

- Duration of the practical examination shall be of **04 (four) hours**.
- Marks obtained in the practical examination have to be submitted to the Head of the department/ Principal of the College. The Head of the Department/Principal of the College will make necessary arrangement for uploading the marks onto the University exam portal. The hard copy of the award list from portal has to be submitted to the Controller of Examination, Kumaun University, Nainital

Semester-IV
Paper-I (Theory)
Course Title: General Chemistry-II

Programme/Class: Diploma in Chemical Science	Year: Second	Semester: Fourth
Paper-I Theory Subject: Chemistry		
Course Code:	Course Title: General Chemistry-II	

Course outcomes: This paper provides detailed knowledge of synthesis of aldehydes, ketones, carboxylic acids and functional groups inter conversion. The students will be able to describe the concepts of electrochemistry in detail and its applications. Also, they will be able to solve the numerical problems based on these concepts. Students will be able to define the acids and bases on the basis of various concepts/ theories and will be able to identify the position of Inner transition elements in the periodic table and able to explain their properties on the basis of their position.

Credits: 4	Compulsory
Max. Marks: 25+75	Min. Passing Marks:

Total No. of Hours- = 60

Unit	Contents	Number of Hours
1	Acids and Bases: Arrhenius concept, Bronsted-Lowry concept, Lux-Flood and Lewis concept of acids and bases; Hard and Soft Acid-Base Theory: Classification of acids and bases as hard and soft. Pearson's hard and soft acid base concept, acid base strength and hardness and softness. Symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and softness.	10
2	Chemistry of Inner Transition Elements: Chemistry of Lanthanides: Electronic configuration, oxidation states, atomic & ionic radii, lanthanide contraction and its consequences, complex formation, colour; Methods of separation of lanthanides- fractional crystallization, fractional precipitation, change in oxidation state, solvent extraction and ion exchange methods. Chemistry of Actinides: General features of actinides-electronic configuration, atomic & ionic radii, ionization potential, oxidation states and complex formation.	10
3	Aldehydes and Ketones: General methods of preparation and their chemical properties. Rossemund reaction, Stephen's	10

	reduction, Etard reaction, Gattermann Koch reaction, Comparative account of properties of aliphatic and aromatic aldehydes and ketones. Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensation. Condensation with ammonia and its derivatives; Wittig reaction, Oxidation of aldehydes, Cannizzaro reaction, Clemmensen reduction.	
4	Carboxylic Acids: General methods of preparation Reactions of carboxylic acids, Hell-Volhard-Zelinsky reaction. Reduction of carboxylic acids, mechanism of decarboxylation. Methods of formation and chemical reactions of hydroxy acids- malic, tartaric. Dicarboxylic acids-methods of preparation and effect of heat and dehydrating agents.	10
5	Electrochemistry I: Electrical transport-conduction in metals and electrolytic solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of equivalent and specific conductance with dilution. Arrhenius theory of electrolytic dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law, its uses and limitations, Numerical Problems.	8
6	Electrochemistry II: Oxidation state, types of redox reactions, Meaning of electrode (Half-cell), Electrode reactions, standard hydrogen electrode-reference electrode, determination of standard electrode potential, determination of p^H and pK_a from hydrogen standard electrode, sign conventions, electrochemical series and its significance. Galvanic cells, conventional representation of electrochemical cells. EMF of a cell and its measurements, Derivation of Nernst equation for electrode potential of half-cell and for EMF of cell., Calculation of thermodynamic quantities of cell reactions (ΔG , ΔH and K), Electrolytic and Numerical Problems.	12

Books Recommended:

- i. Lee, J.D., "Concise, Inorganic Chemistry", Oxford University Press, 2008, India, 5th edition.
- ii. Puri, B.R., Sharma, L.R., and Kalia, K.C., "Principles of Inorganic Chemistry", Vishal Publishing Co., India, 2020, 33rd edition.
- iii. Madan, R.L., "Chemistry for Degree Students, B. Sc. Second Year", S. Chand Publishing, New Delhi, India, 2011, 3rd edition.
- iv. Madan, R.D., Malik, U.M. and Tuli, G.D., "Selected topics in Inorganic Chemistry", S. Chand Publishing, New Delhi, India, 2010.
- v. Chandra, S., "Comprehensive Inorganic Chemistry" New Age International Publishers, India, 2018, 1st edition.
- vi. Prakash, S., Tuli, G.D., Basu, S.K. and Madan, R.D., "Advanced Inorganic Chemistry", S. Chand Publishing, New Delhi, India, 2000, Vol 1.
- vii. Finar, I.L., "Organic Chemistry", Pearson Education India, 2002, 6th edition.

- viii. Eiel, E.L. and Wilen, S.H., "Stereochemistry of Organic Compounds", Wiley, 1994, 1st edition.
- ix. Boyd, Morrison and Bhattacharjee, "Organic Chemistry", Pearson Education India, 2010, 7th edition.
- x. Mukerji, S.M., "Reaction mechanism in Organic Chemistry", Laxmi Publications, 2007, 3rd edition.
- xi. Singh, Jagdamba and Yadav, L.D.S., "Undergraduate Organic Chemistry" Pragati Prakashan, India, 2011, Vol 1.
- xii. Loudon, G. Marc, "Organic Chemistry", Oxford University Press, 2008, 4th edition.
- xiii. Atkins P.W., "Atkin's Physical Chemistry: International", Oxford University Press, 2018, 11th edition.
- xiv. Ball D.W., "Physical Chemistry", Cengage India Private Limited, 2017, 2nd edition.
- xv. Puri, B.R., Pathania, M.S. and Sharma, L.R., "Principles of Physical Chemistry", Vishal Publishing, India, 2020, 47th edition.
- xvi. Bahl, A., Bahl, B.S. and Tuli, G.D., "Essential of Physical Chemistry", S. Chand Publishing, India, 2010.

Suggested online links:

1. https://www.youtube.com/watch?v=UJgzQ5XP8wQ&list=PLmxSS9XYst20FfphDeS03pq_kcuJk0vuvy
2. <https://www.youtube.com/watch?v=2G79lCT5Os8&list=PLmxSS9XYst23WTFnTWuRg-Ww0k6foth7e>
3. <https://www.youtube.com/watch?v=SNXFYz31iFI&list=PLmUlqVgZsTVUfjMBLDQvNLUbF9CIrEsef>
4. https://www.youtube.com/watch?v=1t0GDMSzZ9A&list=PLmxSS9XYst21dec_6u2yWWj295Y8pHGrA
5. <https://swayam.gov.in/>
6. <https://www.coursera.org/learn/physical-chemistry>
7. <https://www.mooc-list.com/tags/physical-chemistry>
8. <https://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/intro1.htm>
9. <https://nptel.ac.in/courses/104/103/104103071/>

Suggested Continuous Evaluation Methods for Internal Assessment: Students can be evaluated on the basis of score obtained in a mid-term exam, together with the performance of other activities which can include short exams, in-class or on-line tests, home assignments, group discussions or oral presentations.

Evaluation method	Marks
Mid-term exam/ in-class or on-line tests/ home assignments/ group discussions/ oral presentations	15 marks
Overall performance throughout the semester, Discipline, participation in different activities) and Attendance	10 marks

Course prerequisites: To study this course, a student must have had Passed Sem-III Theory Paper-1

Suggested equivalent online courses:

Further Suggestions:

Semester-IV Paper-II (Practical)
Course Title: Analytical Procedures-II

Programme/Class: Diploma in Chemical Science	Year: Second	Semester: Fourth
Paper-II Practical Subject: Chemistry		
Course Code:	Course Title: Analytical Procedures-II	

Course outcomes:

After completing this course, the students will be able to analyze inorganic salts for the presence of acidic radicals including interfering radicals along with basic radicals from III and IV groups, qualitatively differentiate between aldehydes, ketones and carboxylic acids and determine the solubility of salts.

Credits:2	Compulsory
Max. Marks: 25+75	Min. Passing Marks:.....

Total Number of Hours = 60

Unit	Contents	Number of Hours
1	Laboratory hazards and safety precautions	6
2	Inorganic exercise: Inorganic salt analysis including acidic/ Interfering radicals and basic radicals from III and IV groups.	18
3	Organic exercise: Systematic analysis and identification of aldehydes, ketones and carboxylic acids. Differentiation between aldehyde and ketones.	22
4	Physical exercise: Determination of solubility of salts.	14

Suggestive digital platforms web links

1. <https://www.labster.com/chemistry-virtual-labs/>
2. <https://www.vlab.co.in/broad-area-chemical-sciences>
3. <http://chemcollective.org/vlabs>

Suggested Continuous Evaluation Methods for Internal Assessment: Students can be evaluated on the basis of score obtained in viva voce, record and overall performance.

Evaluation method	Marks
Attendance	12 marks
Record and overall performance	13 marks

Course prerequisites: To study this course, a student must have Opted Sem-IV Theory Paper-1

Suggested equivalent online courses:

Further Suggestions:

One exercise each from inorganic salt analysis (one acidic and one basic radical), organic exercise (one organic compound) and physical exercise (solubility of salts) shall be given in the examination.

Distribution of marks shall be as given below:

1. Inorganic exercise	20
2. Organic exercise	25
3. Physical exercise	20
4. Viva	10
5. Home assignment/internal assessment, lab record and attendance	25

Note:

- *The lab work of the student has to be evaluated and assessed carefully and periodically. A minimum of 12 experiments covering all the kind of exercises has to be performed during a semester. The semester record has to be maintained by the department/college as an official record.*
- *Less than zero mark will not be awarded.*
- *The total number of students to be examined per batch shall not be more than sixty.*
- *Duration of the practical examination shall be of 04 (four) hours.*
- *Marks obtained in the practical examination have to be submitted to the Head of the department/ Principal of the College. The Head of the Department/Principal of the College will make necessary arrangement for uploading the marks onto the University exam portal. The hard copy of the award list from portal has to be submitted to the Controller of Examination, Kumaun University, Nainital*