Swami Ramanand Teerth Marathwada University, Nanded

B. O. S. IN CHEMISTRY
B. SC. THIRD YEAR (CHEMISTRY)
SEMESTER- V & VI
CBCS Course
Effective from JUNE – 2018

Swami Ramanand Teerth Marathwada University, Nanded
Choice Based Credit System (CBCS) Course
Structure Faculty of Science
B. Sc. Third Year Syllabus
Semester Pattern Effective From June 2018
Subject: Chemistry

Semester	Course No	Name of the course	Instruction Hrs/Week	Total Period	CA (Int.)	ESC (Ext.)	Total Marks	Credits
V	DSEC- V (Section A)	Theory Paper-XII Organic+Inorganic Chemistry (P-XII)	03	45	10	40	50	02
	DSEC- V [(Section B) (Elective)	Theory Paper-XIII Physical+Inorganic Chemistry (P-XIII)-B1 OR (Elective Paper) Physical+Inorganic Chemistry (P-XIII) B2	03 03	45 45	10 10	40 40	50 50	02
	DSECP- IV [DSEC V &VI (Section A)]	Practical's based on P-XII & P-XIV (P-XVI)	04	Practicals 08 08	05 05	20 20	25 25	01 01
	DSEC- IV (Elective)	Practical's based on (Elective)	02	08	05	20	25	
	DSECP-III SEC III (Any one Skill from optional)	(A) Applied Analytical Chemistry OR (A) Computer Application in Chemistry	02+01=03	45	25	25	50	(02)*
VI	DSEC VI [(Section A) (Elective)	Theory Paper-XIV Organic+Inorganic Chemistry (P-XIV)-A1 OR (Elective Paper) Organic+Inorganic Chemistry (P-XIV)-A2	03 03	45 45	10 10	40 40	50 50	02
	DSEC VI (Section B)	Theory Paper-XV Physical+Inorganic Chemistry (P-XV)	03	45	10	40	50	02
	DSECP- IV [DSEC V &VI (Section B)]	Practical's based on P-XIII &P-XV (P-XVII)	04	Practicals 08 08	05 05	20 20	25 25	01 01
	DSEC- IV (Elective)	Practical's based on (Elective)	02	08	05	20	25	
	DSEC IV SEC IV (Any one Skill from optional)	(B) Spectroscopic Techniques and Cosmetic Preparation OR (B) Basic Analytical Chemistry	02+01=03	45	25	25	50	(02)*
	Total credits semester V and VI							12(04)* = 16

DESC: Discipline Subject Elective Chemistry, DESCP: Discipline Subject Elective Chemistry Practical,
ESE: End of Semester Examination, CA: Continuous Assessment, SECC: Skill Enhancement Course Chemistry.
Distribution of Credits: 80% of the total Marks for ESE and 20% for CA.

- CA of Marks 10 : 10 Marks for test. - CA of 25 Marks: 15 Marks for Seminar & 10 Marks for test.

Suggestions: The end examination of Skill Enhancement Course should be conducted on the separate day by calling all the students who have opted Chemistry as SEC.

B. Sc. Third Year: Semester-V
Paper-XII, (DSEC-V, Section A)
Organic & Inorganic Chemistry

Marks – 50 Periods – 45

Section – A (Organic Chemistry)

Unit – I Heterocyclic Compounds 06 Periods

i) Introduction, classification and nomenclature.
ii) Molecular orbital structures, resonance structures and reactivity of furan, pyrrole, thiophene and pyridine.
iii) General mechanism of electrophilic substitution reactions of furan, pyrrole, thiophene & pyridine.

[A] Five-membered heterocycles

(1) Furan: (Oxole)
1.1.1 Synthesis from: a) Mucic acid b) Succinaldehyde
1.1.2 Physical Properties
1.1.3 Chemical Properties:
a) Electrophilic Substitution reactions :
i) Nitration ii) Sulphonation iii) Halogenation
iv) Friedel-Craft's acylation v) Gattermann-Koch reaction
vi) Gomberg reaction vii) Reaction with n-butyl lithium
b) Reduction
c) Diel's-Alder reaction

(2) Pyrrole : (Azole)
1.2.1 Synthesis from: a) Acetylene b) Furan c) Succinimide
1.2.2 Physical properties
1.2.3 Chemical properties:
a) Electrophilic substitution reactions:
i) Nitration ii) Sulphonation iii) Halogenation iv) Friedel-craft acylation
v) Gattermann reaction vi) Reimer-Tiemann reaction vii) Coupling reaction
b) Reduction
c) Ring expansion reaction
d) Acidic character

(3) Thiophene (Thiole)
1.3.1 Synthesis from: a) Acetylene b) n-butane c) Sodium Succinate
1.3.2 Physical properties
1.3.3 Chemical properties
a) Electrophilic substitution reactions: i) Nitration ii) Sulphonation iii) Halogenation
iv) Friedel-Craft acylation v) Chloromethylation vi) Mercuration vii) Reaction with n-butyl lithium
b) Reduction

Unit – II : [B] Six-membered heterocyclic compounds 04 periods

(1) Pyridine: (Azine)
2.1.1 Synthesis from: a) Acetylene b) β -picoline c) Pentamethylenediamine hydrochloride
2.1.2 Physical properties
2.1.3 Chemical properties:
a) Electrophilic Substitution reactions: i) Nitration ii) Sulphonation iii) Bromination
b) Nucleophilic Substitution reactions: (General mechanism)
i) Amination ii) Reaction with KOH iii) Reaction with n-butyl lithium
c) Reduction d) Oxidation e) Basic Character

[C] Condensed heterocyclic compounds:

(1) Indole : (Benzopyrrole) Synthesis by : a) Fischer's Indole Synthesis b) Bischler's Indole Synthesis

(2) Quinoline: (Benzopyridine) Synthesis by: a) Skraup Synthesis b) Friedlander Synthesis

Unit – III: Synthetic drugs and dyes 10 Periods

(1) Synthetic drugs:

3.1.1 Introduction: qualities of good drug.

3.1.2 Classification of drugs based on therapeutic action :-

a) Functional drugs : (Antipyretics, Analgesics, Anaesthetics, Antidiabetics, Anti-inflammatory, sedatives, hypnotics, tranquillizers)

b) Chemotherapeutic agents : (Antimalarials, Antibacterials, Antifungals, Antituberculars,

3.1.3 Synthesis and uses of the following drugs:

a) Paludrine b) Paracetamol c) Sulphanilamide d) Aspirin

e) Benzocaine f) Isoniazide g) Sulphadiazine h) Tolbutamide

(2) Synthetic dyes:

3.2.1 Introduction, qualities of good dye

3.2.2 Classification of dyes based on methods of applications

3.2.3 Colour and chemical constitution: a) Witt's theory b) Armstrong's theory

3.2.4 Synthesis and uses of the following dyes:

a) Alizarin d) Methylorange

b) Diamond black-F e) Congo-Red

c) Indigo f) Orange – II

Unit – IV: Alkaloids, Vitamins and Pesticides 10 Periods

(1) Alkaloids:

4.1.1 Introduction, occurrence and extraction.

4.1.2 Classification and general properties.

4.1.3 Determination of chemical constitution of alkaloids.

4.1.4 Constitution of the following alkaloids.

a) Ephedrine : (Synthesis from : 1-Phenyl propane-1, 2-dione)

b) Nicotine : (Synthesis from : Nicotinonitrile)

(2) Vitamins :

4.2.1 Introduction and classification.

4.2.2 Source, structure and deficiency diseases of the following vitamins :

a) Vitamin – A, D, E and K

b) Vitamin – B_1, B_2, B_3, B_6, B_{12} and C

(3) Pesticides :

4.3.1 Introduction and classification : (Insecticides, Herbicides, Fungicides and Rodenticides)

4.3.2 Synthesis and uses of the following pesticides :

a) DDT b) BHC c) 2, 4 – D d) Methoxychlor e) Carbaryl d) Monochrotophos

Section – B (Inrganic Chemistry)

Unit–V: Coordination Chemistry (Part-I) 10 Periods

5.1.1 Introduction: addition or molecular compound, double salt, coordination compound. Comparison of double salt and coordination compound.

5.1.2 Terminology: complex ion, central metal atom, ligand, types of ligands, coordination number and coordination sphere.

5.1.3 Nomenclature: Rules of nomenclature of coordination compounds, and its applications to nomenclature of simple and bridging complex compounds.

5.1.4 Werner's theory of coordination compound, postulates, applications with reference to $CoCl_3.6NH_3$, $CoCl_3.5NH_3$, $CoCl_3.4NH_3$, $CoCl_3.3NH_3$.

5.1.5 Chelating agents and its classification, difference between metal complex and metal chelate complex.

5.1.6 Isomerism: structural isomerism, ionization, hydrate, linkage, coordination isomerism, geometrical isomerism, optical isomerism in 4 and 6 coordination complex.

5.1.7 E. A. N. of metal complexes.

Unit-VI: The Chemistry of Elements in Medicine 05 Periods

5.2.1 Introduction
5.2.2 Chelation Therapy
5.2.3 Cancer Treatment
5.2.4 Anti-arthritis drugs.
5.2.5 Imaging agents.

Reference Books:

1) Organic chemistry by S.M.Mukherji, S.P.Singh, R.P.Kapoor (Vol. II & III)
2) Organic Chemistry by Jagdamba Singh, L.D.S.Yadav (Vol. II & III)
3) A text book of organic chemistry by P.L.Soni, H.M.Chawla
4) A text book of organic chemistry by K.S.Tewari, S.N.Mehrotra, N.K.Vishnoi
5) A text book of organic chemistry by ArunBahl and B.S.Bahl
6) Principles of organic chemistry by M.K.Jain
7) Heterocyclic chemistry synthesis, reactions and mechanism by Raj K. Bansal
8) Reaction mechanism and reagents in organic chemistry by G.R.Chatwal
9) Synthetic organic chemistry by G.R.Chatwal
10) Natural products by O.P.Agarwal (Vol. I & II)
11) Spectroscopy of organic compounds by P.S.Kalsi
12) Elementary organic absorption spectroscopy by Y.R.Sharma
13) Absorption spectroscopy of organic molecules by V.M.Parikh
14) Chemistry of pesticides by K.H.Buchel (T.W.)
15) Polymer Science by V.R.Gowarikar, N.V.Viswanathan and JayadevSreedhar
16) Medical Chemistry by Burger
17) Organic Chemistry by Clayden, Greeves, Warren and Wothers
18) Reactions, Rearrangements and reagents by S.N.Sanyl
19) Synthetic organic chemistry by KamleshBansal
20) A text book of synthetic drugs by O.D.Tyagi, M.Yadav
21) Synthetic drugs by G.R.Chatwal
22) Synthetic dyes by G.R.Chatwal
23) Industrial Chemistry by B.K.Sharma
24) Organic Chemistry by Morrison and Boyd
25) Organic Chemistry by Carey
26) Organic Chemistry by L.G.Wade
27) Inorganic chemistry (5^{th} edition) by Shriver Atkins
28) Organic Chemistry by Cram D.J. and Hammond G.S.
29) Organic Chemistry by I.L.Finar
30) Advanced Organic Chemistry by Jerry March
31) Organic Chemistry by Fieser and Fieser
32) Principles of Inorganic Chemistry by Puri, Sharmaand Kalia.
33) Inorganic Chemistry by Gurudeep Raj, Chatwal.
34) Advanced Inorganic Chemistry Vol. II by Satyaprakash, Tuli, Basu and Madan.
35) Inorganic Chemistry by huheey, Keiter and Keiter.
36) Concise Inorganic Chemistry by J.D. Lee.

Objective(s)	To acquire basic knowledge about Heterocyclic Compounds, Synthetic Drugs and Dyes, Alkaloids, Vitamins, Pesticides, Co-ordination Chemistry and the chemistry of elements in Medicine.
Course Outcome(s)	
CO1	Learn the mechanism of Electrophilic Substitution reaction of Heterocyclic Compounds
CO2	Know the characteristics, Classification and synthesis of Drugs and Dyes
CO3	Explaining theories of Color and chemical constitution of Dyes
CO4	Gathering basic knowledge of Alkaloids, Vitamins and Pesticides
CO5	Understand the basic principle and application of coordination complexes
CO6	Know the application of elements in Medicine

B. Sc. Third Year: Semester-V
Paper-XIII, (DSEC-V, Section B)
(B1)
Physical & Inorganic Chemistry

Marks – 50 Periods – 45

Section – A (Physical Chemistry)

Unit –I

1.1.1. Spectroscopy-I : 09 Periods

a) Brief introduction to molecular Spectroscopy. Width and intensity of spectral lines. Factors affecting width and intensity of spectral line.
b) Rotational spectra :
Classification of molecules, Rotational spectra of diatomic molecules.(Rigid rotator model) Moment of inertia, energy levels of rigid rotator, selection rule, spacing between spectral lines of diatomic rigid rotator, isotopic effect. Numerical.
c) Vibrational Spectra:
Infrared spectrum, simple harmonic oscillator model, energy levels of simple harmonic oscillator, selection rule, pure vibrational spectrum, intensity, determination of force constant, qualitative relation between force constant and bond energies. Numerical on force constant.

Unit –II

1.1.2. Spectroscopy-I I: 05 Periods

a) Raman spectra :
Raman effect,Concept of polarazability, classical and quantum theory of Raman scattering, rotational Raman spectrum of a diatomic molecule. Experimental Raman Spectroscopy.
b) Electronic spectra :
Concept of potential energy curve, Franck-Condon Principle, Types of electronic transistions.

Unit III

1.1.3. Chemical Kinetics: 08 Periods

a) Introduction, Third order reaction with equal concentration of all reactants, characteristics of third order reaction.
b) Kinetics of complex reaction : i) Opposing reaction ii) Consecutive reaction
c) Kinetics of Photochemical reaction : i) Hydrogen –chlorine reaction ii) Decomposition of HI iii) Dimerization of anthracene.

Unit IV

1.1.4. Distribution Law: 08 Periods

a) Introduction, Nernst Distribution law, Solubility and distribution law, Limitations of law.
b) Association and dissociation of solute in solvent.
c) Henry's law.
d)Determination of equilibrium constant from distribution coefficient.
e) Extraction of solvent.
f) Liquid -liquid chromatography.
g) Applications of distribution law.
h) Numerical on distribution law

Section B (Inorganic Chemistry)

Unit V: 09 Periods

1.1.5 Organometallic compounds

a) Definition
b) Nomenclature and classification of organometallic compounds
c) Preparation, properties, bonding and application of alkyl and aryls of Li , Al, Sn, Ti.

Unit VI:

1.1.6 Metal carbonyls 06 Periods

a. Definition, types 1) MononIuclear carbonyl, characteristics and examples;
2) Polynuclear carbonyl, characteristics and examples.
b. Preparation properties and structure of nickel tetra carbonyl.
c. Nature of metal carbon bond in metal carbonyl and their evidences.
d. Structure of $Fe_2(CO)_9$, $Fe_3(CO)_{12}$, $Ir_4(CO)_{12}$, $Co_2(CO)_8$.

Reference Books:

1. Physical Chemistry by G. M. Barrow (Tata Mc-Graw Hill publishing Co., Ltd.)
2. Elements of Physical Chemistry by S. Glasstone& D. Lewis (D.vannostrand co. inc.)
3. Physical Chemistry by W. J. Moore (Orient Longman).
4. Principles of Physical Chemistry by S. H. Maron and C. F. Prutton.
5. University General Chemistry by C. N. R. Rao (Mc-Millan).
6. Elements of Physical Chemistry by P. W. Atkins. (Oxford University Press).
7. Physical Chemistry by R. A. Alberty (Wiley Eastern Ltd.).
8. Physical Chemistry through problems by S. K. Dogra, D. Dogra(Wiley Eastern Ltd)
9. Principles of Physical Chemistry by Puri, Sharma and Pathania (Vishal Publication Jallandher, Delhi)
10. Physical Chemistry by A. J. Mee. ELBS & Heinemann Educational Books Ltd.
11. Essentials of Physical Chemistry by ArunBhal, B. S. Bahl and G. D. Tuli. (S. Chand)
12. Chemical Kinetics by K. J. Laidler (Tata Mc-Graw Hill Publishing Co. Ltd).
13. Text Book of Physical Chemistry by Soni-Dharmarha.
14. A Text Book Physical Chemistry by S. Glasstone, (Mac Millan.)
15. Advanced Physical Chemistry by D.N.Bajpai. (S.Chand)
16. Advanced Physical Chemistry by Gurdeep Raj. (Goel publishing house, Meerut).
17. Principles of Inorganic Chemistry by Puri, Sharma and Kalia.
18. Inorganic Chemistry by Gurudeep Raj, Chatwal.
19. Advanced Inorganic Chemistry Vol. II by Satyaprakash, Tuli, Basu and Madan.
20. Inorganic Chemistry by huheey, Keiter and Keiter.
21. Inorganic Chemistry by J.D. Lee.
22. Instrumental methods of chemical analysis-Chatwal Anand
23. Instrumental methods of chemical analysis-B. K. Sharma.

Objective(s)	To enable the students to acquire basic knowledge in Spectroscopy, Chemical Kinetics, Distribution law, Organometallic Compunds and Metal Carbonyls.
Course Outcome(s)	
CO1	Understand the concepts of molecular Spectroscopy and its applications
CO2	Analyze Rotational, Vibrational and Raman, Spectra
CO3	Interpret the theoretical and experimental methods of chemical kinetics
CO4	Know the theory and application of Distribution law
CO5	Explain the Nomenclature, classification and application of Organometallic Compounds
CO6	Illustrate the classification and application of Metal Carbonyls

Elective paper (Semester-Vth)
Paper No. : P-XIII
DSEC-V (Section-B)
(B2)
Physical + Inorganic Chemistry

Periods: 45 Mark: 50

Unit I: SOLTIONS OF NON ELECTROLYTES-I 07 Periods

1.1. Solutions of liquids in liquids-(only binary liquids)
1.2. Raoult's law.
1.3. Vapour pressure of ideal solutions.
1.4. Total vapour pressure in terms of mole fraction.
1.5. Activity of a component in an ideal solutions.
1.6. Chemical potential of an ideal and non ideal solution.

Unit II: SOLTIONS OF NON ELECTROLYTES-II 07 Periods

1.1 Gibb's Duhem-Margules equation and ideal solution.
1.2 Temperature dependence of vapour pressure of solution.
1.3 Thermodynamics of ideal solution.
1.4 Free energy change of mixing, enthalpy change of mixing, entropy change of mixing, Volume change of mixing.

Unit III: COLLIGATIVE PROPERTIES : 06 Periods

1.1 Osmotic pressure
1.2 Relative lowering of vapor pressure
1.3 Elevation in boiling point.
1.4 Depression in freezing points and relation of these properties with molecular weight.
1.5 Numericals on depression in freezing point and Elevation in boiling point.

Unit IV: POLAROGRAPHY: 10 Periods

1.1 Principle and theory of poloragraphy.
1.2 Ilkovic equation and its significance
1.3 Half wave potential and its determination.
1.4 Construction and working of dropping mercury electrode.
1.5 Advantages and disadvantages and DME.
1.6 Applications of polarography : Estimation of organic and inorganic substances, analysis of mixture of compounds, determination of diffusion coefficient, determination of stability constant of metal – ion complex.

Section B (Inorganic Chemistry)

Unit IV: Isopoly and Hetéropoly acids and anions. 10 Periods

1.1 Introduction.
1.2 Polymerisation of CrO_4^{-2}. Anion.
1.3 Isopoly anions and isopoly acids of $Mo6^+$ and $W6^+$
1.4 Hetéopoly anions and Hetéopoly acids.
1.5 1:12(Tetrahedral Heteroatom) Polyanions.
1.6 2:18(Tetrahedral Heteroatom) Polyanions.
1.7 1:6 (Octahedral Heteroatom) Polyanions.
1.8 1:12(Icosahedral Heteroatom) Polyanions Important Reaction of Isopoly anions and Heteropolyanions.

Unit V: Concept of Isolobality and Isolobality analogies. 05 Periods

1.1 Introduction.
1.2 Isolobality organometallic fragments and main group fragments.
1.3 The Isolobality fragments, upon polymerization.
1.4 The structure of Ir $(CO)_{12}$ and P_4 fragments.
1.5 The structure of $Os(CO)_4$ and CH_2 fragments

Reference Books:

1) Principles of physical chemistry –Puri ,Sharma, pathania (VPC) 45th Edition.
2) Elements of physical chemistry –P.W.Atkins(oxford University Press)
3) Text book of physical chemistry –Soni, Darmarha
4) Advanced physical chemistry –Gurudeep Raj (Goel Publishing House)
5) Instrumental methods of chemical analysis – Chatwal Anand
6) Instrumental methods of chemical analysis – B.K.Sharma.
7) Principles of Inorganic Chemistry. Puri,sharma and Kalia.

Objective(s)	Creating awareness among students about the importance of Solution of Non Electrolytes, Colligative Properties, Polarography, Isopoly and Heteropoly acids and Anions, Concept of Isolobality and Isolobality analogies is the prime aim of the course.
Course Outcome(s)	
CO1	Know the importance of Solutions of Non Electrolytes
CO2	Understand the basic principle of Colligative properties
CO3	Study the theory and application of Polarography
CO4	Analyze the application of Isopoly and Heteropoly acids and anions
CO5	Introduction and application of Isolobality and Isolobality analogies

Practical paper (Semester- Vth & VIth)
DSECP-IV
DSEC V & VIth (Section-A)
Organic + Inorganic Chemistry
Paper No. : P-XVI

Periods – 120 Laboratory Course – IV (CH-305) Mark 50

Note : At least Sixteen experiments to be completed : (Twelve from Section A and four from Section B)

Section – A (Organic Chemistry)

01. Organic qualitative analysis: (Seven mixtures)

Separation of organic binary mixture containing two solid components (Using $NaHCO_3$, NaOH and HCl) and analysis of (both/one) components with preparation one derivative of each.
At least one mixture from each of the following types should be given:

a) Acid + Phenol b) Acid + Base
c) Acid + Neutral d) Phenol + Base
e) Phenol + Neutral f) Base + Neutral
g) Neutral+Neutral

Following compounds should be used for preparation of mixtures:

A] Acids : Salicylic acid, Phenyl acetic acid, o-Chlorobenzoic acid, Succinic acid, phthalic acid, cinnamic acid, Benzoic acid and m-cholorobenzoic acid.

B] Phenols :α -naphthol, β -naphthol, resorcinol, p-nitro phenol, m-nitro phenol and hydroquinone, C]

Bases : o-nitroaniline, m-nitroaniline, p-nitroaniline, p-anisidine, diphenylamine, p-toluidine and p-chloroaniline

D] Neutrals : Acetanilide, Anthracene, Benzamide, Benzophenone, Biphenyl, Naphthalene, m-Dinitrobenzene, p-Dichloro benzene and Thiourea.

02. Organic Preparation : (Any five)

[Weight of crude product, crude % yield, recrystallisation of crude product and its melting point expected]

a) Acetylation : Preparation of Aspirin from salicylic acid

OR

Preparation of β -naphthyl acetate from β -naphthol

b) Electrophilic substitution :

Preparation of p-nitroacetanilide from acetanilide (Nitration)

Preparation of 2, 4, 6 – Tribromoaniline from aniline (Bromination)

OR

Preparation of p-bromo acetanilide from acetanilide (Bromination)

c) Diazotisation : Preparation of Methylorange from sulphanilic acid (Coupling)

OR

e) Osazone formation : Preparation of Glucosazone from Glucose

f) Amide Formation : Preparation of Benzamide from benzoic acid

g) Hydrolysis : Preparation of p-nitroaniline from p-nitroacetanilide

h) Reduction : Preparation of m-nitroaniline from m-Dinitrobenzene

i) Oxidation : Preparation of Benzoic acid from Toluene

j) Polymerisation : Preparation of phenol formaldehyde resin

3. Only demonstrations :

a) Extraction of clove oil from crushed cloves by steam distillation.

b) Separation of a mixture of methyl orange and methylene blue by column chromatography

c) Separation of a mixture of amino acids by ascending paper chromatography.

d) Separation of various pigments in the extract of spinach leaves by TLC.

Section – B (Inorganic Chemistry)

1. Gravimetric estimation of Iron as Fe_2O_3.
2. Gravimetric estimation of Ba as $BaSO_4$
3. Gravimetric estimation of Nickel as $Ni(DMG)_2$.
4. Gravimetric estimation of Aluminium as $Al(Oxinate)_3$.
5. Gravimetric estimation of zinc as ZnO
6. Gravimetric estimation of Chloride as AgCl

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B.Sc. III Chemistry Practical Paper (Elective)

Practical

Physical + Inorganic Chemistry (XVII)

Section A : Physical Chemistry Marks 50

(Instrumental & Non Instrumental any 12)

1) To study the variation of Viscosity of Liquid Nitrobenzene with temperature.
2) To study the effect of surfactant on surface of water by using Stalagnometer.
3) Determination of solubility of an inorganic salt in water at different temperature and hence determine the solubility curve.
4) Determination of partition coefficient of iodine between water and CCl_4.
5) To investigate the absorption of acetic acid from aqueous solution by activated Charcoal and examine the validity of Freundlich and Langmuir's isotherm.
6) Investigate the reaction kinetics between potassium persulphate and potassium iodide by Colorimetric measurement.
7) Determine the relative strength of given two acids by polarimetric measurement.
8) Determine the half wave potential of metal ion by polarography.
9) To estimate the amount of Cd^{++} ion in an unknown solution by polarography.
10) To plot the current voltage curve for.05 M sulphuric acid using platinum electrode
11) To study the polarographic waves produced by dissolved oxygen.
12) Determination of formula and stability constant of metal ion complex by polorography.
13) Determine the acid and basic dissociation constant of amino acid and hence determine isoelectric point of acid conductometrically.
14) To determine the solubility of sparingly soluble salt at different temperature. Section A : Inorganic Chemistry

Separation and estimation of any one metal ion from binary mixture. (any 04)

1. Ni^{++} and Cu^{++}
2. Cu^{++} and Fe^{++}
3. Ba^{++} and Mg^{++}
4. Fe^{++} and Zn^{++}
05. Cu^{++} and Ba^{++}

SEC III

DSEC-III

DSEC V_{th} & VI_{th} (Section-A)

Periods – 45	Skill Enhancement Course (A)	02 Credits

Computer Application in Chemistry

1. Use of Softwares: 15 Periods
   ISIS draw, Chem draw and Chem sketch.
   For drawing the structures, elemental (CHN) analysis, determination of molecular mass, IUPAC name and prediction of spectral data NMR and MASS.
2. Biological activity and Toxicity evaluation of organic compounds using software: 15 Periods
   Evaluation of toxicity risk assessment of organic compounds using online software.
   Prediction of different biological activities using online software.
3. Use of Excel in Chemistry: 15 Periods

a) Functions and formulas : Sum, mean, average, power etc. Understanding formulas, the cell and the formula bar, the formula in action, copying formulas, copying and pasting a formula and complex formula.

b) Excel chart and data analysis:
   Visual representation of the data through excel graph, plotting and X-Y data set, create calibration curve, format the view graph, add trendline, equation of line and R-square value,determine the slope of a line, scale adjustment, examples, renaming the chart and worksheet, common charting errors, add a chart title.Add regrations and equation to graph, regration analysis, run the regration and interpreting regration results.

OR

APPLIED ANALYTICAL CHEMISTRY

Unit-I Introduction to Quality Assurance and Quality Control: 15 Periods

1.1 Definitions of the terms: Quality policy, Quality Management, Quality system, Quality Control, Quality Assurance and Quality.

1.2 Validation of the Method: Validation of instrument, Validation of analytical method.

Unit – II Analysis of Soil: 10 Periods

Methods of soil sampling, Determination of: i) Bulk density (ii) Specific gravity (iii) Water holding capacity (iv) Moisture content (v) Loss on ignition (vi) Soil pH.

Chemical Analysis of Soil: Determination of i) Total nitrogen (ii) Nitrate Nitrogen (iii) Organic matter.

Determination of potassium and sodium.

Unit – III Analysis of fuels: 10 Periods

Definition and classification of fuels, solid fuels, liquid fuels and gaseous fuels. Calorific value of fuels, Gross and Net calorific value, Determination of calorific value by Bomb Calorimeter.

Unit – IV 10 Periods

1. Analysis of soil:
   (i) Determination of pH of soil.
   (ii) Total soluble salt
   (iii) Estimation of calcium, magnesium, phosphate, nitrate

Reference Books:

1. An introduction to analytical chemistry, S. A. Iqbal, M. Satake, Y. Mido and M. S. Shethi.

2. College analytical chemistry: Joshi, Baliga and Shetty, Himalaya Publishing house.

3. Qualitative analysis: Day and Underwood.
4. Qualitative inorganic analysis: A. I. Vogel.
5. Principles of analytical chemistry: Pandit and Soman.
6. Anayltical chemistry, G. D. Christian, J. Wiley eastern press Ltd.
7. Analytical chemistry: Alka Gupta.
8. Basic concepts of analytical chemistry: S. M. Khopkar.
9. Advanced practical organic chemistry: Vishnoi.
10. list of websites for software and book for UG/PG syllabus:
    I) http://www.acdlabs.com/resources/freeware/chemsketch/

    III) Excel for Chemistry Excel in analytical chemistry by Robert de Levie – Book
    http://chemed.chem.purdue.edu/genchem/lab/datareports/excel/excel.html

Objective(s)	To train the students for the use of Software, Excel ,analysis of Soil and Fuel
Course Outcome(s)	
CO1	Able to know the use of software and Excel in Chemistry
CO2	Grasp the concept of Quality Assurance and Quality Control
CO3	Illustrate the Physical and Chemical analysis of Soil and fuel
CO4	Be able to evaluate Biological activity and toxicity of oganic compounds using softwares

B. Sc. Third Year: Semester-VI
(DSEC-VI, Section A)
(A1)
Organic & Inorganic Chemistry
Paper-XIV

Marks – 50 Periods – 45

Section – A (Organic Chemistry)

Unit – I Spectroscopic Methods: 08 Periods

i) Introduction, Electromagnetic radiations; Characteristics of EMR :- a) Wave length b) Wave number c) Frequency d) Energy of EMR

ii) Electromagnetic spectrum; Meaning of Spectroscopy, types of Spectroscopy and advantages of Spectroscopic methods.

(A) U. V. Spectroscopy:

1.1.1 Introduction.
1.1.2 Absorption of U.V.radiations : Beer-Lambert Law and Molar Absorption.
1.1.3 Types of Electronic Transitions.
1.1.4 Terms used in U.V.Spectroscopy : Chromophore, Auxochrome,Bathochromic. Shift, Hypsochromic Shift, Hypochromic and Hyperchromic effects.
1.1.5 Effect of conjugation on position of U.V. and Visible bands.
1.1.6 Calculation of λ max by Woodward – Fieser rules for conjugated dienes and enones.
1.1.7 Spectral problems based on U.V.

(B) I.R. Spectroscopy:

1.2.1 Introduction
1.2.2 Principle of IR Spectroscopy.
1.2.3 Fundamental Modes and types of Vibrations. Hooke's Law.
1.2.4 Conditions for absorption of IR-radiations.
1.2.5 IR Spectrum : Functional group region and Fingerprint region.
1.2.6 Characteristic absorption of various functional groups.
1.2.7 Interpretation of IR spectra of following organic compounds :

a) Ethane b) Ethene c) Ethyne d) Benzene e) 1-propanol f) 2-propanol
g) t-butyl alcohol h) Phenol i) Acetone j) Acetophenone k) Acetaldehyde
l) Benzaldehyde m) Benzoic acid n) Methylbenzoate o) Phenylcyanide

Unit – II:

(A) NMR – Spectroscopy: 08 Periods

2.1 Introduction
2.2 Principle of NMR Spectroscopy
2.3 Magnetic and non-magnetic nuclei
2.4 PMR-Spectroscopy :- Spinning nuclei, magnetic moment and magnetic field, precessional motion, energy states for proton in magnetic field (Orientations) and nuclear resonance.
2.5 Equivalent and non-equivalent protons
2.6 Number of absorption singals in the following compounds :
a) Acetone b) Cyclobutane c) Methanol d) Ethylbenzene e) Ethyamine
f) Mesitylene g) Diethylether
2.7 Shielding and deshielding effects : (Example of Acetylene and Benzene)
2.8 Chemical shift, measurement of chemical shift by delta scale and tau scale
2.9 TMS as reference, Advantages of TMS.
2.10 Peak area (integration) & spin-spin Splitting (n+1) rule
2.11 Definition of coupling constant : (J-values) of first order coupling
2.12 Interpretation of PMR Spectra of following compounds : a) Ethyl bromide b) Ethyl alcohol
c) Acetaldehyde d) 1,1,2-tribromo ethane e) Ethyl acetate f) Toluene
g) Acetophenone h) Ethylamine i) Acetic acid j) Benzoic acid

(B) Problems pertaining to the structure elucidation of simple organic compounds using PMR- Spectrosopic data (Supporting IR and UV data to be given) 04 Periods

ORGANIC COMPOUNDS :

a) n-propyl alcohol	b) Iso-Propyl alcohol	c) ter.butyl alcohol	d) Acetic acid
e) Ethylamine	f) Ethyl cyanide	g) Ethyl methyl ketone	h) Ethyl acetate
i) Ethyl benzene	j) Phenyl acetaldehyde	k) Phenol	l) Ethyl methyl ether
m) Ethylene glycol	n) Propionamide	o) Propionaldehyde	

Unit – III: Amino acids and Peptides 06 Periods

(A) Amino Acids:

3.1.1 Introduction & classification (acidic, basic and netural).

3.1.2 Dipolar nature of amino acids : Zwitter ion, iso electric point.

3.1.3 Methods of Preparation of α -amino acids :

a) From α -halo acids b) By Gabriel's Phthalimide Synthesis c) By Strecker's Synthesis

3.1.4 Chemical Properties of α -amino acids :

a) Reactions due to $–NH_2$ group b) Reactions due to –COOH group

c) Reactions due to both $–NH_2$ and –COOH groups

3.1.5 Reagents used for identification of amino acids

(B) Peptides:

3.2.1 Introduction, classification and nomenclature

3.2.2 N-terminus and c-terminus protecting agents

3.2.3 Synthesis of peptides from amino acids : (di- & tri-)

a) By protecting – NH_2 group (Using carbobenzoxyl chloride)

b) By protecting – COOH group (Using benzyl alcohol)

3.2.4 Use of DCC (Dicyclohexyl Carbodiimide) as reagent for peptide bond formation

Unit – IV: Molecular Rearrangements 04 Periods 4.2.1 Introduction, classification of rearrangements: On the basis of migratory group (a)Electrophilic rearrangement (ex. Pinacole – Pinacolone rearrangement)

(b) Nucleophilic rearrangement (ex. Favroskii rearrangement)

(c)Free Radical rearrangement (ex. PhotoFries rearrangement)

(d)Aromatic rearrangement (ex Stevens rearrangement)

Section – B (Inorganic Chemistry)

Unit-V: Coordination theory (Part-II) 10 Periods

5.1.1) Valence bond theory of coordination compounds: Postulates, inner orbital and outer orbital complexes of coordination number 4 and 6. Limitations of VBT.

5.1.2) Crystal field theory: Shape of d-orbital's, postulates, splitting of d-orbital in octahedral complexes, tetrahedral complexes, tetragonal and square planarcomplex.

Definition of CFSE, calculations of CFSE for octahedral and tetrahedralcomplexes.

5.1.3) Factors affecting 10 Dq or magnitude of crystal field splitting : Nature of ligand, oxidation state of metal ion, size of d orbital, geometry of complexes.

5.1.4) Applications of CFT.

5.1.5) John teller effect in octahedral complexes of Cu++.

5.1.6) Limitations of CFT.

Unit- VI: Electronic Spectra of Transition Metal complexes: 05 Periods

5.2.1) Types of electronic transition

5.2.2) Selection rule for d-d transistion

5.2.3) Spectroscopic ground state and spectro-chemical series

5.2.4) Orgel energy level diagram for d^1 and d^9 states

5.2.5) Discussion of electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion

Reference Books:

1) Organic chemistry by S.M.Mukherji, S.P.Singh, R.P.Kapoor (Vol. II & III)

2) Organic Chemistry by Jagdamba Singh, L.D.S.Yadav (Vol. II & III)
3) A text book of organic chemistry by P.L.Soni, H.M.Chawla
4) A text book of organic chemistry by K.S.Tewari, S.N.Mehrotra, N.K.Vishnoi
5) A text book of organic chemistry by Arun Bahl and B.S.Bahl
6) Principles of organic chemistry by M.K.Jain
7) Heterocyclic chemistry synthesis, reactions and mechanism by Raj K. Bansal
8) Reaction mechanism and reagents in organic chemistry by G.R.Chatwal
9) Synthetic organic chemistry by G.R.Chatwal
10) Natural products by O.P.Agarwal (Vol. I & II)
11) Spectroscopy of organic compounds by P.S.Kalsi
12) Elementary organic absorption spectroscopy by Y.R.Sharma
13) Absorption spectroscopy of organic molecules by V.M.Parikh
14) Chemistry of pesticides by K.H.Buchel (T.W.)
15) Polymer Science by V.R.Gowarikar, N.V.Viswanathan and Jayadev Sreedhar
16) Medical Chemistry by Burger
17) Organic Chemistry by Clayden, Greeves, Warren and Wothers
18) Reactions, Rearrangements and reagents by S.N.Sanyl
19) Synthetic organic chemistry by Kamlesh Bansal
20) A text book of synthetic drugs by O.D.Tyagi, M.Yadav
21) Synthetic drugs by G.R.Chatwal
22) Synthetic dyes by G.R.Chatwal
23) Industrial Chemistry by B.K.Sharma
24) Organic Chemistry by Morrison and Boyd
25) Organic Chemistry by Carey
26) Organic Chemistry by L.G.Wade
27) Organic Chemistry by Cram D.J. and Hammond G.S.
28) Organic Chemistry by I.L.Finar
29) Advanced Organic Chemistry by Jerry March
30) Organic Chemistry by Fieser and Fieser
31) Principles of Inorganic Chemistry by Puri, Sharmaand Kalia.
32) Inorganic Chemistry by Gurudeep Raj, Chatwal.
33) Advanced Inorganic Chemistry Vol. II by Satyaprakash, Tuli, Basu and Madan.
34) Inorganic Chemistry by huheey, Keiter and Keiter.
35) Concise Inorganic Chemistry by J.D. Lee.

Objective(s)	To familiarize the students with the concept and principle of Spectroscopy, Amino Acids , Peptides, Molecular Rearranements, Co-ordination theory and Electronic Spectra of transition Metal Complexes
Course Outcome(s)	
CO1	To learn the basic principle and terms used in UV, IR & NMR Spectroscopy
CO2	Acquire the fundamental knowledge of classification and Synthesis of Amino Acid and Peptides
CO3	Describe the types of Rearrangement
CO4	Postulates and limitations of VBT and CFT
CO5	Calculation of CFSE for Tetrahedral and Octahedral Complexes
CO6	Explain the types of electronic transition and selection rule
CO7	Apply spectroscopic techniques in analyzing the structure of simple organic Molecules

Elective paper (Semester-VIth)
DSEC-VI (Section-A)
(A2)
Organic + Inorganic Chemistry
Paper No. : P-XIV

Periods: 45

1. Sugar and Alcohol Industry 09
   - 1.1 Manufacturing of raw cane sugar.
   - 1.2 Refining of raw sugar.
   - 1.3 White sugar.
   - 1.4 Byproducts of sugar industry.
   - 1.5 Manufacturing of ethyl alcohol from molasses.
   - 1.6 Rectified spirit, denatured spirit absolute alcohol and powdered alcohol.
   - 1.7 Byproducts of alcohol industry.
2. Textile Chemistry 08
   - 2.1.1 Introduction and classification of fibers
   - 2.1.2 Sizing:
     a) Object of sizing, sizing ingredients and their functions.
     b) General idea of properties of starch, softness, synthetic adhesives.
   - 2.1.3 Bleaching:
     a) Brief study of outline of the process of bleaching cotton and synthetic material.
     b) General idea of processes like singeing, desizing, scouring.
   - 2.1.4 Dyeing: Study of dyeing, dyeing of cellusosic material and synthetic fibres with dyes like direct, vat, reactive and dispersed dyes.

3. Agro chemistry 07
   - 3.1.1 General idea of agrochemicals including pyrethroides.
   - 3.1.2 Synthesis and uses of following agro-chemicals.
     a) Indole-3-acetic acid
     b) Ethophan
     c) Monochrotophos.
   - 3.1.3 Fertilizers: Introduction and advantages of nitrogenous fertilizers, phosphatic fertilizers, potassic fertilizer and complex fertilizers.

4. Green Chemistry 06
   - 4.1.1 Introduction: Twelve principles of green chemistry.
   - 4.1.2 Zeolites: Friedel-Craft alkylation and acylation, oxidation of benzene to phenol and benzoquinone, reduction of benzoquinone to hydroquinone.
   - 4.1.3 Biocatalytic reactions: hydroxylation and oxidation using enzymes.
   - 4.1.4 Introduction to microwave assisted reactions.

Section (B) Inorganic Chemistry

5. Inroganic Polymers 09
   - 5.1.1 Introduction
   - 5.1.2 Basic concepts and definition
     i) Polymer ii) Monomer iii) Polymerization iv) copolymer
     v) Degree of polymerization
   - 5.1.3 Classification of polymers on basis of : i) Origin ii) Composition iii) Properties iv) Uses
   - 51.4 Comparison between organic and inorganic polymers
   - 5.1.5 Polymer backbone
   - 5.1.6 Homoatomic polymers containing-phosphorus
   - 5.1.7 Heteroatomic polymers i) Silicones ii) Phosphonitrilic compounds iii) Fluorocarbons.
6. Nanotechnology 06
   - 6.1.1 Introduction.
   - 6.1.2 Properties of nanoparticles.
   - 6.1.3 Application of nanoparticles.

Elective paper (Semester-VIth)
DSEC-VI (Section-A)
(A2)
Organic + Inorganic Chemistry
Paper No. : P-XIV

Periods: 45

7. Sugar and Alcohol Industry 09
   - 7.1 Manufacturing of raw cane sugar.
   - 7.2 Refining of raw sugar.
   - 7.3 White sugar.
   - 7.4 Byproducts of sugar industry.
   - 7.5 Manufacturing of ethyl alcohol from molasses.
   - 7.6 Rectified spirit, denatured spirit absolute alcohol and powdered alcohol.
   - 7.7 Byproducts of alcohol industry.

8. Textile Chemistry 08
   - 8.1.1 Introduction and classification of fibers
   - 8.1.2 Sizing:
     - c) Object of sizing, sizing ingredients and their functions.
     - d) General idea of properties of starch, softness, synthetic adhesives.
   - 8.1.3 Bleaching:
     - c) Brief study of outline of the process of bleaching cotton and synthetic material.
     - d) General idea of processes like singeing, desizing, scouring.
   - 8.1.4 Dyeing: Study of dyeing, dyeing of cellusosic material and synthetic fibres with dyes like direct, vat, reactive and dispersed dyes.

9. Agro chemistry 07
   - 9.1.1 General idea of agrochemicals including pyrethroides.
   - 9.1.2 Synthesis and uses of following agro-chemicals.
     - d) Indole-3-acetic acid
     - e) Ethophan
     - f) Monochrotophos.
   - 9.1.3 Fertilizers: Introduction and advantages of nitrogenous fertilizers, phosphatic fertilizers, potassic fertilizer and complex fertilizers.

10. Green Chemistry 06
   - 10.1.1 Introduction: Twelve principles of green chemistry.
   - 10.1.2 Zeolites: Friedel-Craft alkylation and acylation, oxidation of benzene to phenol and benzoquinone, reduction of benzoquinone to hydroquinone.
   - 10.1.3 Biocatalytic reactions: hydroxylation and oxidation using enzymes.
   - 10.1.4 Introduction to microwave assisted reactions.

Section (B) Inorganic Chemistry

11. Inroganic Polymers 09
   - 11.1.1 Introduction
   - 11.1.2 Basic concepts and definition
     i) Polymer ii) Monomer iii) Polymerization iv) copolymer
     v) Degree of polymerization
   - 5.1.3 Classification of polymers on basis of : i) Origin ii) Composition iii) Properties iv) Uses
   - 51.4 Comparison between organic and inorganic polymers
   - 5.1.5 Polymer backbone
   - 5.1.6 Homoatomic polymers containing-phosphorus
   - 5.1.7 Heteroatomic polymers i) Silicones ii) Phosphonitrilic compounds iii) Fluorocarbons.

12. Nanotechnology 06
   - 12.1.1 Introduction.
   - 12.1.2 Properties of nanoparticles.
   - 12.1.3 Application of nanoparticles.

Reference books:

1. Basic concept of analytical chemistry by S. M. Khopkar, Wiley estern ltd. Bombay.
2. Industrial chemistry by R. K. Das, Asia publication Mumbai.
3. Rigegels hand book of industrial chemistry by J. A. Kent, Van. Nostrard, London.
4. Chemistry process industries by shreve and Brinic- Ostim, Magraw Hill New York.
5. Biotechnology and applied microbiology by Alani and Moo-young.
6. Immobilize Biocatalysis by Joy Wleser
7. Introduction to polymer chemistry by Reymano B. Seymour.
8. Advances in green chemistry: chemical synthesis using microwave irradiation by R. S. Varma.
9. Green chemistry: Environment friendly alternatives: by Rashmi Sanghi and M. M. shrivastav (Eds) © 2003 Narosa publishing house New Delhi India.
10. Textile Science by J. T. Marsh
11. Book of textile by A. J. Hall.
12. Sizing by D. B. Ajagaonakar
13. Bleaching by V. A. Sheni.
14. Dyeing by V. A. Sheni.
15. Chemicals for crop improvement and pest management by Green, Hartly and Weste
16. Chemistry of pesticides by K. H. Buchel (T.W.)
17. Principles of inorganic chemistry by Puri, Sharma and Kalia.
18. Text Book of inorganic chemistry by K. N. Upadhyanaya Vikas publishing House New Delhi.
19. Progress in inorganic polymer by Laport and Leigh
20. Nanomaterials and nanostructures by Laura Castle, April Feter Dominant publisher 2007
21. Nanoscale materials in chemistry by K. J. Kalbunde (Wiley intersciences)
22. Introduction to Nanoscience and nanotechnology by K. K. Chatopadhya. A. N. Banerjee, PHI learning Pvt. Ltd., New Delhi.
23. Introduction to Nanotechnology by Charles P. Poole (Jr.), Frank J. Owen & Wiley students Etd., 2008.
24. Nanotechnology: future technology with futures, BPB publication, New Delhi.

Objective(s)	The aim of this paper is to expose the students with the knowledge in Sugar and Alcohol Industry, Textile Chemistry, Agro Chemistry, Green Chemistry, Inorganic Polymers and Nanotechnology
Course Outcome(s)	
CO1	Understand the Basic concept of Sugar and Alcohol Industry
CO2	Synthesis and uses of Agro Chemicals
CO3	To enable the students to understand the classification of Fibers
CO4	To learn the basic concept and classification of Inorganic Polymers
CO5	Able to understand the theory of green chemistry
CO6	Ability to apply green chemical laboratory techniques
CO7	To stimulate the learner in understanding the basic concepts and applications of nanotechnology

Practical paper elective (Semester- Vth & VIth)
DSECP-IV
DSEC V & VIth (Section-A)
Organic + Inorganic Chemistry
Paper No. : P-XVI

Periods – 120 Laboratory Course – IV (CH-305) Mark 50

Note : At least Sixteen experiments to be completed : (Twelve from Section A and four from Section B)

Section – A (Organic Chemistry)

01. Organic qualitative analysis: (Seven mixtures)

Separation of organic binary mixture containing two solid components (Using Water $NaHCO_3$, NaOH and HCl) and analysis single components with preparation of derivative.

02. Synthesis of organic compounds : (Any four)

[Weight and percent yield of crude product , recrystallisation of crude product and its melting point expected]

a) Benzoylation of Phenol b) Benzoylation of Aniline

c) Preparation of o-nitro aniline from M-dinitro benzene from acetanilide (Partial Reduction)

d) Preparation of iodoform from ethyl alcohol e) Preparation of iodoform from Acetone

f) Preparation of Benzamide from benzoic acid

3. Only demonstrations :

a) Separation of fluorescein and methylene blue
b) Separation of leaf pigments from spinach leaves
c) Resolution of racemic mixture of (+) mandelic acid

Section – B (Inorganic Chemistry)

1. Preparation of sodium trioxalator ferrate (III), $Na_3[Fe(C_2O_4)_3]$.
2. Preparation of cis-and trans-bisoxalato diaqua chromate (III) ion.
3. Preparation of copper tetraammine complex. $[(Cu(NH_3)_4]SO_4$.

Reference Books :

1) Practical organic chemistry by A.I.Vogel
2) Advanced practical organic chemistry by O.P.Agarwal
3) Advanced practical organic chemistry by N.K.Vishnoi
4) Hand book of organic qualitative analysis by H.T.Clarke
5) Experimental practical organic chemistry by P.R.Singh, D.S.Gupta
6) A laboratory Hand book of organic qualitative analysis by V.S.Kulkarni
7) Hand book of organic qualitative analysis by F.G.Mann, B.C.Sunders
8) A text book of Practical Chemistry for B.Sc. by V.V. Nadkarni, A.N. Kothare and Y.V. Lawande.
9) Advanced practical Inorganic Chemistry by O.P. Agarwal.

Objective(s)	To train the students in laboratory works
Course Outcome(s) :- By considering the scope of chemistry in different pharmaceuticals to make trained man power in synthetic chemistry and analysis .	

B. Sc. Third Year: Semester-VI
(DSEC-VI, Section B)
Physical & Inorganic Chemistry
Paper-XV

Marks – 50 Periods – 45

Section – A (Physical Chemistry)

Unit –I Electrochemistry: 12 Periods

i) Introduction, concept of electrode potential , single electrode potential, standard electrode potential , oxidization and reduction potential
ii) Electrochemical cells , electrolytic and Galvanic cells , reversible and irreversible cells, conventional representation of electrochemical cells.
iii) EMF of cell , SHE.
iv) Reference electrodes , indicator electrodes , calomel electrodes,
v) Relation between EMF and ΔG , ΔH , ΔS
vi) Nernst equation, application of Nernst equation to oxidation half cell and reduction half cell.
vii) Electrolyte concentration cell, Concentration cell with and without transport.
viii) Application of EMF measurement in determination of pH by using i) Quinhydrone electrode b) Glass electrode.
ix) Numerical on Nernst Equation.

Unit II : Thermodynamics I : 07 Periods

a) Introduction
b) Work function and free energy function(G): Helmholtz Function (A) or work function, Change of work function (A) at constant temperature , Gibbs' free energy function, relation between G and A, change of G at constant temperature, variation of work function with temperature and volume, variation of free energy function with temperature and pressure. The Gibb's-Helmholtz equation.
c) The Nernst heat theorem. Third law of thermodynamics.
d) Thermodynamics of open system: partial molar properties; concept of chemical potential, partial molar free energy. Gibb's-Duhem equation. Variation of chemical potential with temperature and pressure. Chemical potential in case of a system of ideal gases.

Unit-III: Thermodynamics II: 05 Periods

a) Thermodynamic derivation of law of mass action. Relation between ΔG^0 and K_P, relation between K_P, K_C AND K_X.
b) Vant-Hoff's reaction isochore. Integrated form of Vant-Hoff's equation.
c) Clausius-Clapeyron equation and its applications.
d) Numerical on Integrated form of Vant-Hoff's equation.

Unit-IV: Magneto chemistry and magnetic properties of substance: 06 Periods

a) Introduction, Magnetic susceptibility, Specific susceptibility, unit of measurement.
b) Types of substances: Paramagnetic, diamagnetic and ferromagnetic.
c) Effect of temperature on Paramagnetic, diamagnetic, ferromagnetic substances.
d) Measurement of magnetic susceptibility: Gouy's method.

Section B (Inorganic Chemistry)

Unit IV : Bioinorganic Chemistry 05 Periods

5.1.1) Essential and trace elements in biological processes
5.1.2) Metalloporphyrin with special reference to hemoglobin and myoglobin
5.1.3) Biological role of alkali and alkaline earth metal ions
5.1.4) Nitrogen fixation

Unit V : Metal cluster 10 Periods

5.2.1) Boranes
5.2.2) Carboranes
5.2.3) Metalloboranes
5.2.4) Metallocarboranes

Reference Books:

1. Physical Chemistry by G. M. Barrow (Tata Mc-Graw Hill publishing Co., Ltd.)
2. Elements of Physical Chemistry by S. Glasstone & D. Lewis (D.van nostrand co. inc.)
3. Physical Chemistry by W. J. Moore (Orient Longman).
4. Principles of Physical Chemistry by S. H. Maron and C. F. Prutton.
5. University General Chemistry by C. N. R. Rao (Mc-Millan).
6. Elements of Physical Chemistry by P. W. Atkins. (Oxford University Press).
7. Physical Chemistry by R. A. Alberty (Wiley Eastern Ltd.).
8. Physical Chemistry through problems by S. K. Dogra, D. Dogra(Wiley Eastern Ltd)
9. Principles of Physical Chemistry by Puri, Sharma and Pathania (Vishal Publication Jallandher, Delhi)
10. Physical Chemistry by A. J. Mee. ELBS & Heinemann Educational Books Ltd.
11. Essentials of Physical Chemistry by Arun Bhal, B. S. Bahl and G. D. Tuli. (S. Chand)
12. Kinetics by K. J. Laidler (Tata Mc-Graw Hill Publishing Co. Ltd).
13. Text Book of Physical Chemistry by Soni-Dharmarha.
14. A Text Book Physical Chemistry by S. Glasstone, (Mac Millan.)
15. Advanced Physical Chemistry by D.N.Bajpai. (S.Chand)
16. Advanced Physical Chemistry by Gurdeep Raj. (Goel publishing house, Meerut).
17. Principles of Inorganic Chemistry by Puri, Sharma and Kalia.
18. Inorganic Chemistry by Gurudeep Raj, Chatwal.
19. Advanced Inorganic Chemistry Vol. II by Satyaprakash, Tuli, Basu and Madan.
20. Inorganic Chemistry by huheey, Keiter and Keiter.
21. Concise Inorganic Chemistry by J.D. Lee.

Objective(s)	To familiarize the students with the concept and principle Electrochemistry, Thermodynamics, Magnetochemistry,Bioinorganic Chemistry and Metal Clusters
Course Outcome(s)	
CO1	Basic concepts of electrochemistry and its applications
CO2	Understanding the Nernst heat theorem and the Thermodynamics open system
CO3	Know the Vant-Hoff's Reaction Osochore and numerical on it
CO4	Explain the types of magnetic substances and effect of temperature on it
CO5	Biological role of alkali and alkaline earth metal ions
CO6	Describe the structures and functions of Metal Cluster

Practical paper (Semester- V^{th} &VI^{th})
DSECP-V
DSEC V^{th} & VI^{th} (Section-B)
Physical + Inorganic Chemistry
Paper No. : P-XVII

Periods – 120 Laboratory Course – V (CH-306) Mark 50

Note : At least Sixteen experiments to be completed : (Twelve from Section A and four from Section B)

Section – A (Physical Chemistry)

Instrumental

1. Determine the normality and strength of oxalic acid conductometrically using standard solution of strong base (NaOH/KOH).
2. Determine the concentration of KCl solution by titrating it with standard solution of $AgNO_3$ conductometrically.
3. Determine the equivalent conductance of a strong electrolyte at several concentrations and hence verify the Onsager's equation.
4. Determine the normality and strength of acids in mixture [strong acidm(HCl/HNO_3) and weak acid (CH3COOH/HCOOH)] potentiomrtrically using standard solution of strong base(NaOH/KOH).
5. Determine the dissociation constant of a weak acid (CH_3COOH/HCOOH) potentiometrically using standard solution of strong base (NaOH/KOH).
6. Determination of empirical formula of a complex between Fe+3 and 5-sulphosalicylic acid by Job's method colorimetrically.
7. Determination of dissociation constant of an organic acid (CH_3COOH) using various buffers (CH_3COOH + CH_3COONa) pH metrically.
8. To study inversion of cane sugar by polarimetrically.

Non-Instrumental

1. Determine the rate constant of the reaction between potassium persulphate and potassium iodide having equal concentrations of reacting species (a=b).
2. Determine energy of activation of hydrolysis of an ester by acid/base.
3. Investigate the reaction between bromic acid and hdroiodic acid.
4. Determine molecular weight of non volatile solute by Rast method / Beckomann's freezing point method.
5. Determine enthalpy change of neutralization of a strong acid by a strong base.
6. Determine interfacial tension between immiscible liquids, benzene and water by stalagmometer.
7. Determine molecular weight of a polymer by viscosity measurement.
8. Separation of mixture of o- and p-nitro anilines on an alumina column.

Section – B (Inorganic Chemistry)

1. Inorganic preparations and estimation of metal ion.

a) $[Cu(NH3)_4]SO_4$
b) $[Ni(NH3)_6]Cl_2$
c) $CoCl_3.4NH_3$
d) Sodium trioxalato ferrate e) $Hg[Co(SCN)_4]$.
f) Mohr's salt, $[FeSO_4(NH_4)_2SO_4].6H_2O$

Reference Books :

1. Experimental Physical Chemistryby A. Findlay., Longman.
2. Advanced Practical Physical Chemistry by J.B. Yadav.
3. Experiments in Physical Chemistry by R.C. Das and B. Behra, Tata Mc Graw Hill.
4. Advanced experimental Chemistry Vol. I. Physical by J.N. Gurtu and R. Kapoor., S. Chand & Co.
5. Experiments in Physical Chemistry by J.C. Ghosh, Bharati Bhavan.
6. Practical book of Physical Chemistry by Nadkarni, Kothari & Lawande., Bombay Popular Prakashan.
7. Systematic Experimental Physical Chemistry by S.W. Rajbhoj, Chondhekar, Anjali Prakashan.
8. Practical Physical Chemistry by B.D. Khosla & V.C. Garg., R. Chand & Sons.
9. Experiments in Chemistry by D.V. Jagirdar.
10. Practical Chemistry, Physical – Inorganic – Organic and Viva – voce by Balwant Raii Satia., Allied Publishers Pvt. Ltd.
11. College Practical Chemistry by H.N. Patel, S.R. Jakali, H.P. Subhedar, Miss. S.P. Turakhia, Himalaya Publishing Hose, Mumbai.
12. College Practical Chemistry by Patel, Jakali, Mohandas, Israney, Turakhia, Himalaya Publishing Hose, Mumbai.
13. A text book of Practical Chemistry for B.Sc. by V.V. Nadkarni, A.N. Kothare and Y.V. Lawande.
14. Advanced practical Inorganic Chemistry by O.P. Agarwal

SEC IV

DSECP-IV

DSEC V_{th} & VI_{th} (Section-B)

Periods – 45 Skill Enhancement Course (B) 02 Credits

Spectroscopic Techniques and Cosmetic Preparation

1. Instruments in spectroscopy. 15 Periods
   Instrumentation: Study of UV, IR, NMR and Mass spectroscopy.
2. Determination of structures of organic compounds by using UV, IR, NMR and Mass spectra: 15 Periods
   Hydrocarbons, unsaturated hydrocarbons, alcohols, amines, aldehydes, ketones, carboxylic acids and esters, acid halides, amides and anhydrides.
3. Preparation of cosmetics 15 Periods
   i) Preparation of talcum powder
   ii) Preparation of shampoo
   iii) Preparation of face cream
   iv) Preparation of nail polish and nail polish remover

Reference Books:

1) Spectroscopy of Organic compounds by P. S. Kalsi.
2) Organic Spectroscopy principle and application by Jag Mohan.
3) Spectroscopy by Pavia, Kriz, Vy vyan.
4) Elementary Organic Spectroscopy by Y.R.Sharma
5) Organic Structure analysis by Phillips Crews, Jaime Roderiguez Marcel Jaspars
6) Industrial Chemistry Vol-I, E.Stochi , Ellis Harwood Ltd. UK
7) Engineering Chemistry, P. C. Jain, Dhanpal Rai & Son's Delhi.
8) Industrial Chemistry by Sharma B. K. and Gaur H., Geol Publishing House Meerat 1996.

OR

BASIC ANALYTICAL CHEMISTRY:

Unit-I : Preliminary Operations in Quantitative Analysis : 15 Periods

Introduction, sampling: definitions, purpose of sampling, theory of sampling, types of sampling, sampling of solids, liquids and gases. Preparation of laboratory samples: crushing and grinding of laboratory samples; moisture in samples and drying, determination of water in sample, decomposition and dissolution of samples, some general considerations.

Unit – II: Principles and Methods of Analysis of Saponifiable Oils and Fats: 15 Periods

Definition, Classification, Nomenclature & Fatty acid composition of oils and fats. Analysis by physical and chemical methods- Density, Specific gravity, colour, acid value, iodine value, Saponification value

1. Determination of Iodine value of an oil sample.
2. Determination of specific gravity of an oil sample.
3. Determination of acid value of an oil sample.
4. Determination of saponification value of an oil sample.

Reference Books:

1. Analytical chemistry: an introduction: D. A. Skoog, D. M. West and F. J. Holler, Saunders College publishers, 6^{th} edition.
2. An introduction to analytical chemistry, S. A. Iqbal, M. Satake, Y. Mido and M. S. Shethi.
3. College analytical chemistry: Joshi, Baliga and Shetty, Himalaya Publishing house.
4. Quantitative Analysis-R.A Day and A.L Underwood.
5. Analytical Chemistry-Theory and Practice UN Dash, Sultan Chand and Sons, New Delhi, 2005.
6. Qualitative inorganic analysis: A. I. Vogel.
7. Principles of analytical chemistry: Pandit and Soman.
8. Anayltical chemistry, G. D. Christian, J. Wiley eastern press Ltd.
9. Analytical chemistry: Alka Gupta.
10. Basic concepts of analytical chemistry: S. M. Khopkar.
11. Advanced practical organic chemistry: Vishnoi.

Objective(s)	This course aims to give clear understanding of the basic concept of Spectroscopic Technique, cosmetics preparation and basic analytical chemistry
Course Outcome(s)	
CO1	Be able to determine the structure by using Spectra
CO2	To train the students for the preparation of various cosmetics
CO3	Know the classification and Fatty acid composition of Oils and Fats
CO4	Analysis of Oils and Fats by physical and chemical method