Appendix to UO No Acad/C2/754/2007 Dated 22/08/2007

REGULATIONS, SCHEME OF EXAMINATION AND SYLLABUS FOR B.Sc DEGREE COURSE IN CHEMISTRY

(With effect from 2007 admission)

1.Duration of the course and Pattern : The course of study will be extended over a period of three years. The course will follow Pattern I as far as Part I (English) and Part II (Second Language)are concerned.

2.**Main and Subsidiary subjects :** In part III the Main subject is Chemistry. There are two subsidiary subjects. The compulsory subsidiary subject is Mathematics. The second subsidiary subject is any one of the following1. Physics 2. Computer Science 3. Biochemistry 4. Biotechnology 5.Microbiology.

3. Eligibility and admission : A candidate seeking admission to B. Sc Chemistry Main should have passed in Higher secondary Examination,+2 or Equivalent Examination with Chemistry as one of the subjects.

4.**Syllabus:** For detailed syllabus refer to Appendix-I

5.The Examination : The examination of the degree shall consists of Theory, Practical, Project work and viva voce. There shall be examination at the end of each year. There are six theory papers and five practical papers. The details of theory and practical papers, year of examination, duration of examination and the marks awarded are detailed in Appendix-I

6. Evaluation : Evaluation of each paper shall be done in two parts viz. External evaluation and Internal continuous assessment. 20%of the total marks in part III should be through internal assessment.

7. Project work : Project work has to be carried out by a group of not more than 5 students under the guidance of a faculty member preferably in the college itself. The work may be carried out through out the course and the report has to be presented at the time of practical examination conducted at the end of the third year.

8. Study tour : Students are required to visit a factory/Laboratory/ Research Institute of repute during the course and present the tour report along with the practical records at the time of practical examination in the third year.

9.Practical Records : Students are permitted to appear for the practical examination only on production of the certified records of respective practical work.

10. Viva voce : Viva voce examination based on practical will be conducted along with practical examination in the third year.

11. Tests : For each paper there will be at least two test papers. Valued answer scripts should be returned to students.

12. Assignment : Students shall be required to do an assignment for each paper. Valued assignments shall be returned to students.

13.Seminar: Students are required to present a seminar on a selected topics in each paper

14.Attendance: Minimum attendance required for each academic year is 75 % of the actual working days.

15.Pass requirement: A student shall be declared to have passed in Part III Main if the candidate obtains not less than 35 % of the total marks for the main subject (Theory & Practical put together) with not less than 30% of the total marks for the theory and not less than30% of the total marks for practical in the Main subject. For the subsidiary subjects in part III the minimum marks for pass is 35 % of the total marks of theory and practical with a minimum of 30% in theory and 30% in practical. Those who fail in any unit need to appear in that unit alone.

16.Classification for successful candidates: I Class- 60% or above of the total marks
II Second class- 50% or above and less than 60%of the total marks
III Class -Less than 50% of the total marks.
A candidate who secures 80% or more marks in part III shall be declared to have passed with distinction.

17.Supplementary and improvement examinations: They are in the same pattern as applicable to other B. Sc degree courses as given in the general regulations for B. Sc Degree Courses.

KANNUR UNIVERSITY
SYLLABUS FOR B. Sc DEGREE CHEMISTRY MAIN
(With effect from 2007 admission)

A.MAIN SUBJECT :CHEMISTRY

1. Written Examination	:	6 Papers	6X60	360
2. Practical Examination	:	5 Papers	5X 40	200
3. Viva- Voce Examination	:			10
4.Report of the visit to Factory/ Research Institute				5
5. Project Report				25
		Total for theory		360
		Total for practical		240
		TOTAL FOR MAIN SUBJECT		600

B. SUBSIDIARY SUBJECTS: MATHEMATICS/PHYSICS/ COMPUTER SCIENCE/BIOTECHNOLOGY/MICROBIOLOGY/ BIOCHEMISTRY

Total Marks for Subsidiary subject I	200
Total Marks for subsidiary subject II	200
TOTAL FOR SUBSIDIARY SUBJECTS	400
TOTAL FOR MAIN & SUBSIDIARY	1000

The order of Six Theory papers and Five Practical papers with title, year of Examination , duration of Examination and the marks allotted are detailed below.

THEORY

Paper No	Title	Year of Examination	Duration	Maximum Marks/External	Internal Marks	Total Marks
Paper I	Theoretical and Inorganic Chemistry	1st year	3hrs	50	10	60
Paper II	Organic Chemistry I	2nd year	3hrs	50	10	60
Paper III	Inorganic and Environmental Chemistry	3rd year	3hrs	50	10	60
Paper IV	Physical Chemistry I	3rd year	3hrs	50	10	60
Paper V	Organic Chemistry II	3rd year	3hrs	50	10	60
Paper VI	Physical Chemistry II	3rd year	3hrs	50	10	60

TOTAL FOR THEORY 360 Marks

PRACTICAL

Paper I	Qualitative Analysis	2nd year	4hrs	30	10	40
Paper II	Volumetric Analysis	3rd year	4hrs	30	10	40
Paper III & Paper IV	Gravimetric Analysis Organic Analysis	3rd year	6 hrs	30 30	10 10	40 40
Paper V	Physical Chemistry Experiments	3rd year	4hrs	30	10	40
Project Report				15	10	25
Tour Report				5	-	5
Viva-Voce				10	-	10

TOTAL FOR PRACTICAL : 240 Marks

TOTAL FOR MAIN (THEORY & PRACTICAL) : 600 Marks

DISTRIBUTION OF TEACHING HOURS

Year	Theory	Practical	Total
I Year	2hrs	2hrs	4hrs
II Year	2 hrs	3hrs	5hrs
III Year	(16+1*) = 17hrs	8hrs	25hrs

*** 1 hr to be allotted for teaching Environmental Studies as and when it is introduced as a separate paper.**

INSTRUCTIONS TO QUESTION PAPER SETTERS IN THEORY EXAMINATION

The Maximum Marks for a Theory Paper is 50

Each of the question paper shall contain THREE sections, viz Section A, Section B and Section C

SECTION A : TEN very short answer questions are to be answered out of 15 questions ,each carrying $1^{1/2}$ mark (10 X $1^{1/2}$ = 15)

SECTION B : FIVE short answer questions are to be answered out of 8 questions ,each carrying 3 marks (5X 3 = 15)

SECTION C : TWO essay type questions are to be answered out of 3 questions, each carrying 10 marks (2X 10 = 20)

Question Papers in Physical Chemistry Paper I and Paper II should contain numerical problems fetching 25% of the total marks.

While setting the question papers weightage is to be given to each of the Units as specified in the syllabus.

SYLLABUS FOR B. Sc DEGREE CHEMISTRY MAIN (I YEAR)
PAPER I THEORETICAL AND INORGANIC CHEMISTRY
(With effect from 2007 admission)

UNIT I STRUCTURE OF ATOM (23 hrs)

Bohr theory- Bohr radius, energy and velocity equations-Spectra of Hydrogen like atoms-Limitations of Bohr theory- Max Planck's quantum theory of radiation- Photo electric effect-Wave particle duality- De Broglie equation- Electron diffraction- Davisson and Germer experiment- Compton effect (derivation not expected)- Heisenberg's uncertainty principle and its significance.

Discussion of operators- eigen function and eigen value- Linear Hermitian operators. Postulates of Quantum mechanics- Derivation of Schrodinger equation from postulates-particle in one dimensional box –Introductory treatment of Schrodinger equation for hydrogen atom-Atomic orbital-Quantum Numbers (n,l,m) –Stern-Gerlac experiment-Spin quantum number- Radial and angular wave functions- radial and angular distribution curves-shapes of s, p, d and f orbital- Hund's rule- Aufbau principle-Electronic configuration of atoms.

UNIT II PERIODIC PROPERTIES (5 hrs)

Long form of the periodic table- Detailed discussion- Periodicity in properties a) Atomic radii and covalent radii b) Ionic radii c) Effective nuclear charge and Screening effect d) Ionization energy e) Electro negativity f) Electron affinity.

UNIT III CHEMICAL BONDING (23 hrs)

Ionic bond- Lattice energy- Born- Lande equation- Derivation- Born- Haber Cycle and its application- Solvation energy- Covalent character of ionic bonds- Polarisation of ions-Fajan's rules- Covalent bonds- Electro negativity scale- Pauling and Mulliken's scale-Dipole moment and molecular structure- % ionic character from dipole moment measurement- hybridization and hybrid bonds- Geometry of molecules containing only bond pairs of electrons- BeF_2, BF_3 CH_4, SF_6, IF_7 – VSEPR theory- Prediction of shapes of molecules and ions using VSEPR theory -XeF_2, XeF_4,ClF_3, NH_3, NH_4^+ , NH_2^- ,H_2O, NF_3, NO_2 ,NO_2^+,Cl_2O, F_2O.

Molecular Orbital Theory- LACO method- Bonding, Anti bonding and non- bonding orbital- M. O configuration of di atomic molecules like N_2, O_2, O^{2+}, O^{2-}, F_2, CO, HCl-Bond order, para magnetism, bond length and bond strength.

Metallic bonding-Qualitative idea of free electron theory- Valence bond theory, and band theory- Explanation of metallic properties using these theories.

Weak chemical forces- Hydrogen bond-inter and intra molecular hydrogen bonds-Van der Waals forces.

UNIT IV SPECTROSCOPY(14 hrs)

General features of spectroscopy-Experimental Techniques-width and intensity of spectral lines-Electromagnetic spectrum- Molecular spectra- Rotation spectra- Moment of inertia- rotational quantum numbers, Rotational constant, intensities of rotational spectral lines- Rotational- vibrational spectrum of diatomic molecules- selection rules for rotational spectra.

Infrared spectroscopy- Range of infrared radiation- Origin of infrared spectra- Selection rule- vibrational mode of atoms, Molecular vibration- Factors influencing vibrational frequencies- calculation of stretching frequencies.

Nuclear magnetic resonance spectroscopy- Introduction-principle- origin of NMR- modes of nuclear spin- Relaxation Process- Chemical shift –Shielding effects-factors affecting chemical shift.

UNIT V COORDINATION CHEMISTRY (13 hrs)

Werner's Theory- Nomenclature- EAN rule-Types of ligands- Chelates- Stereochemistry of different co-ordination Numbers-Isomerism in Coordination complexes-Stability of complexes-Factors affecting the stability.

Theories of bonding in transition metal complexes- Valence bond theory-Application to some complexes- Limitations of V.B. theory- the crystal field theory- Crystal field splitting in octahedral ,tetrahedral and square planar complexes- CFSE-Factors affecting the magnitude of crystal field splitting-Explanation of colour, geometry and magnetic properties of complexes on the basis of the above theories- spectro chemical series-Applications of complexes in qualitative and quantitative analysis.

UNIT VI INTRODUCTION TO NANO TECHNOLOGY (6hrs)

Introduction- What is nanotechnology- Quantum size effect-Single electron tunneling-Classification -Properties- structural-Thermal Chemical- Mechanical, Magnetic, Optical, Electronic-Biological-Applications- Catalysis- Ceramics coating-plastics Hard materials-Lubricants- Image Applications- Writing with atoms- Computing and Electronics- Nano tubes.

UNIT VII INTRODUCTION TO COMPUTATONAL CHEMISTRY (6hrs)

Introduction- Methods of calculation- Molecular mechanics- Quantum Mechanical methods-Semi empirical-abitio methods-HF, DFT (Qualitative treatment only) Basic functions- Slater type orbital Gaussian type orbital- Gaussian in put files- Construction of Z matrix- Ethane, Ethylene and acetylene.

(Total 90hrs)

REFERENCES

1. Theoretical Inorganic Chemistry- Day and Selbin
2. New Concise Inorganic Chemistry- JD Lee
3. Modern Aspects of Inorganic Chemistry-Emelus and sharp
4. Quantum Chemistry- RK Prasad
5. The Nature of Chemical Bonding: Linus Pauling
6. Atomic structure and Chemical bonding- Manas Chanda
7. Co- ordination Chemistry- SFA Kettle
8. Principles of Inorganic Chemistry B. R. Puri, LR Sharma ,Kalia
9. Principles of Physical chemistry Puri, Sharma – Pathania
10. Physical Chemistry- Mc-Quire Viva Publications, News Delhi
11. Quantum Chemistry- IN Levin Pretice Hall Of India
12. Advances In Nanao science & Nano technology- Dr. Ashuthosh Sharma Dr. Bellari- CSIR Publication 2004
13. Processing & Properties of nano crystalline materials- C Sooraj narayana, J Sing FH Froes TMS Warrant
14. Nanotechnology- Richard Brooker,EARL Boyson- Wiley Dream Tech India
15. Nanotechnology (Malayalam) – Anwar sadath- DC Books
16. www.nanoworld.org www. Nanoindustries.com

WEIGHTAGE OF MARKS

UNIT	I	II	III	IV	V	VI	VII
MARKS	20	5	20	10	12	5	5

SYLLABUS OF B. Sc CHEMISTRY MAIN (II YEAR)
PAPER II ORGANIC CHEMISTRY I
(2007 Admission)

UNI I INTRODUCTION TO ORGANIC CHEMISTRY AND BONDING IN ORGANIC MOLECULES (8 hrs)

Difference between Organic and Inorganic compounds- Classification of Organic compounds- Functional groups- IUPAC nomenclature of Organic compounds- Alkanes, Cycloalkanes, Alkenes, Alkynes, Halogen compounds, Alcohols, Ethers, Aldehydes, Ketones, Carboxylic acids-Sigma and Pi bonds Hybridisation- sp^3, $sp^2$and sp hybridization with examples- Representation of structural formulae -Formal charges associated atoms in molecules- hydrogen bonding in organic molecules and its application.

UNIT II INTRODUCTION TO REACTION MECHANISM(14 hrs)

Electronegativity- Polarity in bonds- Homolytic and Heterolytic bond fission – Substrate and reagent- Reaction mechanism- Free radical and Ionic mechanism- Electron displacement inorganic molecules- Inductive effect- Electromeric effect\ mesomeric effect- Hyper conjugation- Steric effect- Their illustrations-Resonance- Rules of resonance- Contribution of resonance structures- Steric hindrance to resonance.

Tautomerism illustrated by Keto- enol tautomerism- Difference between tautomerism and resonance- Reaction intermediates- Carbo cations, Carbanions, Free radicals and Carbenes- Their generation , Structure and stability.

UNIT III ACIDS AND BASES (8 hrs)

Bronsted- Lowry – Lewis Concept- PKa and PKb values- Origin of acidity in Organic compounds- Aliphatic acids, Substituted aliphatic acids, Phenol- Aromatic carboxylic acids- basic/non basic character of aliphatic and aromatic amines and guanidine.

UNIT IV STEREO CHEMISTRY(16hrs)

Geometrical isomerism due to restricted rotation about a double bond-Explanation based on orbital theory-examples- Characterisation of geometrical isomers- Conformation of Ethane, n-butane, cyclohexane and methyl cyclohexane-1,3 interaction.

Configuration-wedge formulae- Fischer projection formula- Optical isomerism- Plane polarized light and optical activity-Chirality- chiral center-enantiomers recemic variety- chirality and elements of symmetry - relative configuration- D- L designation-stereochemistry of compounds containing two similar and two dissimilar chiral centers-mesoform, erythro and theo forms- diastereo isomers—stereo chemistry of allenes, spirans nad biphenyls absolute configuration- R. S. designation-sequence rule-conversion rule-E, Z designation.

UNIT V ORGANIC REACTION (16hrs)

Substitution in alkyl halides- SN1 and SN2 mechanism- Effect of structure on nucleophilic substitution as illustrated by Primary, secondary and Teritiary alkyl halides and benzyl halides-Stereochemistry of Nucleophilic substitution- Nucleophilic substitution in vinyl halides and aryl halides.

Addition to carbon- carbon double bond- Electrophilic addition mechanism-addition of HX, H_2O and X_2 – Markonikoff's rule-Free radical addition of HBr on unsymmetrical double bonds- peroxide effect- Addition to conjugate systems-Mechanism of 1,4 addition and Diels alder reaction illustrated by taking butadiene
Elimination- Beta elimination- E1 and E2 mechanism- Mechanism of dehydration of alcohols and dehydrohalogenation of alkyl halides-Satytef's rule of cleavage of Quartenary ammonium hydroxide- Hofmann's rule.

UNITVI AROMATICITY AND NON BENZENOID AROMATICS(12hrs)

Aromaticity- Molecular orbital Theory of aromaticity- Huckel's rule- Six electron systems-Mention of structures of some non benzenoid aromatic compounds-cyclopentadienyl anion- ferrocen- tropylium cation- antiaromaticity- Mechanism of aromatic electrophilic substitution- Friedel –Craft's alkylation and acylation—evidence of the arinium ion- mechanism-orientation and reactivity in mono substituted benzene rings- Aromatic nucleophilic substitution SN Ar mechanism and Benzyne mechanism- Effect of substrate structure on reactivity.

UNIT VII ORGANIC SPECTROSCOPY (12 hrs)

UV spectrum- Electronic transitions- Position/intensity of absorption-Chromophore/auxochrome concept-absorption intensity shifts- types of absorption bands—Interpretations of the spectra of simple conjugated dienes and enones-Woodward-Fieser rule- UV spectrum of Benzene.

IR Spectrum- stretching bending modes-Fundamental bands and overtones-Factors influencing vibrational frequency-electronic effects- H- bonding- interpretations of the spectra influencing vibrational frequency interpretations of the spectra of alcohols, aldehydes, ketones and esters-aliphatic and aromatic.

NMR spectrum- Theory of NMR phenomenon-resonance-chemical shift-internal standard- chemical equivalence-factors influencing chemical shifts-spin-spin coupling interpretation of simple compounds.

Mass spectrum- Fragmentation pathway- molecular ion-base peak-meta stable ion-general rules for predicting the prominent peaks- Mc Lafferty rearrangement-mass spectra of alkanes ,cycloalkanes, saturated alcohols and aliphatic ketones.

UNIT VIII HYDROCARBONS (14 hrs)

Alkane preparation by reduction- Wurtz reaction and Kolbe's electrolytic method with mechanism-Reaction- Halogenation- Mechanism of chlorination of methane
Alkene- Preparation by Kolbe's electrolytic method, Pyrolysis of acetates, Xanthates and amine oxides- Witting reaction- Reaction-Hydrogenation,Oxidation using different oxidizing agents, ozonalysis and polymerization.

Alkynes-Preparation by Kolbe's electrolysis- Dehydrohalogenation, dehalogenation-Reactions- Hydrogenation- Lindlars catalyst, oxidation using different oxidizing agents, ozonalysis and polymerization-reactions specific to 1- alkynes.

Dienes: Conjugated, cumulated and isolated dienes –examples- Methods of preparations of allene and 1-3 butadiene- Reactions of 1,3 butadiene- 1,2 and 1,4 additions- polymerization.

Poly nuclear hydrocarbons- synthesis of Naphthalene and anthracene-Preparation and important reactions of diphenyl, diphenyl methane and triphenyl methane-
cyoalkanes-preparation by Freunds, Wislicenus, Dieckman and Thrope-Ziegler methods- Reactions – Hydrogenation and Halogenation

UNIT IX HALOGEN DERIVATIVES OF HYDROCARBONS (10 hrs)

Alkyl halides- Preparation from alcohols, Hunsdieker reaction- Reactons of alkyl halides with metal
Dihalides- Gem di halides and Vic dihalides- General methods of preparation and general reactions
Trihalogen derivatives- Preparation of chloroform from ethanol and Acetone-reactions of chloroform- Haloform reaction with mechanism. Methods of preparation of vinyl chloride and vinyl iodide.

UNIT X PERICYCLIC REACTION AND PHOTOCHEMISTRY (10hrs)

Orbital symmetry of pericyclic reactions- orbital symmetry methods- Frontier orbital method and correlation diagram methods- cyclo addition reaction : [2+2] and [4+2] cyclo addition.

Photochemistry-singlet and triplet states- Forbidden transitions-types of excitations-fate of excited molecules-Jablonski diagram- Fluorescence and Phosphorescence-photosensitisation- chemical process- Norrish type I and II cleavages- Production of Ketones.

(Total 120 hrs)

REFERENCES

1. Organic Chemistry- PINE
2. Organic Chemistry Vol I &II –I L FINAR
3. Advanced Organic Chemistry- FIESER and FIESER
4. Guide to Mechanism inorganic Chemistry- PETER SYKES
5. A Text Book of Organic Chemistry- TEWARI, MEHROTHRAN AND VISHNOI
6. Advanced Organic Chemistry- Bahl and Bahl
7. Organic Reaction Mechanism- Raj K Bansal
8. Reaction Mechanism in Organic Chemistry- MUKERJI & SING
9. Advanced Organic Chemistry- JERRY MARCH
10. Spectroscopy of Organic Copmpounds PS KALSI
11. Organic spectrochemistry- JAGMOHAN

WEIGHTAGE OF MARKS

UNIT	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**IX**	**X**
MARKS	**5**	**10**	**5**	**12**	**12**	**10**	**10**	**10**	**7**	**6**

SYLLABUS OF B. Sc CHEMISTRY MAIN (III YEAR)
PAPER III INORGANIC AND ENVIRONMENTAL CHEMISTRY
(With effect from 2007 admission)

UNIT I TRANSITION AND INNER TRANSITION ELEMENTS (10hrs)

Electronic configuration and general characteristics. Comparison of first transition series and third. Colour and spectral behaviour with respect to d^1 and d^9 systems. Lanthanide series. Electronic configuration and general properties. Occurrence of lanthanides, separation- Chemical and ion exchange methods. Oxidation states of lanthanides-lanthanide contraction-Magnetic properties and complex formation behaviour- Actinides- Oxidation states, ionic radii, colour of ions, complex formation in comparison with lanthanides-Trans actinides-names and symbol.

UNIT II PREPARATION, PROPERTIES, STRUCTURE, BONDING AND TECHNICAL APPLICATION OF (10hrs)

Boron hydrides-Boron Nitrides-Borazole-Boric Acid- Inter halogen compounds-pseudo halogens-Fluoro carbons- Inorganic polymers- Phosphorus polymers-Sulphur based polymers-Silicon based polymers-Carbides-Nitrides.

UNIT III GENERAL PRINCIPLES OF METALLURGY (10 hrs)

Occurrence of metals- Native metals- Sulphide minerals- Oxide minerals-oxo salts-halide minerals- benefaction of ores- gravity separation-magnetic separation- froth floatation process.

Reduction of ores- pyro metallurgy-hydrometallurgy-electrometallurgy-purification of metals-liquation- distillation- electrolysis-zone refining-Park process- Van Arkel de Boer process- Mond's process.

Isolation of some important transition metals-Titanium-Chromium-Nickel-Uranium.

UNIT IV ORGANOMETALLIC COMPOUNDS (10hrs)

Definition and classification-nomenclature-nature of carbon metal bond-Preparation ,properties and structure (valence bond theory)of metal carbonyls-mononuclear and poly nuclear carbonyls of iron, nickel and cobalt-Preparation and properties of cyclopentadiene derivatives of transition metals- ferrocene-preparation-properties and structure-Brief study of arene metal complexes.

V BIOINORGANIC CHEMISTRY (8 hrs)

Metal ions present in biological systems-Biochemistry of iron- Oxygen carriers-haemoglobin and myoglobin-structure and mechanism of action Sodium/potassium pump-Biochemistry of magnesium and calcium- metalloenzymes.

UNIT VI INDUSTRIAL CHEMISTRY (8hrs)

Chemical industries in Kerala- A brief study of factories in Kerala where the following products are manufactured-Location , raw material chemistry involved and uses- Ammonium sulphate- Ammonium phsphate-superphosphate of lime, Urea, Cement, Titanium dioxide, sugar, alcohol, synthetic detergents.

UNIT VII ANALYTICAL CHEMISTRY (14 hrs)

Qualitative analysis- principles of elimination of interfering anions- Principles involved in the precipitation of compounds of cation.

Chromatographic methods- Adsorption-partition-ion exchange chromatography-Paper-Thin layer, gas-solid, gas-liquid- HPCL and radial chromatography, Rf value
Volumetric analysis -Acid-base, redox, precipitation and complexometric titrations
Indicators-acid-base, redox and adsorption indicators.

Gravimetric analysis- Factors affecting the solubility of precipitates- co-precipitation and errors due to co- precipitation.

Colorimetric methods – Theory and application.

UNIT VIII ENVIRONMENT (10 hrs)

Concept and scope of environmental chemistry-Nomenclature- Environmental segments-soil formation -Physical and chemical properties- soil profiles-environmental properties of soils.

Atmosphere- Regions of atmosphere-smog- photochemical smog- aerosols. Hydrosphere- Sea water and river water composition- dissolved gases-hydrological cycle-Environmental pollution—Pollutant- definition-origin- classification and types of pollution.

UNIT IX ATMOSPHERIC POLLUTION (10hrs)

Air polluting sources- effect on eco system- Major sources of air pollution-Ozone layer-importance- Ozone depletion- Control measurers- Acid rain- control of acid rain- Green house effect- global warming—effects of pollution on plants and human beings- control of air pollution.

UNIT X SOIL POLLUTION (10 hrs)

Role of micro nutrients in soil on agriculture-Factors responsible for micronutrient deficiency- Management practices- Ecological and biological indicators- Testing soil properties- Sources of soil pollution- Urban wastes- Radioactive pollutanta0-Biological agents-Pesticides-Detergents—Control of pollution.

(Total 120 hrs)

UNIT XI OTHER POLLUTION (10 hrs)

Types of water pollution- sources of water pollution- Water pollutants- detergents, phosphates, oil spills, heavy metal pesticides- Bio magnification and Bioaccumulation- Experimental determination of dissolved oxygen in water- Chemical Oxygen Demand (COD) and Biochemical Oxygen Demand (BOD)- ISI/BIS standards of drinking water.

UNIT XII OTHER TYPES OF POLLUTION (10 hrs)

Thermal Pollution- Definition- Sources of thermal pollution- Harmful effects of thermal pollution-Prevention of thermal pollution- Noise pollution- Physiological response to noise- Noise categories- effects of noise-Biological effects- Permissible levels-control- Plastics and environmental pollution-plastic pollutants- Hazards to human health- control- radioactive pollution- a brie study- some case studies.

REFERENCES

1. Advanced Inorganic Chemistry- Cotton and Willkinson
2. Concise Inorganic Chemistry- JD Lee
3. Modern approach to inorganic Chemistry- Bell and Lott
4. University General Chemistry- CNR ao
5. Theoretical norganic Chemistry- J. Huhey
6. Text Book Of Quantitative Inorganic Analysis AI Vogel
7. Principles of Inorganic Cgemistry- Emelus and Anderson
8. Inoganic Chemistry- Shriver and Atkins
9. Industries in Kerala- KR Rajan
10. Environmental Chemistry- AK De
11. Environmental Chemistry-VP Kudesia
12. Environmental Chemistry- Gary, Vanloonand Stephen J duffy
13. Fundamental Concepts of Environmetal chemistry- GS Sodhi
14. Advanced Inorganic Chemistry- Dr. SK Agarwala and Dr Keemtilal
15. Modern InChemistry- Sathya Prakash and Madan

WEIGHTAGE OF MARKS

UNIT	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
MARKS	6	6	6	6	5	5	13	6	6	6	6	6

SYLLABUS OF B. Sc CHEMISTRY MAIN (III YEAR)
PAPER IV – PHYSICAL CHEMISTRY I
(With effect from 2007 admission)

UNIT I THE PROPERTIES OF GASES (15hrs)

Gas laws- The general gas equation- Mixture of gases- Dalton's Law- Mole fraction and partial pressure- calculation of partial pressure- The Kinetic model of gases- Molecular Speeds- Maxwell's distribution of molecular speeds- Calculation of most probable velocity, average velocity and root mean square velocity- Average kinetic energy- Collision diameter- Mean free path, Collision number and collision frequency- Degrees of freedom of a gaseous molecule- Principle of equipartition of energy and contribution towards heat capacity of an ideal gas

Real gases- Molecular attractions- The compression factor-virial equation of state- Van der waals equation expressed in virial form-calculation of Boyl's temperature- Isotherm of real gases and their comparison with Van der waals isotherms-continuity of states- critical phenomenon- critical constants of a gas and its determination- Determination of molecular mass by limiting density method-Principle of corresponding states- Liquefaction of gases by Joule Thomson effect and adiabatic demagnetization.

UNIT II LIQUID STATE (15 hrs)

Theory of liquids- Vacancy theory and free volume theory -Properties of liquids- vapour pressure and its determination- Heat of vapourisation- Trouton's rule- Surface tension and its determination- Interfacial tension- surface active agents- Parachor and its applications- Viscosity and its determination- refractive index- specific and molar refraction- Measurement of refractive index- Abbe's refractometer- optical activity and its measurement using Polarimeter.

UNIT III SOLID STATE (15 hrs)

Amorphous and crystalline solids-Laws of crystallography- Crystal lattices- Unit cells- seven crystallographic systems- Bravais lattices- Spacing of lattice planes in simple cubic, body centred and face centred cubic systems- Number of particles per unit cell in each of these- calculation of Avogadro number, density and molecular mass from crystallographic data.

Determination of internal structure of crystals by X- ray diffraction methods—derivation of Bragg's equation- Bragg's rotating crystal method and De bye Scherrer Powder diffraction method- Crystal structure of NaCl-anomalous nature of diffraction pattern of KCl- Co- ordination Number- Efficiency of packing- Cubic and Hexagonal packing- Radius ratio rule- Tetrahedral and Octahedral voids

Classification based on cohesive forces in crystals-ionic, covalent , molecular and metallic crystals- Liquid crystals—types- Examples- applications- Properties of solids- Mechanical, Rheological and elastic- Electrical conductivity- Conductor,

semiconductors- extrinsic, intrinsic-n-type and p-type- Hall effect- super conductors- magnetic properties of solids.

UNIT IV THERMODYNAMICS (27hrs)

The first Law- the basic concepts- System- surrounding-process-open, closed and isolated system- Isothermal, Isochoric and Isobaric process- work- Heat – Energy- Internal energy- The statement of first law- the conservation of energy -Expansion work- general expression of work- free expansion- Expansion against constant pressure- reversible expansion- Heat capacity at constant voloume (Cv) and at constant pressure (Cp)- relation between Cp and Cv- Thermodynamic derivation- Enthalpy definition and measurement- Adiabatic change- work of adiabatic change.

Thermo chemistry- Standard enthalpy changes- Enthalpies of physical change- Enthalpy of vapourisation, enthalpy of transition and enthalpy of fusion- enthalpy of chemical changes- Thermo chemical equation- Standard enthalpy of reaction, combustion and formation- Temperature dependence of reaction enthalpies Kirchoff's law.

The First Law-State functions and exact differentials- state and path functions- exact and inexact different differentials- internal pressure- measurement of internal pressure- Joule experiment Changes in enthalpy at constant volume- isothermal compressibility- Joule – Thomson effect- inversion temperature. (15hrs)

The Second Law- the concepts- Spontaneous and non- spontaneous process- statement of second law- Entropy- Thermodynamic definition- Entropy as a state function- Carnot cycle- the Thermodynamic scale of temperature- Entropy changes accompanying phase transitions- variation of entropy with temperature- the Helmholtz and Gibbs free energies- their significance- Maxwell's relations- Criteria of spontaneity- Gibbs- Duhem eqation- Clausius – Clapyeyron equation applicable to solid-liquid, solid-vapour and liquid-vapour equilibria

Third law of thermodynamics- The Nernst heat theorem- Absolute entropy-Calcultion of absolute entropies of solids, liquids and gases. (12 hrs)

UNIT V STATISTICAL THERMODYNAMICS (5 hrs)

The concepts-distribution of molecular states-configuration and weights- Boltzmann distribution- The molecular partition function- rotational, vibrational and translational partition function. Thermodynamic functions in terms of partition function- Internal energy, entropy, Helmholtz free energy and Gibb's free energy- Ensembles their types.

UNIT VI CHEMICAL EQUILIBRIUM (10hrs)

Derivation of law of mass action from kinetic theory and thermodynamics- Experimental verification-Free energy change of chemical reactions- reaction isotherm- Van't Hoff isochore-standard free energy of reaction and equilibrium constant-Predicting the influence of temperature, pressure, concentration changes and addition of an inert gas on the equilibria of the following reactions.

1. $H_{2(g)}+I_{2(g)} \rightarrow 2\,HI_{(g)}$ 2. $N_{2(g)}+ 3H_{2(g)} \rightarrow 2\,NH_{3(g)}$

3. $N_{2\,(g)} + O_{2\,(g)} \rightarrow 2NO_{\,(g)}$ 4. $2SO_{2\,(g)} + O_{2(g)} \rightarrow 2\,SO_{3\,(g)}$

5. $PCl_{5(g)} \rightarrow PCl_{3\,(g)} + Cl_{2\,(g)}$ 6. $N_2O_{4(g)} \rightarrow 2\,NO_{2(g)}$

7. $Ca\,CO_{3(s)} \rightarrow CaO_{\,(s)} + CO_{2\,(g)}$ 8 $NH_4\,HS_{\,(g)} \rightarrow NH_{3\,(g)} + H_2S_{\,(g)}$

Principle of mobile equilibrium- Le- Chatliers Principle and application to the above equilibria- Degree of dissociation and dissociation constant from density measurements- Mention homogeneous and heterogeneous equilibria

UNIT VII CHEMICAL KINETICS (10 hrs)

The rates of chemical reactions- Experimental techniques- rate laws and rate constant- Order and molecularity of reactions- Methods of determining the rate of reaction- Integrated rate laws if first order, second order and third order reactions- Half life- kinetics of consecutive parallel and opposing reactions (first order only)

Temperature dependence of reaction rates- Arrhenius equation- derivation- Interpretation of parameters- Kinetics of unimolecular reactions- steady state approximation- Lindemann's theory

Theories of reaction rates- collision theory- Derivation of rate equation for second order reaction from collision theory- thermodynamic approach of transition state theory—Entropy activation.

Catalysis- Homogeneous and Heterogeneous catalysis- examples- Features of homogeneous catalysis- Enzymes- Michalis- menten mechanism.

Hetyerogenous catalysis- Langmuir- Hinshelwood mechanism- Kinetics of surface reactions- unimolecular and bimolecular.

UNIT VIII NUCLEAR CHEMISTRY (15 hrs)

Structure of nucleus- Elementary idea of nuclear forces Exchange forces as nuclear forces- Nuclear field heory- N/ P ratio and nuclear stability-Natural radioactivity- modes of decay- Geiger- Nuttal rule and the range of alpha particle- unit of radio activity and radiation dosages-Decay constant- Half life period- Average life- Radioactive equilibrium- Disintegration series- Artificial transmutation with proton, neutron deuteron and gamma radiation- packing fraction- mass defect- Binding energy-fusion and their applications-

Radioisotopes- Application of radio isotopes in carbon dating, rock dating, determination of solubility of sparingly soluble salt-diagnosis and treatment of diseases

Separation and concentration of i). Diffusion method ii)Using Aston's mass spectrograph iii). Electromagnetic separation.

UNIT IX PHOTO CHEMISTRY (8 hrs)

Photochemistry- consequences of light absorption- The Jablonski diagrams- Radiative and non radiative transition- Light absorption by solutions- Lambert – Beer Law- Laws of photochemistry—The Grotthus- Draper law- Stark- Einstein law- Quantum efficiency- Quantum yield- Experimental determination of quantum yield- Photochemical rate law- Energy transfer in photochemical reactions- Photo sensitisation and quenching- Chemiluminescence- Lasers – uses.

(Total 120hrs)

REFERENCE BOOKS

1. Atkin's Physical Chemistry : Peter Atkins, Julio de paula 7th Editio

2.Text book of Physical Chemistry. : Samuel Glasstone

3.Physical Chemistry : GM Barrow

4.Physical Chemistry : Daniel and Alberty

5. Physical Chemistry : Puri, Sharma and Pathania

6. Physical Chemistry WJ Moose

7. Physical Chemistry G K Vamulapaki

8.Introduction to to Chemical Thermodynamics Rastogi and Misra

9. Chemical Kinetics K J Laidler

10.Physical Chemistrty PC Rakshit

11.Essentials of Nuclear Chemistry : Arniker

12. Sourse Book on Atomic Energy : Samuel Glasstone

WEIGHTAGE OF MARKS

UNIT	I	II	III	IV	V	VI	VII	VIII	IX
MARKS	9	9	9	20	3	7	7	9	4

SYLLABUS OF B. Sc CHEMISTRY MAIN (III YEAR)
PAPER V – ORGANIC CHEMISTRY II
(With effect from 2007 admission)

UNIT I HYDROXY COMPOUNDS (10hrs)

Alcohols- Primary-secondary and tertiary alcohols- IUPAC names-Preparation from carbonyl compounds using Grignard reagents- Methods to distinguish primry, secondary and tertiary alcohols- Lucas method- Victor Meyer's method and oxidation method-Ascent and descent in alcohol series.

Glycerol- Preparation from oils and fats- synthesis from propylene- properties and uses.

Phenols- Preparation of cresols, nitro phenols-picric acid-Dihydro phenols and naphthols -phenolic ethers-preparation of anisole and phenetole.

UNIT II CARBONYL COMPOUNDS (16 hrs)

Aldehydes and Ketones- Preparation of aldehydes and ketones- Rosenmund's reduction- Stephen's reduction-Etard's reaction- Oppenaur oxidation-Houben-Hoesh synthesis- Reactions of aldehydes and ketones- Reduction using Lithium Aluminium hydride, Sodium boro hydride- MPV reduction- Clemensen and Wolfkishner reduction- Oxidation using mild and strong oxidizing agents- SeO_2 oxidation- Reaction with alcohols, HCN, Sodiumbi sulphite and with derivatives of ammonia
Preparation of acrolein,crotanaldehyde and vanillin
Quinones- Preparation and important reactions of para-Benzoquinone, 1-4 naphthaquinone, 9-10 Anthraquinone
Mechanism of the following reactions- Aldol condensation- Cannizzaro's reaction- Reimer –Tiemann reaction- Perkin's reaction- Benzoin condensation
Mechanism of the following Rearrangements – Pinacole- Pinacolone, Fries, Claisen, Benzidine and Beckmann's rearrangements

UNIT III CARBOXYLIC AND SULPHONIC ACIDS (14hrs)

Ascent and descent in Aliphatic saturated acids- Preparation and reaction of acrylic and crotonic acid. Hydroxy acids- Effect of heat on alpha, beta gamma and delta hydroxy acids. Preparation and reactions of lactic Acid, tartaric acid and citric acid
Dicarboxylic acids Preparation and reactions of Oxalic acid Malonic acid, Succinic acid Maeic acid and Fumeric acid- Blanc's rule. Aromatic acids- Preparation and reactions of Benzoic acid, Anthranilic acid, salicylic acid, Cinnamic acid and Phthalic acid. Preparation and reactions of Benzene sulphonic acid, Toulene sulphonic acid, Benzene sulphonyl chloride, o- and p- Toluene sulphonyl chloride. Preparation and uses of saccharin, Chloramine- T Sulphanilic acid and Sulphanilamide.

UNIT IV NITROGEN COMPOUNDS (12 hrs)

Cynides and iso- cyanides- Distinctions between them- Nitro alkanes- General methods of preparation and reactions of primary, secondary and tertiary nitro alkanes- Distinctions between them.
Aromatic Nitro compounds- Reduction of nitro benzene under different conditions- Preparation of di nitro benzenes, 2,4,6, Tri nitro benzene,- Ttri Nitro Toluenes- T. N. T.- Selective reduction of poly nitro compounds.
Amines-Separation of mixtures of primary, secondary and tertiary amines- Hinsberg and Hofmann's methods to distinguish primary, secondary and tertiary amines- Preparation of Quartenary ammonium salt
Aromatic amines- Preparation and reactions of aniline, N- Methyl aniline, N,N di methyl aniline
Diazonium salts- Preparation, synthetic application and structure of benzene diazonium chloride- Diazomethane- Arndt- Eistert Synthesis.

UNIT V SYNTHETIC REAGENTS (8hrs)

Active methylene group- Preparationa nd synthetic application of Ethyl acetoacetate, Diethyl malonate and Ethyl cyano acetate- Mechanism of Claisen condensation- Preparation and synthetic applications of Grignard reagents and Frankland reagent- mechanism of Reformatsky reaction.

UNIT VI CARBOHYDRATES (10 hrs)

Definition- Classification and nomenclature of carbohydrates- Monosaccharides- Configuration of Aldotrioses, Tetroses, Pentoses and Hexoses- Structure and configuration of glucose and fructose- Cyclic structure- Haworth projection formula- reactions of glucose and fructose- Mutarotations- ascent and descent aldoses- Inter conversion of aldoses and ketoses- Anomers, Epimers and Epimerisation- Conversion of an aldose into its epimer- Disaccharides- Configurational open chain and ring structure of sucrose, maltose and lactose (structural elucidation not expected) Poly saccharides- Elementary study of starch- cellulose and chitin- structural difference between starch and cellulose- Industrial uses of cellulose.

UNIT VII HETEROCYCLICCOMPOUNDS (10hrs)

Nomenclature of 5 and 6 membered heterocyclic compounds-Peparation, properties and structure of the following compounds- Furan, Thiophene, Pyridine-Indole, Quinoline, Isoquinoline and pyrimidine- Relative basic character of Pyrrole, pyridine and piperidine- Hofmann's exhaustive methylation of piperidine.

UNIT VIII DYES AND DRUGS (8 hrs)

Dyes- classification of dyes based on structure and application- Structures of Malachite green- Methyl orange- Eosin- Indigo- Crystal violet- Fluorescein and Alizarine (structure elucidation not expected)
Drugs – Chemotherapy-Introduction- Explanation of anaesthetics- antiseptics- anti pyretics and Analgesics with examples- Sulphadrugs- Sulphanilamide- Sulphapyridine and Sulphadiazine.

UNIT IX BIOORGANIC CHEMISTRY AND NATURAL PRODUCTS (16 hrs)

Amino acids- Classification- Structure of Glycine, Alanine, Phenyl amine, Tryptophan and Glutamic acid (Structure elucidation not expected) Synthesis of amino acids- Gabriel, Strecker and Erlemeyer synthesis- Zwitter ion property- Isoelectric point- Sorenson formal titration- Peptides and poly peptides- C-terminal and N-terminal analysis.

Proteins- Functions of proteins- Primary , secondary and tertiary structure of proteins- Nucleic acids- Introduction- Nucleosides and Nucleotides- Structure (elucidation not expected) of DNA and RNA- Self replication- Protein synthesis- Lipids- Biological function of different types of lipids

Oils and fats- Common fatty acids present in oils and fats- Drying of oils- Rancidity- Analysis of oils- Saponification ,Acid and Iodine values.

Terpenes- Definition- Isoprene rule- Occurrence, isolation and structural elucidation of Citral and Geraniol- natural rubber.

Alkaloids- Introduction- Properties and structure of Coniine, Nicotine and Quinine- Structural elucidation of Coniine only.

Steroids- General characteristics, structure and physiological action of cholesterol. Testosterone and Oestrone.

UNIT X POLYMER CHEMISTRY(10hrs)

Polymers- Classification –Natural and synthetic polymers- Thermo plastic and Thermosetting plastic- Elastomers- Fibres—liquid resins-Types of polymerization-chain and step polymerization-homopolymrs and copolymers.

Synthesis and application of polythene, polypropylene, PVC, polystyrene, polyurethane, Phenolic and epoxy resins.

Synthetic rubbers- Buna-S, Buna-N, Neoprene, Butyl rubber-Biodegradability.

UNIT XI GREEN CHEMISTRY (6hrs)

Basic principles of green chemistry-Explanation of –green reagent- green catalyst and green synthesis- Advantages of green synthesis- Microwave induced green synthesis-Explained by the hydrolysis of benzamide and methyl benzoate and oxidation of toluene- Ultra sound in chemical synthesis –Cannizzaro's reaction and Reformatsky reaction- Bio catalysts in organic synthesis Microbial oxidation and reduction-Choice of solvent for green synthesis- liquid CO2- Aqueous phase reactions- oxidation (epoxidation) and reduction (reduction of > C=C<) in aqueous medium- Green chemistry in day to day life.

(Total 120hrs)

REFERENCE BOOKS

1. Organic Chemistry- FINAR- Volume I &II
2. Organic Chemistry- PINE
3. Advanced Organic Chemistry FEISER & FRISER
4. A text book of Organic Chemistry-THEWARI, MEHROTHRA & VISHNOI
5. Advanced Organic Chemistry- BHAL &BHAL
6. A guide to mechanism in Organic Chemistry-PETER SYKES
7. Organic Reaction Mechanism- RAJ K BENSAL
8. Advanced Organic Chemistry- JERRY MARCH
9. Chemistry of Natural Products- OP AGARWAL
10. New Trends in Green Chemistry- VK Ahluwlia & N. Kidwai Anamaya Publishers New Delhi

WEIGHTAGE OF MARKS

UNIT	**I**	**II**	**III**	**IV**	**V**	**VII**	**VIII**	**IX**	**X**	**XI**
MARKS	**7**	**10**	**8**	**7**	**5**	**7**	**5**	**10**	**7**	**4**

SYLLABUS OF B. Sc CHEMISTRY MAIN (III YEAR)
PAPER VI – PHYSICAL CHEMISTRY II
(With effect from 2007 admission)

UNIT I SYMMETRY AND MOLECULAR STRUCTURE (8 hrs)

Elements of symmetry of molecules-Centre of symmetry, plane of symmetry, proper and improper axis of symmetry- Operations with examples- Point groups- Properties of a group- simple point groups C_{nv}, C_{nh}

UNIT II DILUTE SOLUTIONS (10hrs)

Colligative properties-Lowering of vapour pressure and Raoult's law- Calculation of molar mass. Elevation of boiling point- relation to lowering of vapour pressure-Thermodynamic derivation- Calculation of molar mass- Measurement by Beckmann's and Landsberger's methods-Depression of freezing point-Thermodynamic derivation- Calculation of molar mass- Measurement by Beckmann's method- Osmotic pressure- Measurement by Berkely and Hartley's method- Laws of Osmotic pressure- Van't Hoff equation- Calculation of molar mass-Abnormal molar mass- Van't Hoff factor- Degree of dissociation and association and their calculation from colligative properties.

UNIT III PHASE RULE (20 hrs)

Statement-Explanation of terms involved- Thermodynamic derivation of phase rule-Application to water system and sulphur system- Solid- liquid equilibria involving simple eutectic system- Ag-Pb system- De silverisation of lead- Freezing mixtures-Solid- liquid equilibria involving compound formation with congruent and incongruent melting points- Solid –gas system- Dehydration of CuSO4.5 H2O-Deliquescence and efflorescence- Gas- Liquid system- Absorption coefficient-Henry's Law- Liquid systems- Completely miscible- Ideal and non- ideal solutions-Application of Raoult's Law- Vapour pressure- composition from Raoult's Law Azeotropic mixtures-Partially miscible liquids- Critical solution temperature-Temperature- composition curves- Fractional distillation-Derivation from Raoult's Law- Immiscible liquids-Steam distillation- Molar mass from steam distillation-Nernst distribution Law- Derivation from phase rule- and thermodynamics-Limitations from the law- Application of the law to study association and dissociation- Solvent extraction- Hydrolysis of salts- The equilibrium of $KI+I_2 \rightarrow KI_3$.

UNIT IV COLLOIDS, SURFACE CHEMISTRY (15hrs)

Colloids, Classification - preparation-structure and stability-The electrical double layer- Zeta potential- Properties of Colloids- Tyndall effect- Brownian movement-Coagulation of colloidal solution- Hardy- Shulz rule- Flocculation value-Electro kinetic properties- Electrophoresis-Electro-osmosis- Protective colloids- Gold number- - Emulsion- Oil in water emulsion and water in oil emulsion- Emulsifying agents- Gels- Inbibition- Synerisis- Micelles- Critical micelle concentration- surface films

Physisorption and ChemisorAdsorption isotherms- Freundlich adsorption isotherm-effect of temperature on adsorption- Langmuir adsorption isotherm-derivation-use and limitation.

UNIT V ELECTRICAL CONDUCTANCE (18hrs)

Ohm's Law- Electrical energy—volt-coulomb- Mechanism of electrical conduction-Arrhenius theory- The laws of electrolysis- Faraday's law and its significance-Transference Number- Determination by Hittorf's method and moving boundary method.

Equivalent conductance and Molar conductance Effect of Dilution on conductance-Effect of dielectric constants of solvents- Ionic mobilities -Kohlrausch's Law-applications – Mobilities of Hydrogen and Hydroxyl ions- Diffusion and ionic mobility-

Activity and activity coefficient- standard state ionic activities- and activity coefficient- ionic strength- Debye- Huckel Theory- Ionic atmosphere- Debye- Huckel limiting law- determination of solubilities by conductance measurements-Conductometric titrations—conductance in non- aqueous solvents- Temperature dependence of ionic conductance.

UNIT VI IONIC EQUILIBRIA (15hrs)

Acids and bases- Lowrry- Bronsted concept- Dissociation of acids and bases- Lewis concept of acids and bases- hard and soft acids and bases-and its applications- Ionic product of water- Dissociation constants of acids and bases- pH and its determination-Heat of neutralization- Incomplete neutralization-Hydrolysis- Hydrolysis of different types of salts-Degree of hydrolysis and hydrolytic constant- and its relation with pH and pOH- Buffer solution- pH of Buffer solution- Henderson's equation-Buffer capacity- Application of buffer- Acid – base indicators- Determination of pH of indicators.

UNIT VII ELECTROMOTIVE FORCE (20hrs)

Electrochemical cell- Daniell cell- Reversible and Irreversible cell-Singl electrode potential- EMF of cells- Standard potential and standard emf – Standard Hydrogen electrode and calomel electrode—Types of electrodes - electrode reaction-cell reaction Nernst equation for electrode potential and emf of the cell- Electrochemical series- IUPAC sign convention- Application of Gibb's- Helmholtz equation to galvanic cells- Calculation of ΔG, ΔH, ΔS and equilibrium constant from emf data-The standard cells- Weston Cadmium cell and its emf

Concentration cells- Electrode and electrolytic concentration cells with and with out transference and their emfs-Liquid junction potential- Elimination of liquid junction potential- salt bridge—application of potential measurements-Determination of solubility product, ionic product of water, transport number and the pH value - Hydrogen, Quinhydrone electrode and glass electrode- potentiometric titration- redox indicators- Polarisation- Overvoltage- principle and applications of polorography-Fuel cells.

UNIT VIII INSTRUMENTAL METHODS OF ANALYSIS (14 hrs)

Electro analytical method- Ampeometry- Amperometric titration- Amperometric indicators- Bi amperometric titration- Applications – Advantages of amperometric titration- Disadvantages

Spectrophotometry—Basic instrumentation of UV-visible spectro photometry-Single beam-Double beam instruments-Maximum optical density measurement-IR basic details-application

Thermal methods of analysis- TGA and DTA instrumentation- application- characterization of polymers.

Note : Sufficient number of problems are to worked out in each chapter.

(120hrs)

REFERENCE BOOKS

1.Text Book of Physical Chemistry Glasstone

2. Atkin's Physical Chemistry Peter Atkins Julio de Paula VII Edn

3. Modern Electro Chemistry JOM Bockris & AKN Reddy

4. Physical chemistry Puri, Sharma and Pathania

5. Physical Chemistry P. C. Rakshit

6. Physical Chemistry Walter J Moore

7. Vogel's Text Book Of Qualitative InorganicAnalysis AI Vogel

8. Physical Chemistry Gillbert Casillane

9. Physical Chemistry GK Vemulapalli

10. Physical Chemistry Gurdeepraj

11. Prgathi's Instrumental Methods of analysis H Kaur

12. Group Theory in chemistry V. Ramakrishnan

WEIGHTAGE OF MARKS

UNIT	I	II	III	IV	V	VI	VII	VIII
MARKS	4	7	14	10	10	10	14	8

SYLLABUS OF B. Sc CHEMISTRY MAIN PRACTICAL
(With effect from 2007 Admission)

GENERAL LABORATORY WORK

During the course the students should be trained to be quite laboratory friendly. The lab work includes the preparation of all the required reagents for inorganic and organic qualitative analysis, Volumetric, Gravimetric and Physical chemistry experiments. Students should be grouped and directed to get the reagents ready before the actual experiments. This should be done under the supervision of the lecturer in charge who will give the proper directions. Washing, cleaning, drying and arranging equipments should be done by the laboratory staff.

PRACTICAL PAPER I – INORGANIC Chemistry Practical

1.Study of the reactions of the following ions with a view to their identification and confirmation- Lead, Silver, Mercurous Mercury- Bismuth Copper, Tin, Antimony Iron Aluminium, Chromium, Zinc, Manganese, Cobalt, Nickel, Barium, Strontium, Calcium Magnesium and Ammonium
Carbonate,Acetate,Oxalate,Fluoride,Chloride,Bromide,Iodide,Nitrate,Sulphate, Borate, Phosphate, Chromate, Arsenite, Arsenate
2.Systematic qualitative analysis of a mixture containing two cations and two anions by semi micro methods
Conduct of practical examination is at the end of Second year for four hours
Paper I Systematic qualitative analysis of a mixture containing two cations and two anions by semi micro methods.

II VOLUMETRIC ANALYSIS

Introduction to Volumetric Analysis- Equivalent mass of compounds- Normality of Solutions-Preparation of primary standard solutions- Principles of volumetric analysis
The following practical should be conducted

1. ACIDIMETRY AND ALKALIMETRY
The following experiments are to be done using standard Oxalic acid /anhydrous Sodium Carbonate solution
Titrations involving i)Strong acids Vs Strong Bases ii) Weak acids Vs Strong bases iii)Strong acids Vs weak bases
Three experiments are to be done from this unit.

2. PERMANGANOMETRY
The following estimations are to be done usin Standard Oxalic acid or Mohr's salt solution
i) Ferrous iron ii) Oxalic Acid iii) Calcium iv) Nitrite v) Hydrogen peroxide vi) MnO_2 in pyrolusite
Four experiments are to be done from this unit.

3. DICHROMETRY

The following experiments should be done using standard Potassium dichromate solution

i) Estimation of Ferrous iron using internal indicator

ii)Estimation of Ferric iron after reduction with stannous chloride, using internal indicator

iii) Estimation of Ferrous iron using external indicator

Three experiments to be done from this unit

4.**IODIMETRY AND IODOMETRY**

The following experiments should be done using standard Potassium dichromate or Copper sulphate solution or Sodium Arsenite solution

i)Estimation of Copper/ CuSO4

ii) Estimation of Potassium dichromate/ Chromium

iii) Estimation of As_2O_3 / As

Three experiments to be done from this unit

5.**ARGENTOMETRY**

Use Standard NaCl solution

i)Estimation of Chloride in neutral medium (Mohr's method)

ii) Estimation of Bromide

One experiment to be done from this unit

4. COMPLEXOMETRY

Use standard solution of Magesium Sulphate or Zinc Sulpphate

i)Estimation of Magnesium

ii) Estimation of Zinc

iii) Estimation of total hardness of water

Three Experiments are to be done from this unit

PAPER III GRAVIMETRIC ANALYSIS

The following experiments are to be done using Silica crucible

1.Barium as Barium Sulphate.

2. Sulphate as Barium Sulphate

3.Iron as iron oxide

4.Calcium as Calcium Carbonate

The following experiments are to be done using sintered crucible.

1.Copper as Cuprous Thiocyanate

2.Nickel using dimethyl glyoxime

3.Magnesium as oxinate

Six experiments are to be done in gravimetric analysis

Conduct of Practical Examination in the third year for four hrs on the second day

PAPER IV ORGANIC CHEMISTRY PRACTICAL

1. Tests for elements Nitrogen , Halogens and sulphur
2. Determination of Physical constants
3. Study of the reactions of the following functional groups- Unsaturation, Carboxylic Acid group, phenolic group, aldehydics, ketonic ester, amide, diamide primaryamine, halide (both in the side chain and in the nucleus), Nitro, reducing and non-reducing sugars and polynuclear hydrocarbons using known organic compounds
4. Systematic Qualitative Analysis with a view to characterize the functional groups. The following compounds may be given for analysis
   Phenol, Aniline, p- Toulidine Benzaldehyde, Actophenone, Ethyl benzoate, Methyl salicylate, Benzamide, , Urea, benzoic acid Salicylic acid, Phthalic acid Cinnamic acid, Chlorobenzene , Benzyl Chloride, Naphthalene, Anthracene Glucose, Sucrose.
5. Organic preparation involving i) Halogenation ii) Nitration iii) Oxidation iv) Benzoylation v) Hydrolysis vi) Diazotisation
5. Demonstration experiments
   i)Paper chromatographic separation of mixtures of nitroanilines
   2. TLC method of separation of the above mixture.

Conduct of Practical Examination: The Practical in Paper III (gravimetry) and Paper IV (Organic) are to be conducted in the Third year for six hrs on the second day.

PAPER V PHYSICAL CHEMISTRY PRACTICALS

The following Experiments are to be done

1.Determination of partition coefficient of iodine between CCl_4 and water
2. Critical solution temperature of Phenol water system.
3.Kinetics of hydrolysis of methyl acetate (Acid catalysed)
4.Potentiometric Titration of Fe^{2+} Vs $Cr_2O_7^{2-}$
5.Determination of Molar mass by Rast's method.
6.Colourimetric Estimation of Ferric iron.

Conduct of Practical Examination Physical chemistry practical Examination ,Viva Voce and Project evaluation should be done on the third day (6hrs duration)

For all practical examinations the candidate will be permitted to appear for the examination only on production of certified records.

REFERENCES

1.A I Vogel A Text book of Qualitative analysis including semi micro methods
2.V V Ramanujam Semimicro Qualitative Analysis
3.A I Vogel A Text Book of Quantitative Inorganic Analysis.
4.A I Vogel Elementary Practical Organic Chemistry
5.A. O Thomas Practical Chemistry for B. Sc Chemistry
6.A. Findlay Practical Physical Chemistry
7.R C Das and E Behara Experimental Physical chemistry
8.N K Vishnoi Advanced Practical Chemistry

VIVA VOCE: Vivavoce examination based on practical will be conducted on third day along with/after the physical chemistry Practical examination

PROJECT WORK:

Project work can be carried out by a group of not more than five students under the guidance of a faculty member, done preferably in the college itself. Project work should be planned in the first year itself and done in the second year and presented in the third year along with the practical examination on the third day. The topic may be any area of chemical interest like water, soil, minerals, fertilizer, pesticides, food stuffs, medicines, drugs, plastics,polymers, rubber, pollution, adulteration or any other related or similar areas. The project should contain some analytical work. A report should be prepared by the student in the proper format, certified and presented for evaluation along with the practical examination in the third year.

STUDY TOUR :

Students are required to visit a Laboratory/ Factory / Research institute of eminence during the course and present the study tour report along with the practical records at the time of Practical Examination.

Question Papers in Physical Chemistry Paper I and Paper II should contain numerical problems fetching 25% of the total marks.

While setting the question papers weightage is to be given to each of the Units as specified I the syllabus.

DISTRIBUTION OF INTERNAL MARKS. Each theory and Practical paper has a maximum of 10 marks and the break up of internal marks is given below.

Theory	**Total 10 Marks**	**Practical**	**Total 10 Marks**
***Attendance**	**2 marks**	**Attendance**	**2 Marks**
Test papers	**4**	**Performance in the Lab**	**3**
Seminar/ Assignment	**4**	**Records**	**5**

* Attendance: 90% and above 2 marks
75% to 89% 1mark

The break up of marks for Practical Records is given below

Practical Paper I		**Practical Paper II**	
Reactions of cations & Anions	1 Marks	16 Volumetric Analysis	4 Marks
Analysis of 12 mixtures	3 Marks	Neatness/Presentation	1 Mark
Neatness/presentation	1 Mark		
TOTAL	**5 Marks**	**TOTAL**	**5 Marks**

Practical paper III		**Practical Paper IV**	
6 Gravimetric Expts	3 Marks	Reactions	1 Mark
Neatness/presentation	2 Marks	Preparation	1 Mark
		Analysis	2 Marks
		Neatness/Presentation	1 Mark
TOTAL	**5 Marks**	**TOTAL**	**5 Marks**

Practical V

6 Physical Chemistry experiments	3 Marks
Neatness/Presentation	2 Mark
TOTAL	**5 Marks**

PROJECT : Internal Marks Maximum 10 Marks

Content	2 Marks
Presentation	3
Viva/ Discussion	3
Report	2
TOTAL	**10 Marks**

VIVA-VOCE : Based on practical Examination. Maximum Marks 10(**External**)

REPORT: Report on the visit toFactory/ Laboratory/ Research institute -Maximum Marks 5 (**External**)

Sd/-
Prof. A.V. Vijayan,
Chairman BOS Chemistry (UG)