Department of Chemistry
B.Sc Physical Sciences
SCHEME UG A1: UNDERGRADUATE PROGRAMME (MULTIDISCIPLINARY)

Semester 1

Course Code	Course Title	Course ID	L (Hrs)	T (Hrs)	P (Hrs)	L Credits	T Credits	P Credits	Total Credits	MARKS TI	MARKS TE	MARKS PI	MARKS PE	MARKS Total
Core Course(s)														
CC-A1	Chemistry-I		3		2	3		1	4	25	50	5	20	100

Semester 2

Course Code	Course Title	Course ID	L (Hrs)	T (Hrs)	P (Hrs)	L Credits	T Credits	P Credits	Credits	MARKS TI	MARKS TE	MARKS PI	MARKS PE	MARKS Total
Core Course(s)														
CC-A2	Chemistry-II		3		2	3		1	4	25	50	5	20	100

Semester 3

Course Code	Course Title	Course ID	L (Hrs)	T (Hrs)	P (Hrs)	L Credits	T Credits	P Credits	Credits	MARKS TI	MARKS TE	MARKS PI	MARKS PE	MARKS Total
Core Course(s)														
CC-A3	Chemistry-III		3		2	3		1	4	25	50	5	20	100

Semester 4

Course Code	Course Title	Course ID	L (Hrs)	T (Hrs)	P (Hrs)	L Credits	T Credits	P Credits	Credits	MARKS TI	MARKS TE	MARKS PI	MARKS PE	MARKS Total
Core Course(s)														
CC-A4	Chemistry-IV		3		2	3		1	4	25	50	5	20	100

Semester 5

Course Code	Course Title	Course ID	L (Hrs)	T (Hrs)	P (Hrs)	L Credits	T Credits	P Credits	Credits	MARKS TI	MARKS TE	MARKS PI	MARKS PE	MARKS Total
Core Course(s)														
CC-A5	Chemistry-V		3		2	3		1	4	25	50	5	20	100

Internship is to be done during summer break after 4th Semester, Marks will be added in 5th Semester.

Semester 6

Course Code	Course Title	Course ID	L (Hrs)	T (Hrs)	P (Hrs)	L Credits	T Credits	P Credits	Credits	MARKS TI	MARKS TE	MARKS PI	MARKS PE	MARKS Total
Core Course(s)														
CC-A6	Chemistry-VI		3		2	3		1	4	25	50	5	20	100

The curriculum of semester 7 and 8 will is provided in due course of time.

Department of chemistry UG (sem IV)

Core Course (Multidisciplinary) 240/CHEP/CC401

Semester-IV

COURSE DETAILS:

Course Title	**Chemistry-IV**
Semester	**Semester-IV**
Course Code	**CC-A4**
Course ID	**240/CHE/CC/401**
Level of Course	
Total Credits	**04 (Lecture: 03, Tutorial: 0, Practical: 01)**
Total Marks	**100**
Marks Distribution	**Theory External: 50** **Theory Internal: 25** **Practical External: 20** **Practical Internal: 05**

COURSE CURRICULUM DELIVERY WEEKLY DISTRIBUTION:

Total Hours per Week: 5	
Lectures (L) Hours per Week: 3	**Practical (P) Hours per Week: 2**

COURSE OBJECTIVES:

- To study the structures, properties, and acid strengths of group 15, 16, and 17 elements.
- To understand the general trends and properties of 3d transition elements.
- To explore theories of coordination chemistry, including VBT and CFT.
- To analyze the electronic spectra and magnetic properties of metal complexes.
- To learn the preparation, properties, and key reactions of carboxylic acids and their derivatives.
- To understand electrochemical principles and their industrial applications.

COURSE OUTCOMES:

Students will be able to learn:-

- The trends in electronic configuration, variable valency, and complex formation of 3d transition metals.
- To apply VBT and CFT to explain the stability, geometry, and distortions of coordination complexes.
- The electronic spectra, selection rules, and magnetic behavior of transition metal complexes.
- The preparation, properties, and mechanisms of reactions involving carboxylic acids and derivatives.
- To use electrochemical principles to solve problems related to conductance, EMF, and

industrial applications.

DETAILED CONTENT OF COURSE:

Theory Syllabus: Total Contact Hours: 45

Unit	Topics	Contact Hours
I	**Nitrogen Family (15th group)** Oxides – structures of oxides of N, P. oxyacids – structure and relative acid strengths of oxyacids of Nitrogen and phosphorus. Structure of white, yellow and red phosphorus. **Oxygen Family (16th group)** Oxyacids of sulphur – structures and acidic strength H_2O_2 –structure, properties and uses. **Halogen Family (17th group)** Basic properties of halogen, interhalogens, types properties, hydro and oxyacids of chlorine – structure and comparison of acid strength. **Transition Elements (3d series)** General group trends with special reference to electronic configuration, variable valency, colour, magnetic and catalytic properties, ability to form complexes.	12
II	**Coordination Chemistry** Valence Bond Theory (VBT), Advantages and Drawbacks of VBT, Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Tetrahedral symmetry. Factors affecting the magnitude of D. Spectrochemical series. Comparison of CFSE for Oh and Td complexes, Tetragonal distortion of octahedral geometry, Jahn-Teller distortion, Square planar coordination. **Electronic spectra and Magnetic properties of Transition metal complexes** Selection rules for d-d transition, spectroscopic ground states, Spin only formula, L-S coupling, correlation of μ_{spin} and μ_{eff} values, orbital contribution to magnetic moments,	11
III	**Carboxylic acids and their derivatives** General methods, physical properties and reactions of monocarboxylic acids, effect of substituents on acidic strength. Typical reactions of dicarboxylic acids, hydroxy acids and unsaturated acids. Preparation and reactions of acid chlorides, anhydrides, esters and amides. Comparative study of nucleophilic substitution at acyl group, interconversion of acid derivatives by nucleophilic acyl substitution. Mechanism of acidic and basic hydrolysis of esters, Claisen condensation, Dieckmann and Reformatsky reactions, Hoffmann-bromamide degradation and Curtius rearrangement.	11
IV	**Electrochemistry** Conductivity of electrolytes, Equivalent and molar conductivity, Kohlrausch's law, Debye-Hückel-Onsager equation, Ionic velocities, mobilities, and transference numbers, Applications of conductance measurements, Quantitative aspects of Faraday's laws of electrolysis,	11

	Applications of electrolysis in metallurgy and industry, Electromotive force of a cell, Nernst equation, Standard electrode potentials, Concentration cells, Applications of EMF measurements	
V	**Practicals:** 1. *S*-Benzylisothiouronium salt of one each of water soluble and water insoluble acids (benzoic acid, oxalic acid, phenyl acetic acid and phthalic acid). 2. Hydrolysis of amides and esters. 3. To determine the conductance of a given solution using a conductivity meter. 4. To study the effect of concentration on the conductance of a solution. 5. To determine the dissociation constant (Ka) of a weak acid using conductometry. 6. Gravimetric Analysis: • Estimation of nickel (II) using Dimethylglyoxime (DMG). • Estimation of copper as CuSCN • Estimation of iron as Fe_2O_3 by precipitating iron as $Fe(OH)_3$. • Estimation of Al (III) by precipitating with oxine and weighing as $Al(oxine)_3$ (aluminiumoxinate).	**30**

COURSE EVALUATION METHODS

Theory Exams: Total Marks: 75 (External: 50 + Internal: 25)

Internal Assessment: 25 Marks	• Class Participation: 05 Marks • Seminar/Presentation/ Assignment: 05 Marks • Mid Term Exam: 15 Marks
External Assessment: 50 Marks (02 Hours)	• End Term Exam: 50 Marks

Practical Exam: Total Marks: 25 (External: 20 + Internal: 05)

Internal Assessment: 05 Marks	• Class Participation: 05 Marks
External Assessment: 20 Marks (02 Hours)	• End Term Practical Exam: 10 Marks • Lab record: 05 Marks • Viva Voce: 05 Marks

Instruction for End-Term Theory Exam:

The Examiner is requested to set nine questions in total, selecting two questions from each section. Question-1 will be a compulsory question consisting short answer type questions covering all the units of the syllabus. All questions should carry equal marks. Log table and non-programmable calculator is allowed.

RECOMMENDED BOOKS

1. Inorganic Chemistry: Principles of Structure and Reactivity" by James E. Huheey, Ellen A. Keiter, and Richard L. Keiter
2. Inorganic Chemistry" by Gary L. Miessler, Paul J. Fischer, and Donald A. Tarr

3. Concise Inorganic Chemistry" by J.D. Lee
4. Morrison, R. N.; Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
5. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
6. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
7. Ahluwalia, V.K.; Bhagat, P.; Aggarwal, R.; Chandra, R. (2005), Intermediate for Organic Synthesis, I.K.International.
8. Solomons, T. W. G.; Fryhle, C. B.; Snyder, S. A. (2016), Organic Chemistry, 12th Edition, Wiley.
9. "Vogel's Textbook of Quantitative Chemical Analysis" by A.I. Vogel (Adapted by G.H. Jeffery)