hrs. **[Max. Marks : 60]**

N. B. : (1) All questions are Compulsory.
(2) Figure to the right indicate full marks.

Q. 1	**A)**		Attempt **any two** of the following:	**8**
		i	Write a note on types of web resources.	
		ii	Explain the terms, a) Citation index b) Impact factor.	
		iii	Give main features of e-journals. Gives its advantages and disadvantages.	
		iv	What is an Abstract? What are the characteristics of an abstract?	
	B)		Attempt **any one** of the following:	**4**
		i	Discuss importance of Google scholar, Chem Industry, and ChemSpider in research.	
		ii	What are library resources? Give Selected Internet Resources for Chemistry.	
Q, 2	**A)**		Attempt **any two** of the following:	**8**
		i	Define Chemometrics. Explain the chemometrics process in brief.	
		ii	Define any four terms from the following: Mean, Median, Mode, Range, Variance.	
		iii	Explain in brief the limitations of scientific method.	
		iv	What is SI system? Give any four SI units commonly used by chemists.	
	B)		Attempt **any one** of the following:	**4**
		i	Define variable and explain different types of variables.	
		ii	What is weighted least square regression? Give any two disadvantages of weighted least square regression.	
Q. 3	**A)**		Attempt **any two** of the following:	**8**
		i	What are variables in research? Differentiate between dependent and independent variables.	
		ii	Write in brief general structure of research paper.	
		iii	Describe the language issues in research paper.	
		iv	What are simple rules for making effective oral Presentation?	

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B) Attempt **any one** of the following:

i What is plagiarism and how can it be avoided in research paper? 4

ii State the guidelines for writing project report?

Q. 4 A) Attempt **any two** of the following:

i Write a note on segregation of cytotoxic waste. 8

ii What is chemical waste? Explain the recycling of laboratory chemicals.

iii Write a note on safe uses of flammable and explosive chemicals.

iv Give any four steps of emergency response procedures.

B) Attempt **any one** of the following:

i Write any four general requirements of chemical protective clothing. 4

ii Define Incineration. Write a note on hazardous waste incineration.

Q. 5 Attempt **any four** of the following: 12

A) i) Give any two citation tools.

ii) Define an Abstract.

iii) Gives two examples of primary sources.

B) Gives in brief about citation styles in research.

C) Explain the advantages of weighted least square regression.

D) Define: Accuracy, Precision, Standard deviation.

E) What is a Scientific poster? Give their advantages.

F) Gives guidelines for writing practical project.

G) Discuss the guidelines for materials that should never be disposed of through the sanitary sewer system.

H) Write a note on laboratory ventilations.

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MSc - Chemistry - sem IV

Duration: 2 Hour **Max Marks: 60**

N.B: 1. All question carry equal marks.
2. Figures to the right indicate full marks.
3. Use of non-programmable calculator is allowed.

Q.1	**A.**	**Attempt any TWO of the following:**	**08**
	i)	What is an abstract writing? Gives step by step writing process of abstract.	
	ii)	What is the impact factor of the journal? How it calculated? Explain its importance.	
	iii)	What is a search engine? Gives details about types of search engine.	
	iv)	Describe the term consortium. Give any three examples	
	B.	**Attempt any ONE of the following:**	**04**
	i)	What are the types of web sources? Explain each with suitable example.	
	ii)	What is an e-journal? Gives its advantages and disadvantages.	
Q.2	**A.**	**Attempt any TWO of the following:**	**08**
	i)	What is SI system of measurement? Write down the SI base units used to describe weight, volume, temperature, pressure.	
	ii)	Explain in brief the limitations of scientific methods.	
	iii)	Explain, variance and standard deviation with mathematical expression.	
	iv)	What is curve fitting? Write a note on two general approaches for curve fitting.	
	B.	**Attempt any ONE of the following:**	**04**
	i)	Define, Weighted least square regression. Explain its anyone advantage and disadvantage.	
	ii)	Find the variance and standard deviation of the average temperatures recorded over a five-day period last winter: 18, 22, 19, 25, 12	
Q.3	**A.**	**Attempt any TWO of the following:**	**08**
	i)	Give the general guidelines for reporting a practical and project work.	
	ii)	Gives steps of peer Review process of journals after submission of research paper	
	iii)	What is a scientific poster? Give its advantages and disadvantages.	
	iv)	Why publishing a scientific work is essential? Explain the qualities of good research manuscript.	

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B. **Attempt any ONE of the following:** 04

i) What are Silent features of preparation and delivering talk of Presentation?

ii) Write in brief general structure of research paper

Q.4 A. **Attempt any TWO of the following:** 08

i) Describe any four general requirements of chemical protective clothing.

ii) Write a note on safe use of Flammable and Explosive chemicals.

iii) What is Chemical waste? Write a note on recycling of laboratory chemicals

iv) Explain the general procedure for laboratory disposal of explosive.

B **Attempt any ONE of the following:** 04

i) Explain the various acceptable and non-acceptable discharge to the sanitary sewer system.

ii) Discuss the incineration method for the treatment of hazardous waste.

Q.5 **Attempt any FOUR of the following:** 12

a. Define primary sources. Gives four examples of primary sources.

b. Discuss the terms: a) Chem Industry b) ChemSpider.

c. Express the number 7237, 0.351 in scientific notation and round off the number 1090 to two significant figures

d. The IQs of 13 Students were recorded as 89, 93, 97, 98, 102, 106, 109, 110, 115, 119, 128, 131, 140. Calculate the mean and median.

e. How to avoid authorship abuse in scientific writing?

f. Define word Research. State the rules for writing conclusion.

g. Define incompatible chemicals. Give examples of any two incompatible chemicals.

h. Write a note on safe use of corrosive chemicals.

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MSC – organic – NEP2020 chem

[Time: 1hr] [Marks:25]

Please check whether you have got the right question paper

N.B.: 1. All questions are compulsory.
2. Figure to the right indicates full marks.
3. Use of non – programmable scientific calculator is allowed.

Useful constants

$c = 2.998 \times 10^{8}\ m.s^{-1}$ $e = 1.602 \times 10^{-19}\ C$

$R = 8.314\ J.K^{-1}mol^{-1}$ $k = 1.3811 \times 10\text{-}23\ J.K^{-1}$

$= 2.0\ cal.K^{-1}\ mol^{-1}$

$h = 6.626 \times 10^{-34}\ Js$ $1J = 6.24 \times 10^{18}\ eV$

$m_e = 9.110 \times 10^{-31}\ kg$ $1eV = 8.06 \times 10^{3}\ cm^{-1}$

$NA = 6.022 \times 10^{23}\ mol^{-1}$ $1\ amu = 1.66 \times 10^{-27}\ kg$

Atomic mass of H = 1, C = 12, N = 14, O = 16, S = 32, Cl = 35.5

1. A) Attempt ***any two*** of the following:

i) Explain the Rice-Ramsperger-Kassel-Marcus theory. 04

ii) Show that the rate of polymerization reaction is proportional to square root of its initial concentration of the monomer. 04

iii) The rate of formation of C in the reaction, 04
$2A + B \rightarrow 2C + 3D$ is $5 molL^{-1}s^{-1}$. State the rate of reaction and the rates of formation or consumption of A, B and D.

iv) Explain the formation and decomposition of phosgene. 04

2. A) Attempt ***any two*** of the following:

i) a) Explain the Electrophoretic effect for the conductance of strong electrolytes. 02

b) Calculate the mean ionic activity coefficient of 0.05m $Al_2(SO_4)_3$ in aqueous solution at 298K. (Given: A = 0.509 at 298 K) 02

ii) With the help of diagram explain construction and working of Phosphoric acid fuel cell. 04

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iii) Calculate the resting membrane potential for the following: 04

Ion Species	Intracellular concentration in mM	Extracellular concentration in mM
Ca^{+2}	150	5
Cl^-	0.002	12

(Given that $\frac{2.303RT}{F}$ at 298K = 61)

iv) Explain Debye-Falkenhagen effect and Wein effect for the conductance of strong electrolytes. 04

3. A) Attempt ***any three*** of the following:

i) Explain Consecutive reaction with two examples. 03

ii) Explain three explosion limits of non – stationary chain reaction. 03

iii) Discuss the gas phase combustion reaction between H_2 and O_2. 03

iv) Write a note on the electrochemical enzyme – catalysed oxidation of Styrene. 03

v) Write the Debye-Huckel-Onsager equation and explain its validity for aqueous solutions. 03

vi) Draw well labelled diagram, one advantage and one application of Solid – Oxide fuel cell. 03

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