Seat No.	

Set **P**

M.Sc. Chemistry (Semester - I) (New) (NEP CBCS) Examination: October/November - 2025
Physical Chemistry- I
(2324101/2325101/2326101/2327101)(2302101/2303101/2304101/2305101)

Day & Date: Wednesday, 29-10-2025 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

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

Q.1 A) Choose correct alternative. (MCQ) **08**

1) The entropy of substances at T = 0 K is called _____ entropy.
   a) residual b) ideal
   c) absolute d) normal

2) The canonical ensemble is also called as _____ ensemble.
   a) N, V, T b) N, V, E
   c) N, V, μ d) μ, V, T

3) The perfect black body is _____ of electromagnetic radiation.
   a) absolute absorber b) absolute emitter
   c) both a) and b) d) only absorber

4) The concept of wave particle duality was proposed by _____.
   a) Heisenberg b) de Broglie
   c) Schrodinger d) Bohr

5) S = K log W is called _____ equation.
   a) Boltzmann-Plank's b) Henry's
   c) Huckels's d) Norrish's

6) In adiabatic process _____.
   a) $q = 0$ b) $\Delta S = 0$
   c) $\Delta P = 0$ d) $\Delta T = 0$

7) The reduced form of Gibbs' phase rule is _____.
   a) $F = C - P + 2$ b) $F = C - P + 1$
   c) $F = C - P - 2$ d) $F = C - P - 1$

8) In Maxwell's relation $(\frac{dp}{dT})v =$ _____
   a) $\left(\frac{ds}{dv}\right)T$ b) $\left(\frac{dv}{ds}\right)P$
   b) $\left(\frac{ds}{dp}\right)v$ d) $\left(\frac{dp}{ds}\right)v$

B) Fill in the blanks OR Write true/false. **04**

1) Any material particle can also behave like wave. True/False
2) The mathematical expression for Henry's law is _____.
3) The entropy of mixing of gases is always decreases. True/False
4) In Grand canonical ensemble T, V and _____ remains constant.

Q.2 Answer the following. (Any Six) **12**

a) Give the mathematical expression for energy of a particle in three-dimensional cubic box.
b) Write Gibbs phase rule. Mention physical significance of the terms involved in it.
c) State Henry's law.
d) Give Boltzmann-Planck equation.
e) What are different types of ensembles?
f) Give any two statements of second law of thermodynamics.
g) Mention various thermodynamic criteria for spontaneity of chemical reaction.
h) Give the expression for time independent Schrodinger wave equation.

Q.3 Answer the following. (Any Three) **12**

a) Derive thermodynamic equation of state.
b) Write a note on Photoelectric effect.
c) Derive Gibbs-Duhem equation.
d) Explain different thermodynamic excess functions.

Q.4 Answer the following. (Any Two) **12**

a) Derive any two Maxwell's thermodynamic relations.
b) Derive the expression for Maxwell-Bolltzman distribution law.
c) State Roult's law. Discuss the deviations from Roult's law.

Q.5 Answer the following. (Any Two) **12**

a) Derive time independent Schrodinger wave equation.
b) Discuss the application of phase rule to the three-component system.
c) Derive Boltzmann-planks equation.

Seat No.	

Set **P**

M.Sc. Chemistry (Semester - I) (New) (NEP CBCS) Examination: October/November - 2025
Organic Chemistry - I
(2324102 / 2325102 / 2326102 / 2327102 / 2302102 / 2303102 / 2304102 / 2305102)

Day & Date: Friday, 31-10-2025 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

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

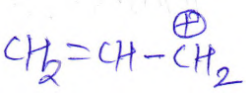
Q.1 A) Choose correct alternative. (MCQ) **08**

1) The most stable isomer between all 1,2 dimethyl cyclohexane is _____
   a) Di-equatorial 1,2-dimethylcyclohexane
   b) Equatorial; axial 1, 2 dimethyl cyclohexane
   c) Di-axial 1, 2 dimethyl cyclohexane
   d) All equally stable isomers

2) In the following compound, the protons H_a and H_b are _____.

   a) Enantiotopic
   b) Diastereotopic
   c) Homotopic
   d) None of these

3) Identify antiaromatic compound from the following.
   a) 
   b) 
   c) 
   d) 

4) _____ is the non-alternant hydrocarbon.
   a) 
   b) $CH_2 = CH - CH = CH_2$
   c) 
   d) 

5) The most stable free radical among the following is _____.
   a) $CH_2 = CH - \dot{C}H_2$ b) $Ph_2\dot{C}H$
   c) $Me_3\dot{C}$ d) $Ph_3\dot{C}$

6) Following reaction is known as ,

$$CHCl_3 \xrightarrow{NaOH} :CCl_2$$

Dichlorocarbene

   a) $E_1 - \text{elimination}$ b) $E_2 - \text{elimination}$
   c) $E_1CB - \text{elimination}$ d) $\propto - \text{elimination}$

7) A substrate that undergoes nucleophilic substitution with anchimeric assistance gives product with _____.
   a) Inversion of configuration b) racemization
   c) retention of configuration d) None of these

8) The good leaving group is SN^1 reaction is _____.
   a) I^- b) Br^-
   b) Cl^- d) F^-

B) Write True or False. **04**

1) β-cyclodextrin contains seven number of glucose unit in its structure.
2) Chair form of cyclohexane in unstable than half chair.
3) In singlet nitrene, both unpaired electrons have same spin. $(+\frac{1}{2}\ \&\ +\frac{1}{2})$
4) In SN^1 mechanism, weak nucleophile is required.

Q.2 Answer the following. (Any Six) **12**

a) Describe the migratory aptitude in Baeyer-Villager reaction.
b) Give the synthesis of 10-annulene.
c) Explain Hyperconjugation effect.
d) Explain the term: E and Z nomenclature.
e) Explain the term plane of symmetry with suitable example.
f) Explain addition reaction of carbene with allene with respect to stereochemistry.
g) What are ambident Nucleophile? Give one example.
h) What is non-classical carbocation? Explain with suitable examples.

Q.3 Answer the following. (Any Three) **12**

a) Explain the term fullerene.
b) Give the different methods for generation of carbanion.
c) Describe various conformations of cyclohexane.
d) Write a short note on SET reaction mechanism.

Q.4 Answer the following. (Any Two) **12**

a) Describe various methods of resolution of racemic mixture.
b) Explain synthesis and reactions of free radical.
c) Discuss in details the SN^1 type mechanism with an example.

Q.5 Answer the following. (Any Two) **12**

a) Define Crown ether. Explain its synthesis and applications.

b) Explain Curtius rearrangement with respect to mechanism and applications.

c) Explain Neighboring group participation (NGP) with suitable examples.

Seat No.	

Set **P**

M.Sc. Chemistry (Semester - I) (New) (NEP CBCS) Examination: October/November - 2025
Inorganic Chemistry –I
(2324107/2325107/2326107/2327107)(2302107/2303107/2304107/2305107)

Day & Date: Monday, 03-11-2025 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

Instructions: 1) Attempt in All questions.
2) Figures to the right indicate full marks.

Q.1 A) Choose correct alternative. **08**

1) Most common oxidation state of Cs(cesium) are _____.
   a) $+2, +3$ b) $+2, +4$
   c) $+3, +4$ d) $+3, +5$

2) _____ is the geometry of pentacarbonyliron(0).
   a) Square planar b) Tetrahedral
   c) Trigonal bipyramidal d) Octahedral

3) _____ of the following compounds contains a square planar metal center.
   a) $\mathrm{Ni(CO)_4}$ b) $\mathrm{Ir(CO)Cl(PPh3)_2}$
   c) $\mathrm{Ni(\eta^3 - C_3H_5)_2}$ d) $\mathrm{Cr(NO)_4}$

4) A half- life is _____.
   a) constantly changing
   b) independent of the rate constant for decay
   c) half of the lifetime of an unstable nucleus
   d) the time for one-half of an unstable nuclei to decay

5) The reaction: $\mathrm{Mn(CO)_5Me + CO \rightarrow Mn(CO)_5(COMe)}$ is an example of _____.
   a) a ligand addition b) β-elimination
   c) an oxidative addition d) an alkyl migration

6) Bonding molecular orbitals are produced by _____.
   a) destructive interaction of atomic orbitals
   b) the overlap of the atomic orbitals of two negative ions
   c) constructive interaction of atomic orbitals
   d) all of these

7) The isotopes of an element have _____.
   a) The same physical properties
   b) Different chemical properties
   c) Different number of neutrons
   d) Different atomic numbers

8) _____ of the metal carbonyls, the C-0 bond order is lowest.

a) $[Mn(CO)]^{6+}$ b) $Fe(CO)_5$

b) $[Cr(CO)_6]$ d) $[V(CO)_6]-$

B) Write true/false. **04**

1) Interstitials is a point defect in crystals.
2) Emitter-Base junction is forward biased when transistor is used as an amplifier.
3) Bond Order of O_2, F_2, N_2 respectively are +2, +3, +1.
4) The 'd-d' transitions in an octahedral $[NiX_6]^{2+}$ complex is: Laporte forbidden but spin allowed.

Q.2 Answer the following (Any Six) **12**

a) What is Racha parameter? Explain in brief.
b) Write in decreasing order of repulsive interactions of electron pairs and lone pairs.
c) What is intrinsic and extrinsic semiconductors?
d) Which criteria used to differentiate slow and fast neutrons in nuclear reactions?
e) What is difference between the metal cluster and metal carbonyl?
f) What Jahn-Teller effect?
g) What is neutron activation analysis?
h) What is effective atomic number?

Q.3 Answer the following (Any Three) **12**

a) Explain the ligand field energy parameters in detail.
b) What is VSEPR theory? Explain using SF_4 molecule.
c) Explain different types of doping in the semiconductor with examples.
d) Write a note on different types of nuclear reaction with two examples each.

Q.4 Answer the following (Any Two). **12**

a) State and explain Jahn-Teller theorem. Show schematically the splitting of d-orbitals in d^7 case for octahedral and tetrahedral system.
b) What is Walsh diagram? Explain BeH_2 molecules.
c) What is band theory? Explain in detail.

Q.5 Answer the following (Any Two). **12**

a) What are the rectifiers? Explain its construction and working.
b) Give the classification of metal clusters, structures of carbonyl clusters such as LNCC and HNCC.
c) Explain the electronic spectra using spectrochemical series, nephelauxetic effect and nephelauxetic series.

Seat No.	

Set **P**

M.Sc. Chemistry (Semester - I) (New) (NEP CBCS) Examination: October/November - 2025
Research Methodology (2324103)/ (2325103)/ (2326103) (2327103)/ (2302103)/ (2303103)/ (2304103)/ (2305103)

Day & Date: Thursday, 06-11-2025 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

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

Q.1 A) Choose correct alternative. **08**

1) When a research study is Conducted to know about an unknown area and collect information, it is known as _____.
   a) Pilot study b) Feasibility study
   c) Explanatory research d) Exploratory research

2) Action-research is: _____.
   a) Applied research
   b) A research carried out to solve immediate problems
   c) Longitudinal research
   d) All the above

3) Which journal metric tracks citations of last two year?
   a) Cite score b) Impact factor
   c) Article influence d) H_5 Index

4) Research paper format, APA stands for _____.
   a) American Psychological Association
   b) American Physical Association
   c) American Physiochemical Association
   d) None of the above

5) _____ electrolytes is typically used in polarography to support the ionic strength of the solution.
   a) Sodium chloride
   b) Potassium nitrate
   c) Hydrochloric acid
   d) Supporting electrolyte like KC1 or KNO_3

6) In polarography _____ type of current is obtained when there is no analyte present in the solution.
   a) Diffusion current b) Residual current
   c) Limiting current d) Capacitance current

7) X-ray diffraction procedures are used for the investigation of _____ structures.
   a) External b) Internal
   c) outer d) none of these

8) _____ type nebuliser is used for handling slurries that can contain upto 10 % solids.
   a) Ultrasonic b) Jet
   c) Babington d) None of these

B) Write true or false. **04**

1) Ex-post facto research method is also called as Quasi Experimental research
2) A research problem, in general, refers to some difficulty which a researcher experiences in the context of either a theoretical or practical situation and wants to obtain a solution for the same
3) The number of publications with 10 citation is called as j_{10} Index
4) TGA is used to measure weight loss due to decomposition or evaporation.

Q.2 Answer the following. (Any Six) **12**

a) What are the Objectives of research?
b) Define Sampling. What are sampling types in Research methodology?
c) What many advantages does the Sci-Finder e-tools finds for researcher?
d) State any four methods of data collection.
e) Define Half-Wave potential.
f) What are the Disadvantages of DME?
g) Write a note on ICP Source
h) Write down the application of X-ray diffraction in determination of crystal structure.

Q.3 Answer the following. (Any Three) **12**

a) Describe the factors that can influence the accuracy of a DTA analysis
b) Explain in brief:
   i) Experimental Research.
   ii) Explanatory research.
c) What is the literature survey? Why it is necessary in Research methodology?
d) An organic compound of molecular formula $C_9H_{11}O_2N$ shows the following features:
IR (KBr) : $1680cm^{-1};\ 3200\ and\ 3400cm^{-1}$
^{1}HNMR : $7.9\delta(d, 2H, J = 8.0\ Hz); 6.6\delta\ (d, 2H, J = 8.0\ Hz);\ 4.3\delta(q, 2H, J = 6.0Hz); 4.0\delta(broad\ s, 2H, D_2O\ exchange);\ \ 1.4\delta(t, 3H, J = 6.0Hz,)$

Q.4 Answer the following. (Any Two) **12**

a) What is a Research Process and steps involved in it? Explain in brief research design

b) What is Plagiarism? What are the different types of plagiarism?

c) Explain factors affecting Chemical shift with respect to-

1) Electronegativity.
2) Anisotropic effect.
3) NMR solvent polarity.

Q.5 Answer the following. (Any Two) **12**

a) What is Hypothesis in Research Methodology? Explain in brief the importance of Null and Alternate Hypothesis

b) What is Ethics in research methodology? What are the ethical issue raised during research publication?

c) Explain the different graphs produced by electro reducible analytes

Seat No.	

Set **P**

M.Sc. Chemistry (Semester - II) (New) (NEP CBCS)
Examination: October/November - 2025
Physical Chemistry - II
(2326201/2325201/2324201/2302201/2304201/2305201/2303201/2327201)

Day & Date: Tuesday, 28-10-2025 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

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

Q.1 A) Choose correct alternative. (MCQ) **08**

1) Which of the following electrodes can be used as a reference electrode?
   a) platinum b) cadmium
   c) calomel d) silver

2) Debye-Huckel - Onsager equation can be verified by plotting the graph of _____.
   a) Λ against $c^{1/2}$ b) Λ against c
   c) Λ against c^2 d) All of these

3) CO_2 is a greenhouse gas because it absorbs heat radiation from the earth. Which is a true statement?
   a) CO_2 absorbs visible light but not IR radiation
   b) CO_2 absorbs IR radiation but not visible light
   c) CO_2 never absorbs any radiation.
   d) CO_2 absorbs both visible light and IR radiation

4) The thickness of ionic atmosphere _____ as the concentration of electrolyte increases.
   a) increases b) decreases
   c) remains constant d) does not affect

5) Among the following products, what gets deposited on the plates of a discharged lead-acid battery?
   a) PbO_2 b) Pb_2O_4
   c) Pb d) $PbSO_4$

6) Which of the following is the advantage of alkaline battery?
   a) High energy density
   b) Good discharge characteristics over a wide range of temperature
   c) The specific gravity of electrolyte remains the same
   d) Cheap raw materials are used

7) Order of a chemical may be _____
   a) zero b) integer
   c) half integer d) All of these

8) Increasing ionic strength of a solution _____ the rate of ionic reactions in solution state.
   a) decreases b) increases
   b) doesn't alter d) None of these

B) Fill in the blanks OR Write True/False. **04**

1) The expression for weight average molecular mass for polymer is _____.
2) The Nernst equation is expressed as _____.
3) Vibrational relaxation is a radiative transition. [True/False]
4) The dependence of the osmotic pressure on concentration for polymer solution is expressed by the relation _____.

Q.2 Answer the following. (Any Six) **12**

a) Define fuel cell.
b) What is polydispersity index?
c) What is glass transition temperature?
d) Name any two alkaline storage batteries.
e) State Kasha's rule.
f) What do you mean by rate determining step in a chemical reaction?
g) Write the expression for Debye-Hückel limiting law.
h) What is excimer? Give one example of substance which shows excimer emission.

Q.3 Answer the following. (Any Three) **12**

a) Illustrate Stern's electrical double layer model.
b) Discuss inter & intramolecular excitation energy transfer process with example.
c) Write on kinetics of free radical polymerization.
d) Discuss in detail the ozone decomposition reaction.

Q.4 Answer the following. (Any Two) **12**

a) Using double sphere model, illustrate the effect of dielectric constant on rate of ionic reactions in solution state.
b) Write in brief Debye Hückel theory.
c) With the help of Jablonski's diagram, explain various non radiative photophysical pathways.

Q.5 Answer the following. (Any Two) **12**

a) With the help of steady state approximation, discuss the kinetics of thermal decomposition of acetaldehyde.
b) Derive an expression for kinetics of bimolecular quenching process.
c) Explain the viscosity method of determination of molecular weight of polymer.

Seat No.	

Set **P**

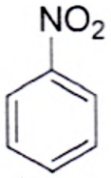
M.Sc. Chemistry (Semester - II) (New) (NEP CBCS) Examination: October/November - 2025
Organic Chemistry – II
(2326202 / 2325202 / 2324202 / 2302202 / 2304202 / 2305202 / 2303202 / 2327202)

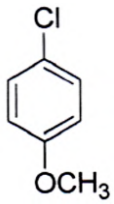
Day & Date: Thursday, 30-10-2025 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

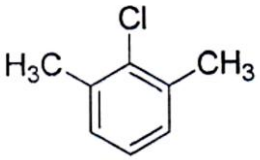
Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.

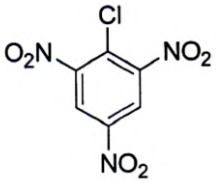
Q.1 A) Choose correct alternative. (MCQ) **08**

1) Which of the following compounds will undergo aromatic nucleophilic substitution through benzyne intermediate?

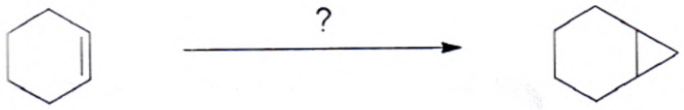
a) 

b) 

c) 

d) 

2) Suggest the suitable reagent for the following transformation



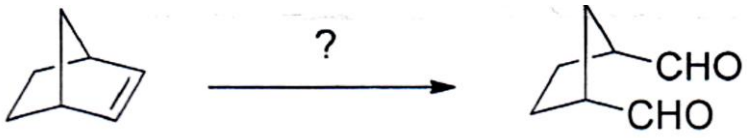
a) Peterson reagent b) Gilman's reagent
c) Simmons-Smith reagent d) Wittig reagent

3) Among the following _____ compound undergoes nitration most readily.
a) Benzene b) Acetanilide
c) Acetophenone d) Chlorobenzene

4) Among the following _____ compound shows thermal elimination reaction.
a) Acetates b) Chlorides
c) Bromides d) Alcohols

5) _____ is particularly known for its ability to selectively oxidise primary and secondary alcohols to aldehyde and ketones respectively under relatively mild conditions.
   a) Hydroboration
   b) Hydroboration-oxidation
   c) Dess-Martin Periodate (DMP)
   d) Hydration

6) Suggest the reagent for the following reaction.



   a) BH_3 , H_2O_2/OH^-
   b) Neutral $KMnO_4$
   c) Alkaline $KMnO_4$
   d) $LiAlH_4/H_2O$

7) _____ is a mild reducing agent commonly used in organic chemistry particularly for reductive aminations.
   a) $NaBH_4$
   b) TBTH
   c) $LiAlH_4$
   d) $NaBH_3CN$

8) The partial reduction of aromatic substrate by alkali metal in liquid ammonia using alcohol is known as _____.
   a) Benkeser reduction
   b) Birch reduction
   b) Clemmenson's reduction
   d) Wolf-Kishner reduction

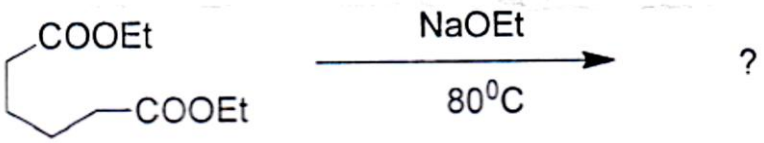
B) Write True or False. **04**

1) The carbocation is the intermediate for E1cb mechanism.
2) Both m-bromoanisole and o-bromoanisole yield the same product m-anisidine.
3) The catalytic hydrogenation of an alkene yields *anti* addition product.
4) The Ceric Ammonium Nitrate (CAN) is a versatile reagent for reductive electron transfer reactions.

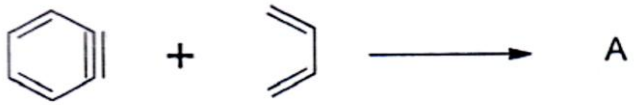
Q.2 Answer the following. (Any Six) **12**

a) Draw the energy profile diagram for electrophilic aromatic substitution reaction.

b) Predict the product and name the reaction.



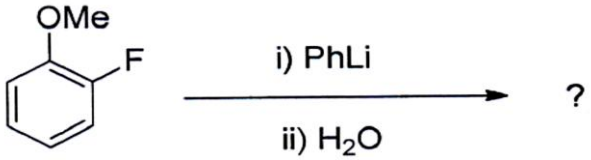
c) Draw the structures of the product A and B.



d) Explain the Rosenmund reduction with example.
e) Explain the addition of Grignard reagent across unsaturated carbonyl compound.
f) What is Lindlar catalyst?
g) Explain the Setzeff rule for elimination reaction
h) Write the ozonolysis in alkenes.

Q.3 Answer the following (Any Three) **12**

a) Complete the following reaction and outline its mechanism



b) Explain why E2 reaction is most common elimination reaction among E2, E1 and E1cb?
c) Discuss the applications of DIBAL-H.
d) Write a note on Jones reagent.

Q.4 Answer the following (Any Two). **12**

a) Discuss about Wolff-Kishner and Clemmensen reduction.
b) What is Baeyer-Villiger reaction? How it is useful in conversion of ketones to esters and cyclic ketones to lactones?
c) Write a note on:
  i) Diazonium coupling
  ii) Hunsdiecker reaction

Q.5 Answer the following (Any Two). **12**

a) What is aromatic electrophilic substitution? Discuss the *ipso* substitution in aromatic ring.
b) Explain the pyrolytic elimination in detail with examples.
c) Write a note on:
  i) Catalytic hydrogenation
  ii) Lead tetra acetate

Seat No.	

Set **P**

M.Sc. Chemistry (Semester - II) (New) (NEP CBCS)
Examination: October/November - 2025
Inorganic Chemistry-II (2326207/2325207/2324207/2302207/2304207/2305207/2303207/2327207)

Day & Date: Saturday, 01-11-2025 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

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

Q.1 A) Choose correct alternative. **08**

1) Among the following which allotrope of carbon is good conductor of electricity?
   a) Diamond b) Graphite
   c) Coal d) Fullerenes

2) The STYX number for B_4H_{10} is _____.
   a) 2002 b) 4120
   c) 4012 d) 4220

3) The hapticity of C_5H_5 in Ferrocene is _____.
   a) 2 b) 5
   c) 4 d) 6

4) According to Wades rule $C_2B_7H_{13}$ adapts which structure?
   a) Closo b) Nido
   c) Arachno d) Hypo

5) The Stability of coordination compounds decreases with _____.
   a) Increase in charge on metal ion
   b) decrease in size of metal ion
   c) decrease in Charge on metal ion
   d) None of the above

6) The process of reduction of ore under molten condition is called _____.
   a) Smelting b) Roasting
   c) Calcination d) Refining

7) The non-heme iron containing protein found in marine invertebrates is _____.
   a) Haemoglobin b) Myoglobin
   c) Hemocyanin d) Hemerythrin

8) $_{92}U$ after three successive β-decay gives _____.
   a) Am b) Cm
   b) Pu d) Np

B) Write true or false. **04**

1) Ionospheres are charge carriers.
2) Phosphorescence phenomenon is shown by Red phosphorus.
3) All ores are minerals but all minerals are not ores.
4) Chain silicates are formed by sharing of 3 oxygens by each SiO4 unit.

Q.2 Answer the following (Any Six) **12**

a) Define interhalogen compounds and give examples.
b) Define Homogenous and Heterogenous catalyst and give one example of each.
c) Define Chelate effect with examples.
d) Name any two preparation methods of Trans uranic elements.
e) Differentiate between Calcination and Roasting process.
f) Define Biological Nitrogen fixation and name some nitrogen fixing bacteria.
g) Write any four applications of Lanthanide elements.
h) Name oxyacid's of Nitrogen.

Q.3 Answer the following (Any Three) **12**

a) Write a short note on synthesis and structure of Phosphazenes.
b) Discuss in short Pi-metal complexes with examples.
c) Describe any two separation methods of lanthanides.
d) Write a short note on Ferredoxins.

Q.4 Answer the following (Any Two). **12**

a) Describe in detail synthesis, structure and properties of Silicones.
b) Explain in detail Hydroformylation of Alkenes with the help of catalytic cycle involved in it.
c) Discuss the factors affecting stability of complexes w.r.t metal ion and ligand.

Q.5 Answer the following (Any Two). **12**

a) Explain in detail the metal extraction process of lead.
b) Describe Photosynthesis PS-I and PS-II in detail.
c) Discuss Spectral and magnetic properties of Lanthanides.

Seat No.	

Set **P**

M.Sc. (Organic Chemistry) (Semester - III) (New) (NEP CBCS)
Examination: October/November - 2025
Advanced Spectroscopic Methods (2326301)

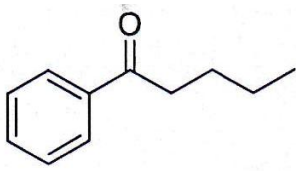
Day & Date: Tuesday, 04-11-2025 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

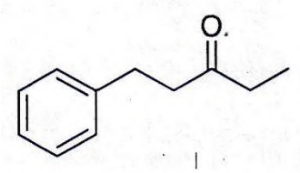
Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.

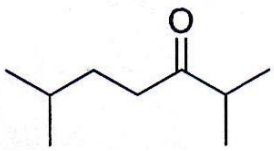
Q.1 A) Choose the correct alternatives from the options. **08**

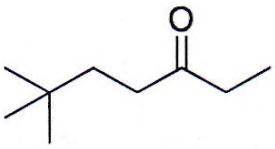
1) Which of the following 2D-NMR technique shows coupling phenomenon through the bond?
   a) DEPT b) HETCOR
   c) NOESY d) All of the above

2) Which of the following can undergo McLafferty rearrangement during mass spectroscopy?

I) 

II) 

III) 

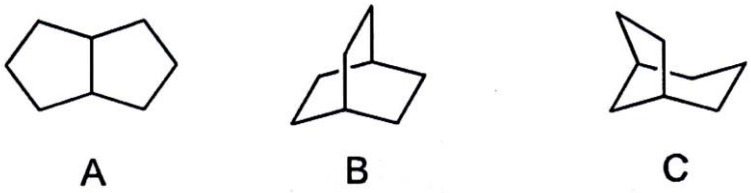
IV) 

   a) Compound I only b) Compound III and IV
   c) Compound III only d) Compound I and III

3) The areas under three separate peaks in an NMR spectrum are 10, 39, and 59. The number of hydrogens for each peak are respectively _____.
   a) 1, 3 and 6 b) 1, 4 and 6
   c) 1, 3 and 5 d) 1, 4 and 5

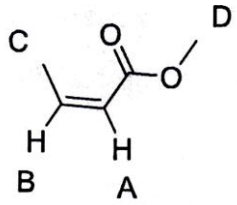
4) The NMR signal of a compound is found to be 260 Hz downfield from TMS peak using spectrometer operating at 200 MHz. What is the downfield shift in Hz for same proton in the spectrometer operating at 300 MHz?
   a) 260 Hz b) 300 Hz
   c) 390 Hz d) 360 Hz

5) In the broad band decoupled ^{13}C-NMR spectra, the number of signals appearing for the bicyclo-octane A-C, respectively, are: _____.



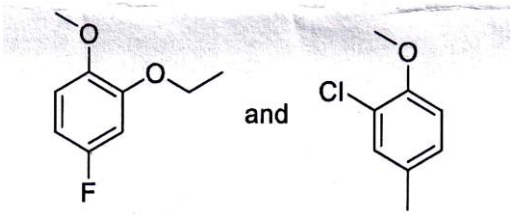
a) 5, 4 & 8
b) 3, 2 & 5
c) 5, 4 & 5
d) 3, 2 & 8

6) Appropriate ^{1}H-NMR chemical shift (δ) for the protons A-D for the following compound are _____.



a) A - 6.8; B - 5.7; C - 3.9; D-2.1 ppm
b) A - 6.8; B - 5.7; C - 2.1; D-3.9 ppm
c) A - 5.7; B - 6.8; C - 3.9; D-2.1 ppm
d) A - 5.7; B - 6.8; C - 2.1; D-3.9 ppm

7) How many signals appears in the ^{1}H NMR spectrum of following compounds respectively?



a) 4, 6
b) 6, 4
c) 6, 5
d) 5, 6

8) Which of the following ion peak shows highest intensity in the mass spectrum?
a) Molecular ion peak
b) Base peak
c) Metastable peak
d) Isotopic peak

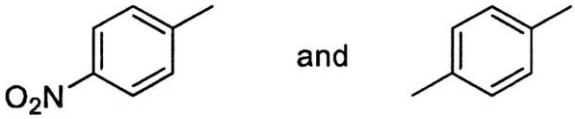
B) Write True or False. **04**

1) The distance between first two lines of multiplet in the second order ^{1}H NMR spectra give the largest J value.
2) The molecular ion peak in the mass spectrum shows highest intensity.
3) The second order ^{1}H NMR spectra occur due to the weak coupling.
4) In NMR, the peaks of first order spectra appear symmetrical and equally spaced.

Q.2 Answer the following. (Any Six) **12**

a) Distinguish between pentan-2-one and pent-3-one using their mass spectra.

b) Comment on the chemical and magnetical equivalence phenomenon of aromatic protons in following compounds.



c) Compound (C_5H_8O) has a strong IR absorption band at 1745 cm^{-1}. The broad-band proton decoupled ^{13}C spectrum of this compound shows three signals: at δ 220 (C), 23 (CH_2), and 38 (CH_2). Propose a structure for this compound.

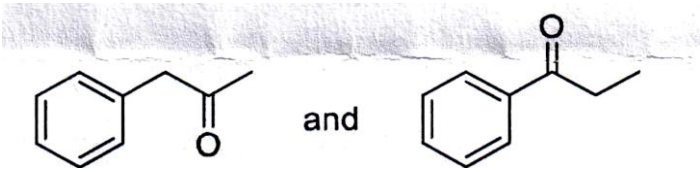
d) Define chemical shift (δ) with equation.

e) What is metastable ion peak?

f) What is the significance of NMR technique in assigning enantiotopic and diastereotopic protons?

g) Define Nitrogen rule in mass spectroscopy with example.

h) Distinguish between following compounds by mass spectroscopy.



Q.3 Answer the following. (Any Three) **12**

a) Address ^3J-coupling phenomenon with Karplus equation in NMR. Comment on cis and trans ^3J-coupling with justification.

b) Assume that chemically equivalent protons show the same signal, but chemically nonequivalent protons show different signals. For the following molecules KK to NN, how many sets of signals would be observed in the respective ^1H NMR spectra? Label all protons in each molecule, so that the protons that give the same ^1H NMR signal are labeled with the same number, and protons that give different signals are labeled with different numbers.

KK LL MM NN

c) Find out the structure of organic compound from following data with detail justifications Molecular Formula: $C_4H_7BrO_2$
IR ($\bar{\upsilon}$ in cm^{-1}): 1707, 2800-3000; ^1H NMR (200 MHz; $CDCl_3$.δ in ppm): 2.0 (s, 6 mm),
11.9 (s, 1 mm); ^{13}C NMR (50 MHz; $CDCl_3$, δ in ppm): 30, 55, 178; DEPT (θ= 135): 30 (up); MASS: m/z = 41 (base peak, 100%), 59, 87, 166/168.

d) Write a sort note on McLafferty rearrangement.

Q.4 Answer the following question. (Any Two) **12**

a) What is second order spectra? Discuss AB, AX spin systems in NMR with examples.

b) Discuss the mode of fragmentation in aromatic ring? Draw the fragments ions of benzyl alcohol such as m/z = 108, 107, 91, 79, 77, 65, 51 and 39.

c) What is 2D NMR? Discuss HETCOR spectra of 2-Hexanone.

Q.5 Answer the following question. (Any Two) **12**

a) Find out the structure of organic compound from following data

Molecular Formula: $C_5H_6N_2$

IR: 3056, 1580, 1527, 1476, 1399, 1302, 1248, 1156, 1020, 829, 750 cm^{-1}

^1H NMR (δ in ppm): 2.5 (s, 30 mm), 8.3 (d, *J*= 2 Hz, 10 mm), 8.4 (d, J= 2 Hz, 20 mm)

^{13}C NMR (δ in ppm): 22 (CH_3), 142 (CH), 144 (CH), 146 (CH), 155 (C); Mass: m/z = 94 (M^+, base), 67 (46), 53 (15), 52 (7), 51 (5), 42 (13), 41 (8), 40 (20), 39 (22).

b) Find out structure of organic compound from following data

Molecular Formula: $C_8H_{14}O_4$

IR($\bar{\upsilon}$ in cm^{-1}): 1190, 1735, 2987.

^{1}HNMR (200 MHz; $CDCl_3$, δ in ppm): 1.2 (t, 6 mm, *J*= 6 Hz), 2.7 (s, 4 mm), 4.2 (q, 4 mm, *J*= 6 Hz); ^{13}C NMR (50 MHz; $CDCl_3$, δ in ppm): 14, 29, 60, 173; DEPT (θ = 135): 14 (up); 29, 60 (down); Mass: m/z =101 (base peak, 100%), 129, 174

c) A compound has M^+= 96 in its mass spectrum and exhibits the ^{13}C spectral data broadband-decoupled ^{13}C NMR: 27.6, 29.3, 32.2, 132.4; DEPT-90: 132.4; DEPT-135: positive peak at 132.4; negative peaks at 27.6, 29.3 32.2 ppm. Find the structure for this compound.

SLR-HF-13

Seat No.	

Set P

M.Sc. Organic Chemistry (Semester - III) (New) (NEP CBCS)
Examination: October/November - 2025
Photochemistry and Pericyclic Reactions (2326302)

Day & Date: Thursday, 06-11-2025 Max. Marks: 60
Time: 11:00 AM To 01:30 AM

Instructions: 1) All questions are compulsory.
2) Draw neat labelled diagram wherever necessary.
3) Figure to the right indicates full marks.

Q.1 A) Choose correct alternative. **08**

1) System having 4n pi electrons shows ____ mode of rotation under photochemical condition.
   a) Con b) Dis
   c) Both A and B d) All of the above

2) An electrocyclic reaction is thermally allowed when symmetries of molecular orbitals of ground state of reactant correlates with _____ of molecular orbitals of product.
   a) First excited state b) Ground state
   c) Second excited state d) All of the above

3) Claisen rearrangement is an example of _____ sigmatropic rearrangement.
   a) [1,3] b) [1,5]
   c) [3,3] d) [1, 7]

4) In photocycloaddition reaction electron rich alkenes will give _____ product with α, β unsaturated carbonyl compounds.
   a) Head to head b) Head to tail
   c) Both A and B d) None of the above

5) Norrish type II reaction shows _____ bond cleavage.
   a) α b) β
   c) γ d) None the above

6) A reaction in which bond is broken or made at the expense of cyclic shift of pi electrons is known as _____ reaction.
   a) Substitution b) Electrocyclic
   c) Rearrangement d) Addition

7) Energies of different Molecular orbitals of conjugated acyclic polyenes can be calculated by using formula _____.
   a) $E_j = \alpha + \beta \cos\theta$ b) $E_j = \alpha + 2\beta \cos\theta$
   c) $E_j = \alpha + \beta \cos 2\theta$ d) $E_j = \alpha + 3\beta \cos\theta$

8) Which of the following technique is used to detect free radicals?
   a) Uv spectroscopy b) ESR
   b) IR spectroscopy d) Mass spectroscopy

B) Write true or false. **04**

1) Lowest energy molecular orbital has 1 node.
2) [3, 3] Sigmatropic rearrangement is photochemicaly forbidden.
3) Energy of delocalised system is calculated by using formula $x\alpha + y2\beta$.
4) Free radicals are detected by ESR technique.

Q.2 Answer the following (Any Six) **12**

a) Calculate energies of different molecular orbitals of benzene.
b) Construct molecular orbital diagram of ethylene system.
c) Explain ESR technique of free radical detection.
d) Endo selectivity in Diels Alder Reaction.
e) Explain halogenation by NBS.
f) Discuss Cis-trans isomerisation of alkenes by direct irradiation.
g) Explain [1, 3] Sigmatropic rearrangement reactions.
h) Discus types of pericyclic reactions.

Q.3 Answer the following (Any Three) **12**

a) Calculate delocalisation energy of cycloheptatrieny1 cation and anion.
b) Explain mechanism of electrocyclic reactions by Huckel-Mobius aromatic and antiaromatic transition states.
c) Explain Claisen rearrangement.
d) Discuss Hunsdiecker reaction.

Q.4 Answer the following (Any Two). **12**

a) Calculate energy involved in bond formation of 9+1 system
b) With the help of correlation diagram explain thermal and photochemical electrocyclic reactions of molecules having 4n+2 pi electrons.
c) Explain Norrish type II reaction in acyclic and cyclic ketones.

Q.5 Answer the following (Any Two). **12**

a) Calculate energies of different molecular orbital of cycloheptatriene.
b) Explain con and dis rotatary mode of rotation in electrocyclic ring closure and opening reaction of 4n pi electron system.
c) Photochemistry of nitrites and azides.

Seat No.	

Set **P**

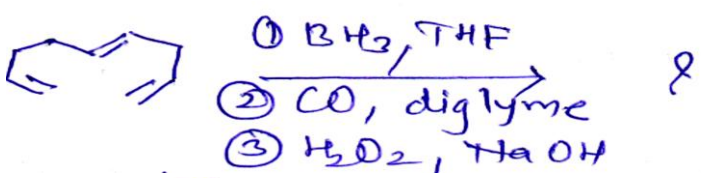
M.Sc. Organic Chemistry (Semester - III) (New) (NEP CBCS)
Examination: October/November - 2025
Advanced Organic Chemistry (2326306)

Day & Date: Saturday, 08-11-2025 Max. Marks: 60
Time: 11:00 AM To 01:30 AM

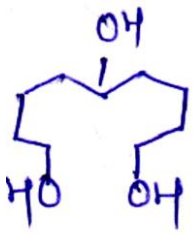
Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.

Q.1 A) Choose correct alternative. **08**

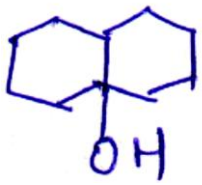
1)



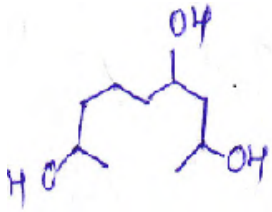
a)



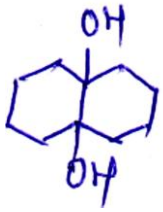
b)



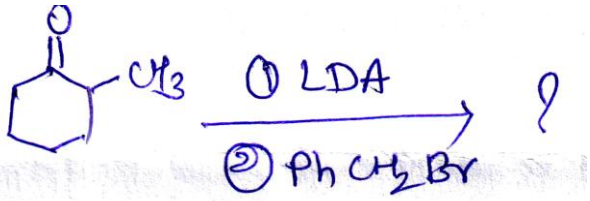
c)



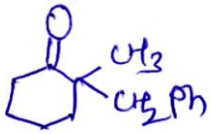
d)



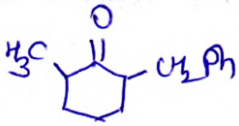
2)



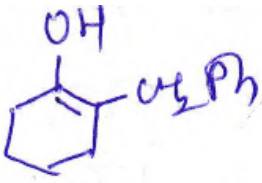
a)



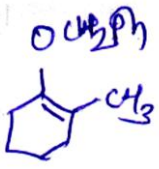
b)

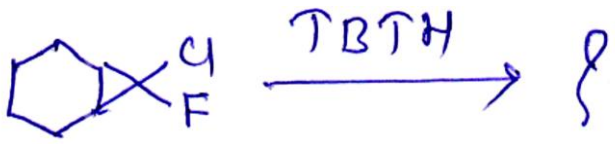


c)



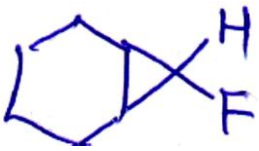
d)

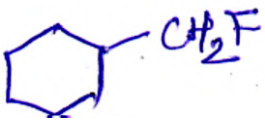


3) 

a) 

b) 

c) 

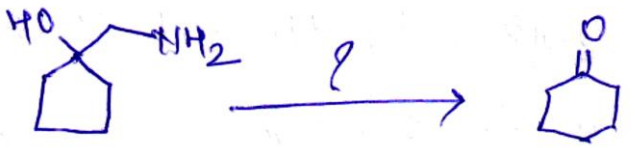
d) 

4) The Ugi reaction between an aldehyde, an amine, an isocyanide and _____ gives ∝-aminoacylamide derivatives.

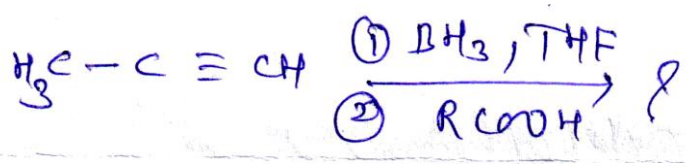
a) acid chloride
b) carboxylic acid
c) ester
d) All three

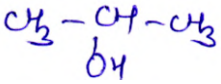
5) The Prins reaction in absence of water gives _____ as a product.

a) dioxane
b) 1, 3- diol
c) allylic alcohol
d) ester

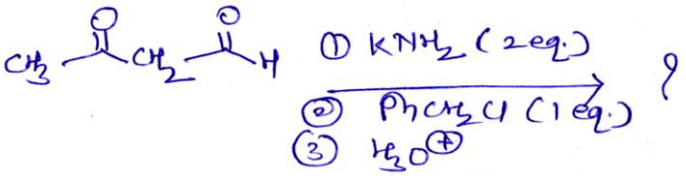
6) 

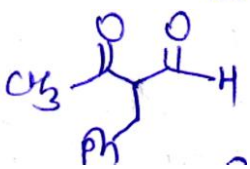
a) HNO_3
b) H_2SO_4
c) HCl
d) HNO_2

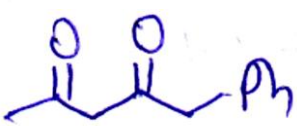
7) 

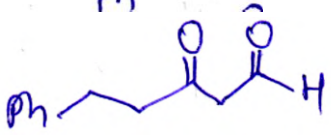
a) $CH_3CH_2CH_3$
b) 

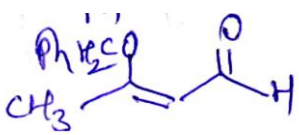
c) $CH_3CH_2CH_2OH$
d) $CH_3CH = CH_2$

8) 

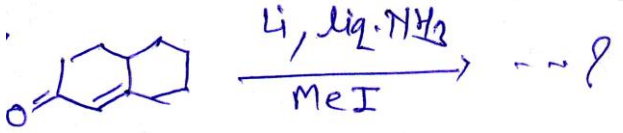
a) 

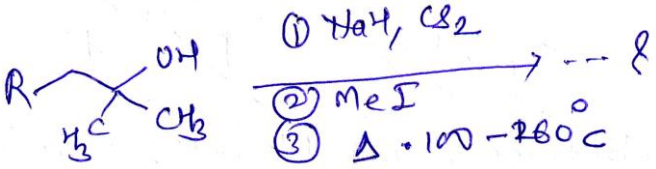
b) 

c) 

d) 

B) Fill in the blanks. **04**

1) Addition of borane to alkene is _____ addition.
2) Peterson reaction is an example of _____ elimination reaction.
3) 

4) 

Q.2 Answer the following. (Any Six) **12**

a) Explain the oxidation of alkenes by SeO_2.
b) Give the synthesis of 9-BBN and Thexylborane.
c) Explain with suitable example mechanism of the Hofmann rearrangement reaction.
d) Give two applications of Baylis-Hillmann reaction.
e) Explain with suitable example the mechanism of Strecker amino acid synthesis.
f) Give the applications of Wolff rearrangement reaction.
g) Explain synthesis of alkyl halide from organoborane.
h) Give two applications of DDQ.

Q.3 Answer the following. (Any Three) **12**

a) Discuss the mechanism of Julia Olefination reaction.
b) Explain the mechanism of Hofmann-Loffler-Freytag reaction and give its application.
c) Explain the synthesis of carbonyl compounds from alkene & alkyne using hydroboranes.
d) Discuss alkylation of aldehydes by using enamines.

Q.4 Answer the following. (Any Two) **12**

a) Discuss the mechanism and applications of Negishi reaction.
b) Discuss the mechanism and applications of Wagner-Meerwein rearrangement reaction.
c) Discuss the synthesis of primary, secondary, and tertiary alcohols by hydroboration reaction.

Q.5 Answer the following. (Any Two) **12**

a) Discuss the applications of DCC in organic synthesis.
b) Explain with suitable example synthesis of specific enolates by methods other than deprotonation.
c) Discuss the mechanism and applications of Shapiro reaction.

Seat No.	

Set **P**

M.Sc. Organic Chemistry (Semester - III) (New) (NEP CBCS)
Examination: October/November – 2025
Applied Organic Chemistry (2326307)

Day & Date: Saturday, 08-11-2025 Max. Marks: 60
Time: 11:00 AM To 01:30 AM

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

Q.1 A) Multiple Choice Questions. (MCQ) **08**

1) The cavity of molecule in which another molecule come and bind is known as _____.
   a) Host b) Podands
   c) Guest d) Cryptands

2) [15]-crown-5 forms complex with _____ ion.
   a) Li^+ b) Na^+
   c) K^+ d) Rb^+

3) Haworth synthesis is used for synthesis of _____.
   a) anthracene b) naphthalene
   c) phenanthrene d) fluorene

4) The reagent used for following transformation is _____.

   a) $A1C1_3$ b) H_2SO_4
   c) Pt_1H_2 d) S

5) Maltose exists in _____.
   a) $\alpha - configuration$ b) $\beta - configuration$
   c) $r - configuration$ d) All of above

6) Formula for monosaccharide is _____.
   a) C_nH_{2n} b) $(CH_2O)_n$
   c) C_nH_{2n+2} d) C_nH_{2n-2}

7) Who is the father of Green chemistry?
   a) John Warner b) Albert Einstein
   c) Joseph Breen d) Paul Ariastas

8) Which of the following is the greenest solvent?
   a) Formald ehyde b) Benzene
   c) Water d) Ethanol

B) True or False **04**

1) Stilbite was the first discovered zeolite.
2) β −cyclodextrin have six glucose monomer in its structure.
3) If – OH group is to left of last stereo center carbon then configuration is L-configuration.
4) Pt, H_2 is used for dehydrogenation of Hydroaromatic compounds.

Q.2 Answer the following. (Any Six) **12**

a) Explain the term atom economy.
b) Give advantages of aqueous phase reactions.
c) Write a note on Land Dand Configuration.
d) Explain the role of following reagents.
   1) Tollen's reagent
   2) Fewings solution
e) What is Elbs reaction? Explain with example.
f) Give 2 examples of dehydrogenation of hydroaromatic compounds using Sulphur.
g) Write a note on Hydrogen bonding.
h) What are the characteristics of cyclodextrin?

Q.3 Answer the following. (Any Three) **12**

a) Explain effects of solvents on formation and stability of supramolecules.
b) Describe the synthesis of Pyrene.
c) Explain the term mutarotation with example.
d) What is "solvent free" synthesis? Explain with example.

Q.4 Answer the following. (Any Two) **12**

a) Explain ultrasound assisted synthesis.
b) Describe the different type of non-covalent interactions.
c) Answer the following.
   1) Give the synthesis of Pyrene.
   2) Write a note on Epimerization.

Q.5 Answer the following. (Any Two) **12**

a) What are carbohydrates? Discuss its classification.
b) Give one synthesis of each of the following.
   1) Picene.
   2) Perylene.
   3) Chrysene.
c) Explain the term:
   1) Complementarity.
   2) Ionic liquids.

Seat No.	

Set P

M.Sc. (Organic Chemistry) (Semester - IV) (New) (NEP CBCS)
Examination: October/November - 2025
Modern Organic Chemistry (2326401)

Day & Date: Tuesday, 28-10-2025 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

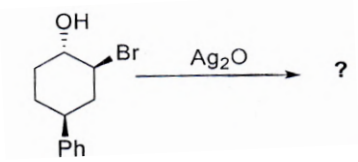
Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.

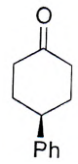
Q.1 A) Choose correct alternative. (MCQ) **08**

1) Bicyclo[2.2.2]octane belongs to which point group?

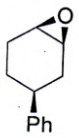
a) C_3h b) C_2V
c) D_3h d) Cs

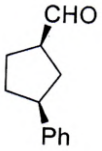
2) Predict the correct option of a major product.



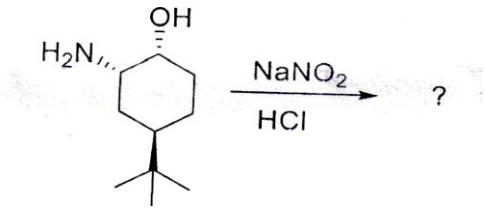
a) 

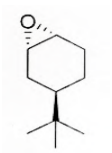
b) 

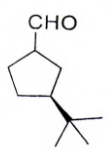
c) 

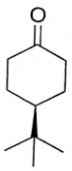
d) 

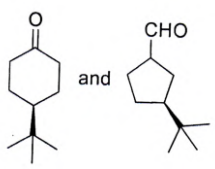
3) Choose the correct alternative for the following reaction transformation.



a) 

b) 

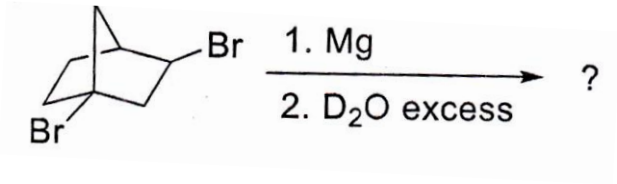
c) 

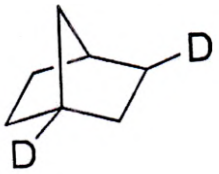
d) 

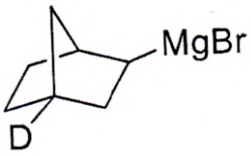
4) Which is the most stable isomer of perhydrophenanthrene?

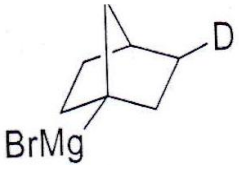
a) trans-t-trans
b) cis-c-trans
c) trans-c-trans
d) cis-t-cis

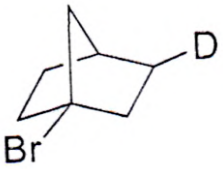
5) Choose the correct alternative for the following reaction.



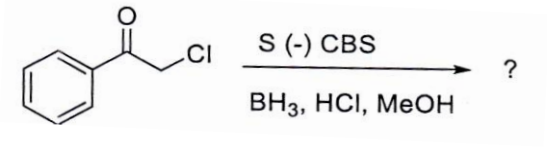
a) 

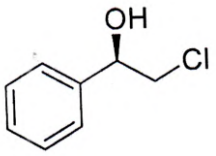
b) 

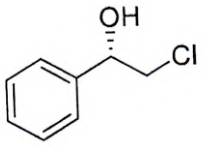
c) 

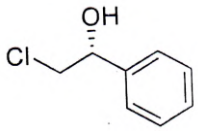
d) 

6) Predict the correct option of a major product in following reduction reaction.



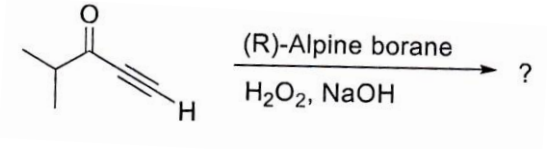
a) 

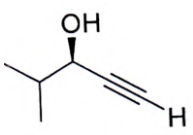
b) 

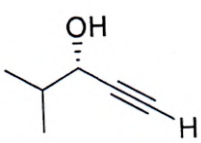
c) 

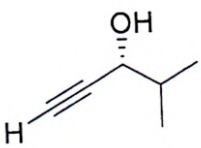
d) both (a) and (c)

7) Predict the correct option of a major product.



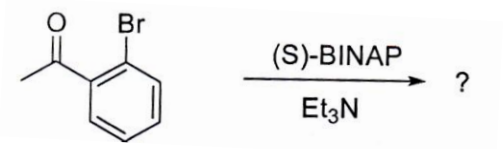
a) 

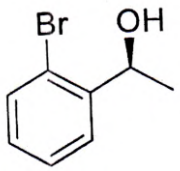
b) 

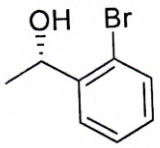
c) 

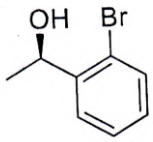
d) both (a) and (c)

8) Predict the correct option of major product.



a) 

b) 

c) 

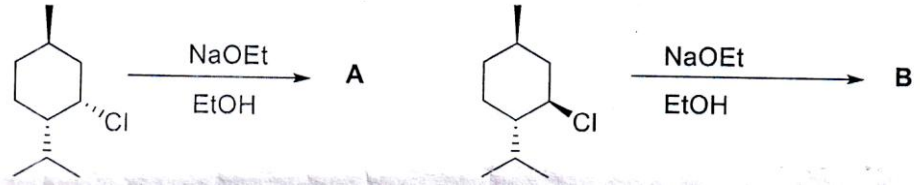
d) both (a) and (b)

B) Fill in the blanks OR Write True/False. **04**

a) In tartaric acid, the meso form is more stable than active form.
b) The cis-decalin is more stable than trans-decalin.
c) The chiral pool approach for asymmetric synthesis always gives product with 100% ee.
d) In Felkin-Ahn model, the nucleophile attacks the carbonyl group along the angle of 107°.

Q.2 Answer the following. (Any Six) **12**

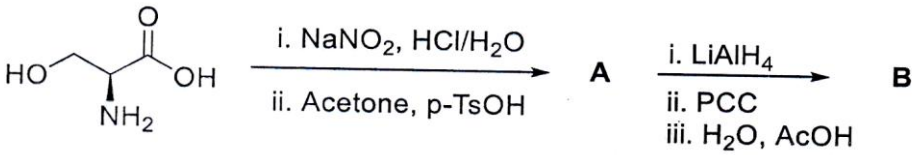
a) What will be the product A and B in following reactions?



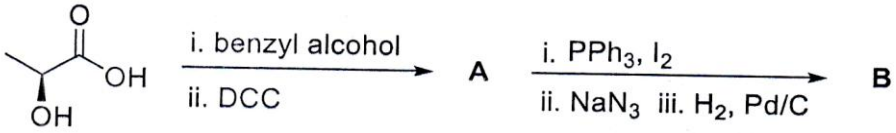
b) What is Bredt's rule? Discuss with two examples.

c) Explain ring flipping phenomenon in decalin?

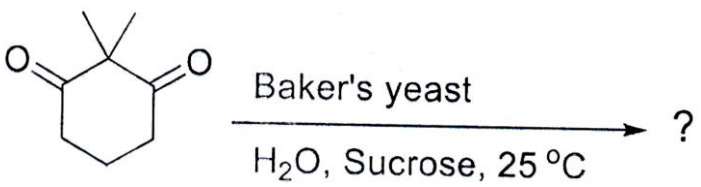
d) What will be the product A and B in following reaction?



e) What will be the product A and B in following reaction?

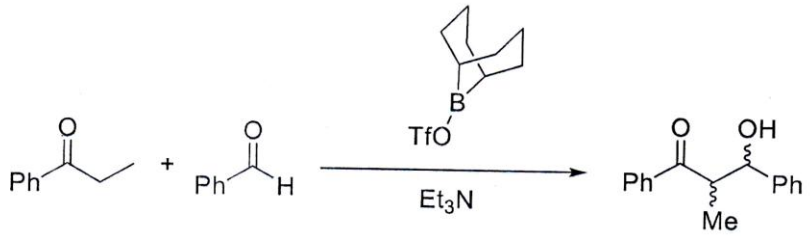


f) What is the major product in following reaction with stereochemistry?



g) What is the difference between fused and bridged ring system? Give one example of each.

h) Rationalize the stereochemistry of the major product for the following reaction.



Q.3 Answer the following. (Any Three) **12**

a) Explain stability of cis and trans-9-methyl decalin and comment on their various physical properties.

b) Discuss the differences in the stability of diastereomers? Explain the stability of 2,3- butanediol and stilbene dichloride.

c) What is Jacobson asymmetric epoxidation? Discuss with examples.

d) What is the reactivity in base induced dehydrobromination of threo/erythro 1-bromo-1,2-diphenyl propane?

Q.4 Answer the following. (Any Two) **12**

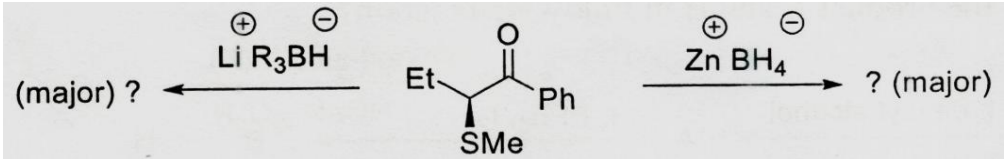
a) Explain application of Meyers' oxazoline and Evans' oxazolidinone chiral auxiliary approach with stereochemistry.

b) Explain different isomers of perhydroanthracene and comment on its stability and chirality?

c) Comment on the proline-catalyzed asymmetric Mannich reaction with stereochemistry and its applications.

Q.5 Answer the following. (Any Two) **12**

a) Rationalize the stereochemical outcome in the following reaction.



b) Rationalize the base induced molecular elimination with pyrolysis of 3-phenyl-2-butyl xanthate and corresponding amine oxide.

c) Predict, with a clear transition state diagram, the stereochemistry of the diastereoselective allylation reaction of Z-crotyl boranes and E-crotyl boranes.

Seat No.	

Set P

M.Sc. Organic Chemistry (Semester - IV) (New) (NEP CBCS)
Examination: October/November - 2025
Chemistry of Bioactive Heterocycles (2326402)

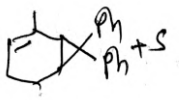
Day & Date: Thursday, 30-10-2025 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

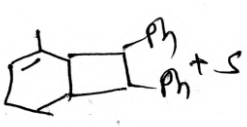
Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.

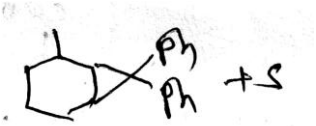
Q.1 A) Choose the correct alternative. **08**

1) Among three membered heterocyclic rings ____ has the lowest strain energy & shows Lowest $\bar{e}$ - density at heteroatom.
   a) Thiirane b) Oxirane
   c) Aziridine d) None of these

2) 

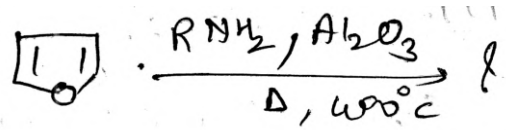
   a) 
   b) 

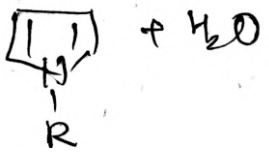
   c) 

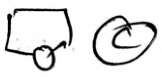
   d) 

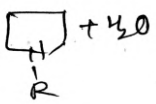
3) Pyridine behaves as a _____ base.
   a) secondary b) primary
   c) tertiary d) None of the above

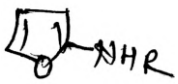
4) Pyrazine is _____.
   a) 1, 2 – diazine b) 1, 3 – diazine
   c) 1, 4 – diazine d) 1, 5 – diazine

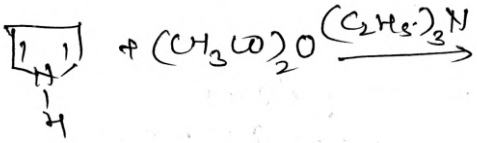
5) 

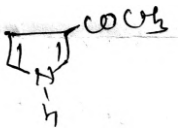
a) 

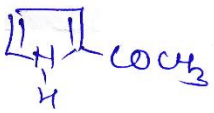
b) 

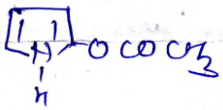
c) 

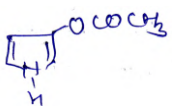
d) 

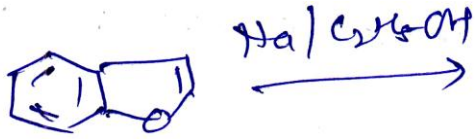
6) 

a) 

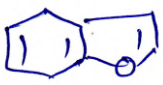
b) 

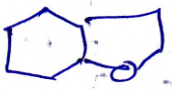
c) 

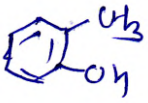
d) 

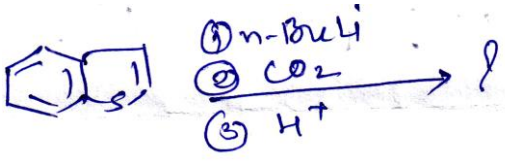
7) 

a) 

b) 

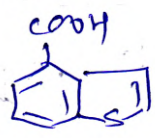
c) 

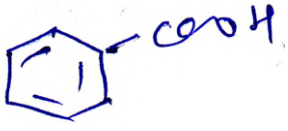
d) 

8) 

a) 

b) 

c) 

d) 

B) Write True/False. **04**

1) Tetrazines are electron deficient and react readily with nucleophiles.
2) In pyrrole electron density is higher at C_3 & C_4 than C_2 & C_5.
3) Aziridine is a saturated heterocyclic compound containing two carbon and one nitrogen atoms.
4) Indole is a planar molecule with a conjugated system of $10\ \pi$ electrons.

Q.2 Answer the following. (Any Six) **12**

a) Give one example of nucleophilic substitution reaction of indole.
b) Explain Chichibabin reaction of quinoline.
c) Explain preparation of oxirane by oxidation of alkenes.
d) Give ring opening reaction of azetidine.
e) Explain F.C. reaction of pyrrole.
f) Explain reaction of thiazole with reducing agent.
g) Draw different commercial forms of pyrazine.
h) Explain acylation of alcohol using pyridine as a catalyst.

Q.3 Answer the following. (Any Three) **12**

a) Discuss any two methods of synthesis of pyrazines.
b) Discuss the synthesis of pyrrole.
c) Discuss the synthesis of oxitane.
d) Discuss the synthesis of quinoline.

Q.4 Answer the following. (Any Two) **12**

a) Discuss the synthesis and chemical reaction of benzofuran.
b) Discuss synthesis and chemical reactions of pyridazine.
c) Discuss the synthesis and chemical reactions of oxazole.

Q.5 Answer the following. (Any Two) **12**

a) Discuss synthesis & chemical reactions of imidazole.
b) Discuss synthesis & chemical indole.
c) Discuss synthesis and chemical reactions of isoquinoline.

Seat No.	

Set **P**

M.Sc. Organic Chemistry (Semester - IV) (New) (NEP CBCS)
Examination: October/November - 2025
Retrosynthesis and Disconnection Approach (2326405)

Day & Date: Saturday, 01-11-2025 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

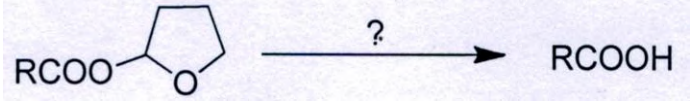
Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.

Q.1 A) Choose correct alternative. **08**

1) Which combination of reagents is appropriate for the following transformation?

a) $1)\mathrm{HO-CH_2-CH_2-OH, H^+}$ $2)\mathrm{LiAlH_4, Et_2O, H_3O^+}$
b) $1)\mathrm{NaBH_4, MeOH}$ $2)\mathrm{LiAlH_4 Et_2O,}$ $3)\mathrm{H_3O^+}$
c) $1)\mathrm{LiAlH_4, Et_2O,}$ $2)\ \mathrm{H_3O^+}$
d) $1)\mathrm{NaBH_4, MeOH}$

2) Mention the suitable conditions for deprotection of following:

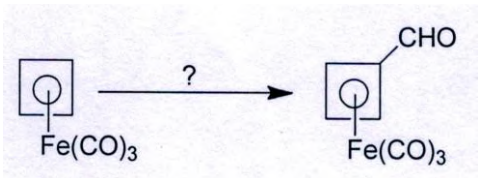


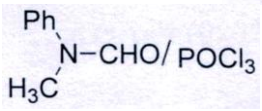
a) $\mathrm{H_2, Pd, heat}$ b) $\mathrm{HgCl_2/ClCO_3\ aq, Me_2CO}$
c) $\mathrm{AcOH-THF-H_2O}$ d) All of above

3) An idealised fragment resulting from disconnection known as _____.
a) Disconnection b) Synthon
c) Synthetic equivalent d) None of these

4) Which of the following acts as a Umpolung reagent?
a) Alkeyns b) 1-3-Dithianes
c) Nitro compounds d) All of these

5) Which combination of reagents is appropriate for following transformation?



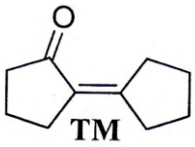
a) 

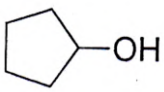
b) $\mathrm{AlCl_3/\ HCHO}$
c) $\mathrm{Hg(OAc)_2/H_2O}$ d) None of these

6) A reaction which predominantly produce one of several possible structural isomers are called _____.
   a) Stereoselectivity b) Regioselectivity
   c) Chemoselectivity d) All of these

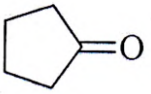
7) Acyl diazo alkanes on heating give _____.
   a) Ketene b) Carbene
   c) Ylide d) Cyclopropane

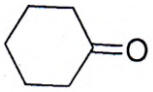
8) Choose the correct synthon for the following target molecule.



a) 

b) 

c) 

d) 

B) Fill in the blanks. **04**

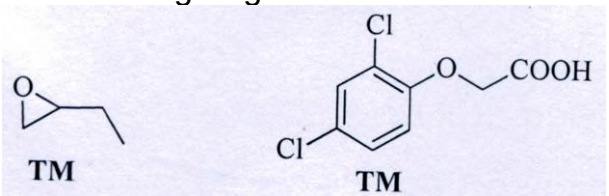
a) The molecule to be synthesized is known as _____.
b) The site of disconnection is shown by _____.
c) _____ reaction involve coupling between terminal alkynes with aryl or vinyl halides.
d) Conversion of one functional group into another functional group is known as _____.

Q.2 Answer the following. (Any Six) **12**

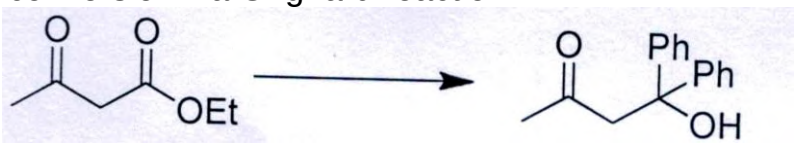
a) Explain the term: Functional group interconversion.
b) Define the term: Disconnection.
c) Mention protecting groups for amines.
d) What is mean by Reversal of polarity?
e) Mention any four transition metal complexes involved in organic synthesis.
f) Define the term synthons and synthetic equivalents.
g) Explain the term stereoselectivity.
h) Explain uses of ketene in organic synthesis.

Q.3 Answer the following. (Any Three) **12**

a) Discuss protecting groups for diols?
b) Explain synthetic utility of Hydroformylation using cobalt complex.
c) Write synthons for following target molecules?



d) Using a suitable protecting group, how would you bring about the following conversion via Grignard reaction?

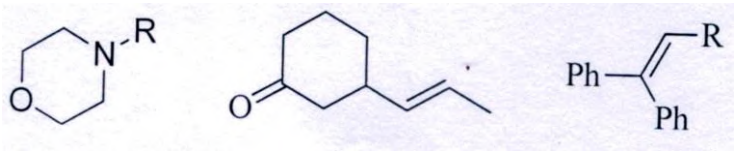


Q.4 Answer the following. (Any Two) **12**

a) Discuss two-group C-X disconnections with suitable examples.
b) Explain reactions of ferrocene.
c) Discuss cyclisation reactions in organic synthesis.

Q.5 Answer the following. (Any Two) **12**

a) How to protect carbonyl functional group?
b) with the help of suitable examples, discuss two-group C-C disconnection.
c) Using disconnection approach, design the synthesis of the following molecules.



Seat No.	

Set P

M.Sc. Organic Chemistry (Semester - IV) (New) (NEP CBCS)
Examination: October/November – 2025
Medicinal Chemistry (2326406)

Day & Date: Saturday, 01-11-2025 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

Instructions: 1) All questions are compulsory.
2) Draw neat labelled diagram wherever necessary.
3) Figures to the right indicate full marks.
4) Use of log table and calculators is allowed.

Q.1 A) Choose correct alternative. (MCQ) **08**

1) _____ is an example of anticancer antimetabolite drug.
   a) Cisplatin b) 5-fluoro uracil
   c) Melphalan d) Cyclophosphamide

2) Diazepam acts on _____ receptor.
   a) GABA
   b) Sodium ion channel
   c) Potassium ion channel
   d) Calcium ion channel

3) Topically used sulphonamide is _____.
   a) Dapsone b) Sulphamethoxazole
   c) Sulphadoxine d) Silver sulphadiazine

4) _____ is a triazole containing antifungal drug.
   a) Itraconazole b) Clotrimazole
   c) Cefazolin d) Nystacin

5) Ibuprofen drug is fairly comparable to _____.
   a) Aspirin b) Cetrizine
   c) Phenelzine d) Cefixime

6) Catopril is used as an _____ drug.
   a) Antidepressant b) Antineoplastic
   c) Antihistamine d) Antihypertensive
   .

7) A compound of the following that can be used as an antihistamine agent is _____.
   a) Diphenylhydramine b) Northindrone
   c) Omeprazoled d) Chloramphenicol

8) The penicillin contain _____ ring.
   a) triazole b) $\beta - \text{lactum}$
   c) imidazole d) quinazoline

B) Write True/False. **04**

a) Streptomycin is an example of antiamalarial drug.
b) Thecephalosporins are beta lactum antibiotics.
c) The chemical name of paracetamol is 2-acetoxy benzoic acid.
d) Verapamil is an antihypertensive drug.

Q.2 Answer the following. (Any Six) **12**

a) Define antihypertensive drug with suitable example.
b) Draw the structure of benzodiazepam.
c) Give any two uses of phenytoin.
d) Draw the structure of chloramphenicol.
e) write any two uses of valproic acid
f) Draw the structure of ibuprofen.
g) Define antihistamine drugs with suitable example.
h) Give any two uses of penicillin.

Q.3 Answer the following. (Any Three) **12**

a) Write Classification and uses of antidiabetic drugs.
b) Discuss mechanism of action and uses of antianginal drugs.
c) Give the method of preparation of carbamazepine.
d) Give the synthesis and SAR of chloroquine.

Q.4 Answer the following. (Any Two) **12**

a) Explain the synthesis and SAR of verapamil.
b) Explain the synthesis and mechanism of action of phenobarbital.
c) Explain the synthesis and SAR of tolbutamide.

Q.5 Answer the following. (Any Two) **12**

a) Explain the synthesis and SAR of phenelzine.
b) Explain the synthesis and mechanism of action of acyclovir.
c) Explain the synthesis and SAR of nitroglycerine

Seat No.	

Set P

M.Sc. (Organic Chemistry) (Semester - IV) (New/Old) (CBCS)
Examination: October/November - 2025
Advanced Organic Chemistry – II (MSC07401)

Day & Date: Tuesday, 28-10-2025 Max. Marks: 80
Time: 03:00 PM To 06:00 PM

Instructions: 1) Questions no. 1 & 2 are compulsory.
2) Attempt any Three Question from Q No.3 to Q No.7
3) Figures to the right indicate full marks.

Q.1 A) Choose correct alternative. (MCQ) **10**

1) Process of converting one functional group into another during retrosynthesis is called _____.
a) Chemoselectivity
b) Regioselectivity
c) Functional group interconversion
d) None of above

2) In Hydroboration addition, addition of boron and hydrogen atoms is _____.
a) Markovnikov addition
b) Anti-Markovnikov addition
c) Anti-addition
d) Hofmann addition

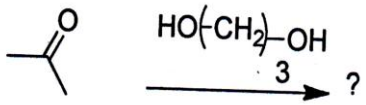
3) Trialkylboranes react with carbon monoxide in the presence of diglyme to gives _____.
a) R3BCO b) R3CBO
c) R3OBC d) R3COB

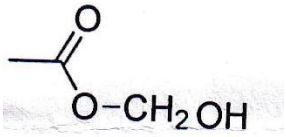
4) Reaction of organoborane in presence of _____ gives alkane as a product.
a) Ethers b) Carboxylic acid
c) Alcohol d) Aldehyde

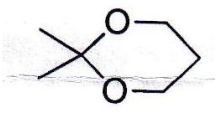
5) Addition of H_2O using hydroboration followed by oxidation with H_2O_2 and NaOH is _____.
a) Syn and Markovnikov addition
b) Syn and antiMarkovnikov addition
c) Anti and Markovnikov addition
d) Anti and antiMarkovnikov addition

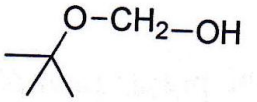
6) An idealised fragment resulting from disconnection is called _____.
a) Synthetic equivalent b) Synthon
c) Disconnection d) All of above

7) Predict product of the following reaction.



a) 

b) 

c) 

d) None of above

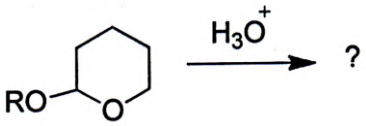
8) A logical approach for designing organic synthesis which involve breaking down of target molecule into available starting material is known as _____.

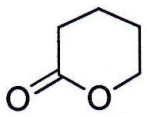
a) Retrosynthesis
b) Disconnection Approach
c) Retrosynthetic analysis
d) All of above

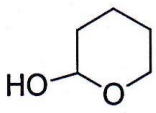
9) A reaction in which one functional group in the molecule reacts leaving another group unaltered is called _____ reaction.

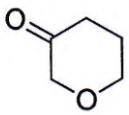
a) Chemoselective b) Regioselective
c) Both a and b d) None of above

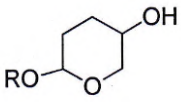
10) Predict product of the following reaction.



a) 

b) 

c) 

d) 

B) Write True/False. **06**

a) Triphenyl methyl group cannot be used for protection of alcohols.
b) A reaction which predominantly produces one of several possible structures is called regioselective reaction.
c) The addition of BH3 to alkene is anti-addition.
d) Organoborane on reaction with halogen and alkali gives alkyl halide.
e) 9-BBN is synthesized from reaction between Cyclo-octadiene and BH3.
f) A real chemical compound equivalent carrying out function of synthons is called synthetic equivalent.

Q.2 Answer the following. **16**

a) Explain protection of amine group.

b) Explain the terms

i) Synthons
ii) Synthetic equivalents
iii) Disconnection approach
iv) Functional group interconversion

c) Give the synthesis of

i) Thexyl Borane
ii) Cyclohexylborane

d) Give the synthesis of

i) 9-BBN
ii) Catechol Borane

Q.3 Answer the following. **16**

a) Explain protection and deprotection of carboxylic acids and hydroxyl groups.

b) Explain two group disconnection in 1, 3 difunctionalised compounds and α, β unsaturated compounds

Q.4 Answer the following. **16**

a) Explain the carbonylation of organoborane reaction.

b) Give the synthesis and mechanism of addition of IPC2BH and IPCBH2.

Q.5 Answer the following. **16**

a) Explain protection and deprotection of carbonyls in aldehydes and ketones.

b) Explain in detail chemoselectivity and regioselectivity in retrosynthetic analysis.

Q.6 Answer the following. **16**

a) Discuss Suzuki coupling reaction in detail.

b) Write a note on preparation of alkane, amine and alkene from organoborane.

Q.7 Answer the following. **16**

a) Write notes on

i) Use of acetylenes and aliphatic nitro compounds in organic synthesis
ii) Reversal of polarity

b) Discuss the role of organoboranes in organic synthesis.

Seat No.	

Set P

M.Sc. (Organic Chemistry) (Semester - IV) (New/Old) (CBCS)
Examination: October/November - 2025
Modern Organic Chemistry (MSC07402)

Day & Date: Thursday, 30-10-2025 Max. Marks: 80
Time: 03:00 PM To 06:00 PM

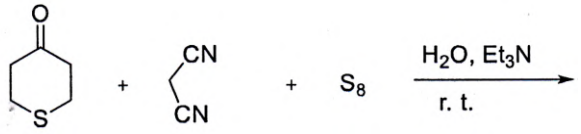
Instructions: 1) Questions nos.1 & 2 are compulsory.
2) Attempt any three questions from Q No.3 to Q No.7.
3) Figures to the right indicate full marks.

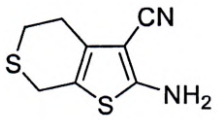
Q.1 A) Choose correct alternative. (MCQ) **10**

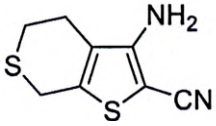
1) In MOF-2, metal node is _____.

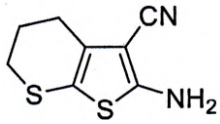
a) Fe b) Ti
c) Zn d) Cu

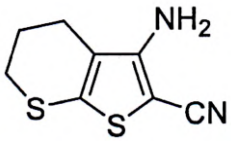
2) Predict the product of the following reaction.



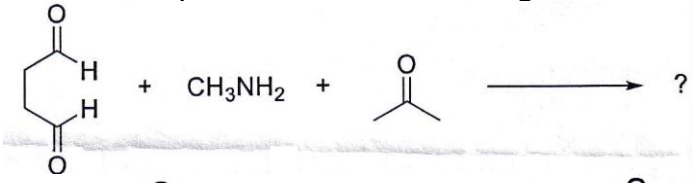
a) 

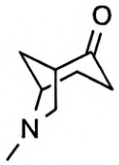
b) 

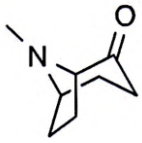
c) 

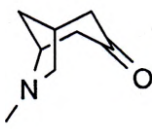
d) 

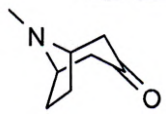
3) Predict the product of the following reaction.



a) 

b) 

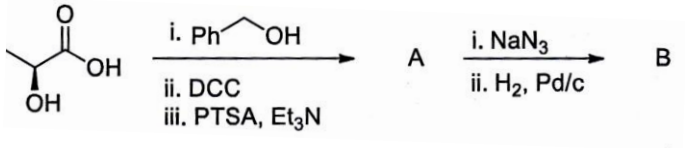
c) 

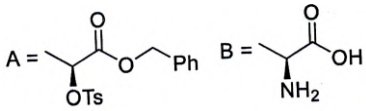
d) 

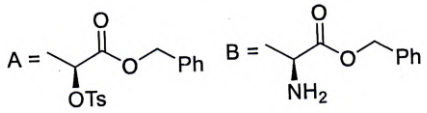
4) By partial substitution of surface ligands in the ZIF-8 framework, the surface _____ improves to enhance thermal stability of the material.

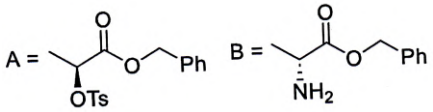
a) Texture
b) Morphology
c) Hydrophilicity
d) Hydrophobicity

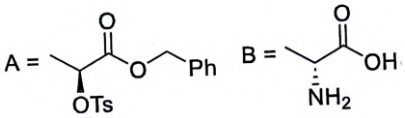
5) Predict the correct option of a major product.



a) 

b) 

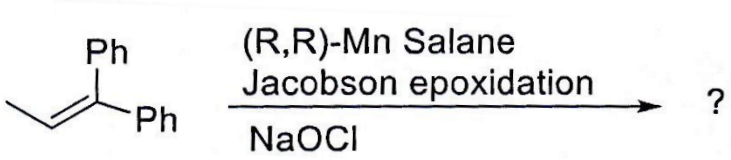
c) 

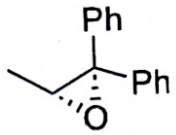
d) 

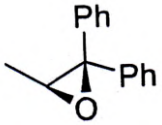
6) The regioselectivity and stereospecificity in the hydroboration-oxidation of an alkene is best described as _____.

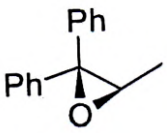
a) Markovnikov orientation with syn-addition
b) Markovnikov orientation with anti-addition
c) Anti-Markovnikov orientation with syn-addition
d) Anti-Markovnikov orientation with anti-addition

7) Predict the correct option of a major product.



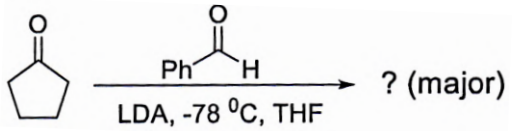
a) 

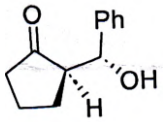
b) 

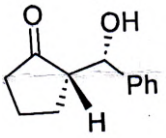
c) 

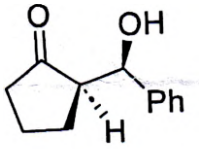
d) both a) and c)

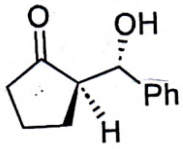
8) Predict the correct option of a major product.



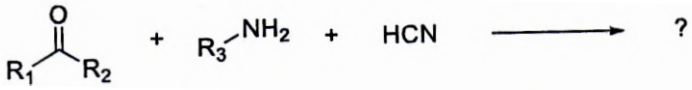
a) 

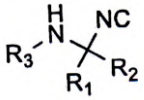
b) 

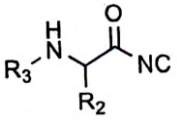
c) 

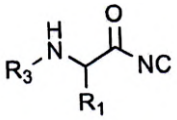
d) 

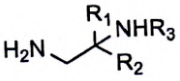
9) Predict the correct option of a major product.



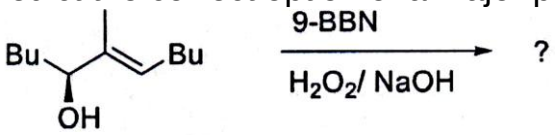
a) 

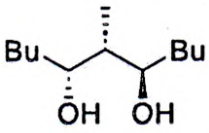
b) 

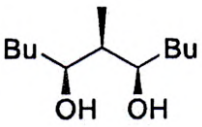
c) 

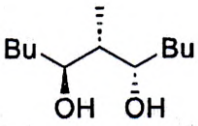
d) 

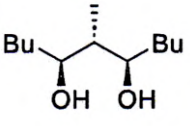
10) Predict the correct option of a major product.



a) 

b) 

c) 

d) 

B) True or False. **06**

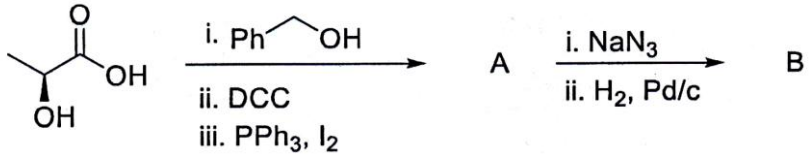
1) The chiral catalyst approach for asymmetric synthesis always gives product with 100% ee.
2) Scanning Electron Microscopy (SEM) of MOF allows the chemist to study its chemical composition.
3) The synthesis involves reactions that include multiple chemical conversions between, substrates, reagents and catalysts which are performed in a single vessel are called one-pot reactions.
4) The Shi epoxidation proceeds *via* ketene intermediate.

5) An enantiomerically pure compound has an enantiomeric excess (ee) of 100%.
6) The Gewald reaction is isocyanide-based multicomponent reactions.

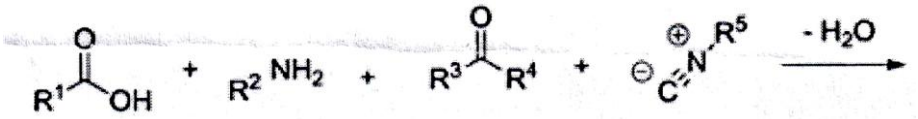
Q.2 Answer the following. **16**

a) Write a note on secondary building unit (SBUs).

b) What is the product A and B in following transformation? Give mechanism with justification.



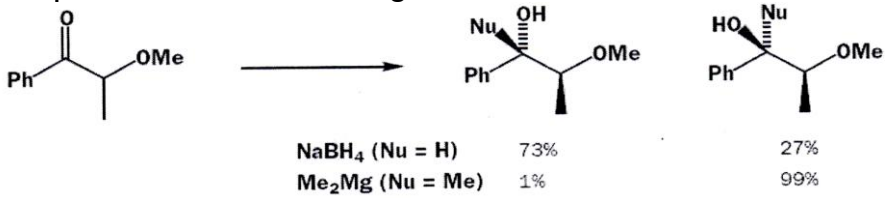
c) What is the product in the following reaction? Give its mechanism?



d) Write a short note on Mayers oxazolines.

Q.3 Answer the following.

a) Predict, with a clear transition state diagram, the stereochemistry of the product in the following reaction. **08**



b) How MCRs are useful for synthesis of heterocycles using Aldol reaction? **08**

Q.4 Answer the following.

a) Rationalize the enantioselectivity of SAMP/RAMP chiral auxiliary and discuss their applications. **08**

b) Discuss diastereoselectivity of Aldol reactions by using Zimmerman Traxler model. Give its applications **08**

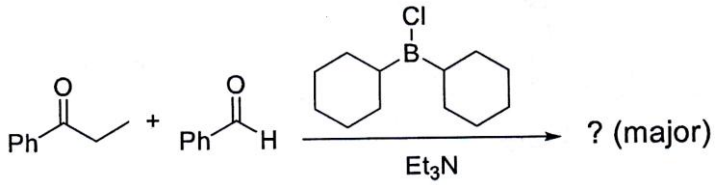
Q.5 Answer the following.

a) What are the synthetic routes to metal organic frameworks? Explain Electrochemical and microwave/ultrasound methods of MOF synthesis with suitable diagrams. **08**

b) What is chiral reagent? What is stereoselective Sharpless epoxidation and its applications? **08**

Q.6 Answer the following.

a) Rationalize the diastereoselectivity of following reaction with mechanism and justification. **08**

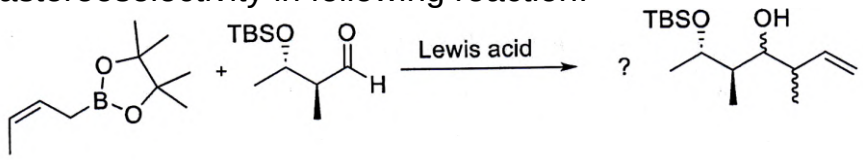


b) How to confirm the structure of synthesized MOF? Explain the ways for MOF analysis in detail. **08**

Q.7 Answer the following.

a) What is the mechanism of Passerini and Gewald reaction? Discuss with examples. **08**

b) Rationalize the major product with mechanism and diastereoselectivity in following reaction. **08**



Seat No.		Set	P

M.Sc. Organic Chemistry (Semester - IV) (New/Old) (CBCS)
Examination: October/November – 2025
Chemistry of Natural Products (MSC07403)

Day & Date: Saturday, 01-11-2025 Max. Marks: 80
Time: 03:00 PM To 06:00 PM

Instructions: 1) Questions no. 1 & 2 are compulsory.
2) Attempt any Three Question from Q No.3 to Q No.7
3) Figures to the right indicate full marks.

Q.1 A) Choose correct alternative. (MCQ) **10**

1) Misoprostol is a stable synthetic derivative of _____.
   a) PGE_1 b) PGE_2
   c) $PGF_{2\alpha}$ d) $PGF_{1\alpha}$

2) Lithobillianic acid has its ____ ring fusion.
   a) B/C b) A/B
   c) C/D d) All three

3) _____ does not undergo condensation with benzaldehyde.
   a) Dinhydrostrychnine b) Strychnine
   c) Strych-nidine d) Monohydrostryehnine

4) Geranyl pyrophosphates serve as the precursor for the various _____ monoterpenoids.
   a) Monocyclic b) Bicyclic
   c) Cicyclic d) All three

5) For the reactions involving thiamine pyrophosphate, the site of action is _____ of the thiazole ring.
   a) N b) C-5
   c) S d) C-2

6) _____ contains α, β – unsaturated ketonic group because it is sensitive to the alkali.
   a) Testosterone b) Bile acid
   c) Androstenone d) Oestrone

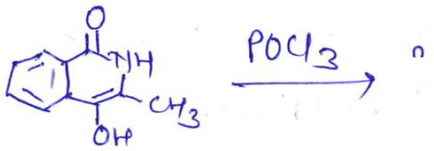
7) The two chair conformation of trans-decalin has a _____ of symmetry and is archival.
   a) alternating axis b) centre
   c) axis d) all three

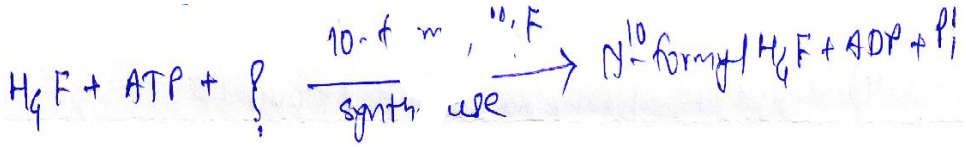
8) The enzyme carboxylase requires the coenzyme pyrophosphate ester of thiamine to break down pyruvic acid into _____.
   a) acetaldehyde b) acetic acid
   c) formaldehyde d) acetone

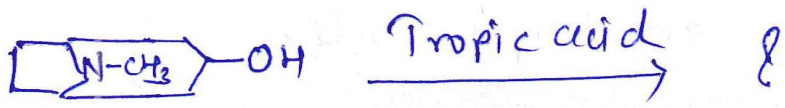
9) Presence of CH_3CO- group in progesterone is confirmed by the formation of _____.
   a) oxime b) unhydride
   c) haloform d) See alcohol

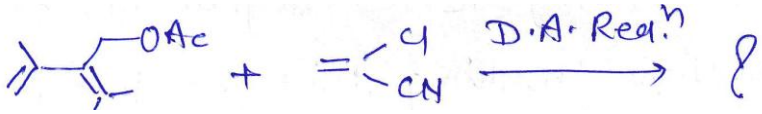
10) Lighin provides _____ to some plant cell walls.
   a) compressive strength
   b) rigidity
   c) hydrophobic water impermeable wall
   d) All three

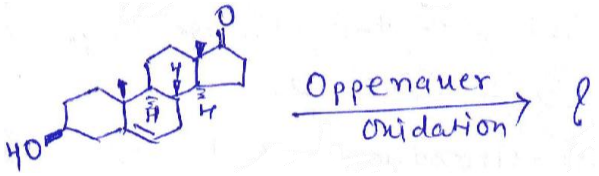
B) Complete the following reactions. **06**

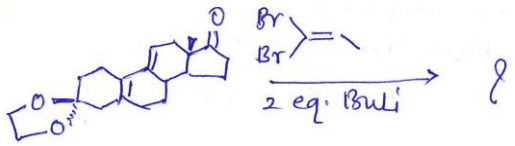
1) 

2) 

3) 

4) 

5) 

6) 

Q.2 Answer the following. **16**

a) Discuss the Harris's synthesis of pyridoxine.
b) Explain the presence of methoxy, carboxy and hydroxy group in the reserpic acid.
c) Discuss biosynthesis of mevalonic acid from acetic acid.
d) Discuss synthesis of testosterone from cholesterol.

Q.3 Answer the following. **16**

a) Discuss conformational analysis of six diastereomers of perhydrophenanthrenes and explain their relative stabilities.

b) Discuss the constitution and synthesis of aldosterone.

Q.4 Answer the following. **16**

a) Discuss the synthesis and biochemical role of folic acid.

b) Discuss the structure elucidation of reserpic acid.

Q.5 Answer the following. **16**

a) Discuss the biosynthesis of tropane, indole and quinoline group alkalrids.

b) Discuss the synthesis of prostaglandins.

Q.6 Answer the following. **16**

a) Discuss the stereo chemistry of the steroids.

b) Discuss the synthesis of mifepristone and give its applications.

Q.7 Answer the following. **16**

a) Discuss the synthesis of fredericamycin A.

b) Discuss the biosynthesis of cli, tri & tetra-terpenoids.

Set No.	

Set **P**

M.Sc. Organic Chemistry (Semester - IV) (New/Old) (CBCS)
Examination: October/November - 2025
Medicinal Chemistry (MSC07408)

Day & Date: Tuesday, 04-11-2025 Max. Marks: 80
Time: 03:00 PM To 06:00 PM

Instructions: 1) Questions no. 1 & 2 are compulsory.
2) Attempt any Three Question from Q No.3 to Q No.7
3) Figures to the right indicate full marks.

Q.1 A) Choose correct alternative. **10**

1) Which of the following sulphonamide is used for treatment of general Infections _____?
a) Sulphisoxazole b) Nitrosulphathiazole
c) Sulphaguanidine d) Sulphapyridine

2) Among the following _____ is an example of β-lactam group of antibiotics.
a) Streptomycin b) Penicillin
c) Tetracycline d) All of the above

3) Ibuprofen corresponds to ____ type of drug.
a) NSAID b) Antibiotics
c) Cardiovascular d) Antifungal

4) IUPAC nomenclature of Thiopental drug is _____.
a) 5-ethy1-5-pentan-2-y1-2-sulfanylidene-1,3-diazinane-4,6-dione
b) 4-ethy1-3-pentan-2-y1-2-sulfanylidene-1,3-diazinane-4,6-dione
c) 5-ethy1-5-pentan-3-y1-2-sulfanylidene-1,2-diazinane-4,6-dione
d) 5-ethy1-4-pentan-2-y1-3-sulfanylidene-1,3-diazinane-4,6-dione

5) Clotrimazole is used as ____ agent.
a) Antiviral b) Antibiotic
c) Antifungal d) Anaesthetic

6) A drug that causes loss of consciousness is called ____agent.
a) Antipyretic b) Analgesic
c) Anesthetic d) Antibiotic

7) Therapeutic use of durg phenobarbital is treatment of _____.
a) Diabetes b) Seizures
c) Anxiety d) Both B and C

8) _____ is a non-selective β −receptor antagonist drug.
a) Phenytoin b) Verapamil
c) Captopril d) Nifedipine

9) Insulin is released from _____ in human body to control blood sugar level.

a) Kidney b) Pancreas
c) Lungs d) Intestine

10) Which of the following Anopheles mosquitoes are responsible for transmission of malaria to human?

a) Male b) Female
c) Both A and B d) None of above

B) Write True or False. **06**

1) Cetirizine is a non-sedative antihistamine drug.
2) IUPAC nomenclature of Halothane is 2-Bromo-2-chloro-1,1,1-trifluoroethane.
3) Amoxycillin does not belong β −lactam penicillins.
4) Chloroquine is not used for treatment of malaria caused due to plasmodium falciparum.
5) Paracetamol is an antipyretic drug.
6) Hypnotics are the drugs that calm patients and reduce anxiety without inducing normal sleep.

Q.2 Answer the following. **16**

a) Explain synthesis and mechanism of action of aspirin.
b) Write structure and explain mechanism of action of Metformin.
c) Explain antihistamine activity of Diphenylhydramine.
d) Write note on synthesis and SAR of cefixime.

Q.3 Answer the following. **16**

a) Write structure and explain mechanism of action of, structure activity relationship of Diazepam.
b) Write the synthesis of SAR of antihypertensive drug captopril.

Q.4 Answer the following. **16**

a) Write note on Antidiabetic agents with suitable example w.r.t. synthesis and mechanism of action.
b) Write note on Classification, SAR and mechanism of action of antibiotics.

Q.5 Answer the following. **16**

a) Write structure and explain mechanism of action of structure activity relationship and therapeutic uses of Phenytoin.
b) Explain in detail antifungal agents.

Q.6 Answer the following. **16**

a) Explain anesthetic agents w.r.t classification, synthesis and mechanism of action.
b) Explain in detail synthesis and mechanism of action of Antihistamines.

Q.7 Answer the following. **16**

a) Explain in detail Non-Steroidal Anti-inflammatory Drugs.

b) Explain synthesis and mechanism of action of

i) Sulfacetamide

ii) Sulfamethoxazole

Seat No.	

Set P

M.Sc. (Industrial Chemistry) (Semester - III) (New) (NEP CBCS)
Examination: October/November - 2025
Unit Operations of Chemical Engineering (2325301)

Day & Date: Tuesday, 04-11-2025 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

Instructions: 1) All questions are compulsory.
2) Draw neat labelled diagrams wherever necessary.
3) Figures to the right indicate full marks.

Q.1 A) Choose correct alternative. **08**

1) What is residue in filtration?
a) Solid portion after filtration
b) Solid portion before filtration
c) Liquid portion after filtration
d) Liquid portion before filtration

2) In the evaporator of refrigerator system, the refrigerant changes from _____
a) Vapour to liquid
b) Liquid to vapour
c) Remains in liquid form
d) None of these

3) Weight percent = mass of the solute / mass of the solution x 100
So, if m is the mass of solute and M is the mass of solvent, then
Weight percent formula will be
Weight percent $= \mathrm{m} / \mathrm{m} + \mathrm{M} \times 100$
Example: A solution is prepared by adding 3 g of a substance A to 17 g of water. Calculate the mass per cent of the solute.
a) 10 b) 20
c) 15 d) 40

4) Solution contains 15% A by Mass (XA = 0.15 and 20 mole % B (yB = 0.20) calculate the total solution now file that corresponds to molar how rate of 25 kg of moles?
a) 100 b) 200
c) 125 d) 300

5) If the amount of water vapour in the air is high, then the rate of evaporation is _____.
a) will decrease b) will be zero
c) will remain the same d) will increases

6) What is the media used in chemical filtration?

a) Soap b) Detergents
c) Salt d) Activated carbons

7) Mass transfer rate between two fluid phases does not necessarily depend on the _____ of the two phases.

a) Chemical properties b) Physical properties
c) Degree of turbulence d) Interfacial area

8) The boiling point of chloroform is _____

a) 334 k b) 286 K
c) 350 K d) 298 K

B) Write True or False. **04**

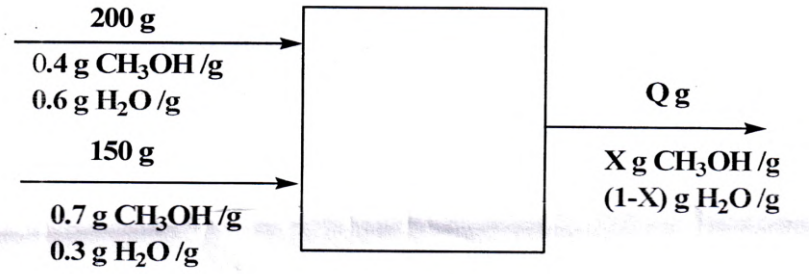
a) The pressure drops across the bed is directly proportional to Rate of flow.
b) For the given overall heat transfer coefficient and temperature difference, if the area of evaporator surface increases, then the capacity of evaporator: Can increase
c) Distillation is the best method to separate liquids having sufficient difference in their boiling point
d) Darcy's law is the law behind filtration.

Q.2 Answer the following. (Any Six) **12**

a) What is vacuum crystallization draw diagram?
b) What is Extraction detail about section of solvent?
c) What is leaching? Write in detail Bollman's extractor and continue leaching.
d) Write down fundamentals of Material Balances and explain their classes of system.
e) With neat diagram explain cyclone separator.
f) What is Steam distillation?
g) Write down in brief the batch and semi batch process.
h) Explain vapour liquid equilibrium.

Q.3 Answer the following. (Any Three) **12**

a) Example: Each year 50,000 people move into a city, 75,000 people move out, 22,000 are born, and 19,000 die. Write a balance on the population of the city.
b) A stream contains 20 g of oxygen gas, 70 g of nitrogen, 5 g of helium, and 5 g of hydrogen. Find the mass and mole fractions, mass and mole percent compositions.
c) Two methanol-water mixtures are contained in separate flasks. The first mixture is 40.0 wt % methanol, and the second is 70.0 wt % methanol. If 200 g of the first mixture is combined with 150 g of the second, what will be the mass and composition of the resulting mixture?



INPUT = OUTPUT

d) Explain Kettle type Heat Exchanger.

Q.4 Answer the following. (Any Two) **12**

a) How to design crystallization and types of crystallization?

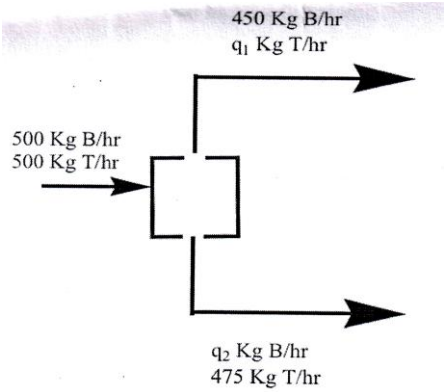
b) Calculate the mole fraction of HCl and H_2O in a solution of HCl acid in water, containing 20% HCl by weight. Solution The solution contains 20 grams of HCl acid and 80 grams of water. Also, Molar mass of HCl is 36.5 grams

c) Explain Filtration and what are types of filtrations?

Q.5 Answer the following. (Any Two) **12**

a) What is leaching write in detail Bollman's extractor and continue leaching?

b) One thousand kilograms per hour of a mixture of benzene (B) & toluene (T) containing 50% benzene by mass is separated by distillation into two fractions. The mass flow rate of benzene in top stream is 450 kg B/h & that of toluene in bottom stream is 475 kg T/h. The operation is at steady state. Write balances on benzene & toluene to calculate unknown component flow rates in output streams.



c) Overall Analysis for a Continuous Distillation Column:
A binary mixture consists of 35 % benzene and 65 % toluene are continuously fed to the distillation column at a rate of 1000 kg/hr. Whereas, the distillate flow rate was 10% from the feed flow rate. The distillate (top product) contains 85 % benzene. Calculate quantity and compositions of the waste stream?

Seat No.	

Set **P**

M.Sc. Industrial Chemistry (Semester - III) (New) (NEP CBCS)
Examination: October/November - 2025
Unit process in Chemical Industries (2325302)

Day & Date: Thursday, 06-11-2025 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

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

Q.1 A) Choose correct alternative. (MCQ) **08**

1) How many -NO_2 groups are there in Picric acid?
a) Zero b) One
c) Two d) Three

2) What is the disadvantage of bulk polymerization?
a) High temperature b) Heat control
c) Need catalyst d) All of the mentioned

3) In which position does the nitro group enters?
a) Ortho b) Para
c) Meta d) All of the mentioned

4) Which of the following types of glass accounts for about 90% of manufactured glass?
a) Potash-lime glass b) Soda-lime glass
c) Potash-lead glass d) Soda-lead glass

5) What is the initial setting time of cement?
a) 1 hour b) 30 minutes
c) 15 minutes d) 30 hours

6) Paint should provide resistance to _____.
a) Corrosion b) Sound
c) Heat d) Warping

7) Sulfomethylating agents comes under which agent?
a) Sulphur trioxide compound
b) Sulphur dioxide compound
c) Sulfoalkylating agents
d) None of the mentioned

8) Lime obtained from calcination of Pure Limestone is called _____.
a) Quick Lime b) Pure Lime
c) Lean Lime d) Rich Lime

B) Write True or False / Fill in the blanks **04**

a) Hypochlorous acid is unstable.
   a) True b) False

b) Glass is not a single compound.
   a) True b) False

c) _____ is released during the production of clinker.

d) Calcium hypochlorite is also called as _____.

Q.2 Answer the following. (Any Six) **12**

a) Describe in brief the polyamides.
b) Discuss in brief the manufacturing process of chlorobenzene.
c) Describe the Nitration.
d) Discuss the mechanism of aromatic sulphonation.
e) What are the working up procedures for sulphonation process?
f) How is monochlorobenzene manufacture?
g) Give the constituents of paints.
h) What are the properties of titanium dioxide?

Q.3 Answer the following. (Any Three) **12**

a) Describe in detail the manufacturing process of vinyl acetate.
b) Write the Synthesis and examples of osmium tetraoxide.
c) Explain the manufacturing process of paints.
d) Describe in brief the Selenium Dioxide.

Q.4 Answer the following. (Any Two) **12**

a) Write the synthesis of Shapiro reaction with its application.
b) Explain Gilman Reagent with its Application.
c) Describe in detail the manufacture of polyethylene.

Q.5 Answer the following. (Any Two) **12**

a) Explain with the flow chart the manufacturing process of Cement.
b) Discuss the manufacturing of glass.
c) Write a note on zinc oxide.

Seat No.	

Set P

M.Sc. Industrial Chemistry (Semester - III) (New) (NEP CBCS)
Examination: October/November – 2025
Industrial Analytical Chemistry - I (2325306)

Day & Date: Saturday, 08-11-2025 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

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

Q.1 A) Choose correct alternative. (MCQ) **08**

1) Which type of sensor is used to measure temperature?
a) Photodiode b) Thermocouple
c) Ultrasonic sensor d) Pressure sensor

2) What is the primary purpose of cyclic voltammetry?
a) To measure the conductivity of a solution
b) To determine the pH of a solution
c) To study the electrochemical properties of a material
d) To analyze the composition of a solution

3) What is a common application of DME?
a) Polarography b) Voltammetry
c) Coulometry d) All of the above

4) What is the primary function of a pH sensor?
a) To measure temperature
b) To measure conductivity
c) To measure the concentration of hydrogen ions
d) To measure the concentration of oxygen

5) What is a limitation of ESR spectroscopy?
a) Limited sensitivity
b) Limited resolution
c) Requires a homogeneous magnetic field
d) Requires a large sample size

6) Which of the following materials is mostly used for making of thermoforming moulds?
a) Steel b) Grey cast iron
c) Aluminium d) White cast iron

7) Which of the following moulding processes is widely used for the manufacturing of plastic bottles?
a) Compression moulding
b) Injection moulding
c) Jet moulding

d) Blow moulding

8) Helium is generally preferred as carrier gas over nitrogen and hydrogen because _____.
a) it is inert
b) it has a lower viscosity
c) it doubles up as a party gas for balloons and funny voices
d) all of above

B) Write true/false. **04**

1) Gas sensors require frequent calibration to maintain their accuracy.
2) Tin oxide is a pure ionic conductor.
3) The blow moulding process is very fast and can produce components, mainly plastic parts very fast and economically.
4) Thermoforming is basically a cheap process as compared to injection and blow moulding process.

Q.2 Answer the following. (Any Six) **12**

a) Explain development of new Voltammetry Techniques.
b) Explain Electro analytical sensor.
c) Define diffusion current.
d) Write advantages and disadvantages of DME.
e) What is meant by Retention time in Gas chromatography?
f) Write the application of ESR.
g) Draw a neat labelled diagram of Extrusion mould machine.
h) Explain in brief the procedure followed to process polymer in injection Moulding.

Q.3 Answer the following. (Any Three) **12**

a) Explain the working of DME (Drop Mercury Electrode).
b) Explain in detail programmed temperature gas chromatography.
c) Write the Instrumentation of ESR and its application.
d) Explain in details polymer being processed by Compression moulding.

Q.4 Answer the following. (Any Two) **12**

a) Discuss the liquid membrane electrode with its application.
b) Distinguish between GC-MS and LC-MS.
c) Explain Sampled DC Polarography and its merit and Demerits.

Q.5 Answer the following. (Any Two) **12**

a) Explain membrane electrode and its type?
b) Describe in detail with neat, labelled diagram the principle and working of Gas chromatography.
c) Discuss principles of ESR and its instrumentation?

Seat No.	

Set | P

M.Sc. (Industrial Chemistry) (Semester - IV) (New) (NEP CBCS)
Examination: October/November - 2025
Pollution Monitoring and Control (2325401)

Day & Date: Tuesday, 28-10-2025 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

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

Q.1 A) Choose correct alternative. (MCQ) **08**

1) Who is responsible for the degradation of biodegradable organic matter present in the domestic sewage?
a) Animals b) Humans
c) Plastic d) Bacteria and other microbes

2) How is the amount of biodegradable organic matter in sewage water estimated?
a) Chemical Oxygen Demand
b) Physical Oxygen Demand
c) Biological Oxygen Demand
d) Mathematical Oxygen Demand

3) The sources of hexavalent chromium [Cr (VI)] in the environment are _____ industries.
a) Plating b) Paint and pigment
c) Leather d) All of the above

4) Excess fluoride in drinking water is likely to cause _____.
a) Blue baby syndrome
b) Fluorosis
c) Change in taste and odour
d) Intestinal irritation

5) _____ is popular method of removal of heavy metal.
a) Chemical reduction b) Coagulation
c) Chemical precipitation d) Alkaline chlorination

6) Step of sewage water treatment in which there is some aeration and organic material is converted to inorganic materials is called as _____.
a) Primary sewage treatment
b) Secondary sewage treatment
c) Activated sludge treatment
d) Chlorination

7) CPCB stands for _____.
a) Control pollution control board
b) Central pollution central board
c) Control pollution central board
d) Central pollution control board

8) The major photochemical oxidant is: _____.
a) Ozone b) Hydrogen peroxide
c) Nitrogen oxides d) Peroxyl Acetyl Nitrate (PAN)

B) Write True/False. **04**
a) Central Pollution Control Board established in 1982.
b) MINAS stands for minimum National Standards.
c) Tertiary treatment removes only suspended solids.
d) Process industries which are major sources of phenolic discharge is petroleum refineries.

Q.2 Answer the following. (Any Six) **12**
a) What is Thermal degradation method in polymer recycling?
b) What is according to IS:2296-1963, the tolerance limit for disposal of fluoride and cyanide in effluent to be discharged into water for public supply and Bathing Ghat?
c) What is the constituent together makes phenosolvan?
d) What are reducing agent used for removal of chromium by reduction precipitation method?
e) What is Electrodialysis in water treatment process?
f) What is Soil Pollution?
g) Explain Soil pH determination process by using universal indicator solution method.
h) Define Air pollution.

Q.3 Answer the following. (Any Three) **12**
a) State the Indian standard for disposal of Industrial effluent into public sewer system, IS:3360-1974.
b) Explain flocculation treatment process for removal of sludge.
c) Explain the procedure for the determination of moisture content in the soil.
d) What is important end product from recycled polymer?

Q.4 Answer the following. (Any Two) **12**
a) Discuss the Air (Prevention and Control of Pollution) Act 1981.
b) Explain Lime Coagulation and Adsorption method for removal of mercury.
c) Explain Analysis of Nitrogen Oxide (NO) in the gaseous effluents.

Q.5 Answer the following. (Any Two) **12**
a) Explain MINAS and plan of action for Distilleries
b) Explain in detail the Ion exchange process for removal of phenolic residue.
c) Explain the Activated sludge process performed on effluent.

Seat No.	

Set | P

M.Sc. Industrial Chemistry (Semester - IV) (New) (NEP CBCS)
Examination: October/November - 2025
Industrial Management and Nonconventional Energy Sources (2325402)

Day & Date: Thursday, 30-10-2025 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

Instructions: 1) All questions are compulsory.
2) Draw neat, labelled diagrams wherever necessary.
3) Figures to the right indicate full marks.

Q.1 A) Choose correct alternative. **08**

1) Which of the following converts chemical energy directly into electrical energy without combustion?
a) Ni-Cd cell b) Fuel cell
c) Dynamo d) Electrolytic cell

2) The Mossbauer Spectroscopy uses _____.
a) β Radiation b) γ Radiation
c) Θ Radiation d) € Radiation

3) What is a battery that stores chemical energy and converts it into electrical energy commonly known as?
a) Thermal cell b) Electrochemical cell
c) Solar cell d) Fuel cell

4) Which plant requires the largest space?
a) Pilot plant
b) Commercial plant
c) Semi-commercial plant
d) None of the above

5) SSI generally set up in _____.
a) City b) Rural Area
c) Metro d) None of the above

6) Which of the following is not a type of Research and Development (R&D)?
a) Basic Research b) Financial Research
c) Applied Research d) Developmental Research

7) The Mossbauer effect is based on ____.
a) Beer-Lamberts law b) Doppler effect
c) Mossier effect d) Spin effect

8) Which of the following is unstable Mossbauer Nuclei?

a) ^{57}Fe b) ^{57}Co

c) ^{129}I d) ^{121}Sb

B) Fill in the Blanks / True or False. **04**

1) _____ is process to identify purity of product (API).
2) Biomass is considered a renewable source of energy. (True/False)
3) The Mössbauer spectroscopy is used to study the nuclear structure with the absorption and remission of gammy. (True /False)
4) To magnify and focus the emitted electrons onto a detector What is the role of an electron lens in photoelectron microscopy. (True/False)

Q.2 Answer the following. (Any Six) **12**

a) What are rules and regulations for export and import?
b) Explain hazardous waste. Give their types.
c) What is meant by Mössbauer Effect?
d) What is pyrophoric Chemical?
e) What is safety concept in industry?
f) What is Biodiesel?
g) What is pp operation and define quality control?
h) Explain SSI.

Q.3 Answer the following. (Any Three) **12**

a) Explain in detail primary and secondary batteries. Define Batteries.
b) What is incineration give advantages and disadvantages.
c) What is fuel cells describe in detail construction and working?
d) What is Isomer shift in Mössbauer spectroscopy?

Q.4 Answer the following. (Any Two) **12**

a) Write down importance of research and developments.
b) What is conventional and non-conventional energy sources? Write advantages and disadvantages.
c) Explain Ignite coal, Bituminous coal and Anthracite coal.

Q.5 Answer the following. (Any Two) **12**

a) What is biofuel describing generation I, II, III, IV in detail?
b) Explain in detail management and hazardous waste and transportation and their types.
c) Give in detail non-financial intensive.

Seat No.	

Set | P

M.Sc. Industrial Chemistry (Semester - IV) (New) (NEP CBCS)
Examination: October/November – 2025
Nano Material and its Characterization (2325405)

Day & Date: Saturday, 01-11-2025 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

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

Q.1 A) Choose correct alternative. (MCQ) **08**

1) What is the term for the manipulation of matter on an atomic or molecular scale?
   a) Nanotechnology b) Biotechnology
   c) Materials science d) Atomic engineering

2) What is the advantage of using spray pyrolysis over other deposition techniques?
   a) High cost
   b) Low throughput
   c) Simple and cost-effective
   d) Limited control over film properties

3) What is the principle behind SEM imaging?
   a) Transmission of electrons through the sample
   b) Reflection of electrons from the sample
   c) Emission of electrons from the sample
   d) Scanning of a focused electron beam across the sample

4) What is the principle behind DTA?
   a) The measurement of heat flow
   b) The measurement of temperature difference
   c) The measurement of mass change
   d) The measurement of volume change

5) What is the role of the magnetic field in Magnetron Sputtering?
   a) To increase the sputtering rate
   b) To decrease the sputtering rate
   c) To improve the uniformity of the deposited film
   d) To confine the plasma

6) What is the typical substrate preparation required for CBD?
   a) High-temperature annealing
   b) Chemical cleaning
   c) Plasma treatment
   d) No preparation needed

7) How is DTA used in material science?
   a) To study thermal properties
   b) To analyze chemical composition
   c) To determine crystal structure
   d) To measure electrical conductivity

8) What information can be obtained from the derivative TGA curve?
   a) Decomposition rate b) Thermal stability
   c) Moisture content d) Sample purity

B) Fill in the blanks OR write true/false. **04**

1) The substrate temperature plays a crucial role in determining the Properties of the deposited film. (True/False)
2) TEM requires a Controlled environment to operate, typically under vacuum. (True/False)
3) The term "nano" refers to a _____ meter.
4) _____ Number of atoms are present in FCC.

Q.2 Answer the following. (Any Six) **12**

a) Define semiconductors.
b) What the use of photo assisted CVD.
c) Write the demerits of sol gel.
d) Define TGA.
e) Draw a DSC Profile.
f) Write application of XPS.
g) Describe Hydrothermal Synthesis.
h) Draw a neat labelled diagram of Coolidge tube.

Q.3 Answer the following. (Any Three) **12**

a) Discuss the working of Chemical bath deposition.
b) Write a note on Magnetron Sputtering.
c) Explain in detail with principle x-ray photon spectroscopy (XPS).
d) Describe DSC (Differential Scanning Calorimetery).

Q.4 Answer the following. (Any Two) **12**

a) Explain the instrumentation of TEM with its application.
b) Write a note on DSC and write its merits.
c) Explain Destructive Interference and Derive Bragg Law.

Q.5 Answer the following. (Any Two) **12**

a) Explain the type of method used for making nano materials.
b) Explain the instrumentation and working of XPS.
c) Describe the hydrothermal method and its application.

SLR-HF-33

Seat No.	

Set P

M.Sc. (Industrial Chemistry) (Semester - IV) (New/Old) (CBCS) Examination: October/November - 2025
Chemical Industries (MSC06401)

Day & Date: Tuesday, 28-10-2025 Max. Marks: 80
Time: 03:00 PM To 06:00 PM

Instructions: 1) Questions no. 1 & 2 are compulsory.
2) Attempt any Three Question from Q No.3 to Q No.7
3) Figures to the right indicate full marks.

Q.1 A) Choose correct alternative. (MCQ) **10**

1) What is the active ingredient in Zineb?
a) Zinc ethylenebisdithiocarbamate
b) Copper oxychloride
c) Mancozeb
d) Chlorothalonil

2) Which component provides color and opacity to paint?
a) Binder b) Pigment
c) Solvent d) Filler

3) Which property is crucial for whiteware?
a) Electrical conductivity
b) Thermal resistance
c) Whiteness and translucency
d) High strength

4) Which type of rock is crude oil typically found in?
a) Igneous b) Sedimentary
c) Metamorphic d) Foliated

5) Which industry is a major consumer of ceramic materials?
a) Automotive b) Aerospace
c) Electronics d) All of the above

6) Which type of enamel is commonly used for appliances?
a) Acrylic enamel b) Polyurethane enamel
c) Alkyd enamel d) Epoxy enamel

7) Which of the following is NOT a common cement constituent?
a) Tricalcium silicate b) Dicalcium silicate
c) Tricalcium aluminate d) Sodium carbonate

8) Which process is used to extract aluminium from bauxite?
a) Electrolysis b) Smelting
c) Refining d) Bayer process

9) Which type of iron ore is richest in iron content?

a) Hematite b) Magnetite
c) Limonite d) Siderite

10) Which type of steel is defined as having a carbon content between 0.05-0.25%?

a) Low-carbon steel b) Medium-carbon steel
c) High-carbon steel d) Alloy steel

B) Write True or False. **06**

1) The Bessemer process is used to produce wrought iron.
2) Paint is a mixture of pigment, binder, solvent, and additives.
3) Agrochemicals have no environmental impact.
4) Petrochemicals are derived from renewable resources.
5) Ceramics are used in aerospace engineering.
6) Glass is 100% recyclable.

Q.2 Answer the following. **16**

a) Give the properties and application of stainless steel.
b) Describe the Mixing of Paints.
c) Write note on synthesis and application on Endosulphan.
d) Write a note on characterization of crude oil.

Q.3 Answer the following. **16**

a) Explain the suitable examples, properties and applications of dyes.
b) Explain any two carbamates used in agrochemicals.

Q.4 Answer the following. **16**

a) Explain the in detail the manufacture of white ware.
b) Describe enamels and varnishes and its application.

Q.5 Answer the following. **16**

a) Give an account of the following organochlorine pesticides with respect to synthesis and applications of Aldrin and Dieldrin.
b) Explain the manufacturing process of zinc oxide and its properties, application.

Q.6 Answer the following. **16**

a) What are petrochemicals? Give an outline of chemicals derive from propylene.
b) Explain the Bessemer process and the application of steel.

Q.7 Answer the following. **16**

a) Describe enamels and varnishes and its application.
b) Give an outline of chemicals derived from benzene.

Seat No.	

Set P

M.Sc. (Industrial Chemistry) (Semester - IV) (New/Old) (CBCS)
Examination: October/November - 2025
Pollution Monitoring and Control (MSC06402)

Day & Date: Thursday, 30-10-2025 Max. Marks: 80
Time: 03:00 PM To 06:00 PM

Instructions: 1) Questions no. 1 & 2 are compulsory.
2) Attempt any Three Question from Q No.3 to Q No.7
3) Figures to the right indicate full marks.

Q.1 A) Multiple Choice Questions: **10**

1) Alkaline chlorination is used for removal of _____.
   a) Chlorine b) Cyanide
   c) Mercury d) Chromium

2) Hard water may cause the following problem _____.
   a) Scale and sludge formation
   b) Priming and foaming
   c) Boiler corrosion
   d) All of these

3) The extraction efficiency for removal of phenolic residue was observed to vary according to the _____.
   a) ratio of the solvent used
   b) solvent used
   c) Temperature
   d) None of these

4) The Kyoto Protocol agreement was signed in _____.
   a) 1997 b) 1990
   c) 1985 d) 1980

5) Denitrification is a process of _____.
   a) Oxidation b) Reduction
   c) Hydration d) Carbonation

6) Carbon dioxide is primarily called greenhouse gas because _____.
   a) Traps heat b) Traps light
   c) Traps warm currents d) None of the above

7) Which gas is mainly produced due to incomplete burning of wood?
   a) CO b) SO_2
   c) NO_2 d) NO_3

8) CNG stands for _____.
   a) Common Natural gas
   b) Compressed National gas
   c) Compressed Natural gas
   d) Certified National gas

9) Which fertilizer produces acidity in soil?
   a) Ammonium sulfate
   b) Sodium nitrate
   c) Calcium ammonium nitrate
   d) Calcium nitrate

10) Which of the following air pollutant effects plants the most?
   a) Fluorine b) SO_2
   c) PAN d) HCl

B) Fill in the blanks. **03**

1) In reverse osmosis, the water flows from _____ concentration to _____ concentration.
2) The sources of hexavalent chromium [Cr (VI)] in the environment are _____ industries.
3) EDTA has the ability to form _____ with metal ions.

C) State True or False. **03**

1) Thiourea is type of Artificial nitrification inhibitors fertilizer.
2) Non-Destructive Integrated Restoration (NDIR) stands for, in the category of spectrometric analysers.
3) Incineration is a waste disposal method where solid organic wastes are converted to the residue and gaseous products through combustion.

Q.2 Answer the following. **16**

a) Give an account of any one method used for the removal of phenolic residues.
b) Describe in detail the tertiary method used for waste water treatment.
c) Explain in short, the methods used for analysis of SOx gas in gaseous effluent.
d) Describe the Tricking filters and oxidation pond for wastewater treatment.

Q.3 Answer the following.

a) Discuss briefly the salient features of the Air (Prevention and Control of Pollution) Act, 1981. **10**
b) Explain the MINAS and plan of action for sugar industries and distilleries unit. **06**

Q.4 Answer the following.

a) Discuss in brief various measures used to control the pollution of air by NOx. **08**

b) State the difference between recycling of natural and man-made polymers. **08**

Q.5 Answer the following.

a) How are BOD and COD experimentally determined? **08**

b) Describe the oxidation method used for the removal of phenolic residue. **08**

Q.6 Answer the following.

a) Give the salient features of Water (Prevention and Control of Pollution) Act, 1974. **08**

b) Explain the analysis of soil for the parameters Moisture, pH and total nitrogen. **08**

Q.7 Answer the following.

a) Discuss the end use of recycled polymer. **08**

b) Give an account on Analysis of CO and Particle size analysis. **08**

SLR-HF-38

Seat No.	

Set P

M.Sc. Polymer Chemistry (Semester - III) (New) (NEP CBCS)
Examination: October/November – 2025
Fundamentals of Polymer Science (2324301)

Day & Date: Tuesday, 04-11-2025 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

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

Q.1 A) Choose correct alternative. **08**

1) Tg of polymer is influenced by: _____.
a) Chain flexibility b) Cross-linking
c) Side groups d) All of the above

2) Which of the following is a trade name for polycarbonate?
a) Teflon b) Lexan
c) Nylon d) Kevlar

3) What is the main advantage of Continuous Process?
a) Easier operation and low cost.
b) Maintaining batch to batch uniformity.
c) Usually an induction period.
d) None of these

4) A polymer in which substituents are arranged on alternate sides of the plane is called: _____.
a) Isotactic b) Atactic
c) Syndiotactic d) Heterotactic

5) Knocking characteristics of fuel used in petrol engine are expressed in terms of what?
a) Octane rating b) Butane rating
c) Cetane rating d) Pentane rating

6) BTX refers to: _____.
a) Butane, Toluene, Xylene
b) Benzene, Toluene, Xylene
c) Benzene, Tetrahydro furan, Xylene
d) Butadiene, Toluene, Xylene

7) What is the role of chain transfer agent in polymerization?
a) To initiate the polymerization
b) To increase the molecular weight
c) To increase polymerization rate
d) To control the molecular weight

8) Degree of polymerisation (DP) is defined as: _____.

a) Total monomer units
b) Number of side groups
c) Number of cross-links
d) Number of repeating units per polymer chain

B) Fill in the blanks and write true or false. **04**

1) Polymers that soften on heating and harden on cooling are known as _____ polymers.
2) In _____ polymerization technique, the monomer and initiator are dissolved in an inert solvent.
3) Carbon dioxide can be used as a polymer feedstock. True or False
4) Glass transition temperature (Tg) is a first-order transition. True or False

Q.2 Answer the following. (Any Six) **12**

a) What is cracking, write down its types?
b) Define term octane number.
c) Give the order of knocking among different types of hydrocarbons.
d) Explain the terms monodispersed and polydispersed polymers with suitable example.
e) How to remove various impurities from crude oil before refining?
f) Write down IUPAC name of nylon-6 and polypropylene
g) State the advantages of interfacial polymerization method.
h) What are geometrical isomers, explain with suitable examples?

Q.3 Answer the following. (Any Three) **12**

a) Explain the stereoisomerism involved in polymers derived from styrene monomer.
b) Discuss the ladder and semi ladder polymers with suitable examples.
c) Write the comparison between addition and condensation polymerization.
d) Give an account on any one renewable resource as building block for polymer industries.

Q.4 Answer the following. (Any Two) **12**

a) Write down equations of different types of average molecular weights (Mn, Mw, Mv and Mz) and name their methods of determination. Draw the molecular weight distribution curves showing these molecular weights.
b) Discuss in detail emulsion polymerization techniques.
c) Write a note on classification of polymers based on origin, thermal behavior and physical properties.

Q.5 Answer the following. (Any Two) **12**

a) Discuss the nomenclature of polymers based on source.

b) Write use of ethylene as building block for monomers and polymers.

c) Describe any one method used for determination of glass transition temperature (Tg) of polymers

Seat No.	

Set **P**

M.Sc. Polymer Chemistry (Semester - III) (New) (NEP CBCS)
Examination: October/November - 2025
Chain Polymerization Mechanism and Kinetics (2324302)

Day & Date: Thursday, 06-11-2025 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

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

Q.1 A) Choose correct alternative. (MCQ) **08**

1) _____ are the components of atom transfer radical polymerization.
a) Initiator b) Monomer
c) Catalyst d) All of the above

2) _____ polymers does not fall within the configuration category.
a) Cross-linked b) Atactic
c) Syndiotactic d) Isotactic

3) _____ polymers is obtained by condensation polymerization.
a) PVC b) Polythene
c) Polystyrene d) Nylon 66

4) The temperature at which rate of propagation as well as depropagation are equal is called as _____.
a) propagation temperature
b) depropagation temperature
c) ceiling temperature
d) All of the above

5) _____ is used for analysis of Co-polymers.
a) AAS
b) Radio isotopic labelling technique
c) Conductometry
d) Potentiometry

6) Highly strained, 3-membered ring epoxides are polymerized by _____ initiators.
a) Cationic b) Anionic
c) Neutral d) Both a and b

7) _____ is used as a catalyst for cationic polymerization.
a) AIBN b) Protonic acids
c) Benzyl peroxide d) Metal alkoxides

8) _____ are the photosensitizes.

a) Anthracene b) Benzophenone
c) Both a) and b) d) Chloroform

B) Write true or false. **04**

a) ATRP can be used to synthesize polymers at room temperature.
b) Azo compounds and peroxides are the main commercially used initiators used in free radial polymerization processes.
c) Ziegler-Natta didn't determined stereo regularity of polymers.
d) Hyper branched (hb) polymers are a special type of dendritic polymers

Q.2 Answer the following. (Any Six) **12**

a) Explain free radical polymerization.
b) Discuss the Reactivity ratio in copolymerization.
c) Write in short commercial importance of cationic and anionic polymerization.
d) Explain the different ATRP agents.
e) Discuss the properties of block copolymers.
f) Write a note on Polymer blends.
g) Discuss the Ziegler-Natta Initiators.
h) Write the ATRP Mechanism.

Q.3 Answer the following. (Any Three) **12**

a) Explain the chain transfer reaction.
b) Explain with an of ABA-triblocks copolymer.
c) Write the advantages of ATRP over conventional free radical polymerization.
d) Describe the ring opening polymerization of cyclic amides.

Q.4 Answer the following. (Any Two) **12**

a) Explain the copolymerization behavior (ideal r1, r2 =1)
b) Discuss the photochemical initiation.
c) Write the mechanism of stereospecific placement in ionic and co-ordination polymerization.

Q.5 Answer the following. (Any Two) **12**

a) Discuss the various types of redox initiators used in polymerization.
b) Explain the Copolymer composition and Copolymerization equations.
c) Explain the Nitroxy-radicals stability and underactivity under certain conditions and their uses in NMP.

Seat No.	

Set P

M.Sc. Polymer Chemistry (Semester - III) (New) (NEP CBCS)
Examination: October/November – 2025
Polymer Analysis and Characterization techniques (2324306)

Day & Date: Saturday, 08-11-2025 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

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

Q.1 A) Choose correct alternative. (MCQ) 08

1) _____ is the region of electromagnetic spectrum of UV-Visible spectroscopy.
a) 1-100nm b) 100-400nm
c) 200-800nm d) 700-2500nm

2) _____ compound is IR inactive.
a) HC1 b) CO_2
c) H_2O d) O_2

3) _____ source of light commonly used in Raman spectroscopy.
a) X- rays b) IR radiations
c) Laser d) UV light

4) The detector in an XRD instrument measures _____.
a) Intensity of diffracted X-rays
b) Temperature
c) Phase of the sample
d) Sample composition

5) In Mass spectroscopy, ions are separated based on their _____.
a) density b) mass to charge ratio
c) Volume d) polarity

6) The furnace in TGA system _____.
a) Heat the sample at controlled rate
b) Maintains a constant weight of the sample
c) Ionizes the sample for analysis
d) Prevent thermal degradation

7) The primary purpose of DTA is to study _____.
a) Electrical conductivity b) Surface morphology
c) Phase transitions d) Magnetic properties

8) In ^{13}C NMR, ^{13}C is used instead of ^{12}C because _____.

a) ^{13}C is more abundant b) ^{12}C has no magnetic moment
c) ^{12}C cannot resonate d) ^{13}C is radioactive

B) Fill in the blanks. **04**

1) The IR spectroscopy is mainly used to determine _____ of sample.
2) In acid value test, the sample is titrated with a _____ solution.
3) Raman spectroscopy is based on _____ phenomenon.
4) The range of chemical shift observed in ^{13}C NMR is _____.

Q.2 Answer the following. (Any Six) **12**

a) What is Auxochrome?
b) Explain $\sigma - \sigma^*$ transition and $\pi - \pi^*$ transition.
c) Explain the Stretching vibrations.
d) What is % elongation at break?
e) Why ^{13}C is used in NMR spectroscopy instead of ^{12}C?
f) What is the principle behind XPS?
g) What is Bulk density in polymers?
h) What is the term Moisture content of polymers?

Q.3 Answer the following. (Any Three) **12**

a) Explain the Lambert's Beer's Law.
b) Describe the rate of reaction and degradation of polymers by UV-Visible spectroscopy.
c) Explain the study of hydrogen bonding by IR- Spectroscopy with suitable example.
d) Give the difference between ^{1}H NMR and ^{13}C NMR.

Q.4 Answer the following. (Any Two) **12**

a) Explain the ATR spectroscopy with suitable diagram.
b) Give in details the instrumentation of IR spectroscopy.
c) Describe the instrumentation technique of SEM.

Q.5 Answer the following. (Any Two) **12**

a) What is the principle of XRD? Give the general instrumentation of XRD.
b) Describe PGCMS technique in details.
c) Explain the Heating and burning test of polymers.

Seat No.	

Set P

M.Sc. (Polymer Chemistry) (Semester - IV) (New) (NEP CBCS)
Examination: October/November - 2025
Industrial Polymer Science (2324401)

Day & Date: Tuesday, 28-10-2025 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

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

Q.1 A) Choose correct alternative. (MCQ) **08**

1) Nylons are _____.
a) elastomers b) fibers
c) rubber d) adhesives

2) Bakelite is polymer of _____.
a) Formaldehyde and Phenol
b) Acetaldehyde and Phenol
c) Benzaldehyde and Phenol
d) Formaldehyde and benzyl alcohol

3) Acid catalyzed reaction of phenol with acetone gives _____.
a) DMT b) PF resin
c) Phenol Carbonate d) Bisphenol-A

4) _____ of the following is semi aromatic polyester.
a) PEEK b) PTT
c) PET d) All of the above

5) _____ is starting material used for preparation of liquid epoxy resin.
a) Bisphenol-A and epichlorohydrine
b) Bisphenol-A and chlorine
c) Phenol and epichlorihydrine
d) All of the above

6) The ability of hydrogels to release drugs over time is an example of _____.
a) Osmotic pressure b) Controlled drug delivery
c) Hydrolysis d) Adsorption

7) Cross-linking of unsaturated Polyester is done by using _____ as a cross-linking agent.
a) alkane monomer b) vinyl monomer
c) alkyl halide monomer d) All of the above

8) _____ is called aminoplast.

a) MF resin b) UF resin
c) PF resin d) Both a and b

B) Fill in the blanks. **04**

a) Base catalyzed PF resin gives _____.
b) _____ are three-dimensional network of hydrophilic cross-linked polymers.
c) _____ is the trade name of PTT.
d) Nylon 6 polymer is prepared from _____ monomer.

Q.2 Answer the following. (Any Six) **12**

a) Define Polyesters with an example.
b) What is polycarbonate?
c) Define self assembling polymers.
d) What is polymer blend?
e) Give the structure of polyurethane.
f) Give the structure of Nomex.
g) Define degree of polymerization.
h) Define lithography with an example of polymer.

Q.3 Answer the following. (Any Three) **12**

a) Write a note on Polymer liquid crystals.
b) Explain the Carothers equation for degree of polymerization.
c) Give the synthesis of Sarona (PTT) by DMT process and give its properties.
d) Give the synthesis of polycarbonate by Interfacial method with its advantages and disadvantages.

Q.4 Answer the following. (Any Two) **12**

a) Define Hydrogel and describe the stimuli sensitive hydrogel.
b) Give the synthesis of polyimide with its monomer synthesis.
c) Give in details about the synthesis and applications of PEEK.

Q.5 Answer the following. (Any Two) **12**

a) Give the synthesis of polyparaphenylene with its properties and applications.
b) Describe polymer blends and alloys with an example.
c) Define lithography. Explain the concept polymers in lithography.

Seat No.	

Set **P**

M.Sc. Polymer Chemistry (Semester - IV) (New) (NEP CBCS)
Examination: October/November - 2025
Paints and Coatings Technology (2324402)

Day & Date: Thursday, 30-10-2025 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

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

Q.1 A) Choose correct alternative. (MCQ) **08**

1) Which of the following is NOT a major component of a typical paint formulation?
   a) Binder b) Catalyst
   c) Pigment d) Solvent

2) Which of the following paints would generally be expected to have the fastest drying time?
   a) Oil-based paint b) Epoxy coating
   c) Alkyd enamel d) Acrylic latex paint

3) What process is typically used to apply powder coating to a surface?
   a) Brushing b) Dipping
   c) Electrostatic spray d) Rolling

4) Which of the following equipment is commonly used for pigment dispersion in paint manufacturing?
   a) Ball mill b) High-speed disperser
   c) Roller mill d) All of above

5) Which of the following is a major environmental health issue?
   a) Air pollution b) Regular exercise
   c) Balanced diet d) Vaccination

6) Epoxy resins are primarily used in which of the following applications?
   a) Packaging materials b) Fabric production
   c) Surface coatings d) Pharmaceutical products

7) Which alcohol is most commonly used in alkyd resin synthesis?
   a) Methanol b) Glycerol
   c) Isopropanol d) Ethanol

8) The primary solvent used in traditional lacquer is _____.
   a) Water b) Oil
   c) Alcohol d) Thinner (organic solvent)

B) Fill in the blanks. **02**

1) The main function of _____ in paint is to provide colour.
2) _____ resins are formed by the reaction of epichlorohydrin with bisphenol-A.

C) Write True/False. **02**

1) Varnish contains solvents, pigments, and binders. (True / False)
2) In powder coating we can use only liquid for spray. (True /False)

Q.2 Answer the following. (Any Six) **12**

a) Define paint in the context of surface coatings.
b) What do you mean by distemper in painting technology?
c) Explain the purpose and composition of varnish.
d) Define pigments and their role in paints.
e) What is role of epoxy resin in coatings?
f) What are alkyd resins?
g) What are the advantages of powder coating?
h) Explain the term Cement paint.

Q.3 Answer the following. (Any Three) **12**

a) Explain the various production strategies of paints.
b) Discuss the scientific principles used in the development of paint formulations.
c) Describe the types of varnishes along with their applications.
d) State various failures in the paint film.

Q.4 Answer the following. (Any Two) **12**

a) How the alkyd resins are synthesized? Mention their applications.
b) Explain the methods of preparation of paints. Write down their applications.
c) Discuss the concept of powder coating with its key advantages and disadvantages.

Q.5 Answer the following. (Any Two) **12**

a) Describe the constituents of paints and explain their functions.
b) Write in detail about different filtration techniques in paints manufacturing.
c) Explain in brief with flow chart seven tank process.

Seat No.	

Set | P

M.Sc. Polymer Chemistry (Semester - IV) (New) (NEP CBCS)
Examination: October/November – 2025
Processing Technology and Polymer Properties (2324405)

Day & Date: Saturday, 01-11-2025 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

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

Q.1 A) Choose correct alternative. (MCQ) **08**

1) The effect of filler on mechanical behaviour is _____.
   a) Increase of filler content in polymer increases the softness of the polymer.
   b) Increase of filler content in polymer decreases the stiffness of the polymer.
   c) Increase of filler content in polymer increases the stiffness of the polymer.
   d) None of these

2) _____ is the property of recovering original shape after the removal of deforming strain.
   a) Rigidity modulus b) Elasticity
   c) Young's modulus d) Bulk modulus

3) The storage of modulus and loss of modulus gives idea about _____.
   a) Dilatants b) Dynamic Mechanical behavior
   c) Pseudoplastic d) Viscous flow

4) The viscosity of molten polymer fluid is determined by using _____.
   a) Falling-ball viscometer
   b) Ostwald viscometer
   c) Vibration viscometer
   d) Rotational viscometer

5) Extrusion molding products are _____.
   a) Pipes and wire coating
   b) Syntax tank and car bumper
   c) bottles and chairs
   d) All of the above

6) The process of separating cotton fibres from the seeds is called _____.
   a) Retting b) Weaving
   c) Ginning d) Spinning

7) _____ physical methods is/are used for Nanocomposites.
   a) Electrospinning b) Inert gas condensation
   c) Spray pyrolysis d) All of above

8) _____ are applied externally on surface of plastics.
   a) Colorant b) Filler
   c) Antioxidant d) Antistatic agents

B) Fill in the blanks. **04**

1) _____ is an example of Ideal fluid.
2) In Non-Newtonian fluid stress strain, curve is _____.
3) The bottles, barrels and other liquid containers are especially manufactured by _____.
4) In plastics processing role of additive is to _____.

Q.2 Answer the following. (Any Six) **12**

a) Explain in short reaction injection molding.
b) Describe in short extruder - Blow molding.
c) Write a note on ideal-fluids.
d) What are the residual stresses in polymer processing?
e) Explain the advantages and disadvantages of compression molding.
f) Write a note on roll coating.
g) Explain the dynamic mechanical behavior of polymer.
h) Explain the viscoelastic behavior.

Q.3 Answer the following. (Any Three) **12**

a) Derive the rheological equation.
b) Describe in detail Transfer Molding.
c) Explain the melt processing of fibers.
d) Write the types of calendars and its configurations.

Q.4 Answer the following. (Any Two) **12**

a) Describe in detail Thermoforming molding.
b) Explain the general features of twin screw extruders & techniques based on extuder.
c) Discuss in detail Rotational Molding.

Q.5 Answer the following. (Any Two) **12**

a) Explain the Mechanical spectra and different factors affecting on mechanical spectra.
b) Describe in detail Compression Molding.
c) Discuss the spray coating and vacuum coating.

Seat No.	

Set **P**

M.Sc. (Polymer Chemistry) (Semester - IV) (New/Old) (CBCS)
Examination: October/November - 2025
Step-Growth Polymers (MSC05401)

Day & Date: Tuesday, 28-10-2025 Max. Marks: 80
Time: 03:00 PM To 06:00 PM

Instructions: 1) Questions no. 1 & 2 are compulsory.
2) Attempt any Three Question from Q No.3 to Q No.7
3) Figures to the right indicate full marks.

Q.1 A) Choose correct alternative. (MCQ) **10**

1) _____ is the progressive powdering of the film on the painted surface.
a) Flacking b) Cracking
c) Chalking d) Peeling

2) The starting materials for polycarbonate are _____.
a) $COCl_2$ and Phenol
b) $COCl_2$ and Bisphenol-A
c) $COCl_2$ and Biphenylene
d) None of these

3) _____ of the following is a thermosetting Polymer.
a) Urea-formaldehyde resin
b) Polyvinyl chloride
c) Polyester
d) Neoprene

4) The trade name of PET is _____.
a) Dacron b) Mylar
c) Terylene d) All of these

5) Kevlar has strong hydrogen bonding due to _____.
a) aromatic structure b) nonlinear structure
c) linear structure d) All of the above

6) Epoxy resin _____.
a) is a polyamide b) is a good adhesive
c) is a Polyester d) cannot be used for surface coating

7) _____ is formed by reaction of diisocynate group with diol.
a) Polyamide b) Polyurethane
c) PEEK d) Polysulphone

8) Polysulfones are used in _____.
a) Coffee material machine
b) Electronic devices
c) Medical & Surgical applications
d) All of these

9) Titanium dioxide (TiO2) is an example of _____ pigment.
a) Black b) Yellow
c) Red d) White

10) Thinners are used to _____ of the paint.
a) reduce viscosity b) increase viscosity
c) increase thickness d) None of these

B) Fill in the blanks. **06**

1) To prevent gelling and skinning of the paint _____ is added.
2) Base catalyzed PF resin gives _____.
3) _____ aromatic polyamide has five times greater strength than steel.
4) _____ is a mechanical dispersion mixture of one or more pigments in a vehicle.
5) Alternative source for phosgene gas is _____.
6) The polyester contains _____ repeating unit in main backbone of polymer chain.

Q.2 Answer the following. **16**

a) Describe the failure of paint film.
b) Define Varnish and give its classification.
c) Explain the synthesis of Alkyd resin.
d) What is PBT? Describe the synthesis of PBT by DMT process.

Q.3 Answer the following. **16**

a) Give the synthesis of PEN by acid process with monomer synthesis.
b) Describe the Ball Mill method with suitable diagram and give its applications.

Q.4 Answer the following. **16**

a) What is Sarona? Explain the formation of propylene diol by different methods & give some properties of Sarona.
b) Explain briefly the synthesis of aliphatic & aromatic polyester with suitable example.

Q.5 Answer the following. **16**

a) Discuss the synthesis of polycarbonates by solution method. Give its advantages and disadvantages.
b) Discuss the synthesis of polyether PPO with its properties and applications.

Q.6 Answer the following. **16**

a) Write down any two methods of synthesis of phenol and give the applications of PF resin.

b) Write down the different structures of diamine and explain the cross-linking mechanism for epoxy resin.

Q.7 Answer the following. **16**

a) Give the synthesis of monomers required for manufacture of Polyimide with the synthesis of Polyimide.

b) Write down the mechanism of raw materials required for the formation of UF resin and preparation of UF resin by unmodified process.

Seat No.		Set	P

M.Sc. Polymer Chemistry (Semester - IV) (New/Old) (CBCS)
Examination: October/November – 2025
Selected Topics in Polymers (MSC05403)

Day & Date: Saturday, 01-11-2025 Max. Marks: 80
Time: 03:00 PM To 06:00 PM

Instructions: 1) Questions no. 1 & 2 are compulsory.
2) Attempt any Three Question from Q No.3 to Q No.7
3) Figures to the right indicate full marks.

Q.1 A) Choose correct alternative. (MCQ) **10**

1) _____ is commonly used to modify natural rubber to improve durability and heat resistance.
   a) Vulcanization b) Polymerization
   c) Co-polymerization d) Trans-esterification

2) The art and science of producing pattern on the substrate is called as _____.
   a) Photography b) Geography
   c) Lithography d) None of these

3) _____is a significant drawback of liquid crystal polymers.
   a) Poor chemical resistance
   b) High production cost
   c) Low dimensional stability
   d) Poor thermal stability

4) _____ is commonly used method for chemical modification of cellulose.
   a) Esterification b) Sputtering
   c) Electroplating d) Chemical vapor deposition

5) _____ property makes optoelectronic polymers suitable for OLED.
   a) High refractive index
   b) High luminescence efficiency
   c) Low mechanical strength
   d) Inert chemical structure

6) In arthroplasty _____ material is used.
   a) UHMWPE b) UHMWPS
   c) UHMWPVC d) UHMWPP

7) Non- conducting polymers are widely used in _____.
   a) Batteries b) Electrical insulation
   c) Flexible displays d) Supercapacitors

8) The conductivity of polymers can be enhanced by Introducing _____.
   a) Cross-linking agent b) Fillers
   c) Non-polar solvents d) Dopants

9) _____ is responsible for the swelling behavior of hydrogels.
   a) Covalent bonds
   b) Hydrogen bonds
   c) Water absorption capacity
   d) ionic bonds

10) _____ is a key component of tissue engineering.
   a) Cells b) Scaffold materials
   c) Signaling molecules d) All of these

B) Fill in the blanks. **06**

1) The most commonly used vulcanizing agent for rubber is _____.
2) _____ is a network of polymer chains that are hydrophilic.
3) The catalyst used in preparation of poly-siloxanes is _____.
4) _____ polymer blend has two glass transition temperatures.
5) _____ product is formed when cellulose reacts with acetic anhydride.
6) Neoprene is a _____ type of rubber.

Q.2 Answer the following. **16**

a) Write a note on polymer supported reagent and catalysts.
b) Give in details about polymer waste management.
c) Explain the use of polymers in lithography.
d) Write a note on polymer adhesives and plasticizers.

Q.3 Answer the following. **16**

a) Describe polyethylene (PE) modification by grafting and radiation cross-linking reaction.
b) Explain in details the modification of polystyrene by hydrogenation reaction and crosslinking process.

Q.4 Answer the following. **16**

a) Give the manufacturing and physical properties of synthetic rubber with a suitable example.
b) Give details about advantages of polymer reagents, catalysts and substrates.

Q.5 Answer the following. **16**

a) Explain curing system, accelerators and curing agents with an example.
b) Describe the mold release agent and miscellaneous additives with an example.

Q.6 Answer the following. **16**

a) Explain the functionalization of polymers with a suitable example.

b) Define additives. Explain rubber additives including fillers, colorants and pigments.

Q.7 Answer the following. **16**

a) Describe the modification of Natural rubber by hydrogenation and cyclisation method.

b) What is polymer waste management? Explain the sortation and microsortaion process.

Set No.		Set	P

M.Sc. (Polymer Chemistry) (Semester - IV) (New/Old) (CBCS)
Examination: October/November - 2025
Processing Technology and Polymer Properties (MSC05408)

Day & Date: Tuesday, 04-11-2025 Max. Marks: 80
Time: 03:00 PM To 06:00 PM

Instructions: 1) Questions no. 1 & 2 are compulsory.
2) Attempt any Three questions from Q No.3 to Q No.7
3) Figures to the right indicate full marks.

Q.1 A) Choose correct alternative. (MCQ) **10**

1) Smoke free, candle like flame occurs during burning test for _____.
a) Styrene - butadiene b) Polychloroprene
c) Poly butylene d) Butyl rubber

2) Fishy smell occurs during burning test for _____.
a) Urea Resin b) Melamine Resin
c) Both a and b d) Phenol Resin

3) If the plastic material does not soften and the rod does not penetrate, the sample is _____.
a) Thermoset b) Thermoplastic
c) Both a and b d) Elastomer

4) % Elongation at break is calculated by using _____ equation.
a) Elongation $= \varepsilon = (\Delta L/L) \times 100$
b) Elongation $= \varepsilon = (L/\Delta L) \times 100$
c) Elongation $= (\Delta L/L) \times 100$
d) All of the above

5) Izod impact test or Charpy impact test are used for measuring the _____.
a) Tear strength b) Flexural strength
c) Impact strength d) Compressive strength

6) Flexural strength is also known as _____ strength.
a) Tear b) Ionic
c) Bending d) All of the above

7) The bottles, barrels and other liquid containers are especially manufactured by _____.
a) Extrusion molding b) Blow molding
c) Calendaring molding d) All of the above

8) _____ is the property of recovering original shape after the removal of deforming strain.
a) Rigidity modulus b) Elasticity
c) Young's modulus d) Bulk modulus

9) The storage of modulus and loss of modulus gives idea about _____.
a) Dilatants
b) Dynamic Mechanical behavior
c) Pseudo plastic
d) Viscous flow

10) The viscosity of molten polymer fluid is determined by using _____.
a) Falling-ball viscometer
b) Ostwald viscometer
c) Vibration viscometer
d) Rotational viscometer

B) Fill in the blanks OR Write True/False. **06**

1) In non-Newtonian fluid stress strain, curve is _____.
2) The carboxy methyl cellulose is an example of _____.
3) _____ is the foaming agent for Polyurethane foam production.
4) The majority of the thermoset resins are used for Compression molding.
5) Silk is the examples of synthetic fiber.
6) The feed zone, compression zone, metering zone are used in Transfer molding.

Q.2 Answer the following. **16**

a) Describe testing procedure for films, and tubes.
b) Write a short note on the flexural strength.
c) Give details of the Rotational molding.
d) Define and explain the Acid value and Softening point.

Q.3 Answer the following.

a) Enlist and describe the factors affecting on mechanical spectra of polymers. **08**
b) Describe the structural relationship of elastomers, fiber and plastics. **08**

Q.4 Answer the following.

a) Discuss the difference between ideal/Newtonian and Non-Newtonian fluid. **08**
b) Explain in detail with neat labeled diagram the injection molding process. **08**

Q.5 Answer the following.

a) Describe in detail bulk-density and hardness of polymeric materials. **08**

b) Draw neat labeled diagram and explain in detail the compression molding. **08**

Q.6 Answer the following.

a) With the help of neat labeled diagram explain gel spinning process. **08**

b) Discuss in detail the impact strength of the thermoplastic polymers. **08**

Q.7 Answer the following.

a) Explain various rheological aspects in polymer Processing. **08**

b) Describe in detail HDT and MFI of polymeric materials. **08**

Seat No.	

Set **P**

M.Sc. Physical Chemistry (Semester - III) (New) (NEP CBCS)
Examination: October/November – 2025
Electrochemistry and Chemical Kinetics (2302302)

Day & Date: Thursday, 06-11-2025 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Use of log table/calculator is allowed.

Q.1 A) Choose correct alternative. (MCQ) **08**

1) What is the primary force driving ion-solvent interactions?
   a) Electrostatic forces b) Van der Waals forces
   c) Hydrogen bonding d) All of the above

2) Which theory describes enzyme-catalysed reactions?
   a) Michaelis-Menten theory
   b) Collision theory
   c) Transition state theory
   d) Marcus theory

3) What is the primary function of a fuel cell?
   a) To generate heat
   b) To produce electricity
   c) To store energy
   d) To convert mechanical energy to electrical energy

4) What is the transition state in a chemical reaction?
   a) The reactants
   b) The products
   c) The highest energy state
   d) The lowest energy state

5) What does the Helmholtz theory assume about the electric double layer?
   a) It is a compact layer
   b) It is a diffuse layer
   c) It has a uniform charge distribution
   d) It is a dynamic layer

6) What is the role of the transition state in reaction rate?
   a) It increases reaction rate
   b) It has no effect on reaction rate
   c) It determines the reaction rate
   d) It decreases reaction rate

7) What is a major advantage of fuel cells?
   a) High efficiency b) Low cost
   c) Zero emissions d) All of the above

8) _____ is the main assumption of collision theory?
   a) Molecules are stationary
   b) Molecules collide with each other
   c) Molecules have zero kinetic energy
   d) Reactions occur spontaneously

B) Fill in the blanks OR write true/false. **04**

1) The unit of specific conductance is _____.
2) The molecularity of a chemical reaction never be zero. [True/False]
3) The mobility of an ion decreases due to electrophoretic force. [True or False]
4) Catalyst always increases the rate of chemical reactions. [True/False]

Q.2 Answer the following. (Any Six) **12**

a) Which electrochemical technique studies ion-solvent interactions?
b) What is steady state treatment?
c) Mention any two limitations of the collision theory of chemical reaction.
d) What is collision frequency?
e) Which model describes ion-solvent interactions using a continuum approach?
f) Lists types of fuel cell.
g) Define partition function.
h) What do you mean by catalytic poisons?

Q.3 Answer the following. (Any Three) **12**

a) Discuss Bjerrum theory.
b) Describe Pourbaix diagrams.
c) Discuss Lineweaver-Burk method used in enzyme catalysed reaction.
d) Calculate reversible decomposition potential of $0.5\ n\ AgNO_3\{Given\ a_{(Ag+)} = 0.396,$ $E^0{}_{(Ag/Ag+)} = 0.799V$ and $E^0{}_{(OH-/02-)} = -0.403V\}$

Q.4 Answer the following. (Any Two) **12**

a) Describe temperature jump method used in the study of kinetics of fast reaction.

b) What is heats of hydration? Mention different methods of its determination. Explain any one method.

c) What is activity coefficients? Write different forms of activity coefficients and give their inter relationships.

Q.5 Answer the following. (Any Two) **12**

a) Illustrate the temperature dependency of the frequency factor.

b) Derive Butler-Volmer equation for an electrode reaction. Give its applications.

c) Given an account of different types of acid-base catalysis.

Seat No.	

Set P

M.Sc. Physical Chemistry (Semester - III) (New) (NEP CBCS)
Examination: October/November – 2025
Solid State Chemistry (2302306)

Day & Date: Saturday, 08-11-2025 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Use of log table/calculator is allowed.

Q.1 A) Choose correct alternative. (MCQ) **08**

1) Quantum dots can be used in _____.
a) Crystallography b) Optoelectronics
c) Mechanics d) Quantum physics

2) Schottky-defect in ceramic material is _____.
a) Interstitial impurity
b) Vacancy- interstitial pair of cations
c) Pair of nearby cation and anion vacancies
d) Substitutional impurity

3) The reaction between solid silver and molten sulphur is also known as _____.
a) decomposition reaction b) structure sensitive reaction
c) Additive reaction d) tarnish reaction

4) Electron sea exists in _____.
a) Polar bonds b) ionic bond
c) Covalent bond d) metallic bond

5) A total number of space groups in crystal is _____.
a) 7 b) 14
c) 32 d) 230

6) What is the advantage of using Czochralski, Bridgman-Stockbarger and Verneuil method?
a) Gives small crystals b) High tech apparatus
c) Rapid growth rates d) Uses plasma torch

7) The rate of solid state reaction is inversely proportional to _____.
a) Time
b) concentration of reactants
c) thickness of the reactants
d) Pressure

8) Nanoparticles are surface functionalized for _____.
a) Preventing aggregation b) Specific drug targeting
c) Diagnosis and sensing d) All of the above

B) Fill in the blanks OR write true/false. **04**

1) In a NaCI cystal, CI ions are surrounded by _____ number of Na^+ ions.
2) Miller indices and Weiss indices are always same. [True/False]
3) The creating of nanoscale materials by chemically or physically breaking down the larger materials is known as _____ approach in nanotechnology.
4) The solids are compressible. [True/False]

Q.2 Answer the following. (Any Six) **12**

a) What is Kirkendall effect?
b) What are composite materials?
c) Illustrate zone refining technology of purification of materials.
d) Mention different types of crystal systems and give their characteristics.
e) State Bragg's diffraction law.
f) Mention the characteristics of nanomaterials.
g) Express Debye-Sherrer formula.
h) Lists different types of solids?

Q.3 Answer the following. (Any Three) **12**

a) Discuss optical and electrical properties of metal nano particles.
b) Explain various possible chemical bonding in solids.
c) Illustrate grain boundary diffusion of silver in copper.
d) Give an overview of sol gel method for synthesis of nanomaterial.

Q.4 Answer the following. (Any Two) **12**

a) What is tarnish reaction? Explain its mechanism by considering suitable example.
b) Describe the top-down synthesis strategy/approach of nanoparticles.
c) What is homogeneous nucleation? How this nucleation affects the single crystal growth.

Q.5 Answer the following. (Any Two) **12**

a) Write in detail on sintering of solids with respect successive stages in solid state sintering.
b) Explain with a neat diagram. AFM setup and its use in analyzing nanostructures.
c) Mention different types of atomic imperfections. Describe Schottky defect with suitable example.

Seat No.	

Set **P**

M.Sc. Physical Chemistry (Semester - III) (New) (NEP CBCS)
Examination: October/November – 2025
Biophysical Chemistry (2302307)

Day & Date: Saturday, 08-11-2025 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

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

Q.1 A) Choose correct alternative. (MCQ) **08**

1) Which technique is commonly used to study protein structure and function?
a) X-ray crystallography
b) Nuclear magnetic resonance (NMR) spectroscopy
c) Mass spectrometry
d) All of the above

2) What is the primary function of ATP in cells?
a) Energy storage and transfer
b) DNA replication and repair
c) Protein synthesis and degradation
d) Cell signaling and communication

3) Which type of spectroscopy is used to study protein-ligand interactions?
a) Ultraviolet-visible (UV-Vis) spectroscopy
b) Fluorescence spectroscopy
c) Infrared (IR) spectroscopy
d) Nuclear magnetic resonance (NMR) spectroscopy

4) What is the role of thermodynamics in biophysical chemistry?
a) To study the energy changes in biological reactions
b) To study the kinetics of biological reactions
c) To study the structure and function of biomolecules
d) To study the interactions between biomolecules

5) What is the primary goal of biophysical chemistry?
a) To understand the chemical reactions in living organisms
b) To study the physical principles underlying biological systems
c) To develop new drugs and therapies
d) To understand the structure and function of biomolecules

6) What is the function of amino acid side chains?
a) To provide structural support
b) To participate in enzyme-catalyzed reactions
c) To interact with other molecules through hydrogen bonding and hydrophobic interactions
d) To store energy

7) What is the function of an enzyme active site?
a) To bind substrate molecules
b) To catalyze chemical reactions
c) To regulate enzyme activity
d) To store energy

8) Which of the following biopolymers is composed of amino acids?
a) Proteins b) Carbohydrates
c) Nucleic acids d) Lipids

B) Fill in the blanks OR write true/false. **04**

1) _____ biopolymer is composed of monosaccharides.
2) An amino acid, Glycine, is commonly found in connective tissue. [True/False]
3) During osmosis, the water molecules move from high to low concentration of solute. [True/False]
4) The site of transmission of nerve impulse is known as _____.

Q.2 Answer the following. (Any Six) **12**

a) What is the function of an enzyme's cofactor?
b) What is biological importance of electrolytes?
c) Define photosynthesis.
d) What is the primary function of a protein's tertiary structure?
e) Which biopolymer is composed of nucleotides?
f) What is the biological role of elastic proteins?
g) Give two examples of biochemical processes.
h) What is osmosis?

Q.3 Answer the following. (Any Three) **12**

a) Explore the concept of chirality of biological molecules.
b) Write a note on properties of amino acids.
c) Differentiate between hydrophobic hydration and interaction.
d) Explain different weak and strong interactions present in biochemical processes.

Q.4 Answer the following. (Any Two) **12**

a) Illustrate the molecular mechanism of photoreceptor.
b) How do thermodynamic measurements provide insights into protein structure, function, and interactions?
c) Write a note on muscle and muscle proteins.

Q.5 Answer the following. (Any Two) **12**

a) Explain the conduction of a nerve impulse.

b) Describe X ray diffraction technique for study of biopolymers.

c) Discuss the concept of biophysical chemistry and its relevance to understanding biological systems.

Seat No.	

Set P

M.Sc. (Physical Chemistry) (Semester - IV) (New) (NEP CBCS)
Examination: October/November - 2025
Statistical Mechanics and Irreversible Thermodynamics (2302401)

Day & Date: Tuesday, 28-10-2025 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

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

Q.1 A) Choose correct alternative. (MCQ) **08**

1) Fermions are those species whose wave functions are _____ with respect to the exchange of particles.
a) symmetric b) antisymmetric
c) spherical d) linear

2) Phase space is a _____.
a) 3 Dimensional Space b) 4 Dimensional Space
c) 5 Dimensional Space d) 6 Dimensional Space

3) At the steady state all the flows corresponding to unrestricted forces vanish. This statement belongs to _____.
a) Prigogine's principle
b) Le Chatelier's principle
c) Heisenberg's principle
d) All of these

4) The Debye characteristic temperature is expressed as _____.
a) $\theta_D = h\nu/T$ b) $\theta_D = h\nu \times T$
c) $\theta_D = h\nu/k$ d) $\theta_D = h\nu \times k$

5) Bose-Einstein statistics is for the _____.
a) distinguishable particles
b) antisymmetrical particles
c) particles with half integral spin
d) particles with integral spin

6) The pressure difference per unit potential difference when the flow of matter is zero, is defined as _____.
a) streaming potential b) electro osmosis
c) streaming current d) electro osmotic pressure

7) The ensemble in which N, V and E are constant is referred as _____ ensemble.
a) canonical b) micro canonical
c) grand canonical d) both (a) and (b)

8) What is the ratio of para to ortho hydrogen at room temperature?

a) 25:75 b) 75:25
c) 50:50 d) 0:100

B) Fill in the blanks OR Write True/False. **04**

a) dw and dq are the inexact differentials. [True/False]
b) Electronic partition function, Q_{ele}, is simply the degeneracy of the ground electronic state. [True/False]
c) For all the quantum states with energy greater than Fermi energy to be empty in a Fermi-Dirac system, the temperature should be _____.
d) In an open system, for maximum work, the process must be entirely _____.

Q.2 Answer the following. (Any Six) **12**

a) What is an integrating factor?
b) At what condition Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics becomes the same?
c) What are microstates?
d) Give the names of two particles which obey B-E statistics.
e) State Dulong-Petit law.
f) What is Legendre transformation?
g) Define most probable configuration.
h) What do you mean by extensive properties?

Q.3 Answer the following. (Any Three) **12**

a) Explain Onsagar's reciprocity theorem.
b) Describe entropy production in chemical reactions.
c) Calculate vibrational characteristic temperature and vibrational partition function of N_2 molecule. (Given: $\omega = 2358\ \mathrm{cm}^{-1},\ \mathrm{T} = 298\ \mathrm{K}$)
d) Write a short note on ortho and para hydrogen.

Q.4 Answer the following. (Any Two) **12**

a) Derive the expression for Sackur-Tetrode equation.
b) Diagrammatically explain canonical and Grand canonical ensemble.
c) Derive the expression for Maxwell-Boltzmann distribution law.

Q.5 Answer the following. (Any Two) **12**

a) What are the different assumptions of B-E statistics? Derive the expression for it.
b) Deduce Debye molar heat capacity equation for solids. Discuss its low and high temperature forms.
c) If $E = f(T,V)$ and dE is an exact differential then prove that $(dE/dV)_T = T(dP/dT)_v - P$
[Given: $dq = dE + PdV$ and $1/T$ is an integrating factor]

Seat No.	

Set P

M.Sc. Physical Chemistry (Semester - IV) (New) (NEP CBCS)
Examination: October/November - 2025
Molecular Structure (2302402)

Day & Date: Thursday, 30-10-2025 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

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

Q.1 A) Choose correct alternative. (MCQ) **08**

1) The primary principle behind NMR spectroscopy is _____.
a) Absorption of radiation by nuclei in a magnetic field
b) Emission of radiation by nuclei in a magnetic field
c) Scattering of radiation by nuclei in a magnetic field
d) Reflection of radiation by nuclei in a magnetic field

2) The unit of measurement for chemical shift in NMR spectroscopy is _____.
a) Hz (Hertz) b) ppm (Parts Per Million)
c) MHz (Megahertz) d) Tesla

3) The g-factor in ESR spectroscopy is _____.
a) A measure of the electron's magnetic moment
b) A measure of the nuclear spin
c) A measure of the hyperfine coupling constant
d) A measure of the signal intensity

4) What is hyperfine coupling in ESR spectroscopy?
a) The interaction between electron spins and nuclear spins
b) The interaction between electron spins and other electron spins
c) The interaction between nuclear spins and other nuclear spins
d) The interaction between electron spins and the magnetic field

5) The fundamental role of the laser in Raman spectroscopy is _____.
a) To excite the molecules to a higher energy state
b) To detect, the scattered radiation
c) To analyze the molecular structure
d) To provide a reference signal

6) Which of the following factors affects the frequency of a vibrational mode?
a) Molecular weight b) Bond strength
c) Molecular structure d) All of the above

7) Which of the following shows the relationship between the rotational constant (B) and the moment of inertia (I)?

a) $B \propto I$ b) $B \propto 1/I$

c) $B = I$ d) $B = 1/I\text{^}2$

8) The symmetry element is _____.

a) A point, axis, or plane about which a symmetry operation is performed
b) A molecule that exhibits symmetry
c) A type of chemical bond
d) A type of molecular orbital

B) Fill in the blanks OR Write True/False. **04**

1) _____ is the typical frequency range used in ESR spectroscopy.
2) For spherical top molecule, ail the three moments of inertia are equal. [True/False]
3) ____ is the commonly used detector in FT IR spectrometer.
4) The selection rule for pure rotational spectra is _____.

Q.2 Answer the following. (Any Six) **12**

a) What is the ideal source for Raman Spectroscopy?
b) What is polarizability?
c) What are the symmetry operation?
d) In hydrogen molecule, when hydrogen is replaced by deuterium what will happen to the rotational constant B?
e) What is the difference between a singlet and a triplet state?
f) State Franck-Condon principle.
g) Mention the factors which contribute to the width of the spectral lines.
h) What is the degeneracy of the rotational energy level with $J = 4$ for a heteronuclear diatomic molecule?

Q.3 Answer the following. (Any Three) **12**

a) Write a note on Birje-Sponer extrapolation
b) The HCI molecule gives the vibrational absorption line of wavelength 3.456×10^{-6} m Calculate force constant of H-Cl bond.
c) Give the quantum theory of Raman Effect.
d) Identify the various symmetry elements in water molecule. Work out the character table for the group C_{2v}.

Q.4 Answer the following. (Any Two) **12**

a) Explain with the help of chemical shift concept in NMR, why OH proton requires low field and CH proton requires high field for methanol.
b) Calculate the resonance frequency of the proton when subjected to field strength 2.5 Tesla.
(Given: g value for proton is $5.585, \beta = 5.05 \times 10^{-27}\ JT^{-1}$)
c) Illustrate relevance of the intensity of the electronic spectra and Franck-Condon principle.

Q.5 Answer the following. (Any Two) **12**

a) What is anharmonic oscillator? Discuss the spectra of a diatomic vibrating system.

b) Considering NH_3 as an example, show all the possible symmetry operations.

c) With the help of schematic diagram explain the technique and instrumentation of ESR spectrometer.

SLR-HF-58

Seat No.	

Set P

M.Sc. Physical Chemistry (Semester - IV) (New) (NEP CBCS)
Examination: October/November - 2025
Surface Chemistry (2302405)

Day & Date: Saturday, 01-11-2025 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

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

Q.1 A) Choose correct alternative. (MCQ) **08**

1) What is contact angle hysteresis?
   a) Difference between liquid-vapor and solid-liquid contact angles
   b) Difference between static and dynamic contact angles
   c) Difference between advancing and receding contact angles
   d) Difference between theoretical and experimental contact angles

2) When there are no external forces, the shape of a liquid drop is determined by _____.
   a) Surface tension of the liquid
   b) Density of liquid
   c) Viscosity of liquid
   d) Temperature of air only

3) Wetting phenomenon is the _____.
   a) Spread of liquid on solid surface
   b) Repulsion of liquid from solid surface
   c) Absorption of liquid into solid
   d) Evaporation of liquid from solid

4) _____ is the sign of the Gibbs free energy change (ΔG) for positive adsorption.
   a) Positive b) Negative
   c) Zero d) Depends on the system

5) The surface tension of water at 25^0C is _____.
   a) 90.0 dynes/cm b) 45 dynes/cm
   c) 82 dynes/cm d) 72 dynes/cm

6) Which of the following is the role played by an emulsifier?
   a) Accelerates the dispersion
   b) stabilizes the emulsion
   c) homogenizes the emulsion
   d) aids the flocculation of emulsion

7) According to the Langmuir adsorption isotherm, the amount of gas adsorbed at very high pressure _____.
   a) reaches a constant limiting value
   b) goes on decreasing with pressure
   c) goes on increasing with pressure
   d) increases first and then decreases

8) Amongst the following, cationic surfactant is _____.
   a) octadecyl ammonium chloride
   b) sodium palmitate
   c) sodium stearate
   d) all of these

B) Fill in the blanks OR write true/false. **04**

1) Because of _____ force, the gas molecules are held on solid surface in physical adsorption.
2) Always entropy of micellization is high. [True/False]
3) The binding of fine powders together into dense solid is known as _____.
4) The accessories used in the Langmuir surface pressure balance are hydrophilic in nature. [True/False]

Q.2 Answer the following. (Any Six) **12**

a) What is positive catalysis?
b) What is critical micelle concentration?
c) Give the examples of solid lubricants.
d) Write a note on classification of surfactants.
e) What is micro emulsion?
f) A given liquid completely wets the surface solid. Predict the angle made by the liquid with surface of solid.
g) Define specific surface free energy of solids.
h) State and explain Trube's rule.

Q.3 Answer the following. (Any Three) **12**

a) Describe various types of adsorption isotherms and give a brief comment on the factors affecting adsorption.
b) Derive Kelvin equation which relates surface tension with the vapor pressure of water inside and outside the droplet.
The ratio of vapour of droplet to that of water is 2.95 at 27^0C. The surface tension of water is $71 \times 10^{-3} Nm^{-1}$. Calculate the radius of the droplet.
c) Explain the factors affecting adsorption isotherm.
d) Discuss Herkins-Jura Equation.

Q.4 Answer the following. (Any Two) **12**

a) Derive Langmuir adsorption isotherm and explain its advantages and disadvantages.

b) Discuss Langmuir-Adam surface pressure balance.

c) Describe Bartell method of determination of contact angle made by the liquid with the solid surface.

Q.5 Answer the following. (Any Two) **12**

a) What are the solid lubricants? Discuss the mechanisms of hydrodynamic and boundary lubrication.

b) Discuss tilting plat and capillary rise method of determination of contact angle between liquid and solid surface.

c) Explain heterogeneous catalysis with suitable examples.

Set No.	

Set P

M.Sc. (Physical Chemistry) (Semester - IV) (New/Old) (CBCS)
Examination: October/November - 2025
Statistical Mechanics and Irreversible Thermodynamics (MSC11401)

Day & Date: Tuesday, 28-10-2025 Max. Marks: 80
Time: 03:00 PM To 06:00 PM

Instructions: 1) Questions no. 1 & 2 are compulsory.
2) Attempt any Three Question from Q No.3 to Q No.7
3) Figures to the right indicate full marks.

Q.1 A) Choose correct alternative. (MCQ) **10**

1) Fermions are those species whose wave functions are _____ with respect to the exchange of particles.
a) symmetric b) antisymmetric
c) spherical d) linear

2) The rate of entropy production is _____ process.
a) reversible b) spontaneous
c) irreversible d) All of these

3) At the steady state all the flows corresponding to unrestricted forces vanish. This statement belongs to _____.
a) Prigogine's principle b) Le Chatelier's principle
c) Heisenberg's principle c) All of these

4) The most probable distribution is having _____ microstates.
a) minimum b) maximum
c) lowest d) few

5) The Debye characteristic temperature is expressed as _____.
a) $\theta_D = h\nu/T$ b) $\theta_D = h\nu \times T$
c) $\theta_D = h\nu/k$ d) $\theta_D = h\nu \times k$

6) Bose-Einstein statistics is for the _____.
a) distinguishable particles
b) antisymmetrical particles
c) particles with half integral spin
d) particles with integral spin

7) According to Dulong-Petit law, for a monoatomic crystal, Cv is _____ cal/K/mol.
a) R b) $2R$
c) $3R$ d) $^1/_2\,R$

8) The magnitude of the rotational partition function is of the order of _____.

a) 10^2 to 10^4 b) 10 to 10^2
c) 1 to 10 d) 10^{30} to 10^{32}

9) For every rotational level 'J', corresponding degeneracy is _____.

a) $\mathrm{J}+1$ b) $2\mathrm{J}+1$
c) $\mathrm{J}-1$ d) $2\mathrm{J}-1$

10) What is the probability of drawing a card of Queen of heart from a standard pack of 52 cards?

a) $1/13$ b) $1/4$
c) $1/52$ d) $2/52$

B) Fill in the blanks OR Write True/False. **06**

1) The symmetry number of hetero nuclear diatomic molecules is _____.
2) dw and dq are the inexact differentials. [True/False]
3) Electronic partition function, Q_{ele}, is simply the degeneracy of the ground electronic state. [True/False]
4) For all the quantum states with energy greater than Fermi energy to be empty in a Fermi-Dirac system, the temperature should be _____.
5) The lowest possible energy (Z.P.E.) for simple harmonic oscillator having frequency $'v'$ is _____.
6) In an open system, for maximum work, the process must be entirely _____.

Q.2 Answer the following. **16**

a) For an ideal gas, $PV = RT$, show that $1/T$ is an integrating factor.
b) Give comparison of Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics.
c) Calculate Q_{trans} for toluene in $1\ m^3$ volume at $25^0\mathrm{C}$. $(M = 92\ \mathrm{gm\ mol^{-1}})$
d) Give an account of different phenomenological laws.

Q.3 Answer the following.

a) Explain Onsagar's reciprocity theorem. **08**
b) Describe entropy production in chemical reactions. **08**

Q.4 Answer the following.

a) Derive the expression for Sackur-Tetrode equation. **08**
b) Diagrammatically explain canonical and Grand canonical ensemble. **08**

Q.5 Answer the following.

a) What are the different assumptions of B-E statistics? Derive the expression for it. **08**
b) Deduce Debye molar heat capacity equation for solids. Discuss its low and high temperature forms. **08**

Q.6 Answer the following.

a) Discuss in detail electrokinetic effects. **08**

b) Discuss in brief Einstein's theory for heat capacity of solid. **08**

Q.7 Answer the following.

a) For Cu θ_E is $-63^0\mathrm{C}$. Calculate heat capacity of Cu using Einstein's heat capacity model at 100 and 150 K. **08**

b) Evaluate vibrational partition function for O_2 molecule at $2727\ ^{o}\mathrm{C}$. (Given - fundamental vibrational frequency $= 1.3216 \times 10^{14}\ \mathrm{Hz}$) **08**

Set No.		Set	P

M.Sc. Physical Chemistry (Semester - IV) (New/Old) (CBCS)
Examination: October/November - 2025
Chemical Kinetics (MSC11402)

Day & Date: Thursday, 30-10-2025 Max. Marks: 80
Time: 03:00 PM To 06:00 PM

Instructions: 1) Questions no. 1 & 2 are compulsory.
2) Attempt any Three Question from Q No.3 to Q No.7
3) Figures to the right indicate full marks.

Q.1 A) Choose correct alternative. (MCQ) **10**

1) If E_a of a particular reaction is zero, then k is equal to _____ where A is frequency factor.
a) Infinity b) 0
c) A d) A^{-1}

2) In the SSA, if 'I' is intermediate formed then, _____.
a) $[I] = 0$ b) $[I] = 1$
c) $d[I]/dt = 0$ d) All of these

3) What is an optimum temperature in an enzyme catalyzed reaction?
a) temperature at which rate is maximum
b) temperature at which rate is minimum
c) temperature at which rate is zero
d) temperature at which rate is infinity

4) The reactions having smaller values of energy of activation are _____.
a) fast b) slow
c) steady d) Both (a) and (b)

5) If for a reaction the plot of In k verses 1/T gives a straight line, then _____.
a) $\mathrm{E_a} = -(\mathrm{slope}) \times \mathrm{R}$ b) $\mathrm{E_a} = (\mathrm{slope}) \times \mathrm{R}$
c) $\mathrm{slope} = \mathrm{R} \times \mathrm{E_a}$ d) $\mathrm{R} = \mathrm{slope} \times \mathrm{E_a}$

6) In elastic collision energy is _____.
a) remains constant b) transferred
c) absorbed d) All of these

7) Reaction between hydrogen and chlorine gas is an example of _____ reaction.
a) chain b) opposing
c) parallel d) consecutive

8) Which condition favours zero-order kinetics?
a) High catalyst concentration
b) Low reactant concentration
c) High reactant concentration
d) Low catalyst concentration

9) What is the mechanism of acid-base catalysis?
a) Nucleophilic substitution b) Proton transfer
c) Electrophilic substitution d) All of the above

10) What is the order of a chemical reaction?
a) Number of reactant molecules involved
b) Number of product molecules formed
c) Dependence of rate on reactant concentration
d) Energy required for reaction

B) Fill in the blanks OR Write True/False. **06**

1) Molecularity and order of a chemical reaction is always same. [True/False]
2) $t_{1/2}$ for first order reaction is expressed as _____.
3) Disintegration of radioisotopes follows _____ order kinetics.
4) Catalysts can increase or decrease the rate of chemical reactions. [True/False]
5) The mathematical expression for Arrhenius equation is given as _____.
6) In a chemical reaction, if short lived species formed, the rate of formation is equal to the rate of decomposition. [True / False]

Q.2 Answer the following. **16**

a) Illustrate kinetics of parallel reactions with suitable example.
b) Explain with suitable example autocatalysis.
c) Using SSA, illustrate ozone decomposition reaction.
d) Describe integration and graphical method for determination of order of a reaction.

Q.3 Answer the following.

a) Describe Michaelis-Menten mechanism for enzyme catalyzed reaction. **08**
b) Give an account of the activated complex theory. Explain how thermodynamic activation parameters can be calculated with the help of this theory. **08**

Q.4 Answer the following.

a) Define what is meant by a saddle point, reaction coordinate and explain the tunnelling effect. **08**
b) In an acid catalyzed reaction, differentiate between protolytic and prototropic mechanism. **08**

Q.5 Answer the following.

a) Using vibrational partition functions of reactants, A and B obtain an expression for the rate constant. **08**

b) Discuss in detail the kinetics of first-order opposed first-order equilibrium reaction. **08**

Q.6 Answer the following.

a) Give an account of the theory of absolute reaction rates. **08**

b) Discuss the kinetics of consecutive reaction. $A \rightarrow B \rightarrow C$**.** Calculate the time when the concentration of B will be maximum and also find out that concentration. **08**

Q.7 Answer the following.

a) Illustrate enzyme catalysed reactions. **08**

b) Describe in brief the kinetics of branching chain reactions and explosion limits. **08**

Set No.		Set	P

M.Sc. Physical Chemistry (Semester - IV) (New/Old) (CBCS)
Examination: October/November – 2025
Molecular Structure-II (MSC11403)

Day & Date: Saturday, 01-11-2025 Max. Marks: 80
Time: 03:00 PM To 06:00 PM

Instructions: 1) Questions no. 1 & 2 are compulsory.
2) Attempt any Three Question from Q No.3 to Q No.7
3) Figures to the right indicate full marks.

Q.1 A) Choose the most correct alternative of the following and rewrite the sentences. **10**

1) Debye equation is applicable for only _____.
   a) Polar molecule b) Non-polar molecule
   c) Linear molecule d) Complex molecule

2) Benzene molecule have _____ dipole moment.
   a) One b) Positive
   c) Zero d) Negative

3) In NMR spectrum the nuclei in up field resonate at _____.
   a) High frequency
   b) Low frequency
   c) It is constant throughout the spectrum
   d) It doesn't depend on chemical shift

4) The NMR technique deals with _____.
   a) non-zero nuclear spins
   b) zero nuclear spins
   c) with any nuclear spin
   d) None

5) The ESR frequency of unpaired electron in magnetic field depends on its _____.
   a) line width b) degeneracy
   c) spin quantum no d) magnetic moment

6) The Mossbauer Spectroscopy uses _____ radiation.
   a) γ-radiation b) β-radiation
   c) α-radiation d) x-ray radiation

7) Compound A has greater shielding constant than compound B. Which of them will have more chemical shift?
   a) Compound A
   b) Compound B
   c) Both will have equal chemical shifts
   d) Chemical shift has no relation with shielding constants

8) The diamagnetic contribution of atoms and bonds in a molecule is called as _____ constant.
   a) Debye b) Curie
   c) Pascal d) Weiss

9) Induced polarization is applicable for _____ molecule.
   a) Polar b) non polar
   c) Linear d) Nonlinear

10) The magnetic materials follow which law?
   a) Faraday's law b) Ampere law
   c) Lenz law d) Curie Weiss law

B) Fill in the blanks. **06**

1) Dipole character of nonpolar molecule is always _____.
2) The temperature at which paramagnetic substance is converted into ferromagnetic substance is called as _____ temperature.
3) If "n" equivalent protons interact with the protons of an adjacent Carbon atom, then the peak is split into _____ peaks.
4) The ESR spectrum of CH_3 radical shows _____ number of peaks.
5) Possible orientations do spin $^1/_2$nuclei have when they are located in an applied magnetic field _____.
6) When a moving body emits radiation a stationary observer sees a shifted frequency; this is called _____.

Q.2 Answer the following. **16**

a) Write note on Lennard-Jones potential.
b) Write note on Van Vleck general equation of magnetic susceptibility.
c) Write note on Exchange phenomena.
d) Doppler effect in Mossbauer.

Q.3 Answer the following.

a) Distinguish between ^{1}H and ^{13}C NMR spectroscopy. **08**
b) Define diploe moment. Discuss vapour- temperature method for the determination of dipole moment. **08**

Q.4 Answer the following.

a) Discuss in detail the Gouy method of determining magnetic susceptibility. **08**
b) Discuss the applications of Mossbauer spectroscopy of iron compounds with suitable examples. **08**

Q.5 Answer the following.

a) What is dipole moment? Discuss applications of dipole moment measurement in the study of structure of compounds. **10**

b) Describe interaction between spin and a magnetic field in NMR spectroscopy. **06**

Q.6 Answer the following.

a) Discuss the basic principles of ESR spectroscopy. **06**

b) Describe the working of a Mossbauer spectrometer with a neat sketch **10**
If the energy of emitted γ-rays from the first excited state of Fe^{57} nucleus is $14.4\ keV$. Calculate its recoil energy $(N = 6.023 \times 10^{23}, 1keV = 1.6 \times 10^{-19}\ J, c = 3 \times 10^{8}\ ms^{-1})$

Q.7 Answer the following.

a) Discuss factors affecting chemical shift in NMR. **08**

b) Derive an expression for molar susceptibility using Langevin's theory of diamagnetism. **08**

Set No.		Set	P

M.Sc. (Physical Chemistry) (Semester - IV) (New/Old) (CBCS)
Examination: October/November - 2025
Surface Chemistry (MSC11408)

Day & Date: Tuesday, 04-11-2025 Max. Marks: 80
Time: 03:00 PM To 06:00 PM

Instructions: 1) Questions no. 1 & 2 are compulsory.
2) Attempt any Three questions from Q No.3 to Q No.7
3) Figures to the right indicate full marks.

Q.1 A) Choose correct alternative. (MCQ) **10**

1) What is contact angle hysteresis?
a) Difference between advancing and receding contact angles
b) Difference between static and dynamic contact angles
c) Difference between liquid-vapor and solid-liquid contact angles
d) Difference between theoretical and experimental contact angles

2) Langmuir adsorption isotherm based on ____.
a) Multilayer adsorption b) Monolayer adsorption
c) Electrostatic interactions d) Hydrophobic interactions

3) Which of the following is the characteristic of Type VI adsorption isotherms?
a) Monolayer formation
b) Multilayer formation
c) Stepwise, multilayer formation
d) No hysteresis

4) What is the main difference between micelles and reverse micelles?
a) Solvent polarity b) Surfactant structure
c) Concentration d) Temperature

5) _____ is the sign of the Gibbs free energy change (ΔG) for positive adsorption.
a) Positive b) Negative
c) Zero d) Depends on the system

6) What is contact angle?
a) Angle between liquid-solid interface and liquid-vapor interface
b) Angle between solid-liquid interface and solid-vapor interface
c) Angle between liquid-vapor interface and solid-liquid interface
d) Angle between solid-vapor interface and liquid-solid interface

7) Wetting phenomenon is the ____.
   a) Spread of liquid on solid surface
   b) Repulsion of liquid from solid surface
   c) Absorption of liquid into solid
   d) Evaporation of liquid from solid

8) Freundlich adsorption isotherm is given by the expression $\frac{x}{m} = kp^{\frac{1}{n}}$. Which of the following conclusions can be drawn from this expression?
   a) When $\frac{1}{n} = 0$, the adsorption is independent of pressure
   b) When $n = 0, \frac{x}{m}$ versus p graph is a line parallel to X-axis
   c) both a and b
   d) neither a nor b

9) Which of the following is an example of a water-in-oil (W/O) emulsion?
   a) Mayonnaise b) Milk
   c) Cream d) Butter

10) Amongst the following, cationic surfactant is _____.
   a) octadecyl ammonium chloride
   b) sodium palmitate
   c) sodium stearate
   d) All of these

B) Fill in the blanks OR Write True / False. **06**

1) Acetic acid does not form monomolecular film on the surface of water. [True/False]
2) Because of _____ force, the gas molecules are held on solid surface in physical adsorption.
3) Always entropy of micellization is high. [True/False]
4) The binding of fine powders together into dense solid is known as _____.
5) The accessories used in the Langmuir surface pressure balance are hydrophilic in nature. [True/False]
6) Positive adsorption is the phenomenon in which surface tension of liquid decreases with concentration of surfactant, state whether statement is true or false.

Q.2 Answer the following. **16**

a) Derive following equation for the spreading coefficient of liquid B on the surface of liquid $S_{B/A} = \gamma_A - \gamma_B - \gamma_{AB}$, where γ_A , γ_B , and γ_{AB} are the surface tension of liquid A, liquid B and interfacial tension between liquid A and B.

b) At $25^0\mathrm{C}$ and a surface pressure of 0.10 dynes per cm lauric acid occupies an area of $31\mathrm{nm}^2$ per molecule in a water surface. Assuming the film to be a two-dimensional ideal gas, calculate the gas constant in ergs per degree per mole and compare the results with the accepted value.

c) Give an account of a phenomenon, sintering.

d) Write a note on classification of surfactants.

Q.3 Answer the following. **16**

a) Describe various types of adsorption isotherms and give a brief comment on the factors affecting adsorption.

b) Derive Kelvin equation which relates surface tension with the vapor pressure of water inside and outside the droplet.

The ratio of vapour of droplet to that of water is 2.95 at $27^0\mathrm{C}$. The surface tension of water is $71 \times 10^{-3}\ \mathrm{Nm}^{-1}$. Calculate the radius of the droplet.

Q.4 Answer the following. **16**

a) Derive Langmuir adsorption isotherm and explain its advantages and disadvantages.

b) Discuss Langmuir-Adam surface pressure balance.

Q.5 Answer the following. **16**

a) What are the solid lubricants? Discuss the mechanisms of hydrodynamic and boundary lubrication.

b) Discuss tilting plat and capillary rise method of determination of contact angle between liquid and solid surface.

Q.6 Answer the following. **16**

a) What is critical micelle concentration? How it is determined using surface tension measurements?

b) Explain

i) Detergency

ii) Selective wetting

Q.7 Answer the following. **16**

a) What are emulsions? Discuss theories of emulsion stabilization.

b) Derive Gibb's adsorption equation.

Seat No.	

Set P

M.Sc. Analytical Chemistry (Semester - III) (New) (NEP CBCS)
Examination: October/November - 2025
Advance Separation Techniques (2304301)

Day & Date: Tuesday, 04-11-2025 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

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

Q.1 A) Choose correct alternative. (MCQ) **08**

1) The electrodes in electrodialysis are neither oxidized nor reduced because _____
a) they are chemically inert
b) they act as catalyst
c) no acid is present
d) there is no acid-base reaction involved in the process

2) 0.1-0.01 μm _____ used in ultrafiltration membrane.
a) concentration b) solution
c) pore size d) frequency

3) _____ is the basis of solvent extraction.
a) Gibbs phase rule b) Thompson phase
c) Faradays phase rule d) None of these

4) In _____ technique it is possible to separates charged particles using electric field.
a) Hydrolysis b) Protein synthesis
c) Electrophoresis d) Protein denaturing

5) Electrophoresis was developed by the scientist _____
a) Tswett b) Tsvedberg
c) Tiselius d) Sanger

6) The use of insulin hormone to purify its receptor is an example of _____
a) ion exchange chromatography
b) gel filtration chromatography
c) paper chromatography
d) affinity chromatography

7) Gel filtration is techniques that fractionate substances largely according to their _____ size.
a) ionic b) atomic
c) molecular d) particle

8) In affinity chromatography separation is based on _____
a) Specific interaction between analyte and ligand
b) Molecular weights
c) The duration of the analyte
d) Time flow of analyte

B) Fill in the blanks. **04**
a) In electrophoresis cell, the pressure is about _____.
b) Blood pressure required for ultra-filtration is provided through _____.
c) Electrophoresis is not suitable for the separation of _____.
d) Solvent extraction is also called _____ extraction.

Q.2 Answer the following. (Any Six) **12**
a) Give the classification of extractor.
b) Give the applications of ultrafiltration.
c) Explain the terms R_f value.
d) Write a short note on Zone electrophoresis
e) Define synergic extraction.
f) Define the term capillary electrophoresis.
g) Explain the affinity chromatography.
h) Write a short note on Ultracentrifugaion.

Q.3 Answer the following. (Any Three) **12**
a) Explain the elusion methods used in affinity chromatography.
b) Give the application of dialysis.
c) What is Micellar electrokinetic capillary chromatography?
d) Write a short note on solid phase extraction.

Q.4 Answer the following. (Any Two) **12**
a) Explain in detail high performance liquid chromatography (HPLC).
b) Explain factors affecting solvent extraction.
c) What is the principle in zone refining technique? Explain process of Zone refining.

Q.5 Answer the following. (Any Two) **12**
a) Describe in detail capillary electro-chromatography.
b) Explain in detail the techniques of solvent extraction.
c) What is the principle of affinity chromatography? Describe components involved in affinity medium.

SLR-HF-67

Seat No.	

Set P

M.Sc. Analytical Chemistry (Semester - III) (New) (NEP CBCS)
Examination: October/November – 2025
Instrumental Methods of Chemical Analysis-I (2304302)

Day & Date: Thursday, 06-11-2025 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

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

Q.1 A) Choose correct alternative. (MCQ) **08**

1) In TGA, the result obtained appears as a _____.
a) Continuous parabola
b) Discontinuous chart
c) Continuous circular positions
d) Continuous chart

2) In DTA curve _____ is measured on the Y-axis.
a) sample mass
b) heat flow
c) Temperature difference between sample & reference
d) specific heat capacity

3) The change in current with the varying voltage gives a plot known as _____.
a) voltammogram b) chromatogram
c) both a & b d) none of these

4) _____ relates the amount of chemical change to the quantity of electricity in coulometry.
a) Law of conservation of energy
b) Arrhenius Equation
c) Faradays Law
d) Law of mass action

5) In amperometric titration, platinum electrode is rotated at _____.
a) 700 rpm b) 600 rpm
c) 800 rpm d) 100 rpm

6) High frequency titration relies on monitoring the changes in _____.
a) pH
b) Temperature
c) Electrical conductance
d) Light at absorption

7) Radiochromatography involves the measurement of _____ in the separated components of chromatogram.

a) mass b) conductivity
c) temperature d) radioactivity

8) In neutron activation analysis the radiation commonly detected as _____ rays.

a) Alpha b) Beta
c) Gramma d) X

B) Fill in the blanks. **04**

1) High frequency titration is also known as _____.
2) _____ is used to determine the amount of heat flow in DSC.
3) A glass membrane ion selective electrode is composed of special glass that is highly sensitive to _____.
4) _____ is a technique that uses radioactive isotope to measure the concentration of specific antigen as well as hormones in biological samples.

Q.2 Answer the following. (Any Six) **12**

a) Define dielectric constant.
b) Define gas sensing electrode.
c) Give various application of DTA.
d) Write advantages of amperometric titration.
e) What are the applications of radiometric titration?
f) Give the factors affecting on heating rate in TGA.
g) What is inverse isotopic dilution method?
h) What are types of TGA?

Q.3 Answer the following. (Any Three) **12**

a) Write a note on stripping voltammetry.
b) What are different types of electrodes? Explain liquid-liquid membrane electrode?
c) Discuss principle of amperometric titration. Give its advantages & disadvantages.
d) Give the principle of TGA.

Q.4 Answer the following. (Any Two) **12**

a) Explain in detail electro-gravimetric titration.
b) Discuss principle & instrumentation of DSC.
c) Write a detailed note on electrolytic separation of metals.
d) Describe the direct isotopic dilution method.

Q.5 Answer the following. (Any Two) **12**

a) Discuss principle & instrumentation of High frequency titration.
b) Discuss types of coulometric techniques.
c) Explain in detail Neutron Activation Analysis.

Seat No.	

Set **P**

M.Sc. Analytical Chemistry (Semester - III) (New) (NEP CBCS)
Examination: October/November – 2025
Analytical Spectroscopy (2304306)

Day & Date: Saturday, 08-11-2025 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

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

Q.1 A) Choose correct option. (MCQ) **08**

1) Which type of radiation is typically used in photoelectron spectroscopy for studying core-leave electrons?
a) X-rays b) Visible light
c) Microwave d) infra-red

2) In ESR, the typical radiation frequency used is in the range of ____.
a) X-rays b) Visible light
c) microwave d) infra-red

3) What is the source of imaging in scanning electron microscope?
a) X-rays b) Visible light
c) electrons d) infra-red

4) Which component of AFM interacts directly with sample surface?
a) cantilever b) photodiode
c) laser detector d) Piezoelectric scanner

5) In NQR, 'η' is a measure of _____.
a) symmetry of EFG b) Spins
c) Couplings d) Non-symmetrical EFG

6) Inner shell electrons are ejected only in _____.
a) UPES b) XPES
c) Both d) None of these

7) M*ö*ssbauer spectroscopy arises due to the transition of _____.
a) Electron b) Nuclear
c) Vibrational d) Rotational

8) SEM belongs to the family of _____ microscopies.
a) photoemission b) Electron
c) photo-absorption d) none of these

B) Write true/ false. **04**

1) The B.E. of electron in PES is the energy required to remove the electron from atom/ molecule.
2) In SEM, anode is placed between two lenses.
3) Electron beams and magnetic fields are used in electron microscope.
4) AFM stands for Atomic Force Mapping.

Q.2 Answer the following. (Any Six) **12**

a) Define Rayleigh scattering.
b) Write the principle of photoacoustic spectroscopy.
c) Define Raman scattering?
d) Give any two essential characteristics which a nuclide have for exhibiting Mossbauer effect?
e) Describe chemical applications of PAS.
f) Define Auger effect.
g) What are the limitations of ESCA?
h) Compare between ESCA and UPS.

Q.3 Answer the following. (Any Three) **12**

a) Explain the use of Mossbauer spectroscopy in the investigation of tin compounds.
b) Write the classification of electron microscopy.
c) Explain in brief ESR spectrometer with instrumentation.
d) Discuss the chemical applications of photoacoustic spectroscopy.

Q.4 Answer the following. (Any Two) **12**

a) Explain the factors responsible for multiple lines in NQR spectrum.
b) Illustrate the quantum mechanics approach of Raman spectroscopy.
c) Discuss the isomer shift in Mossbauer spectra with examples.

Q.5 Answer the following. (Any Two) **12**

a) Write the theory of XPES and UPES.
b) Discuss pure rotational Raman spectrum.
c) Enumerate NQR frequencies for nucleus with I= 32 in an axially symmetric EFG $(\eta = 0)$.

SLR-HF-69

Seat No.	

Set P

M.Sc. Analytical Chemistry (Semester - III) (New) (NEP CBCS)
Examination: October/November – 2025
Applied Analytical Chemistry (2304307)

Day & Date: Saturday, 08-11-2025 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

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

Q.1 A) Multiple choice questions. **08**

1) Neutral soil has pH = _____.
a) 7 b) 5
c) 3 d) 10

2) Ni from its alloy is ppted by _____.
a) DMG b) OMG
c) CMG d) CNG

3) _____ is not an alloy.
a) Brass b) Zn
c) Bronze d) Steel

4) _____ are estimated by gravimetric method.
a) Ba b) Ca
c) Fe d) All

5) Soil are also known as _____.
a) Pedosphere b) Biosphere
c) Lithiosphere d) All

6) Pyralusite is Ore of _____.
a) Fe b) Al
c) Mn d) Zn

7) Phenol reacts with bromine from _____ tribromo derivative.
a) 2,3,4 b) 2,4,6
c) 3,4,5 d) 4,5,6

8) Deodorants are _____ based.
a) Water b) Alcohol
c) Oil d) Acid

B) Fill in the blanks. **04**

1) Ec of soil is measured by _____.
2) _____ instrument used to determine Na & k.
3) Substance used to eliminate armpit odour but not perspiration is _____.
4) In iodometric titration, solution is titrated with _____ using starch indicator.

Q.2 Answer the following. (Any Six) **12**

a) Give factors controlling soil reaction.
b) Write method to determine moisture from soil.
c) Give the principle to determine Sulphur from soil sample.
d) Draw structure of DDT & give its use.
e) Define ore, give in example.
f) Define cosmetics. Give its example.
g) How will you determine carbonate from face powder.
h) How will you detect chloride from face powder.

Q.3 Answer the following. (Any Three) **12**

a) Explain cation exchange process.
b) Explain classification of pesticides.
c) Explain estimation of Mn from its alloy.
d) Explain gravimetric estimation of calcium.

Q.4 Answer the following. (Any Two) **12**

a) Explain wet digestion process.
b) Explain collection of sample & sample preparation of fertilizer.
c) How will you estimate nickel from its alloy.

Q.5 Answer the following. (Any Two) **12**

a) Explain Kjeldahl's method to estimate nitrogen from sample.
b) Explain estimate of lead from solder alloy.
c) Explain estimation of fats & fatty acid from cosmetics by volumetric method.

Seat No.	

Set **P**

M.Sc. (Analytical Chemistry) (Semester - IV) (New) (NEP CBCS)
Examination: October/November - 2025
Advanced Analytical Techniques (2304401)

Day & Date: Tuesday, 28-10-2025 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

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

Q.1 A) Choose correct options. (MCQ) **08**

1) In LC-MS, _____ is the most commonly used interface.
a) chopper b) vaporizing chamber
c) filter d) nebulizer

2) The ions are focused and de-clustered through which of the following regions?
a) Dry helium region b) Dry chlorine region
c) Dry nitrogen region d) Dry hydrogen region

3) _____ particles are smaller than $44\ \mu$ but greater than $1\ \mu$ aperture.
a) Sieve b) Sub-micron
c) Sub-sieve d) Ultra-fine

4) The COD test is used to measure the content of _____ matter of waste water.
a) organic b) metallic
c) inorganic d) All of these

5) How can we change the density of the supercritical fluid?
a) By continuously changing the temperature
b) By continuously changing the pH
c) By continuously changing the pressure
d) All of these

6) _____ is a simple automated technique that aims to obtain high-quality chemical data.
a) FIA b) SQUID
c) NMR d) UV

7) The _____ time is the time between sample injection and peak height.
a) residence b) absorption
c) retention d) All

8) Which of the following is most often used in GC-MS?

a) Cuvette b) Capillary tube
c) Paper support d) Test tube

B) Write True/ False. **04**

a) Using an interface would reduce detection limit and sensitivity.
b) Cold tray is provided for liquid N_2 or CO_2 but is used for extremely small samples.
c) A reagent blank is prepared by using external standard in FIA.
d) A supercritical fluid can be used only for the solid supercritical fluid extraction.

Q.2 Answer the following. (Any Six) **12**

a) Disadvantages of automation.
b) Properties of super critical fluids.
c) Describe about COD analyzer.
d) What is mean by hyphenated techniques?
e) Write the principle of dynamic light scattering.
f) Explain data analysis in LC-MS.
g) Explain BUN analyzers.
h) Compare super critical fluid chromatography (SFC) with other chromatography.

Q.3 Answer the following. (Any Three) **12**

a) Explain the principle of ion chromatography and its applications.
b) Explain GC-MS technique and its merits.
c) Discuss in short the structure determination of biopolymers.
d) Explain the instrumentation of super critical fluid chromatography.

Q.4 Answer the following. (Any Two) **12**

a) Explain the structure of resins used in ion chromatography.
b) Explain the basic instrumentation of LC-MS and applications of HPLC.
c) Explain automatic glucose analyzer and how the ammonia in water is analyzed.

Q.5 Answer the following. (Any Two) **12**

a) Write the instrumentation of super critical fluid extraction (SFE) and applications of it.
b) Discuss low-angle laser light scattering instrumentation and its applications.
c) Explain in brief automatic elemental analyzer.

Seat No.	

Set P

M.Sc. Analytical Chemistry (Semester - IV) (New) (NEP CBCS)
Examination: October/November - 2025
Instrumental Methods of Chemical Analysis - II (2304402)

Day & Date: Thursday, 30-10-2025 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

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

Q.1 A) Choose correct alternative. (MCQ) **08**

1) Fluorescence always occurs at _____ than the excitation wavelength.
a) higher wavelength b) lower wavelength
c) same wavelength d) None of these

2) According to Snell's law, _____ $= n$ (refractive index).
a) $\sin i / \sin r$ b) $\sin r / \sin i$
c) $\sin i \times \sin r$ d) $\sin^2 r$

3) Scattering of radiation happens due to _____.
a) colloidal solids
b) optical inhomogeneity
c) thermal density fluctuations
d) All of the these

4) Turbidimetric method is similar to _____.
a) filter photometry b) colorimetric method
c) fluorometry d) both (a) and (b)

5) In emission spectrometers, the optical windows for radiation transmission _____ material is used.
a) fused silica b) quartz
c) glass d) both (a) and (b)

6) In X-ray tube generally _____ metals are used as targets (anode).
a) Cu b) Mo
c) W d) All of these

7) In which of the state, the excited electron flips its spin?
a) singlet b) triplet
c) excited singlet d) All of these

8) Typical lifetime for phosphorescence emission is _____.
a) milliseconds b) microseconds
c) nanoseconds d) picoseconds

B) Fill in the blanks OR Write True/False. **04**

1) In Rayleigh scattering phenomenon, incident and scattered wavelength is same. [True/False]
2) The unit of refractive index is _____.
3) The hottest flame in O_2 is produced by _____.
4) The X-ray region of the electromagnetic spectrum consists of wavelengths in the region of _____.

Q.2 Answer the following. (Any Six) **12**

a) Mention different parts of a flame.
b) What is self-quenching?
c) What is atomization process?
d) What is critical angle principle?
e) What is heavy atom effect?
f) Lists different electronic transitions observed in organic molecules.
g) Calculate R_M of carbon tetrachloride at 25^0C.
(Given - $n = 1.47$ and $d = 1.540$ g/cc)
h) Mention different x-ray diffraction methods.

Q.3 Answer the following. (Any Three) **12**

a) Write on interferences observed in flame photometry.
b) Illustrate XRF technique.
c) Give the principles of nephelometry and turbidimetry.
d) Write a note on surface contamination.

Q.4 Answer the following. (Any Two) **12**

a) Discuss various types of emission spectra.
b) With the help of Jablonski's energy level diagram, show various photophysical pathways with their typical lifetimes.
c) Factors influencing the intensity of radiation in flame photometry.

Q.5 Answer the following. (Any Two) **12**

a) Write different types of excitation sources encountered in emission spectroscopy.
b) Describe X-ray production techniques.
c) Describe the principle and working of flame photometer.

Seat No.	

Set **P**

M.Sc. Analytical Chemistry (Semester - IV) (New) (NEP CBCS)
Examination: October/November - 2025
Biochemical and Food Analysis (2304405)

Day & Date: Saturday, 01-11-2025 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

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

Q.1 A) Choose correct alternative. (MCQ) **08**

1) Triglycerides on saponification given _____.
   a) Glycerol b) Aldehyde
   c) Ketone d) Carbonates

2) Fat is rich in _____.
   a) Steric acid b) Glycerol
   c) Fatty acid d) Phenol

3) Normal range of bilirubin is _____ mg/dd.
   a) 3 b) 2
   c) 1 d) 0.5

4) Urine contains _____.
   a) Uric acid b) Urea
   c) Calcium d) All

5) The drug which produces drowsiness sleep to reduce restlessness & emotional tension are known as _____.
   a) Antipyretic b) Analgesic
   c) Anaesthetic d) Hypnotics

6) Cardiovascular drug affect _____ & blood vessel.
   a) Lunges b) Liver
   c) Heart d) Kidney

7) _____ is known as bad cholesterol.
   a) DL b) LDL
   c) COL d) CLC

8) Vitamin C is also known as _____.
   a) ascorbic acid b) fatty acid
   c) saturated acid d) retinal

B) Fill in the blanks. **04**

a) Rancidity depends on _____ value.
b) _____ method is used to determine bilirubin.
c) _____ is an antianxiety drug.
d) Progesterone is synthesized from _____.

Q.2 Answer the following. (Any Six) **12**

a) What are the composition of milk.
b) Define titrepoint & cloud point.
c) Write the function of hemoglobin.
d) Write principle used to determine calcium in urine.
e) Define drug. Give one example.
f) Give any one difference between drug & medicine.
g) Give two properties of vitamin.
h) Give two types of snake venom.

Q.3 Answer the following. (Any Three) **12**

a) Write note on classification of oil.
b) Write four properties of purpose of food colouring.
c) Give classification of poison.
d) Write essay on vitamin A.

Q.4 Answer the following. (Any Two) **12**

a) Explain Kjeldahl's method for estimation of nitrogen from food.
b) Explain the process to estimate urea from blood.
c) Explain in brief about narcotics drug.

Q.5 Answer the following. (Any Two) **12**

a) Explain the process to estimate glucose from blood.
b) Give the properties of ideal drug.
c) Give an account on snake venom.

Seat No.	

Set P

M.Sc. (Analytical Chemistry) (Semester - IV) (New/Old) (CBCS) Examination: October/November - 2025
Advanced Analytical Techniques (MSC013401)

Day & Date: Tuesday, 28-10-2025 Max. Marks: 80
Time: 03:00 PM To 06:00 PM

Instructions: 1) Questions no. 1 & 2 are compulsory.
2) Attempt any Three Question from Q No.3 to Q No.7
3) Figures to the right indicate full marks.

Q.1 A) Choose correct options. (MCQ) **10**

1) In LC-MS, _____ is the most commonly used interface.
a) chopper b) vaporizing chamber
c) filter d) nebulizer

2) The ions are focused and de-clustered through which of the following regions?
a) Dry helium region b) Dry chlorine region
c) Dry nitrogen region d) Dry hydrogen region

3) _____ particles are smaller than $44\ \mu$ but greater than $1\ \mu$ aperture.
a) Sieve b) Sub-micron
c) Sub-sieve d) Ultra-fine

4) The COD test is used to measure the content of _____ matter of waste water.
a) organic b) metallic
c) inorganic d) All of these

5) How can we change the density of the supercritical fluid?
a) By continuously changing the temperature
b) By continuously changing the pH
c) By continuously changing the pressure
d) All of these

6) _____ is a simple automated technique that aims to obtain high-quality chemical data.
a) FIA b) SQUID
c) NMR d) UV

7) The _____ time is the time between sample injection and peak height.
a) residence b) absorption
c) retention d) All

8) Which of the following is most often used in GC-MS?
a) Cuvette b) Capillary tube
c) Paper support d) Test tube

9) _____ is the type of separator used in commercial GC-MS systems.
a) Porous tube b) Flow type separator
c) Teflon tube d) Jet type molecular separator

10) The ions are passed into the high vacuum analyzer through which of the following?
a) Nozzle b) Nebulizer
c) Orifice d) Venturi tube

B) Write True/ False. **06**

a) Using an interface would reduce detection limit and sensitivity.
b) Cold tray is provided for liquid N_2 or CO_2 but is used for extremely small samples.
c) A reagent blank is prepared by using external standard in FIA.
d) A supercritical fluid can be used only for the solid supercritical fluid extraction.
e) Entry of biodegradable organics into wastewater is due to domestic waste.
f) In gas chromatography, stationary phase may be solid.

Q.2 Answer the following. **16**

a) Disadvantages of automation.
b) Properties of super critical fluids.
c) COD analyzer, write a brief note.
d) What is mean by hyphenated techniques?

Q.3 Answer the following. **16**

a) Explain the principle of ion chromatography and its applications.
b) Explain GC-MS technique and its merits.

Q.4 Answer the following. **16**

a) Explain the structure of resins used in ion chromatography.
b) Explain the basic instrumentation of LC-MS and applications of HPLC.

Q.5 Answer the following. **16**

a) Write the instrumentation of super critical fluid extraction (SFE) and applications of it.
b) Discuss low-angle laser light scattering instrumentation and its applications.

Q.6 Answer the following. **16**

a) Explain in brief automatic elemental analyzer.
b) Discuss the structure determination of biopolymers.

Q.7 Answer the following. **16**

a) Explain the instrumentation and operating variables of super critical fluid chromatography.

b) Explain automatic glucose analyzer and how the ammonia in water is analyzed?

Seat No.	

Set P

M.Sc. Analytical Chemistry (Semester - IV) (New/Old) (CBCS)
Examination: October/November – 2025
Biochemical and Food Analysis (MSC013403)

Day & Date: Saturday, 01-11-2025 Max. Marks: 80
Time: 03:00 PM To 06:00 PM

Instructions: 1) Questions no. 1 & 2 are compulsory.
2) Attempt any Three Question from Q No.3 to Q No.7
3) Figures to the right indicate full marks.

Q.1 A) Choose correct alterntives. **10**

1) Hemoglobin in blood carries _____.
   a) Oxygen from lungs b) Releases oxygen
   c) Provide energy d) All of these

2) Drug which increases activity of various portions of central nervous system is known as _____.
   a) diazepam b) Barbiturates
   c) CNS stimulant d) Diuretic acids

3) Amount of milligrams of KOH required to saponify one gram of oil is _____.
   a) Hydrolysis b) Saponification
   c) Oxidation d) Reduction

4) In biological samples Pb & As is _____ material.
   a) Poisonous b) Neutral
   c) Acidic d) Basic

5) Fat is rich in _____.
   a) Glycerol b) Glycerate
   c) Fatty acid d) All

6) _____method is used to determine bilirubin in blood.
   a) Polenske b) RM
   c) Malloy & even d) None

7) Drug which influences sleep is _____drug.
   a) Dangerous b) Narcotic
   c) Antihistamine d) Antipyretic

8) Deficiency of vitamin A causes _____.
   a) Night blindness b) Lower resistance
   c) Check growth d) All of these

9) Indicator used in acid base titration is _____.
   a) EBT b) MR
   c) P^hP^h d) MO

10) _____ element is present in Hemoglobin.
   a) P b) Ca
   c) N d) Fe

B) Fill in the blanks. **06**

1) _____ is used as local anesthetic.
2) Another name of vitamin C is _____.
3) Ranicidity of oil depends on _____ value.
4) Insulin reporters are _____.
5) Urine contains _____.
6) Substance produced by lining organism which Act as catalyst to bring about specific biochemical reactions are known as _____.

Q.2 Write short notes on. **16**

a) Polenske value.
b) Estimation of urea from blood.
c) Estimation of phenobarbitone.
d) Essay on pepsin enzyme.

Q.3 Answer the following. **16**

a) Explain classification of oils.
b) Write purpose of colouring & write purpose of food flavors.

Q.4 Answer the following. **16**

a) Describe different sources of impurities in pharmaceutical raw materials.
b) Explain procedure to estimate Na & k from blood.

Q.5 Answer the following. **16**

a) Explain the process of drug screening using gas chromatography.
b) write properties of ideal drug.

Q.6 Answer the following. **16**

a) Write essay on vitamin A.
b) Explain the procedure for analysis of blood glucose.

Q.7 Answer the following. **16**

a) i) Write the experiment to determine saponification value of oil.
   ii) How will you estimate bilirubin from blood.
b) i) What are good & bad cholesterol.
   ii) Explain in brief about vitamin C.

SLR-HF-79

Set No.	

Set P

M.Sc. Analytical Chemistry (Semester - IV) (New/Old) (CBCS)
Examination: October/November - 2025
Pharmaceutical Analysis (MSC013409)

Day & Date: Tuesday, 04-11-2025 Max. Marks: 80
Time: 03:00 PM To 06:00 PM

Instructions: 1) Questions no. 1 & 2 are compulsory.
2) Attempt any Three Question from Q No.3 to Q No.7
3) Figures to the right indicate full marks.

Q.1 A) Choose the most correct alternative. **10**

1) In pharmaceutical industry, light sensitive materials should be stored in _____ vessels.
   a) darkened glass b) Copper
   c) Plastic d) transparent glass

2) The process in which chemical compound breaks down into simpler substances is called _____.
   a) Oxidation b) Isomerization
   c) Decomposition d) Condensation

3) Expiry date of medicine is expressed in terms of _____.
   a) month and year b) year only
   c) day and month d) day and year

4) _____ is an example of chelating agent.
   a) Disodium EDTA b) Salicylic acid
   c) NaC1 d) Chlorine

5) In mouthwash, salicylic acid is used as an ____.
   a) anti-oxidant b) antimalarial
   c) antibiotic d) antibacterial

6) Tablet manufacturing involves _____ steps.
   a) Seiving b) Coating
   c) Packing d) all of these

7) The normal rotation speed in dissolution test is _____.
   a) 60 rpm b) 220 rpm
   c) 120 rpm d) 260 rpm

8) Microbial contamination is avoided by ____ process.
   a) Sterilization b) Precipitation
   c) Distillation d) Disintegration

9) In pharma industry, FDA visit to _____.
   a) QC lab
   b) production and packaging unit
   c) Store
   d) All of these

10) Gutzeit test is used for the detection of _____.
   a) Copper b) Arsenic
   c) Aluminum d) Mercury

B) Fill in the blanks and rewrite the sentences. **06**

1) The Karl Fisher reagent assembly contain _____ electrode.
2) Rh means _____.
3) Emulsion of _____ and water is called as cream.
4) Ointments are used externally to _____.
5) In limit test, due to addition of Sodium sulphide _____ colour is produced.
6) FDA stands for _____.

Q.2 Answer the following. **16**

a) What are advantages of aerosole?
b) How personal error can be controlled?
c) Discuss pills in details.
d) Write a note on liquid dosage form.

Q.3 **a)** Discuss in detail atmospheric and particulate contamination. **10**
b) Explain labeling procedure in pharmaceutical drug synthesis. **06**

Q.4 **a)** What is FDA? Discuss how FDA controls pharmaceutical and cosmetic Industries? **10**
b) 0.314 gm benzocaine [$C_9H_{11}NO_2$] dissolved in mixture of 25 ml HC1 and 50 ml distilled water. After cooling this solution to 15^oC titrate with 0.095 N $NaNO_2$ gave burette reading 12,2 m1. Calculate percentage of benzocaine in the given sample. [At. Wt.: C-12, H-1, O-16, N-14]. **06**

Q.5 **a)** Discuss in detail ophthalmic preparation in dosage form. **10**
b) What is Karl-Fisher reagent? How is it prepared and standardized? **06**

Q.6 **a)** What are general errors occur during packaging of pharmaceuticals. **08**
b) Explain Limit test for chloride and sulphate. **08**

Q.7 **a)** Discuss dissolution test for tablet. **08**
b) Discuss in detail clinical study in development of new drug. **08**

Seat No.	

Set P

M.Sc. (Pharmaceutical Chemistry) (Semester - III) (New) (NEP CBCS)
Examination: October/November - 2025
Advanced Spectroscopic Methods (2303301)

Day & Date: Tuesday, 04-11-2025 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

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

Q.1 A) Choose correct alternative. (MCQ) **08**

1) In a 2D experiment, what is sandwiched between two evolution times?
a) Preparation period b) Mixing period
c) Decoupling period d) Detection period

2) Which of the following is not the advantage of Fourier Transform Spectrometers?
a) Signal to noise ratio is high
b) Information could be obtained on all frequencies
c) Retrieval of data is possible
d) Easy to maintain

3) Which of the following is not a soft ionization technique?
a) ESI b) FAB
c) MALDI d) CI

4) The distance between the centers of the peaks of doublet is called as?
a) Coupling constant b) Spin constant
c) Spin-spin coupling d) Chemical shift

5) Which of the following is a homonuclear NMR experiment?
a) HSQC b) HMQC
c) COSY d) HMBC

6) How many peaks are observed in the 13C NMR spectrum of 1, 3- dimethylbenzene?
a) 3 b) 4
c) 5 d) 6

7) Chemical shift value of Alkyne is _____.
a) 3 to 4 b) 2 to 3
c) 1 to 2 d) 5 to 8

8) In mass spectra _____ peak is usually at higher m/e value.

a) Molecular ion b) Base
c) Fragment ion d) Metastable ion

B) Fill in the blanks. **04**

1) The aldehydes and ketones that contain _____ can undergo the McLafferty rearrangement.
2) Unit of chemical shift is _____.
3) Range of 1H NMR for organic compounds is _____ ppm.
4) In mass spectrometry bombarding of electrons move between ____.

Q.2 Answer the following. (Any Six) **12**

a) Write main components of FT-IR.
b) What is coupling in NMR spectroscopy?
c) What is nitrogen rule?
d) Write difference between 1H NMR and ^{13}C NMR.
e) What is noise decoupling?
f) Define molecular ion peak with one example.
g) What is difference between NOESY and COSY NMR?
h) What is FAB in mass spectroscopy?

Q.3 Answer the following. (Any Three) **12**

a) Write calculations of chemical shift of hydrocarbons.
b) Write note on McLafferty rearrangement.
c) Write note on Nuclear Overhauser Effect (NOE) with examples.
d) Write note on DEPT technique in 2D NMR spectroscopy.

Q.4 Answer the following. (Any Two) **12**

a) Write advantages and disadvantages for FT technique.
b) Write note on NOESY and ROESY techniques in 2D NMR spectroscopy.
c) Write note on HETCOR technique with interpretation in 2D NMR spectroscopy.

Q.5 Answer the following. (Any Two) **12**

a) An organic compound of molecular formula $C_{10}H_{12}O$ shows the following features
$IR(KBr)$: a strong band at $1730\ cm^{-1}$
$1HNMR: 2.6\delta(q, 2H, J = 7Hz); 1.5\delta; (t, 3H, J = 7.2\ Hz)\ 2.2\delta(s, 3H);$
$7.23\delta(d, 2H, J = 7.1Hz); 7.49\delta(d, 2H, J = 7.0\ Hz);$
Make proper assignment of the data.

b) Write note on ion analysis and ion abundance in mass spectrometry.

c) Deduce the structure of organic compound using given spectral data.
Molecular formula $C_9H_{12}O$
$UV: 241nm;\ IR(cm^{-1}): 600-700, 1200, 1680, 2900.$
$1H\ NMR\ (200\ MHz;\ CDCl_3\ in\ ppm): 1.0\ (t, 9\ mm), 1.7\ (sextet, 6\ mm),$
$3.0\ (t, 6\ mm), 7.5\ (m, 9\ mm), 8.0\ (m, 6\ mm);$
$MASS: m/z\ =\ 77, 105\ (base\ peak, 100\%), 120, 136.$

Seat No.	

Set P

M.Sc. (Pharmaceutical Chemistry) (Semester - III) (New) (NEP CBCS)
Examination: October/November – 2025
Drug Development (2303302)

Day & Date: Thursday, 06-11-2025 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

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

Q.1 A) Choose correct alternative. (MCQ) **08**

1) Among the following _____ is the fastest receptor.
a) Enzyme linked b) Ion-gated
c) GPCR d) Nuclear

2) The study of _____ refers to Proteomics.
a) Set of proteins in a specific region of the cell
b) Biomolecules
c) Set of proteins
d) The entire set of expressed proteins in the cell

3) The term _____ is defined as the rate and extent of absorption of unchanged drug from its dosage form.
a) availability b) Bioavailability
c) systemic availability d) None of these

4) The computer simulation refers to _____.
a) Dry lab b) Invitro
c) In silico d) Wet lab

5) Drugs are excreted from the body through _____.
a) Kidney b) Breast milk, saliva, sweat & bile.
c) Intestine d) All of the above

6) Most weakly basic drugs (pKa >8) are absorbed from _____.
a) Intestine b) Stomach
c) Intestine and stomach d) None of these

.

7) The science which is concerned with the study of mechanism of action of drug and pharmacological effects produced on the human body is known as _____.
a) Pharmacokinetics b) Toxicology
c) Pharmacology d) Pharmacodynamics

8) In drug design, the molecular descriptors are used for _____.
a) Identifying manufacturing defects
b) Monitoring patient response to a drug
c) Calculating chemical and physical properties of molecules
d) Visualizing chemical reactions in real time

B) Fill in the blanks. **04**

1) In QSAR equation, _____ is represented by the symbol 'P'.
2) The theoretical volume of body fluid containing drug from which the drug is completely removed in a given period of time is called as _____.
3) The combined effect of two drug effects is higher than either individual effect is called as _____.
4) The conversion of drug into polar or water-soluble substance known as _____.

Q.2 Answer the following. (Any Six) **12**

a) Give the different types of receptors.
b) Explain the term Pharmacokinetics.
c) What is MIC?
d) What are soft drugs?
e) Write about the agonists.
f) Discuss the types of molecular descriptors.
g) Define the terms: LD50, ED50.
h) Write about Lipinski rule of 5.

Q.3 Answer the following. (Any Three) **12**

a) Write a note on drug absorption.
b) What are the partitioning value term Log P and log D.
c) Explain the concept of lead identification and modification.
d) Discuss the principles of drug action.

Q.4 Answer the following. (Any Two) **12**

a) Explain the different pharmacokinetic parameters for the drug.
b) Discuss the physicochemical properties of drug.
c) What are the types of molecular descriptors? Explain the methods of molecular descriptor selection.

Q.5 Answer the following. (Any Two) **12**

a) Discuss the concept of drug and explain the sources of drugs with examples.
b) Explain the plasma drug concentration-time profile showing pharmacokinetic as well as pharmacodynamics parameters.
c) What is dose of drug? Write about the combined effect of drug.

Seat No.	

Set **P**

M.Sc. Pharmaceutical Chemistry (Semester - III) (New) (NEP CBCS)
Examination: October/November – 2025
Modern Pharmaceutical Analytical Techniques (2303306)

Day & Date: Saturday, 08-11-2025 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

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

Q.1 A) Choose correct alternative. (MCQ) **08**

1) Beer Lambert's law gives the relation between which of the following?
   a) Reflected radiation and concentration
   b) Scattered radiation and concentration
   c) Energy absorption and concentration
   d) Energy absorption and reflected radiation

2) Which of the following is not true about Absorption spectroscopy?
   a) It involves transmission
   b) Scattering is kept minimum
   c) Reflection is kept maximum
   d) Intensity of radiation leaving the substance is an indication of a concentration

3) In which type of chromatography, the stationary phase held in a narrow tube and the mobile phase is forced through it under pressure?
   a) Column chromatography b) Planar chromatography
   c) Liquid chromatography d) Gas chromatography

4) Which of the following is not a source used in Mid Infrared Spectrophotometer?
   a) Nernst glower
   b) High pressure mercury arc lamp
   c) Globar
   d) Nichrome wire

5) In Differential Thermal Analysis (DTA), what is the role of the reference material?
   a) To introduce a known chemical reaction into the system
   b) To provide a baseline for comparison against the sample
   c) To absorb all the heat from the sample
   d) To catalyze any thermal events occurring in the sample

6) Which of the following is not an application of Flame emission photometers?
   a) Analysis of biological fluids
   b) Determination of sodium, potassium in soil
   c) Determination of metals such as Mn, Cu
   d) Analysis of complex mixtures

7) Which of the following is not a feature of carrier gas used in gas chromatography?
   a) It must be chemically inert
   b) It should be suitable for the detector employed
   c) It should be cheap
   d) It should not be completely pure

8) Beer's law states that the intensity of light decreases with respect to _____.
   a) Concentration b) Distance
   c) Composition d) Volume

B) Write True/ False. **04**

1) Slow injection of large samples leads to band broadening and loss of resolution.
2) Colorimeters are used in applications where great accuracy is required.
3) Atomic absorption spectroscopy is also called as Absorption Flame Photometry
4) In Total consumption burner, only samples of particular droplet size will enter the burner.

Q.2 Answer the following. (Any Six) **12**

a) Draw a neat labeled diagram of Ion selective electrode.
b) Enlist the applications of IR spectroscopy.
c) Give the advantages and disadvantages of TGA.
d) Explain Hooke's law.
e) Define Rf value. Give its calculation.
f) Write mechanism of quenching.
g) Give the difference between TLC and Paper chromatography.
h) Give the common solvents used in UV spectroscopy with their one advantage.

Q.3 Answer the following. (Any Three) **12**

a) What is the solvent effect in UV Spectroscopy?
b) Give the instrumentation of Gas Chromatography.
c) Explain theory behind fluorimetry.
d) Write a note on ion exchange chromatography.

Q.4 Answer the following. (Any Two) **12**

a) How the samples are prepared for IR spectroscopy?
b) How the various factors are affecting TGA?
c) Explain in detail principle behind AAS.

Q.5 Answer the following. (Any Two) **12**

a) Explain in detail different modes of vibrations.
b) Enlist and explain the factors affecting fluorescence.
c) Explain in detail principle behind DTA.

Seat No.	

Set **P**

M.Sc. Pharmaceutical Chemistry (Semester - III) (New) (NEP CBCS)
Examination: October/November – 2025
Biochemistry (2303307)

Day & Date: Saturday, 08-11-2025 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

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

Q.1 A) Choose correct alternative. (MCQ) **08**

1) The monosaccharide units are linked by alpha $1 \rightarrow 4$ glycosidic linkage in _____.
a) Maltose b) Sucrose
c) Cellulose d) Cellobiose

2) The primary storage polysaccharide in animals is _____.
a) Starch b) Glycogen
c) Cellulose d) Chitin

3) The spectrochemical series is a ranking of ligands based on their ability to _____.
a) Split d-orbitals b) Form sigma bonds
c) Form pi bonds d) Stabilize metal ions

4) Which of the following vitamin helps in blood clotting?
a) Vitamin A b) Vitamin C
c) Vitamin D d) Vitamin K

5) Metallothionein's are proteins that ____.
a) Bind and store metal ions
b) Transport metal ions
c) Catalyze metal ion reactions
d) Regulate gene expression

6) Correct ordering of lipoprotein molecules from lowest to the greater density is _____.
a) LDL, IDL, VLDL, chylomicron
b) Chylomicron, VLDL, IDL, LDL
c) VLDL, IDL, LDL, chylomicron
d) LDL, VLDL, IDL, chylomicron

7) The number of base pair in a single turn of B-form DNA about the axis of the molecule is _____.
a) 4 b) 8
c) 10 d) 12

8) Vitamin B1 is a precursor for the coenzyme _____.

a) Coenzyme A b) FADH2
c) TPP d) NADH

B) Write true/false. **04**

1) Alanine is an aromatic amino acid.
2) Monosaccharides cannot exist in both open-chain and cyclic forms.
3) The molecular mechanism of synthesis of protein is known as translation.
4) Metal ions play a crucial role in the folding and stability of biomolecules.

Q.2 Answer the following. (Any Six) **12**

a) How micelles are formed?
b) What are metalloproteins?
c) Write biological function and deficiency of vitamin A.
d) Give ring structures of any two monosaccharides.
e) What is the primary technique used for protein sequencing?
f) What is the role of mRNA in protein synthesis?
g) What is a coenzyme? Give an example.
h) What are common properties of amino acids?

Q.3 Answer the following. (Any Three) **12**

a) Write about properties and forms of DNA.
b) Discuss the role of biochemistry in pharmaceutical sciences, particularly in drug discovery and development.
c) Describe classification of lipids based on their density.
d) Write a note on binding of metal ions with bio-molecular active centers.

Q.4 Answer the following. (Any Two) **12**

a) Write a note on Genetic code and its importance in heredity.
b) Explain in detail beta oxidation of fatty acids.
c) Describe organization of protein structure at different levels of conformation.

Q.5 Answer the following. (Any Two) **12**

a) Write a note on structure, dietary requirements, and deficiency conditions of fat soluble vitamins.
b) Explain the double helix structure of DNA in detail.
c) What are carbohydrates? Classify carbohydrates based on their structure and give examples of each class.

Seat No.	

Set P

M.Sc. (Pharmaceutical Chemistry) (Sem - IV) (New) (NEP CBCS)
Examination: October/November - 2025
Advanced Organic Chemistry - II (2303401)

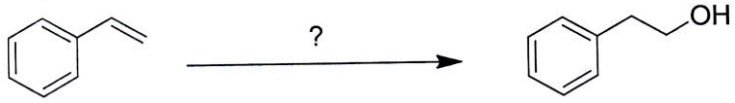
Day & Date: Tuesday, 28-10-2025 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

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

Q.1 A) Choose correct alternative. (MCQ) 08

1) The interaction of a reaction centre with a lone pair of electrons in an atom or the electrons present in a pi bond contained within the parent molecule with the reaction centre is called as _____.
a) Neighbouring group assistance
b) Intermolecular rearrangement
c) Intramolecular rearrangement
d) Concerted reaction

2) The reagent used to bring about the following conversion ____.



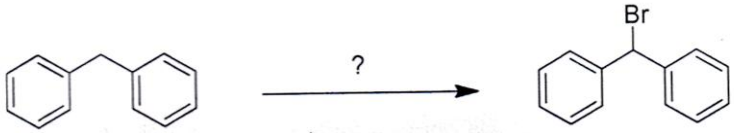
a) Alkaline $KMnO_4$ b) O_SO_4
c) BH_3, H_2O_2/OH^- d) $LiAlH_4$/ H_2O

3) _____ is rate determining step in the Stille reaction.
a) Oxidative addition b) Isomerisation
c) Transmetallation d) Reductive elimination

4) In Stevens rearrangement, formation of _____ takes place from quaternary ammonium salt.
a) tertiary amine b) amide
c) aldehyde d) None of these

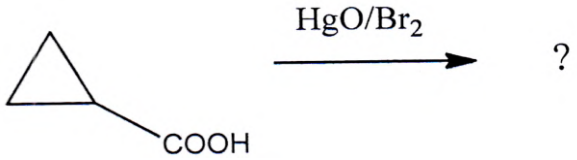
5) _____ reaction is a two-step hydration reaction that converts an alkene into an alcohol.
a) Hydroboration b) Hydroboration-oxidation
c) Oxidation d) Hydration

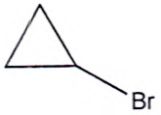
6) Suggest the reagent for the following reaction.

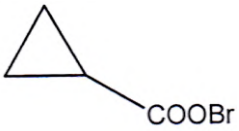


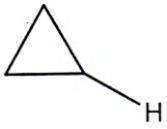
a) Br_2 / acetic acid b) Br_2 / H_2O
c) N-bromophthalimide d) N-bromosuccinamide

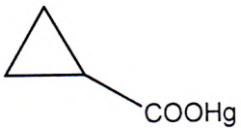
7) Predict the product.



a) 

b) 

c) 

d) 

8) Oxidation of α- carbon of carbonyl group by selenium dioxide is known as _____.

a) Riley reaction
b) Oppenaur oxidation
c) Allylic oxidation
d) None of these

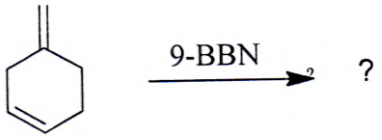
B) Write True/ False. **04**

a) Hydroboration is a chemical reaction resulting in Markovnikov addition.
b) Amides on treatment with sodium hypobromite gives secondary amines.
c) The Aldol- Tishchenko reaction is an organic chemical reaction that involves disproportionation of an aldehyde in the presence of an alkoxide.
d) The free radicals are electron deficient species.

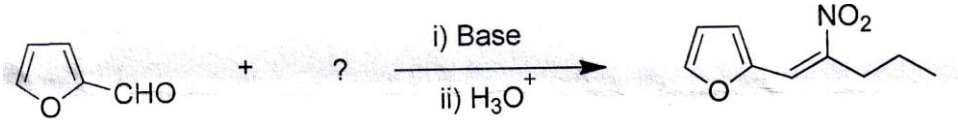
Q.2 Answer the following. (Any Six) **12**

a) What are Bridge head free radicals?

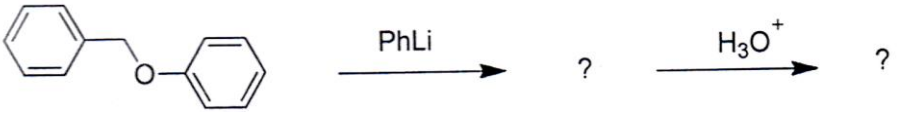
b) Predict the product.



c) Suggest the reagent and name the reaction.



d) Complete the following sequence of reaction.

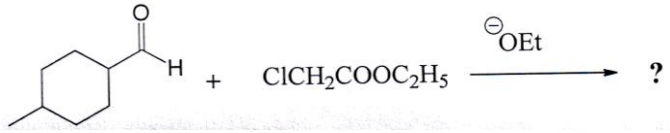


e) Write any two applications of selenium dioxide

f) Give any two types of free radical reactions.

g) How are the organoboranes prepared from Grignard reagents?

h) Identify the reaction and predict the product.



Q.3 Answer the following. (Any Three) **12**

a) Write a note on Grubb's metathesis.

b) Explain the free radical rearrangement reaction.

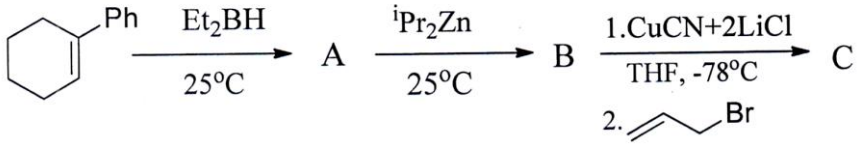
c) Discuss the applications of Lithium dialkylcuprate.

d) Explain the stereo and regioselectivity of hydroboration reaction.

Q.4 Answer the following. (Any Two) **12**

a) Discuss the Wolf rearrangement in detail. Give its application.

b) What is hydroboration? Complete the following conversion and identify the structure of A, B and C.



c) Write a note on,

i) DCC reagent

ii) Effect of solvent on the reactivity of free radical

Q.5 Answer the following. (Any Two) **12**

a) Describe coupling of alkynes and arylation of aromatic by diazonium salts.

b) Write reaction and mechanism involved in Tiffeneau-Demjanov rearrangement reaction in detail and give its application.

c) Write a note on,

i) Thexyl borane

ii) Hoffmann-Loffler Fretag reaction

Seat No.	

Set **P**

M.Sc. (Pharmaceutical Chemistry) (Semester - IV) (New) (NEP CBCS)
Examination: October/November - 2025
Drugs and Heterocycles (2303402)

Day & Date: Thursday, 30-10-2025 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

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

Q.1 A) Choose correct alternative. (MCQ) **08**

1) Thiopental is a _____.
a) Anticonvulsant b) Anesthetic
c) Antibiotic d) Antimalarial

2) The difference in structure of quinolone and isoquinoline is due to _____.
a) position of ring size b) number of carbon atoms
c) number of N atoms d) position of N atom

3) Molecular formula of Pyrazine is _____.
a) $C_4H_2N_2$ b) $C_4H_4N_4$
c) $C_4H_4N_2$ d) $C_2H_4N_2$

4) Glipizide drug is a _____.
a) Antidiabetic b) Antihypertensive
c) Antimalerial d) Antineoplastic

5) Chloroquine is used as _____.
a) Antimalerial b) Antidiabetic
c) Antibiotic d) Anesthetic

6) Pyridine ring is present in _____.
a) Indole b) Benzopyrrole
c) Quinoline d) Benzofuran

7) Name of Non steroid anti-inflammatory drug is _____.
a) Metformin b) Captopril
c) Tolbutamide d) Nimesulide

8) Six membered pyrimidine ring consists _____ atoms.
a) 3 carbon and 3 nitrogen
b) 2 carbon and 4 nitrogen
c) 4 carbon and 2 nitrogen
d) 5 carbon and 1 nitrogen

B) Fill in the blanks. **04**

1) In Indole structure benzene is fused with _____.
2) Insulin is used in _____ disease.
3) Methyldopa is used for _____.
4) Molecular formula of quinoline is _____.

Q.2 Answer the following. (Any Six) **12**

a) Define antidiabetics and write two names of antidiabetic drugs.
b) What is pharmaceutical importance of quinolone?
c) What is NSAID? Write the use of Nimesulide.
d) Define antibiotics with one example.
e) Write the structure of Aceclofenac.
f) Write the names of benzene fused with five membered heterocyclic compounds.
g) Write structure and medicinal use for Thiazole.
h) Define antineoplastic drugs with example.

Q.3 Answer the following. (Any Three) **12**

a) Write synthesis and medicinal use for Piperazine.
b) Write the mechanism of action and synthesis of Diazepam.
c) Write synthesis and medicinal use for Benzofuran.
d) Write SAR for Tolbutamide.

Q.4 Answer the following. (Any Two) **12**

a) Write the synthesis of Imidazole and Pyran.
b) What are hypertensive drugs? Write synthesis of Atenolol.
c) Write the synthesis of tetracycline and thiopental.

Q.5 Answer the following. (Any Two) **12**

a) Write the synthesis of quinine and amoxicillin.
b) Write the synthesis of Oxazole and Pyridine.
c) Write synthesis of Benzopyrrole and Isoquinoline.

Seat No.	

Set P

M.Sc. Pharmaceutical Chemistry (Semester - IV) (New) (NEP CBCS)
Examination: October/November – 2025
Pharmaceutical Dosage Forms (2303405)

Day & Date: Saturday, 01-11-2025 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

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

Q.1 A) Choose correct alternative. (MCQ) **08**

1) Drug is _____.
   a) Any chemical compound
   b) Substance which alter physiological function
   c) Substance which cures disease
   d) All of these

2) What is the drawback of parental controlled release system?
   a) Injecting is a difficulty
   b) The drug cannot be easily removed once administered
   c) Can get easily precipitated in the injection site
   d) rapid onset but fast excretion

3) Which of the following agents are used in enteric coating of the tablet.
   a) HPMC b) CMC
   c) CAP d) All of the above

4) Rate of sedimentation is high in _____ suspension.
   a) Flocculated b) Deflocculated
   c) both a) and b) d) none of these

5) Elexirs are _____.
   a) Aqueous b) Viscous
   c) hydroalcoholic liquids d) Semisolid

6) Which drug delivery system has longest duration of action?
   a) Nasal preparation b) Implants
   c) Depot injection d) Transdermal patch

7) _____ is most commonly used dosage form.
   a) Liquid b) Solid
   c) Semisolid d) Gaseous

8) Suspension is a _____.
   a) one phase system b) two phase system
   c) 3 phase system d) none of above

B) Write true/ false. **04**

1) Emulsion is a biphasic liquid dosage form.
2) Nanoparticles have size range in micrometer.
3) Cellulose is used for enteric coated tablet.
4) Clonidine patches have been used for moderate hypertension.

Q.2 Answer the following. (Any Six) **12**

a) What are the types of tablets?
b) Explain the concept of excipients.
c) Explain the types of dosage forms.
d) Explain the concept of Pre-formulation.
e) Give the classification of emulsifying agents.
f) Define Suspensions and Emulsions with example.
g) Write formulation of eye ointment.
h) Explain Ophthalmic products.

Q.3 Answer the following. (Any Three) **12**

a) Classify semisolid dosage forms.
b) Describe the steps involved in sugar coating.
c) Write a note on powders.
d) Explain stability testing protocol.

Q.4 Answer the following. (Any Two) **12**

a) Describe recently design Ocular dosage form.
b) Write excipients used in formulation of tablets.
c) Explain oral drug delivery system.

Q.5 Answer the following. (Any Two) **12**

a) Write in detail formulation considerations of suspension.
b) Describe routes of drug administrations.
c) Write a note on parenteral drug delivery systems.

Seat No.	

Set P

M.Sc. Pharmaceutical Chemistry (Semester - IV) (New) (NEP CBCS)
Examination: October/November – 2025
Pharmaceutical Technology (2303406)

Day & Date: Saturday, 01-11-2025 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

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

Q.1 A) Choose correct alternative. **08**

1) What size of equipment is needed in continuous process when compared with batch process?
   a) does not depend on size b) Larger
   c) Smaller d) none of these

2) Which one of these is responsible for hardness of tablet?
   a) die filling b) compression force
   c) both a and b d) None of these

3) Providing documented evidence that a method or product does what it intends to do is termed as _____.
   a) Qualification b) Validation
   c) Calibration d) Verification

4) The transfer of technology between sites of different companies is called as _____.
   a) Inter - company transfer
   b) Intra-company transfer
   c) Technology transfer
   d) Technology transfer protocol

5) Which of the following is not applicable to Direct Compression method?
   a) Mixing of the therapeutic agents with the excipient
   b) Granulation of the mixed powders
   c) Mixing with another excipient
   d) Compression into tablets

6) Which type of process validation we perform periodic and after change?
   a) Prospective validation b) Concurrent validation
   c) Revalidation d) Retrospective validation

7) Coating used to protect the tablet from acidic environment of stomach is _____.
   a) film coating b) sugar coating
   c) enteric coated d) encapsulation

8) The guidelines that describe the analytical method validation are-Text and Methodology are _____.
   a) ICH Q2 b) ICH Q1
   c) ICH Q8 d) ICH Q9

B) Fill in the blank. **04**

1) FDA stands for _____.
2) GLP stands for _____.
3) API stands for _____.
4) IRB Stand for _____.

Q.2 Answer the following. (Any Six) **12**

a) Draw a process flow diagram of API manufacturing unit.
b) What is pilot plant? What are its objectives.
c) Explain the blending process in short.
d) Give the difference between calibration and validation.
e) Write short note on Effluent Treatment Plant
f) What is Technology transfer? Explain in short.
g) Explain the coating process of tablet in short.
h) Explain Regulatory guidelines.

Q.3 Answer the following. (Any Three) **12**

a) Write a note on granulation method.
b) Draw a unit process diagram for monochloroacetic acid.
c) Describe the validation of manufacturing equipment.
d) What are the types of process validation?

Q.4 Answer the following. (Any Two) **12**

a) Discuss the typical industrial chlorination process for the preparation of monochloro benzene.
b) Explain working of tablet compression machine with neat labelled diagram.
c) Explain unit process of vinyl chloride.

Q.5 Answer the following. (Any Two) **12**

a) Illustrate the mixing technique in tablet operation.
b) Discuss the factors affecting on chemical process.
c) Discuss the typical industrial nitration process for the preparation of α −Nitronaphthalene.

Seat No.	

Set **P**

M.Sc. (Pharmaceutical Chemistry) (Semester - IV) (New/Old) (CBCS)
Examination: October/November - 2025
Photochemistry and Pericyclic Reactions (MSC012401)

Day & Date: Tuesday, 28-10-2025 Max. Marks: 80
Time: 03:00 PM To 06:00 PM

Instructions: 1) Questions no. 1 & 2 are compulsory.
2) Attempt any three questions from Q. No.3 to Q. No.7.
3) Figures to the right indicate full marks.
4) Draw neat, labelled diagrams and give equations wherever necessary.

Q.1 A) Choose the correct alternative from the options. 10

1) Huckel's delocalization energy (HDE) for 1,3,5-hexatriene is ____.
   a) $0.85\ \beta$ a) $0.94\ \beta$
   c) $0.49\ \beta$ c) $0.59\ \beta$

2) The γ-hydrogen abstraction with $\beta -$ bond cleavage to form olefin and enol is known as _____.
   a) Norrish type II a) Norrish type I
   c) Paterno-Buchi c) Photoreduction

3) _____ is the more stable according to Huckels theory.
   a) Cycloheptatrienyl anion
   b) Cycloheptatrienyl cation
   c) Cycloheptatrienyl radical
   d) Cycloheptatriene

4) The _____ reaction is the concerted interconversion of a conjugated polyene and acycloalkene.
   a) cycloaddition b) sigmatropic
   c) electrocyclic d) chelotropic

5) The phenomenon in which electron returns to ground state (S_0) from singlet (S_1) by liberating energy is known as _____.
   a) Phosphorescence b) Fluorescence
   c) Photosensitisation d) Luminescence

6) The molecular orbitals having m-symmetry always give _____ motion.
   a) rotational b) vibrational
   c) conrotatory d) disrotatory

7) The light formed from a chemical reaction is called as _____.
   a) Luminescence b) Bioluminescence
   c) Chemiluminescence d) All the above

8) The thermally induced rearrangement of an allyphenyl ether to an o-allylphenol is known as _____ rearrangement.
   a) Lossen b) Claisen
   c) Schimdt d) Hofmann

9) The Diels-Alder reaction of cyclic diene always gives endo product as major product due to _____.
   a) primary interactions
   b) steric repulsion
   c) secondary interactions
   d) electronic effect

10) Chelotropic reactions are _____.
   a) Regioselective b) Chemoselective
   c) Stereoselective d) Stereospecific

B) Fill in the blanks. **06**

1) The thermal reaction of alkene having an allylic hydrogen with a compound having multiple bonds is known as _____ reaction.
2) The cycloaddition reaction between an electronically excited carbonyl group and a ground state olefin to yield an oxetane is known as _____ reaction.
3) The _____ rearrangement is an extensively studied organic reaction involving the [3,3]-sigmatropic rearrangement of 1,5-dienes.
4) E_2 or Ψ_2 energy of butadiene has value _____.
5) The homolysis of protonated N-haloamines either thermally or photochemically to form amine salts with halogenated alkyl substituents is known as _____ reaction.
6) Rotation of bond in same direction either clockwise or anticlockwise is known as _____ motion.

Q.2 Answer the following questions. **16**

a) Give the mechanism of the chelotropiccycloaddition reactions between.
   i) alkene and carbene
   ii) alkene and SO_2

b) Write a note on oxidative coupling.

c) Define the terms.
   i) Intersystem crossing
   ii) Singlet state (S_1)
   iii) Photo Fries reaction
   iv) Photoreduction

d) Explain Suprafacial and antarafacial shifts with suitable example.

Q.3 Answer the following questions.

a) Give name of the photochemical reactions for ketones. Describe Norrish type I and II reactions with suitable examples. **08**

b) Butadiene -cyclobutene interconversion under thermal condition, conrotatory mode is allowed process, explain by FMO method. **08**

Q.4 Answer the following questions.

a) Explain the selection rules derived for electrocyclic reactions for $(4n)\ \pi$ and $(4n+2)\ \pi$ system by Huckel- Mobius (H-M) method. **08**

b) With the help of correlation diagram and PMO method, show that the Diels- Alder reaction is thermally allowed process. **08**

Q.5 Answer the following questions.

a) 1, 3 - sigmatropic rearrangement is photochemically allowed process. Explain. **08**

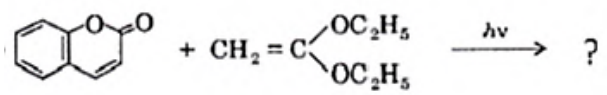
b) What is Paterno-Büchi reaction? Discuss its mechanism along with the stereochemical consequences. **08**

Q.6 Answer the following questions. **08**

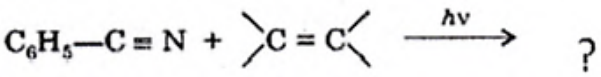
a) Explain Huckel's molecular orbital theory (HMO) and calculate the Huckel's delocalization energy (HDE) for buta-1,3-diene & hexa-1,3,5-triene.

b) Predict the product and write the mechanism for each. **08**

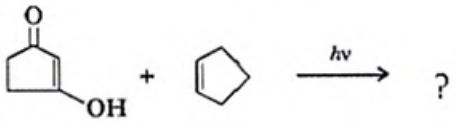
i)



ii)



iii)



iv)

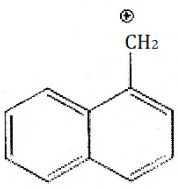
Q.7 Answer the following questions.

a) The electrocyclic transformation of $(2E, 4Z, 6E)$-2,4,6-octatriene gives cis-5,6- dimethyl-1,3-cyclohexadiene under thermal conditions but gives the *trans*- isomer on photochemical conditions. Explain. **10**

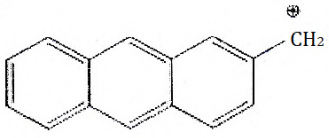
b) Calculate charge density of the following. **06**

1)

2)



3)



Seat No.		Set	P

M.Sc. (Pharmaceutical Chemistry) (Semester - IV) (New/Old) (CBCS)
Examination: October/November - 2025
Advanced Organic Chemistry - II (MSC012402)

Day & Date: Thursday, 30-10-2025 Max. Marks: 80
Time: 03:00 PM To 06:00 PM

Instructions: 1) Questions no. 1 & 2 are compulsory.
2) Attempt any three questions from Q No.3 to Q No.7
3) Figures to the right indicate full marks.

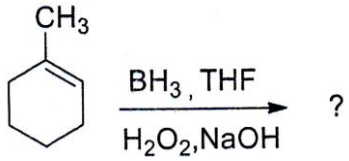
Q.1 A) Choose correct alternative. (MCQ) **10**

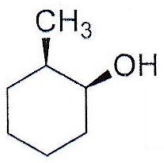
1) Molecular formula of perhydro anthracene is _____.
a) $C_{12}H_{12}$ b) $C_{10}H_{10}$
c) $C_{14}H_{24}$ d) $C_{24}H_{14}$

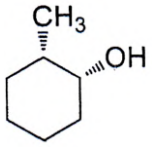
2) Synthons are _____.
a) Positively charged b) Negatively charged
c) Neutral d) Both a) and b)

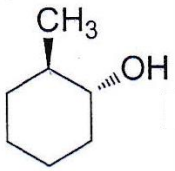
3) Carboxylic acids by protecting with alcohol give _____.
a) Anhydride b) Ketone
c) Cyanide d) Ester

4) What is the stereochemistry of product in following reaction?



a) 

b) 

c) 

d) None of these

5) Which of the following act as umpolung reagent?
a) Nitro compounds b) 1,3- Dithianes
c) Alkynes d) All of the above

6) In Sharpless asymmetric epoxidation _____ is responsible for enantioselective product.
a) Allylic alcohol
b) (±) DET
c) Titanium isopropoxide
d) Ter. Butyl hydroperoxide

7) In the case of alcohols, the hydroxyl group may be protected by formation of _____.
a) an ether b) an ester
c) an acetal d) All of the above

8) When a tetrahedral carbon can be converted to a chiral center by changing only one of the attached groups, it is referred to as a _____.
a) Chiral carbon b) Prochiral carbon
c) Carbon d) None of these

9) In trans-Decalin, two rings are fused through _____ bonds.
a) a,e b) e,e
c) a,a d) None of these

10) The art of synthetic planning starts with the final product (target molecule) is _____.
a) Metathesis b) Retrosynthesis
c) Synthesis d) Carbonation

B) Fill in the blanks. **06**

a) The cyclohexane units in both cis and trans decalins exist in _____ conformation.
b) Conversion of one functional group into another functional group is known as _____.
c) Hydroboration oxidation converts alkene to alcohol corresponding to the _____.
d) The site of disconnection is shown by _____ line.
e) Which type of functional group is commonly protected by forming a silyl ether _____.
f) Cis- Decalin exists as a _____ pair.

Q.2 Answer the following. **16**

a) Explain the one group C-X disconnections with suitable examples.
b) Explain Sharpless Asymmetric Epoxidation.
c) Explain Bredts rule.
d) Give an account on the principle of protection of amines.

Q.3 Answer the following. **16**

a) Discuss the principle of protection of carboxylic group with suitable examples.
b) Explain Cram's rule and Felkin Anh rule with examples. Write the differences between Cram’s mile and Felkin Anh rule.

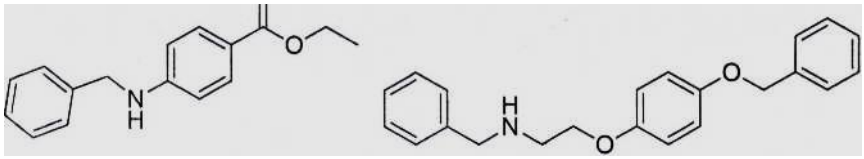
Q.4 Answer the following. **16**

a) Explain the Michael addition and Robinson's annulation.

b) Explain prochirality with suitable example.

Q.5 Answer the following. **16**

a) By using disconnection approach, design a suitable synthesis for following compounds.



b) Write note on perhydrophenanthrene and perhydroanthracene.

Q.6 Answer the following. **16**

a) Explain protection and deprotection of carbonyls in aldehydes.

b) Write note of boranes in asymmetric synthesis.

Q.7 Answer the following. **16**

a) Write note on decalin and 9-methyl decalin.

b) Explain two group C-C disconnection using Diels-Alder reactions and 1,3 difunctionalized compounds.

Set No.	

Set | P

M.Sc. Pharmaceutical Chemistry (Semester - IV) (New/Old) (CBCS)
Examination: October/November – 2025
Pharmaceutical Dosage Forms (MSC012403)

Day & Date: Saturday, 01-11-2025 Max. Marks: 80
Time: 03:00 PM To 06:00 PM

Instructions: 1) Questions no. 1 & 2 are compulsory.
2) Attempt any Three Question from Q No.3 to Q No.7
3) Figures to the right indicate full marks.

Q.1 A) Choose correct alternative. (MCQ) **10**

1) Powders used for external use are _____.
   a) Dusting powder b) Bulk powder
   c) Divided powder d) Effervescent powder

2) An ingredient used to improve flow properties of granules into a die for compression during tablet formulation is a _____.
   a) Disintegrant b) Glidant
   c) Surfactant d) Lubricant

3) Which of the following agent is/are used in enteric coating of the tablet _____.
   a) HPMC b) CMC
   c) CAP d) All of the above

4) Depending on the nature of the product concentrate, the aerosol can be filled by _____.
   a) cold-filling b) pressure-filling
   c) both of these d) none of these

5) Corneal sensations are diminished in _____.
   a) Herpes simplex b) Conjunctivitis
   c) Fungal infections d) Marginal keratitis

6) The sure diagnostic sign of corneal ulcer is _____.
   a) Ciliary injection b) Blepharospasm
   c) Miosis d) Positive fluorescein test

7) Which of the following drugs cannot be given as transdermal administration?
   a) Drugs with very short half-lives
   b) Drugs with narrow therapeutic indices
   c) Easy removal and termination
   d) Drugs against peptic ulcer

8) Alzet is an example of _____ type of parenteral system.
   a) Osmotic pressure activated
   b) Vapour pressure activated
   c) Magnetically activated
   d) Hydration activated

9) Disintegration time for sugar coated tablet is _____.
   a) 15 minutes b) 30 minutes
   c) 60 minutes d) 90 minutes

10) Vaginal suppositories are also called as _____.
   a) Pessaries b) Simple suppositories
   c) Bougies d) None of the above

B) Write True or False. **06**

1) Oral controlled drugs release the drug only inside the intestine.
2) Microspheres have size range in nanometers.
3) Nanoparticles have size range in micrometer.
4) Cellulose is used for enteric coated tablet.
5) Emulsion is a biphasic liquid dosage form.
6) Eye lotions are supplied in diluted form.

Q.2 Answer the following. **16**

a) What are excipients. Give their detail classification.
b) What is pre-formulation? Enlist pre-formulation tests.
c) What are suspensions? Give the stability of suspension.
d) Write a note on powders.

Q.3 Answer the following.

a) Write a note on controlled release dosage forms. **08**
b) Write a note on transdermal drug delivery system. **08**

Q.4 Answer the following.

a) What is stability study. How stability testing is done. **08**
b) Write a note on ocular drug delivery system. **08**

Q.5 Answer the following.

a) What are biphasic liquid dosage forms. Give the formulation of the same. **08**
b) Describe Parenteral routes of drug administrations. **08**

Q.6 Answer the following.

a) What are aerosols, explain in detail. **08**
b) Write a note on inhalation products. **08**

Q.7 Answer the following.

a) Write a note on semisolid dosage forms. **08**
b) Explain the process of wet granulation in detail. **08**

Seat No.	

Set P

M.Sc. Pharmaceutical Chemistry (Semester - IV) (New/Old) (CBCS)
Examination: October/November - 2025
Pharmaceutical Technology (MSC012408)

Day & Date: Tuesday, 04-11-2025 Max. Marks: 80
Time: 03:00 PM To 06:00 PM

Instructions: 1) Questions no. 1 & 2 are compulsory.
2) Attempt any Three Question from Q No.3 to Q No.7
3) Figures to the right indicate full marks.

Q.1 A) Choose correct alternative. **10**

1) Which one of these is responsible for hardness of tablet?
   a) die filling b) compression force
   c) both a and b d) None of these

2) The formation of acetic acid through oxidation is done in _____ phase.
   a) Vapour b) Liquid
   c) Solid d) All of the above

3) Providing documented evidence that a method or product does what it intends to do is termed as _____.
   a) Qualification b) validation
   c) calibration d) verification

4) The transfer of technology between sites of different companies is called as _____.
   a) Inter - company transfer
   b) Intra-company transfer
   c) Technology transfer
   d) Technology transfer protocol

5) Which of the following is not applicable to Direct Compression method?
   a) Mixing of the therapeutic agents with the excipient
   b) Granulation of the mixed powders
   c) Mixing with another excipient
   d) Compression into tablets

6) Which type of process validation we perform periodic and after change?
   a) Prospective validation b) Concurrent validation
   c) Revalidation d) Retrospective validation

7) Coating used to protect the tablet from acidic environment of stomach is _____.
   a) film coating b) sugar coating
   c) enteric coated d) Encapsulation

8) Moisture and heat sensitive drug are formulated into tablets by _____.
   a) direct compression b) dry granulation
   c) Wet granulation d) All of these

9) The guidelines that describe the analytical method validation are-Text and Methodology are _____.
   a) ICH Q2 b) ICH Q1
   c) ICH Q8 d) ICH Q9

10) What size of equipment is needed in continuous process when compared with batch process?
   a) does not depend on size
   b) Larger
   c) Smaller
   d) none of these

B) Fill in the blank. **06**

a) FDA stands for _____.
b) GLP stands for _____.
c) API stands for _____.
d) IRB Stand for _____.
e) IP stands for _____.
f) ICH stands for _____.

Q.2 Answer the following. **16**

a) Describe level of screening.
b) Draw a unit process diagram for monochloroacetic acid
c) Give details about qualification phases according to WHO.
d) Give the difference between calibration and validation.

Q.3 Answer the following. **16**

a) Explain unit process of vinyl chloride.
b) Write a note on granulation method.

Q.4 Answer the following. **16**

a) Discuss the typical industrial chlorination process for the preparation of mono chlorobenzene.
b) Discuss compression method.

Q.5 Answer the following. **16**

a) Describe sampling techniques in cleaning validation.
b) What are the types of process validation?

Q.6 Answer the following. **16**

a) Write a brief note on reactors used in API manufacturing unit.

b) Discuss the factors affecting on chemical process.

Q.7 Answer the following. **16**

a) Discuss the typical industrial nitration process for the preparation of α-Nitronaphthalene.

b) Explain validation of standard method in analytical method validation.

Seat No.	

Set P

M.Sc. (Medicinal Chemistry) (Semester - III) (New) (NEP CBCS)
Examination: October/November - 2025
Advanced Spectroscopic Methods (2327301)

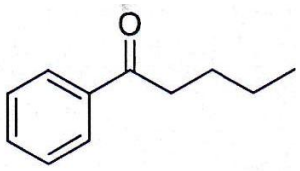
Day & Date: Tuesday, 04-11-2025 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

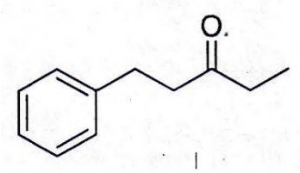
Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.

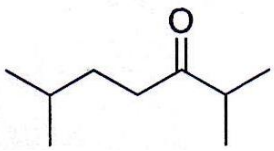
Q.1 A) Choose the correct alternatives from the options. **08**

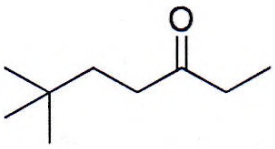
1) Which of the following 2D-NMR technique shows coupling phenomenon through the bond?
   a) DEPT b) HETCOR
   c) NOESY d) All of the above

2) Which of the following can undergo McLafferty rearrangement during mass spectroscopy?

I) 

II) 

III) 

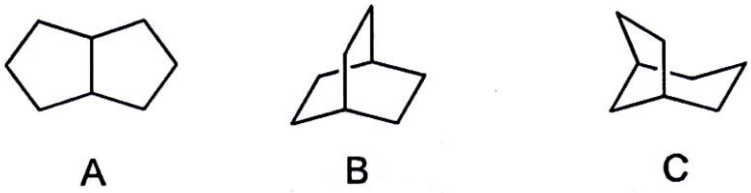
IV) 

   a) Compound I only b) Compound III and IV
   c) Compound III only d) Compound I and III

3) The areas under three separate peaks in an NMR spectrum are 10, 39, and 59. The number of hydrogens for each peak are respectively _____.
   a) 1, 3 and 6 b) 1, 4 and 6
   c) 1, 3 and 5 d) 1, 4 and 5

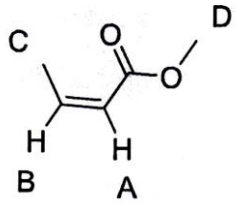
4) The NMR signal of a compound is found to be 260 Hz downfield from TMS peak using spectrometer operating at 200 MHz. What is the downfield shift in Hz for same proton in the spectrometer operating at 300 MHz?
   a) 260 Hz b) 300 Hz
   c) 390 Hz d) 360 Hz

5) In the broad band decoupled ^{13}C-NMR spectra, the number of signals appearing for the bicyclo-octane A-C, respectively, are: _____.



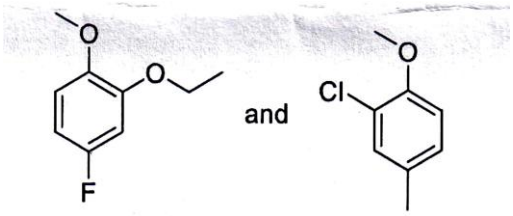
a) 5, 4 & 8
b) 3, 2 & 5
c) 5, 4 & 5
d) 3, 2 & 8

6) Appropriate ^{1}H-NMR chemical shift (δ) for the protons A-D for the following compound are _____.



a) A - 6.8; B - 5.7; C - 3.9; D-2.1 ppm
b) A - 6.8; B - 5.7; C - 2.1; D-3.9 ppm
c) A - 5.7; B - 6.8; C - 3.9; D-2.1 ppm
d) A - 5.7; B - 6.8; C - 2.1; D-3.9 ppm

7) How many signals appears in the ^{1}H NMR spectrum of following compounds respectively?



a) 4, 6
b) 6, 4
c) 6, 5
d) 5, 6

8) Which of the following ion peak shows highest intensity in the mass spectrum?
a) Molecular ion peak
b) Base peak
c) Metastable peak
d) Isotopic peak

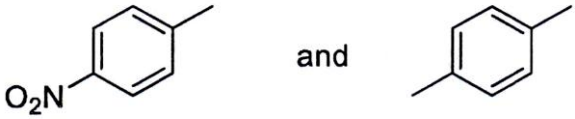
B) Write True or False. **04**

1) The distance between first two lines of multiplet in the second order ^{1}H NMR spectra give the largest J value.
2) The molecular ion peak in the mass spectrum shows highest intensity.
3) The second order ^{1}H NMR spectra occur due to the weak coupling.
4) In NMR, the peaks of first order spectra appear symmetrical and equally spaced.

Q.2 Answer the following. (Any Six) **12**

a) Distinguish between pentan-2-one and pent-3-one using their mass spectra.

b) Comment on the chemical and magnetical equivalence phenomenon of aromatic protons in following compounds.



c) Compound (C_5H_8O) has a strong IR absorption band at 1745 cm^{-1}. The broad-band proton decoupled ^{13}C spectrum of this compound shows three signals: at δ 220 (C), 23 (CH_2), and 38 (CH_2). Propose a structure for this compound.

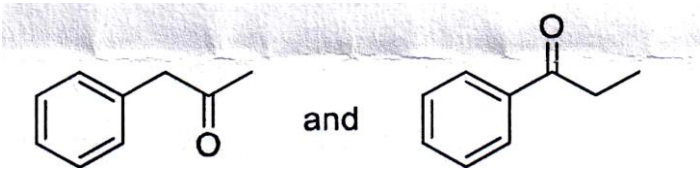
d) Define chemical shift (δ) with equation.

e) What is metastable ion peak?

f) What is the significance of NMR technique in assigning enantiotopic and diastereotopic protons?

g) Define Nitrogen rule in mass spectroscopy with example.

h) Distinguish between following compounds by mass spectroscopy.



Q.3 Answer the following. (Any Three) **12**

a) Address ^3J-coupling phenomenon with Karplus equation in NMR. Comment on cis and trans ^3J-coupling with justification.

b) Assume that chemically equivalent protons show the same signal, but chemically nonequivalent protons show different signals. For the following molecules KK to NN, how many sets of signals would be observed in the respective ^1H NMR spectra? Label all protons in each molecule, so that the protons that give the same ^1H NMR signal are labeled with the same number, and protons that give different signals are labeled with different numbers.

KK LL MM NN

c) Find out the structure of organic compound from following data with detail justifications Molecular Formula: $C_4H_7BrO_2$
IR ($\bar{\upsilon}$ in cm^{-1}): 1707, 2800-3000; ^1H NMR (200 MHz; $CDCl_3$.δ in ppm): 2.0 (s, 6 mm),
11.9 (s, 1 mm); ^{13}C NMR (50 MHz; $CDCl_3$, δ in ppm): 30, 55, 178; DEPT (θ= 135): 30 (up); MASS: m/z = 41 (base peak, 100%), 59, 87, 166/168.

d) Write a sort note on McLafferty rearrangement.

Q.4 Answer the following question. (Any Two) **12**

a) What is second order spectra? Discuss AB, AX spin systems in NMR with examples.

b) Discuss the mode of fragmentation in aromatic ring? Draw the fragments ions of benzyl alcohol such as m/z = 108, 107, 91, 79, 77, 65, 51 and 39.

c) What is 2D NMR? Discuss HETCOR spectra of 2-Hexanone.

Q.5 Answer the following question. (Any Two) **12**

a) Find out the structure of organic compound from following data

Molecular Formula: $C_5H_6N_2$

IR: 3056, 1580, 1527, 1476, 1399, 1302, 1248, 1156, 1020, 829, 750 cm^{-1}

^1H NMR (δ in ppm): 2.5 (s, 30 mm), 8.3 (d, *J*= 2 Hz, 10 mm), 8.4 (d, J= 2 Hz, 20 mm)

^{13}C NMR (δ in ppm): 22 (CH_3), 142 (CH), 144 (CH), 146 (CH), 155 (C); Mass: m/z = 94 (M^+, base), 67 (46), 53 (15), 52 (7), 51 (5), 42 (13), 41 (8), 40 (20), 39 (22).

b) Find out structure of organic compound from following data

Molecular Formula: $C_8H_{14}O_4$

IR($\bar{\upsilon}$ in cm^{-1}): 1190, 1735, 2987.

^{1}HNMR (200 MHz; $CDCl_3$, δ in ppm): 1.2 (t, 6 mm, *J*= 6 Hz), 2.7 (s, 4 mm), 4.2 (q, 4 mm, *J*= 6 Hz); ^{13}C NMR (50 MHz; $CDCl_3$, δ in ppm): 14, 29, 60, 173; DEPT (θ = 135): 14 (up); 29, 60 (down); Mass: m/z =101 (base peak, 100%), 129, 174

c) A compound has M^+= 96 in its mass spectrum and exhibits the ^{13}C spectral data broadband-decoupled ^{13}C NMR: 27.6, 29.3, 32.2, 132.4; DEPT-90: 132.4; DEPT-135: positive peak at 132.4; negative peaks at 27.6, 29.3 32.2 ppm. Find the structure for this compound.

Seat No.	

Set **P**

M.Sc. (Medicinal Chemistry) (Semester - III) (New) (NEP CBCS)
Examination: October/November – 2025
Drug Development (2327302)

Day & Date: Thursday, 06-11-2025 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

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

Q.1 A) Choose correct alternative. (MCQ) **08**

1) _____ property is most critical for a drug to cross the blood brain barrier.
a) High water solubility b) Lipophilicity
c) High MW d) Acidity

2) _____ is not a natural source for obtaining drugs.
a) Plants b) Minerals
c) Synthetic chemicals d) Microorganisms

3) Ligand-based drug design (LBDD) relies primarily on _____.
a) The 3D structure of the target protein
b) Knowledge of known active ligands and their chemical properties
c) High-throughput screening of all available compounds
d) The use of computational docking to find binding sites

4) Lipinski's Rule of Five helps to assess _____.
a) The potential toxicity of a drug candidate
b) The binding affinity of a molecule to its target
c) The rate of drug metabolism
d) The likelihood of a molecule being orally bioavailable (Drug-likeness)

5) _____ is the primary site of first-pass metabolism for orally administered drugs.
a) Kidneys b) Lungs
c) Liver d) Brain

6) _____ factors do not influence the process of drug distribution in the body.
a) Blood flows to tissues
b) Plasma protein binding
c) The drug's affinity for tissue components
d) The speed of an individual's metabolism

7) _____ type of drug-receptor bond is the strongest and often irreversible.

a) Hydrogen bond b) Ionic bond
c) Covalent bond d) Van der Waals bond

8) A non-competitive antagonist _____.

a) Binds to the same site as the agonist
b) Reduces the maximum response of the agonist
c) Can be overcome by increasing the agonist dose
d) Increases the potency of the agonist

B) Write true/false. **04**

1) The FDA requires a company to submit an Investigational New Drug (IND) application before beginning clinical trials in humans.
2) CAD is an acronym for Computer-Aided Design and only applies to creating 2D drawings.
3) A drug with high plasma protein binding will have a higher volume of distribution.
4) A drug's potency is usually a more important clinical consideration than its efficacy.

Q.2 Answer the following. (Any Six) **12**

a) Give examples of drugs from obtained from different sources.
b) Define lead. Enlist different drug-like properties.
c) Write a note on drug distribution.
d) Define:
1) Drug potency.
2) Drug Efficacy.
e) Enlist different biomolecules which includes protein as its composition.
f) Enlist types of combinatorial synthesis.
g) Write a note on soft drug.
h) Define:
1) LD_{50}
2) ED_{50}

Q.3 Answer the following. (Any Three) **12**

a) Write a note on receptors.
b) Elaborate on different approaches for drug design.
c) Enlist and explain different factors affecting drug absorption.
d) Enlist different theories for drug receptor interaction. Explain Two-state model of receptor activation theory.

Q.4 Answer the following. (Any Two) **12**

a) Describe in detail about different compartmental models.
b) Explain various methods of molecular descriptor selection.
c) Define protein. Explain in detail about its structure.

Q.5 Answer the following. (Any Two) **12**

a) Elaborate in detail about drug development process.

b) Explain in detail different protein databases.

c) Give classification of mechanism of drug action and explain it in detail.

Seat No.	

Set **P**

M.Sc. MEDICINAL CHEMISTRY (Semester - III) (New) (NEP CBCS)
Examination: October/November - 2025
Biochemistry (2327307)

Day & Date: Saturday, 08-11-2025 Max. Marks: 60
Time: 11:00 AM To 01:30 PM

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

Q.1 A) Choose correct alternative. (MCQ) **08**

1) The structural polysaccharide in plant cell wall is_____.
a) Glycogen b) Cellulose
c) Starch d) Chitin

2) Prokaryotic cells lack _____.
a) Nucleus b) Ribosome
c) Plasma membrane d) DNA

3) Which Amino acid is Ketogenic?
a) Alanine b) Lysine
c) serine d) Cysteine

4) Biochemistry is important in pharmacy because _____.
a) It explains drug solubility
b) It explains molecular basis of diseases
c) It studies ecosystem balance
d) It measures radioactive decay

5) DNA replication requires enzyme_____.
a) Helicase b) DNA polymerase
c) Ligase d) All of these

6) Metalloproteins are important for _____.
a) Catalysis b) Structural roles
c) Electron transport d) All of the above

7) Metal ion concentration is regulated by _____.
a) Transport protein b) Storage protein
c) Chelation d) All of the above

8) Metal ions in enzymes can functions as _____.
a) Catalytic center b) Structural Stabilizers
c) Both a and b d) None

B) Write True/Flase. **04**

1) The α and β forms of glucose are called anomers.
2) Apoptosis refers to programmed cell death.
3) The uptake and incorporation of metal ions into protein is called metalation.
4) Cu^{2+} in enzymes often acts in redox reaction.

Q.2 Answer the following. (Any Six) **12**

a) Define Amphipathic lipids.
b) Define Disaccharide with one example.
c) Define Proteoglycans.
d) What is the secondary structure of protein?
e) State the function of ferritin.
f) Define bioinorganic chemistry.
g) Name two fat-soluble vitamins and their deficiency diseases.
h) What are the main structural differences between DNA and RNA?

Q.3 Answer the following. (Any Three) **12**

a) Discuss the classification of amino acids.
b) Explain reducing and non-reducing sugars with examples.
c) Define vitamins write classification of vitamins with examples
d) Give principles of co-ordination chemistry related to bioinorganic-proteins, nucleic acids and other metal binding biomolecules.

Q.4 Answer the following. (Any Two) **12**

a) Describe the steps involved in ß- oxidation of fatty acids.
b) Explain the structure of DNA and RNA.
c) Explain methods of protein sequencing and characterization.

Q.5 Answer the following. (Any Two) **12**

a) Discuss the structure of protein.
b) Explain cyclic structure of monosaccharaides with Haworth projection.
c) Explain water soluble vitamins, their functions and deficiency.

Seat No.	

Set **P**

M.Sc. (Medicinal Chemistry) (Semester - IV) (New) (NEP CBCS)
Examination: October/November - 2025
Modern Organic Chemistry (2327401)

Day & Date: Tuesday, 28-10-2025 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

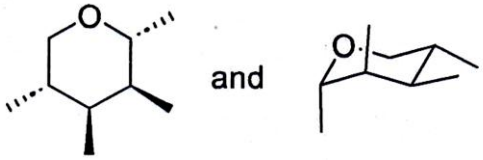
Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.

Q.1 A) Choose correct alternative. (MCQ) **08**

1) The IUPAC name of the bridged 9-BBN compound is _____.

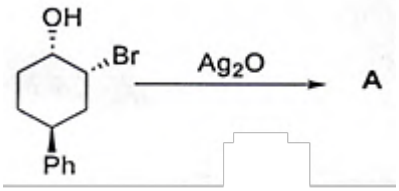
a) 9-borabicyclo[3,3,1]nonane
b) 9-borabicyclo[3,3,0]nonane
c) 1-borabicyclo[3,3,1]nonane
d) 1-borabicyclo[3,3,0]nonane

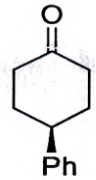
2) What relationship do the following pairs of compounds have to each other?

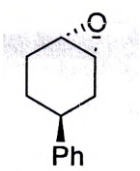


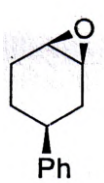
a) Enantiomers b) Diastereomers
c) Identical c) Epimers

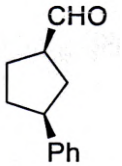
3) Choose the correct alternative for the following reaction transformation.



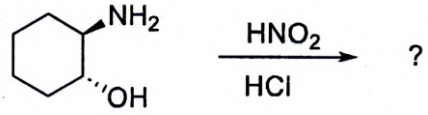
a) 

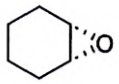
b) 

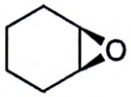
c) 

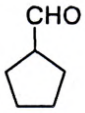
c) 

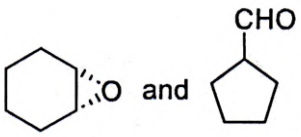
4) Choose the correct alternative for the following reaction transformation.



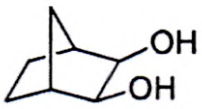
a) 

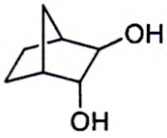
b) 

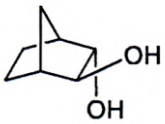
c) 

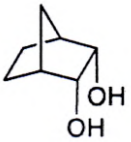
d) 

5) Predict the correct option of a major product _____.

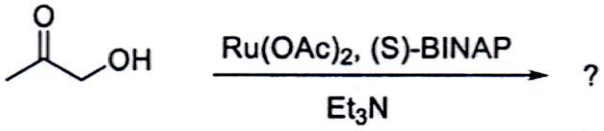
a) 

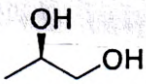
b) 

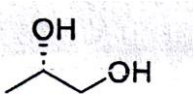
c) 

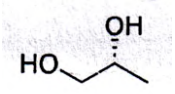
d) 

6) Predict the correct option of a major product.



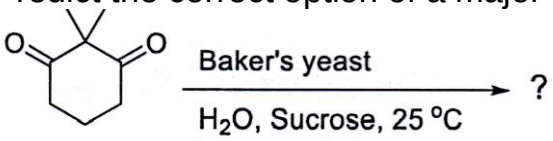
a) 

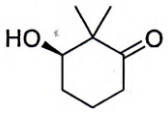
b) 

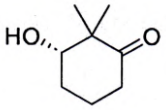
c) 

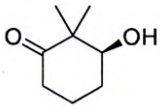
d) Both a) and c)

7) Predict the correct option of a major product.



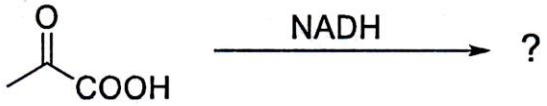
a) 

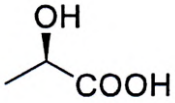
b) 

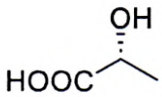
c) 

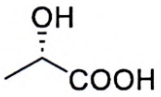
d) Both a) and c)

8) Predict the correct option of a major product.



a) 

b) 

c) 

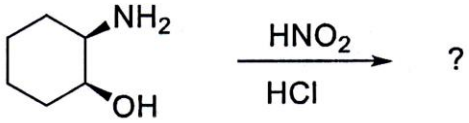
d) Both a) and b)

B) Write True/False. **04**

1) The point group of trans-decalin is C_2h.
2) An enantiomerically pure compound has an enantiomeric excess (ee) of 100%.
3) The most stable isomer of perhydrophenanthrene is cis-anti-cis.
4) The chiral pool approach for asymmetric synthesis always gives product with 100% ee.

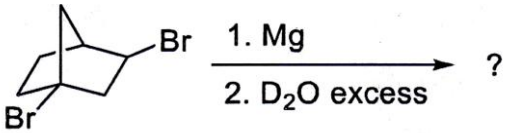
Q.2 Answer the following. (Any Six) **12**

a) Predict the correct option of a major product with mechanism.

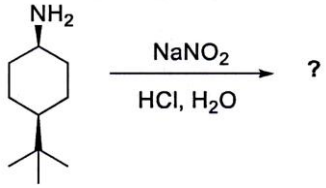


b) What the stability of 2,3-butanediol diastereomer's?

c) What is the major product in following reaction with stereochemistry?

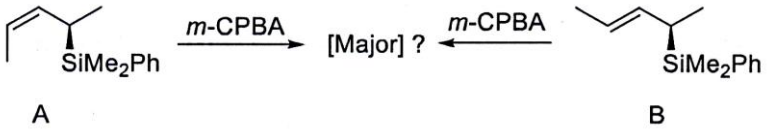


d) Predict the correct option of a major product with mechanism.

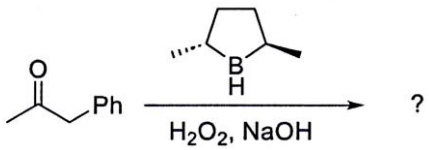


e) Draw Newman projection of trans-c-trans perhydroanthracene.

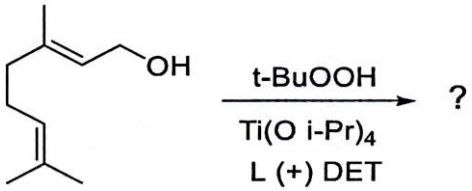
f) What will be the product A and B in following transformation?



g) What is the major product in following reaction with stereochemistry?



h) What is the major product in following reaction with stereochemistry?



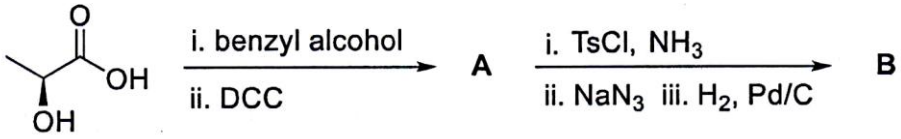
Q.3 Answer the following. (Any Three) **12**

a) Explain stability of cis and trans-9-methyl decalin and comment on their various physical properties.

b) Rationalize the base induced molecular elimination with pyrolysis of 3-phenyl-2-butylxanthate and corresponding amine oxide.

c) What is Sharpless asymmetric epoxidation? Discuss in details with examples.

d) What is the product A and B in following reaction? Discuss with mechanism.



Q.4 Answer the following. (Any Two) **12**

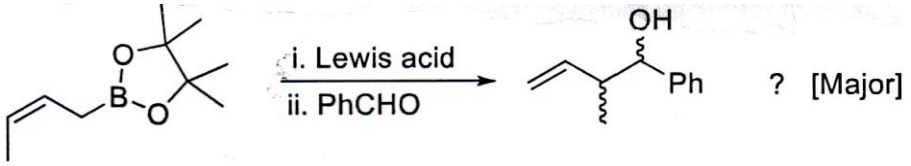
a) Discuss relative reactivity of diastereomers in ionic elimination.

b) Comment on the proline-catalyzed asymmetric Mannich reaction with stereochemistry and its applications.

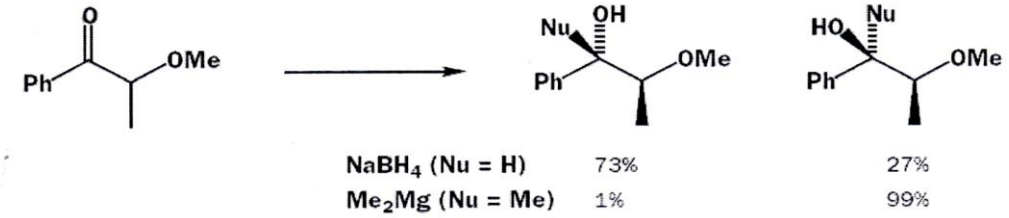
c) Explain different isomers of perhydrophenanthrene and comment on its stability and chirality.

Q.5 Answer the following. (Any Two) **12**

a) Rationalize the stereochemical outcome in the following reaction.



b) Predict, with a clear transition state diagram, the stereochemistry of the product in the following reaction.



$NaBH_4$ (Nu = H)	73%	27%
Me_2Mg (Nu = Me)	1%	99%

c) Discuss SAMP/RAMP chiral auxiliary approach for α-alkylation of ketones with stereochemistry.

Seat No.	

Set **P**

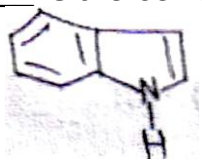
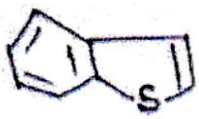
M.Sc. (Medicinal Chemistry) (Semester - IV) (New) (NEP CBCS)
Examination: October/November - 2025
Drug & Heterocycles (2327402)

Day & Date: Thursday, 30-10-2025 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

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

Q.1 A) Choose correct alternative. (MCQ) **08**

1) Attack by a nucleophile occurs in the pyridine ring of quinoline and ____ is the preferred site for such an attack.
   a) position-2 b) position-1
   c) position-3 d) None of these

2) _____ is the correct structure of indole.
   a)  b) 
   c)  d) 

3) The parent five membered heterocyclic rings namely pyrrole, furan and thiophene are formally derived from benzene by replacing the two _____ groups with one heteroatom.
   a) $-CH_2$ b) $-CH$
   c) $-CH_3$ d) $C = O$

4) With P-dimethylaminobenzaldehyde, pyrrole gives an intense red colour, this is referred to as _____ test and is regarded as characteristic of pyrroles.
   a) Ehrlich test b) Benedicts test
   c) Schiff's test d) Tollens test

5) An _____ is a chemical that is produced by a living organism in a comparatively high dilution and inhibits the growth or reproduction of some other micro-organism.
   a) Sedative b) Anesthetic
   c) Antibiotic d) Hypnotics

6) Penicillins consist of β-lactam ring fused with _____.
   a) dihydrothiazine ring b) pyrroline ring
   c) oxazolidine ring d) thiazolidine

7) _____ is defined as the series of changes that occur in living tissues following injury.
   a) Fungi b) Inflammation
   c) Cancer d) Antibiotics

8) _____ are a variants of insulin products that are available as a drug.
   a) Insulin Injection b) Isophane Insulin suspension
   c) Insulin zinc suspension d) All of the above

B) Write True/ False. **04**

1) Indole is a planar molecule with a conjugated system of 10π-electrons, three from the nitrogen and seven from the carbon atoms and is thus a π-excessive molecule.
2) Five membered heterocyclic compounds with an additional heteroatom are termed azoles.
3) The D- (-) Ampicillin is found to be more active appreciably in comparison to its isomer L- (+) ampicillin.
4) In case of Ibuprofen drug (+)- enantiomer possess greater activity than (-)-enantiomer.

Q.2 Answer the following. (Any Six) **12**

a) Write down with reaction the Fischer-Indole synthesis.
b) Write down with reaction the synthesis of Benzofuran from Coumarin.
c) Write down with reaction the synthesis of pyrrole from Ammonium Mucate.
d) Write down with reaction the synthesis of furan from carbohydrates.
e) Write down the classification of Antibiotics.
f) Write down the classification of Sulfonamides drug.
g) Write down the classification of NSAIDs.
h) Write down the classification of Antidiabetics.

Q.3 Answer the following. (Any Three) **12**

a) Write in detail the Alkylation and Electrophilic Substitution chemical reactions of Indole.
b) Explain the chemical reactions of pyridazines with Nucleophilic reagents and reaction with oxidizing and reducing agents.
c) Write down the synthesis and mechanism of action of Ampicillin drug.
d) Write down the structure, SAR and mechanism of action of Tolbutamide drug.

Q.4 Answer the following. (Any Two) **12**

a) Explain in detail the various chemical reactions of pyrazines.
b) Write down the SAR, mechanism of action and synthesis of Chloramphenicol drug.
c) Write down the SAR, mechanism of action and synthesis of Aspirin drug.

Q.5 Answer the following. (Any Two) **12**

a) Explain with reaction any six chemical reactions of furan.

b) Write down the SAR, mechanism of action and synthesis of Sulfacetamide drug.

c) Write down the SAR, mechanism of action and synthesis of Diclofenac drug.

Seat No.	

Set P

M.Sc. MEDICINAL CHEMISTRY (Semester - IV) (New) (NEP CBCS)
Examination: October/November – 2025
Pharmaceutical Dosage Forms (2327405)

Day & Date: Saturday, 01-11-2025 Max. Marks: 60
Time: 03:00 PM To 05:30 PM

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

Q.1 A) Choose correct alternative. (MCQ) **08**

1) Following are the fillers used in wet granulation except _____.
   a) Pharmaceutical shellac b) Lactose
   c) Cellulose d) Starch

2) A _____ is used to produce flexibility and elasticity of the coating and thus provide durability.
   a) Surfactant b) Plasticizer
   c) Glossant d) Film former

3) The _____ are used in topical pharmaceutical aerosols because of their environmental acceptance and their low toxicity and non-reactivity.
   a) Hydrochlorofluorocarbons b) Hydrofluorocarbons
   c) Hydrocarbons d) Chlorofluorocarbons

4) The test for sterility may be carried out by _____.
   a) Membrane filtration method b) Direct inoculation method
   c) Spectroscopic method d) Both a & b

5) _____ drug experience greater vapour pressures with increased temperature as compared to cyclophosphamide.
   a) 5-fluorouracil b) Etoposide
   c) Carmustine d) Cisplatin

6) Aspirin combines with a water molecule and hydrolyzes into one molecule of _____ and one molecule of acetic acid.
   a) Citric acid b) Acetylsalicylic acid
   c) Oxalic acid d) Salicylic acid

7) _____ is nonbiodegradable intraocular implant.
   a) Trivaris b) Ozurdex
   c) Triesence d) Iluvien

8) The main advantage of biodegradable intraocular implant is _____.
   a) They do not have to be removed from body.
   b) Production cost is comparatively low.
   c) They are inert.
   d) None of these.

B) Write True/False. **04**

1) Enteric coatings are employed to protect the content of tablet from gastric acid destruction.
2) The isotonicity of sterile solution may be adjusted by adding sodium chloride, dextrose, boric acid.
3) Digoxin 0.125 mg drug is indicated for Angina Pectoris.
4) Drugs having shorter and longer half-life cannot be formulated as sustained release dosage formulation.

Q.2 Answer the following. (Any Six) **12**

a) Write a note on Local routes of drug administration.
b) Write down the types of dosage forms.
c) Write down the Advantages and Disadvantages of respiratory drug delivery.
d) Write down the examples of Oral Inhalation Powders.
e) Define and give example of following ingredients.
   1) Buffering agent.
   2) Chelating agent.
f) Define and give example of following ingredients.
   1) Humectant.
   2) Plasticizer.
g) Write the factors influencing design of sustained release dosage form.
h) Write a note on Osmotic Pressure Controlled Systems.

Q.3 Answer the following. (Any Three) **12**

a) Explain about Film coating of tablets.
b) Write down in detail the mechanism of drug absorption into the skin and factors affecting skin penetration.
c) Explain in detail about flavoring agents and their role in pharmaceutical preparations.
d) Explain the pharmacopeial requirements for parenteral products.

Q.4 Answer the following. (Any Two) **12**

a) Explain in detail about the various types of tablets.
b) Write in detail about Metered-dose inhalers and explain formulation and operation of an Metered-dose inhaler.
c) Write in detail about Preformulation studies of a drug substance.

Q.5 Answer the following. (Any Two) **12**

a) Explain in detail about the various Systemic routes of drug administration.
b) Write in detail the various types of powder dosage form.
c) Explain in detail the various routes of parenteral drug administration.

Set No.	

Set **P**

M.Sc. Medicinal Chemistry (Semester - IV) (New/Old) (CBCS)
Examination: October/November - 2025
Medicinal Chemistry (MSC08408)

Day & Date: Tuesday, 04-11-2025 Max. Marks: 80
Time: 03:00 PM To 06:00 PM

Instructions: 1) Questions no. 1 & 2 are compulsory.
2) Attempt any Three Question from Q No.3 to Q No.7
3) Figures to the right indicate full marks.

Q.1 A) Choose correct alternative. **10**

1) Which of the following sulphonamide is used for treatment of general Infections _____?
a) Sulphisoxazole b) Nitrosulphathiazole
c) Sulphaguanidine d) Sulphapyridine

2) Among the following _____ is an example of β-lactam group of antibiotics.
a) Streptomycin b) Penicillin
c) Tetracycline d) All of the above

3) Ibuprofen corresponds to ____ type of drug.
a) NSAID b) Antibiotics
c) Cardiovascular d) Antifungal

4) IUPAC nomenclature of Thiopental drug is _____.
a) 5-ethy1-5-pentan-2-y1-2-sulfanylidene-1,3-diazinane-4,6-dione
b) 4-ethy1-3-pentan-2-y1-2-sulfanylidene-1,3-diazinane-4,6-dione
c) 5-ethy1-5-pentan-3-y1-2-sulfanylidene-1,2-diazinane-4,6-dione
d) 5-ethy1-4-pentan-2-y1-3-sulfanylidene-1,3-diazinane-4,6-dione

5) Clotrimazole is used as ____ agent.
a) Antiviral b) Antibiotic
c) Antifungal d) Anaesthetic

6) A drug that causes loss of consciousness is called ____agent.
a) Antipyretic b) Analgesic
c) Anesthetic d) Antibiotic

7) Therapeutic use of durg phenobarbital is treatment of _____.
a) Diabetes b) Seizures
c) Anxiety d) Both B and C

8) _____ is a non-selective β −receptor antagonist drug.
a) Phenytoin b) Verapamil
c) Captopril d) Nifedipine

9) Insulin is released from _____ in human body to control blood sugar level.

a) Kidney b) Pancreas
c) Lungs d) Intestine

10) Which of the following Anopheles mosquitoes are responsible for transmission of malaria to human?

a) Male b) Female
c) Both A and B d) None of above

B) Write True or False. **06**

1) Cetirizine is a non-sedative antihistamine drug.
2) IUPAC nomenclature of Halothane is 2-Bromo-2-chloro-1,1,1-trifluoroethane.
3) Amoxycillin does not belong β –lactam penicillins.
4) Chloroquine is not used for treatment of malaria caused due to plasmodium falciparum.
5) Paracetamol is an antipyretic drug.
6) Hypnotics are the drugs that calm patients and reduce anxiety without inducing normal sleep.

Q.2 Answer the following. **16**

a) Explain synthesis and mechanism of action of aspirin.
b) Write structure and explain mechanism of action of Metformin.
c) Explain antihistamine activity of Diphenylhydramine.
d) Write note on synthesis and SAR of cefixime.

Q.3 Answer the following. **16**

a) Write structure and explain mechanism of action of, structure activity relationship of Diazepam.
b) Write the synthesis of SAR of antihypertensive drug captopril.

Q.4 Answer the following. **16**

a) Write note on Antidiabetic agents with suitable example w.r.t. synthesis and mechanism of action.
b) Write note on Classification, SAR and mechanism of action of antibiotics.

Q.5 Answer the following. **16**

a) Write structure and explain mechanism of action of structure activity relationship and therapeutic uses of Phenytoin.
b) Explain in detail antifungal agents.

Q.6 Answer the following. **16**

a) Explain anesthetic agents w.r.t classification, synthesis and mechanism of action.
b) Explain in detail synthesis and mechanism of action of Antihistamines.

Q.7 Answer the following. **16**

a) Explain in detail Non-Steroidal Anti-inflammatory Drugs.

b) Explain synthesis and mechanism of action of

i) Sulfacetamide

ii) Sulfamethoxazole

Seat No.	

Set **P**

M.Sc. Pharmaceutical Chemistry (Semester - III) (CBCS)
Examination: October/November – 2025
Advanced Organic Chemistry – I (MSC012301)

Day & Date: Tuesday, 04-11-2025 Max. Marks: 80
Time: 11:00 AM To 02:00 PM

Instructions: 1) Q. No. 1 and 2 are compulsory.
2) Figures to the right indicate full marks.
3) Attempt any three questions from Q. No.3 to Q. No.7.

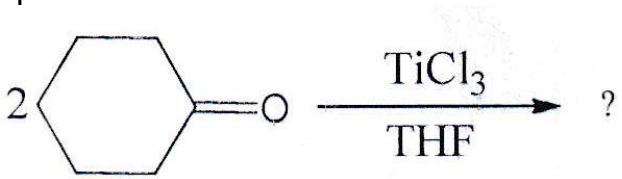
Q.1 A) Choose the correct alternative. **10**

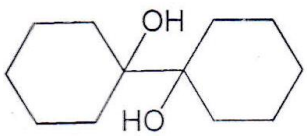
1) The _____ is the reaction in which oxidation of a- carbon of carbonyl group take place.
   a) Riley reaction b) Oppenaur oxidation
   c) Allylic oxidation d) None of these

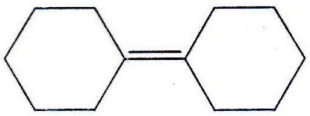
2) The intermediate formed during the Hofmann rearrangement is _____.
   a) Carbene b) Carbocation
   c) Isocyanate d) Ketene

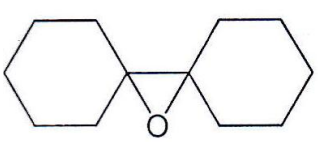
3) The formylation of phenol with hexamines is known as _____ reaction.
   a) Reimer-Tiemann b) Duff
   c) Vilsmeir- Hack d) Guttermann-Koch

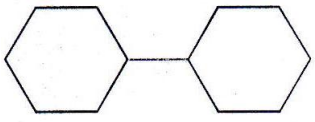
4) Predict the product.



a) 

b) 

c) 

d) 

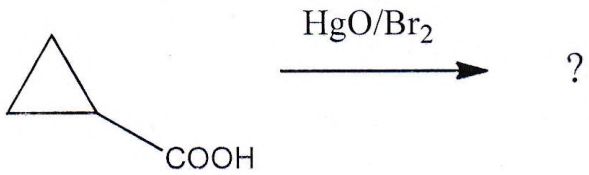
5) In the Stille reaction _____ is rate determining step.
   a) Transmetallation b) Isomerisation
   c) Oxidative addition d) Reductive elimination

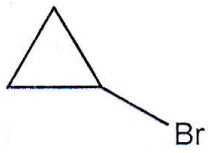
6) The interaction of a reaction centre with a lone pair of electrons in an atom or the electrons present in a pi bond contained within the parent molecule with the reaction centre is called as _____.
   a) Neighbouring group assistance
   b) Intermolecular rearrangement
   c) Intramolecular rearrangement
   d) Concerted reaction

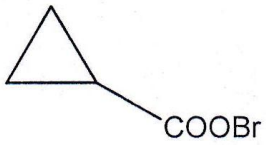
7) The stability order of free radical in the reduction of halides using organo tin compound is _____.
   a) $1° > 2° > 3°$ b) $2° > 3° > 1°$
   c) $3° > 2° > 1°$ d) $1° > 3° > 2°$

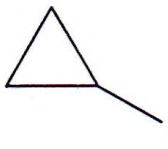
8) The formation of _____ take place during the mechanism of Neber rearrangement.
   a) Oxirane b) Azirine
   c) Azitidine d) Cyclopropane

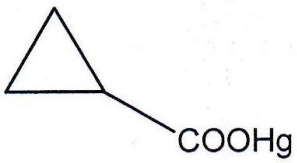
9) Predict the product.



a) 

b) 

c) 

d) 

10) DCC is used as powerful _____ agent.
   a) Hydrating b) Dehydrating
   c) Reducing d) oxidizing

B) Fill in the blanks. **06**

1) The _____ reaction is an organic chemical reaction that involves disproportionation of an aldehyde in the presence of an alkoxide.
2) The _____ as intermediate is formed during Wagner-me.erwein rearrangements
3) Lithium dialkydcuprate are also known as _____ reagent.
4) DDQ is used as a powerful _____ agent.
5) The _____ reagent is used for the allylic halogenation
6) For the synthesis of aryl halides from aryl diazonium salts using copper salts as reagents or catalysts, the _____ is used.

Q.2 Answer the following. **16**

a) Write a note on Grubb's metathesis

b) Explain the Darzen reaction with example.

c) Give the applications of DDQ reagent.

d) Discuss the Sandmayer's reaction in detail.

Q.3 Answer the following. **16**

A) Write a brief note on,

1) Period.
2) Trimethyl silyl iodide.

B) What is Gilman's reagent? Explain the applications of Lithium dialkylcuprate reagent.

Q.4 Answer the following. **16**

a) Explain in detail Bamford -Steven reaction and give its applications.

b) Describe coupling of alkynes and arylation of aromatic by diazonium salts.

Q.5 Answer the following. **16**

a) Explain Corey-Fuchs reaction with example.

b) Write reaction and mechanism involved in Tiffeneau-Demjanov rearrangement reaction in detail and give its application.

Q.6 Answer the following. **16**

a) Discuss the Wolf rearrangement in detail. Give its application.

b) Write a note on,

1) DCC reagent.
2) Organotion reagent.

Q.7 Answer the following. **16**

a) Explain the following.

1) Free radical rearrangement.
2) Auto-oxidation.

b) Explain the Hoffmann-Loffler-Fretag reaction with its mechanism and example.

Seat No.	

Set **P**

M.Sc. Pharmaceutical Chemistry (Semester - III) (CBCS)
Examination: October/November – 2025
Chemistry of Bioactive Hetero cycles (MSC012302)

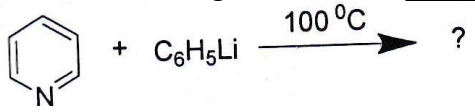
Day & Date: Thursday, 06-11-2025 Max. Marks: 80
Time: 11:00 AM To 02:00 PM

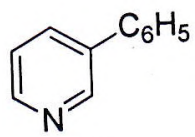
Instructions: 1) Q. No. 1 and 2 are compulsory.
2) Figures to the right indicate full marks.
3) Attempt any three questions from Q. No.3 to Q. No.7.

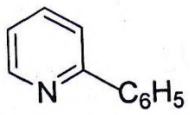
Q.1 A) Choose the correct alternative. **10**

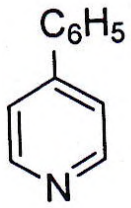
1) Which of the following is the prefix of Sulphur?
   a) Oxa b) Thia
   c) Aza d) Sila

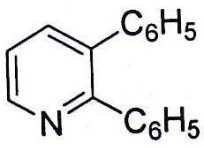
2) The major product of the following reaction is _____.



a) 

b) 

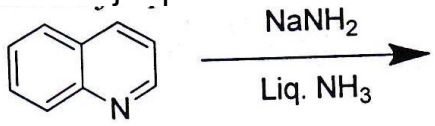
c) 

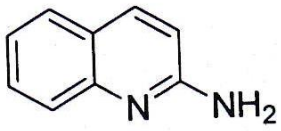
d) 

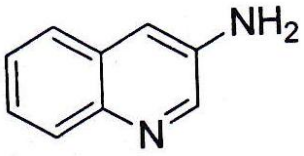
3) The IUPAC nomenclature for the following heterocyclic compound is _____.

   a) Oxarane b) Oxorane
   c) Oxane d) Oxirane

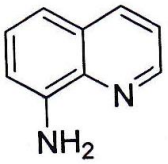
4) The major product of the following reaction is _____.



a) 

b) 

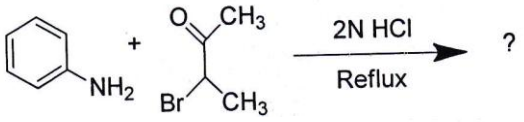
c) 

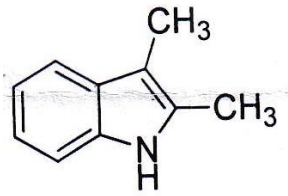
d) 

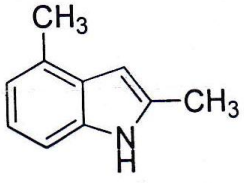
5) Which of the following is the weakest base among heterocyclic bases?

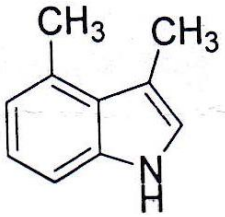
a) Pyrrole
b) Pyridine
c) Pipeidine
d) Pyrazole

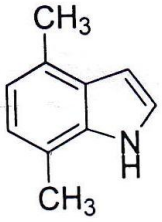
6) The major product of the following reaction is _____.



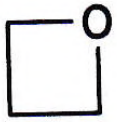
a) 

b) 

c) 

d) 

7) The IUPAC nomenclature for the following heterocyclic compound is _____.



a) Oxarane
b) Oxorane
c) Oxane
d) Oxitane

8) Friedlander synthesis is used for _____.

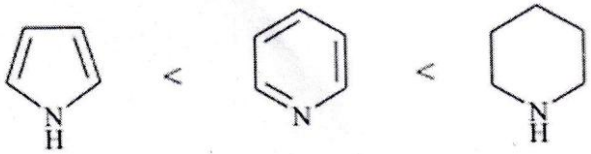
a) Isoquinoline
b) Quinolines
c) Quinones
d) Pyridine

9) What is the hybridization of Nitrogen in pyridine ring?
   a) sp b) sp2
   c) sp3 d) None of these

10) Which kind of bond contributes to aromaticity in the thiophene?
   a) Sigma bond b) Pi-Bond
   c) Hydeogen bond d) None of these

B) Write weather true/false. **06**

1) Pyridine is more basic than imidazole.
2) The suffix 'ole' used for the five membered saturated ring.
3) Aza is the prefix used for oxygen containing heterocycles.
4) When furan reacts with bromine in presence of dioxane at 0 °C gives-2 bromofuran.
5) Basicity order of following compound



6) Furan is more reactive towards electrophile than pyrrole.

Q.2 Answer the following. **16**

a) Discuss the two methods for synthesis of aziridines.
b) Give two methods of pyrazine synthesis with mechanism.
c) What are the methods for synthesis of coumarins? Discuss with mechanism.
d) Write a short note on synthesis of triazole.

Q.3 Answer the following. **16**

a) Discuss Baldwin ring closure rules for the formation of 3, 4, 5 and 6 membered rings.
b) Discuss with mechanism the Paul-Knorr synthesis of furan and pyrrole.

Q.4 Answer the following. **16**

a) What are the methods for synthesis of imidazole and pyrazole?
b) Write two methods of each with mechanism for synthesis of quinolines and benzoxazole.

Q.5 Answer the following. **16**

a) What are the different methods for synthesis of pyrimidine?
b) Discuss the different methods for synthesis of indole.

Q.6 Answer the following. **16**

a) Discuss different methods for synthesis of piperazine with mechanism.
b) Discuss the two methods of each for synthesis of oxiranes and thiaranes.

Q.7 Answer the following. **16**

a) Write two methods of each for synthesis of thiazole and isothiazole.

b) What are the various methods for synthesis of benzimidazoles and benzothiazoles.

Seat No.	

Set P

M.Sc. Pharmaceutical Chemistry (Semester - III) (CBCS)
Examination: October/November - 2025
Medicinal Chemistry (MSC012310)

Day & Date: Saturday, 08-11-2025 Max. Marks: 80
Time: 11:00 AM To 02:00 PM

Instructions: 1) Q. No. 1 & 2 are compulsory
2) Attempt any three questions from Q. No. 3 to Q. No. 7
3) Figures to the right indicate full marks.

Q.1 A) Choose correct alternative. (MCQ) **10**

1) Propranolol drug is a derivative of _____.
   a) Aryloxyamine b) Aryloxypropanolamine
   c) Aryloxyamide d) Both A & C

2) Captopril drug is a _____ ACE inhibitors.
   a) Sulfhydryl containing
   b) Dicarboxylate containing
   c) Phosphonate containing
   d) None of the above

3) Indomethacin drug contains _____ Heterocyclic ring.
   a) Thiophene b) Furan
   c) Indole d) Imidazole

4) _____ is the primary acid metabolite of hydroxyzine.
   a) Promethazine b) Diphenhydramine
   c) Cyclizine d) Cetirizine

5) _____is a 1,4 dihydropyridine derivative.
   a) Lidocaine b) Verapamil
   c) Nifedipine d) Propanolol

6) Which of the following branched aliphatic carboxylic acid is used as anticonvulsant.
   a) 2-propyl pentanoic acid
   b) 2-propyl hexanoic acid
   c) Valproic acid
   d) Both A & C

7) Which of the following drug is an example of propylamine class of Hl-antagonist.
   a) Diphenhydramine b) Pyrilamine
   c) Chlorpheniramine d) All of the above

8) Cephalosporanic acid contains _____ ring.
   a) Tetrhydrothiazole b) Dihydrometathiazine
   c) Thiazolidine d) Both A & C

9) _____ Drugs acts by inhibiting prostaglandin synthesis.
   a) NSAIDS b) Antimalarial
   c) Antiviral d) Antifungal

10) Type-1 diabetes involves _____.
   a) relative deficiency in insulin secretion
   b) Absolute deficiency in insulin secretion.
   c) End organ insulin resistance
   d) All of the above

B) Write True or False **06**

a) Organic nitrates are not used in the treatment of angina pectoris.
   a) True b) False

b) Antihistaminic agents are H2 receptor antagonist.
   a) True b) False

c) Thiopental sodium is an ultra short acting barbiturate used as general anesthetic agent.
   a) True b) False

d) Ranitidine drug is a proton pump inhibitor used in the treatment of gastric acidity.
   a) True b) False

e) Class -II of Antiarrhythmic drug contains beta adrenergic blockers.
   a) True b) False

f) Glimepiride is the first-generation sulfonyl ureas of oral antidiabetic drug
   a) True b) False

Q.2 Answer the following **16**

a) Define and classify Anesthetics. Write a note on Thiopental sodium.
b) Write SAR of Penicillin antibiotic.
c) Define NSAIDS. Describe Arylacetic acid derivatives of NSAIDS.
d) Define antifungal agents. Discuss any one class of it.

Q.3 Answer the following. **16**

a) Discuss with suitable examples the drugs of beta blockers & Calcium channel blockers.
b) Define and classify antidiabetic agents. Discuss on Insulin.

Q.4 Answer the following. **16**

a) Write a note on broad spectrum Cephalosprins. Discuss on SAR of Sulfonamides.

b) Define & classify Antidepressants. Discuss on Tricyclic Antidepressants with suitable examples.

Q.5 Answer the following. **16**

a) Write in detail on Tetracycline. Give synthesis of Ampicillin.

b) Define and classify Sedatives and Hypnotics. Elaborate on Benzodiazepines. Give synthesis of Diazepam.

Q.6 Answer the following. **16**

a) Define antimalarial agents. Elaborate on Chloroquine. Discuss in detail on Alkylating agents of Antineoplastic agents.

b) Write a note on Hydantoins. Give synthesis of Phenytoin. Discuss on any one drug of antiviral agent.

Q.7 Answer the following. **16**

a) Classify antimalarial agents and discuss any one class. Write structure, Mechanism of action and synthesis of Captopril.

b) Classify antifungal agents. Write a note on Clotrimazole. Write in detail on H2-receptor antagonist.

Set No.		Set	P

M.Sc. Pharmaceutical Chemistry (CBCS) Examination: October/November - 2025
Analytical Chemistry–I (MSC05108)

Day & Date: Wednesday, 29-10-2025 Max. Marks: 80
Time: 03:00 PM To 06:00 PM

Instructions: 1) Questions no. 1 & 2 are compulsory.
2) Attempt any Three Questions from Q No.3 to Q No.7
3) Figures to the right indicate full marks.

Q.1 A) Choose correct alternative. (MCQ) **10**

1) Standard deviation of population is denoted by _____.
a) Φ b) Ω
c) σ d) β

2) Text-styling feature of MS word is _____.
a) Word Color b) Word Fill
c) Word Art d) Word Font

3) Systematic errors occur due to _____.
a) overuse of instruments
b) careless usage of instruments
c) human sight
d) both a and b

4) _____ In which voltage range DME can be applied in polarography.
a) +2.3 to -3.3 V b) +2.4 to -3.3 V
c) +2.3 to -3.0 V d) +2.4 to -3.0 V

5) Voltammetry of the following forms of electrochemistry seek to obtain condition for _____ polarization.
a) null b) half
c) Both a and b d) full

6) Superscript, subscript, strikethrough is known as _____.
a) Font Effects b) Font Style
c) Font Face d) Font Format

7) ICP's principle is similar to which of the following _____.
a) Flame emission spectroscopy
b) Fourier transforms spectroscopy
c) Atomic emission spectroscopy
d) Absorption spectroscopy

8) _____ of the following is the principle of Atomic Absorption Spectroscopy.

a) Radiation is absorbed by nonexcited atoms in vapour state and are excited to higher states
b) Medium absorbs radiation and transmitted radiation is measured
c) Colour is measured
d) Colour is simply observed

9) Measurement which is reproducibility is _____.

a) Accurate b) Average
c) Precise d) Error

10) _____ is capillary constant in Ilkovic equation.

a) $m^{1/3}.t^{1/6}$ b) $m^{3/2}.t^{1/6}$
c) $m^{2/3}.t^{1/6}$ d) None of these

B) Fill in the blanks. **06**

1) In Atomic absorption spectroscopy, _____ is the generally used radiation source.
2) _____ state of samples are introduced into the ICP spectrometer.
3) The auxiliary electrode in polarography is _____.
4) Half-wave potential ($E_{1/2}$) is _____.
5) Linear regression analysis is _____.
6) The least square method is _____.

Q.2 Answer the following. **16**

a) Write a note on CHEM SKETCH.
b) Write a note on qualitative applications of polarography.
c) Explain linear regression with examples.
d) Explain the difference between AAS and FES.

Q.3 Answer the following.

a) Discuss in variance, confidence Limit, average deviation and standard deviation. **08**
b) Discuss the principles, instrumentation, and nature of titration curves of Amperometry. **08**

Q.4 Answer the following.

a) Discuss in detail various types of errors observed in measurement. **08**
b) Discuss the principles and instrumentation of ICP. **08**

Q.5 Answer the following.

a) What are electroanalytical techniques? Explain the polarography principle and working. **08**
b) Discuss the principles and instrumentation of AAS. **08**

Q.6 Answer the following.

a) Discuss the detection limit and interference of AAS. **08**

b) Define the accuracy. Explain the analytical methods used for determination of the accuracy. **08**

Q.7 Answer the following.

a) What is sampling, explain the technique used for sampling of gases and solids. **08**

b) Discuss the use of power point and excel in chemistry. **08**

Seat No.	

Set P

M.Sc. Chemistry (Semester - II) (CBCS) Examination: October/November – 2025
Analytical Chemistry-II (MSC05210)

Day & Date: Tuesday, 04-11-2025 Max. Marks: 80
Time: 11:00 AM To 02:00 PM

Instructions: 1) Questions no. 1 & 2 are compulsory.
2) Attempt any Three Question from Q No.3 to Q No.7
3) Figures to the right indicate full marks.

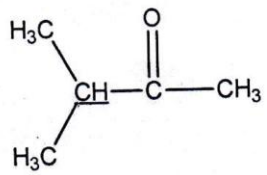
Q.1 A) Choose correct alternative. (MCQ) **10**

1) Due to hydrogen bonding the IR absorption band becomes _____.
a) sharp b) weak
c) broad d) shoulder

2) ^{12}C, ^{13}C and ^{16}O have nuclear spin equal to _____ respectively.
a) 0, ½ , 1 b) 0, 1, 0
c) 0, ½ , 0 d) 1, 0, ½

3) In NMR, chemical shift value is expressed in _____.
a) ppm b) Hz
c) MHz d) KHz

4) The underline proton in the following compound shows a signal in ^{1}H NMR as _____.

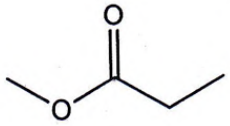


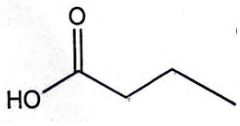
a) triplet b) quartet
c) pentet d) septet

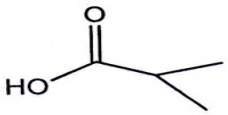
5) In DEPT-45, _____.
a) Carbon bearing at least one proton shows a positive signal
b) Quaternary carbon shows a positive signal
c) Both a) and b)
d) None of these

6) In proton coupled ^{13}C NMR spectra shows a signals as _____.
a) $-CH_3$ shows quartet and $-CH_2$ gives triplet
b) Quaternary carbon does not shows any signal
c) All carbon shows singlet
d) All of these

7) Which of the following compound shows McLafferty rearrangement?

a) 

b) 

c) 

d) All of these

8) In the mass spectrum of Br2, how many peaks will the parent ion contain?

a) 4 b) 3
c) 2 d) 1

9) Karplus equation is for coupling constant of _____.

a) geminal protons b) long range coupling
c) vicinal protons d) all of these

10) Highest intensity peak in mass spectra is called _____.

a) molecular ion peak b) base peak
c) fragment ion peak d) metastable ion peak

B) Fill in the blanks. **06**

1) Vibrational frequency of a band can be calculated by using _____ Law.
2) In Mass spectroscopy the determination of molecular weight can be done by _____ peak.
3) DEPT is _____.
4) In NMR spectroscopy,_____ radiations are used.
5) Degree of unsaturation for compound having formula $C_6H_6O_2$ is _____.
6) In the mass spectrum, the m/e value of molecular ion $C_2H_3O^+$ appear at _____.

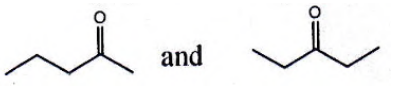
Q.2 Answer the following. **16**

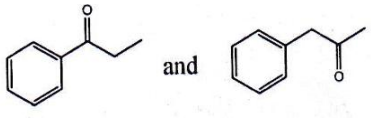
a) What is basic principle of mass spectroscopy? Give its applications.
b) Write a short note on proton coupled ^{13}C NMR spectra.
c) Discuss Nitrogen rule.
d) Discuss the solvent used in NMR spectroscopy in detail.

Q.3 Answer the following. **16**

a) Deduce the structure of organic compound using given spectral data:
Molecular Formula: $C_9H_{12}O$
UV: 241 nm; IR ($\bar{\upsilon}$ in cm^{-1}): 600-700, 1200, 1680, 2900.
^1H NMR (200 MHz; $CDCl_3$, δ in ppm): 1.0 (t, 9 mm), 1.7 (sextet, 6 mm), 3.0 (t, 6 mm), 7.5 (m, 9 mm), 8.0 (m, 6 mm);
MASS: m/z = 77, 105 (base peak, 100%), 120, 136.

b) Differentiate following pair compounds:

i)  (by ^{13}C NMR)

ii)  (by Mass spectrometry)

Q.4 Answer the following. **16**

a) Discuss the HETCOR spectra of n-butanoic acid.
b) Discuss magnetic anisotropic and inductive effects in ^1H NMR.

Q.5 Answer the following. **16**

a) Discuss DEPT with suitable example.
b) Discuss McLafferty rearrangement with suitable examples.

Q.6 Answer the following. **16**

a) A compound having M.F. $C_6H_{12}O_2$ gave spectral data as follows:
UV: λ_{max} 283 nm ($\varepsilon = 27$)
IR: 3300, 1705 cm^{-1}
^1H NMR: δ 1.25 ppm, s, 6H; δ 2.7 ppm, s, 2H; δ 3.7 ppm, bs, exchange with $D_2$0,1H.
M.S. show's significant ions at m/z 99, 84, 58 and 43.
Deduce the structure.

b) A compound of M.F. $C_{10}H_{14}O$ gave the following signal in its ^1H NMR spectra:
δ 1.25 ppm (s, 9H)
δ 5.20 ppm (bs, exchange with D_2O, 1H)
δ 6.82 ppm (d, J= 8Hz, 2H)
δ 7.25 ppm (d, J= 8Hz, 2H)
Deduce the structure.

Q.7 Answer the following. **16**

a) Discuss Spin-Spin splitting in ^1H NMR with suitable example.
b) Discuss the fragmentations in:
i) straight chain hydrocarbon.
ii) alky1 ary1 hydrocarbon.