UNIVERSITY OF JAMMU

(NAAC ACCREDITED 'A' GRADE' UNIVERSITY)
Baba Sahib Ambedkar Road, Jammu-180006 (J&K)

Academic Section
Email: academicsectionju14@gmail.com

NOTIFICATION
(23/July/Adp./53)

It is hereby notified for the information of all concerned that the Vice-Chancellor, in anticipation of the approval of the Academic Council, is pleased to authorize the adoption of the Syllabi and Courses of Studies in the subject of **Chemistry** of Semester **IIIrd** and **IVth** for **Four Year Under Graduate Programme (FYUGP)** under the **Choice Based Credit System** as per **NEP-2020 (as given in the annexure)** for the examinations to be held in the years as per the details given below:

Subject	**Semester**	**For the examinations to be held in the year**
Chemistry	Semester- III	Dec. 2023, 2024 and 2025
	Semester-IV	May 2024, 2025 and 2026

The Syllabi of the courses is also available on the University website: www.jammuuniversity.ac.in.

Sd/-
DEAN ACADEMIC AFFAIRS

No. F. Acd/II/23/6012-6051
Dated: 6-7-2023.
Copy for information and necessary action to:

1 Dean, Faculty of Science
2 Convener, Board of Studies in **Chemistry**
3 Sr. P.A.to the Controller of Examinations
4 All members of the Board of Studies
5 Confidential Assistant to the Controller of Examinations
6 I/C Director, Computer Centre, University of Jammu
7 Deputy Registrar/Asst. Registrar (Conf. /Exams. UG)
8 Incharge, University Website for Uploading of the notification.

06/7/23
Deputy Registrar (Academic)

6/7/23 6/7/23

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

UNIVERSITY OF JAMMU

SYLLABUS FOR FOUR YEAR UNDERGRADUATE PROGRAMME (FYUGP) IN CHEMISTRY W.E.F. ACADEMIC SESSION 2022 AS PER NATIONAL EDUCATION POLICY (NEP)

List of Major (MJ), Minor (MI), Skill (SEC) and Multi Disciplinary (MD) Courses for 3rd and 4th Semesters of Four Year Undergraduate Program (FYUGP) in Chemistry as per National Education Policy (NEP)

[Semester III–IV]

S. No.	Level (UG/Sem)	Course Code	Credits	Course Name	Nature of open Elective
1.	UG/Sem-3	UMJCHT-301	4 (3 credit theory + 1 credit practical)	Foundation Course Chemistry-3	MJ
2.	UG/Sem-3	UMJCHT-302	4 (3 credit theory + 1 credit practical)	Analytical Chemistry	MJ
3.	UG/Sem-3	UMICHT-303	4 (3 credit theory + 1 credit practical)	Foundation Course Chemistry-3	MI
4.	UG/Sem-3	UMDCHT-304	3	Chemistry in Everyday Life	MD
5.	UG/Sem-3	USECHT-305	2 (1 credit theory + 1 credit practical)	Chemistry of Food & Cosmetics	SEC
6.	UG/Sem-4	UMJCHT-401	4 (3 credit theory + 1 credit practical)	Physical Chemistry-1	MJ
7.	UG/Sem-4	UMJCHT-402	4 (3 credit theory + 1 credit practical)	Organic Chemistry-1	MJ
8.	UG/Sem-4	UMJCHT-403	4 (3 credit theory + 1 credit practical)	Inorganic Chemistry-1	MJ
9.	UG/Sem-4	UMJCHT-404	4 (3 credit theory + 1 credit practical)	Spectroscopic and Nuclear Chemistry	MJ
10.	UG/Sem-4	UMICHT-405	4 (3 credit theory + 1 credit practical)	Inorganic Chemistry-1	MI

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years Dec. 2023, 2024 &2025)

Semester-III

Course No.: UMJCHT-301 (Major course)

Title: FOUNDATION COURSE CHEMISTRY-3

Credits: 03 (Theory) + 01 (Practical)

Maximum Marks: 100 [75 (Theory) + 25 (Practical)]

Duration of Examination: 3 hours

Theory: 03 Credits **Duration of Course: 45 hours**

UNIT-I: Chemistry of saturated and unsaturated Aliphatic Hydrocarbons **(13 Lectures)**

a) Chemistry of Alkanes : Formation of alkanes by Wurtz Reaction, Wurtz Fitting Reaction, Free Radical Substitution in alkanes, Halogenation : Relative reactivity and selectivity.

b) Chemistry of Alkenes and Alkynes :

Formation of Alkenes by E1, E2, E1cB reactions , Hoffmann Elimination and Saytzeff rule. Addition of Halogen to alkenes : Carbocation and Halonium ion Mechanism. Ozonolysis of Propene with Mechanism. Addition of Hydrogen halides to alkenes with mechanism, Markownikoff's rule Addition of HBr to Propene (Peroxide Effect/Anti-Markownikoff addition), Syn and Anti Addition Hydrogenation, Hydroxylation , Hydration , reaction with NBS

Alkynes: Acidity of Alkynes, Alkylation of terminal Alkynes, hydrogenation and hydration of Alkynes

Relative Reactivity of Alkenes and Alkynes

c) **Butadiene**: 1,2 and 1,4 addition reaction of butadiene

d) **Cycloalkanes (upto Cyclohexane)** : Nomenclature, Methods of Preparation. Stability of Cycloalkanes : Bayer Strain Theory

UNIT-II: Aromatic hydrocarbons **(10 Lectures)**

Concept of Aromaticity: Benzenoids and Hückel's rule, **Structure of Benzene**: Kekule Structures, Resonance and Molecular Orbital Theory

Preparation (Case Benzene): from Phenol, , from Acetylene, from Benzene sulphonic acid, by decarboxylation

Reactions: (Case Benzene): General mechanism of Electrophilic Substitution reactions, σ and π complexes , Nitration, Halogenation and Sulphonation.

Friedel-Craft's reaction : alkylation (upto 3 carbons on benzene) and **acylation**

Side chain oxidation of alkyl benzenes (upto 3 carbons on benzene).

Activating and Deactivating groups, Orientation effect, Ortho-para ratio

Aromatic nucleophilic Substitution (S_NAr) with mechanism.

UNIT-III : Thermodynamics-I **(11 Lectures)**

Definition of thermodynamics terms: system, surroundings, boundary. Types of system, Thermodynamic variables, intensive and extensive properties. State and path functions. Thermodynamic equilibrium. Thermodynamic process. Concept of heat and work.

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(For examinations to be held in the years Dec. 2023, 2024 &2025)

Semester-III
Course No.: UMJCHT-301 (Major course)
Title: FOUNDATION COURSE CHEMISTRY-3

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 hours

First Law of Thermodynamics: Statement and our daily life examples, internal energy and its physical significance. Heat change at constant volume, heat change at constant pressure: Enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Variation of internal energy with temperature and volume, Joules law. Variation of enthalpy with temperature and pressure, Joule-Thomson coefficient and inversion temperature.

UNIT-IV Chemistry of s and p Block Elements-I **(11 Lectures)**

Inert pair effect, Relative stability of different oxidation states, diagonal relationship and anomalous behaviour of first member of each group. Allotropy and catenation. Complex formation tendency of s and p block elements. Hydrides and their classification ionic, covalent and interstitial. Preparation, structure and bonding of borohydrides (diborane).

BOOKS RECOMMENDED:

1. Morrison, R.N., Boyd, R.N.' Bhattacharjee, S.k. (2010) Organic Chemistry.
2. Finar, I.L. (2002) Organic Chemistry Volume I, II , 6th Edition Pearson Education.
3. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
4. Sykes, P.A. Guidebook to Mechanism in Organic Chemistry, Orient Longman, Longman, new Dehli (1988).
5. Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.
6. R.P.Rastogi, R.R.Misra. Sixth Revised Edition. Vikas Publishing House Pvt. Ltd.
7. Bell, R. P. , Proton in Chemistry , 2nd Ed., Chapmaon Hall, (1973).
8. Drago, R. S., Modern Approach to Acid base Chemistry, J. C.Chem. Educ., 51, 300 (1974).
9. Gillespie, R. R., Proton acids, Lewis acids, hard acids, soft acids and super acids. Chapman and Hall (1975).
10. Jensen, W.B.,The Lewis Acid-Base Concepts, Wiley, New York (1980).
11. Nicholls, D. Inorganic Chemistry in Liquid Ammonia, Elsevier (1979).
12. Pearson, R. G., Ed., Hard and Soft Acids and Bases, Dowden, Hutchinson (1973).

Duration : 30 Hours

Practical: 01 Credit

Section A : Organic Chemistry :
Qualitative analysis of following Organic Compounds :
1. Naphthalene
2. Anthracene

Semester-III
Course No.: UMJCHT-301 (Major course)
Title: FOUNDATION COURSE CHEMISTRY-3

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 hours

3. Benzoic Acid
4. Salicylic Acid
5. Glucose
6. Sucrose
7. Catechol
8. Resorcinol
9. Salicylaldehyde
10. Acetophenone
11. Benzophenone
12. P-aminobenzoic
13. Urea
14. Thiourea
14. Acetamide
15. Benzamide

(Note : Any 07 to 09 Compounds to be analysed in a semester)

Section B : Physical Chemistry :
1. Determination of heat capacity of calorimeter.
2. Determination of heat of neutralization hydrochloric acid with sodium hydroxide.

Section C: Inorganic Chemistry:
Semi-micro qualitative analysis using H_2S of mixtures of salts (not more than four ionic species, two anions and two cations and excluding insoluble salts) out of the following:
Cations : NH_4^+ , Pb^{2+}, Ag+ , Bi^{3+} , Cu^{2+} , Cd^{2+}, Sn^{2+}, Fe^{3+}, Al^{3+}, Co^{2+} , Cr^{3+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, K^+
Anions : CO_3^{2-} , S^{2-} , SO_2^- , $S_2O_3^{2-}$, NO_3^- , CH3COO$^-$, Cl^- , Br^- , I^-, NO_3^- ,SO_4^{2-} , PO_4^{3-} , BO_3^3, $C_2O_4^{2-}$, F^- (Students should be encouraged to perform Spot tests wherever feasible)

NOTE FOR PAPER SETTING:

Total marks = 75
The evaluation of course shall contain two parts:
Mid semester assessment: The internal assessment shall be held on completion of about 50% of the prescribed syllabus. The question paper shall comprise of four questions of five marks each. The candidate has to attempt any three of them. **(Total Marks: 15; Time Duration: 1½ hour)**
End semester assessment: It consists of two sections:

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years Dec. 2023, 2024 &2025)

Semester-III
Course No.: UMJCHT-301 (Major course)
Title: FOUNDATION COURSE CHEMISTRY-3

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 hours

Section A will consist of four short answer questions (one question from each unit) of 3 marks each covering the entire syllabi. **Section B** consists of eight long answer questions (two questions from each unit) of 12 marks each.
Section A is compulsory. From Section B, the candidate has to attempt four questions in total, selecting one from each unit. (**Total Marks: 60; Time Duration: 3 hours**)

EVALUATION OF PRACTICALS:

Daily evaluation of practical records/viva-voce etc.	10 marks	
Final examination	100 % Syllabus	15 marks (10 marks = practical assessment + 5 marks= viva-voce examination)

BOOKS RECOMMENDED:

1. Vogel's Textbook of Practical Organic Chemistry, Brian S. Furniss, Antony J. Hannaford, Peter W. G. Smith, Austin R. Tatchell. Pearson 5th Edition, 2012.
2. Man,F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson education (2009).
3. Practical Physical Chemistry; Khosla, B. D.; Garg, V. C. & Gulati, A.; R. Chand & Co.; 2011.
4. Experiments in Physical Chemistry; Das, R. C, and Behra, B.; Tata McGraw Hill.
5. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
6. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years Dec. 2023, 2024 &2025)

Semester-III
Course No.: UMJCHT-302 (Major course)
Title: ANALYTICAL CHEMISTRY

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 hours

Theory: 03 Credits **Duration of Course: 45 hours**

UNIT-I: Basics of Analytical chemistry **(12 Lectures)**

Classification of analytical techniques. Choice of analytical method choosen: accuracy, precision, sensitivity, selectivity and method validation. Limit of detection (LOD), Limit of quantification (LOQ), Limitations of analytical methods – Errors: Determinate and indeterminate errors, absolute error, relative error, minimization of errors.

Basic laboratory practices: calibration of glassware (pipette, burette and volumetric flask), Sampling (solids and liquids), weighing, drying, dissolving, Acid treatment, Safety in Chemical

Laboratory, Rules of fire prevention and accidents. First aid, Precautions to be taken while handling toxic chemicals, concentrated/fuming acids and organic solvents.

UNIT-II: Acid-base and complexometric Titrimetry **(11 Lectures)**

Basic principle and Classification of titrimetric analysis.

Acid-base titrimetry: Titration curves for strong acid vs strong base, weak acid vs strong base and weak base vs strong acid titrations. Titration curves, Quantitative applications – selecting and standardizing a titrant, inorganic analysis - alkalinity, acidity.

Complexometric titrimetry: Indicators for EDTA titrations- theory of metal ion indicators, titration methods employing EDTA - direct, back, displacement and indirect determinations, Application-determination of hardness of water.

UNIT-III: Redox and Precipitation Titrimetry and Gravimetric Analysis **(11 Lectures)**

Redox titrimetry: Balancing redox equations, calculation of the equilibrium constant of redox reactions, titration curves, Theory of redox indicators, calculation of standard potentials using Nernst equation. Applications.

Precipitation titrimetry: Titration curves, titrants and standards, indicators for precipitation titrations involving silver nitrate- Volhard's and Mohr's methods and their differences.

Gravimetric Analysis: Principle and mechanism of precipitation, Factors influencing precipitation, Co-precipitation, post-precipitation, Advantages of organic reagents over inorganic reagents, Importance of reagents used in gravimetry [8-hydroxyquinoline (oxine) and dimethyl glyoxime (DMG)].

UNIT-IV: Chromatographic Methods **(11 Lectures)**

Classification of chromatographic methods: Principles of differential migration, description of Chromatographic process, distribution coefficients, capacity factor, column efficiency and resolution, Techniques of sample preparation in chromatography.

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years Dec. 2023, 2024 &2025)

Semester-III
Course No.: UMJCHT-302 (Major course)
Title: ANALYTICAL CHEMISTRY

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 hours

Brief overview of paper chromatography (detections of spots, retardation factors, factors that affect reproducibility of R_f values) and Thin Layer Chromatography (Stationary phase, adsorbents, liquid phase support, plate preparation, mobile phase, sample application, development, detection of spot, R_f values).

Practical: 01 Credit **Duration : 30 Hours**

1. Separation of ortho- & para-nitrophenol and o- and p-aminophenol by thin layer chromatography (TLC) and calculation of their R_f values.
2. Separation of divalent 3d transition metal ions by paper chromatography.
3. Determination of carbonate and bicarbonate present in water sample.
4. Preparation of EDTA solution and estimation of hardness ($CaCO_3$) of two different samples.
5. Preparation of standard Na_2CO_3 solution, standardization of given HCl solution and estimation of alkali present in given antacid.
6. Determination of chlorine in two different samples of bleaching powder by iodometry (standard sodium thiosulphate solution to be supplied)
7. Estimation of Cu(II) using sodium thiosulphate solution (Iodometrically).
8. Estimation of $K_2Cr_2O_7$ using sodium thiosulphate solution (Iodometrically).

NOTE FOR PAPER SETTING:

Total marks = 75
The evaluation of course shall contain two parts:
Mid semester assessment: The internal assessment shall be held on completion of about 50% of the prescribed syllabus. The question paper shall comprise of four questions of five marks each. The candidate has to attempt any three of them. **(Total Marks: 15; Time Duration: 1½ hour)**
End semester assessment: It consists of two sections:
Section A will consist of four short answer questions (one question from each unit) of 3 marks each covering the entire syllabi. **Section B** consists of eight long answer questions (two questions from each unit) of 12 marks each.
Section A is compulsory. From Section B, the candidate has to attempt four questions in total, selecting one from each unit. **(Total Marks: 60; Time Duration: 3 hours)**

EVALUATION OF PRACTICALS:

Daily evaluation of practical records/viva-voce etc.	10 marks

Semester-III
Course No.: UMJCHT-302 (Major course)
Title: ANALYTICAL CHEMISTRY

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 hours

Final examination	100 % Syllabus	15 marks (10 marks = practical assessment + 5 marks= viva-voce examination)

BOOKS RECOMMENDED:

1. Jeffery, G.H., Bassett, J., Mendham, J.& Denney, R.C. Vogel's Textbook of Quantitative Chemical Analysis, John Wiley & Sons,1989.
2. Willard, H. H., Merritt, L.L., Dean, J. & Settle, F.A. Instrumental Methods ofAnalysis, Wadsworth Publishing Company Ltd., Belmont, California, USA, 1988.
3. Christian, G.D; Analytical Chemistry, VI Ed. John Wiley & Sons, New York,2004.
4. Harris, D. C. Exploring Chemical Analysis, Ed. New York, W.H. Freeman, 2001.
5. Skoog, D. A. Holler F.J. & Nieman, T.A. Principles of Instrumental Analysis, Cengage Learning India Ed,2017.
6. Ditts, R.V. Analytical Chemistry; Methods of Separation, van Nostrand, 1974.
7. Fifield, F.W.; Kealey, D. (2000), Principles and Practice of Analytical Chemistry, Wiley.
8. Harris, D. C. (2007), Exploring Chemical Analysis, W.H. Freeman and Co.
9. Harris, D. C. (2007), Quantitative Chemical Analysis, 6th Edition, Freeman.
10. Mikes, O. (2000), Laboratory Handbook of Chromatographic methods, D.Van Nostrand Company Inc.

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Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years Dec. 2023, 2024 &2025)

Semester-III
Course No.: UMICHT-303 (Minor course)
Title: FOUNDATION COURSE CHEMISTRY-3

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 hours

Theory: 03 Credits **Duration of Course: 45 hours**

UNIT-I : Chemistry of saturated and unsaturated Aliphatic Hydrocarbons **(13 Lectures)**

a) Chemistry of Alkanes : Formation of alkanes by Wurtz Reaction , Wurtz Fitting Reaction, Free Radical Substitution in alkanes, Halogenation : Relative reactivity and selectivity.

b) Chemistry of Alkenes and Alkynes:

Formation of Alkenes by E1, E2, E1cB reactions , Hoffmann Elimination and Saytzeff rule. Addition of Halogen to alkenes : Carbocation and Halonium ion Mechanism. Ozonolysis of Propene with Mechanism. Addition of Hydrogen halides to alkenes with mechanism, Markownikoff's rule Addition of HBr to Propene (Peroxide Effect/Anti-Markownikoff addition) , Syn and Anti Addition Hydrogenation, Hydroxylation , Hydration.

Alkynes : Acidity of Alkynes, Alkylation of terminal Alkynes, hydrogenation and hydration of Alkynes

Relative Reactivity of Alkenes and Alkynes

c) Cycloalkanes (upto Cyclohexane) : Nomenclature and Methods of Preparation.

UNIT-II : Aromatic hydrocarbons **(10 Lectures)**

Concept of Aromaticity: Benzenoids and Hückel's rule, **Structure of Benzene**: Kekule Structures, Structure of Benzene on the basis of Resonance and Molecular Orbital Theory. Concept of resonance energy.

Preparation (Benzene): from Phenol, from Acetylene, from Benzene sulphonic acid, by decarboxylation

Reactions: (Benzene): General mechanism of Electrophilic Substitution reactions, Nitration, Halogenation and Sulphonation.

Friedel-Craft's reaction : alkylation (upto 3 carbons on benzene) and acylation

Activating and deactivating groups, Orientation effect, ortho-para ratio.

UNIT-III: Thermodynamics-I **(11 Lectures)**

Definition of thermodynamics terms: system, surroundings, boundary. Types of system, Thermodynamic variables, intensive and extensive properties. State and path functions. Thermodynamic equilibrium. Thermodynamic process. Concept of heat and work.

First Law of Thermodynamics: Statement and our daily life examples, internal energy and its physical significance. Heat change at constant volume, heat change at constant pressure: Enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Variation of internal energy with temperature and volume. Variation of enthalpy with temperature and pressure. Entropy and its significance. 2nd Law of thermodynamics.

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years Dec. 2023, 2024 &2025)

Semester-III
Course No.: UMICHT-303 (Minor course)
Title: FOUNDATION COURSE CHEMISTRY-3

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 hours

UNIT-IV Chemistry of s and p Block Elements – I **(11 Lectures)**

Inert pair effect, Relative stability of different oxidation states, diagonal relationship and anomalous behaviour of first member of each group. Allotropy and catenation. Complex formation tendency of s and p block elements. Hydrides and their classification ionic, covalent and interstitial. Preparation, structure and bonding of borohydrides (diborane).

BOOKS RECOMMENDED:

1. Morrison, R.N., Boyd, R.N.' Bhattacharjee. S.k. (2010) Organic Chemistry.
2. Finar, I.L. (2002) Organic Chemistry Volume I, II , 6th Edition Pearson Education.
3. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
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6. R.P.Rastogi, R.R.Misra. Sixth Revised Edition. Vikas Publishing House Pvt. Ltd.
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8. Drago, R. S., Modern Approach to Acid base Chemistry, J. C.Chem. Educ., 51, 300 (1974).
9. Gillespie, R. R., Proton acids, Lewis acids, hard acids, soft acids and super acids. Chapman and Hall (1975).
10. Jensen, W.B.,The Lewis Acid-Base Concepts, Wiley, New York (1980).
11. Nicholls, D. Inorganic Chemistry in Liquid Ammonia, Elsevier (1979).
12. Pearson, R. G., Ed., Hard and Soft Acids and Bases, Dowden, Hutchinson (1973).

Practical: 01 Credit **Duration : 30 Hours**

Section A : Organic Chemistry :

Qualitative analysis of following Organic Compounds :

1. Naphthalene
2. Anthracene
3. Benzoic Acid
4. Oxalic Acid
5. Salicylic Acid
6. Sucrose
7. Catechol
8. Resorcinol
9. Salicylaldehyde

10

Semester-III
Course No.: UMICHT-303 (Minor course)
Title: FOUNDATION COURSE CHEMISTRY-3

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 hours

10. Acetophenone
11. Benzophenone
12. P-aminobenzoic acid
13. p-chlorobenzoic acid
14. Thiourea
15. Acetamide
16. Benzamide

(Note : Any 07 to 09 Compounds to be analysed in a semester)

Section B : Physical Chemistry :

1. Determination of heat capacity of calorimeter.
2. Determination of heat of neutralization hydrochloric acid with sodium hydroxide.
3. Determination of heat of neutralization acetic acid with sodium hydroxide.

Section C: Inorganic Chemistry :

Semi-micro qualitative analysis using H_2S of mixtures of salts (not more than four ionic species, two anions and two cations and excluding insoluble salts) out of the following:

Cations : NH_4^+ , Pb^{2+}, Ag+ , Bi^{3+} , Cu^{2+} , Cd^{2+}, Sn^{2+}, Fe^{3+}, Al^{3+}, Co^{2+} , Cr^{3+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, K^+

Anions : CO_3^{2-} , S^{2-} , SO_2^- , $S_2O_3^{2-}$, NO_3^- , $CH3COO^-$, Cl^- , Br^- , I^-, NO_3^- ,SO_4^{2-} , PO_4^{3-} , BO_3^3, $C_2O_4^{2-}$, F^- (Students should be encouraged to perform Spot tests wherever feasible)

NOTE FOR PAPER SETTING:

Total marks = 75

The evaluation of course shall contain two parts:

Mid semester assessment: The internal assessment shall be held on completion of about 50% of the prescribed syllabus. The question paper shall comprise of four questions of five marks each. The candidate has to attempt any three of them.**(Total Marks: 15; Time Duration: 1½ hour)**

End semester assessment: It consists of two sections:

Section A will consist of four short answer questions (one question from each unit) of 3 marks each covering the entire syllabi. **Section B** consists of eight long answer questions (two questions from each unit) of 12 marks each.

Section A is compulsory. From Section B, the candidate has to attempt four questions in total, selecting one from each unit. **(Total Marks: 60; Time Duration: 3 hours)**

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years Dec. 2023, 2024 &2025)

Semester-III
Course No.: UMICHT-303 (Minor course)
Title: FOUNDATION COURSE CHEMISTRY-3

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 hours

EVALUATION OF PRACTICALS:

Daily evaluation of practical records/viva-voce etc.	10 marks	
Final examination	100 % Syllabus	15 marks (10 marks = practical assessment + 5 marks = viva-voce examination)

BOOKS RECOMMENDED:

1. Vogel's Textbook of Practical Organic Chemistry, Brian S. Furniss, Antony J. Hannaford, Peter W. G. Smith, Austin R. Tatchell. Pearson 5th Edition, 2012.
2. Man,F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson education (2009).
3. Practical Physical Chemistry; Khosla, B. D.; Garg, V. C. & Gulati, A.; R. Chand & Co.; 2011.
4. Experiments in Physical Chemistry; Das, R. C. and Behra, B.: Tata McGraw Hill.
5. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
6. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years Dec. 2023, 2024 &2025)

Semester-III

Course No.: UMDCHT-304 (Multi Disciplinary Course)

Title: CHEMISTRY IN EVERYDAY LIFE

Credits: 03 (Theory)
Maximum Marks: 75 (Theory)
Duration of Examination: 3 hours

Theory: 03 Credits **Duration of Course: 45 hours**

Learning Objectives:
To learn about food additives and chemical composition of drugs.

UNIT-I Chemotherapy **(13 Lectures)**
Definition of chemotherapy- examples each for (i) Analgesics, (ii) antibacterial, (iii) anti-inflammatory, (iv) antipyretic, (v) antibiotic, (vi) antacid (vii) antiviral, (viii)antidepressant, (ix)antiallergic, (x) antidiabetics, (xi) antihypertensive, (xii) anaesthetics (local and general) **Structures not necessary.**

UNIT-II Food Additives and Preservation **(12 Lectures)**
Artificial sweeteners - saccharin - cyclomate and asparatate, food flavours esters and aldehydes. Food colours - restricted use of spurious colors - emulsifying agents - leavening agents, bakingpowder, yeast - taste makers - MSG, vinegar. Food preservation – Methods – preservation bylow temperature, high temperature - preservatives.
Structures not necessary.

UNIT-III Biomolecules-I **(10 Lectures)**
Carbohydrates: Definition, classification and their importance
Amino acids :Essential and non-essential. Definition, classification and theirimportance.
Oils and Fats: Definition, classification and importance. Saponification value
Structure not necessary.

UNIT- IV Biomolecules-II **(10 Lectures)**
Vitamins: Nomenclature and Classification, Sources, deficiency diseases due to vitamins A, B,C, D, E and K. Structure not necessary.
Minerals: Macro and micro elements, importance and deficiency diseases.
Structure not necessary.

NOTE FOR PAPER SETTING:

Total marks = 75
The evaluation of course shall contain two parts:
Mid semester assessment: The internal assessment shall be held on completion of about 50% of the prescribed syllabus. The question paper shall comprise of four questions of five marks

Semester-III
Course No.: UMDCHT-304 (Multi Disciplinary Course)
Title: CHEMISTRY IN EVERYDAY LIFE

Credits: 03 (Theory)
Maximum Marks: 75 (Theory)
Duration of Examination: 3 hours

each. The candidate has to attempt any three of them.**(Total Marks: 15; Time Duration: 1½ hour)**
End semester assessment: It consists of two sections:
Section A will consist of four short answer questions (one question from each unit) of 3 marks each covering the entire syllabi. **Section B** consists of eight long answer questions (two questions from each unit) of 12 marks each.
Section A is compulsory. From Section B, the candidate has to attempt four questions in total, selecting one from each unit. **(Total Marks: 60; Time Duration: 3 hours)**

BOOKS RECOMMENDED:

1. Thangamma Jacob, Textbook of Applied chemistry for home science and Allied Science, New Delhi, Macmillan Co., (1979).
2. Macmillan, 1st Ed., 1990. M. Swaminathan, Text Book on Food chemistry, Printing and Publishing Co., Ltd., Bangalore, 1993.
3. Alex Ramani, V., Food Chemistry, MJP Publishers, Triplicane, Chennai, 2009. 9. Sivasankar, B., Food Processing and Preservation, PHI Learning Private Limited, Delhi, 2013.
4. B. S. Bahl, A. Bhal, —Textbook of Organic chemistryl, S. Chand and Company Ltd., New Delhi, 22nd Ed., 2016.
5. Organic Chemistry of Natural Products-Volume I and II by Gurdeep R Chatwal, Himalaya Publishing House.

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years Dec. 2023, 2024 &2025)

Semester-III
Course No.: UMJCHT-305 (Skill Enhancement Course)
Title: CHEMISTRY OF FOOD AND COSMETICS

Credits: 01 (Theory) + 01 (Practical)
Maximum Marks: 50 [25 (Theory) + 25 (Practical)]
Duration of examination: 2.5 hours

Theory: 01 Credit **Duration of Course: 15 hours**

UNIT-I Food Preservation and Food Adulteration **(05 Lectures)**

Principles of Food Preservation: Meaning, mode of action and changes in foods.
Traditional methods of Food Preservation: Smoking, Sun Drying, Pickling and Fermentation.
Food Adulteration: Common adulterants in different foods- milk and milk products, vegetable oils, and fats, spices and condiments, cereals, pulses.
Sweetening agents and beverages.
Contamination with toxic chemicals- pesticides and insecticides. Methods involved in the detection and prevention of food adulteration.

UNIT-II Chemistry of Cosmetics **(05 Lectures)**

History of cosmetics, classification of cosmetics, professional image of self grooming, beauty and wellness. Chemical peels and peeling agents, lasers and light devices, Electro Chemistry, bath salts, gels, soaps, bubble baths and scrubs.

UNIT-III Cosmetic Products **(05 Lectures)**

A general study including preparation and uses of the following: Hair dye, hair spray, shampoo, suntan lotions, sun screen, face powder, lipsticks, talcum powder, nail enamel, creams (cold, vanishing and shaving creams), moisturisers, cleansers, acne and anti aging creams.

Practical: 01 Credit **Duration: 30 hours**

Practicals

1. Preparation of shampoo
2. Preparation of face cream
3. Preparation of Soap
4. Preparation of Lip Balm
5. Testing for the presence of adulterants in various food samples -milk and milk products, vegetable oils, and fats, spices and condiments, cereals, pulses.
6. Practice any two traditional methods of food Preservation (from theory component).

NOTE FOR PAPER SETTING:

Total marks = 25
The evaluation of course shall contain two parts:

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years Dec. 2023, 2024 &2025)

Semester-III
Course No.: UMJCHT-305 (Skill Enhancement Course)
Title: CHEMISTRY OF FOOD AND COSMETICS

Credits: 01 (Theory) + 01 (Practical)
Maximum Marks: 50 [25 (Theory) + 25 (Practical)]
Duration of examination: 2.5 hours

Mid semester assessment: The internal assessment shall be held on completion of about 50% of the prescribed syllabus. The question paper shall comprise of three questions of 2.5 marks each. The candidate has to attempt any two of them. **(Total Marks: 5; Time Duration: 01 hour).**
End semester assessment: It consists of two sections:
Section A will consist of four short answer questions (at least one question from each unit) of 01 mark each covering the entire syllabi. **Section B** consists of six long answer questions (two questions from each unit) of 04 marks each.
Section A is compulsory. From Section B, the candidate has to attempt any four questions in total. **(Total Marks: 20; Time Duration: 2½ hours)**

EVALUATION OF PRACTICALS:

Daily evaluation of practical records/viva-voce etc.	10 marks	
Final examination	100 % Syllabus	15 marks (10 marks = practical assessment + 5 marks = viva-voce examination)

BOOKS RECOMMENDED:

1. Rick Parker (2003) Introduction to Food Science, New York: Delmar Thomson Learning.
2. Scottsmith and Hui Y.H (Editors) (2004) Food Processing – Principles and Applications, London Blackwell Publishing.
3. Subbulakshmi, G and Udipi, S. A. (2001).Foods Processing and Preservation, New Delhi, New Age International (P) Ltd. Publishing.
4. Swaminathan, M. (1995).Food Science Chemistry and Experimental Food, The Bangalore Printing and Publishing Co. Ltd.
5. Vacklavick, V. and Christian, E. (2003). Essentials of Food Science. New York, Kluwer Academic/ Plenum Publisher.
   ** All new journals related to Food Preservation**
6. Perry Romanowski, Beginning Cosmetic Chemistry, Allured Pub Corp.2009.
7. Dr. Ramesh Kumari, Chemistry of Cosmetics, Prestige Publishers.
8. Srilakshmi B., Food Science, New age International Pvt. Ltd. Publishers, III ed. 2003.
9. Shakuntala Manay N. and Shadaksharaswamy M. FOODS: Facts and Principles. New Age International Pvt. Ltd. Publishers, II ed. 2002.
10. Norman N. Potter, Food Science, CBS Publishers and Distributors, New Delhi. 1994.
11. Swaminathan M. Advanced Text Book on Food and Nutrition, Volume I and II Printing and Publishing Co., Ltd., Bangalore. 1993.

UNIVERSITY OF JAMMU

SYLLABUS FOR FOUR YEAR UNDERGRADUATE PROGRAMME (FYUGP) IN CHEMISTRY W.E.F. ACADEMIC SESSION 2022 AS PER NATIONAL EDUCATION POLICY (NEP)

List of Major (MJ), Minor (MI), Skill (SEC) and Multi Disciplinary (MD) Courses for 3rd and 4th Semesters of Four Year Undergraduate Program (FYUGP) in Chemistry as per National Education Policy (NEP)

[Semester III–IV]

S. No.	Level (UG/Sem)	Course Code	Credits	Course Name	Nature of open Elective
1.	UG/Sem-3	UMJCHT-301	4 (3 credit theory + 1 credit practical)	Foundation Course Chemistry-3	MJ
2.	UG/Sem-3	UMJCHT-302	4 (3 credit theory + 1 credit practical)	Analytical Chemistry	MJ
3.	UG/Sem-3	UMICHT-303	4 (3 credit theory + 1 credit practical)	Foundation Course Chemistry-3	MI
4.	UG/Sem-3	UMDCHT-304	3	Chemistry in Everyday Life	MD
5.	UG/Sem-3	USECHT-305	2 (1 credit theory + 1 credit practical)	Chemistry of Food & Cosmetics	SEC
6.	UG/Sem-4	UMJCHT-401	4 (3 credit theory + 1 credit practical)	Physical Chemistry-1	MJ
7.	UG/Sem-4	UMJCHT-402	4 (3 credit theory + 1 credit practical)	Organic Chemistry-1	MJ
8.	UG/Sem-4	UMJCHT-403	4 (3 credit theory + 1 credit practical)	Inorganic Chemistry-1	MJ
9.	UG/Sem-4	UMJCHT-404	4 (3 credit theory + 1 credit practical)	Spectroscopic and Nuclear Chemistry	MJ
10.	UG/Sem-4	UMICHT-405	4 (3 credit theory + 1 credit practical)	Inorganic Chemistry-1	MI

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years May 2024, 2025 & 2026)

Semester-IV
Course No.: UMJCHT-401 (Major course)
Title: PHYSICAL CHEMISTRY-1

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]

Theory: 03 Credits
Duration of Course: 45 hours
Duration of Examination: 3 hours

UNIT-I Chemical Equilibrium **(11 Lectures)**

Introduction , State of chemical equilibrium , Law of mass action, Law of chemical equilibrium, Thermodynamic derivation of the law of chemical equilibrium, , Types of equilibrium constants , Relationship between K_p and K_c , Application of equilibrium constants, Van't Hoff Reaction Isotherm, Le Chatlier's Principle, Applications of Le Chatlier's Principle, Clausius-Clapeyron Equation.

UNIT-II Phase Equilibrium **(12 Lectures)**

Introduction , Phase, Component , Degree of freedom, Criteria for Phase Equilibrium, Thermodynamic derivation of phase rule, Phase Diagram, One Component system, phase diagram of water, Sulphur, Freezing Mixtures.

Immiscible liquids, Steam Distillation, Partially miscible liquids (Upper and Lower Critical Solution Temperature), Effect of temperature on Critical Solution Temperature, Nernst Distribution Law, Introduction, thermodynamic derivation of law and its applications.

UNIT-III Electrochemistry-I **(11 Lectures)**

Introduction, Electrolytic Conductance, Conductance, Cell constant, Specific conductivity, Equivalent conductivity, Molar conductivity and their relation with specific conductivity , Variation of different types of conductivities with dilution.

Arrhenius theory of ionisation , Ostwald's dilution law, Debye-Huckel-Onsager equation, Anomalous behaviour of strong electrolytes, Kohlrausch's Law, Transport Number, Determination of transport number (Hittorf's and Moving Boundary Method), Conductometric titrations.

UNIT-IV Electrochemistry-II **(11 Lectures)**

Electrochemical Cell, Electrolytic Cell, EMFof a cell, Reversible and Irreversible Cell, Types of electrodes, Relationship between electrical energy and chemical energy, Measurement of electrode potentials (Zinc and copper electrodes), Electrochemical series, Applications, Nernst Equation for measuring EMF of a cell, Conentration Cells (definition and examples only), Liquid JunctionPotential (definition only), Potentiometric titrations.

BOOKS RECOMMENDED:

1. Rodgers, G.E. Inorganic and solid state chemistry, Cengage Learning India Ltd., (2008).
2. Barrow, G.M. Physical Chemistry Tata McGraw-Hill, (2007)

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years May 2024, 2025 & 2026)

Semester-IV
Course No.: UMJCHT-401 (Major course)
Title: PHYSICAL CHEMISTRY-1

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]

Theory: 03 Credits
Duration of Course: 45 hours
Duration of Examination: 3 hours

3. Castellan, G.W. Physical Chemistry 4th Ed. Narosa, (2004)
4. P. W. Atkins, J de Paula, Physical Chemistry, 8th Ed, Oxford University Press, New Delhi, (2006).
5. I. N. Levine, Physical Chemistry, 6th Ed, Mcgraw Hill Education, (2011).

Practical: 01 Credit **Duration : 30 Hours**

Course Objectives:

- To know different phases of a substance.
- To know the miscibility of two liquids
- To know conductance of the different electrolytic solutions

Learning Objectives:

- To know the miscibility of different solutions.
- To learn the practical application of conductance.

Experiments:

1. Determination of critical solution temperature and composition of phenol-water system.
2. Effect of impurities on critical solution temperature on phenol-water system.
3. Construction of phase diagrams.
4. Determination of cell constant.
5. Determination of equivalent conductivity, degree of dissociation and dissociation of a weak acid.
6. Determination of equivalent conductivity of a strong electrolyte and hence verify Debye-Huckel Onsager Equation.
7. Conductometric Titrations of Strong acid, weak acids and their different combinations.
8. Potentiometric Titrations of Strong acid, weak acids and their different combinations.

Course Outcome:

After successful completion of the course, students will be able to:

- Understand different phases of a solution.
- Knowledge about conductance and its various types.

NOTE FOR PAPER SETTING:

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years May 2024, 2025 & 2026)

Semester-IV
Course No.: UMJCHT-401 (Major course)
Title: PHYSICAL CHEMISTRY-1

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]

Theory: 03 Credits
Duration of Course: 45 hours
Duration of Examination: 3 hours

Total marks = 75
The evaluation of course shall contain two parts:
Mid semester assessment: The internal assessment shall be held on completion of about 50% of the prescribed syllabus. The question paper shall comprise of four questions of five marks each. The candidate has to attempt any three of them. **(Total Marks: 15; Time Duration: 1½ hour)**
End semester assessment: It consists of two sections:
Section A will consist of four short answer questions (one question from each unit) of 3 marks each covering the entire syllabi. **Section B** consists of eight long answer questions (two questions from each unit) of 12 marks each.
Section A is compulsory. From Section B, the candidate has to attempt four questions in total, selecting one from each unit. (**Total Marks: 60; Time Duration: 3 hours**)

EVALUATION OF PRACTICALS:

Daily evaluation of practical records/viva-voce etc.	10 marks	
Final examination	100 % Syllabus	15 marks (10 marks = practical assessment + 5 marks= viva-voce examination)

BOOKS RECOMMENDED:

1. UGC Advanced Physical Chemistry, J.N. Gurtu, A. Gurtu, Pragati Prakashan.
2. Advanced Practical Chemistry, Singh, Yadav, Siddiqui, Pragati Prakashan.
3. Advanced Practical Physical Chemistry, J.B. Yadav, God Publishing House, Krishna Prakash Media Ltd.
4. Advanced Physical Chemistry Experiments, J.N. Gurtu, A. Gurtu, Pragati Prakashan.

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years May 2024, 2025 & 2026)

Semester-IV
Course No.: UMJCHT-402 (Major course)
Title: ORGANIC CHEMISTRY-1

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 hours

Theory: 03 Credits **Duration of Course: 45 hours**

UNIT-I: Alkyl & Aryl Halides **(12 Lectures)**

Alkyl Halides (Upto 5 Carbons) Types of Nucleophilic Substitution (SN1, SN2 and SNi) reactions.

Preparation: from alkenes *and* alcohols.

Reactions: hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation. Williamson's ether synthesis.

Aryl Halides *Reactions (Chlorobenzene):* Aromatic nucleophilic substitution (replacement by –OH group) and effect of nitro substituent. Benzyne Mechanism: KNH_2/NH_3 (or $NaNH_2/NH_3$). Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides.

UNIT-II: Alcohols & Phenols **(13 Lectures)**

Alcohols

Preparation: Preparation of 1°, 2° and 3° alcohols: using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters.

Reactions: With sodium, HX (Lucas test), esterification, oxidation (PCC, alk. $KMnO_4$, acidic dichromate, conc. HNO_3). Oppeneauer oxidation.

Phenols: (Phenol case) *Preparation:* Cumene hydroperoxide method, from diazonium salts. *Reactions:* Electrophilic substitution: Nitration, halogenation and sulphonation. Reimer-Tiemann Reaction, Gattermann-Koch Reaction, Houben–Hoesch reaction.

UNIT-III: Ethers & Epoxides **(10 Lectures)**

Nomenclature of ethers and methods of their formation, physical properties, Chemical reactions – cleavage and autoxidation, Ziesel's method. Synthesis of epoxides, Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides.

UNIT-IV: Carbohydrates **(10 Lectures)**

Classification and General Properties, Glucose and Fructose (open chain and cyclic structure), Determination of configuration of monosaccharides, absolute configuration of Glucose and Fructose, Mutarotation, ascending and descending in monosaccharides. Structure of disacharrides (sucrose, maltose, lactose) and polysacharrides (starch and cellulose) excluding their structure elucidation.

Semester-IV
Course No.: UMJCHT-402 (Major course)
Title: ORGANIC CHEMISTRY-1

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 hours

BOOKS RECOMMENDED:

1. Graham Solomon, T.W., Fryhle, C.B. &Dnyder, S.A. Organic Chemistry, John Wiley & Sons (2014).
2. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage LearningIndia Edition, 2013.
3. Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).
4. Finar, I.L. Organic Chemistry (Vol. I & II), E.L.B.S.
5. Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.
6. Bahl, A &Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.
7. Berg, J.M., Tymoczko, J.L. &Stryer, L. Biochemistry, W.H. Freeman, 2002.
8. Petrucci, R.H. General Chemistry, 5th Ed., Macmillan Publishing Co.: New York (1985).
9. Kotz, J.C., Treichel, P.M. & Townsend, J.R. General Chemistry Cengage Learning India Pvt. Ltd., New Delhi (2009).

Practical: 01 Credit — Duration : 30 Hours

Experiments:

1. Purification of organic compounds by crystallization (from water and alcohol) and distillation.
2. Criteria of Purity: Determination of melting and boiling points.
3. Preparations: Mechanism of various reactions involved to be discussed.
4. Recrystallisation, determination of melting point and calculation of quantitative yields to be done.
   (a) Bromination of Phenol/Aniline
   (b) Benzoylation of amines/phenols
   (c) Oxime and 2,4-dinitrophenylhydrazone of aldehyde/ketone
5. Action of salivary amylase on starch
6. Effect of temperature on the action of salivary amylase on starch.
7. Differentiation between a reducing and a non-reducing sugar.

NOTE FOR PAPER SETTING:

Total marks = 75
The evaluation of course shall contain two parts:
Mid semester assessment: The internal assessment shall be held on completion of about 50% of the prescribed syllabus. The question paper shall comprise of four questions of five marks

Semester-IV
Course No.: UMJCHT-402 (Major course)
Title: ORGANIC CHEMISTRY-1

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 hours

each. The candidate has to attempt any three of them. **(Total Marks: 15; Time Duration: 1½ hour)**

End semester assessment: It consists of two sections:

Section A will consist of four short answer questions (one question from each unit) of 3 marks each covering the entire syllabi. **Section B** consists of eight long answer questions (two questions from each unit) of 12 marks each.

Section A is compulsory. From Section B, the candidate has to attempt four questions in total, selecting one from each unit. (**Total Marks: 60; Time Duration: 3 hours**)

EVALUATION OF PRACTICALS:

Daily evaluation of practical records/viva-voce etc.	10 marks	
Final examination	100 % Syllabus	15 marks (10 marks = practical assessment + 5 marks= viva-voce examination)

BOOKS RECOMMENDED:

1. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.
2. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.
3. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry, Universities Press.

Semester-IV
Course No.: UMJCHT-403 (Major Course)
Title: INORGANIC CHEMISTRY-1

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 hours

UNIT-I Chemistry of s and p Block Elements – II **(12 Lectures)**

Study of the following compounds with emphasis on structure, bonding, preparation, properties and uses. Boric acid and borates, boron nitrides, carboranes andgraphiticcompounds, silanes. Oxides and oxoacids of nitrogen, Phosphorus andchlorine. Peroxo acids of sulphur, interhalogen compounds, polyhalide ions, pseudohalogensand basic properties of halogens. Occurrence and uses, preparation and properties of XeF2, XeF4 and XeF6; Nature of bonding in noble gas compounds (Valence bond treatment and MO treatment for XeF2). Molecular shapes of noble gas compounds (VSEPR theory).

UNIT-II Transition Elements-I **(11 Lectures)**

General group trends with special reference to electronic configuration, colour, variable valency, magnetic and catalytic properties, and ability to form complexes. Stability of various oxidation states and e.m.f. (Latimer & Bsworth diagrams). Chemistry of elements of second and third transition series- general characteristics, comparative treatment with their 3d analogues in respect of ionic radii, oxidationstates, magnetic behaviour spectral properties and stereochemistry.

UNIT-III Transition Elements-II **(11 Lectures)**

Chemistry of Ti, V, Cr Mn, Fe and Co in various oxidation states (excludingtheirmetallurgy). Lanthanoids and Actinoids: Electronic configuration, oxidation states, colour, spectral and magnetic properties,lanthanide contraction, separation of lanthanides(ion-exchange method only). General features of actinoids, separation of Np, Pm, Amfrom U.

UNIT-IV Basics of coordination chemistry **(11 Lectures)**

Definitions and terminology, Werner's coordination theory and its experimental verification, EAN concept, IUPAC nomenclature of coordination compounds, structural and stereoisomerism in complexes with coordination numbers 4and6, Distinction between cis- and trans- compounds. A brief outline of thermodynamic and kinetic stability of metal complexes, stepwise and overall stability constants, factors affecting the stability of complexes, chelate effect.

BOOKS RECOMMENDED:

1. Lee J. D., Concise Inorganic Chemistry Wiley India, 5th Edn., 2008.
2. Huheey J. E., Keiter E. A. and Keiter R. L., Inorganic Chemistry –Principlesofstructure and reactivity, Pearson Education, 4th Ed. 2002.
3. Puri, Sharma, Kalia, Principles of Inorganic Chemistry, Vishal Pub. Co., 33rded., 2017.
4. Shriver D. E.,Atkins P. W., InorganicChemistry, Oxford UniversityPress,5thEdn.(2010).

Semester-IV
Course No.: UMJCHT-403 (Major Course)
Title: INORGANIC CHEMISTRY-1

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 hours

5. Das Asim K., Fundamentals of Inorganic Chemistry, Vol. I, CBS Publications, 2nd Ed. 2010.
6. Cotton, F.A. and Wilkinson, G Basic Inorganic Chemistry, Wiley.
7. Catherine E. Housecraft and Alan G. Sharpe, Inorganic Chemistry, Pearson.
8. Gary L. Miessler, Paul Fischer and Donald A. Tarr, Inorganic Chemistry, Pearson.
9. James E. Huheey, Ellen A. Keiter, Richard L. Keiter, Okhil K. Mehdi, Pearson.
10. Banerjea D., Coordination Chemistry, Asian Books.

Practical: 01 Credit **Duration : 30 Hours**

1. Estimate the amount of nickel present in a given solution as bis(dimethylglyoximato) nickel(II) in a given solution gravimetrically.
2. Estimation of (i) Mg^{2+} or (ii) Zn^{2+} by complexometric titrations using EDTA.
3. Determine the composition of the Fe^{3+}-salicylic acid complex solution by Job's method.
4. Estimate the amount of aluminium as oximate in a given solution gravimetrically.
5. Draw calibration curve (absorbance at λmax vs. concentration) for various concentrations of a given coloured compound ($KMnO_4$/$CuSO_4$) and estimate the concentration of the same in a given solution.
6. Estimation of total hardness of a given sample of water by complex metric titration.

NOTE FOR PAPER SETTING:

Total marks = 75
The evaluation of course shall contain two parts:
Mid semester assessment: The internal assessment shall be held on completion of about 50% of the prescribed syllabus. The question paper shall comprise of four questions of five marks each. The candidate has to attempt any three of them. **(Total Marks: 15; Time Duration: 1½ hour)**
End semester assessment: It consists of two sections:
Section A will consist of four short answer questions (one question from each unit) of 3 marks each covering the entire syllabi. **Section B** consists of eight long answer questions (two questions from each unit) of 12 marks each.
Section A is compulsory. From Section B, the candidate has to attempt four questions in total, selecting one from each unit. **(Total Marks: 60; Time Duration: 3 hours)**

BOOKS RECOMMENDED:

1. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
2. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.

Semester-IV
Course No.: UMJCHT-403 (Major Course)
Title: INORGANIC CHEMISTRY-1

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 hours

3. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years May 2024, 2025 & 2026)

Semester-IV

Course No.: UMJCHT-404 (Major Course)

Title: SPECTROSCOPY AND NUCLEAR CHEMISTRY

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 hours

UNIT-I: Molecular Spectroscopy I **(12 Lectures)**

Introduction: Electromagnetic radiation, regions of electromagnetic spectrum, basic features of different spectrometers.

Origin of molecular spectra: Born-Oppenheimer approximation.

Rotational spectra of diatomic molecules: Relationship between internuclear distance and moment of inertia. Expression for pure rotational spectra of diatomic molecules. Numerical problems. Criterion for absorption of radiation-selectionrule.

UNIT-II: Molecular Spectroscopy II **(11 Lectures)**

Vibrational spectroscopy: Hooke's law- Expression for the frequency of SHO-force constant and its significance. Expression for vibrational energy levels of SHO. Zero-point energy, numerical problems. Degree of freedom of polyatomic molecules– modes of vibration for CO_2 and H_2O molecules.

UNIT-III: Ultraviolet (UV) Absorption Spectroscopy **(11 Lectures)**

Absorption laws (Beer-Lambert law), molar absorptivity, types of electronic transitions, concept of chromophores and auxochromes, absorption and intensity shifts, effect of conjugation, effect of solvents. UV spectra of conjugated Enes and Enones (Woodward - Fieser rules).

UNIT-IV: Nuclear Chemistry **(11 Lectures)**

Natural and artificial radioactivity, nuclear reactions, artificial transmutation of elements, nuclear energy-nuclear fission and fusion, nuclear reactors, Radioactive isotopes and their uses, Half-life period, Applications of Radioactivity and Radioisotopes as radio tracers, for medical use and, radio-dating of minerals and rocks.

BOOKS RECOMMENDED:

1. Alberty, R.A, Physical Chemistry,4th Edition Wiley Eastern Ltd ,2001.
2. Atkins, P W, The Elements of Physical Chemistry, Oxford, 1991.
3. Barrow, G.M, International Student Edition. McGraw Hill, McGraw-Hill,1973.
4. Clayden, J., Greeves, N., Warren, S., Organic Chemistry, Second edition, Oxford University Press 2012.
5. Silverstein, R.M., Bassler, G. C., Morrill, T. C. Spectrometric Identification of Organic Compounds, John Wiley and Sons, INC, Fifth edition.
6. Pavia, D.L. et al. Introduction to Spectroscopy, 5th Ed. Cengage Learning India Ed.
7. Willard, H.H. et.al.: Instrumental Methods of Analysis, 7th Ed. Wardsworth Publishing Company, Belmont, California, USA, 1988.
8. Christian, G.D. Analytical Chemistry, 6th Ed. John Wiley & Sons, New York, 2004.

Semester-IV
Course No.: UMJCHT-404 (Major Course)
Title: SPECTROSCOPY AND NUCLEAR CHEMISTRY

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 hours

9. Khopkar, S.M. Basic Concepts of Analytical Chemistry. New Age International Publisher, 2009.
10. Mukherji, Singh, Kapoor, Organic Chemistry, Vol 1 and 2. New Age International 2014
11. RL Madan, Chemsitry for Degree Students Elective Sem V/VI as per CBS Quantum and Spectroscopy, S Chand Publishing
12. Y.R.Sharma, Elementary Organic Spectroscopy Vol 4, S Chand.
13. Gurdeep Raj, Advanced Physical Chemsitry, Krishna Publishing.
14. K.L.Kapoor, A Textbook of Physical Chemistry - Quantum Chemistry and Molecular Spectroscopy, Volume 4, Macmillan.
15. T.N. Srivastva and PC Kampoj, Systematic Analytical Chemistry, Shobanlal Nagin Chand.
16. H. J. Arnikar, Essentials of Nuclear Chemistry, 4th ed., New Age International, New Delhi, 1995.
17. Bariyar, and Goyal, Physical Chemistry-II, Krishna Prakashan Media, Meerut , Third Edition, 2019.

Duration : 30 Hours

Practical: 01 Credit

1. To verify Beer – Lambert Law for KMnO4/K2Cr2O7 and determining the concentration of the given solution of the substance from absorption measurement
2. Analyse the given vibration-rotation spectrum of HCl(g).
3. Determine the dissociation constant of an indicator (phenolphthalein).
4. Study the 200-500 nm absorbance spectra of KMnO4 and K2Cr2O7 (in 0.1 M H2SO4) and determine the λmax values. Calculate the energies of the two transitions in different units (J molecule-1, kJ mol-1, cm-1 , eV).
5. Study the pH-dependence of the UV-Vis spectrum (200-500 nm) of K2Cr2O7
6. Record the 200-350 nm UV spectra of the given compounds (acetone, acetaldehyde, 2-propanol, acetic acid) in water. Comment on the effect of structure on the UV spectra of organic compounds
7. Determination of Radioactivity in Surface Soil, Cement and Fly Ash.

NOTE FOR PAPER SETTING:

Total marks = 75
The evaluation of course shall contain two parts:
Mid semester assessment: The internal assessment shall be held on completion of about 50% of the prescribed syllabus. The question paper shall comprise of four questions of five marks

Semester-IV
Course No.: UMJCHT-404 (Major Course)
Title: SPECTROSCOPY AND NUCLEAR CHEMISTRY

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 hours

each. The candidate has to attempt any three of them.**(Total Marks: 15; Time Duration: 1½ hour)**

End semester assessment: It consists of two sections:

Section A will consist of four short answer questions (one question from each unit) of 3 marks each covering the entire syllabi. **Section B** consists of eight long answer questions (two questions from each unit) of 12 marks each.

Section A is compulsory. From Section B, the candidate has to attempt four questions in total, selecting one from each unit. **(Total Marks: 60; Time Duration: 3 hours)**

BOOKS RECOMMENDED:

1. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.
2. Khosla, B. D.; Garg, V. C. & Gulati, A., Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).
3. Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. Experiments in Physical Chemistry 8th Ed.; McGraw-Hill: New York (2003).
4. Halpern, A. M. & McBane, G. C. Experimental Physical Chemistry 3rd Ed.; W.H. Freeman & Co.: New York (2003).
5. Advance Practical Physical Chemistry by J.B. Yadav, Goel Publication, Meerut.
6. Practical Physical Chemistry by B. Vishwanathan and P.S. Raghvan, Viva Books Pvt. Ltd.

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years May 2024, 2025 & 2026)

Semester-IV
Course No.: UMICHT-405 (Minor Course)
Title: Inorganic Chemistry-1

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 hours

UNIT-I Chemistry of s and p Block Elements – II **(12 Lectures)**

Study of the following compounds with emphasis on structure, bonding, preparation, properties and uses. Boric acid and borates, silanes. Oxides and oxoacids of nitrogen, Phosphorus and chlorine. Interhalogen compounds, polyhalide ions, pseudohalogensand basic properties of halogens. Occurrence and uses, preparation and properties of XeF2, XeF4 and XeF6.

UNIT-II Transition Elements-I **(11 Lectures)**

General group trends with special reference to electronic configuration, colour, variable valency, magnetic and catalytic properties, and ability to form complexes. Chemistry of elements of second and third transition series- general characteristics, comparative treatment with their 3d analogues in respect of ionic radii, oxidationstates, magnetic behaviour spectral properties and stereochemistry.

UNIT-III Transition Elements-II **(11 Lectures)**

Chemistry of Ti, V, Cr Mn, Fe and Co in various oxidation states (excludingtheirmetallurgy). Lanthanoids and Actinoids: Electronic configuration, oxidation states, colour, spectral and magnetic properties,lanthanide contraction, separation of lanthanides(ion-exchange method only).

UNIT-IV Basics of coordination chemistry **(11 Lectures)**

Definitions and terminology, Werner's coordination theory and its experimental verification, EAN concept, IUPAC nomenclature of coordination compounds, structural and stereoisomerism in complexes with coordination numbers 4and6, Distinction between cis- and trans- compounds.

BOOKS RECOMMENDED:

1. Lee J. D., Concise Inorganic Chemistry Wiley India, 5th Edn., 2008.
2. Huheey J. E., Keiter E. A. and Keiter R. L., Inorganic Chemistry –Principlesofstructure and reactivity, Pearson Education, 4th Ed. 2002.
3. Puri, Sharma, Kalia, Principles of Inorganic Chemistry, Vishal Pub. Co., 33rded., 2017.
4. Shriver D. E.,Atkins P. W., InorganicChemistry, Oxford UniversityPress,5thEdn.(2010).
5. Das Asim K., Fundamentals of Inorganic Chemistry, Vol. I, CBS Publications, 2nd Ed. 2010.
6. Cotton, F.A. and Wilkinson, G Basic Inorganic Chemistry, Wiley.
7. Catherine E. Housecraft and Alan G. Sharpe, Inorganic Chemistry, Pearson.
8. Gary L. Miessler, Paul Fischer and Donald A. Tarr, Inorganic Chemistry, Pearson.
9. James E. Huheey, Ellen A. Keiter, Richard L. Keiter, Okhil K. Mehdi, Pearson.

Syllabus and courses of studies in the subject of Chemistry under CBCS as per NEP-2020

(For examinations to be held in the years May 2024, 2025 & 2026)

Semester-IV
Course No.: UMICHT-405 (Minor Course)
Title: Inorganic Chemistry-1

Credits: 03 (Theory) + 01 (Practical)
Maximum Marks: 100 [75 (Theory) + 25 (Practical)]
Duration of Examination: 3 hours

10. Banerjea D., Coordination Chemistry, Asian Books.

Practical: 01 Credit **Duration : 30 Hours**

1. Estimate the amount of nickel present in a given solution as bis(dimethylglyoximato) nickel(II) in a given solution gravimetrically.
2. Estimation of (i) Mg^{2+} or (ii) Zn^{2+} by complexometric titrations using EDTA.
3. Determine the composition of the Fe^{3+}-salicylic acid complex solution by Job's method.
4. Estimate the amount of aluminium as oximate in a given solution gravimetrically.
5. Draw calibration curve (absorbance at λmax vs. concentration) for various concentrations of a given coloured compound ($KMnO_4$/$CuSO_4$) and estimate the concentration of the same in a given solution.
6. Estimation of total hardness of a given sample of water by complex metric titration.

NOTE FOR PAPER SETTING:

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Section A is compulsory. From Section B, the candidate has to attempt four questions in total, selecting one from each unit. **(Total Marks: 60; Time Duration: 3 hours)**

BOOKS RECOMMENDED:

1. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012.
2. Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.
3. Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).