

**NALANDA OPEN UNIVERSITY**  
**M.Sc. Chemistry, Part-I**  
**PAPER-I**

(Physical Chemistry)  
Annual Examination, 2023

Time : 3 Hours.

Full Marks : 80

*Answer any FIVE Questions.*  
*All questions carry equal marks.*

- (a) What is Half wave potential ? What are its significance ?  
(b) How is Half wave potential denoted by ?
- What are postulates of Lindermann's theory of unimolecular reaction ? Derive mathematical formula for Lindermann's reaction ?
- What is polymer ? Differentiate between additive polymer and condensation polymer ? Explain giving examples for each. What are the five types of polymers ?
- What is ionic activity ? What do you mean by term ionic strength ? Discuss the activity coefficient of ionic strength.
- What are macromolecules and explain the mechanism of polymerization ? Describe light scattering method of determination of molecular mass of polymer.
- What do you understand by the term over potential ? Write notes on :—
  - Oxygen overvoltage, and
  - Hydrogen overvoltage.
- (a) What is entropy and explain that entropy is a state function.  
(b) Explain the relation between the chemical potential and composition.
- Write notes on any **Two** of the following :—
  - Flash Photolysis
  - Polarography
  - Laplace Equation
- Explain the following :—
  - An ensemble and types of ensembles.
  - Lagrange's method of undetermined multipliers.
- Express the term molecular interpretation of second law and third law of thermodynamics. Give atleast one example in each case.

\* \* \*

**EXAMINATION PROGRAMME-2023**  
**M.Sc. Chemistry, Part-I**

Date	Papers	Time	Examination Centre
04.07.2023	Paper-I	2.30 PM to 5.30 PM	Nalanda Open University, 2 <sup>nd</sup> Floor, Biscomaun Bhawan, Patna
06.07.2023	Paper-II	2.30 PM to 5.30 PM	Nalanda Open University, 2 <sup>nd</sup> Floor, Biscomaun Bhawan, Patna
08.07.2023	Paper-III	2.30 PM to 5.30 PM	Nalanda Open University, 2 <sup>nd</sup> Floor, Biscomaun Bhawan, Patna
11.07.2023	Paper-IV	2.30 PM to 5.30 PM	Nalanda Open University, 2 <sup>nd</sup> Floor, Biscomaun Bhawan, Patna
13.07.2023	Paper-V	2.30 PM to 5.30 PM	Nalanda Open University, 2 <sup>nd</sup> Floor, Biscomaun Bhawan, Patna
15.07.2023	Paper-VI	2.30 PM to 5.30 PM	Nalanda Open University, 2 <sup>nd</sup> Floor, Biscomaun Bhawan, Patna
18.07.2023	Paper-VII	2.30 PM to 5.30 PM	Nalanda Open University, 2 <sup>nd</sup> Floor, Biscomaun Bhawan, Patna
20.07.2023	Paper-VIII	2.30 PM to 5.30 PM	Nalanda Open University, 2 <sup>nd</sup> Floor, Biscomaun Bhawan, Patna

# NALANDA OPEN UNIVERSITY

## M.Sc. Chemistry, Part-I

### PAPER-II

(Inorganic Chemistry)

Annual Examination, 2023

Time : 3 Hours.

Full Marks : 80

Answer any FIVE Questions.  
All questions carry equal marks.

- (a) What are Lanthanides ? Write electronic configuration of all 14 lanthanides elements.  
(b) Explain Lanthanide contraction and its consequences.
- What are Boranes ? How they are classified ? Describe structure and bonding in  $B_2H_6$  and also explain banana bond ?
- Determine the ground state term symbol and Free Ion Term for  $d^2$ ,  $d^5$ ,  $d^9$  and  $d^7$  system. Describe also their no. of microstates.
- Construct the character table for the point group  $C_{2v}$  and  $C_{3v}$ .
- Draw molecular orbital diagram of  $NO_2$ ,  $CO_2$  and  $CH_2$  molecule. Explain their configuration bond order, stability and magnetic property.
- (a) Describe the shell-model and liquid drop model of a nucleus.  
(b) Write a note on G-M counter.
- Describe the ways in which Actinides resemble with Lanthanides ? Give an account of the Chemistry of Neptunium and Plutonium. How are Neptunium and Plutonium are Synthesized.
- Explain the following :—  
(a) Nuclear reaction and their types ? (b) Nuclear fission and manufacturing of Atom bomb.
- Write notes on any **Two** of the following :—  
(a) Radio Carbon dating (b) Paramagnetic behaviour of Lanthanide (c) Dirty bomb
- What is Scintillation ? Describe the Scintillation Counter operation to detect radiation caused due to radio active substances. What are its advantages over Geigler-Muller Counter.

\* \* \*

### M.Sc. Chemistry, Part-I Programme for Practical Counselling Classes and Practical Examination, 2023 Venue : Chemistry Lab, 4<sup>th</sup> Floor, Biscomaun Bhawan, Patna

For Enrollment No. : 200250001 to 200251300 and 210250001 to 210250600

Counselling Class Programme		Practical Examination Programme		
Date	Time	Paper	Date	Time
21.07.2023	11.00 AM to 5.00 PM	I	22.07.2023	11:00 AM to 2:00 PM
		II	22.07.2023	2:30 PM to 5:30 PM
		III	24.07.2023	11:00 AM to 2:00 PM
		V	24.07.2023	2:30 PM to 5:30 PM

For Enrollment No. 220250001 to 220250150

Counselling Class Programme		Practical Examination Programme		
Date	Time	Paper	Date	Time
25.07.2023	11.00 AM to 5.00 PM	I	26.07.2023	11:00 AM to 2:00 PM
		II	26.07.2023	2:30 PM to 5:30 PM
		III	27.07.2023	11:00 AM to 2:00 PM
		V	27.07.2023	2:30 PM to 5:30 PM

For Enrollment No. : 220250151 to 220250320

Counselling Class Programme		Practical Examination Programme		
Date	Time	Paper	Date	Time
28.07.2023	11.00 AM to 5.00 PM	I	31.07.2023	11:00 AM to 2:00 PM
		II	31.07.2023	2:30 PM to 5:30 PM
		III	01.08.2023	11:00 AM to 2:00 PM
		V	01.08.2023	2:30 PM to 5:30 PM

For Enrollment No. : 220250321 to 220250430

Counselling Class Programme		Practical Examination Programme		
Date	Time	Paper	Date	Time
02.08.2023	11.00 AM to 5.00 PM	I	03.08.2023	11:00 AM to 2:00 PM
		II	03.08.2023	2:30 PM to 5:30 PM
		III	04.08.2023	11:00 AM to 2:00 PM
		V	04.08.2023	2:30 PM to 5:30 PM

For Enrollment No. : 220250431 to 220250600

Counselling Class Programme		Practical Examination Programme		
Date	Time	Paper	Date	Time
05.08.2023	11.00 AM to 5.00 PM	I	07.08.2023	11:00 AM to 2:00 PM
		II	07.08.2023	2:30 PM to 5:30 PM
		III	08.08.2023	11:00 AM to 2:00 PM
		V	08.08.2023	2:30 PM to 5:30 PM

**NALANDA OPEN UNIVERSITY**  
**M.Sc. Chemistry, Part-I**  
**PAPER-III (Organic Chemistry)**  
*Annual Examination, 2023*

**Time : 3 Hours.**

**Full Marks : 80**

*Answer any FIVE Questions. All questions carry equal marks.*

- Write in detail notes with mechanism of any **Two** of the following :-  
 (a) Perkin reaction. (b) Benzoin condensation. (c) Mannic reaction
- Explain any **Two** term of the following :-  
 (a) Tautomerism. (b) Conjugation. (c) Reflection symmetry.
- (a) Explain with mechanism that electrophilic substitution occurs more easily in Toluene than in benzene.  
 (b) Which of the following compound show aromaticity :-  
 (i) Benzene (ii) Cyclopentadiene (iii) Pyrrole.
- Explain the conformation of Dimethyl Cyclohexane.
- What are Carbenes ? How are they generated ? Give the important reactions of Carbenes.
- What do you mean by aromatic nucleophilic substitution reaction ? Explain unimolecular Nucleophilic aromatic substitution reaction.
- Explain any **Two** of the following :-  
 (a) Hyper Conjugation.  
 (b) Sandmeyer reaction.  
 (c) Element of symmetry.
- (a) Explain why aniline is more reactive than acetanilide in electrophilic substitution reaction ?  
 (b) Chlorobenzene is far less reactive than aniline in electrophilic substitution although chlorine and nitrogen have almost the same electronegativity. Explain.
- Explain the following :-  
 (a) -NH<sub>2</sub> group is ortho and para directing group. (b) -NO<sub>2</sub> group is meta-directing group.  
 (c) Halogens are ortho and para directing group.
- Discuss the following of any **Two** :-  
 (a) Hammond Postulate. (b) Free Radical rearrangement. (c) Aldol condensation

\* \* \*

**M.Sc. Chemistry, Part-I**  
**Programme for Practical Counselling Classes and Practical Examination, 2023**  
**Venue : Chemistry Lab, 4<sup>th</sup> Floor, Biscomaun Bhawan, Patna**

*For Enrollment No. : 200250001 to 200251300 and 210250001 to 210250600*

Counselling Class Programme		Practical Examination Programme		
Date	Time	Paper	Date	Time
21.07.2023	11.00 AM to 5.00 PM	I	22.07.2023	11:00 AM to 2:00 PM
		II	22.07.2023	2:30 PM to 5:30 PM
		III	24.07.2023	11:00 AM to 2:00 PM
		V	24.07.2023	2:30 PM to 5:30 PM

*For Enrollment No. 220250001 to 220250150*

Counselling Class Programme		Practical Examination Programme		
Date	Time	Paper	Date	Time
25.07.2023	11.00 AM to 5.00 PM	I	26.07.2023	11:00 AM to 2:00 PM
		II	26.07.2023	2:30 PM to 5:30 PM
		III	27.07.2023	11:00 AM to 2:00 PM
		V	27.07.2023	2:30 PM to 5:30 PM

*For Enrollment No. : 220250151 to 220250320*

Counselling Class Programme		Practical Examination Programme		
Date	Time	Paper	Date	Time
28.07.2023	11.00 AM to 5.00 PM	I	31.07.2023	11:00 AM to 2:00 PM
		II	31.07.2023	2:30 PM to 5:30 PM
		III	01.08.2023	11:00 AM to 2:00 PM
		V	01.08.2023	2:30 PM to 5:30 PM

*For Enrollment No. : 220250321 to 220250430*

Counselling Class Programme		Practical Examination Programme		
Date	Time	Paper	Date	Time
02.08.2023	11.00 AM to 5.00 PM	I	03.08.2023	11:00 AM to 2:00 PM
		II	03.08.2023	2:30 PM to 5:30 PM
		III	04.08.2023	11:00 AM to 2:00 PM
		V	04.08.2023	2:30 PM to 5:30 PM

*For Enrollment No. : 220250431 to 220250600*

Counselling Class Programme		Practical Examination Programme		
Date	Time	Paper	Date	Time
05.08.2023	11.00 AM to 5.00 PM	I	07.08.2023	11:00 AM to 2:00 PM
		II	07.08.2023	2:30 PM to 5:30 PM
		III	08.08.2023	11:00 AM to 2:00 PM
		V	08.08.2023	2:30 PM to 5:30 PM

**NALANDA OPEN UNIVERSITY**  
**M.Sc. Chemistry, Part-I**  
**PAPER-IV (Solid State Chemistry & Quantum Chemistry)**  
**Annual Examination, 2023**

**Time : 3 Hours.**

**Full Marks : 80**

*Answer any FIVE Questions. All questions carry equal marks.*

- What are perfect and imperfect crystals ? Write notes on the cohesive energy.
- Discuss solid state defect with special reference to :— (a) Schottky defect (b) Frenkel defect
- Derive the Schrödinger wave equation with respect to space. Derive the equation also for H-atom.
- (a) Discuss the postulates of Quantum mechanics.  
(b) What is Eigen function and Eigen value ?
- What is maximum electron density in H-atom in the 1s, 2s and 2p orbitals ?
- Explain the following terms :—  
(a) Non-conductor and Semi-conductor (b) Super conductor  
(c) Pauli Exclusion Principle
- Explain any **Two** of the following :—  
(a) Operators. (b) Hund's Rule of maximum spin multiplicity  
(c) Zero-point Energy
- Calculate the average distance of the electron from nucleus of Hydrogen atom in the 2s configuration.
- Determine the term symbol and no. of microstates of following configuration :—  
(a)  $d^2$  system (b)  $d^5$  system (c)  $p^2$  system (d)  $d^9$  system
- Write notes on any **Two** of the following :—  
(a) Basic assumption of the Hückel theory of conjugated system  
(b) Angular momentum operators (c) Intrinsic and extrinsic semiconductor

\* \* \*

**M.Sc. Chemistry, Part-I**  
**Programme for Practical Counselling Classes and Practical Examination, 2023**  
**Venue : Chemistry Lab, 4<sup>th</sup> Floor, Biscomaun Bhawan, Patna**

**For Enrollment No. : 200250001 to 200251300 and 210250001 to 210250600**

Counselling Class Programme		Practical Examination Programme		
Date	Time	Paper	Date	Time
21.07.2023	11.00 AM to 5.00 PM	I	22.07.2023	11:00 AM to 2:00 PM
		II	22.07.2023	2:30 PM to 5:30 PM
		III	24.07.2023	11:00 AM to 2:00 PM
		V	24.07.2023	2:30 PM to 5:30 PM

**For Enrollment No. 220250001 to 220250150**

Counselling Class Programme		Practical Examination Programme		
Date	Time	Paper	Date	Time
25.07.2023	11.00 AM to 5.00 PM	I	26.07.2023	11:00 AM to 2:00 PM
		II	26.07.2023	2:30 PM to 5:30 PM
		III	27.07.2023	11:00 AM to 2:00 PM
		V	27.07.2023	2:30 PM to 5:30 PM

**For Enrollment No. : 220250151 to 220250320**

Counselling Class Programme		Practical Examination Programme		
Date	Time	Paper	Date	Time
28.07.2023	11.00 AM to 5.00 PM	I	31.07.2023	11:00 AM to 2:00 PM
		II	31.07.2023	2:30 PM to 5:30 PM
		III	01.08.2023	11:00 AM to 2:00 PM
		V	01.08.2023	2:30 PM to 5:30 PM

**For Enrollment No. : 220250321 to 220250430**

Counselling Class Programme		Practical Examination Programme		
Date	Time	Paper	Date	Time
02.08.2023	11.00 AM to 5.00 PM	I	03.08.2023	11:00 AM to 2:00 PM
		II	03.08.2023	2:30 PM to 5:30 PM
		III	04.08.2023	11:00 AM to 2:00 PM
		V	04.08.2023	2:30 PM to 5:30 PM

**For Enrollment No. : 220250431 to 220250600**

Counselling Class Programme		Practical Examination Programme		
Date	Time	Paper	Date	Time
05.08.2023	11.00 AM to 5.00 PM	I	07.08.2023	11:00 AM to 2:00 PM
		II	07.08.2023	2:30 PM to 5:30 PM
		III	08.08.2023	11:00 AM to 2:00 PM
		V	08.08.2023	2:30 PM to 5:30 PM

**NALANDA OPEN UNIVERSITY**  
**M.Sc. Chemistry, Part-I**  
**PAPER-V (Co-ordination Chemistry)**  
**Annual Examination, 2023**

**Time : 3 Hours.**

**Full Marks : 80**

*Answer any FIVE Questions. All questions carry equal marks.*

- Determine CFSE value for  $d^4$ ,  $d^6$ ,  $d^9$  and  $d^{10}$  configuration with d-orbital occupancy diagrams.
- Explain any **Two** of the following :—  
 (a) Limitation of Crystal Field Theory. (b) John-Teller Effect. (c) Labile and inert complex.
- Draw the Molecular Orbital diagram of  $[Co(CN)_6]^{-3}$ .
- What is Trans-effect ? Explain the theory of Trans-effect.
- S and P terms do not split in crystal field but D and F term split. Explain.
- Discuss the reaction mechanism of substitution reaction in octahedral complex along with the factors that causes complication.
- Write notes on any **Two** of the following :—  
 (a) Quenching of Orbitals (b) Acid Hydrolysis reaction.  
 (c) Determination of stability constant
- Calculate free ion terms, ground state term and no. of microstates of following configuration :—  
 $Ti^{+3}$ ,  $Cr^+$ ,  $Fe^{+2}$ ,  $Sc^{+2}$
- Explain the multiplet width. Explain the population of J level in context to KT.
- (a) Explain magnetic moment and magnetic susceptibility and establish relationship between them.  
 (b) What are the factors which determine the crystal field stabilization energy ? Justify the order  $\Delta_{sp} > \Delta_0 > \Delta_t$ .

\* \* \*

**M.Sc. Chemistry, Part-I**  
**Programme for Practical Counselling Classes and Practical Examination, 2023**  
**Venue : Chemistry Lab, 4<sup>th</sup> Floor, Biscomaun Bhawan, Patna**

**For Enrollment No. : 200250001 to 200251300 and 210250001 to 210250600**

Counselling Class Programme		Practical Examination Programme		
Date	Time	Paper	Date	Time
21.07.2023	11.00 AM to 5.00 PM	I	22.07.2023	11:00 AM to 2:00 PM
		II	22.07.2023	2:30 PM to 5:30 PM
		III	24.07.2023	11:00 AM to 2:00 PM
		V	24.07.2023	2:30 PM to 5:30 PM

**For Enrollment No. 220250001 to 220250150**

Counselling Class Programme		Practical Examination Programme		
Date	Time	Paper	Date	Time
25.07.2023	11.00 AM to 5.00 PM	I	26.07.2023	11:00 AM to 2:00 PM
		II	26.07.2023	2:30 PM to 5:30 PM
		III	27.07.2023	11:00 AM to 2:00 PM
		V	27.07.2023	2:30 PM to 5:30 PM

**For Enrollment No. : 220250151 to 220250320**

Counselling Class Programme		Practical Examination Programme		
Date	Time	Paper	Date	Time
28.07.2023	11.00 AM to 5.00 PM	I	31.07.2023	11:00 AM to 2:00 PM
		II	31.07.2023	2:30 PM to 5:30 PM
		III	01.08.2023	11:00 AM to 2:00 PM
		V	01.08.2023	2:30 PM to 5:30 PM

**For Enrollment No. : 220250321 to 220250430**

Counselling Class Programme		Practical Examination Programme		
Date	Time	Paper	Date	Time
02.08.2023	11.00 AM to 5.00 PM	I	03.08.2023	11:00 AM to 2:00 PM
		II	03.08.2023	2:30 PM to 5:30 PM
		III	04.08.2023	11:00 AM to 2:00 PM
		V	04.08.2023	2:30 PM to 5:30 PM

**For Enrollment No. : 220250431 to 220250600**

Counselling Class Programme		Practical Examination Programme		
Date	Time	Paper	Date	Time
05.08.2023	11.00 AM to 5.00 PM	I	07.08.2023	11:00 AM to 2:00 PM
		II	07.08.2023	2:30 PM to 5:30 PM
		III	08.08.2023	11:00 AM to 2:00 PM
		V	08.08.2023	2:30 PM to 5:30 PM

**NALANDA OPEN UNIVERSITY**  
**M.Sc. Chemistry, Part-I**  
**PAPER-VI (Chemistry of Biomolecule)**  
**Annual Examination, 2023**

**Time : 3 Hours.**

**Full Marks : 80**

*Answer any FIVE Questions. All questions carry equal marks.*

1. How you will establish the Primary, Secondary and Tertiary structure of protein ?
2. Discuss the degradative and synthetic evidences leading to the structure of nicotine.
3. Name the important lipids. Write details about biological functions of lipids and its metabolism.
4. What are the classification of carbohydrates ? Explain the structure of D-glucose.
5. Name the products of the reaction of D-glucose with the following reagents :—  
(a)  $NH_2OH$       (b)  $C_6H_5NHNH_2$       (c)  $Br_2 / H_2O$       (d)  $CH_3OH / HCl$       (e)  $CH_3I / Ag_2O$
6. How you will carry the following conversions :—  
(a) Glucose to Fructose      (b) Fructose to Glucose      (c) Citral to Cyclocitral
7. Write notes on any **Two** of the following :—  
(a) Inversion of Sucrose      (b) Peptides linkage      (c) Morphine
8. Write down the structure and synthesis of any **Two** of the following :—  
(a) Adenine      (b) Guanine      (c) Uracil
9. Discuss the structure of DNA. In what ways the structure of DNA differs from that of RNA ?
10. What are aminoacids ? Discuss the chemical reaction of aminoacids involving the both functional groups present in the molecule.

\* \* \*

**परीक्षाफल प्रकाशन से सम्बन्धित आवश्यक सूचना**

सम्बन्धित सभी विद्यार्थियों को सूचित किया जाता कि वे अपने विषय के रिजल्ट से सम्बन्धित जानकारी हेतु समय-समय पर (time to time) विश्वविद्यालय के वेबसाईट ([www.nou.ac.in](http://www.nou.ac.in)) का संदर्भ करेंगे ।

- परीक्षाफल प्रकाशित हो जाने के उपरान्त सभी विद्यार्थियों का **e-marksheet** उनके **Student Login** पर मौजूद रहेगा, जिसे वे नालन्दा खुला विश्वविद्यालय में किसी प्रयोजनार्थ व्यवहार में ला सकते हैं ।
- परीक्षा में उत्तीर्ण विद्यार्थी अपने **Student Login** से निर्धारित तिथियों (जो कि रिजल्ट नोटिस पर मौजूद रहेगा) के अन्तर्गत अगले सत्र में **Online Admission** लेना सुनिश्चित करेंगे ।

• • •

**NALANDA OPEN UNIVERSITY**  
**M.Sc. Chemistry, Part-I**  
**PAPER–VII (Reaction Mechanism and Supra Molecular Chemistry)**  
**Annual Examination, 2023**

**Time : 3 Hours.**

**Full Marks : 80**

*Answer any FIVE Questions. All questions carry equal marks.*

1. How are supramolecular catalysts similar to enzyme catalyst ? What are differences between them ?
2. Explain the Free-ion ground state terms of  $d^2$ ,  $d^7$ ,  $d^9$  and  $d^4$  configuration and also determine the no of microstates of those ion.
3. Define photo substitution and explain with suitable example. Explain photo oxidation and photo reduction theory.
4. Give two general methods of preparation of metal alkoxide. Draw the structure of dimeric and transmeric alkoxides.
5. Explain the isomerisation of octahedral complexes and intermolecular rearrangement.
6. Mention substitution reaction which undergoes without Cleavage of metal-ligand bond. Give mechanism with examples.
7. Write special features of anionic bonding. Write the synthesis of crown ether.
8. Write short notes on any **Two** of the following :—  
(a) Excited electron transfer      (b) Reaction of 2,2' bipyridines      (c) Optical inversion
9. Explain the following :—  
(a) Bailar Twist Mechanism.      (b) Marcus-Husch Theory
10. (a) What are non-complimentary reaction  
(b) Describe inner and outer sphere mechanism of electron transfer reaction in complexes. Give examples.

\* \* \*

**परीक्षाफल प्रकाशन से सम्बन्धित आवश्यक सूचना**

सम्बन्धित सभी विद्यार्थियों को सूचित किया जाता कि वे अपने विषय के रिजल्ट से सम्बन्धित जानकारी हेतु समय-समय पर (time to time) विश्वविद्यालय के वेबसाईट ([www.nou.ac.in](http://www.nou.ac.in)) का संदर्भ करेंगे ।

- परीक्षाफल प्रकाशित हो जाने के उपरान्त सभी विद्यार्थियों का **e-marksheet** उनके **Student Login** पर मौजूद रहेगा, जिसे वे नालन्दा खुला विश्वविद्यालय में किसी प्रयोजनार्थ व्यवहार में ला सकते हैं ।
- परीक्षा में उत्तीर्ण विद्यार्थी अपने **Student Login** से निर्धारित तिथियों (जो कि रिजल्ट नोटिस पर मौजूद रहेगा) के अन्तर्गत अगले सत्र में **Online Admission** लेना सुनिश्चित करेंगे ।

• • •

**NALANDA OPEN UNIVERSITY**  
**M.Sc. Chemistry, Part-I**  
**PAPER-VIII**  
(Natural Product)  
*Annual Examination, 2023*

**Time : 3 Hours.**

**Full Marks : 80**

*Answer any FIVE Questions. All questions carry equal marks.*

1. Discuss the structure of Vitamin C and discuss its synthesis.
2. What are Terpenoids ? How are they classified ? Establish the structure of Phytol.
3. Establish the structure of Vitamin  $B_{12}$ . Give the synthesis of Vitamin  $B_{12}$ .
4. Discuss the structure of abietic acid and conformed by synthetic method.
5. Write notes on any **Two** of the following :—  
(a) Santonin                      (b) Structure of Eestron                      (c) Synthesis of Chlorophyll-a
6. (a) Establish the structure of Vitamin  $B_6$   
(b) Discuss the position of the two angular methyl group in cholesterol.
7. Discuss the biosynthesis of isoflavones.
8. What are Hormones ? Draw the structure of cholesterol, cholestanol and cholestanone.
9. What is Opianic acid? Establish the structure of Opianic acid.
10. What are porphyrins ? Write the degravative and synthetic evidence for the determination of structure of Haemin.

\* \* \*

**परीक्षाफल प्रकाशन से सम्बन्धित आवश्यक सूचना**

सम्बन्धित सभी विद्यार्थियों को सूचित किया जाता कि वे अपने विषय के रिजल्ट से सम्बन्धित जानकारी हेतु समय-समय पर (time to time) विश्वविद्यालय के वेबसाईट ([www.nou.ac.in](http://www.nou.ac.in)) का संदर्भ करेंगे ।

- परीक्षाफल प्रकाशित हो जाने के उपरान्त सभी विद्यार्थियों का e-marksheet उनके Student Login पर मौजूद रहेगा, जिसे वे नालन्दा खुला विश्वविद्यालय में किसी प्रयोजनार्थ व्यवहार में ला सकते हैं ।
- परीक्षा में उत्तीर्ण विद्यार्थी अपने Student Login से निर्धारित तिथियों (जो कि रिजल्ट नोटिस पर मौजूद रहेगा) के अन्तर्गत अगले सत्र में Online Admission लेना सुनिश्चित करेंगे ।

• • •



# NALANDA OPEN UNIVERSITY

## M.Sc. Chemistry, Part-II

### PAPER-IX

(Spectroscopy)

Annual Examination, 2023

Time : 3 Hours.

Full Marks : 80

Answer any FIVE Questions. All questions carry equal marks.

- What are the application of ESR in the study of organic and inorganic radicals ?
  - Which electromagnetic radiation is used in ESR ?
- What are meant by chemical shift in *NMR* spectroscopy ? Describe the factors affecting chemical shift.
  - What are the formula of chemical shift and what increases chemical shift ?
- Explain the following :—
  - Stark effect.
  - Hyperfine structure in ESR spectra.
- Distinguish between pure rotational spectrum and vibration rotation spectrum of molecule. How are they different from electronic spectrum ?
  - Which type of molecule give pure rotational spectra ?
- Explain the Zero-field splitting in ESR Spectroscopy. What causes zero field splitting ?
- Determine the ground state term and no. of microstates of following :—
  - $\text{Fe}^{+3}$
  - $\text{Ni}^{++}$
  - $\text{Cu}^{++}$
  - $\text{Ti}^{++}$
- State and explain the Franck-Condon principle. How is Franck-Condon principle helpful in predicting the relative intensities of vibronic transition ?
  - What is bond length and how it is calculated ? How is bond length related to bond order ?
- Explain the following :—
  - Red and Blue shift.
  - Nuclear ion peak and metastable peak.
  - Pascal Triangle and its significance.
- Explain the following :—
  - Basic principle of TMS.
  - Why TMS is used as a reference compound in NMR spectroscopy.
  - Which of the following are microwave active ?
    - HCl
    - $\text{CO}_2$
    - $\text{H}_2$
    - $\text{O}_2$
    - HF
  - Which of the following nuclei do not show nuclear magnetic resonance :—  
 $^1\text{H}$ ,  $^{12}\text{C}$ ,  $^{14}\text{N}$ ,  $^{16}\text{O}$ ,  $^{19}\text{F}$  and  $^4\text{He}$ .
- Write notes on any **Two** of the following :—
  - Beer Lambert Law.
  - Solution rule in I-R spectroscopy.
  - Steric effect in biphenyls.

\* \* \*

### EXAMINATION PROGRAMME-2023

#### M.Sc. Chemistry, Part-II

Date	Papers	Time	Examination Centre
30.09.2023	Paper-IX	2.30 PM to 5.30 PM	Nalanda Open University, 2 <sup>nd</sup> Floor, Biscomaun Bhawan, Patna
04.10.2023	Paper-X	2.30 PM to 5.30 PM	Nalanda Open University, 2 <sup>nd</sup> Floor, Biscomaun Bhawan, Patna
06.10.2023	Paper-XI	2.30 PM to 5.30 PM	Nalanda Open University, 2 <sup>nd</sup> Floor, Biscomaun Bhawan, Patna
09.10.2023	Paper-XII	2.30 PM to 5.30 PM	Nalanda Open University, 2 <sup>nd</sup> Floor, Biscomaun Bhawan, Patna
12.10.2023	Paper-XIII	2.30 PM to 5.30 PM	Nalanda Open University, 2 <sup>nd</sup> Floor, Biscomaun Bhawan, Patna
14.10.2023	Paper-XIV	2.30 PM to 5.30 PM	Nalanda Open University, 2 <sup>nd</sup> Floor, Biscomaun Bhawan, Patna
17.10.2023	Paper-XV	2.30 PM to 5.30 PM	Nalanda Open University, 2 <sup>nd</sup> Floor, Biscomaun Bhawan, Patna
19.10.2023	Paper-XVI	2.30 PM to 5.30 PM	Nalanda Open University, 2 <sup>nd</sup> Floor, Biscomaun Bhawan, Patna

NALANDA OPEN UNIVERSITY

M.Sc. Chemistry, Part-II  
PAPER-X

(Advance Chemical Dynamics)

Annual Examination, 2023

Time : 3 Hours.

Full Marks : 80

Answer any FIVE Questions.  
All questions carry equal marks.

1. What is Faradaic and non-Faradaic process ? Explain stoichiometric number and transfer co-efficients ?
2. Explain the Kinetic of reaction in liquid and gas phase. What is diffusion controlled reaction ?
3. Explain Corrosion ? Describe the theories of Corrosion. Discuss the various factors which influence the corrosion.
4. Answer the following :—
  - (a) General Mechanism of Catalytic Reaction.
  - (b) Bronsted Catalysis Reaction and Oscillatory reaction.
5. Write notes on any **Two** of the following :—
  - (a) Laser Flash photolysis
  - (b) Primary and secondary salt effect
  - (c) Theory of acid. base catalyst
6. Discuss the NMR method for study of fast reaction ?
7. Describe the postulates of the Transition state theory ? Compare between the collision and the transition state theory ?
8. Explain the following :—
  - (a) Photo dissociation and recombination reaction.
  - (b) Activation controlled reaction
9. Discuss the effect of ionic strength and dielectric constant of the medium on the rate constant of the reaction.
10. Explain the following :—
  - (a) Ground state terms and no. of microstates of  $d^8 d^5$  configuration.
  - (b) Stoichiometric Number
  - (c) Van't Hoff intermediates

\* \* \*

**NALANDA OPEN UNIVERSITY**  
**M.Sc. Chemistry, Part-II**  
**PAPER–XI**  
(Molecular Thermodynamics)  
*Annual Examination, 2023*

**Time : 3 Hours.**

**Full Marks : 80**

*Answer any FIVE Questions. All questions carry equal marks.*

- Explain the following of any two :—  
(a) Bose-Einstein distribution (b) Fermi-Dirac distribution (c) Specific heat of solids
- Explain statistical interpretation of entropy and heat capacity of gases ?
- Describe the Liouville's theorem and its mathematical interpretation. Why Liouville's theorem is important ?
- What do you mean by entropy production ? Derive the expression for the rate of entropy production resulting from heat of mass flow in the system.
- Explain the following :—  
(a) Micro-canonical ensembles. (b) Canonical and grand canonical ensembles  
(c) Nuclear partition function
- State and derive the Bose-Einstein statistics.
- Write notes on any **Two** of the following :—  
(a) Entropy of ortho and para hydrogen and their ratio.  
(b) Electronic partition function.  
(c) Thermodynamic Reversibility.
- Explain the following :—  
(a) Dulong and Petit's law  
(b) Comparison of various ensembles.  
(c) Vibrational partition function
- What is Onsager reciprocal relation ? What is basic of this relationship ? Discuss the unity of these relations in couples flow system.
- Explain the following :—  
(a) Rotational Partition function  
(b) Translational partition function.  
(c) Chandrayan-III and Moon orbit

\* \* \*

**M.Sc. Chemistry, Part–II**  
**Programme for Practical Counselling Classes and Practical Examination, 2023**  
**Venue : Chemistry Lab, 4<sup>th</sup> Floor, Biscomaun Bhawan, Patna**

***For Enrollment No. 180250001 to 180250100 & 190250001 to 190250900 & 200250001 TO 200251300 & 210250001 to 210250100***

<b>Counselling Class Programme</b>		<b>Practical Examination Programme</b>		
<b>Date</b>	<b>Time</b>	<b>Paper</b>	<b>Date</b>	<b>Time</b>
20.10.2023	11.00 AM to 5.30 PM	XII	26.10.2023	11:30 AM to 2:30 PM
		XIII	26.10.2023	2:45 PM to 5:45 PM
		XV	27.10.2023	11:30 AM to 2:30 PM
		XVI	27.10.2023	2:45 PM to 5:45 PM

***For Enrollment No. 210250101 to 210250700***

<b>Counselling Class Programme</b>		<b>Practical Examination Programme</b>		
<b>Date</b>	<b>Time</b>	<b>Paper</b>	<b>Date</b>	<b>Time</b>
28.10.2023	11.00 AM to 5.30 PM	XII	30.10.2023	11:30 AM to 2:30 PM
		XIII	30.10.2023	2:45 PM to 5:45 PM
		XV	31.10.2023	11:30 AM to 2:30 PM
		XVI	31.10.2023	2:45 PM to 5:45 PM

# NALANDA OPEN UNIVERSITY

## M.Sc. Chemistry, Part-II

### PAPER–XII

(Ligand Field Theory)

*Annual Examination, 2023*

**Time : 3 Hours.**

**Full Marks : 80**

*Answer any FIVE Questions. All questions carry equal marks.*

1. Derive the free ion term, state term and no. of microstates of following configuration :  
 $Fe^{+2}$ ,  $Cu^{+2}$ ,  $Ni^{+2}$ ,  $Ti^{+2}$
2. Explain the application of E.S.R. Spectroscopy in study of Inorganic Chemistry.
3. (a) How does the term  $^4F$  split by spin orbit coupling.  
(b) What is vibronic coupling.
4. Explain the application of IR spectroscopy in metal carbonyl and nitrosyl.
5. Explain the following :—  
(a) Racah Parameters  
(b) Non-crossing Rule  
(c) Hund's Rule of maximum spin multiplicity
6. Explain the following :—  
(a) Nephelauxetic Ratio.  
(b) Distinguish between  $NO^+$  and  $NO$  by IR spectroscopy
7. Explain charge transfer Bands and their assignment in both octahedral and tetrahedral field.
8. Explain the following :—  
(a) Condon Shortley Parameters.  
(b) Spin Cross Over Phenomenon.  
(c) High spin and low spin octahedral complex
9. Write short notes on any **Two** of the following :—  
(a) Correlation diagrams for  $d^1$  and  $d^8$  systems.  
(b) Cross Over Points.  
(c) Ground state terms and no. of microstates in  $V^{+3}_{ion}$
10. Explain the application of NMR and ESR spectroscopy to transition metal complex.

\* \* \*

### M.Sc. Chemistry, Part–II

**Programme for Practical Counselling Classes and Practical Examination, 2023**

**Venue : Chemistry Lab, 4<sup>th</sup> Floor, Biscomaun Bhawan, Patna**

***For Enrollment No. 180250001 to 180250100 & 190250001 to 190250900 & 200250001 TO 200251300 & 210250001 to 210250100***

<b>Counselling Class Programme</b>		<b>Practical Examination Programme</b>		
<b>Date</b>	<b>Time</b>	<b>Paper</b>	<b>Date</b>	<b>Time</b>
20.10.2023	11.00 AM to 5.30 PM	XII	26.10.2023	11:30 AM to 2:30 PM
		XIII	26.10.2023	2:45 PM to 5:45 PM
		XV	27.10.2023	11:30 AM to 2:30 PM
		XVI	27.10.2023	2:45 PM to 5:45 PM

***For Enrollment No. 210250101 to 210250700***

<b>Counselling Class Programme</b>		<b>Practical Examination Programme</b>		
<b>Date</b>	<b>Time</b>	<b>Paper</b>	<b>Date</b>	<b>Time</b>
28.10.2023	11.00 AM to 5.30 PM	XII	30.10.2023	11:30 AM to 2:30 PM
		XIII	30.10.2023	2:45 PM to 5:45 PM
		XV	31.10.2023	11:30 AM to 2:30 PM
		XVI	31.10.2023	2:45 PM to 5:45 PM

# NALANDA OPEN UNIVERSITY

## M.Sc. Chemistry, Part-II

### PAPER–XIII

(Organotransition Metal Chemistry and Metal Clusters)

Annual Examination, 2023

Time : 3 Hours.

Full Marks : 80

Answer any FIVE Questions. All questions carry equal marks.

- (a) Write the general method of preparation of metal carbonyl and its properties.  
(b) Explain the structure of Carbonyl ?
- Write the Molecular orbital diagram of NO, NO<sup>+</sup>, CO, CN<sup>-</sup>.
- (a) What is the formula of Zeigler-Natta catalyst.  
(b) How Zeigler-Natta catalyst is prepared.  
(c) What type of polymerisation is Zeigler-Natta catalyst.  
(d) What is coordination polymerisation ? Explain with suitable example.
- (a) What is the concept of organometallic compound ?  
(b) Explain the preparation and structure of zeise's salt ?  
(c) What are the application of Zeise salt ?
- (a) What is a metal cluster ? What is the use of metal cluster ?  
(b) What is the structure of metal cluster compounds ?  
(c) What are types of cluster in inorganic chemistry explain ?
- What is ZSM-5 ? How methanol can be transformed into gasoline using ZSM-5 ?
- Write notes on any Two of the following :-  
(a) Zintl ions. (b) Gasoline of four types. (c) Oxo process
- How you will synthesize the  $\delta$  bonded organo-transition metal compound.
- Explain the following :-  
(a) MO treatment for 3 centres-2 electron Bond formation in  $B_2H_6$  molecule.  
(b) Fischer-Tropsch reaction. (c) What is naked cluster ?
- What is metal nitrosyl ? Explain the structure of nitrosyl ? Explain the EAN for central metal atom in Nitrosyl with the example of  $[Co^{+3}(NO^-)(CN)_5]^{-3}$

\* \* \*

### M.Sc. Chemistry, Part-II

Programme for Practical Counselling Classes and Practical Examination, 2023

Venue : Chemistry Lab, 4<sup>th</sup> Floor, Bismaun Bhawan, Patna

For Enrollment No. 180250001 to 180250100 & 190250001 to 190250900 & 200250001 TO 200251300 & 210250001 to 210250100

Counselling Class Programme		Practical Examination Programme		
Date	Time	Paper	Date	Time
20.10.2023	11.00 AM to 5.30 PM	XII	26.10.2023	11:30 AM to 2:30 PM
		XIII	26.10.2023	2:45 PM to 5:45 PM
		XV	27.10.2023	11:30 AM to 2:30 PM
		XVI	27.10.2023	2:45 PM to 5:45 PM

For Enrollment No. 210250101 to 210250700

Counselling Class Programme		Practical Examination Programme		
Date	Time	Paper	Date	Time
28.10.2023	11.00 AM to 5.30 PM	XII	30.10.2023	11:30 AM to 2:30 PM
		XIII	30.10.2023	2:45 PM to 5:45 PM
		XV	31.10.2023	11:30 AM to 2:30 PM
		XVI	31.10.2023	2:45 PM to 5:45 PM

### आवश्यक सूचना

आपको ज्ञात है कि आपके पाठ्यक्रम की परीक्षा दिनांक 30.09.2023 से संचालित है, जिसमें Paper-IX की परीक्षा दिनांक 30.09.2023 को प्रथम एवं द्वितीय पाली में आयोजित हुयी । आप में से कतिपय परीक्षार्थियों ने विश्वविद्यालय प्रशासन से लिखित रूप में (BPSC Admit Card के साथ) यह अनुरोध किया था कि उक्त दिवस को ही BPSC की परीक्षा बिहार के विभिन्न जिलों में आयोजित है । लिखित रूप में प्राप्त अभ्यावेदन पर सहानुभूतिपूर्वक विचार करते हुये विश्वविद्यालय प्रशासन ने यह निर्णय लिया है कि, दिनांक 30.10.2023 की परीक्षा से वंचित वैसे परीक्षार्थी जिन्होंने अपना BPSC Admit विश्वविद्यालय में जमा कर दिया है, वे दिनांक 18.10.2023 को अपराह्न 2.30 से 5.30 के बीच आयोजित की जाने वाली Paper-IX की परीक्षा में सम्मिलित हो सकते हैं । परीक्षा में सम्मिलित होने के लिए परीक्षार्थियों को 500/- रुपये का बैंक ड्राफ्ट या SBI Collect का चालान या POS की रसीद के साथ उपस्थित होना होगा ।

**NALANDA OPEN UNIVERSITY**  
**M.Sc. Chemistry, Part-II**  
**PAPER-XIV**

(Photochemistry and Pericyclic Reaction)  
*Annual Examination, 2023*

**Time : 3 Hours.**

**Full Marks : 80**

*Answer any FIVE Questions. All questions carry equal marks.*

1. Give mechanism of Norrish Type-I process. How many types of Carbonyl compounds gives this reaction ?
2. Explain Barton reaction. Give its synthetic use and application.
3. What is the endo-rule as applied to Diel-Alder reaction ?
4. Give  $\pi$  molecular diagram of
  - (a) 1, 3 – Pentadiene
  - (b) 1, 3, 5 – Heptatriene
5. Give the photochemistry of intermolecular dimerisation (2+2) cycloaddition.
6. Discuss Zimmerman mechanism for the rearrangement given by 2, 5-dinones.
7. Explain the following :—
  - (a) Franck Condon Principle.
  - (b) Photochemistry of aromatic compounds.
8. Discuss Zimmerman mechanism for the rearrangement given by 2, 5-dinones.
9. Write notes on any **Two** of the following :—
  - (a) Quenching and orbitals
  - (b) Singlet and Triplet State
  - (c) Dimerisation of higher alkenes
10. Explain the following :—
  - (a) What do you mean by pericyclic reaction ? What are the types of pericyclic reaction ?
  - (b) What characteristics a pericyclic reaction ? Give example.

\* \* \*

**M.Sc. Chemistry, Part-II**  
**Programme for Practical Counselling Classes and Practical Examination, 2023**  
**Venue : Chemistry Lab, 4<sup>th</sup> Floor, Biscomaun Bhawan, Patna**

**For Enrollment No. 180250001 to 180250100 & 190250001 to 190250900 & 200250001 TO 200251300 & 210250001 to 210250100**

Counselling Class Programme		Practical Examination Programme		
Date	Time	Paper	Date	Time
20.10.2023	11.00 AM to 5.30 PM	XII	26.10.2023	11:30 AM to 2:30 PM
		XIII	26.10.2023	2:45 PM to 5:45 PM
		XV	27.10.2023	11:30 AM to 2:30 PM
		XVI	27.10.2023	2:45 PM to 5:45 PM

**For Enrollment No. 210250101 to 210250700**

Counselling Class Programme		Practical Examination Programme		
Date	Time	Paper	Date	Time
28.10.2023	11.00 AM to 5.30 PM	XII	30.10.2023	11:30 AM to 2:30 PM
		XIII	30.10.2023	2:45 PM to 5:45 PM
		XV	31.10.2023	11:30 AM to 2:30 PM
		XVI	31.10.2023	2:45 PM to 5:45 PM

**आवश्यक सूचना**

आपको ज्ञात है कि आपके पाठ्यक्रम की परीक्षा दिनांक 30.09.2023 से संचालित है, जिसमें Paper-IX की परीक्षा दिनांक 30.09.2023 को प्रथम एवं द्वितीय पाली में आयोजित हुयी । आप में से कतिपय परीक्षार्थियों ने विश्वविद्यालय प्रशासन से लिखित रूप में (BPSC Admit Card के साथ) यह अनुरोध किया था कि उक्त दिवस को हीं BPSC की परीक्षा बिहार के विभिन्न जिलों में आयोजित है । लिखित रूप में प्राप्त अभ्यावेदन पर सहानुभूतिपूर्वक विचार करते हुये विश्वविद्यालय प्रशासन ने यह निर्णय लिया है कि, दिनांक 30.09.2023 की परीक्षा से वंचित वैसे परीक्षार्थी जिन्होंने अपना BPSC Admit विश्वविद्यालय में जमा कर दिया है, वे दिनांक 18.10.2023 को अपराह्न 2.30 से 5.30 के बीच आयोजित की जाने वाली Paper-IX की परीक्षा में सम्मिलित हो सकते हैं । परीक्षा में सम्मिलित होने के लिए परीक्षार्थियों को 500/- रुपये का बैंक ड्राफ्ट या SBI Collect का चालान या POS की रसीद के साथ उपस्थित होना होगा ।

# NALANDA OPEN UNIVERSITY

## M.Sc. Chemistry, Part-II

### PAPER–XV

(Organic Synthesis)

Annual Examination, 2023

Time : 3 Hours.

Full Marks : 80

Answer any FIVE Questions. All questions carry equal marks.

1. Explain the synthetic use of  $H_2O_2$  and  $O_5O_4$  in the oxidation of alkene to glycol.
2. How organo magnesium compounds is prepared ? How does Grignard reagents react with :—  
(a) Acetaldehyde (b) Formaldehyde (c) Acetone (d)  $CO_2$  (e)  $H_2O$
3. Discuss the preparation and four properties of thioether.
4. Write notes on any **Two** of the following :—  
(a) Sulpha Drug (b) Mustard Gas (c) Barton Reaction
5. (a) Explain the synthetic use of  $NaBH_4$ . Compare reductions with  $NaBH_4$  and  $LiAlH_4$ .  
(b) Is  $NaBH_4$  oxidising or reducing agent ?
6. How thio alcohol may be prepared from alcohol ? How thiols react with :—  
(a) Acetone (b) Acetyl Chloride (c)  $HgCl_2$  (d)  $NaOH$
7. How are organic lithium compounds are prepared ? Explain that organic lithium compounds give  $\alpha, \beta$  unsaturated alcohol with  $\alpha, \beta$  unsaturated ketone whereas Grignard reagent give saturated ketones under same condition.
8. Explain the reduction reaction of the following compounds with examples :—  
(a) Reduction of Aldehyde.  
(b) Reduction of Ketones.  
(c) Reduction of Nitro Compounds.  
(d) Reduction of Alkene and Alkyne
9. Write mechanism of each of the following rearrangements :—  
(a) Claisen's Rearrangement. (b) Etard Reaction. (c) Gattermaon Reaction
10. Compare relative acidities of the following pair :—  
(a) Benzene sulphuric acid and Benzoic acid (b) Alcohol and thio alcohol

\* \* \*

### M.Sc. Chemistry, Part–II

Programme for Practical Counselling Classes and Practical Examination, 2023

Venue : Chemistry Lab, 4<sup>th</sup> Floor, Biscomaun Bhawan, Patna

For Enrollment No. 180250001 to 180250100 & 190250001 to 190250900 & 200250001 TO 200251300 & 210250001 to 210250100

Counselling Class Programme		Practical Examination Programme		
Date	Time	Paper	Date	Time
20.10.2023	11.00 AM to 5.30 PM	XII	26.10.2023	11:30 AM to 2:30 PM
		XIII	26.10.2023	2:45 PM to 5:45 PM
		XV	27.10.2023	11:30 AM to 2:30 PM
		XVI	27.10.2023	2:45 PM to 5:45 PM

For Enrollment No. 210250101 to 210250700

Counselling Class Programme		Practical Examination Programme		
Date	Time	Paper	Date	Time
28.10.2023	11.00 AM to 5.30 PM	XII	30.10.2023	11:30 AM to 2:30 PM
		XIII	30.10.2023	2:45 PM to 5:45 PM
		XV	31.10.2023	11:30 AM to 2:30 PM
		XVI	31.10.2023	2:45 PM to 5:45 PM

### आवश्यक सूचना

आपको ज्ञात है कि आपके पाठ्यक्रम की परीक्षा दिनांक 30.09.2023 से संचालित है, जिसमें Paper-IX की परीक्षा दिनांक 30.09.2023 को प्रथम एवं द्वितीय पाली में आयोजित हुयी । आप में से कतिपय परीक्षार्थियों ने विश्वविद्यालय प्रशासन से लिखित रूप में (BPSC Admit Card के साथ) यह अनुरोध किया था कि उक्त दिवस को हीं BPSC की परीक्षा बिहार के विभिन्न जिलों में आयोजित है । लिखित रूप में प्राप्त अभ्यावेदन पर सहानुभूतिपूर्वक विचार करते हुये विश्वविद्यालय प्रशासन ने यह निर्णय लिया है कि, दिनांक 30.09.2023 की परीक्षा से वंचित वैसे परीक्षार्थी जिन्होंने अपना BPSC Admit विश्वविद्यालय में जमा कर दिया है, वे दिनांक 18.10.2023 को अपराह्न 2.30 से 5.30 के बीच आयोजित की जाने वाली Paper-IX की परीक्षा में सम्मिलित हो सकते हैं । परीक्षा में सम्मिलित होने के लिए परीक्षार्थियों को 500/- रुपये का बैंक ड्राफ्ट या SBI Collect का चालान या POS की रसीद के साथ उपस्थित होना होगा ।

**NALANDA OPEN UNIVERSITY**  
**M.Sc. Chemistry, Part-II**  
**PAPER-XVI**  
 (Environmental Chemistry and Analytical Chemistry)  
*Annual Examination, 2022*

**Time : 3 Hours.**

**Full Marks : 80**

*Answer any FIVE Questions. All questions carry equal marks.*

1. Explain Biogeochemical cycles in environments ? How do they sustain life in biosphere ?
2. Explain the composition of soil ? Discuss the organic and inorganic components of soil. Write a note on waste treatment of soil.
3. Explain defluorination and fluoridation. How you will estimate the fluoride in the sample of water ?
4. Write notes on any **Two** of the following :-
  - (a) Acid Rain
  - (b) Measuring of BOD and COD
  - (c) Photochemical Reaction in Atmosphere
5. Explain the following :-
  - (a) Rf Value
  - (b) TLC
  - (c) TGA
6. What are heavy metals which pollute drinking water ? How will you estimate Hg and Pd in water sample ?
7. How SO<sub>2</sub>, CO<sub>2</sub>, CO, NO<sub>2</sub> pollutants gas are measured ? How these gasses damage our health system in society ?
8. Write notes on the following :-
  - (a) Green House Effect
  - (b) Arsenic in drinking water and its hazardous effect on your health.
9. What is smog ? What are its mechanism ? How does it harm the human life and other living World ?
10.
  - (a) What is gasoline ? What are its types on the basis of octane number ?
  - (b) Is gasoline a gas or oil ?
  - (c) What is a gasoline made of ?

\* \* \*

**M.Sc. Chemistry, Part-II**  
**Programme for Practical Counselling Classes and Practical Examination, 2022**  
**Venue : Chemistry Lab, 4<sup>th</sup> Floor, Biscomaun Bhawan, Patna**

***For Enrollment No. 180250001 to 180250300 & 190250001 to 190250600***

<i>Counselling Class Programme</i>		<i>Practical Examination Programme</i>		
<i>Date</i>	<i>Time</i>	<i>Paper</i>	<i>Date</i>	<i>Time</i>
15.02.2023	11.00 AM to 5.30 PM	XII	16.02.2023	11:30 AM to 2:30 PM
		XIII	16.02.2023	2:45 PM to 5:45 PM
		XV	17.02.2023	11:30 AM to 2:30 PM
		XVI	17.02.2023	2:45 PM to 5:45 PM

***For Enrollment No. 200250001 to 200250230***

<i>Counselling Class Programme</i>		<i>Practical Examination Programme</i>		
<i>Date</i>	<i>Time</i>	<i>Paper</i>	<i>Date</i>	<i>Time</i>
20.02.2023	11.00 AM to 5.30 PM	XII	21.02.2023	11:30 AM to 2:30 PM
		XIII	21.02.2023	2:45 PM to 5:45 PM
		XV	22.02.2023	11:30 AM to 2:30 PM
		XVI	22.02.2023	2:45 PM to 5:45 PM

***For Enrollment No. 200250231 to 200251300***

<i>Counselling Class Programme</i>		<i>Practical Examination Programme</i>		
<i>Date</i>	<i>Time</i>	<i>Paper</i>	<i>Date</i>	<i>Time</i>
23.02.2023	11.00 AM to 5.30 PM	XII	24.02.2023	11:30 AM to 2:30 PM
		XIII	24.02.2023	2:45 PM to 5:45 PM
		XV	25.02.2023	11:30 AM to 2:30 PM
		XVI	25.02.2023	2:45 PM to 5:45 PM



**NALANDA OPEN UNIVERSITY**  
**M.Sc. Chemistry, Part-II**  
**PAPER-XVI**  
 (Environmental Chemistry and Analytical Chemistry)  
*Annual Examination, 2023*

**Time : 3 Hours.**

**Full Marks : 80**

*Answer any FIVE Questions. All questions carry equal marks.*

1. Explain the following :—  
 (a) Green House Effect  
 (b) Fluoride in drinking water and its hazardous effect on our health.
2. Explain the following :—  
 (a) R<sub>f</sub> Value                      (b) TLC                      (c) TGA
3. Write notes on any **Two** of the following :—  
 (a) Acid Rain  
 (b) Measuring of BOD and COD  
 (c) Photochemical Reaction in Atmosphere
4. What is smog ? What are its mechanism ? How does it harm the human life and other living World ?
5. How SO<sub>2</sub>, CO<sub>2</sub>, CO, NO<sub>2</sub> pollutants gas are measured ? How these gasses damage our health system in society ?
6. Explain Biogeochemical cycles in environments ? How do they sustain life in biosphere ?
7. Explain the following :—  
 (a) Micro and Macronutrient of Soil  
 (b) Estimation of Protein in given sample  
 (c) Estimation of total solid in Water
8. (a) What is gasoline ? What are its types on the basis of octane number ?  
 (b) Is gasoline a gas or oil ?  
 (c) What is a gasoline made of ?
9. What are the basis of the following types of Chromatography :—  
 (a) Paper Chromatography  
 (b) ION Exchange Chromatography  
 (c) Column Chromatography
10. Write notes on any **Two** of the following :—  
 (a) Arsenic in drinking water and its hazardous effect on health.  
 (b) Heavy metals which pollute drinking water and estimation of Hg and Pb with sample  
 (c) Chandrayan-III landing on the surface of moon

\* \* \*

**M.Sc. Chemistry, Part-II**  
**Programme for Practical Counselling Classes and Practical Examination, 2023**  
**Venue : Chemistry Lab, 4<sup>th</sup> Floor, Biscomaun Bhawan, Patna**

**For Enrollment No. 180250001 to 180250100 & 190250001 to 190250900 & 200250001 TO 200251300 & 210250001 to 210250100**

<b>Counselling Class Programme</b>		<b>Practical Examination Programme</b>		
<b>Date</b>	<b>Time</b>	<b>Paper</b>	<b>Date</b>	<b>Time</b>
20.10.2023	11.00 AM to 5.30 PM	XII	26.10.2023	11:30 AM to 2:30 PM
		XIII	26.10.2023	2:45 PM to 5:45 PM
		XV	27.10.2023	11:30 AM to 2:30 PM
		XVI	27.10.2023	2:45 PM to 5:45 PM

**For Enrollment No. 210250101 to 210250700**

<b>Counselling Class Programme</b>		<b>Practical Examination Programme</b>		
<b>Date</b>	<b>Time</b>	<b>Paper</b>	<b>Date</b>	<b>Time</b>
28.10.2023	11.00 AM to 5.30 PM	XII	30.10.2023	11:30 AM to 2:30 PM
		XIII	30.10.2023	2:45 PM to 5:45 PM
		XV	31.10.2023	11:30 AM to 2:30 PM
		XVI	31.10.2023	2:45 PM to 5:45 PM