Chaudhary Ranbir Singh University, Jind, Haryana

M.Sc. Chemistry (Two years Course)

CHOICE BASED CREDIT SYSTEM

SCHEME OF EXAMINATION w.e.f. 2018-19

M.Sc. Ist Semester

Paper No.	Code	Nomenclature	Contact hours (L+T+P)	Credits	Max. Marks
Paper-I	18CHE21C1	Inorganic Chemistry-1 Core	4+0+0 = 04	04	80+20
Paper-II	18CHE21C2	Physical Chemistry-1 Core	4+0+0 = 04	04	80+20
Paper-III	18CHE21C3	Organic Chemistry-1 Core	4+0+0 = 04	04	80+20
Paper-IV	18CHE21CL1	Inorganic Chemistry Practical-1	0+0+8 = 08	04	100
Paper-V	18CHE21CL2	Physical Chemistry Practical-1	0+0+8 = 08	04	100
Paper-VI	18CHE21CL3	Organic Chemistry Practical-1	0+0+8 = 08	04	100
Paper-VII	18CHE21F1	Computer for Chemists OR A paper out of panel of papers for foundation course provided by the University	2+0+0= 02	02	40 +10
Paper-VIIA	18CHE21Q1	Mathematics (for Medical Students)/ Biology for Non-Medical Students	2+0+0=02	00	40+10

Note:

- All the papers in M.Sc. 1st semester are core and mandatory for M.Sc. 1st semester students.
- Each theory paper will include 20% marks (15% best of two class tests out of three class tests + 5% Attendance) as internal assessment as per University rules.
- Each practical examination will be of 08 hours and will be conducted in two sessions (Morning & Evening) of 04 hours each.
- Maximum marks of M.Sc. 1st semester will be 650. Theory 300 marks; Practical 300 marks
- Practical marks will include 10% marks for viva-voce and 10% for record files.
- The payment to the internal as well as external examiners will be made on the basis of sessions.
- Total credits: 26, Core = 24; Foundation Course = 02
- Paper-VIII (Math/Bio) carrying 50 marks is qualifying (02 hrs.)

M.Sc. 2nd Semester

Paper No.	Code	Nomenclature	Contact hours (L+T+P)	Credits	Max. Marks
Paper-VIII	18CHE22C1	Inorganic Chemistry-II Core	4+0+0 =04	04	80+20
Paper-IX	18CHE22C2	Physical Chemistry-II Core	4+0+0 =04	04	80+20
Paper-X	18CHE22C3	Organic Chemistry-II Core	4+0+0 =04	04	80+20
Paper-XI	18CHE22CL1	Inorganic Chemistry Practical-II	0+0+8 =08	04	100
Paper-XII	18CHE22CL2	Physical Chemistry Practical-II	0+0+8 =08	04	100
Paper-XIII	18CHE22CL3	Organic Chemistry Practical-II	0+0+8 =08	04	100
Paper-XIV (DSE)	18CHE22D1 OR 18CHE22D2	General Spectroscopy OR Techniques in Chemistry	4+0+0=04	04	80+20
Paper-XV	18CHE22 O1 Open Elective (OE)	To be chosen from the pool of Open Electives provided by the University	4+0+0 =04	04	80+20

Note:

- Core papers are mandatory for M.Sc. 2nd semester students.
- Candidate has to opt one Discipline Specific Elective (DSE) paper out of two, namely, 18CHE22D1 & D2

- 18CHE22 O1 is to be opted by M.Sc. students from Chemistry Department/ other Departments. (Open Elective)
- Maximum marks of M.Sc. 2nd semester will be 800 (Theory 500; Practical 300)
- Each theory paper will include 20% marks (15% best of two class tests out of three class tests + 5% Attendance) as internal assessment as per University rules.
- Each practical examination will be of 08 hours and will be conducted in two sessions (Morning & Evening) of 04 hours each.
- Practical marks will include 10% marks for viva-voce and 10% for record files.
- The payment to the internal as well as external examiners will be made on the basis of Sessions.
- Total Credits = 32
  Core = 24; DSE = 04; Open Elective = 04

M.Sc. 3rd semester

Paper No.	Code	Nomenclature	Contact hours (L+T+P)	Credits	Max. Marks
Paper-XVI (a)	19CHE23GA1	Inorganic Special-I	4+0+0 = 04	04	80+20
Paper-XVI(b)	19CHE23GB1	Physical Special-I	4+0+0 = 04	04	80+20
Paper-XVI (c)	19CHE23GC1	Organic Special-I	4+0+0 = 04	04	80+20
Paper-XVII (a)	19CHE23GA2	Inorganic Special-II	4+0+0 = 04	04	80+20
Paper-XVII(b)	19CHE23GB2	Physical Special-II	4+0+0 = 04	04	80+20
Paper-XVII (c)	19CHE23GC2	Organic Special-II	4+0+0 = 04	04	80+20
Paper-XVIII (a)	19CHE23GA3	Inorganic Special-III	4+0+0 = 04	04	80+20
Paper-XVIII(b)	19CHE23GB3	Physical Special-III	4+0+0 = 04	04	80+20
Paper-XVIII (c)	19CHE23GC3	Organic Special-III	4+0+0 = 04	04	80+20
Paper-XIX (a)	19CHE23PW1	Inorganic Special **Project Work**	0+0+12 = 12	12	300
Paper-XIX (b)	19CHE23PW2	Physical Special **Project Work**	0+0+12 = 12	12	300
Paper-XIX (c)	19CHE23PW3	Organic Special **Project Work**	0+0+12 = 12	12	300
Paper-XX	19CHE23 01 Open Elective (OE)	To be chosen from the pool of Open Electives provided by the University	4+0+0 =04	04	80+20

Note:

- GA1, GB1, GC1, GA2, GB2, GC2, GA3, GB3, GC3 are core papers.
- PW1, PW2, PW3 are discipline specific.
- Candidate has to opt three core papers & PW Discipline Specific Project from the same series i.e. GA1,GA2,GA3 or GB1,GB2,GB3 or GC1,GC2,GC3; and PW1 or PW2 or PW3.
- Maximum marks of M.Sc. 3rd semester will be 700(Theory 400; Project Work 300)
- Each theory paper will include 20% marks (15% best of two class tests out of three class tests + 5% Attendance) as internal assessment as per University rules.
- Each practical examination will be of 08 hours and will be conducted in two sessions (Morning & Evening) of 04 hours each.
- Practical marks will include 10% marks for viva-voce and 10% for record files.
- The payment to the internal as well as external examiners will be made on the basis of sessions.
- Total Credits = 28
- Project will be assessed by Discipline Specific external examiner.
- M.Sc. Chemistry students have to choose Environmental Chemistry-II paper or any one other paper from the pool of open elective papers provided by the University.
- Topic of project will be assigned by the discipline specific teacher (Supervisor).

M.Sc. 4th semester

Paper No.	Code	Nomenclature	Contact hours (L+T+P)	Credits	Max. Marks
Paper-XXI (a)	19CHE24GA1	Inorganic Special-IV	4+0+0 = 04	04	80+20
Paper-XXI(b)	19CHE24GB1	Physical Special-IV	4+0+0 = 04	04	80+20
Paper-XXI(c)	19CHE24GC1	Organic Special-IV	4+0+0 = 04	04	80+20
Paper-XXII (a)	19CHE24GA2	Inorganic Special-V	4+0+0 = 04	04	80+20
Paper-XXII(b)	19CHE24GB2	Physical Special-V	4+0+0 = 04	04	80+20
Paper-XXII(c)	19CHE24GC2	Organic Special-V	4+0+0 = 04	04	80+20
Paper-XXIII (a)	19CHE24GA3	Inorganic Special-VI	4+0+0 = 04	04	80+20
Paper-XXIII (b)	19CHE24GB3	Physical Special-VI	4+0+0 = 04	04	80+20
Paper-XXIII(c)	19CHE24GC3	Organic Special-VI (a) or (b) or (c) **(Elective Paper)**	4+0+0 = 04	04	80+20
Paper-XXIV (a)	19CHE24GDAL1	Inorganic Special Practical-IV	0+0+8 = 08	04	100
Paper-XXIV (b)	19CHE24GDBL1	Physical Special Practical-IV	0+0+8 = 08	04	100
Paper-XXIV (c)	19CHE24GDCL1	Organic Special Practical-IV	0+0+8 = 08	04	100
Paper-XXV (a)	19CHE24GDAL2	Inorganic Special Practical-V	0+0+8 = 08	04	100
Paper-XXV (b)	19CHE24GDBL2	Physical Special Practical-V	0+0+8 = 08	04	100
Paper-XXV (c)	19CHE24GDCL2	Organic Special Practical-V	0+0+8 = 08	04	100
Paper-XXVI (a)	19CHE24GDAL3	Inorganic Special Practical-VI	0+0+8 = 08	04	100
Paper-XXVI (b)	19CHE24GDBL3	Physical Special Practical-VI	0+0+8 = 08	04	100
Paper-XXVI (c)	19CHE24GDCL3	Organic Special Practical-VI	0+0+8 = 08	04	100

Note:

- GA1, GB1, GC1, GA2, GB2, GC2, GA3, GB3, GC3 are core papers.
- GDAL1, GDBL1, GDCL1, GDAL2, GDBL2, GDBL2, GDAL3, GDBL3, GDCL3 are Discipline Specific papers.
- Candidate has to opt three core & three Discipline Specific core papers from the same series i.e. GA1,GA2,GA3 or GB1,GB2,GB3 or GC1,GC2,GC3 and GDAL1,GDAL2,GDAL3 or GDBL1,GDBL2,GDBL3 or GDCL1, GDCL2, GDCL3
- Maximum marks of M.Sc. 4th semester will be 600 (Theory 300; Practical 300)
- Each theory paper will include 20% marks (15% best of two class tests out of three class tests + 5% Attendance) as internal assessment as per University rules.
- Each practical examination will be of 08 hours and will be conducted in two sessions (Morning & Evening) of 04 hours each.
- Practical marks will include 10% marks for viva-voce and 10% for record files.
- The payment to the internal as well as external examiners will be made on the basis of sessions.
- Credits :
  Core = 12
  DSE = 12
  Total credits = 24

Note: Total Marks of M.Sc. Chemistry (02 year Course) = 2750

1st Sem. = 650 (350 + 300)	Credits = 26
2nd Sem = 800 (500+ 300)	Credits = 32
3rd Sem = 700 (400 + 300)	Credits = 28
4th Sem + 600 (300 + 300)	Credits = 24

Total Credits = 110

M.Sc. Chemistry(Ist Semester)

Paper I 18CHE21C1 Inorganic Chemistry-I

4 hrs. / Week
Credits: 04
Max. Marks: 80
Time: 3 Hrs.

Note:-*Examiner will set 09 questions and the candidates will be required to attempt 05 questions in all. Out of 09 questions one question will be compulsory containing 08 short answer type questions covering the entire syllabus. Further, examiner will set 02 questions from each section and the candidates will be required to attempt one question from each section. All questions will carry equal marks.*

Section- A

Stereochemistry and Bonding in Main Group compounds: VSEPR theory, dπ -pπ bonds.

Bent rule and energetic of hybridization. (including shapes of homo and hetero nuclear molecules)

Metal-Ligand Equilibria in solution

Stepwise and overall formation constants and their interactions, trends in stepwise constants, factors affecting stability of metal complexes with reference to the nature of metal ion and ligand, chelate effect and its thermodynamic origin, determination of binary formation constants by pH-metry and spectrophotometry.

(8 Hrs.)

Section-B

Reaction Mechanism of Transition Metal Complexes-I

Inert and labile complexes, Mechanisms for ligand replacement reactions, Formation of complexes from aquo ions, Ligand displacement reactions in octahedral complexes- acid hydrolysis, Base hydrolysis, racemization of tris chelate complexes, electrophilic attack on ligands.

(15 Hrs.)

Section-C

Reaction Mechanism of Transition Metal Complexes-II

Mechanism of ligand, displacement reactions in square planar complexes, the trans effect, theories of trans effect, mechanism of electron transfer reactions – types; outer sphere electron transfer mechanism and inner sphere electron transfer mechanism, electron exchange.

(15 Hrs.)

Section-D

Crystallography

Crystal diffraction by X-rays and electrons Bragg's, Structure determination by X-ray, Separation of planes of simple, orthorhombic, BCC and FCC unit cell.

(7 Hrs.)

Crystal Structures

Structures of some binary and ternary compounds such as fluorite, antifluorite, rutile, antirutile, crystobalite, layer lattices- Cd I_2, Bi I_3; Re O_3, Mn_2O_3, corundum, pervoskite, Ilmenite and Calcite.

(8 Hrs.)

Books Recommended:

1. Concise Inorganic Chemistry – J.D. Lee
2. Inorganic Chemistry – T. Moeller.
3. Modern Aspects of Inorganic Chemistry – H.J. Emeleus & A.G. Sharpe.
4. Introduction to ligand field – B.N. Figgis.
5. Chemical bonding – O.P. Agarwal.
6. Inorganic Reaction Mechanism – Edberg.
7. Inorganic Reactin Mechanism – Basolo Pearson.
8. Structural Principles in Inorganic Compounds – W. E. Addison.

M.Sc. Chemistry (1st Semester)

Paper II; 18CHE21C2 Physical Chemistry-I

4 hrs. / Week
Credits: 04
Max. Marks: 80
Time: 3 Hrs.

Note:-*Examiner will set 09 questions and the candidates will be required to attempt 05 questions in all. Out of 09 questions one question will be compulsory containing 08 short answer type questions covering the entire syllabus. Further examiner will set 02 questions from each section and the candidates will be required to attempt one question from each section. All questions will carry equal marks.*

Section-A

Quantum Mechanics-I: Postulates of Quantum Mechanics; derivation of Schrodinger wave equation; Max-Born interpretation of wave functions □and the Heisenberg's uncertainty principle; Quantum mechanical operators and their commutation relations, Hermition operators, (elementary ideas, quantum mechanical operator for linear momentum, angular momentum and energy as Hermition operator). The average value of the square of Hermition operators; commuting operators and uncertainty principle(x & p; E &t); Schrodinger wave equation for a particle in one dimensional box; evaluation of average position, average momentum and determination of uncertainty in position and momentum and hence Heisenberg's uncertainty principle, picorial representation of the wave equation of a particle in one dimensional box and its influence on the kinetic energy of the particle in each successive quantum level, lowest energy of the particle.

Section-B

Thermodynamics-I: Brief resume of first and second Law of thermodynamics. Entropy changes in reversible and irreversible processes, variation of entropy with temperature , pressure and volume, entropy concept as a measure of unavailable energy and criteria for the spontaneity of reaction; free energy, enthalpy functions and their significance, criteria for spontaneity of a process; partial molar quantities (free energy, volume ,heat concept), Gibb's-Duhem equation;

Section-C

Chemical Dynamics-I: Effect of temperature on reaction rates, Rate law for opposing reactions of Ist order and IInd order, Rate law for consecutive & parallel reactions of Ist order reactions. Collision theory of reaction rates and its limitations, steric factor, Activated complex theory. Ionic reactions: single and double sphere models, influence of solvent and ionic strength, the comparison of collision and activated complex theory.

Section-D

Electrochemistry-I:

Ion - Ion Interactions: The Debye -Huckel theory of ion - ion interactions; potential and excess charge density as a function of distance from the central ion, Debye Huckel reciprocal length, ionic cloud and its contribution to the total potential, Debye - Huckel limiting law of activity coefficients and its limitations, ion - size effect on potential, ion -size parameter and the theoretical mean - activity coefficient in the case of ionic clouds with finite - sized ions.

Debye - Huckel -Onsager treatment for aqueous solutions and its limitations. Debye -Huckel-Onsager theory for non-aqueous solutions, the solvent effect on the mobality at infinite dilution, equivalent conductivity (□) vs. concentration $c^{1/2}$ as a function of the solvent, effect of ion association upon conductivity (Debye- Huckel - Bjerrum equation).

Books Recommended:

1. Thermodynamics for chemists by S.Glasstone.
2. Physical Chemistry by G.M. Barrow
3. Thermodymaics by R.C. Srivastava, S.K. Saha & A.K.Jain
4. Modern electrochemistry Vol.1 by J.O.M. Bockris and A.K.N. Reddy
5. Chemical Kinetics by K.J. Laidler
6. Kinetics & Mechanism of reaction rates by A.Frost & G.Pearson
7. Modern chemical kinetics by H.Eyring
8. Theories of reaction rates by K.J. laidler, H.Eyring & S. Glasstone.
9. Theoretical Chemistry by S. Glasstone.
10. Introduction to Quantum Mechanics by R. Chandra.

M.Sc. Chemistry (1st Semester)

Paper III 18CHE21C3 Organic Chemistry-I

4 hrs. / Week
Credits: 04
Max. Marks: 80+20
Time: 3 Hrs.

Note:-*Examiner will set nine questions and the candidates will be required to attempt five questions in all. Out of nine questions one question will be compulsory containing eight short answer type questions covering the entire syllabus. Further examiner will set two questions from each section and the candidates will be required to attempt one question from each section. All questions will carry equal marks*

Unit-1

Nature of Bonding in Organic Molecules

Delocalized chemical bonding, Conjugation, hyperconjugation, bonding in fullwrences. tautomerism. Aromaticity in benzenoid and non-benzenoid compounds, alternant and non-alternant hydrocarbons, Huckl's rule level of n-molecular orbitals, annulenes, antiaromaticity, w-aromaticity, PMO approach. Bonds weaker than covanlent-ad addition compounds. crown ether complex and cryptands, inclusion compounds,cylodextrins, catenanes and rotaxanes.

Unit-2

Setreochemiatry

Conformational analysis of cycloalkanes, decalins, effect of conformation on reactivity, confoamtion of sugars, setric strain due to unavoidable crowding. Elements of symmetry, chirality, molecules with more than one chiral center, threo and erythro isomers, methods of resolution, optical purity. Enantiotopic and diastreotopic atoms, group and faces. Stereospecific and stereoselective synthesis. Asymmetric synthesis. Optical activity in the absence of chiral carbon (biphenyls,allwnes and spiranes), chirality due to helical shape.Seereochemistry of the compounds containing nitrogen, sulphur and phosphorus.

Unit-3

Reaction Mechanism: Structure and Reactivity

Types of mechanisms, types of reactions, thermodynamic and kinetic requirements, kinetic and thermodynamic control, Hammond's postulate, Curtin-Hammett principle. Potential energy diagrams, transition states and intermediates, methods of determining mechanisms, isotope effects. Hard and soft acids and bases. Generation, structure, stability and reactivity of

carbocations, carbanions, free redicals, carbebes and nitrenes. Effect of structure on reactivity-reasonance and field effects, steric effects, steric effect, quantitative treatment. The Hammett equation and linear free energy relationship, substitnent and reaction constants. Taft equation.

Unit-4

Aliphatic Nucleophilic Substituation

The SN2, SN1, mixed SN1 & SN2 and SET mechanisms. The neighbouring group mechanism, neighbouring group participation by π and σ bonds, anchimeric assistance. Classical and nonclassical carbocations, phenoniumions, nonbornyl system, Common carbocation rearrangements. Application of NMR spectroscopy in the detection of carbocations.

The SNi mechanism, Nucleophilic substitution at an allylic, aliphatic trigonal and a vinylic carbon. Reactivity effects of substrate structure, attacking nucleophlie, leaving group and reaction medium. Phase transfer catalysis and ultrasound, ambident nucleophile, regioselectivity.Bimolecular mechanism-SE2 and SE1. The SE1 mechanism, electrophilic substitution accompanied by double bond shifts. Effect of substrates, leaving group and the solvent polarity on the reactivity.

Books Recommended:

1. Advanced Organic Chemistry- Reactions Mechanism and Structure by Jerry March.
2. A guide Book to Mechanism in Organic Chemistry by Peter Sykes.
3. Organic Chemistry by R.T. Morrison and R.N.Boyd.
4. Reaction Mechanism in Organic Chemistry by S.M. Mukherji and S.P. Singh.
5. Stereochemistry of Organic Compounds by D. Nasipuri.
6. Stereochemistry of Organic Compounds by P.S. Kalsi.
7. Carbohydrate byS.P. Bhutani.
8. Organic Chemistry by I.L. Finar.
9. Color Chemistry byR.L.M. Allen.
10. Chemistry of Synthetic Dyes byK. Venkatraman.

Paper –IV

Inorganic Chemistry Practical-I
18CHE21CL1

M.Sc. Chemistry (1st Semester)

8 Hrs./Week)
Credits: 04
Time: 8Hrs.
Max. Marks: 100

1. Volumetric Analysis (40 Marks)

(a) Potassium iodide titrations
Determination of iodide, hydrazine and antimony (III)

(b) Potassium bromate titrations
(i) Determination of antimony (III) (by Direct Method)
(ii) Determination of aluminium, Magnesium and zinc (by Oxine method)

(c) EDTA titrations
(i) Determination of calcium, copper, barium.
(ii) Back titration
(iii) Titration of mixtures using masking

2. Green methods of Preparation of the following (40 Marks)

(i) Bis(acetylacetonato) copper(II)
(ii) Tris(acetylacetonato) iron (III)
(iii) Tris(acetylacetonato)managanese(III)
(iv) $[Cu(NH_3)_4]\ SO_4.\ H_2O$
$K_3[Fe(C_2O4)_3]$
$[Ni(en)_3]\ S_2O_3$

3. Viva-Voce (10Marks)

4 Note Book (10 Marks)

Books Recommended

a. A text Book of Quantitative Inorganic Analysis: A.I. Vogel.
b. Applied Analytical Chemistry: O.P. Vermani.

Paper V

Physical Chemistry Practical - I
18CHE21CL2

M.Sc. Chemistry (1st Semester)

8Hrs./Week
Credits: 04
Max. Marks 100
Time: 8 Hrs.

1. Condutometry

(i) To determine cell constant of conductivity cell.
(ii) NaOH vs. HCl titration.
(iii) NaOH vs. Oxalic acid titration.
(iv) NaOH vs CH_3COOH titration
(v) $Ba(NO_3)_2$ vs. Na_2SO_4 titration

2. Thermochemistry

Determination of heat of neutralization of the followings:-

(i) NaOH vs. Hcl
(ii) NaOH vs. CH_3COOH
(iii) NaOH vs. Oxalic acid.

3. Refractometry

(i) To determine molar refractivity of the given liquid.
(ii) To determine percentage composition of liquids in the given binary mixture.
(iii) To determine concentration of sugar in a given solution.

4 Surface tension

To determine interfacial tension oftwo immiscible liquids.

5. Adsorption

To study the adsorption of Oxalic acid and Acetic acid on charcoal.

Viva Voce (10 Marks)
Practical Note Book (10 Marks)

Book Recommended

1.Senior practical physical chemistry: B.D. Khosla, V.C. Garg and A. Khosla.
2.Experimental Physical Chemistry: A Thawale and P. Mathur.
3.Practical Physical Chemistry: B. Vishwanatha and P. S Raghav
4.Practical in Physical Chemistry: P.S. Sindhu.

Organic Chemistry Practical-I
Paper-VI 18CHE21CL3

M.Sc. Chemistry (1st Semester)

8Hrs/Week
Credits: 04
Max.Marks: 100
Time: 8 Hrs

1. Quantitative Analysis.

Separation, purification and identification of organic compounds in binary mixtures by chemical tests and preparation of their derivatives.

2. Viva-Voce 10 Marks

3. Note Book 10 Marks

Books Recommended

1. Experiments and Techniques in Organic Chemistry, by D. Pasto, C. Johnson and M. Miller.
2. Macroscale and Microscale Organic Experiments by K. L. Williamson, & D.C. Heath.
3. Systematic Qualitative Organic Analysis by H. Middleton .
4. Handbook of Organic Analysis-Qualitative and Quantitative by H. Clark.
5. Vogel'sTextbook of Practical Organic ChemistrybyA. R. Tatchell.

Mathematics for Chemists

(For Medical Students)

M.Sc. Chemistry (1st Semester)
Paper VII A 18CHE21 Q1

2 hrs. / Week
Credits: 00
Max. Marks: 40+10
Time: 2 Hrs.

Note: The question paper will comprise of nine questions, three from each unit. The candidates will be required to attempt five questions selecting at least one from each unit. All questions will carry equal marks.

UNIT-I

Vector: Examples of scalar and vectors, definitions of vectors in two, three spaces, representation and simple properties of vectors, addition and subtraction of vectors, vector addition by the method of triangles, resolution of vectors into rectangular components, addition of vectors by components, addition of vectors by components, multiplication and differentiation

of vectors. Scalar and vector product. **(4Hrs) Matrices and Determinants:** Definition of matrix, types of matrices, viz. row matrix, column matrix, null matrix, square matrix, diagonal matrix, addition, subtraction and multiplication by a number, matrix multiplication. Transpose and adjoint of matrix, elementary transformation. Definition of determinant, properties of determinants, evaluation of determinants. Illustration or

applications to group theory, problems from chemistry.

Elements of Algebraic and Trigonometric Functions

The binomial expansion, some example from chemistry, sines, cosines and tangents,

trigonometric identities.

UNIT-II

Differential and Integral Calculus: Theory, rules of differentiation, powers, added and subtracted functions, constants, products, quotients, functions of a function, logarithmic differentiation, parametric functions. Algebraic simplification, differentiation of implicit functions, graphical significance of differentiation, rate of change of slope, successive differentiation. Examples related to maximally populated rotational energy levels, Bohr's radius and most probable velocity from Maxwell's distribution. Exact and inexact differential with their application to thermodynamic principles. Integral theory, basic rules of integration,

integration by parts, partial fraction, and substitution.

UNIT-III

Graphical Representation of Equations: Rectangular coordinates, straight lines, slope and intercept of the equation, slope and point equation, two point equation, parallel lines, points of

intersection, distance between two points, change of origin. **(3 Hrs) Partial Differentiation:** The fundamental theorem, geometrical significance of partial differentiation, special cases of fundamental theorem, successive partial differentiation. Integral transforms (Fourier and Laplace). Reduction formulae, application to chemical problems.

Differential Equation: Simple differential equations, separable variables, homogeneous equations. exact equations, linear equations, equation of the first and second order, partial

differential equation, application to physico-chemical problems. **(6 Hrs)**

Books Suggested

1. Mathematical Methods for Science Students, G. Stephemen, ELBS.
2. The Chemistry Mathematics Book, E. Stener, Oxford University Press.
3. Mathematics for Chemistry, Doggett and Sucliffe, Longman.
4. Mathematical Preparation for Physical Chemistry, F. Daniels, McGraw Hill.
5. Chemical Mathematics, D.M. Hirst, Longman.
6. Applied Mathematics for Physical Chemistry, J.R. Barrante, Prentice Hall.
7. Basic Mathematics for Chemists, Tebbutt, Wiley.
8. Differential equation, Schaum series, Tata McGraw Hill.
9. Elements of Partial Differential Equation, I.N.Sneddom, Tata McGraw Hill..
10. Advanced Engg. Mathematics, E Kreyszig, John Wiely & sons.
11. Mathematical Techniques, Jordan &Smith, Oxford University Press.

Biology for Chemists

(For Non- Medical Students)

M.Sc. Chemistry (1st Semester)
Paper VII A 18CHE21 Q1

2 hrs. / Week
Credits: 00
Max. Marks: 40+10
Time: 2 Hrs.

Note: The question paper will comprise of nine questions, three from each unit. The candidates will be required to attempt five questions selecting at least one from each unit. All questions will carry equal marks.

UNIT - I

Cell Structure and Functions

Structure of prokaryotic and eukaryotic cells, intracellular organelles and their functions, comparison of plant and animal cells. Overview of metabolic processes - catabolism and

anabolism. ATP - the biological energy currency.

Carbohydrates

Conformation of monosaccharides, structure and functions of important derivatives of monosaccharides like glycosides, deoxy sugars, myoinositol, amino sugars. N-acetylmuramic acid, sialic acid, disaccharides and polysaccharides. Structural polysaccharides - cellulose and chitin. Storage polysaccharides - starch and glycogen.

Structure and biological functions of glucosaminoglycans or mucopolysaccharides. Carbohydrates of glycoproteins and glycolipids. Role of sugars in biological recognition. Blood group substances. Ascorbic acid.

Carbohydrate metabolism - Kreb's cycle, glycolysis, glycogenesis and glycogenolysis,

gluconeogenesis, pentose phosphate pathway.

UNIT - II

Lipids

Fatty acids, essential fatty acids, structure and function of triacylglycerols, glycerophospholipids, sphingolipids, cholesterol, bile acids, prostaglandins. Lipoproteins - composition and function.

Properties of lipid aggregates-micelles, bilayers, liposomes and their possible biological functions. Biological membranes. Fluid mosaic model of membrane structure.

Lipid metabolism - β-oxidation of fatty acids.

Proteins

Chemical and enzymatic hydrolysis of proteins to peptides, Secondary structure of proteins, forces responsible for holding of secondary structures. α-helix, β-sheets, super secondary structure, triple helix structure of collagen. Tertiary structure of protein- folding and

domain structure. Quaternary structure.

UNIT - III

Nucleic Acids and Genetic Code

Structure of nucleotides, nucleosides, DNA (Watson-Crick model) RNA structure and conformation, Replication of DNA, transcription, translation of genetic material, genetic code, universality of the code, codon, anticodon pairing, RNA, protein biosynthesis (initiation,Elongation, termination and processing of the peptide chain).

Books Suggested

1. Principles of Biochemistry, A. L. Lehninger, Worth Publishers.
2. Biochemistry, L.Stryer, W.H.Freeman.
3. Biochemistry, J. David Rawn, Neil Patterson.
4. Biochemistry, Voet and Voet, John Wiley.
5. Outlines of Biochemistry, E. E.Conn and P. K. Stumpf, John Wiley.

M.Sc. Chemistry (1st Semester)
Paper -VII 18CHE21F1 Computer for Chemists 2 hrs. / Week

Credits: 02
Max. Marks: 40
Time: 2 Hrs.

Note:-*Examiner will set eight questions and the candidates will be required to attempt five questions in all. All questions will carry equal marks.*

Essentials of Computer:
Historical Evolution of Computers, Block diagram of a Computer and functions of various units; Classification of Computers; Input/Output devices (Display Devices, Printers, etc.) Memories: RAM, ROM, Cache Memory, Virtual memory; Mass-storage Media: Magnetic Disks, Magnetic Tapes and Optical Disks; Batch processing systems, Time sharing systems, Multiprocessor, Parallel Processing Systems.
Introduction to Programming languages: 1 GL to 5 GL languages. Software and its types; Operating System with DOS as an example, Introduction to UNIX and Windows.
Overview of: Information Technology (IT), Data Communication, Computer Networks (LAN, WAN and MAN and their applications, Introduction to Internet and Intranet technology.
Computer Applications: Scientific, Business, Research, Sports, Medicine & Health Care, Engineering, Teaching etc.
Problem Solving: Problem Identification, Analysis, flowcharts, Decision Tables, Pseudo codes and algorithms, Program Coding, Program Testing and Execution.

Books Recommended:
1 Computers and Common Sense, R. Hunt and J. Shelley, Prentice Hall.
2 Computational Chemistry, A.C. Norris.
3 Microcomputer Quantum Mechanics, J.P. Killngbeck,Adam Hilger.

M.Sc. Chemistry (2nd Semester)

Paper- VIII 18CHE22C1 Inorganic Chemistry-II **4 hrs. / Week**

Credits: 04

Max. Marks: 80

Time: 3 Hrs.

Note:-*Examiner will set 09 questions and the candidates will be required to attempt 05 questions in all. Out of 09 questions one question will be compulsory containing 08 short answer type questions covering the entire syllabus. Further, examiner will set 02 questions from each section and the candidates will be required to attempt one question from each section. All questions will carry equal marks.*

Section-A

Metal-Ligand Bonding

Limitation of crystal field theory, molecular orbital theory, octahedral, tetrahedral or square planar complexes, π-bonding and molecular orbital theory.

Acid & Base

Concept of Acids and Bases, HSAB concept and Non-Aqueous solvents (H_2SO_4, NS_3, SO_2, HF N_2O_4)

(15 Hrs.)

Section-B

Electronic Spectra of Transition Metal Complexes

Spectroscopic ground states, correlation and spin-orbit coupling in free ions for Ist series of transition metals, Orgel and Tanabe -Sugano diagrams for transition metal complexes (d^1 – d^9 states) calculation of Dq, B and β parameters, effect of distortion on the d-orbital energy levels. Structural evidence from electronic spectrum, John-Tellar effect, Spectrochemical and nephalauxetic series, charge transfer spectra, electronic spectra of molecular addition compounds.

(16 Hrs.)

Section-C

Magantic Properties of transition metal complexes

Elementary theory of magneto - chemistry, Guoy's method for determination of magnetic susceptibility, calculation of magnetic moments, magnetic properties of free ions, orbital contribution, effect of ligand-field, spectral and magnetic properties of transition and inner transition matels. Magnetic exchange coupling and spin state cross over.

(8 Hrs.)

Metal Clusters

Structure and bonding in higher boranes, Wade's rules, Carboranes, Metal Carbonyl clusters- Low Nuclearity Carbonyl clusters, total electron count (TEC), HNCC, structure of Zintle ions

(8 Hrs.)

Section-D

Metal- π Complexes

Metal carbonyls, structure and bonding, vibrational spectra of metal carbonyls for bonding and structure elucidation, important reactions of metal carbonyls; preparation, bonding, structure and important reactions of transition metal nitrosyl, dinitrogen and dioxygen complexes; tertiary phosphine as ligand.

(15 Hrs.)

Books Recommended:

1. Advanced Inorganic Chemistry – F.A. Cotton & G. Wilkinson.
2. Inorganic Chemistry: Principles of Structure & reactivity – J.E. Huheey.
3. Chemistry of the Elements – N.N. Greenwood & A. Earnshaw.
4. Concise Co-ordination Chemistry – R. Gopalan & R. Ramalingam.
5. Magneto Chemistry – R.L. Carlin.
6. Concise Inorganic Chemistry – J.D. Lee.
7. Introduction to Magneto Chemistry – A. Earnshasw.

M.Sc. Chemistry (2nd Semester)

Paper IX 18CHE22C2 Physical Chemistry-II

4 hrs. / Week
Credits: 04
Max. Marks: 80
Time: 3 Hrs.

Note:-*Examiner will set 09 questions and the candidates will be required to attempt 05 questions in all. Out of 09 questions one question will be compulsory containing 08 short answer type questions covering the entire syllabus. Further examiner will set 02 questions from each section and the candidates will be required to attempt one question from each section. All questions will carry equal marks.*

Section-A

Quantum Mechanics-II Schrodinger wave equation for a particle in a three dimensional box. The concept of degeneracy among energy levels for a particle in three dimensional box. Schrodinger wave equation for a linear harmonic oscillator & its solution by polynomial method. Zero point energy of a particle possessing harmonic motion and its consequence. Schrodinger wave equation for three dimensional Rigid rotator, energy of rigid rotator, space quantization; Schrodinger wave equation for hydrogen atom, separation of variable in polar spherical coordinates and its solution, principle, azimuthal and magnetic quantum numbers and the magnitude of their values, probability distribution function, radial distribution function and shape of atomic orbitals (s,p & d).

Section-B

Thermodynamics-II: Classius – Clayperon equation; law of mass action and its thermodynamic derivation. Third law of thermodynamics (Nernest heat theorem, determination of absolute entropy, unattainability of absolute zero) and its limitation. Phase diagram for two completely miscible components systems. Eutectic systems, Calculation of eutectic point, systems forming solid compounds A_x B_y with congruent and incongruent melting points, phase diagram and thermodynamic treatment of solid solutions.

Section-C

Chemical Dynamics – II:-

Chain reactions: hydrogen - bromine reaction, pyrolysis of acetaldehyde, decomposition of ethane. Photochemical reactions (hydrogen - bromine & hydrogen -chlorine reactions). General treatment of chain reactions (ortho -para hydrogen conversion and hydrogen - bromine reactions). apparent activation energy of chain reactions, chain length, Rice- Herzfeld mechanism of organic molecules decomposition(acetaldehyde) Branching chain reactions and explosions (H_2 - O_2 reaction). Kinetics of (one intermediate) enzymatic reaction : Michaelis - Menton treatment, evaluation of Michaelis 's constant for enzyme - substrate binding by Lineweaver - Burk plot and Eadie- Hofstae methods. Competitive and non-competitive inhibition.

Section-D

Electrochemistry-II:

Ion Transport in solutions: Ionic movement under the influence of an electric field . mobility of ions, ionic drift velocity and its relation with current density, Einstein relation between the absolute mobility and diffusion coefficient, the Stokes - Einstein relation , the Nernst -Einstein equation, Waldens rule, the Rate- Process approach to ionic migration , the Rate process equation for equivalent conductivity, total driving force for ionic transport, Nernst - Planck Flux equation, ionic drift and diffusion potential , the Onsager phenomenological equations. The basic equation for the diffusion, Planck- Henderson equation for the diffusion potential.

Books Recommended:

1. Thermodynamics for chemists by S.Glasstone.
2. Physical Chemistry by G.M. Barrow
3. Thermodymaics by R.C. Srivastava, S.K. Saha & A.K.Jain
4. Modern electrochemistry Vol.1 by J.O.M. Bockris and A.K.N. Reddy
5. Chemical Kinetics by K.J. Laidler
6. Kinetics & Mechanism of reaction rates by A.Frost & G.Pearson
7. Modern chemical kinetics by H.Eyring
8. Theories of reaction rates by K.J. laidler, H.Eyring & S. Glasstone.
9. Theoretical Chemistry by S. Glasstone

M.Sc. Chemistry (2nd Semester)

Paper X 18CHE22C3 Organic Chemistry-II

4 hrs. / Week
Credits:04
Max. Marks: 80+20
Time: 3 Hrs.

Note:-*Examiner will set 09 questions and the candidates will be required to attempt 05 questions in all. Out of 09 questions one question will be compulsory containing 08 short answer type questions covering the entire syllabus. Further examiner will set 02 questions from each section and the candidates will be required to attempt one question from each section. All questions will carry equal marks.*

Unit – 1

Aromatic Electrophilic Substitution

The arenium ion mechanism, orientation and reactivity, energy profile diagrams. The ortho/para ratio, ipso attack, orientation in other ring systems. Quantitiative treatment of reactivity in substrates and electrophiles. Diazonium coupling, Vilsmeir reaction, Gattermann-Koch reaction.

Aromatic Nucleophilic Substitution

The SNAr, SN 1, benzyne and SRN 1 mechanisms. Reactivity – effect of substrate structure, leaving group and attacking nucleophile. The von Richter, Sommelet-Hauser, and Smiles rearrangrments.

Unit – II

Free Radical Reactions

Types of free radical reactions, free radical substitution mechanism, mechanism at an aromatic substrate, neighbouring group assistance. Reactivity for aliphatic and aromatic substrates at a bridgehead. Reactivity in the attacking radicals. The effect of solvents on reactivity. Allylic halogenations (NBS), oxidation of aldehydes to carboxylic acids, autooxidation, coupling of alkynes and arylation of aromatic compounds by diazonium salts. Sandmeyer reaction. Free radical rearrangement. Hunsdiecker reaction.

Addition to Carbon-Carbon Multiple Bonds

Mechanistic and stereochemical aspects of addition reactions involving electrophiles, nucleophiles and free radicals, regio-and chemoselectivity, orientation and reactivity. Addition to cyclopropane ring. Hydrogenation of double and triple bonds, hydrogenation of aromatic rings. Hydroboration. Michael reaction. Sharpless asymmetric epoxidation.

Unit – III

Addition to Carbon-Hetero Multiple Bonds

Mechanism of metal hydride reduction of saturated and unsaturated carbonyl compounds, acids, esters and nitriles. Addition of Grignard reagents, organozinc and organolithium reagents to carbonyl and unsaturated carbonyl compouns. Witting reaction. Mechanism of condensation reactions involving enolates – Aldol, Knoevenagel, Claisen, Mannich, Benzoin, Perkin and Stobbe reactions. Hydrolysis of esters and amides, ammonolysis of esters.

Elimination Reactions

The E, EI and EI CB mechanisms and their spectrum. Orientation of the doubt bond. Reactivity – effects of substrate structures, attacking base, the leaving group and the medium. Mechanism and orientation in prolytic elimination.

Unit – IV

Pericyclic Reactions

Molecular orbital symmetry, Frontier orbitals of ethylene, 1,3- butadiene, 1,3,5-hexatriene and allyl system. Classification of pericyclic reactions. Woodward-Hoffmann correlation diagrams. FMO and PMO approach. Electrocyclic reactions – conrotatory and disrotatory motions, 4n, 4n+2 and allyl systems. Cycloadditions – antarafacial and suprafacial additions, 4n and 4n+2 systems, 2+2 addition of ketenes, 1,3 dipolar cycloadditions and cheleotropic reactions.

Sigmatropic rearrangements- suprafacial and antarafacial shifts of H, Sigmatropic shifts involving carbon moieties, 3, 3 and 5, 5- Sigmaropic rearrangements. Claisen cope. Sommelet Hauser rearrangement, Ene reaction.

Books Recommended:

1. Advanced Organic Chemistry -Reactions, Mechanism and Structure by Jerry March.
2. Advanced Organic Chemistryby F.A. Carey and R.J. Sundberg.
3. A Guide Book to Mechanism in Organic Chemistry by Peter Sykes.
4. Structure and Mechanism in Organic Chemistry by C.K. Ingold.
5. Organic Chemistry by R.T. Morrison and R.N. Boyd.
6. Modern Organic Reactions by H.O. House .
7. Principles of Organic Synthesis by R.O.C. Norman and J.M. Coxon.
8. Reaction Mechanism in Organic Chemistry by S.M. Mukherji and S.P. Singh.

Paper-XI

INORGANIC CHEMISTRY PRACTICAL-II
18CHE22CL1

M.Sc. Chemistry (2nd semester)

8 Hrs./Week
Credits: 04
Time: 8Hrs.
Max. Marks: 100

1. **Quantitative Inorganic Analysis**

Separation and determination of two metal ions such as

i) Silver- Copper,
ii) Copper-Nickel,
iii) Copper-Zinc,
iv) Nickel-Zinc,
v) Copper-Iron Involving volumetric and gravimetric methods.

2. (a) **Determination by Cerimetry**
   i) Ferrous,
   ii) Oxalate,
   iii) Nitrite

3. **Estimation of metal ions by atomic absorption spectrophotometry**

4. **Viva-Voce** (10 Marks)

5. **Note Book** (10 Marks)

Books Recommended

1. A text Book of Quantitative Inorganic Analysis: A.I. Vogel.
2. Applied Analytical Chemistry: O.P. Vermani.

Physical Chemistry Practical II
Paper XII; 18CHE22CL2

M.Sc. Chemistry (2nd semester)

8Hrs./Week
Credits: 04
Max. Marks 100
Time: 8 Hrs.

1. Potentionmetry

(i) NaOH vs. HCl titration.
(ii) NaOH vs. Oxalic acid titration.
(iii) NaOH vs. CH_3 COOH titration.

2. pH metry

(i) NaOH Vs. HCl titration.
(ii) NaOH vs Oxalic acid titration.
(iii) NaOH vs. CH_3COOH titration.

3. Chemical Kinetics

(i) To study kinetics of hydrolysis of ester in the presence of acid.
(ii) To compare the relative strength of acids (HCl and H_2SO_4).

4. Distribution Law

(i) To determine partition coefficient of benzoic acid between benzene and water.
(ii) To determine partition coefficient of Iodine between Carbon tetrachloride and water.
(iii) Determination of Equilibrium constant for $I_2 + I^- = I_3$

Viva Voce (10 Marks)

Practical Note Book (10 Marks)

Book Recommended

1.Senior practical physical chemistry: B.D. Khosla, V.C. Garg and A. Khosla.
2. Experimental Physical Chemistry: A Thawale and P. Mathur.
3. Practical Physical Chemistry: B. Vishwanatha and P. S Raghav
4. Practical in Physical Chemistry: P.S. Sindhu.

Organic Chemistry Practical-II
Paper-XIII; 18CHE22CL3

M.Sc. Chemistry (2nd semester)

8Hrs/Week
Credits: 04
Max.Marks: 100
Time: 8 Hrs

1. Organic Synthesis and Checking purity of samples prepared.
Two Step preparations.

1. p-Nitroaniline from acetanilide.
2. p-Bromoaniline from acetanilide
3. Anthranilic acid from phthalic anhydride.
4. p-Bromoacetanilide from aniline.
5. p-Nitroacetanilide from aniline.
6. Sym-tribromobenzene from aniline.
7. 2,4-Dinitrophenyl hydrazine from chlorobenzene.
8. 2.5-Dihydroxyacetophenone from hydroquinone.

2. Viva-Voce — 10 Marks

3. Note Book — 10 Marks

Books Recommended

1 Experiments and Techniques in Organic Chemistry by D. Pasto, C. Johnson and M. Miller.
2 Macroscale and Microscale Organic Experiments by K. L. Williamson and D.C. Heath.
3 Systematic Qualitative Organic Analysis by H. Middleton.
4 Handbook of Organic Analysis-Qualitative and Quantitative by H. Clark
5 Vogel's Textbook of Practical Organic Chemistry by A. R. Tatchell.

M.Sc.(2nd Semester)

Paper- XIV; 18CHE22D1 General Spectroscopy

3Hrs./Week
Credits: 04
Max. Marks: 80
Time: 03 Hrs.

Note: - Examiner will set 10 questions and the candidates will be required to attempt 05 questions in all. Out of 10 questions one question will be compulsory containing 08 short answer type questions covering the entire syllabus. Further examiner will set 03 questions from each section and the candidates will be required to attempt atleast one question from each section. All questions will carry equal marks.

Unit I

1. Electromagnetic radiation, interaction of electromagnetic radiation with matter, regions of the Spectrum the width and intensity of spectral transitions. Resolving power.
2. **Rotational spectra:-** The rotation of molecules, rotational spectra of diatomic molecules, the spectrum of non rigid rotator, the effect of isotopic substitutions rotational spectra of linear and symmetric top polyatomic molecules.
3. **Vibrational and Vibrational- Rotational Spectra:** The vibrating diatomic molecule; simple harmonic vibrations, anharmonicity of vibrations, the diatomic vibrating rotator, the interaction of rotations and vibrations the vibrations of polyatomic molecules, analysis by infrared technique.
4. **Electronics Spectra:** Electronic spectra of diatomic molecules, vibrational course structure, and rotational fine structure of electronic band. The Frank- Condon principle, intensity of vibrational-electronic band, dissociation energy, the Fortrat diagram.

Unit II

NMR Spectra:- Spin active nuclei, chemical shift, shielding and deshielding, internal standards, spin-spin coupling, equivalent and non- Equivalent Protons, effect of changing solvents and hydrogen bonding on chemical shifts, anisotropic effect.

Principles and Applications of UV, IR and NMR Spectra in the structure elucidation of Organic Compounds.

Unit – III

Electronic Absorption Spectroscopy: Energy levels in diatomic molecules, introduction to electronic transition, Assignment of transitions, Spectra of transition metal complexes, Orgel diagrams

Nuclear Magnetic Resonance: Applications of spin-spin coupling to structure alignment of inorganic compounds, evaluation of reaction rates of fast exchange reactions. The double resonance technique.

Application of infra-red spectroscopy to the determination of inorganic compounds.

Book Recommended

1. Physical Methods in Inorganic Chemistry- R.S. Drago.
2. Infrared Spectra of Inorganic and Coordination Compound- K. Nakamoto.
3. Fundamentals of Molecules Spectroscopy-C.N.Banwel.
4. Introduction to Magnetic Resonance Spectroscopy ESR, NMR, NRR-D.N. Sathyanarayan

M.Sc.(2nd Semester)

Paper:-XIV;18CHE22D2 Techniques in Chemistry

3 Hrs./Week
Credits: 04
Max Marks: 80
Time: 03 Hrs

Note:- Examiner will set 10 questions and the candidates will be required to attempt 05 questions in all. Out of 10 questions one question will be compulsory containing 08 short answer type questions covering the entire syllabus. Further examiner will set 03 questions from each section and the candidates will be required to attempt atleast one question from each section. All questions will carry equal marks.

Unit-I

Atomic Absorption Spectroscopy - Principles, Instrumentation, Sensitivity and detection limits. Interferences in AAS and their elimination.

Atomic Emission Spectroscopy- Principles, Sources for excitation, Instrumentation, Qualitative and quantitative Analysis.

Flame Photometry- Principles, Interferences, Evaluation methods in Flame Photometry. Principle and Applications of TGA and DTA.

Unite – II

Nano materials Technology:

Nano materials and their historical perspective. Applications of nanoscience and nanotechnology in various fields. Unique properties of nanomaterials due to their nanosize, Quantum dots. Techniques for their synthesis:- Hydrothermal, Solvothermal, Microwave irradiation, sol-gel, Precipitation, Reverse Micelle Synthesis, Physical Vapour deposition (PVD), Chemical Vapour Deposition (CVD), Electro deposition, Characterization of nanomaterials by X-ray diffraction (XRD), Scanning Electron Microscope (SEM), Energy dispersive X-ray Analysis. Transmission Electron Microscope (TEM), Atomic Force microscopy (AFM) techniques. Properties of nanostructured materials: opticals, magnetic, chemical and photo catalytic properties.

Unite – III

Purification of organic compounds using chromatographic techniques: paper chromatography, Thin- Layer Chromatography, Column Chromatography, High Pressure Liquid Chromatography (HPLC), Gas Chromatography, Ion-Exchange Chromatography, Counter- Current distribution and Electrophoresis

Book Recommended

1. Introduction to nanotechnology : Charles P. Poole, Jr. Frank, J. Owens : Wiley India
2. Basics of nanochemistry., Sachdeva, Mamta V
3. Nanochemistry, Sergeev, G. B. and K. L. Klabunde, Elsevier, 2013.
4. Nano Technology and Nanoelectronics by W.R. Fahrner- Springer International.
5. Introducation to Nanoscience and Technology Edited By M. D. Vantra, S. Evoy, J.R. Heflin-Springer.
6. Introduction to Nanosciences by S. M. Lindsey Oxford Press.
7. Nano Science and Technolony by V. S. Muralidharan and A. Subramania.
8. Separation Chemistry by R.P. Budhiraja, New age International Publishers.
9. Basic Concepts of Analytical Chemistry by S.M. Khopkar, New age International Publishers.
10. Instrumental Methods of Chemical analysis, B.K. Sharma, Goel Publishing House.

M.Sc.(2nd Semester)

Paper:- XV ; 18CHE22O1 Environmental Chemistry –I
(Open Elective)

3 Hrs./Week
Credit: 04
Max. Marks: 80
Time: 3 Hrs

Note:- Examiner will set 10 questions and the candidates will be required to attempt 05 questions in all. Out of 10 questions one question will be compulsory containing 08 short answer type questions covering the entire syllabus. Further examiner will set 03 questions from each section and the candidates will be required to attempt atleast one question from each section. All questions will carry equal marks.

Unit-I

Environment: Atmosphere, environmental segments, composition of the atmosphere, earth's radiation balance, particulates, ions, radicals and their formation, chemical and photochemical reactions in the atmosphere, air pollution: oxides of C,N,S and their effects, acid-rain, smog formation, Green house effects (global warming and ozone depletion). Analytical Methods for measuring air pollutants. Continuous monitoring instruments.

Unit-II

Hydrosphere: Chemical composition of water bodies-lakes, streams rivers, sea etc, hydrological cycle, complexation in natural and waste water and microbially mediated redox reactions. Water pollution-inorganic, organic pesticides, industrial and radioactive materials, oil spills and oil pollutants eutrophication, acid-mine drainage, waste water treatment, domestic waste water aerobic and (anaerobic treatment), and industrial waste water treatment

Noise Pollution: sources, effect on human health, mitigation and control.

Unit III

Environmental Toxicology:- chemical solutions to environmental problems, biodegradability, principles of decomposition, better industrial processes. Bhopal gas tragedy, Chernobyl, three mile island, sewozo and Minamata disasters.

Books Recommended

1. Environmental Chemistry- A.K. De
2. Environmental Chemistry – Manaham
3. Environmental Pollution Analysis- Khopkar
4. Environmental Chemistry, Sharma & Kaur.
5. Standard Method of Chemical analysis, F.J. Welcher vol. III
6. Environmental Toxicology, Ed.J.Rose.
7. Elemental Analysis of Airborne particles, Ed. S. Landsberger and M-Creatchman.
8. Environmental Chemistry, C.Baird.

M.Sc.(3rd Semester)

Paper XVI (a) 19CHE23GA1 Inorganic Special-I 4 hrs. / Week
Credits: 04

(Instrumental Techniques) *Max. Marks: 80*
Time: 3 Hrs.

Note:-*Examiner will set nine questions and the candidates will be required to attempt five questions in all. Out of nine questions one question will be compulsory containing eight short answer type questions covering the entire syllabus. Further examiner will set two questions from each section and the candidates will be required to attempt one question from each section. All questions will carry equal marks.*

Section-A

Vibrational Spectroscopy: Symmetry and shapes of AB_2, AB_3,AB_4.AB_5 and AB_6, modes of bonding of ambidentate ligands, ethylenediamine and diketonate complexes, application of resonance Raman Spectroscopy particularly for the study of active sites of metalloproteins as myoglobin and haemoglobin.

(15 Hrs)

Section-B

Electron Spin Resonance Spectroscopy: Principle, Presentation of the spectrum, hyperfine coupling, hyperfine splitting in various structures, Factors affecting magnitude of g, zero field splitting and Kramer's degeneracy, Applications to transition metal complexes having one and more than one unpaired electron, applications to inorganic free radicals, study of electron exchange reactions.

(15 Hrs)

Section-C

Mossbauer Spectroscopy: Basic Principles, spectral display, isomer shift, factors affecting the magnitude of isomer shift, quadrupole and magnetic hyperfine interaction, applications of technique to the study of bonding and structure of Fe^{2+}, Fe^{3+} ; Sn^{2+} and Sn^{4+} compounds: detection of oxidation states, nature of M-L bond,.

(8 Hrs)

Mass Spectrometry: Principle, representation, interaction of molecule with high energy electrons, interpretation of mass spectrum, effect of isotopes on appearance of mass spectrum; applications- finger print application, molelcular weight determination, evaluation of heat of sublimation of high melting solids.

(7 Hrs)

Section-D

Nuclear Magnetic Resonance Spectroscopy: ^{19}F and ^{31}P NMR spectra – Chemical shifts, coupling constants, ^{19}F Spectra of fluoroacetone, 1-bromo-1-Fluoroethane, dimethyl phosphorus trifluoride and bromine pentafluoride ; ^{31}P spectra of HPF_2 $HPO(OH)_2$ H_2 PO(OH), cis- $Pt(Pet_3)_2$ Cl_2, Application of ^{31}P NMR for structural determination of Complexes with phosphorus ligands.

Spectra of Paramagnetic materials: Contact shift, its origin and application, Pseudo contact shift, Diamagnetic complexes, Spectra of free radicals, Lanthanide shift Reagents, Magnetic susceptibility Measurement.

Solid state NMR- Wide line NMR, Magnetic Angle spinning and Applications Magnetic Resonance Imaging.

Nuclear Quadrupole Resonance Spectroscopy: Introduction, Nuclear Quadropole Moment, Electric field gradient and Asymmetry Parameter.

Nuclear Quadrupole Transitions- Axially symmetric and Non-symmetric Molecules.

Effect of an External magnetic field

Application-(i) Chemical bonding and Structure

(ii) Solid state Effects.

(iii) Hydrogen

Bonding. Experimental aspects

Books Recommended:

1. Vibrational Spectrosocpy – D.N. Sathyanarayana.
2. Introduction to Magnetic Resonace Spectroscopy ESR, NMR, NQR - D.N. Sathyanarayana.
3. Physical methods in Inorganic Chemistry – Russel S. Drago.
4. Infrared & Raman Spectra of Inorganic & Co-ordination compounds – K. Nakamoto.
5. Inorganic Infrared & Raman Spectra – S.D. Ross.

M.Sc. (3rd Semester)

Paper XVI (b) 19CHE23GB1 Physical Special-I

4 hrs. / Week
Credits: 04
Max. Marks: 80
Time: 3 Hrs.

Note:-*Examiner will set nine questions and the candidates will be required to attempt five questions in all. Out of nine questions one question will be compulsory containing eight short answer type questions covering the entire syllabus. Further examiner will set two questions from each section and the candidates will be required to attempt one question from each section. All questions will carry equal marks.*

Section-A

Electrifield Interfaces: Thermodynamics of electrified interfaces: electrocapillary thermodynamics, non-polarizable interface and thermodynamic equilibrium, fundamental thermodynamic equation of polarizable interfaces, determination of excess charge density on the electrode, electrical capacitance and surface excess of the interface, potential of zero charge, Helmholtz-Perrin model, Gouy - Chapman model and Stern model of electrified interfaces.

Section-B

Ionic Liquids: The thermal dismantling of an ionic lattice, characteristics of ionic liquids, The fundamental problems in the study of pure liquid electrolytes, models of simple ionic liquids: lattice oriented models (Vacancy model, Hole model) , quantification of the hole model, The Furth approach to the work of hole formation, distribution function for the sizes of the holes and the average size of a hole.

Electrodics: Rate of charge - transfer reactions under zero fields, under the influence of an electric field, the equilibrium exchange current density, the non-equilibrium drift-current density (Butler - Volmer) equation. Some general and special cases of Butler- Volmer equation, the high-field and low-field approximations, physical meaning of the symmetry factor ( ), a preliminary to a second theory of , a simple picture of the symmetry factor and its dependence on overpotential. Polarizable and non-polarizable interfaces.

Section-C

Adsorption : Surface tension, capillary action, pressure difference across curved surface (Leplace equation), Gibb's adsorption equation and its applications, determination of BET equation and its application for the determination of surface area; surface active agents and their classification, concept of micelles, critical micelle concentration (cmc), determination of cmc by conductivity and surface tension methods; factors affecting cmc, counter - ion binding to micelles, thermodynamics of micellization

Section-D

Chemical Dynamics: Study of fast reactions, Flow method, Relaxation method, Flash photolysis and shocktube method. Theoriesof unimolecular reactions: Lindemann's theory, Hinshelwoods treatment, R.R.K. and R.R.K.M. theories,The theory of absolute reaction rates, potential energy surfaces, activation energies, London— Eyring - Polanyi method for the calculation of energy of activation.

Books Recommended:

1. Modern electrochemistry Vol.1& 2 by J.O.M. Bockris and A.K.N. Reddy
1. Chemical Kinetics by K.J. Laidler
2. Kinetics & Mechanism of reaction rates by A.Frost & G.Pearson
3. Theories of reaction rates by K.J. laidler, H.Eyring & S. Glasstone.
4. Electrochemistry by S.Glasstone.

M.Sc. (3rd Semester)

Paper XVI(c) 19CHE23GC1 Organic Special-I

4 hrs. / Week
Credits: 04
Max. Marks: 80
Time: 3 Hrs.

Note:-*Examiner will set nine questions and the candidates will be required to attempt five questions in all. Out of nine questions one question will be compulsory containing eight short answer type questions covering the entire syllabus. Further examiner will set two questions from each section and the candidates will be required to attempt one question from each section. All questions will carry equal marks.*

Section-A

Ultraviolet and Visible Spectroscopy:

Introduction – Electronic energy levels, electronic transitions and selection rules. The origin, general appearance and designation of UV bands, absorption laws and measurement of absorption intensity, chromophores, auxochromes, bathochromic shift, hypsocromic shift, hypochromic effect and hyperchromic effect. The ultraviolet spectrometer-. Woodward and Fieser's rules for calculating ultraviolet absorption maxima for substituted dienes and conjugated dienes, unsaturated carbonyl compounds and aromatic carbonyl compounds. Applications of UV spectroscopy to problems in organic chemistry.

Section-B

Infrared Spectroscopy:

Introduction – basic theory and instrumentation including FT IR infrared spectrum. Functional group and finger print regions. Absorption of infrared radiation and molecular vibrations. Fundamental vibrations and overtones. Intensity and position of infrared absorption bands and bands resulting from combination or difference of vibrational frequencies or by the interaction of overtones (or combination bands) with the fundamental vibrations (fermi resonance). Frequency of vibrations of a diatomic molecule, spectral features of major functional groups: alkanes, alkenes, alkynes, aromatic compounds, alcohols, ethers, phenols, ketones, aldehydes, esters, amides, acids, anhydrides, lactones, lactams, conjugated carbonyl compounds and amines. Effect of hydrogen bonding and solvent effect on vibrational frequencies, Overtones, combination bands and fermi resonance. Applications of IR spectroscopy to problems in organic chemistry.

Section-C

Nuclear Magnetic Resonance Spectroscopy:

Introduction – spin active nuclei behave as spinning nuclear magnets, orientation of spinning nuclear magnets in a uniform magnetic field and energy description of NMR phenomenon. Continuous wave (CW) NMR spectrometer and Fourier transform (FT) NMR spectrometer.

Phenomenon of resonance and relaxation, chemical shift , chemical shift parameters and internal standards, Factors affecting the chemical shift: shielding and deshielding of a nucleus, substitution effects leading to empirical co-relations for proton chemical shifts, anisotropic effect, effect of changing solvents, effect of hydrogen bonding, influence of chirality on the chemical shifts of enantiomers and intermolecular Vander Walls deshielding, Spin spin coupling, multiplicity of splitting and relative intensity of lines in a multiplet, integration, mechanism of coupling-one bond coupling (^{1}J), two bond coupling (^{2}J) three bond coupling (^{3}J) including Karplus relationship. Techniques for simplification of complex spectra, solvent effects, Lanthanide shift reagents, spin decoupling (double resonance), Fourier Transform technique and Nuclear Overhauser effect (NOE). Effect of sensitivity of C- 13 NMR compared to H–1 NMR, comparison of C–13 NMR and H-1 NMR, chemical shifts of C–13 NMR. Simplification of C – 13 spectra by process of decoupling, off resonance decoupling.

Section-D

Mass Spectroscopy:

Introduction – basic theory , instrumentation, process of introducing the sample into mass spectrometer. Methods of generation of positively charged ions, electron ionization method , chemical ionization, FD and fast atom bombardment (FAB) techniques. Mass spectrum, base peak, molecular and parent ion, Mass to charge ratio (M/Z), relative intensity, fragment ions, even electron rule, nitrogen rule, matastable ions, McLafferty rearrangement and ortho effect. Determination of molecular weight and molecular formula using mass spectrometry

Optical Rotatory Dispersion (ORD) and Circular Dichroism (CD):

Definition, haloketone rule, octant rule for ketones.

Cotton effect and Cotton curves, deduction of absolute configuration.

Books Recommended:

1. Spectroscopic Identification of Organic Compounds by R.M. Silverstein, G.C. Bassler and T.C. Morrill.
2. Introduction to NMR Spectroscopy by R.J. Abraham, J.Fisher and P.Loftus.
3. Applications of Spectroscopy of Organic Compounds by J.R. Dyer.
4. Spectroscopic Methods in Organic Chemistry by D.H. Williams and I.Fleming.
5. Organic Spectroscopy by Jag mohan.
6. Organic Spectroscopy by W. Kemp.
7. Organic Spectroscopy by Pavia.

M.Sc. (3rd Semester)

Paper XVII (a) 19CHE23GA2 Inorganic Special-II — 4 hrs. / Week
Credits: 04

(Nuclear & Radiochemistry) — *Max. Marks: 80*
Time: 3 Hrs.

Note:-*Examiner will set nine questions and the candidates will be required to attempt five questions in all. Out of nine questions one question will be compulsory containing eight short answer type questions covering the entire syllabus. Further examiner will set two questions from each section and the candidates will be required to attempt one question from each section. All questions will carry equal marks.*

Section-A

Nuclear Binding Energy: Justifications and applications; nuclear stability rules and decay of unstable nuclei.

Nuclear Structure: Nuclear forces; liquid drop model, Shell Model and collective model. (15 hrs.)

Section-B

Interaction of Radiation with matter: Physical and chemical effects of radiation on matter (photoelectric effect, Compton effect and pair production). (7 hrs.)

Radiochemical Techniques:

NAA - Principle, Application and Limitation
IDA - Principle, Application and Limitation
Radiometric titrations and activation analysis (8 hrs.)

Section-C

Detection of Nuclear Radiation: Various methods of detecting nuclear radiations, Gas-filled counters – Ionization chamber; Proportional counter and G.M. counters. Scintillation detectors; Solid state detectors. (15 hrs.)

Section-D

Nuclear Reactions: Energetics of nuclear reactions; various types of nuclear reactions including photonuclear, thermonuclear and spallation reactions; mechanism of nuclear reaction by compound nucleus model.
Nuclear fission – Fission probability; energy release; theories of fission.

Nuclear Fussion: Brief idea about breeder reactors,; accelerators and cyclotron. (15 hrs.)

Books Recommended:

1. Essentials of Nuclear Chemistry – H. J. Arnikar.
2. Radio Chemistry & Nuclear Chemistry – G.Choppin, J.O. Liljenzin & J.Rydberg.
3. Nuclear Chemistry – M. Sharon.
4. Modern Nuclear Chemistry – W.D. Loveland, D.J. Morrissey & G.T. Seaborg.

5. Handbook of Nuclear Chemistry: Instrumentation, Separation Techniques, Environmental issues – A. Vertes, S. Nagy & Z. Klencsar.
6. Flow through nuclear chemistry By R.K. Malik and Neelam Kumari (Pargati Parkashan Merrut)

M.Sc. (3rd Semester)

Paper XVII(b) 19CHE23GB2 Physical Special-II

4 hrs. / Week
Credits: 04
Max. Marks: 80
Time: 3 Hrs.

Note:-*Examiner will set nine questions and the candidates will be required to attempt five questions in all. Out of nine questions one question will be compulsory containing eight short answer type questions covering the entire syllabus. Further examiner will set two questions from each section and the candidates will be required to attempt one question from each section. All questions will carry equal marks*

Section-A

Statistical Thermodynamics-I: Concept of distribution, Thermodynamic probability and most probable distribution; Canonical, grand canonical and micro canonical ensembles. Maxwell - Boltzmann statistics, Statistical thermodynamic formulation of Maxwell - Boltzmann distribution law, Maxwell - Boltzmann law of distribution of energy and evaluation of average velocity, root mean square velocity; Law of equipartition of energy; Partition function and its factorization, relationship of atomic and molar partition function to thermodynamic properties(i) internal energy (ii) entropy (iii) Gibb's free energy (iv) heat contant (v) work function (vi) pressure and heat capacity at constant volume and pressure. Derivation of equation of state for a mono atomic ideal gas.

Section-B

Statistical Thermodynamics-II: Translational partition function, calculation of absolute entropy of an ideal monoatomic gas, Seckure -Tetrode equation, Vibrational , Rotational, and electronic partition function of diatomic molecules, Derivation of expressions for transitional ,vibrational, rotational and electronic energies; expressions for entropy, Gibbs free energy, work function due to transitional, vibrational and rotational motion of a molecule. Effect of change of zero point energy on partition function and also on thermodynamic properties like internal energy, Gibbs free energy, enthalpy, work function & entropy. Chemical equilibrium and equilibrium constant in terms of partition functions, Free energy function.

Section-C

Quantum Mechanics-I: Quantum mechanical treatment of Helium atom and the failure of rigorous quantum mechanical method. Need of approximate methods, first order perturbation theory (excluding time dependent), Variation principle. Application of first order perturbation and variation principle to evaluate ground state of helium atom. Applicability of perturbation theory to an electron in a one dimensional box under the influence of electric field.

Section-D

Quantum Mechanics-II:Valance bond method, valance bond method to hydrogen, hydrogen molecule ion (their symmetric and anti symmetric solution without actual valuation of various integrals, energy of molecular hydrogen system, LCAO-MO approximation, refined treatment of hydrogen molecules Concept of resonance and its role in the stability of hydrogen molecule ion, electron spin, pauli's exclusion principle, hybridization.

Books Recommended:

1. Theoretical chemistry by S. Glasstone
2. Quantum chemistry by Levinine
3. Quantum chemistry by Pauling, Eyring & Wilson
4. Introduction to Statistical Mechanics by L.K. Nash.

M.Sc. (3rd Semester)

Paper XVII(c) 19CHE23GC2 Organic Special-II

4 hrs. / Week
Credits: 04
Max. Marks: 80+20
Time: 3 Hrs.

Note:-*Examiner will set nine questions and the candidates will be required to attempt five questions in all. Out of nine questions one question will be compulsory containing eight short answer type questions covering the entire syllabus. Further examiner will set two questions from each section and the candidates will be required to attempt one question from each section. All questions will carry equal marks*

Section-A

Vitamins

Structure and synthesis of vitamins A, B_1, B_2, B_6, C, D, E, nicotinic acid, pantothenic acid and Biotin

Section-B

Carotenoids:

General methods of structure elucidation and synthesis of □-carotene, □-carotene, lycopene, and □-carotene. Biosynthesis of carotenoids

Porphyrins:

Structure , spectral properties and synthesis of Porphyrins and Haemin. Structure of chlorophyll (without synthesis)

Section-C

Plant pigments:

Occurance, general chemical and spectroscopic methods for structure determination.

Structure elucidation and synthesis of Flavone, Chrysin, Flavonol, Quercetin, Diadazin, Xanthone, Euxanthone, Cyanidin chloride, Malvidin chloride, Hirsudin chloride. Biosynthesis of flavonoids: Acetate pathway and shikimic acid pathways.

Section-D

Enzymes and co-enzymes:
Introduction to biological catalysis, nomenclature, classification and specificity.

Kind of reaction catalysed by enzymes: Oxidation – reduction, isomerisation, epimerisation, hydrolysis, phosphorylation, acylation, methylation, decarboxylation and dehydration.
Co-enzymes: Chemistry of Co-enzymes; Co-I, Co-II, Co-A, Co-carboxylase, FMN, FAD and Pyridoxal phosphate

Books Recommended:

1. Bioinorganic Chemistry: A Chemical Approach to Enzyme Action by Herman Duags and C. Penny.
2. Understanding Enzymes by Trevor Palmer
3. Enzyme Chemistry, Impact and Applications by Ed. Collin J. Suckling.
4. Enzyme Mechanisms Ed, M.I. Page and A. Williams
5. Fundamentals of Enzymology by N.C. Price and L. Stevens.
6. The Chemistry of Natural products by P.S. Kalsi.
7. Organic Chemistry by I.L. Finar.

M.Sc.(3rd Semester)

Paper XVIII(a) 19CHE23GA3 Inorganic Special-III
(Bio-Inorganic Chemistry and Environmental Chemistry)

4 hrs. / Week
Credits: 04
Max. Marks: 80
Time: 3 Hrs.

Note:-*Examiner will set nine questions and the candidates will be required to attempt five questions in all. Out of nine questions one question will be compulsory containing eight short answer type questions covering the entire syllabus. Further, examiner will set two questions from each section and the candidates will be required to attempt one question from each section. All questions will carry equal marks.*

Section-A

Metal Ions in Biological Systems: General survey of essential and trace metals, Disturbing factors in metabolic process and causes of diseases, different classes of drugs.
Alkali and alkaline earth metals in biological systems: Ionophores, active transport of cations across membranes, sodium pump, Calcium pump, Calcium carriers, role of carriers in muscle contraction, blood clotting and hormones.

Interaction of metal ions with Nucleotides: metal ions in nucleotide systems, effect of metal ions on nuclei acids. **(15 hrs.)**

Section-B

Oxygen carriers: Porphyrins, metalloporphyrins, Hemoproteins, structure and functions of hemoglobin and myoglobin, synthetic oxygen carrier model systems
Nitrogen fixation: Biological nitrogen fixation, Nitrogenase, model for nitrogenase, metal-N_2 complexes, photosynthesis and chlorophyll.
Metal transport and storage: Transferrin, Ferritin, Siderophores **(15 hrs.)**

Section-C

Metalloenzymes:

Zinc Enzymes – Carboxypeptidase & Carbonic anhydrase Iron
Enzymes – Catalase, peroxidase & cytochrome P- 450 Copper
Enzymes – Superoxide dismutase, blue copper- proteins

Coenzymes – Vitamins B_{12} **(15 hrs.)**

Section-D

Environmental Chemistry: Atmosphere: Chemical composition of atmosphere, atmospheric structure, Earth's radiation balance; oxides of N,C,S and their effects, Green house effect, acid rain, photochemical smog , air quality standards, depletion of ozone, particulate matter in atmosphere , mechanism of aerosol formation in air, Noise pollution and their health hazards.

(15 hrs.)

Books Recommended:

1. Inorganic Chemistry: Principles of Structure & Reactivity – J.E. Huheey.
2. Environmental Chemistry – A.K. De.
3. Environmental Pollution Analysis – Khopkar.
4. Environmental Chemistry – V. Subramaniam.
5. Environmental and Bioinorganic Chemistry by R.K. Malik and Neelam Kumari (Sunrise publication, Ansari Road, New Delhi).

M.Sc. (3rd Semester)

Paper XVIII (b) 19CHE23GB3 Physical Special-III

4 hrs. / Week
Credits: 04
Max. Marks: 80
Time: 3 Hrs.

Note:-*Examiner will set nine questions and the candidates will be required to attempt five questions in all. Out of nine questions one question will be compulsory containing eight short answer type questions covering the entire syllabus. Further examiner will set two questions from each section and the candidates will be required to attempt one question from each section. All questions will carry equal marks*

Section-A

Spin Resonance Spectroscopy: Spin and an applied field; the nature of spinning particles. interaction between spin and magnetic field, Larmor precession, population of energy levels. Nuclear MagneticResonance Spectroscopy; Hydrogen Nuclei, the chemical shift, the coupling constant, coupling between several nuclei, analysis by NMR technique, exchange phenomena, simplication of complex spectra.

Section-B

Electron spin resonance spectroscopy; the theory of E.S.R. the position of E.S.R. absorption, the g factor, the fine and hyperfine structures of E.S.R. absorption. Applications of E.S.R. spectroscopy.

Moss Bauer Spectroscopy: Theory of Moss-Bauer spectroscopy, the chemical shift quadrupole effects, the effect of magnetic field. Applications of Moss-Bauer spectroscopy.

Section-C

Introduction: Definition of corrosion, importance and cost of corrosion classification of corrosion

Electrochemistry of Corrosion: Electrode reactions, electrode potentials, electrochemical cell formation, Nernst equation, exchange current density, polarization of electrode (resistance. concentration and activation), mixed potential theory, polarization diagrams, pourbaix diagrams, corrosion rate expression and weight loss method for corrosion rate, galvanic series. Electrochemical techniques to study corrosion – Galvanostatic and potentiostatic techniques. Stern –Geary equation, Tafel slopes, measurement of corrosion potential and corrosion current density, Tafel extrapolation and Linear polarization resistance methods, recording and interpretation of anodic and cathodic polarization curves

Section-D

Kinetics of Passivity: Introduction , electrochemical behaviour of active/passive metals, Flade potential, criteria for selecting a metal exhibiting passivity, factors influencing electrochemical passivity and corrosion rate, theories of passivity.

Protection Methods against Corrosion: Change of metal, design improvement, change of environment, anodic protection, cathodic protection and protective coatings.

Corrosion inhibitors: classification, mechanism, selection of corrosion inhibitors, inhibition efficiency and factors influencing inhibition efficiency, measurement of inhibition efficiency.

Books Recommended:

1. Introduction of molecular spectroscopy by G.M. Barrow
2. Fundamental of molecular spectroscopy by C.N. Banwell
3. Corrosion inhibitors Principle & Applications by V.S. Sastri
4. Corrosion by K.R. Trephewey & J. Chamberlain
5. Introduction to Metallic corrosion & its prevention by Raj Narain
6. An introduction to the Science of Corrosion and its inhibiton ByS.N. Banerjee.
7. Corrosion engineering by M.G. Fontana

M.Sc. (3rd Semester)

Paper XVIII (C) 19CHE23GC3 Organic Special-III
(Heterocyclic Chemistry)

4 hrs. / Week
Credits: 04
Max. Marks: 80+20
Time: 3 Hrs.

Note:-*Examiner will set nine questions and the candidates will be required to attempt five questions in all. Out of nine questions one question will be compulsory containing eight short answer type questions covering the entire syllabus. Further examiner will set two questions from each section and the candidates will be required to attempt one question from each section. All questions will carry equal marks*

Unit – I

Nomenclature of Heterocycles

Replacement and systematic nomenclature (Hantzsch-Sidman System) for monocycle, fused and bridged heteroycles.

Aromatic Heterocycles

General chemical behavior of aromatic heteroclcles, classification (structural type), criteria of aromaticity (bond lengths, ring current and chemical shifts in H) NMR-spectra, empirical resonance energy, delocalization energy and Dewar resonance energy, diamagnetic susceptibility exaltations). Heteroaromatic reactivity and tautomerism in aromatic heterocycles.

Unit- II

Non-Aromatic Heterocycles

Heterocyclic Synthesis

Principles of heterocyclic synthesis involving cyclization reactions and cycloadditiion reactions.

Small Rings Heterocycles

Three-membered and four membered heterocycles-synthesis and reactions of aziridines. Oxiranes, thiranes, azetidines, oxetanes and theitanes.

Unit- III

Benzo –Fused Five-Membered Heterocycles

Synthesis and reactions including medical application of benzopyrroles, benzofurans and benzothiophenes.

Meso-ionic Heterocycles

General classification, chemistry of some important meco-ionic heterocycles of type- A ans type-B ans their application.

Unit- IV

Six-Membered heterocycles with One Heteroatom

Synthesis and reactions of pyrylium salts and pyrones and their comparison with pyridinium and thiophyrylium salts and pyridines. Synthesis snd recations of quinolizinium and benzopyrylium salts, cumarins and chromones.

Six-membered Heterocycles with two of more Heteroatoms

Synthesis and recations if azepines, oxepines, thepines, diazepines, thiazepines, azocines, diazocines, dioxocines and dithiocines.

Books Recommended:

1. Hetrocyclic Chemistry by R.R. Gupta, M. Kumar and V. Gupta.
2. Hetrocyclic Chemistry by T.L. Gilchrist.
3. Hetrocyclic Chemistry by V.K. Ahluwalia.
4. Organic Reaction Mechanism by V.K. Ahluwalia & R.K. Parashar.
5. Reaction Mechanism in Organic Synthesis by S.M. Mukherji, S.P. Mukharji, S.P. Singh & R.P. Kapoor.
6. Organic Name Reactions- A Unified Approach by Gautam Brahmachari.
7. Organic Chemistry by I.L. Finar.
8. An Introduction to Medicinal Chemistry by Graham L. Patrick.
9. Textbook of Organic Medicinal and Pharmaceutical Chemistry by Charles O. Wilson, Ole Gisvold & Rebert F. Doerge.
10. Principals of medicinal Chemistry by William O. Foye, Thomas L. Lemice and David A. Williams.
11. Burgers Medicinal Chemistry and Drug by M.E. Wolff.

12. M.Sc. (3rd Semester)

Paper XIX (a), 19CHE23PW1

Project Work **Inorganic Special**

12 hrs. / Week
Credits: 12
Max. Marks: 300

Marks Distribution

1. Dissertation Work - 90 Marks
2. Internal assessment of Project Work - 90 marks
3. External Viva- Voce - 120 Marks

M.Sc. (3rd Semester)

Paper XIX (b), 19CHE23PW2

Project Work **Physical Special**

12 hrs. / Week
Credits: 12
Max. Marks: 300

Marks Distribution

1. Dissertation Work - 90 Marks
2. Internal assessment of Project Work - 90 marks
3. External Viva- Voce - 120 Marks

M.Sc. (3rd Semester)

Paper XIX (c), 19CHE23PW3

Project Work **Organic Special**

12 hrs. / Week
Credits: 12
Max. Marks: 300

Marks Distribution

4. Dissertation Work - 90 Marks
5. Internal assessment of Project Work - 90 marks
6. External Viva- Voce - 120 Marks

M.Sc.(3rd Semester)

Op **Paper:- XX ; 19CHE23 01 Environmental Chemistry-II**
Open Elective (OE)

4 Hrs./Week
Credits: 04
Max Marks: 80
Time: 03 Hrs

Note:- Examiner will set 09 questions and the candidates will be required to attempt 05 questions in all. Out of 09 questions one question will be compulsory containing 08 short answer type questions covering the entire syllabus. Further examiner will set 02 questions from each section and the candidates will be required to attempt atleast one question from each section. All questions will carry equal marks.

Unit-I

Water Quality parameters and standards: Analytical methods for measuring DO, BOD, COD, fluoride, oils and grease and metals (As, Cd, Hg, Pb, Zn Cu, Cr), Biochemical effects of As, Cd, Hg, Pb, Cr, CN and pesticides.

Lithosphere: soil composition, micro and macro nutrients, soil pollution-fertilizers, pesticides.

Unit-II

Industrial Pollution:- Cement, Sugar, distillery, drug, paper and pulp, thermal power plants, nuclear power plants, metallurgy, Polymers, drugs etc. Radionuclide analysis. Disposal of wastes and their management.

Unit-III

Green Chemistry:- Importance, Principles of Green Chemistry, Thrust Areas, Applications of non-conventional techniques in organic synthesis: Ultrasonic, microwave and grinding, solid state synthesis and synthesis under solvent free conditions, Use of Ionic Liquids.

Unit-IV

Persistant Organic Pollutants: Aldrin, chlordane, Dieldrin,, Dioxins, DDT, Endrin, Furans, Helptachlor, Hexachlorobenzene, Mirex, Polychlorinated biphenyls, Toxaphene.

Books Recommended

1. Environmental Chemistry – A.K. De
2. Environmental Chemistry- Manaham.
3. Environmental Pollution Analysis- Khopkar.
4. Environmental Chemistry- V. Subra maniam.
5. Chemistry of Atmosphere-Murray J. Mc Ewan and Leon F. Philips.
6. Atmospheric Chemistry – J. Heichlen.

M.Sc. (4th Semester)

Paper XXI (a) 19CHE24GA1 Inorganic Special-IV
(Organotransition metal Chemistry)

4 hrs. / Week
Credits: 04
Max. Marks: 80
Time: 3 Hrs.

Note:-*Examiner will set nine questions and the candidates will be required to attempt five questions in all. Out of nine questions one question will be compulsory containing eight short answer type questions covering the entire syllabus. Further examiner will set two questions from each section and the candidates will be required to attempt one question from each section. All questions will carry equal marks.*

Section-A

Introduction and Classification of organometallic compounds by bond types viz. covalent, ionic, electron deficient and cluster compounds. **(7 Hrs.)**

Alkyls and Aryls of Transition Metals: Types, routes of synthesis, stability and decomposition pathways, organocopper in organic synthesis. **(8 Hrs.)**

Section-B

Transition Metal π–Complexes: Transition metal π–complexes with unsaturated molecules-alkenes, alkynes, allyl, & dienyl(metallocene) complexes, preparation, properties and nature of bonding and structural features, important reactions related to nucleophilic and electrophilic attack on ligands and to organic synthesis.

(15 Hrs.)

Section-C

Compounds of Transition Metal-Carbon Multiple Bonds: Transition metal- carbene complexes: Fischer type and Schrock type carbene complexes, their synthesis, reactions and structures & bonding; Transition metal-carbyne complexes: their synthesis, reactions and structural features.

(15 Hrs.)

Section-D

Fluxional Organometallic Compounds: Fluxionality & dynamic equilibria in compounds such as acyclic alkenes,σ-bonded and π–bonded cyclic alkenes, rotation of ligands on metals, ligand scrambling on metals.

(7 Hrs.)

Applications of Transition metal Organometallics as Catalysts: Zeigler-Natta polymerization ; homogeneous catalytic hydrogenation; alkene hydrogenation-Wilkinson Catalyst; Oxidation of

olefins-Wacker's process; hydroformylation of olefins – the oxo process.

8 Hrs.)

Books Recommended

1. Principles & Applications of Organotransition metal Chemistry by J.P. Collman, L.S. Hegedus, J.R. Norton & R.G. Finke.
2. Organometallic Chemistry – R.C. Mehrotra & A.Singh.
3. Principles of Organometallic Chemistry – G.E. Coates, M.L.H. Green, P. Powel & K. Wade.
4. Transition Metal Organometallic Chemistry – R.B. King.
5. Organotransition Metal Chemistry – V. Ishii & M.Tsutsui
6. The Organometallic Chemistry of the Transition Metals – R.H. Crabetree.

M.Sc. (4th Semester)

Paper XXI (b); 19CHE24GB1 Physical Special-IV

4 hrs. / Week
Credits: 04
Max. Marks: 80
Time: 3 Hrs.

Note:-*Examiner will set nine questions and the candidates will be required to attempt five questions in all. Out of nine questions one question will be compulsory containing eight short answer type questions covering the entire syllabus. Further examiner will set two questions from each section and the candidates will be required to attempt one question from each section. All questions will carry equal marks.*

Section-A

Applications of Electrochemistry: The maximum intrinsic efficiency, actual efficiency and current - potential relation in an electrochemical energy converter, factors influencing the electrochemical energy conversion, the power output of an electrochemical energy converter. Electrochemical electricity generators (fuel cells), brief idea about H_2- O_2, hydrocarbon - air, and natural gas & CO -air fuel cells. Electricity storage: some important quantities in electricity storage (electricity storage density, energy density, power), desirable conditions for an ideal strorer , storage of electricity using the lead-Acid battery, dry cell, silver-zinc cell and Sodium-Sulfur cell, Amperometric titrations determination of activation energy for an irreversible electrode process.

Section-B

Polarography: General principles of polarography, the limiting current, diffusion current, derivation of Ilkovic equation, consequences of the Ilkovic equation, Koutecky's equation for diffusion current, half -wave potential, equations for reversible cathodic, anodic, and cathodic-anodic waves, analysis of reversible polarographic wave, factors affecting the half- wave potential, reversible processes controlled by diffusion of complex ions, $(Me^{n+} + pX^{m-} \rightarrow MeX_p]^{(mp-n)-}$, reversible reduction of organic substances (quinone - quinol system).

Irreversible electrode processes : An approximate treatment of a slow electrode process and regorous treatment of a slow electrode process, irreversible reduction of complexes, polarography of organic substances, polarographic coulometry at constant potential, determination of number of electrons by analysis of the decrease in the limiting current.

Section-C

Polymers-I: Classification of polymers and polymerisation, condensation and addition polymers, kinetics of condensation (step-wise) polymerisation, size distribution in linear condensation polymers, molecular size control, degree of polymerization; mechanism of vinyl radical polymerisation, molecular weight and its determination, effect of temperature and pressure on chain polymerisation, stereochemistry of polymer chain & stereo regular polymerisation, Ionic polymerisation (similarities and contrast), kinetics of cationic, anionic polymerisation, kinetics of copolymerisation, criteria for polymer solubility; Mass number and Mass average molecular weight, determination of molecular weight of polymers by osmometry,

viscometry, light scattering and sedimentation methods.

Section-D

Polymers-II:

Statistical method of biopolymers: Chain configuration of polymer chains, statistical distribution of end to end dimensions (freely jointed chains in **ID & 3 D**); influence of bond angle restriction, radius of gyration, thermodynamics of biopolymer solution (entropy of mixing & liquid state model along with limitation), free volume theory, heat and free energy of mixing.

Books Recommended:

1. Text book of Polymer science by F.W. Billmeyer & Jr. Wiley
2. Contemporary polymer chemistry by H.R. Alcock & F.W. Lambe.
3. Physics & Chemistry of polymer by J.M.C. Cowie
4. Polymer Chemistry by P.J. Flory
5. Modern Electrochemistry Vol.1 & II by J.O.M. Bockris & A.K.N. Reddy
6. Electrochemistry by S. Glasstone
7. Electrochemistry by P.H. Reiger.
8. Polarography by Heyrovsky.
9. Introduction to Polarography & Allied Techniques by Zutshi Kannala

M.Sc. (4th Semester)

Paper- XXI (c) 19CHE24GC1 Organic Special-IV

4 hrs. / Week
Credits: 04

Photochemistry

Max. Marks: 80+20
Time: 3 Hrs.

Note:-*Examiner will set nine questions and the candidates will be required to attempt five questions in all. Out of nine questions one question will be compulsory containing eight short answer type questions covering the entire syllabus. Further examiner will set two questions from each section and the candidates will be required to attempt one question from each section. All questions will carry equal marks*

Unit- I

Basic of Photochemisty

Absorption, excitation, photochemical laws, quantum yield, electronically excited states-life times-measurements of the times. Flash photolysis, stopped Flow techniques, Energy dissipation by radiative and non-radiative processes, absorption spectra, Franck-Condon principle, photochemical stages-primary and secondary processes.

Unit- II

Photochemical Reactions

Interaction of electromagnetic radiation with matter, types of excitations, fate of excited molecule, quantum, yield, transfer of excitation energy, actinometry.

Properties of Excited States

Structure, dipole moment, acid-base strengths, reactivity. Photochemicalkinetics-calculation of rates of radiative processes. Bimolecular deactivation quenching.

Determination of Reaction Mechanism

Classification, rate constants and life times of reactive energy states-determination of rate constants of reactions. Effect of light intensity on the rate of photochemical reactions. Types of photochemical-photo-dissociation, gas-phase photolysis.

Unit- III

Photochemistry of Alkenes

Intromolecular reactions of the olefinic bond-geometrical isomerism, cyclisation reactions, rearrangement of 1,4 and 1,5-dienes,

Photochemistry of Carbonyl compounds

Intramolecular reactions of carbonyl compounds-saturated, cyclic and acyclic, B, Y-undsaturated and a,B, unsaturated compounds, Cyclohexadienones. Intermolecuar.....buchi Reaction.

Unit- IV

Photochemistry of Aromatic Compounds
Isomerisations, additions and substitutions.
Miscellaneous Photochemical Reactions
Photo-Fries reactions of anilides. Photo Fries rearrangement. Barton reaction. Singlet molecular oxygen reactions. Photochemical formation of smog. Photo degradation of polymers. Photochemistry of vision.

Books Recommended:

1 Molecular Photochemistry by N. J. Turo and W.A. Benjamin.
2 Introductory PhotochemistrybyA. Cox and T. Camp.
3 Photochemistry byR.P. Kundall and A. Gilbert.
4 Organic Photochemistry byJ. Coxon and B. Halton.
5 Organic Photochemistry by Orville L. Chapman.
6 Pericyclic Reactions by S.M. Mukherji.
7 The Conservation of Orbital Symmetry by R.B. Woodward and R. Hoffman.
8 Orbital Symmetry by R.E. Lehr and A.P. Merchant.
9 Reaction Mechanism in Organic Chemistry by S.M. Mukherji and S.P. Singh.
10 Stereochemistry of Organic Compounds by D. Nasipuri.
11 Stereochemistry of Organic Compounds by P. S.Kalsi.

M.Sc. (4th Semester)

Paper XXII (a) 19CHE24GA2 Inorganic Special-V
(Analytical Chemistry)

4 hrs. / Week
Credits: 04
Max. Marks: 80
Time: 3 Hrs.

Note:-*Examiner will set nine questions and the candidates will be required to attempt five questions in all. Out of nine questions one question will be compulsory containing eight short answer type questions covering the entire syllabus. Further examiner will set two questions from each section and the candidates will be required to attempt one question from each section. All questions will carry equal marks.*

Section-A

Electrons at and across interfaces, Electro-chemical and chemical reactions,.

Basic principles, residual current, migration current, diffusion current and limiting current, saturated calomel electrode(SCE) and dropping mercury electrode(DME). Ilkovic equation, Koutecky equation for diffusion current, Polarographic waves(anodic and cathodic), Half wave potentials. Oxygen interference, maxima, function of supporting electrolyte,

(15 Hrs.)

Section-B

Determination of stability constants of complexes (reversible systems only) by D.C.Polarography, Catalytic hydrogen wave. Principles of Amperometric titrations, types of titration curves, apparatus and techniques.

Hanging mercury drop electrode, rotating droping mercury electrode, platinum electrodes(RPE), Gold electrode, carbon paste electrode, glassy carbon electrode and graphite electrode.

(15 Hrs.)

Section-C.

Analytical applications of Redox chemistry of inner transition elements. Analytical Chemistry-separation,spectroscopy,electro and Thermo analytical methods. Thermal methods of analysis - : Introduction to different thermal methods,Thermogravimetry-TGA,DTA,Static and dynamic. Thermogram and factor affecting .

Chronopotentiometry, chronoamperometry and coulometry.

(15 Hrs.)

Section-D

Theory of anodic stripping voltametry, concentration process, rest period, stripping process. Cathodic stripping voltametry, Anodic deposition, Cathodic redissolution, Experimental and applications of above system to Inorganic systems. Theory of ion selective electrodes, Experimental and applications of ISE to Inorganic systems.

(15 Hrs.)

Books Recommended:

1. Introduction to Polarography & Allied Techniques – K. Zutshi
2. Basic concepts of Analytical Chemistry – S.M. Khopkar.
3. Principles of Polarography – R.C. Kapoor & B.S. Aggarwal.
4. Fundamentals of Analytical Chemistry – Skoog West.

M.Sc. (4th Semester)

Paper XXII (b) 19CHE24GB2 Physical Special-V

4 hrs. / Week
Credits: 04
Max. Marks: 80
Time: 3 Hrs.

Note:-*Examiner will set nine questions and the candidates will be required to attempt five questions in all. Out of nine questions one question will be compulsory containing eight short answer type questions covering the entire syllabus. Further examiner will set two questions from each section and the candidates will be required to attempt one question from each section. All questions will carry equal marks*

Section-A

Statistical Thermodynamics:

Free energy functions and the partition functions, calculation of equilibrium constant using partition function, Bose - Einstein statistics, statistics of photon gas, gas degeneration, Fermi-Dirac statistics, extreme gas degeneration, energy of Bosons &Fermi particles, specific heat of electron gas, , Thermionic emission, comparison of Maxwell-Boltsmann, Bose –Einstein and Fermi-Dirac statistics.

Section-B

Non –Equilibrium Thermodynamics: General theory of non-equilibrium processes, entropy production and entropy flow; thermodynamic criteria for non -equilibrium states, entropy production in heat flow, mass flow, electric current, chemical reactions, Saxen's relation, Onsager's reciprocity relation, , Electro kinetic phenomenon.

Theory of fluctuation, energy fluctuations in the canonical ensemble, distribution function and fluctuations, fluctuations of density and energy.

Section-C

Angular Momentum : Angular momentum, angular momentum operators in cartesian coordinates, eigen function & eigen values, commutation relation between angular momentum operators (L_x,L_y , L_z , L^2), total orbital angular momentum and spin angular momentum, commutation relation between components of total orbital angular momentum and spin angular momentum, ladder operators, commutators of [L^2 , L_+] and [L^2 ,L_-] , application of ladder operators to an eigen function of L_z.

Section-D

Molecular Orbital Theory: Huckel molecular orbital (HMO) theory of llinear and cyclic conjugated systems, Applications of HMO theory to (i) set up and solve Huckel determent equation; (ii) calculate resonance energy; (iii) wave functions for molecular orbitals and molecular diagrams for the following :

(a) Ethylene molecule (b) Allyl system (Allyl radical and the related cation and anion) (c) Butadiene; (d) Cyclobutadiene (e) Cyclopropenyl system (cyclopropenyl radical and the related cation and anion

Books Recommended:

1. Non- Equilibrium Thermodynamics by I. Prigogine
2. Non-Equilibrium Thermodynamics by C. Kalidas.
3. Theoretical Chemistry by S. Glaston.
4. Quantum Mechanics by M.S. Pathania.
5. Quantum Chemistry by Pauling , Eyring and Wilson.

M.Sc. (4th Semester)

Paper- XXII(c) 19CHE24GC2 Organic Special-V
Chemistry of Natural Products

4 hrs. / Week
Credits: 04
Max. Marks: 80+20
Time: 3 Hrs.

Note:-*Examiner will set nine questions and the candidates will be required to attempt five questions in all. Out of nine questions one question will be compulsory containing eight short answer type questions covering the entire syllabus. Further examiner will set two questions from each section and the candidates will be required to attempt one question from each section. All questions will carry equal marks*

Unit- I

Terpenoids and Caroteniods: Classification, nomenclature, occurrence, isolation, general methods of structure, determination, isoprene rule, Structure determination, stereochemistry biosynthesis and synthesis of the following representative molecules: Citral, Geraniol, termpeneol Menthod, Farnesol, Zingiberen.

Unit- II

Alkaloids: Definition,nomenclature and physiological action, occurrence, isolation, general methods or structure elucidation, degradation, classification based on nitrogen heterocyclic rings, role of alkaloids in plants, structure, stereochemistry, synthesis and biosynthesis if the following: Ephedrine.(+) Coniline, Atropine, Quinine and Morphine.

Unit- III

Steroids : Ossurrence,nomenclature, basic skeletion, Diel's hydrocarbon and stereochemistry, Isolation, Structure determination and synthesis of Cholestrol, Bile acids, Androsetrone, Tenosterone, Estrone, Progestrone, Aldoserone, Biosynthesis of steroids.

Unit - IV

Plant Pigments: Occurrence, nomenclature and general method of structure determination, Isolation and synthesis of Apigenin, Luteolin, Querctio, mytcelin, Quercetin-3-glucoside, Vitexin, Diadzein, Butein, Aureusin, Cyanidin-7 arabinoside, Cysncin, Hirsutidin. Bioysnthesis of flavoniids; Acetate pathway and Shikimic acid pathyway.

Prophyrins:Structure and synthesis of Haemoglobin and Chlorophyll. Prostaglandins: Occurrence, biogenesis and physiological effects Synthesis of PGE and PGE.

Book remanded:-

1. The Chemistry of Natural Products by P.S. Kalsi.
2. Organic Chemistry by I.R. Finar
3. Natural Products – Chemistry and Biological significance by J.Mann, R.S. Davidson, J.B. Hobbs.
4. Chemistry of Natural Products by Nakamshi.
5. New Trends in Natural Products chemistry by Att-ur-Retiman, M.I. Choudhary.

M.Sc. (4th Semester)

Paper XXIII(a) 19CHE24GA3 Inorganic Special-VI
(Medicinal Aspects of Inorganic Chemistry)

4 hrs. / Week
Credits: 04
Max. Marks: 80
Time: 3 Hrs.

Note:-*Examiner will set nine questions and the candidates will be required to attempt five questions in all. Out of nine questions one question will be compulsory containing eight short answer type questions covering the entire syllabus. Further, examiner will set two questions from each section and the candidates will be required to attempt one question from each section. All questions will carry equal marks.*

Section-A

Metals in Medicine: Biochemical bases of essential metal deficient diseases; Iron, copper and zinc deficiencies and their therapies, carcinogens and carcinostatic agents, zinc in tumour growth and inhibition, anticancer activity and mechanism of platinum complexes, anticancer activity of Rhodium, copper and Gold complexes, anti cancer activity of Selenium, antibacterial and antiviral properties of metal complexes, polyamino carboxylic acids and polyethylene amines as chelating drugs.

(16 hrs.)

Section-B

Miscellaneous applications of Inorganic compounds as medicines: Drugs in hypo and hyper activity of thyroids, Inorganic drugs in dental carries, clinical disorders of alkali and alkaline earth metals and their remedies, lithium drugs in psychiatry.

(7 hrs.)

Heavy metals in Biological systems : Toxicity of heavy metals – and their detoxification, role of Selenium in Biological systems with reference to its essentiality and toxicity, mechanism of metal ion induced toxicity, interaction between orally administered drugs and metal ions in gut.

(7 hrs.)

Section-C

Ligand Therapy: Ligand induced toxicity, interference with haemoglobin in oxygen transport system, intefererence with metallo-enzymes, beneficial effects of ligand chelation; carcinogenic ligands, carcinostatic ligands, alkylating agents as anticancer drugs. Thiosemicarbazones as anticancer drugs, macrocyclic antibiotic ligands and prodable mechanism of the drug, antiviral activity of chelating agents, aspirin chelation, drugs where chelation and therapeutic activity are unrelated. (15 hrs.)

Section-D

Vitamins and their functions in general, recommended dietary allowances , deficiencies and supplementations, dietary miners, calcium and vitamin D, antioxidants and their health effects, biomineralisation

Radiopharmacology, nuclear medicines, radioiodine -I 31, technetium – 99m, gallium and indium scan. (15 hrs.)

Books Recommended

1. A Text Book on Medicinal Aspects of Bio-Inorganic Chemistry – A.K. Das.
2. Bioinorganic Medicinal Chemistry – E.Alessio.
3. Bioinorganic Chemistry – K.H. Reddy.
4. Inorganic Chemistry: Principle of Structure Reactivity – J.E. Huheey, E.A. Keiter & R.L.Keiter.
5. Handbook of Radiopharmaceuticals: Radio Chemistry & Applications – M.J. Welch & C.S. Redvanly.
6. Perspectives on Bioinorganic Chemistry – R.W. Hay, J.R. Dilworth & K.B. Nolan.

M.Sc. (4th Semester)

Paper XXIII(b) 19CHE24GB3 Physical Special-VI

4 hrs. / Week
Credits: 04
Max. Marks: 80
Time: 3 Hrs.

Note:-*Examiner will set nine questions and the candidates will be required to attempt five questions in all. Out of nine questions one question will be compulsory containing eight short answer type questions covering the entire syllabus. Further examiner will set two questions from each section and the candidates will be required to attempt one question from each section. All questions will carry equal marks*

Section-A

Symmetry and Group Theory in Chemistry: Symmetry elements and symmetry operationgroup and its properties, Multiplication table, point symmetry groups. Schonflies symbol, representations of groups by matrices (representation for the C_n, C_{nv}, C_{nh}, D_{nh} etc. groups
to be worked out explicity) Irreduceable representation of groups. The great orthogonality theorem (without proof) and its importance. Character tables and their use in spectroscopy.

Section-B

Electronic Spectroscopy of Polyatomic Molecules : Free electron model, spectra of carbonyl group, spectra of ethene, n-II and II-II transitions, spectra of benzene , spectra of transition metals, charge-transfer transition, fluorescence phosphorescence.
Raman Spectroscopy : Quantum theory of Raman effect, Classical theory of Raman effect, Pure rotational Raman spectra, Raman activity of vibrations, vibrational Raman spectra, polarization of light and Raman effect, applications.

Section-C

Forms of Corrosion: Uniform corrosion, galvanic corrosion, pitting corrosion, crevice corrosion, intergranular corrosion, stress corrosion cracking, corrosion Dfatigue, fretting corrosion, dealloying, hydrogen embrittlement, erosion corrosion, microbial induced corrosion, filliform corrosion and exfoliation.

Section-D

Industrial Corrosion Problems: Atmospheric corrosion and high temperature oxidation. Corrosion in industrial cooling water system, corrosion in boilers and condensate pipe lines, corrosion due to acids, corrosion during metal surface cleaning and descaling, corrosion in chemical industries, corrosion in oil and gas wells, corrosion in refinery and petrochemical plants, corrosion in fertilizer industries.

Books Recommended:

1. Molecular symmetryand group theory by A.Vincent
2. Applied group theory by A. Nass Bauim
3. Group theory in Chemistry by S.Swarnlakshmi, T.Saroja & R.M. Ezhilarasi.
4. Introduction of molecular spectroscopy by G.M. Barrow
5. Fundamental of molecular spectroscopy by C.N. Banwell
6. Corrosion inhibitors Principle & Applications by V.S. Sastri
7. Corrosion by K.R. Trephewey & J. Chamberlain
8. Introduction to Metallic corrosion & its prevention by Raj Narain
9. An introduction to the Science of Corrosion and its inhibiton ByS.N. Banerjee
10. Corrosion engineering by M.G. Fontana

M.Sc. (4th Semester)

Paper- XXIII(c) 19CHE24GC3 Organic Special-VI (a) 4 hrs. / Week
Organic Reactions and Reagents Credits: 04
(Elective) *Max. Marks: 80+20*
Time: 3 Hrs.

Note:-*Examiner will set nine questions and the candidates will be required to attempt five questions in all. Out of nine questions one question will be compulsory containing eight short answer type questions covering the entire syllabus. Further examiner will set two questions from each section and the candidates will be required to attempt one question from each section. All questions will carry equal marks*

Section-A

Preparation, properties and applications of following reagents in organic synthesis with mechanistic details.

Organometallic Reagents:
n-Butyllithium, Grignard reagent, Organo chromium(III) compounds, Dialkyl copper lithium, Pentacarbonyl iron, Tetracarbonyl nickel, octacarbonyl dicobalt, Alkene Palladium (II) complexes, Wilkinsons catalyst, Methyl triisopropoxy titanium, Tri-n-butyl tin hydride, Trimethyl silyl iodide, Diborane.

Section-B

General Reagents:
DCC I, 1,3-dithianes, Polyphosphoric acid, Diazomethane, Ethyldiazoacetate, Boron Trifluoride, Trifluoro acetic acid, Cuprous chloride, N-Bromosuccinamide,Mont- K-10, and KSF (clays). Phase Transfer catalysts.

Section-C

Oxidation:
Leadtetraacetate, Osmium tetraoxide, Selenium dioxide, Potassium permanganate, Fenton's reagent, Ozone, Perbenzoic acid, Periodic acid, Chromium oxide, Thallium (III) nitrate.

Reduction:
Catalytic hydrogenation, lithium aluminium hydride, Sodium borohydride, Sodamide, Zinc dust, Sodiumliquid ammonia reduction of carbonyl compounds, acids, their derivatives, epoxides, nitro and azo compounds.

Section-D

Rearrangement:

General mechanistic considerations – nature of migration, migratory aptitude. A detailed study of following rearrangements: Pinacol – pinacolone, Wagner-Meerwein, Demjanov, Benzil-Benzilic acid, Favorskii, Arndt-Eistert synthesis, Neber, Beckmann, Hofman, Curtius, Schmidt, Baeyer-Villiger and Shapiro reaction, Barton, Chihibaben, wittig reaction, Hoffman- Lofler Freytag reaction.

Books Recommended:

1. Designing Organic Synthesis by S. Warren .
2. Organic Synthesis Concept, Methods and Starting Materials by J.Fuhrhop and G. Penzillin.
3. Some Modern Methods of Organic Synthesis by W.Carruthers.
4. Modern Synthesis Reactions by H.O. House & W.A. Benjamin.
5. Advanced Organic Chemistry -Reactions Mechanism and Structure by Jerry March.
6. Principles of Organic Synthesis by R. Norman and J.M. Coxon.
7. Advanced Organic Ohemistry Part-B by F.A. Carey and R.J. Sundburg.
8. Organometallic Chemistry-A Unified Approach by R.C. Mehrotra & A. Singh.
9. Concise Coordination Chemistry by R. Gopalan & V. Ramalingam
10. Organometallic Chemistry by G.S. Sondhi

M.Sc. (4th Semester)

Paper- XXIII(c) 19CHE24GC3 Organic Special-VI (b) 4 hrs. / Week

Medicinal Chemistry

(Elective) Credits: 04

Max. Marks: 80+20

Time: 3 Hrs.

Note:-*Examiner will set nine questions and the candidates will be required to attempt five questions in all. Out of nine questions one question will be compulsory containing eight short answer type questions covering the entire syllabus. Further examiner will set two questions from each section and the candidates will be required to attempt one question from each section. All questions will carry equal marks*

Section: 1.

Introduction to Medicinal Chemistry:

Introduction to important functional groups in medicinal chemistry, a century of drug research.

Drug design:

Strategies for drug research including various targets. Lead generation/sources for drugs, receptor and drug receptor interactions; enzymes and design of inhibitors; concept of Prodrugs, hard and soft drugs.

Section: 2.

Combinatorial Chemistry:

Introduction; solid support and linkers; combinatorial synthesis of compounds on solid phase. split and mix method, premix method, spatially addressable parallel chemical synthesis, multiple synthesis; Identification of active compounds from combinatorial libraries: Analytical methods for characterization of combinatorial libraries;

Application of combinatorial libararies using solid phase chemistry.

Computational approaches:

Structure activity relationship, concept of QSAR, physicochemical parameters- lipopilicity, partition coefficient, electronic-ionization constants, H-bonding, steric parameters, Hammett equation. Isosterism, bioisosterism.

Biodisposition and implications:

Pharmacokinetics; concepts including absorption, distribution, metabolism and excretion of the drug, pharmacokinetic parameters; drug metabolism including phase I and phase II biotransformatins; mention of the uses of pharmacokinetics in drug development process. Molecular toxicology, avoidance of toxic intermediates.

Section 3.

Neuroactive agents:

The chemotherapy of the mind: Introduction, neurotransmitters, CNS depressant, General anaesthetics, mode of action of hypnotics, sedatives, antianxiety agents benzodiazepines, buspirone, neurochemistry of mental diseases. Antipsychotic drugsthe neuroleptics, antidepressants, butyrophenone, serendipity and drug development, stereochemical aspects of neuroactive drugs. Synthesis of Diazepam, Oxazepam, Chlorazepam, barbiturates.

Cardiovascullar agents:
Introduction, cardiovascular diseases, drug inhibitors of theperipheral sympathetic function, central intervention of the cardiovascular output, direct action arteriolar dilators, synthesis of amyl nitrate, sorbitrate, diltiazam, quinidine , verapamil, methydopa, atenolol, oxeprenolol.

Section 4.

Antincoplastic agents:
Introductionm cancer chemotherapy, role of alkylating agents antimetabolites in the treatement of cancer. Mention of carcinolytic antibiotics and mitotic inhibitors; synthesis of mechlorethamine, cyclophosphamide, melphalan, uracil, mustards, 6- mercaptopurine. Recent development in cancer chemotherapy, the hormones and natural products.

Local anti-infective drugs:
Introduction and general mode of action, synthesis of sulphonamide, furazolidone, naxilidic acid, eiprofloxacin, dapsone, aminosalicylic acid, isoniazid, ethionamide, ethambutol, fluconazole, gresiofulvin, chloroquin, primaquin.

Book suggested:

1. The Organic Chemistry of Drug Design and Drug action by Richard B. Silveman form Academic press, inc.
2. Principles of Biochemistry, A.L. Lehninger, Worth Publishers.
3. Principles of Organic Synthesis, R. Norman and J.M. Coxon, Blakie, Academic and Professional.
4. Fundamental of Photochemistry, K.K. Rohtagi Mukherjee, Wiley Eastern.
5. Medicinal chemistry, 4th Edition, A. Burger, Wiley Interscience.
6. Medicinal chemistry, 5th Edition, A. Kar, New age internstional.
7. Text Book of organic medicinal and Pharmaceutical chemistry, 8th Edition, R.F. Boerge, Ed. Wilson and Gisvelds, J.B. Lippincott Co.
8. Natural Products, their chemistry and biological significance. J. Mann, R.S. Davidson, J.B. Hobbs, D.V. Banthrope and J.B. Harborne, Longmann, Essex, 1994. Medicinal Biochemistry, N.V. Bhagavan, Academic Press, Elsevier.
9. Natural Product Synthesis II: Targets, Methods, Concepts. Topics in current Chemistry, 24th ED. Edited by Johann Mulzer (Universitat Wien). Springer: Berlin, Heideberg, New York. 2005.
10. Natural Products from Plants 2nd ed., Cseke: National Scientific Book Agency, Delhi.
11. Gringauz, A. Introduction to Medicinal Chemistry: How drugs Act and Why? John Wiley & Sons (1997).
12. Patrick, G.L. Introduction to Medicinal Chemistry Oxford University Press (2001).
13. Biomedical Polymers and Polymer Therapeutics By Emo Chiellini from Springer.
14. Polymers as Drugs, Conjugates and Gene Delivery Systems, by Ronit Satchi- Fainaro, Ruth Duncan from Springer.

Cancer Drugs Delivery, Wiley- VCH Books 2011 by Eds. F. Kratz, H. Syeinhagen

M.Sc. (4th Semester)

Paper- XXIII(c) 19CHE24GC3 Organic Special-VI (C) 4 hrs. / Week
Polymers Chemistry
(Elective)

Credits: 04
Max. Marks: 80+20
Time: 3 Hrs.

Note:-*Examiner will set nine questions and the candidates will be required to attempt five questions in all. Out of nine questions one question will be compulsory containing eight short answer type questions covering the entire syllabus. Further examiner will set two questions from each section and the candidates will be required to attempt one question from each section. All questions will carry equal marks*

Unit- 1

Basics

Importance of polymers. Basic concepts: Monomers, repeat units, degree of polymerization. Linear, branched and network polymers. Classification of polymers. Polymerization: condensation, addition, radical chain-ionic and co-ordination and copolymerization in homogeneous and heterogeneous systems.

Unit- 2

Polymer Characterization

Polydispersion-average molecular weight concept, Number, Weight and Viscosity average molecular weight. Polydispersity and molecular weight distribution. The practical significance of molecular weight. Measurement of molecular weight. End group, viscosity light scattering, osmotic and ultracentrifugation methods. Analysis and testing of polymers and chemical analysis of polymers, spectroscopic methods, physical testing – tensile strength, fatigue, impact. Tear resistance. Hardness and abrasion resistance

Unit- 3

Structure and Properties

Morphology and order in crystalline polymers-configurations of polymer chains. Crystal structures of polymers. Morphology of crystalline polymers, strain-induced morphology. crystallization and melting. Polymer structure and physical properties-crystalline melting point Tm-melting points of homogeneous series, effect of chain flexibility and other steric factors, entropy and heat of fusion. The glass transition temperature, Tgrelationship between Tm & Tg, effects of molecular weight, diluents, chemical structure, chain topology, branching and cross linking. Property requirements and polymer utilization.

Unit- 4.

Polymer Procession

Plastics, elastomers and fibers. Compounding. Processing techniques: Calendaring, die casting, rotational casting, film casting, injection moulding, blow mouldin, extrusion moulding, thermoforming, foaming, reinforcing and fiber spinning.

Properties of Commercial Polymers

Polyethylene, Polyvinyl chloride, polyamides, polyesters, phenolic resins, epoxy resins and silicon polymers. Functional Polymers- Fire retarding polymers and electrically conducting polymers. Biomedical polymers. Biomedical polymers-contact lens, dental polymers, artificial heart, kidney, skin and blood cells.

Books Recommended:-

1. Polymer Chemistry by Gowerker
2. Text book of Polymer Chemistry VOL. I, II, III by S. Chand Publication
3. Text book of Polymer Science, F.W. Billmeyer, Willey, 3rd edition.
4. Plastic material by J.A. Brydson, Butterworth- Heinemann, 7th edition.
5. Polymer Chemistry by C.E. Carraher, Jr. Marcel Dekker, 6th edition.
6. A practical guide to understanding the NMR of polymers by Peter A. Mirau.
7. Polymer: Polymer Characterization and analysis by Jaquieline I Kroschwitz. Wiley Interscience.
8. Spectrometric identification of organic compounds by R.M. Silverstein and F.X. Webster, Wiley Interscience.
9. Principals of Polymer Processing by Zehev Tadmor, Costas G. Gogos Willey, 2nd edition.
10. Introduction to Thermal Analysis, by Michael E. Brown, Kluwer Academoc.
11. Thermal Characterisation of Polymeric Materials by Edith A. Turi, 2nd edition. Vol. 1-2
12. Handbook of polymer technology by Vishnu Shah, Willey intersciene.
13. Injection moulding of plastic components by John brown, MGH.
14. Polymer chemistry by Paul C. Heimenz, marcel-Dekker INC.
15. Material Science and engineering by V. Raghavan, PHI learning 5th edition
16. Handbook of conducting polymers by Terje A. Skotheim, M.Dekker 3rd edition.

Inorganic Special Practical-IV
Paper-XXIV (a) 19CHE24GDAL1

M.Sc. Chemistry (4th Semester)

8Hrs/Week
Credits: 04
Max.Marks 100
Time: 8 Hrs

Interpretation of IR spectrum and determination of structure/bonding in some simple inorganic compounds and coordination compounds, such as: 40 marks

(i) Ammonium salts [NH_4Cl, $(NH_4)_2SO_4$, NH_4SCN, NH_4NO_3]
(ii) Sulphate ions in different bonding mode: ionic – K_2SO_4 , $CaSO_4$ etc., unidentate, bidentate, bridged etc.
(iii) Thiocynate and Isothiocynate complexes.
(iv) Oxalato complexes
(v) Cyano complexes – $K_4Fe(CN)_6$, $Na_2[Fe(CN)_5NO]$
(vi) Ammine complexes
(vii) Spectra of isomers – Nitro – and Nitrito

Record File 10 marks

Viva-Voce 10 marks

Physical Special Practical-IV
Paper-XXIV (b) 19CHE24GDBL1

M.Sc. Chemistry (4th Semester)

(8Hrs. /Week)
Credits: 04
Max. Marks: 100
Time: 8 Hrs

1. Potentiometry

(i) $KMnO_4$ vs. Mohr's salt or $FeSO_4$ titration
(ii) NaOH vs. H_3PO_4 titration.
(iii) NaOH vs. (HCl + CH_3COOH) mixture
(iv) NaOH vs. Boric Acid
(v) $ZnSO_4$ vs $K_4[Fe(CN)_6]$
(vi) $Na_2S_2O_3$ vs Iodine
(vi) To determine solubility and solubility product of sparingly soluble salts $BaSO_4$, AgCl and $PbSO_4$
(vii) To determine degree of hydrolysis of aniline hydro chloride
(viii) To determine dissociation constant of weak acid.
(ix) $AgNO_3$ vs. KCl or KI Titration

2. pH metry Titrations

(i) NaOH vs. H_3PO_4
(ii) NaOH vs. (HCl + CH_3COOH) mixture
(iii) NH_4OH vs. HCl
(iv) NH_4OH vs. CH_3COOH
(v) To determine dissociation constant of weak acid.

3. Dipole metry

1. To determine the dielectric constant of various organic liquids.
2. To determine dipole moment of various organic liquids

Record File	10 marks
Viva-Voce	10 marks

Organic Special Practical-IV
Paper-XXIV (c)19CHE24GDCL1

M.Sc. Chemistry (4th Semester)

8Hrs/Week
Credits: 04
Max.Marks: 100
Time: 8 Hrs

1. Multi-step Synthesis
(i) m-Nitroaniline from benzene.
(ii) 5-Acetoxy-1,3-benzoxathiol-2-one from hydroquinone.
(iii) 2'-Hydroxy-4-methoxyphenylstyryl ketone from resorcinol.
(iv) Acridone from anthranilic acid.

Record File — 10 marks

Viva-Voce — 10 marks

Inorganic Special Practical-V
Paper-XXV(a)19CHE24GDAL2

M.Sc.Chemistry (4th Semester)

8Hrs/Week
Credits: 04
Max.Marks: 100
Time: 8 Hrs.

1 Conductometrically- Composition of mixture of weak and strong acide, Precipitation and displacement titrations.
2 pH-metry-Composition of mixture of strong and weak acide pK value of organic acids.
3 Potentiometry- redox titrations, Precipitations, Simultaneous determination of Halide ions.
4 Ion- selective electrodes – F, Ca, Na, K etc.

Note: Candidate is required to perform one experiment in the examination.

Record File 10 marks

Viva-Voce 10 marks

Physical Special Practical-V
Paper-XXV (b) 19CHE24GDBL2

M.Sc. Chemistry (4th Semester)

(8Hrs. /Week)
Credits : 04
Max.Marks:100
Time: 8 Hrs

1. Conductometry Titrations

(i) NH_4OH vs CH_3COOH
(ii) CH_3COONa vs HCl
(iii) NaOH vs. (HCl + CH_3COOH) mixture

(iv) $AgNO_3$ vs KCl or KI
(v) $AgNO_3$ vs KCl+ KI
(vi) To determine concentration of Salicylic acid by
(a) Salt line method and (b) Double alkali method
(vii) To determine solubility and solubility product of sparingly soluble salts (AgCl, $PbSO_4$, $BaSO_4$)
(viii) To study the kinetics of sponification of ester conductometrically
(ix) Verification of D.H.O. equation for strong electrolytes.
(x) To estimate the concentration of each component in a mixture of AgNO3 and HNO3.

2. Polarometry

(i) To determine specific rotation for various optically active substances.
(ii) To determine concentration of glucose or fructose or sucrose or tartaric acid in solution
(iii) To determine the percentage composition of optical substances in the binary mixture (components comprise of Glucose or Fructose or sucrose or Tartaric acid)
(iv) To determine the rate constant for inversion of sugar using polarometry technique.

3. Flame Photometry

(i) To determine the concentration of Na^{+} or Li^{+} or Ca^{++} ions in solution

Record File	10 marks
Viva-Voce	10 marks

Organic Special Practical-V
Paper-XXV(c) 19CHE24GDCL2

M.Sc. Chemistry (4th Semester)

8Hrs/Week
Credits: 04
Max.Marks: 100
Time: 8 Hrs

1. **Spectrophotometric (UV/VISIBLE) Estimations:**

   (a) Amino acids
   (b) Proteins
   (c) Carbohydrates
   (d) Ascorbic acid
   (e) Aspirin
   (f) Caffeine
   (g) Cholesterol

2. **Isolation**
   (i) Caseinfrom milk
   (ii) D (+) Glucose from cane sugar
   (iii) Hippuric acid from urine

Record File — 10 marks

Viva-Voce — 10 marks

Inorganic Special Practical-VI
Paper-XXVIII (a) 17CHE24GDAL3

M.Sc. Chemistry (4th Semester)

8Hrs/Week
Credits: 04
Max.Marks: 50
Time: 8 Hrs

Ion Exchange methods in Column Chromatographic Analysis:-

(i) Determination of the capacity of a cation – exchange resin i.e. Amberlite IR – 120.
(ii) Determination of the capacity of an anion exchange resin i.e. Amberlite IRA – 400 or De – Acidite FF.
(iii) Separation of Ions by Ion –exchangers.

40 Marks

Note: Candidate is required to perform one experiment in the examination.

Viva-Voce 05 marks
Record file 05 marks

Books Recommended:

1. A Text Book of Quantitative Analysis – A.I. Vogel.
2. A Text Book of Qualitative Analysis – A.I. Vogel.
3. Senior Practical Physical Chemistry – B.D. Khosla, V.C. Garg & A. Gulati
4. Infrared and Raman Spectra of Inorganic & Co-ordination compounds – K. Nakamoto.
5. Inorganic Infrared & Raman Spectra – S.D. Ross.
6. Basic Concepts of Analytical Chemistry – S.M. Khopkar.

Physical Special Practical-VI
Paper-XXVI (b) 19CHE24GDBL3

M.Sc. Chemistry (4th Semester)

(8Hrs. /Week)
Credits: 04
Max. Marks: 100
Time: 8 Hrs

1. **Ultrasonic Interferrometry:**

   (i) To measure speed of sound for various liquids.
   (ii) To determine the isentropic compressibility of liquids.
   (iii)To determine excess isentropic compressibility of given binary liquid mixture.

2. **Spectrocolorimetry:**

   (i) Determine the composition of $KMnO_4$ and $K_2Cr_2O_7$ in the given mixture.
   (ii) Determine the pK value of the methyl red and phenolphthalein indicator.
   (iii) To study complex formation between ferric and thiocyanate ions.

3. **Chemical Kinetics:**

   (i) To study of kinetics of iodination of acetone.
   (ii) To study the kinetics of sponification of ethyl or methyl acetate.
   (iii) To study the kinetics of acid catalyzed inversion of cane sugar.
   (iv) To study of kinetics of bromination of Gallic acid by bromide-bromate mixture in acid medium. (Clock reaction).

4. **Viva-Voce** 10 marks
5. **Practical Note Book** 10 marks

Books Recommended:

6. Senior practical physical chemistry: B.D. Khosla, V.C. Garg and A. Khosla.
7. Experimental Physical Chemistry: A Thawale and P. Mathur.
8. Practical Physical Chemistry: B. Vishwanatha and P. S Raghav
9. Practical in Physical Chemistry: P.S. Sindhu.

Organic Special Practical-VI
Paper-XXVI (c) 19CHE24GDCL3

M.Sc. Chemistry (4th Semester)

8Hrs/Week
Credits: 04
Max.Marks:100
Time: 8 Hrs

1. Qualitative Analysis:

Identification of organic compound using spectroscopic methods (UV, IR, NMR & Mass) followed by characterization by chemical methods.

2 Viva- Voce 10 Marks

3. Note Book 10 Marks

Books Recommended:

1 Experiments and Techniques in Organic Chemistry by D. Pasto, C. Johnson and M. Miller.
2 Macroscale and Microscale Organic Experiments by K. L. Williamson, D.C. Heath.
3 Systematic Qualitative Organic Analysis by H. Middleton.
4 Handbook of Organic Analysis-Qualitative and Quantitative by H. Clark.
5 Vogel's Textbook of Practical Organic chemistry byA. R. Tatchell.

27/6/18 27/6/18 27/6/2018 27/06/18