

12.	High Performance Thin Layer Chromatography in Food analysis, by Prem kumar, CBS Publisher and distributor	Unit/s (4.1,4.2,4.3)
13.	Instrumental methods of Analysis, by Dr Supriya S Mahajan, Popular Prakashan Ltd	Unit/s (4.1,4.2,4.3)
14.	Instrumental methods Of Analysis, by Willard Merritt Dean, 7thEdition, CBS Publisher and distribution Pvt Ltd	Unit/s (3.1,3.2,3.3)
15.	Instrumental Methods of Chemical Analysis by B.K. Sharma Goel Publishing House	Unit/s (4.1,4.2,4.3)
16.	Principles of Instrumental Analysis , 5th Edition, By Skoog, Holler, Nieman	Unit/s (4.1,4.2,4.3)(3.1,3.2,3.3)
17.	Quality control and Quality assurance in Analytical Chemical Laboratory, Piotr Konieczka and Jacek Namiesnik, CRC press (2018)	Unit/s (1.1)
18.	Quality in the Analytical Chemistry Laboratory, Elizabeth Prichard, Neil T. Crosby, Florence Elizabeth Prichard, John Wiley and Sons, 1995	Unit/s (1.1)
19.	Solvent extraction and ion exchange, J Marcus and A. S. Kertes Wiley INC 1969	Unit/s (4.1,4.2,4.3)
20. .	Thin Layer Chromatography, A LAB. Handbook, Egon Stahl, Springer International Student Edition	Unit/s (4.1,4.2,4.3)

PRACTICALS

SEMESTER V

ANALYTICAL CHEMISTRY

COURSE CODE: USCHP13

CREDITS: 02

<ol style="list-style-type: none"> 1. Spectrophotometric estimation of fluoride 2 Estimation of magnesium content in Talcum powder by complexometry, using standardized solution of EDTA 3 Determination of COD of water sample. 4 To determine potassium content of a Fertilizer by Flame Photometry (Calibration curve method). 5 To determine the amount of persulphate in the given sample solution by back titration with standard Fe (II) ammonium sulphate solution. 6 To determine the amount of sulphate in given water sample turbidimetrically.
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Note: Calculation of percent error is expected for all the experiments.

REFERENCES

1.	Vogel's Textbook of Quantitative Chemical Analysis, 5thEdn., G. H. Jeffery, J Bassett, J Memdham and R C Denney, ELBS with Longmann (1989).
2.	Vogel's Textbook of Quantitative Chemical analysis, Sixth edition, J.Mendham et.al

SEMESTER VI ANALYTICAL CHEMISTRY

COURSE CODE: USCH604

CREDITS: 02

LECTURES: 60

UNIT I: ELECTRO ANALYTICAL TECHNIQUES(3 & 6 UNITS)

1.1	Polarography (Numerical and word problems are expected)	11L
1.1.1	Difference between potentiometry and voltammetry, Polarizable and non-polarizable electrodes	
1.1.2	Basic principle of polarography H shaped polarographic cell, DME (construction, working, advantages and limitations)	
1.1.3	DC polarogram: Terms involved - Residual current, Diffusion current, Limiting current, Half-Wave Potential Role and selection of supporting electrolyte, Interference of oxygen and its removal, polarographic Maxima and Maxima Suppressors Qualitative aspects of Polarography: Half wave potential $E_{1/2}$, Factors affecting $E_{1/2}$ Quantitative aspects of polarography: Ilkovic equations: various terms involved in it (No derivation)	
1.1.4	Quantification 1) Wave height – Concentration plots (working plots/calibration) 2) Internal standard (pilot ion) method 3) Standard addition method	
1.1.5	Applications advantages and limitations	
1.2	Amperometric Titrations	04L
1.2.1	Principle, Rotating Platinum Electrode(Construction, advantages and limitations)	
1.2.2	Titration curves with example	
1.2.3	Advantages and limitations	

19.	Principles of Instrumental Analysis , 5th Edition, By Skoog, Holler, Nieman	Unit/s (4.1,4.2,4.3)
20.	Principles of Polarography by Jaroslav Heyrovský , Jaroslav Kůta, 1st Edition, Academic Press, eBook ISBN: 978148326478	Unit/s (1.1,1.2,1.3)
21.	Solvent extraction and ion exchange, J Marcus and A. S. Kertes Wiley INC 1969	Unit/s (2.1,2.2,)

PRACTICALS
SEMESTER VI
ANALYTICAL CHEMISTRY

COURSE CODE: USCHP14

CREDITS: 02

- 1 Estimation of Chromium in water sample spectrophotometrically by using Diphenyl carbazide.
- 2 Estimation of reducing sugar in honey by Willstatter method.
- 3 Estimation of Mg^{+2} & Zn^{+2} by anion exchange resin.
using an anion exchange resin
- 4 Estimation of acetic acid in Vinegar sample by using Quinhydrone electrode potentiometrically.
- 5 Determination of phosphoric acid in cola sample pH metrically.

Note: Calculation of percent error is expected for all the experiments.

References:

1.	Vogel's Textbook of Quantitative Chemical Analysis, 5thEdn., G. H. Jeffery, J Bassett, J Memdham and R C Denney, ELBS with Longmann (1989).
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2.	Vogel's Textbook of Quantitative Chemical analysis, Sixth edition, J.Mendham et.al
3.	The chemical analysis of food and food products III edition Morris Jacob
4.	The chemical analysis of food by David Pearson and Henry Edward

3. J. D. Lee, Concise Inorganic Chemistry, 4thEdn., ELBS,
4. D. F. Shriver and P. W. Atkins, Inorganic chemistry, 3rd edition, Oxford University Press
5. Cotton, Wilkinson, Murillo and Bochmann, Advanced Inorganic Chemistry, 6th Edition.
6. Gary Wulfsberg, Inorganic chemistry, Viva Books Pvt.,Ltd. (2002).
7. Richard Harwood, Chemistry, chapter 10 Industrial inorganic chemistry
8. Greenwood, N.N. and Earnshaw, Chemistry of the Elements, Butterworth Heinemann. 1997.
9. Huheey, J.E., Inorganic Chemistry, Prentice Hall, 1993
10. Satya Prakash, G.D.Tuli, R.D. Madan , Advanced Inorganic Chemistry.S. Chand & Co Ltd 2004

Practicals

SEMESTER V

INORGANIC CHEMISTRY

COURSE CODE: USCHP05

CREDITS: 02

Course USCH502: Inorganic Practical

(60L)

I. Inorganic preparations

1. Preparation of Potassium diaquobis- (oxalato)cuprate (II)
2. Preparation of Ferrous ethylene diammonium sulphate.
3. Preparation of bisacetylacetonatocopper(II)

II. Determination of percentage purity of the given water soluble salt and qualitative detection w.r.t added cation and/or anion (qualitative analysis only by wet tests).

(Any three salts of transition metal ions)

Reference Books (practicals)

1. Vogel Textbook of Quantitative Chemical Analysis G.H. Jeffery, J. Basset.

2. Advanced experiments in Inorganic Chemistry., G. N. Mukherjee., 1st Edn., 2010., U.N.Dhur & Sons Pvt Ltd .
3. Vogel's. Textbook of. Macro and Semimicro qualitative inorganic analysis. Fifth edition.

SEMESTER VI

INORGANIC CHEMISTRY

COURSE CODE: USCH602

CREDITS: 02

LECTURES: 60

COURSE CODE	CREDITS
USCH602	(60 Lectures)
(Numericals and word problems are expected)	
UNIT-I	L/week
1.Theories of the metal-ligand bond (I) (15L)	
1.1 Limitations of Valence Bond Theory.	
1.2 Crystal Field Theory and effect of crystal field on central metal valence orbitals in various geometries from linear to octahedral(from coordination number 2 to coordination number 6)	
1.3 Splitting of <i>d</i> orbitals in octahedral, square planar and tetrahedral crystal fields.	
1.4 Distortions from the octahedral geometry : (i) effect of ligand field and (ii) Jahn-Teller distortions.	
1.5 Crystal field splitting parameters Δ ; its calculation and factors affecting it in octahedral complexes, Spectrochemical series.	
1.6 Crystal field stabilization energy(CFSE), calculation of CFSE for octahedral complexes with d^0 to d^{10} metal ion configurations.	
1.7 Consequences of crystal field splitting on various properties such as ionic radii, hydration energy and enthalpies of formation of metal complexes of the first transition series.	
1.8 Limitations of CFT : Evidences for covalence in metal complexes (i) intensities of d-d transitions, (ii) ESR spectrum of $[\text{IrCl}_6]^{2-}$ (iii) Nephelauxetic effect.	
UNIT-II	
2.Theories of the metal-ligand bond (II)	
2.1 Molecular orbital Theory for coordination compounds. (4L)	

- 7 Greenwood, N.N. and Earnshaw, Chemistry of the Elements, Butterworth Heinemann. 1997.
- 8 Huheey, J.E., Inorganic Chemistry, Prentice Hall, 1993.
- 9 Lippard, S.J. & Berg, J.M. Principles of Bioinorganic Chemistry Panima Publishing Company 1994.
- 10 Satya Prakash, G.D.Tuli, R.D. Madan , , Advanced Inorganic Chemistry.S. Chand & Co Ltd

PRACTICALS

SEMESTER VI

INORGANIC CHEMISTRY

COURSE CODE: USCHP06

CREDITS: 02

I. Inorganic preparations

1. Preparation of Tris(acetylacetonato) iron(III)
2. Green synthesis of bis(dimethylglyoximato) nickel(II) complex using nickel carbonate and sodium salt of dmg .
3. Preparation of potassium trioxalato aluminate (III)

II. Determination of percentage purity of the given water soluble salt and qualitative detection w.r.t added cation and/or anion (qualitative analysis only by wet tests).

(Any three salts of main group metal ions)

Reference Books (practicals)

4. Vogel Textbook of Quantitative Chemical Analysis G.H. Jeffery, J. Basset.
5. Advanced experiments in Inorganic Chemistry., G. N. Mukherjee., 1st Edn., 2010., U.N.Dhur & Sons Pvt Ltd .
6. Vogel's. Textbook of. Macro and Semimicro qualitative inorganic analysis. Fifth edition.

3. Elementary organic spectroscopy (Third edition), Y.R.Sharma, S.Chand publication..
4. Introduction to spectroscopy (third edition), Pavia ,Lampman,Kriz,John vonDeling,Emily Barrosse.
5. Organic chemistry Paula Y. Bruice, Pearson education.
6. Spectral identification of organic molecules by Silverstein.
7. Absorption spectroscopy of organic molecules by V.M.Parikh.

4.2 Natural Products: (10L)

4.2.1. Terpenoids: Introduction, Isoprene rule, special isoprene rule and the gem-dialkyl rule.

4.2.2 Citral:

- a) Structural determination of citral.
- b) Synthesis of citral from methyl heptenone
- c) Isomerism in citral. (cis and trans form).

4.2.3. Alkaloids Introduction and occurrence.

Hofmann's exhaustive methylation and degradation in: simple open chain and N – substituted monocyclic amines.

4.2.4 Nicotine:

- a) Structural determination of nicotine. (Pinner's work included)
- b) Synthesis of nicotine from nicotinic acid
- c) Harmful effects of nicotine.

4.2.5 Hormones:

Introduction, structure of adrenaline (epinephrine), physiological action of adrenaline.

Synthesis of adrenaline from

- a) Catechol
- b) p-hydroxybenzaldehyde(Ott's synthesis)

References:

1. Chemistry of natural products by Chatwal Anand – Vol I and Vol II
2. Chemistry of natural products by O.P. Agarwal
3. Chemistry of natural products by Meenakshi Sivakumar and Sujata Bhat.
4. Organic chemistry by Morrison and Boyd, 7th edition.
5. I.L.Finar, Vol-I and Vol-II, 5th edition.

PRACTICALS

SEMESTER V

ORGANIC CHEMISTRY

COURSE CODE: USCHP09

CREDITS: 02

A) SEMESTER V: Separation of Binary solid-solid mixture (2.0 gms mixture to be given).

1. Minimum Six mixtures to be completed by the students.
2. Components of the mixture should include water soluble and water insoluble acids (carboxylic acid), water insoluble phenols(2-naphthol, 1-naphthol), water insoluble bases

(nitroanilines) , water soluble neutral (thiourea) and water insoluble neutral compounds (anilides , amides, m-DNB, hydrocarbons)

After correct determination of chemical type, the separating reagent should be decided by the student for separation.

4. Follow separation scheme with the bulk sample of binary mixture.

5. After separation into component A and component B, one component (decided by the examiner) is to be analyzed and identified with m.p..

References:

1. Practical organic chemistry – A. I. Vogel
2. Practical organic chemistry – H.Middleton.
3. Practical organic chemistry – O.P.Aggarwal.

SEMESTER VI

ORGANIC CHEMISTRY

COURSE CODE: USCH603

CREDITS: 02

LECTURES: 60

Unit I

1.1 Stereochemistry II

(10 L)

1.1.1 Stereoselectivity and stereospecificity: Idea of enantioselectivity (ee) and diastereoselectivity (de) , Topicity : enantiotopic and diastereotopic atoms, groups and faces.

1.1.2 Stereochemistry of –

- i) Substitution reactions : S_{Ni} (reaction of alcohol with thionyl chloride)
- ii) Elimination reactions: E_2 -Base induced dehydrohalogenation of 1-bromo-1,2-diphenylpropane.
- iii) Addition reactions to olefins:
 - a) bromination (electrophilic anti addition)
 - b) syn hydroxylation with O_3 and $KMnO_4$
 - c) epoxidation followed by hydrolysis.

References:

Refer Stereochemistry –I (Sem-V, Unit-II)

1.2 Amino acids & Proteins

(5 L)

1.2.1 α -Amino acids: General Structure, configuration, and classification based on structure and nutrition. Properties: pH dependency of ionic structure, isoelectric point and zwitter ion. Methods of preparations: Strecker synthesis, Gabriel phthalamide synthesis.

1.2.2 Polypeptides and Proteins: nature of peptide bond. Nomenclature and representation of polypeptides (di- and tri-peptides) with examples Merrifield solid phase polypeptide synthesis. .Protiens:general idea of primary,secondary,tertiary & quaternary structure

- b. Pt and PtO₂ (C=C, CN, NO₂, aromatic ring)
- c. Pd/C : C=C, COCl→CHO (Rosenmund)
- d. Lindlar catalyst: alkynes

d.2.2 Reagents:

- a. LiAlH₄ (reduction of CO, COOR, CN,NO₂)
- b. NaBH₄ (reduction of CO)
- c. SeO₂ (Oxidation of CH₂ alpha to CO)
- d. mCPBA (epoxidation of C=C)
- e. NBS (allylic and benzylic bromination)

References:

1. Organic chemistry by Francis Carey – McGrawHill .
2. Organic chemistry by Carey and Sundberg, Part A & B

PRACTICALS

SEMESTER VI

ORGANIC CHEMISTRY

COURSE CODE: USCHP10

CREDITS: 02

A) SEMESTER VI: Separation of Binary liquid-liquid and liquid- solid mixture.

1. Minimum Six mixtures to be completed by the students.
2. Components of the liq-liq mixture should include volatile liquids like acetone, methylacetate, ethylacetate, isopropylalcohol, ethyl alcohol, EMK and non volatile liquids like chlorobenzene , bromobenzene, aniline, N,N dimethylaniline, acetophenone, nitrobenzene, ethyl benzoate.
3. Components of the liq- solid mixture should include volatile liquids like acetone, methylacetate, ethylacetate, ethyl alcohol, IPA, EMK and solids such as water insoluble acids, phenols, bases, neutral.
4. A sample of the mixture one ml to be given to the student for detection of the physical type of the mixture.
5. After correct determination of physical type, separation of the binary mixture to be carried out by distillation method using microscale technique.
6. After separation into component A and component B, the compound to be identified can be decided by examiner.

References:

4. Practical organic chemistry – A. I. Vogel
5. Practical organic chemistry – H.Middleton.
6. Practical organic chemistry – O.P.Aggarwal.

T.Y.B.Sc Physical Chemistry Practical

SEMESTER V

PHYSICAL CHEMISTRY

COURSE CODE: USCHP01

CREDITS: 02

Non- Instrumental

Colligative properties

To determine the molecular weight of compound by Rast Method

Chemical Kinetics

To determine the order between $K_2S_2O_8$ and KI by fractional change method. **(six units and three units)**

Surface phenomena

To investigate the adsorption of acetic acid on activated charcoal and test the validity of Freundlich adsorption isotherm.

Instrumental

Potentiometry

To determine the solubility product and solubility of AgCl potentiometrically using chemical cell.

Conductometry

To determine the velocity constant of alkaline hydrolysis of ethyl acetate by conductometric method.

pH-metry

To determine acidic and basic dissociation constants of amino acid and hence to calculate isoelectric point.

Reference books

1. Practical Physical Chemistry 3rd edition
A.M.James and F.E. Prichard , Longman publication
 2. Experiments in Physical Chemistry R.C. Das and
B. Behra, Tata Mc Graw Hill
 3. Advanced Practical Physical Chemistry J.B.Yadav,
Goel Publishing House
 4. Advanced Experimental Chemistry. Vol-I
J.N.Gurtu and R Kapoor, S.Chand and Co.
 5. Experimental Physical Chemistry By V.D.Athawale.
 6. Senior Practical Physical Chemistry By: B. D.
Khosla, V. C. Garg and A. Gulati, R Chand and Co..
2011
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6. Fundamental of Molecular Spectroscopy, 4th Edn., Colin N Banwell and Elaine M McCash Tata McGraw Hill Publishing Co. Ltd. New Delhi, 2008.
7. Physical Chemistry, G.M. Barrow, 6th Edition, Tata McGraw Hill Publishing Co. Ltd. New Delhi.
8. The Elements of Physical Chemistry, P.W. Atkins, 2nd Edition, Oxford Universtity Press Oxford.
9. Physical Chemistry, G.K. Vemullapallie, 1997, Prentice Hall of India, Pvt.Ltd. New Delhi.
10. Principles of Physical Chemistry B.R. Puri, L.R. Sharma, M.S. Pathania, VISHAL PUBLISHING Company, 2008.
11. Textbook of Polymer Science, Fred W Bilmeyer, John Wiley & Sons (Asia) Ple. Ltd., Singapore, 2007.
12. Polymer Science, V.R. Gowariker, N.V. Viswanathan, Jayadev Sreedhar, New Age International (P) Ltd., Publishers, 2005.
13. Essentials of Nuclear Chemistry, Arnikar, Hari Jeevan , New Age International (P) Ltd., Publishers, 2011..
14. Chemical Kinetics,K. Laidler, Pearson Education India, 1987.

T.Y.B.Sc Physical Chemistry Practical

SEMESTER VI

PHYSICAL CHEMISTRY

COURSE CODE: USCHP02

CREDITS: 02

Non-Instrumental

Chemical Kinetics

To interpret the order of reaction graphically from the given experimental data and calculate the specific rate constant.

(No fractional order)

Viscosity

To determine the molecular weight of high polymer polyvinyl alcohol (PVA) by viscosity measurement.

Instrumental

Potentiometry

To determine the amount of iodide, bromide and chloride in the mixture by potentiometric titration with silver nitrate.

To determine the number of electrons in the redox reaction between ferrous ammonium sulphate and ceric sulphate potentiometrically.

Conductometry

To titrate a mixture of weak acid and strong acid against strong base and estimate the amount of each acid in the mixture conductometrically.

Colorimetry

To estimate the amount of Fe(III) in the complex formation with salicylic acid by Static Method.

Reference books

1. Practical Physical Chemistry 3rd edition A.M.James and F.E. Prichard , Longman publication
2. Experiments in Physical Chemistry R.C. Das and B. Behra, Tata Mc Graw Hill
3. Advanced Practical Physical Chemistry J.B.Yadav, Goel Publishing House

4. Advanced Experimental Chemistry. Vol-I J.N.Gurtu and R Kapoor, S.Chand and Co.

5. Experimental Physical Chemistry By V.D.Athawale.

6. Senior Practical Physical Chemistry By: B. D. Khosla, V. C. Garg and A. Gulati, R Chand and Co.. 2011