This question paper contains **3** printed pages]

NEPSST—1—2025

FACULTY OF SCIENCE AND TECHNOLOGY

M.Sc. (First Year) (First Semester) EXAMINATION

APRIL/MAY, 2025

(NEP 2020)

RESEARCH METHODOLOGY

Paper NEPRN-1001

(Wednesday, 16-4-2025)   **Time : 10.00 a.m. to 12.30 p.m.**

Time—2½ Hours   *Maximum Marks—60*

N.B. :—   (*i*)   Question No. **1** is compulsory.

   (*ii*)   Of the remaining solve any *three* questions.

   (*iii*)   Calculator and log table is allowed.

1.   Attempt any *three* of the following :   15

   (*a*)   Qualities of good research.

   (*b*)   Features of good design.

   (*c*)   ANOVA

   (*d*)   Types of data.

2.   (*a*)   What is research ? Explain steps involved in research process.   8

   (*b*)   Discuss interview as a technique of data collection.   7

P.T.O.

3. (*a*) Calculate the Mean, Median and Mode of the following data : 8

Class Interval (CI)	Frequency (F)
50–54	2
45–49	5
40–44	8
35–39	7
30–34	10
25–29	5
20–24	9
15–19	2
10–14	1
5–9	1

(*b*) What is hypothesis ? Give the characteristics of good research hypothesis. 7

4. (*a*) Describe non-probability and probability sampling. 8

(*b*) Calculate the Chi-square value of the following data : 7

Excellent	Average	Poor	Total
58	32	30	120

5. (*a*) Define case study. Give their components. 8

(*b*) Explain extraneous variable. 7

6. Write short notes on : 15

(*a*) Descriptive types of research

(*b*) Non-parametric test

(*c*) Primary data sources.

NEPSST—59—2025

FACULTY OF SCIENCE

M.Sc. (NEP) (First Year) (First Semester) EXAMINATION

APRIL/MAY, 2025

CHEMISTRY

Paper SCHEC-401

(Inorganic Chemistry)

(Saturday, 19-04-2025)   **Time : 10.00 a.m. to 1.00 p.m.**
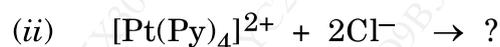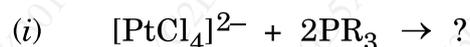
Time—Three Hours   *Maximum Marks—80*

Note :—   (*i*)   Question No. **1** is compulsory. Solve any *three* from remaining five questions.

      (*ii*)   Log table and calculator is allowed.

1.   (*a*)   Explain liability and inertness of complex compounds on the basis of C.F.T.   5

     (*b*)   Predict the product of the following reaction :   5

        (*i*) $[PtCl_4]^{2-} + 2PR_3 \rightarrow ?$

        (*ii*) $[Pt(Py)_4]^{2+} + 2Cl^- \rightarrow ?$

                                        P.T.O.

(c) Explain top-down and bottom-up fabrications for the synthesis of nano-particles. 5

(d) Calculate the number of microstates for d^4 and d^7 electronic configuration. 5

2. (a) Explain outer sphere electron transfer mechanism in complex with suitable examples. 10

(b) Describe the preparation of nano-materials by electrospining method. 10

3. (a) What are mesoporous nano-materials ? Explain its catalytic application. 10

(b) Explain ligand to metal and metal to ligand charge transfer spectra in metal complexes. 10

4. (a) What is trans effect ? Explain electrostatic polarization theory of trans effect. 10

(b) Draw and explain the Orgel diagram for d^2 and d^8 configuration of metal ion octahedral complexes. 10

5. (a) Explain solution based synthesis of nano-particles. 10

(b) (i) Define and explain nephelauxetic effect and nephelauxetic ratio. 5

(ii) Determine ground state term symbol for d^1 and d^4 configuration. 5

6   Write short notes on :

(*a*)   SN^{1}CB Mechanism with evidence in Farous.   5

(*b*)   Cis effect   5

(*c*)   DNA bioinorganic nano-material.   5

(*d*)   Selection rules.   5

NEPSST—155—2025

FACULTY OF SCIENCE

M.Sc. (First Year) (First Semester) EXAMINATION

APRIL/MAY, 2025

(NEP-2020)

CHEMISTRY

Paper–SCHEC-402

(Organic Chemistry)

(Tuesday, 22-4-2025)   **Time : 10.00 a.m. to 1.00 p.m.**

Time—3 *Hours*   *Maximum Marks*—80

N.B. :—   (*i*)   Question No. **1** is compulsory.

      (*ii*)   Solve any *three* from remaining five questions.

      (*iii*)   Simple calculator and log table is allowed.

1.   Solve the following :   20

   (*a*)   Explain the structure and stability of carbanions.

   (*b*)   Write a note on threo and erythro isomers.

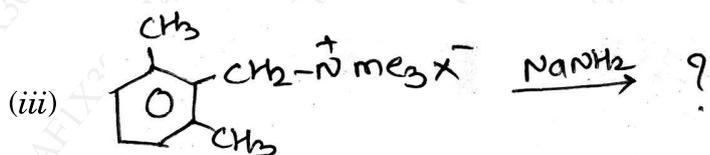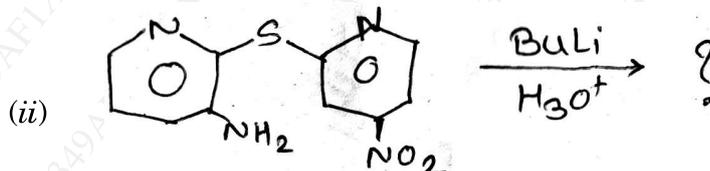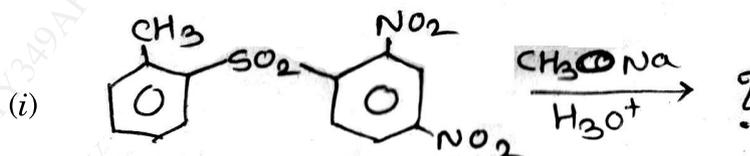   (*c*)   Explain the effect of leaving group in SN^1 reaction.

   (*d*)   Explain Vilsmeir reaction with mechanism.

P.T.O.

2. Answer the following : 20

(a) (i) Explain the Huckel rule and anti-aromaticity.

   (ii) Explain the term Conjugation and Hyper-conjugation with example.
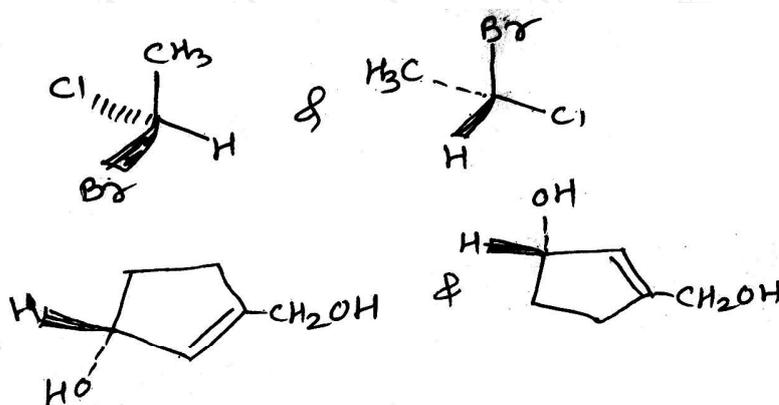
(b) Predict the following products :

(i)

(ii)

(iii)

(iv)
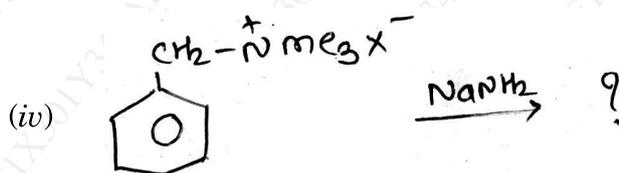
3. Solve the following : 20

    (*a*)   (*i*)   Explain conformation of 1, 4-dimethyl cyclohexane.

           (*ii*)   Give the stereochemical relationship between the pair of compounds :

    (*b*)   Write the mechanism of SE' reaction. How does it compare with SN^1 reaction.

4. Solve the following : 20

    (*a*)   (*i*)   Define Homo-aromaticity. Explain aromaticity in benzoid and non-benzenoid compounds with suitable example.

           (*ii*)   What are free radicals ? Explain its stability.

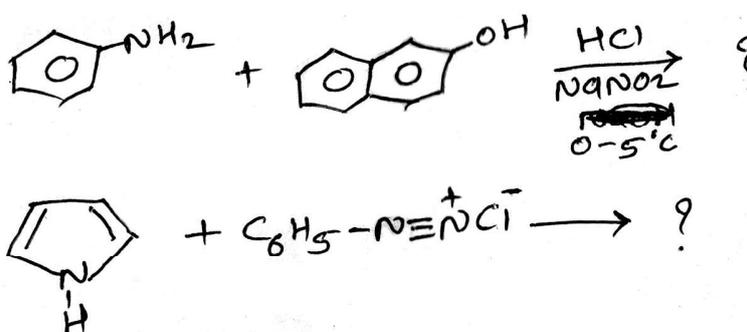   (*b*)   Discuss the stereochemistry of spiranes and allenes.

P.T.O.

5. Answer the following : 20

(a) (i) Explain Von-Richter rearrangement reaction with mechanism.

(ii) Write a note on Phase transfer catalysis.

(b) Explain diazonium coupling reaction with mechanism and predict the following product :

6. Write short notes on the following : 20

(a) Hammond's postulates

(b) Asymmetric Synthesis

(c) SET mechanism

(d) Ortho-para ratio.

NEPSST—263—2025

FACULTY OF SCIENCE

M.Sc. (First Year) (First Semester) EXAMINATION

APRIL/MAY, 2025

(NEP-2020 Pattern)

CHEMISTRY

Paper SCHEC-403

(Physical Chemistry—I)

(Thursday, 24-4-2025)   **Time : 10.00 a.m. to 1.00 p.m.**

Time—3 Hours   *Maximum Marks*—80

N.B. :— (1)   Question No. **1** is compulsory.

(2)   Solve any *three* questions from Q. Nos. **2** to **6**.

(3)   Use of log table and calculator is allowed.

(4)   Figures to the right indicate full marks.

Given :

(*i*) $\sigma_{HCl} = 1$

(*ii*)   Boltzmann constant, $k = 1.38 \times 10^{-23}$ JK^{-1}

(*iii*) $h = 6.626 \times 10^{-34}$ Js

(*iv*) $C = 3 \times 10^{10}$ cm/s

(*v*) $I = 4.60 \times 10^{-48}$ kgm^2.

P.T.O.

1. Solve the following : 20

    (a) Explain why $\psi^2 = \psi \cdot \psi^*$ why not $\psi \cdot \psi$? State its importance.

    (b) Calculate the mean activity coefficient, $\sqrt{\pm}$ of :

    (i) 0.02 m NaCl and

    (ii) 1×10^{-3} sodium sulphate in aqueous solution, 25°C.

    (c) Write an account on Stern's theory of an electric double layer.

    (d) What is lattice energy ? Explain Born-Haber cycle.

2. Solve the following : 20

    (a) Derive the Schrödinger's wave equation to a Linear Harmonic Oscillator and derive, $E = \left(v + \dfrac{1}{2}\right)h\nu$, where v is vibrational quantum number. Sketch the various energy levels when $v = 1, 2$ and 3.

    (b) Derive the Lippmann equation for surface excess phenomenon.

3. Solve the following : 20

    (a) What is symmetry number ? The rotational constant (B) of $HCl_{(g)}$, determined by microwave spectroscopy is 10.59 cm^{-1}. Calculate the q_{rot}. of HCl at :

    (i) 100 K and

    (ii) 500 K.

    Comment your results.

(b) What is Tie-line ? Explain a three-component system involving one pair of partially miscible liquids with a suitable phase diagram.

4. Solve the following : 20

(a) Find the degrees of degeneracy of the energy-levels for a particle in a cubic box with edges of length 'a' and volume 'a^3' with the following values of $8\,M e\,a^2 E/h^2$? Explain in short :

(i) 12

(ii) 14

(iii) 17 and

(iv) 27.

(b) Explain the Graphical method for determination of Fugacity of a real gas in detail.

5. Solve the following : 20

(a) Explain :

(i) Debye-Hückel theory and

(ii) Onsager's theory applied to strong electrolytes.

How to verify the Onsager's equation ?

(b) What are :

(i) Schottky defects and

(ii) Frenkel defects ?

Explain their consequences.

6. Write short notes on : 20

 (*a*) Perturbation theory

 (*b*) The solubility method for determination of activity and activity coefficient.

 (*c*) Two solid and a liquid component Eutectic systems.

 (*d*) The Wein effect.

This question paper contains **2** printed pages]

NEPSST—28—2025

FACULTY OF SCIENCE

M.Sc. (First Year) (Second Semester) EXAMINATION

APRIL/MAY, 2025

(NEP Pattern)

CHEMISTRY

Paper SCHEC-1451

(Inorganic Chemistry)

(Thursday, 17-4-2025)   **Time : 10.00 a.m. to 1.00 p.m.**

Time—Three Hours   *Maximum Marks—80*

N.B. :— (i) Question No. **1** is compulsory. Solve any *three* from the remaining five.

      (ii) Log table and calculator is allowed.

1. (a) Give an account on essential trace and ultratrace elements.   5

     (b) Explain the role of catalyst in alkene polymerisation reaction.   5

     (c) How many lines do you expect in the ESR of $ro^+(I = 7/2)$?   5

     (d) Prove that $\overset{\cdot}{C}H_3$ and $Fe(CO)_5$ are isolobal with each other.   5

2. (a) What is Fischer-Tropsch Catalyst ? Explain its role in alkene polymerisation.   10

     (b) What will be force constant for the bond in Cu-O of $Cu(acac)_2$ complex ?   10

     Given :

     Fundamental Vibrational Frequency = $4.60 \times 10^{13}\, s^{-1}$

     Atomic wright of Cu = 63.58

     Atomic weight of O = 16

     Arogadro's No = 6.022×10^{23} grams.

                        P.T.O.

3. (a) What are frontier orbital ? Explain it with suitable example. 10

(b) Explain quadrupole doublet spectrum of $Na_2[Fe(CN)_5NO]$ complex. 10

4. (a) Discuss the mechanism of hydroformulation of olefins using Cobalt salt. 10

(b) What is metalloporphyrin ? Explain the function of haemoglobin and myoglobin. 10

5. (a) Describe the number of EPR lines, spectrum, hyperfine splitting and relative intensities of methyl radical. 10

(b) Explain the importance of Na/K pump in biological system. 10

6. Write short notes on :

(a) Cytochrome 5

(b) Marker in ESR spectra 5

(c) Isolobal analogy 5

(d) Ziegler-Natta catalyst. 5

NEPSST—107—2025

FACULTY OF SCIENCE AND TECHNOLOGY

M.Sc. (Second Semester) EXAMINATION

APRIL/MAY, 2025

CHEMISTRY

Paper SCHEC-1452

(Organic Chemistry)

(Monday, 21-4-2025)   **Time : 10.00 a.m. to 1.00 p.m.**

Time—Three Hours   *Maximum Marks—80*

N.B. :—   (*i*)   Question No. **1** is compulsory.

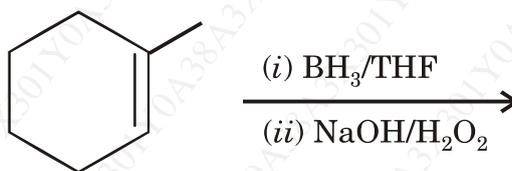(*ii*)   Solve any *three* from remaining *five* questions.

(*iii*)   Simple calculator and log table is allowed.

1.   Solve the following :   20

(*i*)   What is pyrolytic elimination ? Explain with suitable example.

(*ii*)   Predict the product with Mechanism :

$\xrightarrow{\text{(i) BH}_3\text{/THF}}{\text{(ii) NaOH/H}_2\text{O}_2}$

(*iii*)   Explain cope rearrangment with suitable example.

(*iv*)   Describe the process of Fluorescence and Phosphorescence with reference to Jablonski diagram.
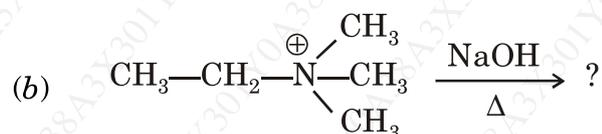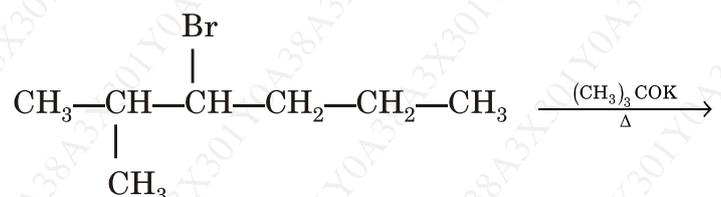
P.T.O.

2. Answer the following : 20

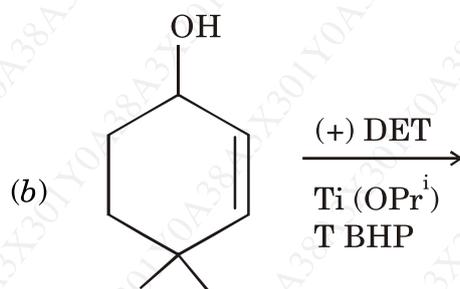   (*i*)   (*a*)   Predict the product of the following reaction with mechanism :

$$CH_3-CH-CH-CH_2-CH_2-CH_3 \xrightarrow[\Delta]{(CH_3)_3COK} \ .$$

with Br on the third carbon and CH$_3$ on the second carbon:

$$CH_3-\underset{\underset{CH_3}{|}}{CH}-\underset{\overset{Br}{|}}{CH}-CH_2-CH_2-CH_3 \xrightarrow[\Delta]{(CH_3)_3COK} \ .$$

    (*b*) $CH_3-CH_2-\overset{\oplus}{N}(CH_3)_3 \xrightarrow[\Delta]{NaOH}$?

(with the nitrogen bearing three CH_3 groups and a positive charge)

    (*ii*)   What are sigmatropic rearrangement. Say whether 5-methylcyclopentadiene can offer such a rearrangement

3. Answer the following : 20

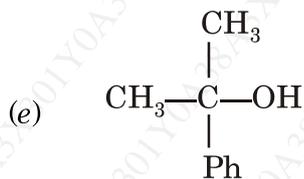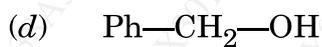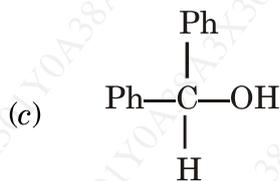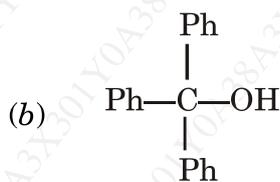   (*i*)   Predict the product with mechanism :

    (*a*)   (furan-2-carbaldehyde) $\xrightarrow[\Delta]{KCN/C_2H_5OH/H_2O}$

    (*b*)   (4,4-dimethylcyclohex-2-en-1-ol) $\xrightarrow[\substack{Ti(OPr^i) \\ TBHP}]{(+) DET}$
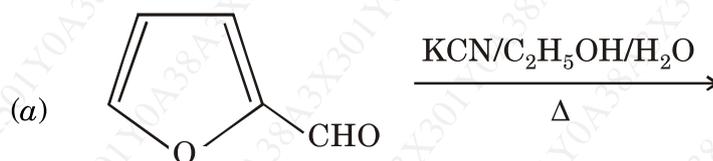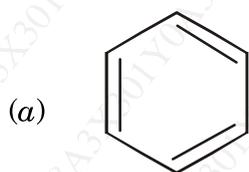
    (*ii*)   Explain Norrish type–I and II reactions with suitable example.

4. Solve the following : 20

   (*i*) Discuss E^1 and E^2 elimination reaction with example. Comment on E^1CB elimination.

   (*ii*) How will you achieve the following compound using phenyl magnesium :

   (*a*)

   (*b*) Ph—C(Ph)(Ph)—OH

   $$\text{Ph}-\underset{\underset{\text{Ph}}{|}}{\overset{\overset{\text{Ph}}{|}}{\text{C}}}-\text{OH}$$

   (*c*)

   $$\text{Ph}-\underset{\underset{\text{H}}{|}}{\overset{\overset{\text{Ph}}{|}}{\text{C}}}-\text{OH}$$

   (*d*) Ph—CH$_2$—OH

   (*e*)

   $$\text{CH}_3-\underset{\underset{\text{Ph}}{|}}{\overset{\overset{\text{CH}_3}{|}}{\text{C}}}-\text{OH}$$

P.T.O.

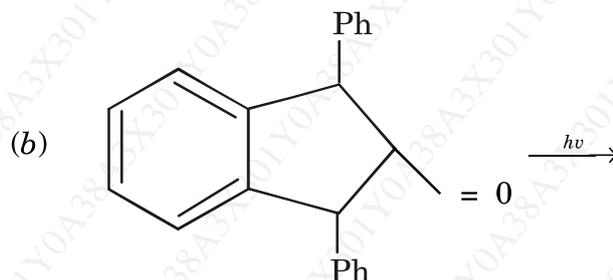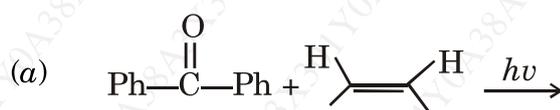5. Discuss the following : 20

    (*i*)   Explain the following :

        (*a*)   1, 3-dipolar cycloaddition reaction.

        (*b*)   What is electrocyclic reactions ? With the help of correlation diagram analyse the : cis-3, 4-dimethyl cychobutene $\rightleftharpoons$ 2, 4-hexadiene under thermal condition.

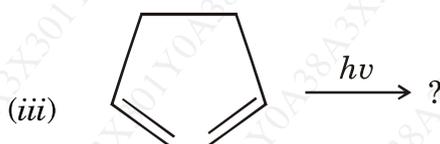   (*ii*)   Predict the product of the following reaction with suitable mechanism :

        (*a*)

$$Ph-\overset{\overset{\displaystyle O}{\|}}{C}-Ph + \quad \overset{H}{}\!\!\diagup\!\!=\!\!\diagdown\!\overset{H}{} \quad \xrightarrow{\;h\nu\;}$$

        (*b*)

$$\xrightarrow{\;h\nu\;}$$

6. Write short notes on the following : 20

    (*i*)   Effect of substrate structure on elimination reaction.

    (*ii*)   Knoevenagel reaction.

    (*iii*)

$$\xrightarrow{\;h\nu\;} \; ?$$

    (*iv*)   Photo-Fries reaction of anilides.

NEPSST—204—2025

FACULTY OF SCIENCE

M.Sc. (First Year) (Second Semester) EXAMINATION

APRIL/MAY, 2025

CHEMISTRY

Paper SCHECT-453

(Physical Chemistry)

(Wednesday, 23-4-2025)   **Time : 10.00 a.m. to 1.00 p.m.**

Time—3 Hours   *Maximum Marks*—80

N.B. :— (1) Question No. **1** is compulsory.

       (2) Solve any *three* questions from remaining five questions.

       (3) Use of calculatar and log table is allowed.

1. Solve the following :   20

    (*a*)   Explain surface tension along with its units. Derive Laplace equation for curved surfaces.

    (*b*)   Discuss Polydispersity Index (PDI). Determine $\bar{M}_N$ and $\bar{M}_M$ of a polymer sample consisting of equal number of molecules with $M_1 = 20{,}000$ and $\bar{M}_2 = 2{,}00{,}000$.

    (*c*)   Explain any *two* applications of polarography.

    (*d*)   Explain the kinetics of photochemical reaction between H_2 and Cl_2.

                                                              P.T.O.

2. Attempt the following : 20

(*a*) Discuss in detail about surfactants and their classification.

(*b*) Define semi-conductor interface. Explain theory of double layer at semi-conductor and effect of light at semi-conductor interface.

3. Solve the following : 20

(*a*) Discuss viscometric method of determination of molecular weight of polymer in detail. At 25°C, the plot of $\frac{\pi}{c}$ *Vs.* 'C' gave an intercept 3.2 × 10^{-3} at m.kg^{-1}. Calculate the molar mass of polymer. (Given : R = 0.08206 dm^3 at mK^{-1}mol^{-1})

(*b*) Explain fast reactions and methods to study fast reactions in brief.

4. Attempt the following : 20

(*a*) Discuss about electrokinetic phenomenon for surface films on liquids.

(*b*) Define polymers and write in detail about electrically conducting polymer and liquid crystal polymers.

5. Solve the following : 20

(*a*) State the principle involved in polarography and explain its experimental set-up with any *one* application.

(b) Describe fractional change method of rate laws. At a certain temperature half life period for catalytic decomposition of ammonia were found to be as :

Pressure (mm)	Half life period ($t_{1/2}$)
50	3.52
100	1.92
200	1.0

Find out order of reaction.

6. Write short notes on the following : 20

(a) Surface films on liquids

(b) Kinetics of Addition polymerisation

(c) Half-wave potential along with its significance

(d) Oscillatory reactions.

NEPSST—354—2025

FACULTY OF SCIENCE AND TECHNOLOGY

M.Sc. (First Year) (Second Semester) EXAMINATION

APRIL/MAY, 2025

CHEMISTRY

SCHEE-1451

(Principles of Spectroscopy)

(Friday, 25-4-2025)   **Time : 10.00 a.m. to 1.00 p.m.**

Time—3 Hours   *Maximum Marks—60*

N.B. :—   (*i*)   Q. No. **1** is compulsory.

      (*ii*)   Attempt any *three* questions from Q. No. 2 to Q. No. 6.

      (*iii*)   Use of logarithm table and simple nonprogramable calculator is allowed.

1.   Answer the following questions :   15

(*a*)   Explain the term reflection and refraction related to spectroscopy.

(*b*)   Explain the qualitative relationship between force constant and bond strength in vibrational frequency of molecule.

(*c*)   State and explain Frank Condon principle.

                    P.T.O.

2. Solve the following questions : 15

(a) (i) Show that spacing between two lines in rotational spectrum of rigid diatomic molecule is constant.

(ii) The microwave spectra of gaseous diatomic molecule consists of series of equally spaced line separated by 2.00 cm^{-1}. Calculate bond length. The reduced mass of molecule is 10.6×10^{-27} kg ($h = 6.6 \times 10^{-34}$ J.S., C = 3×10^{8} m/s). 4+4=8

(b) What is Raman effect ? Explain Resonance Raman spectroscopy. 7

3. Solve the following questions : 15

(a) (i) Explain the factors affecting band positions and intensities in IR spectra.

(iii) If the force constant of one molecule is 420 Nm^{-1} and reduced mass is 1.76×10^{-27} kg determine the fundamental vibrational frequency of molecule. 4+4=8

(b) Explain the spectrum of non-rigid rotator diatomic molecule. 7

4. Answer the following questions : 15

(a) Explain the spectrum of hydrogen atom and alkali metal atoms.

(b) Explain the breakdown of Born-Oppenheimer approximation in IR spectroscopy.

5. Answer the following questions : 15

   (*a*) Explain the factors affecting width and intensity of spectral line in rotational spectrum of molecule.

   (*b*) Explain the charge transfer spectra with suitable examples.

6. Write short notes on the following : 15

   (*a*) Photoelectric effect

   (*b*) Stark effect

   (*c*) Overtone and hot bands.

NEPSST—353—2025

FACULTY OF SCIENCE

M.Sc. (First Year) (Second Semester) EXAMINATION

APRIL/MAY, 2025

CHEMISTRY

Paper NEPWT-275

(Laboratory Safety)

(Friday, 25-4-2025) **Time : 10.00 a.m. to 1.00 p.m.**

Time—3 Hours *Maximum Marks—*60

N.B. :— (*i*) Question No. **1** is compulsory.

(*ii*) Attempt any *three* questions from Q. No. 2 to Q. No. 6.

1. Answer the following questions :

    (*a*) Discuss health risks in pesticide sector. 5

    (*b*) Discuss in brief Bhopal Gas Incidence. 5

    (*c*) Explain in brief disposal of biological materials. 5

2. Answer the following questions :

    (*a*) Give an account on health risks in electrical and radioactive sectors. 7

    (*b*) Discuss in detail health effects due to hazardous exposure. 8

P.T.O.

3.   Attempt the following questions :

(*a*)   Give an account on explosive substances.   8

(*b*)   Discuss health risks in fertilizer and pesticide sector.   7

4.   Attempt the following questions :

(*a*)   Discuss in detail material safety data sheets.   8

(*b*)   Give an account on characterization and collection of waste.   7

5.   Answer the following questions :

(*a*)   Explain in detail types of toxins.   7

(*b*)   Discuss health risks in pharmacy and cracker industries.   8

6.   Attempt the following questions :

(*a*)   Give the importance of first aid for accidents.   5

(*b*)   Write a short note on biosafety.   5

(*c*)   Discuss in brief vizag gas leak incidence.   5

This question paper contains **6** printed pages]

NEPSST—17—2025

FACULTY OF SCIENCE

M.Sc. (Second Year) (Third Semester) EXAMINATION

APRIL/MAY, 2025

(NEP Pattern)

ORGANIC CHEMISTRY

Paper SEHECT-1501

(Advanced Spectroscopic Methods)

(Wednesday, 16-4-2025)   **Time : 2.00 p.m. to 5.00 p.m.**

Time—3 Hours   *Maximum Marks—80*

N.B. :—   (i)   *First* question is compulsory.

(ii)   Solve any *three* questions from remaining *five*.

1.   Solve the following :   20

(a)   The U.V. spectrum of ethene shows absorption at 171 nm but butadiene shows absorption at 217 nm. Explain.

(b)   In PMR spectrum of aldehyde proton appears at δ 9-10 ppm. Explain.

(c)   Explain use of mass spectroscopy in detection of halogen atoms in organic compounds.

(d)   How will you distinguish the following compounds by using IR spectroscopy ?
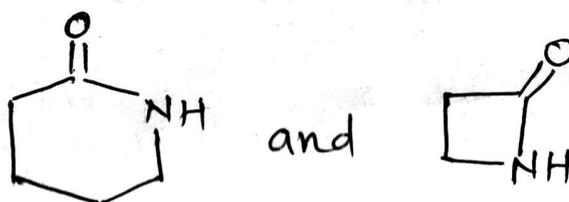
2. Answer the following : 20

    (a)   Calculate the λ_{max} of following compounds :

       (i)
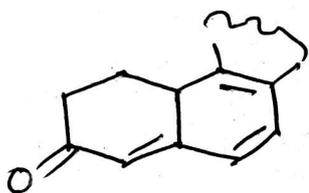
       (ii)
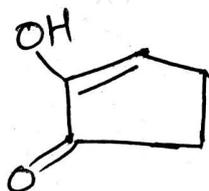
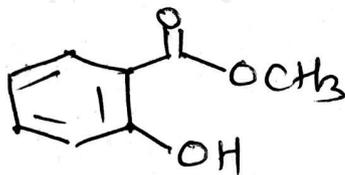
       (iii)
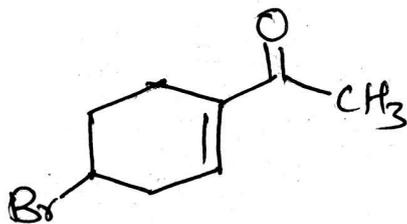
       (iv)
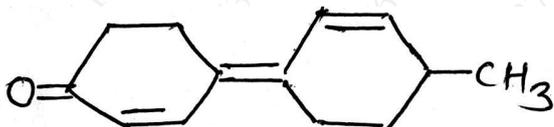
    (b)   Explain the genesis of ions of the following :

       (i)

$m/z = 152,\ 121,\ 120,\ 93$
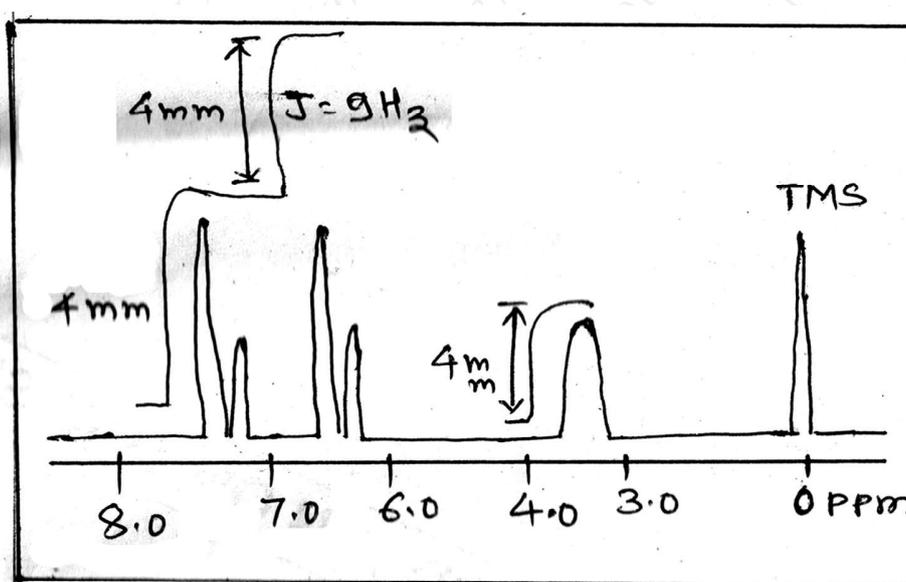
       (ii)

$m/z = 126,\ 128,\ 91,\ 65,\ 39$

3. Answer the following : 20

(a) The compound having M.F. C_6H_6NCl shows the following NMR spectrum, deduce the structure :

(b) An organic compound having MF $C_7H_{12}O_4$ exhibits the following spectral data :

UV : 212 nm ϵ_{max} 60

IR : (cm^{-1}) 2941 – 2857, 1742 (s)

1460 (m), 1056 (s) 1260 (s).

PMR : (δ, ppm)

(i)   2.5, 2H, s

(ii)   1.29, 6H, t

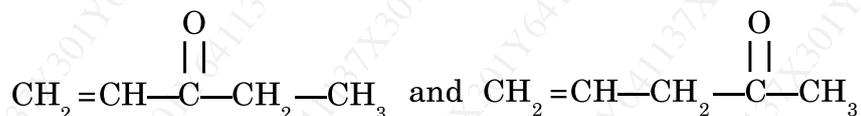(iii)   4.16, 4H, 2

Deduce the structure of compound.

P.T.O.

4. Answer the following : 20

(*a*) Solve the following :

(*i*) Discuss and arrange the following compounds in order of increasing wave number of carbonyl compounds :
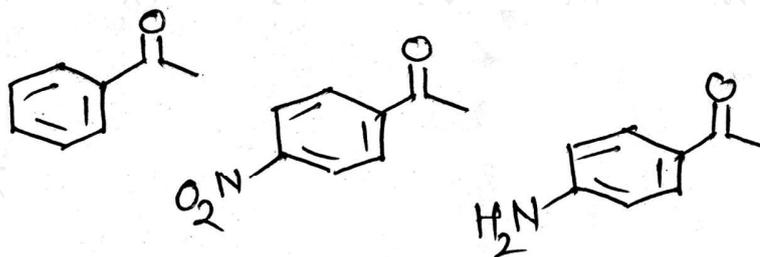
(*ii*) How will you distinguish following pair of compounds with help of IR spectrum :

$$CH_2=CH\overset{\overset{\displaystyle O}{\|}}{-C}-CH_2-CH_3 \quad \text{and} \quad CH_2=CH-CH_2\overset{\overset{\displaystyle O}{\|}}{-C}-CH_3$$

(*b*) An organic compound having M.F. C_9H_8O shows the following spectral data. Deduce the structure :

IR : (cm^{-1}) 2710, 1700, 1675, 1600, 1580, 1500, 760, 700.

PMR : (δ, ppm)

(*i*) 6.7, *dd*, IH, J = 16 H*z* and 8 H*z*

(*ii*) 7.1 − 7.4, *m*, 5H.

(*iii*) 7.6, *d*, IH, J = 16 H*z*

(*iv*) 10.0, *d*, IH, J = 8 H*z*

C^{13} NMR : δ scale off resonance 128 (*d*), 129 (*d*), 131 (*d*), 134 (*s*), 152 (*d*), 160 (*d*), 195 (*d*).
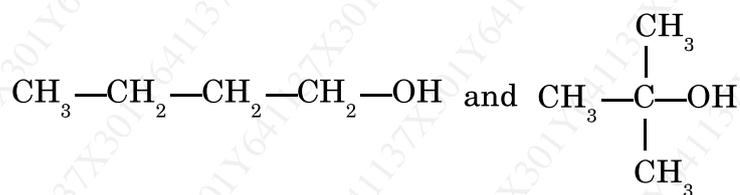
5. Answer the following : 20

    (a) (i) Why TMS solvent used as standard reference in NMR spectroscopy ?

        (ii) How will you distinguish the following compounds by using off-resonance decoupled ^{13}C—NMR.

$$CH_3-CH_2-CH_2-CH_2-OH \text{ and } CH_3-\overset{\overset{\displaystyle CH_3}{|}}{\underset{\underset{\displaystyle CH_3}{|}}{C}}-OH$$

    (b) An organic compound with the following spectral data :

C = 36.9%, H = 5.67%, Br = 41.0%

IR : (cm^{-1}) 1735, 1250.

^{1}H—NMR (δ, ppm) :

4.1, 2H, q, J = 7.5 Hz

3.8, 2H, t, J = 7.0 Hz

1.8, 2H, m

1.25, 3H, t, J = 7.5 Hz

2.4, 2H, t, J = 7.2 Hz.

Mass : (m/z) : 194 (M$^+$), 196 (M + 2), 115.

Deduce the structure.

6. Write short notes on the following : 20

    (*a*) Use of deuterium exchange in NMR spectrum.

    (*b*) Mc Lafferty rearrangement.

    (*c*) Chemical shift in PMR.

    (*d*) Fermi Resonance and overtone band.

This question paper contains **5** printed pages]

NEPSST—84—2025

FACULTY OF SCIENCE AND TECHNOLOGY

M.Sc. (Second Year) (Third Semester) EXAMINATION

APRIL/MAY, 2025

(NEP-2020)

ORGANIC CHEMISTRY

Paper–I (SCHECT-1502)

(Organic Synthesis)

(Saturday, 19-4-2025)   **Time : 2.00 p.m. to 5.00 p.m.**

Time—3 Hours   *Maximum Marks—80*

N.B. :— (*i*)   Question No. **1** is compulsory.

   (*ii*)   Solve any *three* from remaining *five* questions.

1.   Solve the following :   20

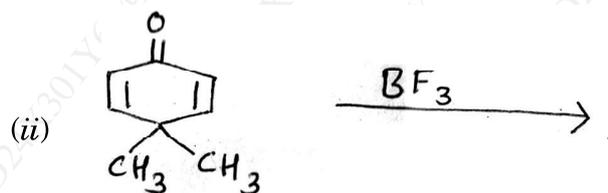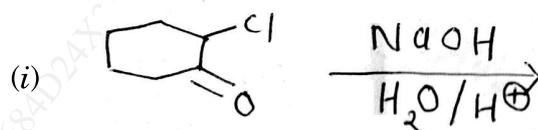(*a*)   Predict the product of the following reaction with mechanism :
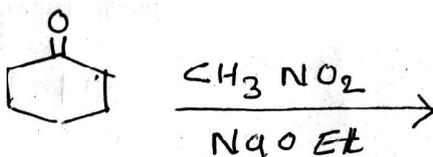
P.T.O.

(b) Explain Suzuki reaction with mechanism.

(c) How will you convert alkene into diole using OsO_4 ? Comment on role of NMO.

(d) Complete the following reaction :

(i)

(ii)
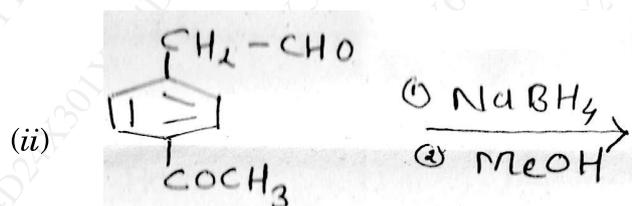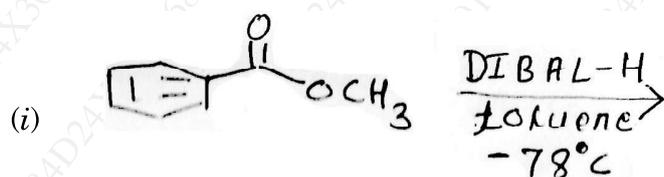
2. Answer the following : 20

(a) Complete and outline the mechanism of the following reaction :

(i)

(ii)

(b) Give the uses of the following oxidizing agent with mechanism in organic synthesis :
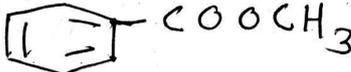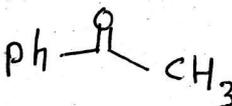
(i) DDQ

(ii) MnO_2.

3. Explain the following : 20

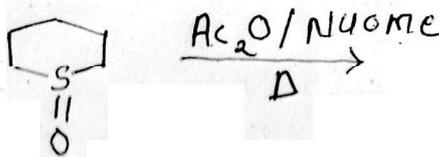(a) What is Corey-Fuchs reaction ? Explain with suitable example and mechanism.

(b) How will you obtain the following compounds using suitable reagent ? Explain with mechanism :
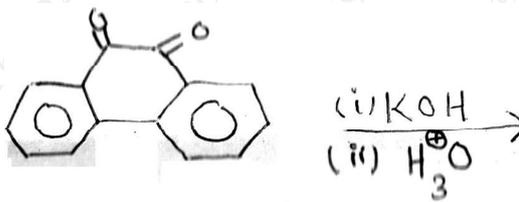
(i) $COOCH_3$ using Diazomethane

(ii) $Ph - \overset{O}{\underset{}{C}} - CH_3$ using 1, 3–Dithiane

4. Discuss the following : 20

(a) Predict the product of the following reaction with mechanism :

(i) $\xrightarrow[\Delta]{Ac_2O/NaOMe}$

(ii) $\xrightarrow[(ii)\ H_3\overset{\oplus}{O}]{(i)\ KOH}$

(b) Predict the product of the following reactions with mechanism :

(i)

1] n BuLi
2] C_6H_{13}-CHO
3] Ac_2O
4] Na/Hg

(ii)

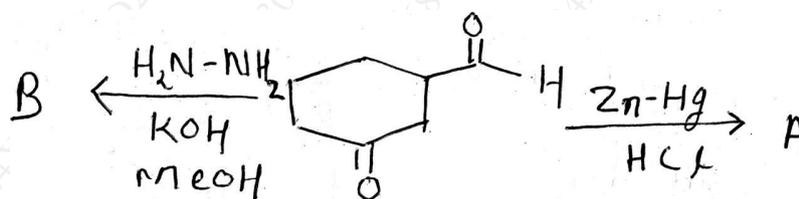

1] $Pd(OAc)_2$
2] PPh_3
3] K_2CO_3
130°C
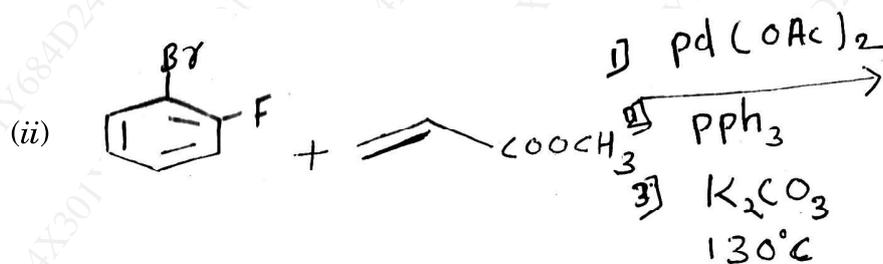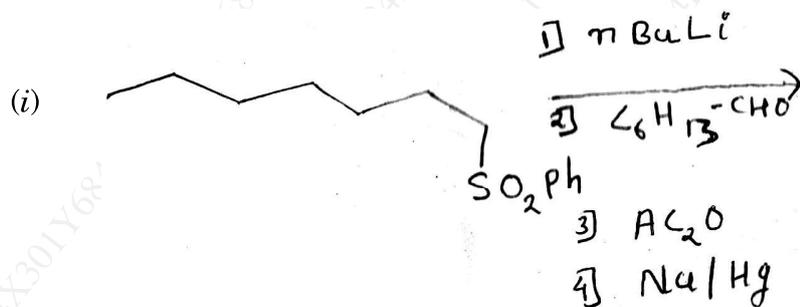
5. Solve the following : 20

(a) Explain Woodward modification and Prevost oxidation with example. Comment on steriochemistry of both.

(b) Predict the product of the following reaction with mechanism :

$B \xleftarrow[\substack{KOH \\ MeOH}]{H_2N-NH_2}$ ... $\xrightarrow[HCl]{Zn-Hg} A$

6. Write short notes on the following : 20

    (*a*)   Payne rearrangement

    (*b*)   Shapiro reaction and discuss how it differs from Bamford Stevens

    (*c*)   Chemoselectivity of Dess-Martin Periodinate (DMP)

    (*d*)   Applications of sodium cyano borohydride (any *two*).

NEPSST—180—2025

FACULTY OF SCIENCE AND TECHNOLOGY

M.Sc. (Second Year) (Third Semester) EXAMINATION

APRIL/MAY, 2025

(NEP-2020)

ORGANIC CHEMISTRY

Paper–SCHECT-1503

(Natural Product)

(Tuesday, 22-4-2025) **Time : 2.00 p.m. to 4.00 p.m.**

Time—2 Hours *Maximum Marks—40*

N.B. :— (*i*) Question No. **1** is compulsory.

(*ii*) Attempt any *three* questions from remaining questions.

(*iii*) *All* questions carry equal marks.

1. Solve the following : 10

(*a*) Discuss the structure determination of Citral.

(*b*) Give the synthesis of vitamin A from β-ionone nucleus.

(*c*) Discuss the structure of methyl morphol

(*d*) Discuss the structure of Diel's hydrocarbon.

P.T.O.

2. (*a*) Give the synthesis of Quaninic acid. 10

   (*b*) What are vitamins ? How are they classified ? Give the sources and deficiency disease caused due to lack of Vitamin A, C and E.

3. (*a*) Discuss the constitution of Androsterone. 10

   (*b*) Presence of phenanthrene ring system in morphine.

4. (*a*) Discuss the presence of side chain in cholesterol. 10

   (*b*) Offer the synthesis for Menthol.

5. (*a*) Discuss structure determination of Retinol. 10

   (*b*) What are alkaloids ? How are they classified ?

6. Explain in detail : 10

   (*a*) Nature of ring system in cholesterol

   (*b*) Presence of γ-lactone ring in Ascorbic acid

   (*c*) Presence of cyclic tertiary base in morphine

   (*d*) Conversion of cholesterol to progestenone.

NEPSST—302—2025

FACULTY OF SCIENCE AND TECHNOLOGY

M.Sc. (Second Year) (Third Semester) EXAMINATION

APRIL/MAY, 2025

(NEP 2020)

ORGANIC CHEMISTRY

Paper SCHEET-1501

(Medicinal Chemistry)

(Thursday, 24-4-2025)   **Time : 2.00 p.m. to 5.00 p.m.**

Time—Three Hours   *Maximum Marks—80*

N.B. :— (i) Question No. **1** is compulsory.

    (ii) Solve any *three* questions from remaining five questions.

1. Solve the following :   20

    (i) Define drug Assay. Describe Biological Assay.

    (ii) Explain the term pharmacophore.

    (iii) Explain oxidation involved in the drug metabolism.

    (iv) Write a note on mechanism of blood clotting.

2. Discuss the following : 20

    (*i*) Explain the following terms :

        (1) Toxicology

        (2) Metabolites.

    (*ii*) Discuss about competitive inhibitors and active site directed irreversible inhibition of enzymes.

3. Answer the following : 20

    (*i*) Discuss physico-chemical properties – lipophilicity, electronic parameter and steric substituent constant used in QSAR studies.

    (*ii*) Describe about distribution and elimination of drugs with respect to pharmacokinetics.

4. Solve the following : 20

    (*i*) Explain the structural modification w.r.t. Homologation and chain branching to increase the potential of drugs.

    (*ii*) How will you synthesis chlortetracycline ? Give structure activity of tetracycline.

5. Explain the following : 20

    (*i*) Explain structure and activity of Streptomycin and Viomycin.

    (*ii*) Write a note on semisynthetic penicillin and cephalosporin.

6. Write short notes on the following : 20

    (*i*) Biological defences

    (*ii*) Soft drugs

    (*iii*) Sulphonamide

    (*iv*) Structure activity of Coumarin derivatives.

NEPSST—303—2025

FACULTY OF SCIENCE AND TECHNOLOGY

M.Sc. (Second Year) (Third Semester) EXAMINATION

APRIL/MAY, 2025

ORGANIC CHEMISTRY

Paper–SCHEET-1505

(Applied Chemistry)

(Thursday, 24-4-2025)   **Time : 2.00 p.m. to 5.00 p.m.**

Time—3 Hours   *Maximum Marks—80*

N.B. :—   (*i*)   Question No. **1** is compulsory.

       (*ii*)   Solve any *three* questions from remaining five.

       (*iii*)   Simple calculator and log table is allowed.

1.   Solve the following :   20

     (*a*)   Explain the following properties of covalent bond :

          (*i*)   Bond length

          (*ii*)   Bond angle

          (*iii*)   Force constant.

                                              P.T.O.

(*b*) Explain the term molecular electronics and molecular magnets.

(*c*) Explain forensic profile and role of forensic scientist.

(*d*) Explain analysis of narcotic and stimulant.

2. Answer the following :   20

(*a*) Discuss electrostatic induction with suitable example and comment on dispersion and resonance energy.

(*b*) Discuss crime-scene investigation precaution and care for collection and preservation of evidences.

3. Discuss the following :   20

(*a*) Explain transition metal based molecular magnet and organic magnet ? Why organic magnet could be beneficial over inorganic ?

(*b*) Discuss procedure for explosive residue analysis and comment on lethal drug analysis.

4. Explain the following :   20

(*a*) Discuss applications of calixeranes and cyclodextrin in supramolecular chemistry.

(*b*) What are conducting polymers ? Explain with examples of :

(*i*) Polyacetylene

(*ii*) Polypyrrole

(*iii*) Polythiophene.

5. Discuss the following : 20

    (*a*) How will you perform analysis of the following :

        (*a*) Liquor analysis

        (*b*) Trap-case analysis.

    (*b*) Discuss importance of physiological test in forensic science. Comment on reporting of analysis results.

6. Write short notes on the following : 20

    (*a*) Non-covalent interaction in porphyrin

    (*b*) Molecular electronic logic and architecture

    (*c*) Lethal drug analysis

    (*d*) Future prospects of forensic science.

NEPSST—43—2025

FACULTY OF SCIENCE AND TECHNOLOGY

M.Sc. (Second Year) (Fourth Semester) EXAMINATION

APRIL/MAY, 2025

(NEP 2020)

RESEARCH AND PUBLICATION ETHICS

NEPPE-1002

(Thursday, 17-4-2025)   **Time : 2.00 p.m. to 4.00 p.m.**

Time—2 Hours   *Maximum Marks—40*

N.B. :— (*i*)   Question Number **1** is compulsory.

(*ii*)   Solve any *three* questions of the remaining.

1.   Write notes on :   5×2=10

(*a*)   Nature of philosophy

(*b*)   Research integrity

(*c*)   Importance of publication ethics

(*d*)   Characteristics to call a journal open

(*e*)   *h*-index.

2. (*a*) Define philosophy. Explain its branches. 5×2=10

 (*b*) What do you mean by fabrication, falsification and plagiarism (FFP).

3. (*a*) Define publication ethics. Write the importance of publication ethics.

5×2=10

 (*b*) Describe SHERPA/ROMEO online resource and list three variant of text.

4. (*a*) What is predatory journal ? List the common characteristics of it.

5×2=10

 (*b*) What is impact factor ? How does it calculate ? Explain it with a suitable example.

5. (*a*) What is plagiarism ? Give their types. 2×5=10

 (*b*) Describe in detail SNIP and SJR.

6. Write short notes on : 4×2.5=10

 (*a*) Moral philosophy

 (*b*) Duplicate publication

 (*c*) Principle of transparency

 (*d*) Turnitin.

NEPSST—132—2025

FACULTY OF SCIENCE AND TECHNOLOGY

M.Sc. (Fourth Semester) EXAMINATION

APRIL/MAY, 2025

ORGANIC CHEMISTRY

Paper–SCHECT-1551

(Organic Synthesis–II)

(Monday, 21-4-2025)   **Time : 2.00 p.m. to 5.00 p.m.**

Time—3 Hours   *Maximum Marks*—80

N.B. :— (*i*)   Question No. **1** is compulsory.

(*ii*)   Solve any *three* from remaining five questions.

(*iii*)   Simple calculator and log table is allowed.

1.   Solve the following :   20

(*a*)   What is Umpolang concept ? Explain with suitable example.

(*b*)   Discuss the retrosynthetic analysis of the following molecule :
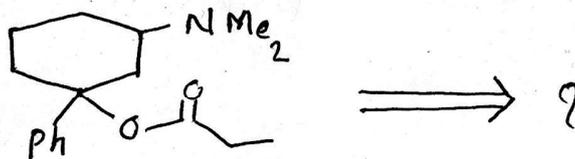
(*c*)   Obtain the major disteriomer of the following reaction using cram model :
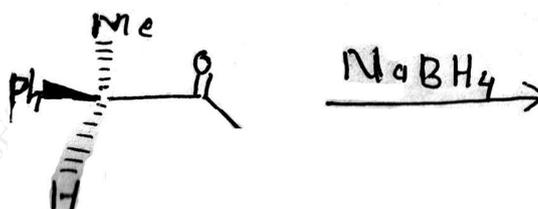
(*d*)   Explain any *two* applications of alkyl lithium.

2.   Answer the following :   20

(*a*)   Using disconnection approach outline the synthesis of the following target molecule ?
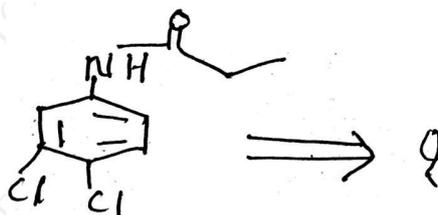
(*b*)   Predict the major isomer of the following reaction. Write mechanism of any *one* :
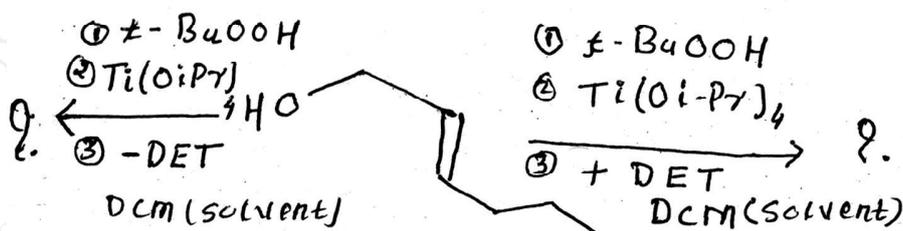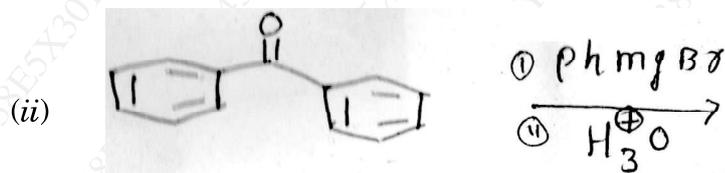
3. Explain the following : 20

(a) Outline retrosynthetic analysis and the corresponding synthesis of the following molecules :

(i) $\Longrightarrow$?
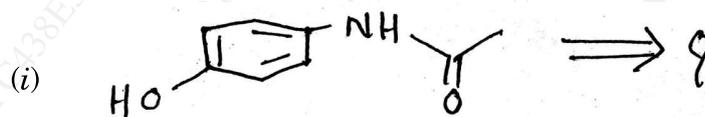
(ii) $\Longrightarrow$?

(b) Predict the product of the following reaction :

(i) $R\!-\!\!\equiv\!\! + N_3\!-\!R' \xrightarrow{\Delta}$

(ii) $\xrightarrow[\textcircled{1} H_3^{\oplus}O]{\textcircled{1} Ph\,mg\,Br}$
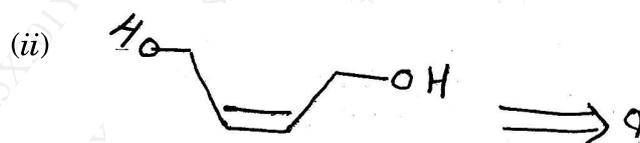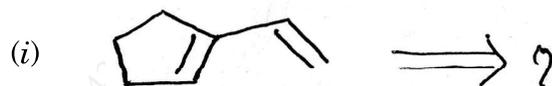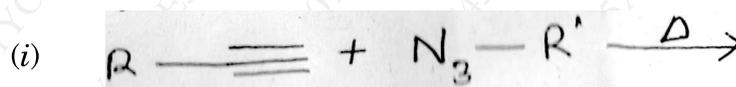
4. Discuss the following : 20

(a) Using retrosynthetic analysis suitable method for the synthesis of the following :

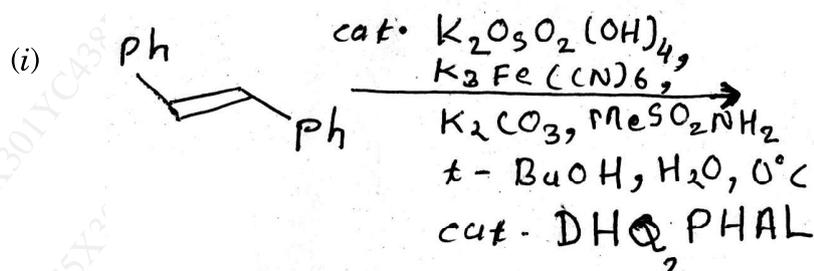(i) $\Longrightarrow$?

(ii) $\Longrightarrow$?
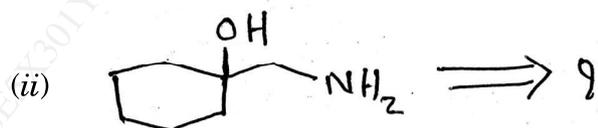
(b) Using retrosynthetic analysis suggest the suitable method for the following :

(i)

(ii)
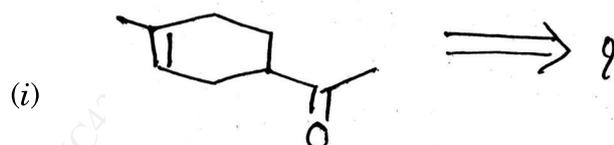
5. Write the following : 20

(a) Predict the product of the following :

(i)

(ii)

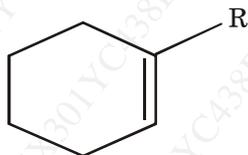(b) Explain N-Heterocyclic carbene ? Write its two applications.

6. Write short notes on the following : 20

    (*a*)   Explain protection of carbonyl compounds with suitable example.

    (*b*)   Explain alkene synthesis with the following examples :

    (*c*)   Explain Hydroboration using IPC_2BH

    (*d*)   C—H bond activation using Pd.

This question paper contains **4** printed pages]

NEPSST—229—2025

FACULTY OF SCIENCE

M.Sc. (Second Year) (Fourth Semester) EXAMINATION

APRIL/MAY, 2025

ORGANIC CHEMISTRY

(Advanced Heterocyclic Chemistry)

(Wednesday, 23-4-2025)   **Time : 2.00 p.m. to 5.00 p.m.**
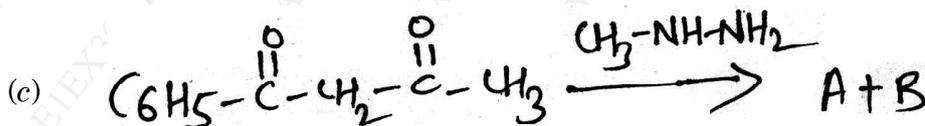
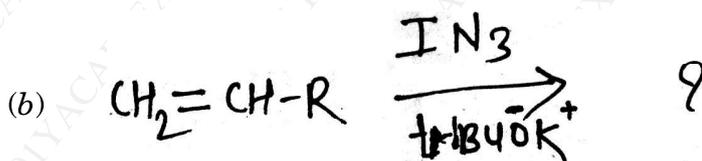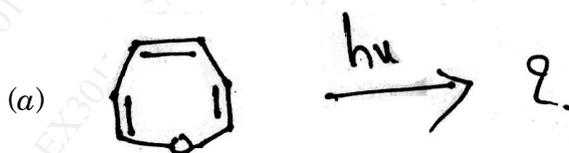*Time—3 Hours*   *Maximum Marks—80*

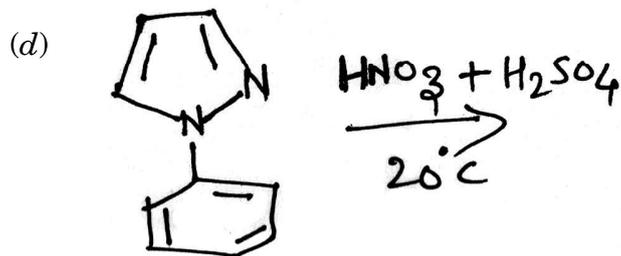N.B. :—   (i)   *First* question is compulsory.

      (ii)   Solve any *three* questions from remaining five.

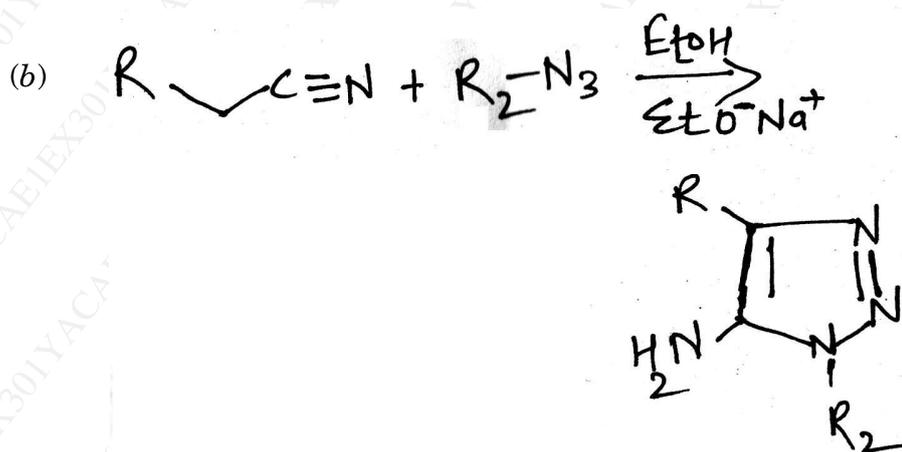1.   Predict the products of the following :   20

(a)

(b) $CH_2=CH-R \xrightarrow[t\text{-}BuOK^+]{IN_3}$?

(c) $C_6H_5-\overset{O}{\overset{||}{C}}-CH_2-\overset{O}{\overset{||}{C}}-CH_3 \xrightarrow{CH_3-NH-NH_2} A+B$

                     P.T.O.

(d)

$$HNO_3 + H_2SO_4 \xrightarrow{20°C}$$

2. Suggest the mechanism for the following : 20

(a)

$$Cl-CH_2-COOH$$

$$Cl-CH_2-\overset{\overset{O}{\|}}{C}-NH-CH_2-\overset{Cl}{\underset{O}{\|}}$$

(b) $R \diagdown C \equiv N + R_2-N_3 \xrightarrow[EtO^-Na^+]{EtOH}$

(c)

(d)
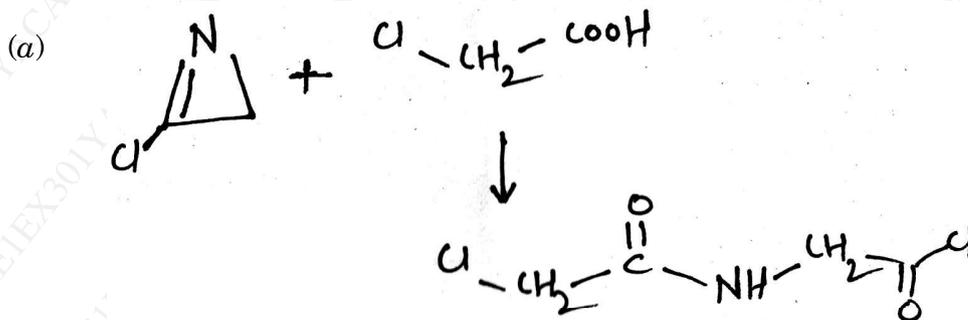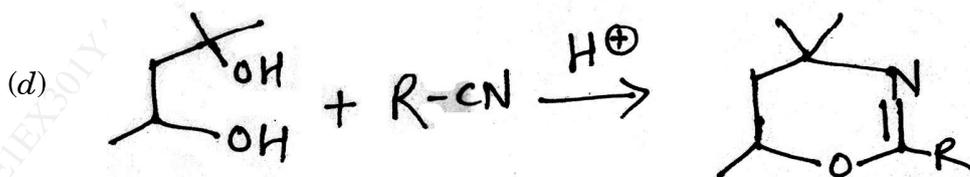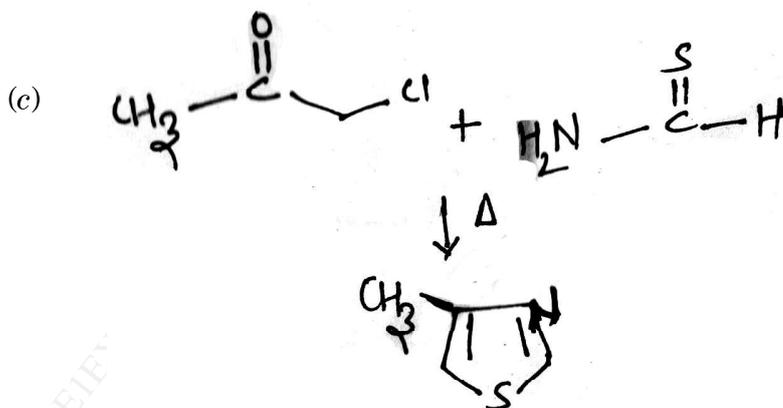
3. Answer the following : 20

(a) Indicate how the following reagents can be useful for the synthesis of 1, 2, 4–Thiadiazoles :

(i) Thioamide

(ii) Amidine and Thiocarboxylic ester

(iii) Amidine and Thiocyanate.

(b) Explain the synthesis of azepines :

(i) By valence bond isomerization

(ii) From azirines.

4. Answer the following : 20

    (*a*) How will you prepare imidazole by :

        (*i*) The Radiszewski synthesis

        (*ii*) From α-haloketones.

    (*b*) Explain the synthesis of azetidines from :

        (*i*) Isoxazole derivatives

        (*ii*) Cyclization method.

5. Answer the following : 20

    (*a*) Explain Hantzsch-Widman nomenclature system for heterocyclic compounds.

    (*b*) Explain the synthesis of diaziridines from :

        (*i*) Schiff's base

        (*ii*) Ketones.

6. Write short notes on : 20

    (*a*) Azetidine

    (*b*) Oxazole

    (*c*) Triazine

    (*d*) 1, 4 diazepines.

NEPSST—410—2025

FACULTY OF SCIENCE AND TECHNOLOGY

M.Sc. (NEP) (Second Year) (Fourth Semester) EXAMINATION

APRIL/MAY, 2025

ORGANIC CHEMISTRY

Paper—SCHEET-1552

(Medicinal Chemistry)

(Friday, 25-4-2025)   **Time : 2.00 p.m. to 5.00 p.m.**

Time—3 Hours   *Maximum Marks—80*

N.B. :—   (*i*)   Question No. **1** is compulsory.

        (*ii*)   Solve any *three* from remaining five questions.

1.   Solve the following :   20

    (*a*)   Give synthesis and structure activity of Malphalan.

    (*b*)   What are antimalarial drugs ? Explain life cycle of plasmodia.

    (*c*)   Discuss the SAR of 6, 7 benzomorphans.

    (*d*)   Explain application for patents.

                                                 P.T.O.

2. Discuss the following : 20

    (*i*)   Discuss surgery and radiation therapy for treatment of cancer.

    (*ii*)   Offer synthesis of pamaquine and pyrimethamine.

3. Answer the following : 20

    (*i*)   Synthesis and SAR of 8-Aminoquinoline derivatives as antimalarials.

    (*ii*)   Discuss synthesis and SAR stovaine and Hydantoins.

4. Solve the following : 20

    (*i*)   Synthesis and structure activity of pentothal sodium.

    (*ii*)   Give the concept of Anthelmintic agents offer synthesis of Mebendozol.

5. Explain the following :

    (*i*)   How will you prepare primaquine ? Discuss chemotherapy of Malaria.

    (*ii*)   Explain SAR of methyl salicylate and phenyl butazone.

6. Write short notes on the following :

    (*i*)   Discuss surgery and radiation therapy for treatment of cancer.

    (*ii*)   Write a note on 4-amino quinoline derivatives.

    (*iii*)   Give synthesis of allopurinol.

    (*iv*)   Discuss about water soluble and water insoluble contrast media.