J.S. UNIVERSITY SHIKOHABAD (FIROZABAD)

BACHELOR OF SCIENCE (B.Sc.)

(THREE YEAR DEGREE COURSE)

CHEMISTRY

Faculty of Science

Bachelor of Science (B.Sc.)

ORDINANCES & RULES / REGULATIONS

For Regular Candidates

1. **The Programme**

   The course leading to the Bachelor of Science Degree shall extend over three year's and comprise Physical Education, Rastra Gaurav, Environmental Science, Core Course and Applied Courses as prescribed under ordinances 3 and 4 following.

2. **Eligibility**

   For eligibility to enter upon the B.Sc. Course a candidate must have passed the

   (i) Intermediate examination in Science (i.e. with subjects including Physics, Chemistry and either Mathematics or Biology) of the Madhyamic Shiksha Parishad, Uttar Pradesh or any Indian University duly incorporated by any Law enforce for the time being or

   (ii) Any other examination recognized by the University as equivalent there to.

   (iii) Provided that a candidate, who has passed the Intermediate Examination (or an equivalent examination) in agriculture may be permitted to take up B.Sc. course in Life Science Group only but candidate having passed Intermediate or an equivalent examination in Arts or Commerce shall not be eligible.

   (iv) The reservation for the SC/ST/OBC/PWD and other category shall be as per the rules of the UP government.

3. **Admission**

   Admission shall be made on the basis of merit prepared according to marks obtained in Intermediate examination of the Madhyamic Shiksha Parishad, Uttar Pradesh or equivalent thereto or in the entrance examination.

4.

Duration / Working Days:

(a) The B.A. programme shall be of three academic years, however, student shall, be permitted to complete the programme within a maximum period of five years from the date of admission to the programme.

(b) In a year, there shall be at least two hundred working days per year excluding the period of examination and admission.

(c) The institutions / University shall work for a minimum of thirty six (36) hours in a week, during which physical presence in the institutions/ University of all the teachers and students is necessary to ensure their availability for advice, guidance, dialogue and consultation as and when needed.

5. **Attendance:**

(a) Attendance shall be counted and shortage thereof may be condoned for special reasons subject to the condition that if his actual attendance is less than 75% he/she shall not be eligible to appear in the examination.

(b) The minimum attendance of student shall have to be 75% for all courses. The remaining twenty five per cent (25%) of attendance shall account for illness and contingencies of serious and unavoidable nature.

6. **Fees:**

Every candidate shall pay such fee to the University under jurisdiction of the University as may be prescribed from time to time.

7. (a) Physical Education shall be studied in the B.Sc. (Part–I) First year only. The candidate shall be required to obtain 35% marks. If the candidate failed in such examination, may be provisionally permittedto appear at the next higher examination concerned B.Sc. (Part–II)

   (b) Rastra Gaurav shall be studied in the B.Sc. (Part–II) Second year only. The candidate shall be required to obtain 35% marks. If the candidate failed in such examination, may be provisionally permitted to appear at the next higher examination concerned B.Sc.(Part–III)

   (c) Environmental Studies shall be studied in the B.Sc. (Part – III) Third year only. The candidate shall be required to obtain 35% marks. If the candidate failed in such examination, may be provisionally permitted to appear at the next higher examination concerned.

   (d) If any, for B.Com. Degree subject to the condition that the result of this B.Com. (Part–III) examination shall not be declared until he/she also passed in the **Physical Education, Rastra Gaurav, Environmental Studies** paper.

   (e) The Core Course shall be studied in all the three years. The Core Course shall be in the following subjects:

(i) Physics.	(ii) Geography.

(iii) Chemistry.	(iv) Military Studies
(v) Mathematics.	(vi) Bio-Technology
(vii) Botany.	(viii) Computer Science
(ix) Zoology.	(x) Industrial Chemistry
(xi) Statistics.	(xii) Industrial Microbiology
(xiii) Geology.	(xiv) Economics
(xv) Seed Technology	(xvi) Still Photography
(xvii) Clinical Nutrition &Dietetics	(xviii) Microbiology

(f) A candidate shall be required to opt for any one group out of the following and offer from that group three subject as his core course which shall continue in all the three years. The following groups are given below:-

(A). Physical Science Group:

1. Mathematics.
2. Any two of the following:
   - (i) Physics.
   - (ii) Chemistry.
   - (iii) Statistics.
   - (iv) Economics.
   - (v) Military Studies.
   - (vi) Geology.
   - (vii) Computer Science.

Provided Economics will be offered only if Statistics is offered as the other subjects.

(B). Life Science Group:

1. Botany and /or Zoology and / or Seed Technology.
2. Any two of the following:
   - (i) Chemistry.
   - (ii) Geology.
   - (iii) Geography.
   - (iv) Military Studies.
   - (v) Bio-Technology.
   - (vi) Industrial Microbiology.

(vii) Industrial Chemistry.

(viii) Seed technology.

(ix) Still Photography.

(x) Clinical Nutrition & Dietetics.

(xi) Microbiology

Provided that Geography will be offered only by those who offer Geology as the other subjects.

8. **Examinations**

(a) The examination for the degree of Bachelor of Science shall consist of three parts:

i. B.Sc. (Part–I) at the end of the first year.

ii. B.Sc. (Part–II) at the end of the second year.

iii. B.Sc. (Part–III) at the end of the third year.

(b) The examinations shall be conducted by means of written papers and will include practical in core courses (other than those in Mathematics and Economics).

A candidate who has been admitted to B.Sc. (Part–I) course and has attended in any affiliated colleges for one academic year the regular course of study as prescribed for B.Sc. (Part–I) examination of the University, under these Ordinances, may be permitted, if otherwise eligible, to appear at the B.Sc. (Part–I) examination.

(a). A candidate who, having passed the B.Sc. (Part–I) examination ofthe University, under these ordinances, has attended in an affiliated college for one academic year the regular course of study as prescribed for the B.Sc. (Part–II) examination of the University underthese ordinances may be permitted, if otherwise eligible to appear at the B.Sc. (Part–II) examination.

A candidate who, having passed the B.Sc. (Part–I) examination after 10+2, of any other University duly incorporated by any law in force for the time being, may also be permitted, if otherwise eligible, to appear at B.Sc. (Part–II) examination of the University, provided that

He/She offered at the above mentioned B.Sc. (Part–I)examination of such University a course of an equivalent standard with almost such syllabi as is prescribed for B.Sc. (Part–I) examination of the University under these ordinance.

He/She has attended in an affiliated college for one academic year the regular course of study prescribed for B.Sc. (Part–II) examination of the University under these ordinances.

A candidate who has passed the B.Sc. (Part–I) examination and has attended in an affiliated college for one academic year the regular course of study prescribed for B.Sc. (Part–II) examination of the university under these ordinances together with the regular course prescribed for B.Sc. (Part–I) under these Ordinance, may also be permitted to appear at the B.Sc. (Part–II) examination.

(a) A candidate who having passed the B.Sc. (Part–II) examination of the University, under these ordinances has attended in an affiliated college for one academic year the regular course of study as prescribed for B.Sc. (Part–III) examination of the university, under these ordinances may be permitted to appear at the B.Sc. (Part–III) examination.

A candidate who has passed the B.Sc. (Part–II) examination after 10+2 of any other university duly incorporated by any law in force for the time being may also be permitted, if otherwise eligible, to appear at B.Sc. (Part–III) examination of the University, provided that

He/She offered at the above mentioned B.Sc. (Part–II) examination of such University a course of an equivalent standard with almost such syllabi as is prescribed for B.Sc. (Part–II) examination of the University under these ordinance.

He/She has attended in an affiliated college for one academic year the regular course of study prescribed for B.Sc. (Part–III) examination of the University under these ordinances.

9. For a pass in B.Sc. Examination a candidate shall be required to secure the minimum of 35% marks in each theory paper and the minimum of 35% in each practical paper aggregate together in core course. Where,a course comprises theory as well as practical the candidate shall have to least 35% marks in theory and practical separately.
10. Provided that in respect of the students who have completed and passed all the three years of the B.Sc. Programme in the aforesaid manner, the division shall be declared on the basis of the total marks scored in all the three years as follows:
    a) **First Division, where student secures 60% or above.**
    b) **Second Division where student secures 45% or above but less than 60% marks.**
    c) **Third Division where student secures 35% or above but less than 45% marks.**
11. A candidate who has been declared successful at the B.Sc. Part–I, IIand III examination in accordance with ordinance – 07, 08 and 09 here in above shall be awarded the degree of Bachelor of Science.

12. Curriculum, Scheme of Examination and Distribution of Marks

The curriculum, scheme of examination and distribution of marks in various courses of B.A. shall be as approved by Board of Studies/Academic Council from time to time.

FOUNDATION COURSE

PHYSICAL EDUCATION

SYLLABUS

Note:- Physical Education shall be studied in the B.Com. (Part–I) First year only. The Maximum Marks of this Paper is 50 Marks. The candidate shall be required to obtain 35% marks (minimum passing marks should be 18). This paper is compulsory forRegular and Private Candidates.

1. Meaning and Definition of Physical Education, Aims and Objectives Importance.
2. Age and Physical activities and Sports, Chronological, Anatomicaland Physiological ages.
3. Sociological implications of Sports and Cultural Heritage.
4. Brief History of Physical Education: Ancient to Modem.
5. Important Institutions of Physical Education and Sports in India.
6. Olympic Games, Asian Games and Commonwealth Games.
7. Need and Importance of Anatomy, Physiology, Recreation and Health Education.
8. Skeletal and Muscular System of Human Body.
9. Respiratory and Digestive Systems.
10. Blood and Circulatory System.
11. Nutrition and Balanced Diet.
12. Ill-effects of Drugs and Tobacco.
13. First Aid and Personal Hygiene.
14. Communicable diseases.
15. Importance of Posture and deviations.
16. Importance of Sports Psychology.
17. Learning, Motivation and Transfer of Training in Physical Education.
18. Prevention and treatment of Sports injuries.
19. Rehabilitation Therapies in Sports injuries
20. Therapeutic Exercises – Isotonic and Isometric.
21. Common Massage Techniques and Therapeutic use.

22. Importance of Management in Physical Education and Sports.
23. Kinesiology-Proximal & Dismal attachments and action of Muscles.
24. Lever and Law of Motion-their application to human body.
25. Force and its application in sports activities.
26. Application to human body of axis and plane, centre and gravity, line of gravity, equilibrium, mass and weight, speed, velocity, acceleration and momentum.

FOUNDATION COURSE

RASTRA GAURAV

SYLLABUS

Note:- Rastra Gaurav shall be studied in the B.Sc. (Part – II) Second year only. The Maximum Marks of this Paper is 50 Marks. The candidate shall be required to obtain 35% marks (minimum passing marks should be 18). This paper is compulsory for Regular and Private Candidates.

प्रश्न पत्र का ढॉचा :–

1. पूर्णांक – 50 न्यूनतम उत्तीर्णक – 18।
2. प्र" नपत्र में एक–एक अंक के कुल 50 वस्तुनिष्ठ प्रश्न होगें, जो बहुविकल्पीय होंगें। प्रत्येक प्रश्न के उत्तर के 4 विकल्प रहेंगें। परीक्षार्थी को इन विकल्पों में सें किसी एक सही विकल्प पर चिह्न लगाकर उत्तर देना होगा।
3. सभी प्रश्न अनिवार्य होंगें।
4. प्रश्न हिन्दी तथा अंग्रजी दोनों भाषाओं में होगें।

~~मातृभूमि की विशेषताएं~~ पाठ्यक्रम में निम्नलिखित 5 विषयों (या प्रश्नों) पर 10 अंक का होगा।

2. सामान्य हिन्दी व्याकरण (संधि–विग्रह, समास, प्र्यायवाची, विलोम शब्द) – 10 प्रश्न/10 अंक का होगा।

3. सामान्य संस्कृत व्याकरण (संधि–विग्रह, समास, तत्सम, तद्भव शब्द) –

सामान्य हिन्दी व्याकरण (संधि–विग्रह, समास, पर्यायवाची, विलोम शब्द) -

4. भारतीय इतिहास, दर्शन, संस्कृति का सामान्य परिचय – 10 प्रश्न/10 अंक का होगा।

5. पर्यटन एवं पर्यावरण विषयक सामान्य जानकारी – 10 प्रश्न/10 अंक का होगा।

FOUNDATION COURSE

ENVIRONMENTAL STUDIES

SYLLABUS

Note :- (i). Environmental Studies shall be studied in the B.Com. (Part –III) Third year only. The Maximum Marks of this Paper is 50 Marks. The candidate shall be required to obtain 35% marks (minimum passing marks should be 18). This paper is compulsory for Regular and Private Candidates.

(ii) The Question Paper carries 50 marks as follows:

(a) Short Answers Pattern of 20 marks.

(b) Essay Type with candidate choice of 30 marks.

Contents of Syllabus:-Unit 1:

The Multidisciplinary nature of environmental studies – Definition, Scope and Importance. Need for public awareness.

Unit 2:

Natural Resources.

Renewable and Non-renewable resources. Natural resources and Associated Problems.

(a) Forest Resources: Use and over exploitation, deforestation case studies. Timber extraction, mining, cams and their on forests and tribal people.

(b) Water Resources: Use and Over-utilization of surface and ground water, floods, drought, conflicts over water, dam's benefits and problems.

(c) Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

(d) Food Resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer–pesticides problems, water logging, salinity, case studies.

(e) Energy Resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.

(f) Land Resources: Land as a resource, land degradation, man inducedlandslides, soil erosion and desertification.

(g) Role of an individual in conservation of natural resources.

Unit 3:

Ecosystems :

(a) Concept of an ecosystem.

(b) Structure and function of an ecosystem.

(c) Procedure, consumers and Decomposers.

(d) Ecological Succession.

(e) Food chains, food webs and ecological pyramids.

(f) Introduction, Types, Characteristics, Features, Structures and Functions of the following ecosystem:-

(i) Forest Ecosystem.

(ii) Grass Land Ecosystem.

(iii) Desert Ecosystem.

(iv) Aquatic Ecosystems (ponds, streams, lakes, rivers, oceans,estuaries).

Unit 4:

(a) Biodiversity and its conservation: Introduction, Definition, genetics, species and ecosystem.

(b) Value of Biodiversity: Consumptive use, Productive use, Social Ethical, Aesthetic and Option values.

(c) Biodiversity at global, national and local levels.

(d) Hot-spots of biodiversity.

(e) Threats to biodiversity: Habitat Loss, Poaching of wildlife, Man-wildlife conflicts.

(f) Endangered and endemic species of India.

(g) India as a mega-diversity nation.

(h) Conservation of biodiversity: In-situ and Ex-situ conservation ofbiodiversity.

Unit 5:

Environmental Pollution:

(a) Definition

(b) Causes, effects and control measures of :-

(a) Air Pollution.

(b) Water Pollution.

(c) Soil Pollution.

(d) Marine Pollution.

(e) Noise Pollution.

(f) Thermal Pollution.

(g) Nuclear Hazards.

(c) Solid Waste Management: Causes, effects and control measuresof urban and industrial wastes.

(d) Role of an individual in prevention of pollution.

(e) Pollution case studies.

(f) Disaster Management: Floods, Earthquake, Cyclone and Landslides.

Unit 6:

Social Issues and the Environment:

(a) From unsustainable to sustainable development.

(b) Urban problems related to energy.

(c) Water conservation, rain water harvesting, water shed management.

(d) Climate change, global warming, acid rain, ozone layerdepletion, nuclear accidents and holocaust, case studies.

(e) Consumerism and water products.

(f) Environment Protection Act.

(g) Air (Prevention and Control of Pollution) Act.

(h) Water (Prevention and Control of Pollution) Act.

(i) Wildlife Protection Act.

(j) Forest Conservation Act.

(k) Issues involved in environment of environmental legislation,public awareness.

Unit 7:

Human Populated and the Environment:

(a) Population growth, variation among nations.

(b) Population explosion – Family Welfare Program.

(c) Environment and Human Health.

(d) Human Rights.

(e) Value Education.

(f) HIV/AIDS.

(g) Women and Child Welfare.

(h) Role of Information Technology in Environment and HumanHealth.

Distribution of Marks in B.Sc. (2018) each Paper

S.No.	Subject Name	Theory Paper		Practical Paper	
		Max. Marks	Mini. Pass Marks	Max. Marks	Mini. Pass Marks
(i)	Physics	150	53	50	17
(ii)	Chemistry	150	53	50	17
(iii)	Botany	150	53	50	17
(iv)	Zoology	150	53	50	17
(v)	Mathematics	150	53	50	17
(vi)	Geology	150	53	50	17
(vii)	Geography	150	53	50	17
(viii)	Computer Science	150	53	50	17
(ix)	Economics	200	70	----	----
(x)	Statistics	150	53	50	17
(xi)	Biotechnology	150	53	50	17
(xii)	Industrial Chemistry	150	53	50	17
(xiii)	Industrial Microbiology	150	53	50	17
(xiv)	Seed Technology	150	53	50	17
(xv)	Military Studies	150	53	50	17
(xvi)	Still Photography	150	53	50	17
(xvii)	Clinical Nutrition & Dietetics	150	53	50	17
(xviii)	Microbiology	150	53	50	17

Programme Education Objectives (PEOs)

The PEOs of the B.Sc. program Chemistry are as follows:

PEO1: Chemistry graduates will be well prepared for successful careers in the profession at an industry and/or in government in one or more of discipline of chemistry.

PEO2: Chemistry graduates will be academically prepared to become licensed professional chemists in due course and will contribute effectively in serving the society.

PEO3: Chemistry graduates will be engaged in professional activities to enhance their own achievement and simultaneously contribute in service of humankind.

PEO4: Chemistry graduates will be successful in higher education in Chemistry.

PEO5: Chemistry graduates will provide leadership quality to work in all kind of circumstances, diverse environment such as interdisciplinary and multidisciplinary learning systems.

B.Sc.(CHEMISTRY)

COURSE STRUCTURE

FIRST YEAR

PAPER 101: Inorganic Chemistry 50 MARKS

PAPER 102: Organic Chemistry 50 MARKS

PAPER 103: Physical Chemistry 50 MARKS

PAPER 104: PRACTICAL (Based on Paper 101, 102, 103) 50 MARKS

SECOND YEAR

PAPER 201: Inorganic Chemistry 50 MARKS

PAPER 202: Organic Chemistry 50 MARKS

PAPER 203: Physical Chemistry 50 MARKS

PAPER 204: PRACTICAL (BasedonPaper201,202,203) 50 MARKS

THIRD YEAR

PAPER301: Inorganic Chemistry	50MARKS
PAPER 302: Organic Chemistry	50MARKS
PAPER 303: Physical Chemistry	50MARKS
PAPER304: PRACTICAL (Based on Paper 301, 302, 303)	50MARKS

Program Outcomes

PO-1: Apply knowledge of sciences to become competent professionals at global level.

PO-2: Identify and solve scientific problems for higher studies at national and international levels.

PO-3: Investigate problems related to sciences using knowledge for analysis and interpretation of data.

PO-4: Select, design and apply appropriate experimental techniques along with IT tools to solve problems related to sciences.

PO-5: Apply contextual knowledge to assess societal, health, safety, and cultural issues relevant to the science practices.

PO-6: Investigate and demonstrate the scientific knowledge in environmental contexts for sustainable development.

PO-7: Apply ethical principles and responsibilities of a science graduate to serve the society.

PO-8: Communicate effectively through soft skills, report writing, documentation and effective presentations.

PO-9: Perform effectively as an individual and as a member or leader in diverse teams in multidisciplinary settings.

PO-10: Engage in independent and lifelong learning in the broadest context of science and technological changes.

PO-11: Enhance skills for future employability through activities such as internship, MOOC courses, seminars, summer trainings and project work.

PO-12: Learn and perform experiments to apply their knowledge in learning of advances in sciences for job opportunities.

Programme Specific Outcomes

PSO-1: Core competency: The chemistry graduates are expected to gain knowledge of the fundamental concepts of chemistry and applied chemistry through theory and practical. These fundamental concepts would be reflected in the latest understanding of the field to keep continues its progression.

PSO-2: Communication skills: Chemistry graduates are expected to possess minimum standards of communication skills to read and understand documents so that they can solve their problems very methodically, independently and with logical argument. Graduates are expected to build good communication skill so that they can easily share their idea/finding/concepts to others.

PSO-3: Critical thinking: Chemistry graduates are expected to achieve critical thinking ability to design, carry out, record and analyze the results of chemical reactions. They can have that much potential and confidence that they can overcome many difficulties with the help of their sharp scientific knowledge and logical approaches.

PSO-4: Problem-solving: Graduates are expected to be well trained with problem-solving philosophical approaches that are pertinent across the disciplines.

PSO-5: Analytical skill development and job opportunity: Chemistry graduates are expected to possess sufficient knowledge how to synthesize a chemical compound and perform necessary characterization and analysis in support of the formation of the product by using modern analytical tools and advanced technologies. Because of this course curriculum chemistry graduates have lot of opportunity to get job not only in academic and administrative field but also in industry.

PSO-6: Research motivation: Chemistry graduates are expected to be technically well trained with modern devices and Chemistry based software and has powerful knowledge in different disciplines of Chemistry so they can easily involve themselves in theory and laboratory-based research activities.

PSO-7: Teamwork: Graduates are expected to be team players, with productive co-operations involving members from diverse socio-cultural backgrounds.

PSO-8: Social Awareness: As an inhabitant of this green world it is our duty to make our planet clean and suitable for living to all. In this context Chemistry graduates are expected to be more aware about finding green chemical reaction routes for sustainable development. They are expected to maintain good laboratory practices and safety.

B.Sc. (CHEMISTRY)

FIRSTYEARDETAILEDSYALLBUS

PAPER101

Inorganic Chemistry

Course Outcome (COs): Upon successful completion of B.Sc. Inorganic Chemistry First year programme students should be able to

- Explain the atomic structure, Schrödinger wave equation, trends of periodic properties like ionization energy and electron affinity.
- Define the chemical bonding, Valence bond theories and its limitation ad ionic solids
- Explain the s-block elements, Reactions of alkali and alkaline earth metals with oxygen, Environmental pollution; water pollution, BOD, COD, sewage treatment, air pollution and soil pollution.
- Define the p-block elements, basic properties of halogens and Chemical properties of the noble gases.

60hrs (2hrs/week)

Unit I

I. Atomic Structure 6hrs

Idea of de-Broglie matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrödinger wave equation, significance of Ψ and Ψ^2, quantum numbers, radial and angular wave functions and probability distribution curves, shapes of s, p, d, orbitals. Aufbau and Pauli exclusion principles, Hund's multiplicity rule. Electronic configurations of the elements.

II. Periodic Properties 5 hrs

Atomic and ionic radii, ionization energy, electron affinity and electronegativity-definition, effective nuclear charge, methods of determination or evaluation, trends inperiodictableandapplicationsinpredictingandexplainingthechemical behaviour.

III.

Lattice energy and Born-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarizability of ions, Fajan's rule. Metallic bond-free electron, valence bond and band theories.

Unit II

III. Chemical Bonding 20hrs

(A) Covalent Bond–Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions. Valence shall electron pair repulsion (VSEPR) theory to NH_3,H_3O^+, SF_4, CIF_3, ICl_2^- and H_2O. Molecular Orbital (MO) theory and applications for homonuclear and heteronuclear (CO and NO) diatomic molecules, multicenter bonding in electron deficient molecules, Fajan's rules and consequences of polarization, Weak Interactions - Hydrogen bonding, van der Waals forces.

(B) Chemistry of Elements of First Transition Series, Characteristic properties of d-block elements. Properties of the elements of the first transition series, their complexes illustrating relative stability of their oxidation states, coordination number and geometry.

(C) Chemistry of Elements of Second and Third Transition Series, General characteristics, comparative treatment with their 3d-analogues in respect of ionic radii, oxidation states, magnetic behavior, spectral properties and stereochemistry.

Unit III

IV. s-Block Elements 6hrs

Comparative study, diagonal relationship, salient features of hydrides, solvation and complexation tendencies including their function in biosystems, an introduction to alkyls and aryls. Reactions of alkali and alkaline earth metals with oxygen, hydrogen, nitrogen and water, General characteristics: melting point, flame colour, reducing nature, diagonal relationships and anomalous behavior of first member of each group.

V. Environmental Chemistry 5hrs

Pollution, long distance movement of pollutants, air pollution, Sampling – particulates (air-born solids), gases and vapours, sulphur oxides – sources, analysis and control measures. Carbon monoxide – sources, analysis and control measures, water pollution (BOD, COD, sewage treatment, industrial wastewater treatment, reverse osmosis), Water quality parameters and their determination, steps in water treatment, determination of metal and metalloids, qualitative and quantitative analysis of ingredients of detergents. soil pollution (causes, effects and remedies)

Unit IV

VI. p-BlockElements 15hrs

Comparative study (including diagonal relationship) of groups 13-17 elements, compounds like hydrides, oxides, oxyacids and halides of group 13-16, hydrides of boron – diborane and higher boranes, borazine, borohydrides, fullerenes, carbides, fluorocarbons, silicates (structural principle), tetrasulphur tetranitride, basic properties of halogens, interhalogens and polyhalides, metallic/non-metallic character, melting point, Catenation, Allotropy of C, P, S; inert pair effect, diagonal relationship between B and Si and anomalous behaviour of first member of each group.

Chemistry of Noble Gases 3hrs

Chemical properties of the noble gases, chemistry of xenon, structure and bonding in xenon compounds.

Reference Books:

1. J. D. Lee, Concise Inorganic Chemistry, Elbs, Chapman and Hall, 2006.
2. M. Weller,T. Overton, J. Rourke, & F. Armstrong, Inorganic Chemistry, Oxford University Press , 6th edition.
3. J. E. Huheey, E. A. Keiter, R. L. Keiter& O. K. Medhi. Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Education (2006).
4. B. R. Puri, L. R. Sharma and K. C. Kalia; Principles of Inorganic Chemistry. Vishal Pub. 2016.
5. B. Douglas, D. McDaniel and J. Alexander. Concepts and Models of Inorganic Chemistry (3rd edn.), John Wiley & Sons (1994).
6. G. L.Meissler and D. A. Tarr; Inorganic Chemistry, 3rd. Edition, Pearson.

B.Sc.(CHEMISTRY)

FIRST YEAR DETAILED SYALLBUS

PAPER-102

Organic Chemistry

Course Outcome (COs): Upon successful completion of B.Sc. organic Chemistry First year programme students should be able to

- Explain the structure and bonding; Hybridization, chemical bonding, methods of determination of reaction mechanism, Wurtz and Wurtz Fitting reaction.
- Define the stereo chemistry of organic compounds, Fischer and their interconversion, geometric isomerism in oximes, D/L and R/S designations and conformational isomerism.
- Explain the Methods of formation Alkenes, Cyclo alkenes, Dienes and alkynes, mechanisms of dehydration of alcohols and dehydrohalogenation, nomenclature and classification of dienes.
- Define the nomenclature of benzene derivatives, Huckle rule, Friedel Crafts alkylation/ acylation with their mechanism and nucleophilic substitution reactions.

J.S. UNIVERSITY, SHIKOHABAD

60hrs(2hrs/week)

Unit I

I. Structure and Bonding 5hrs

Hybridization, bond lengths and bond angles, bond energy, localized and delocalized chemical bonding, van der Waals interactions, inclusion compounds, clathrates, charge transfer complexes, resonance, hyperconjugation, Dipole moment; Electronic Displacements: Inductive, electrometric, resonance mesomeric effects and their applications.

II. Mechanism of Organic Reactions 8 hrs

Curved arrow notation, drawing electron movements with arrows, half-headed and double-headed arrows, homolytic and heterolytic bond fissions. Types of organic reagents–electrophiles and nucleophiles. Types of organic reactions, Energy considerations.

Reactiveintermediates–Carbocations,carbanions,freeradicals,carbenes, arynes and nitrenes (with examples). Assigning formal charges on intermediatesandotherionicspecies.

III. AlkanesandCycloalkanes 7hrs

General methods of preparation- Wurtz and Wurtz Fittig reaction, Corey House synthesis, physical and chemical properties of alkanes, Free radical substitutions; Halogenation, concept of relative reactivity v/s selectivity. Conformational analysis of alkanes (Conformations, relative stability and energy diagrams of Ethane, Propane and butane).General molecular formulae of cycloalkanes and relative stability, Baeyer strain theory, Cyclohexane conformations with energy diagram, Axial and equatorial positions.
Conformations of monosubstituted cyclohexanes.

Unit II

IV. StereochemistryofOrganicCompounds 15hrs

Stereoisomerism: Optical activity and optical isomerism, asymmetry, chirality, enantiomers, diastereomers. specific rotation; Configuration and projection formulae: Newmann, Sawhorse, Fischer and their interconversion. Chirality in molecules with one and two stereo centres; meso configuration. Racemic mixture and their resolution. Relative and absolute configuration: D/L and R/S designations. Geometrical isomerism: cis-trans, syn-anti and E/Z notations using CIP rules.

Unit III

V. Alkenes, Cyclo alkenes, Dienes and Alkynes 7 hrs

Methods of formation, dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration. The Saytzeff rule, Hofmann elimination, Relative stabilities of alkenes. Chemical reactions-mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule. Hydroboration-oxidation, oxymercuration-demercuration, epoxidation, ozonolysis, hydration, hydroxylation with $KMnO_4$.

Methods of formation, conformation and chemical reactions of cycloalkenes.

Classification- isolated, conjugated and cumulated dienes. Structure, method of formation and reactions (1, 2- and 1,4-additions, Diels-Alder reaction) of butadiene.

Mehtods of formation, chemical reactions and acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reaction.

Unit IV

VI. Arenes and Aromaticity 8hrs

Nomenclatureofbenzenederivatives.Arylgroup.Aromaticnucleusandside chain.

Structure of benzene: Molecular formula and Kekule structure.

Stabilityandcarbon-carbonbondlengthsofbenzene,resonancestructure, MOpicture.

Concept of Aromaticity, Huckel's rule, aromatic character of arenes, cyclic carbocations and carbanions with suitable examples and heterocyclic compounds

with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation, Friedel Crafts alkylation/ acylation with their mechanism.

Aromaticelectrophilicsubstitution–Generalpatternofthemechanism,role of σ andπ complexes, Mechanism of nitration, halogenation, sulphonation, mercurationandFriedel-Craft'sreaction.Energyprofilediagrams.Activating anddeactivatingsubstituents,orientationandortho/pararatio.Sidechain reactions of benzene derivatives. Birchreduction.

Methods of formation and chemical reactions of alkylbenzenes, alkynylbenzenes, biphenyl, naphthalene and anthracene.

VII. Alkyl and Aryl Halides 10hrs

Alkyl halides: Methods of preparation and properties, nucleophilic substitution reactions – SN1, SN2 and SNi mechanisms with stereochemical aspects and effect of solvent; nucleophilic substitution vs. elimination. Aryl halides: Preparation (including preparation from diazonium salts) and properties, nucleophilic aromatic substitution; SNAr, Benzyne mechanism. Relative reactivity of alkyl, allyl, benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.

Organometallic compounds of Mg (Grignard reagent) – Use in synthesis of organic compounds.

Reference Books:

1. Advanced organic chemistry by J. March, (4th Ed) (2008) published by Wiley.
2. S. H. Pine. Organic Chemistry (5th edn.), McGraw-Hill Bool (2012).
3. Organic Chemistry by T.W. Graham Solomons and Craig B. Fryhle (10th Edition), Willy Student Edition (2012).
4. Organic Reactions and their mechanisms (3rd revised edition) by P.S. Kalsi, New Age International (P) Ltd (2010).
5. Organic Chemistry (VI edition) - R.T Morrison, R.N. Boyd. Prentice Hall of India Pvt Ltd, (2009).
6. Reaction Mechanism and Reagents in Organic Chemistry -Gurdeep R Chatwal, New Age International (P) Ltd (2010).
7. A guidebook to mechanism in organic chemistry – Peter Sykes (6th Ed) Orient Longman (2005).
8. Organic Chemistry - I.L. Finar, 6th Edition (Low price) Pearson Education, 2009.

B.Sc.(CHEMISTRY)

FIRST YEAR DETAILED SYALLBUS

PAPER-103

Physical Chemistry

Course Outcome (COs): Upon successful completion of B.Sc. Physical Chemistry First year programme students should be able to

- Explain the mathematical concepts and computers, General introduction to computers, Applications of integral calculus in Physical Chemistry and Programming Operating systems.
- Define the gaseous and liquid states; Postulates of kinetic theory of gases, Deviations from ideal gas behaviour, relationship between critical constants and law of corresponding states.
- Explain the solid and colloidal state, Nature of the solid state, X-ray diffraction, Bragg's law, classification of colloids and application of colloids.
- Define the Chemical kinetics and its scope, mathematical characteristics of simple chemical reactions, polarimetry, spectrophotometry and characteristics of catalysed reactions.

Unit I

I. Mathematical Concepts and Computers *a*

(A) Mathematical Concepts

Logarithmicrelations,curvesketching,lineargraphsandcalculationof slopes,differentiationoffunctionslikek_x,e^x,x^n,sinx,logx;maxima and minima, Basic rules for differentiation, First Derivatives, Second Derivatives, Partial Derivatives, Exact and inexact differentials.

Basic rules for integration, Methods of Integration-Substitution, Partial Fractions and by parts. Applications of integral calculus in Physical Chemistry, Integration of some useful/relevant functions; permutations and combinations. Factorials Probability.

(B) Computers

General introduction to computers, different components of a computer, hardware and software, input-output devices, binary n s and arithmetics, introduction to computer languages. Programming. u Operating systems, Hardware and Software; Input devices, Storage m devices, Output devices,

Central Processing Unit (Control Unit and b Arithmetic Logic Unit); Number system (Binary, Octal and e Hexadecimal Operating System). r

Unit II

I. Gaseous States

Kinetic molecular model of a gas: postulates and derivation of the kinetic gas equation; collision frequency; collision diameter; mean free path and viscosity of gases, including their temperature and pressure dependence, relation between mean free path and coefficient of viscosity, calculation of σ from η; variation of viscosity with temperature and pressure. Maxwell distribution and its use in evaluating molecular velocities (average, root mean square and most probable) and average kinetic energy, law of equipartition of energy, degrees of freedom and molecular basis of heat capacities. Behaviour of real gases: Deviations from ideal gas behaviour, compressibility factor, Z, and its variation with pressure and temperature for different gases. Causes of deviation from ideal behaviour. Equation of states for real gases; van der Waals equation of state, its derivation and application in explaining real gas behaviour, Virial coefficients, calculation of Boyle temperature. Isotherms of real gases and their comparison with van der Waals isotherms, continuity of states, critical state, relation between critical constants and van der Waals constants, law of corresponding states.

II. Liquid State

Qualitative treatment of the structure of the liquid state; physical properties of liquids; vapour pressure, surface tension and coefficient of viscosity, and their determination. Effect of addition of various solutes on surface tension and viscosity. Explanation of cleansing action of detergents. Temperature variation of viscosity of liquids and comparison with that of gases.

Unit III

III. Solid State

Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry, symmetry elements and symmetry operations, qualitative idea of point and space groups, seven crystal systems and fourteen Bravais lattices; X-ray diffraction, Bragg's law, a simple account of rotating crystal

IV. Colloidal State

Definition of colloids, classification of colloids.

Sols: properties -kinetic, optical and electrical; stability of colloids, protective colloids, Hardy- Schulze rule, gold number. Emulsions: types of emulsions, preparation.

Gels: classification, preparation and properties.

Unit IV

V. Chemical KineticsandCatalysis

Chemical kinetics and its scope, rate of a reaction, factors influencing the rate of a reaction-concentration, temperature, pressure, solvent, light, catalyst. Concentration dependence of rates, mathematical characteristics of simple chemical reactions - zero order, first order, second order, pseudo order, halflife and mean life. Determination of the order of reaction -differential method, method of integration, method of half-life period and isolation method.

Radioactive decay as a first order phenomenon. Problems

Experimental methods of chemical kinetics: conductometric, optical methods, polarimetry and spectrophotometry.

Catalysis-Effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy. Homogeneous Catalysis, characteristics of catalysed reactions, classification of catalysis, miscellaneous examples. Enzyme Catalysis.

Reference Books:

1. Introduction to Physical polymer science, L.H. Sperling, Wiley Interscience, New York, 1986.
2. Physical Chemistry (Vol. 1 & 2), K.L. Kapoor, Macmillan, 2001.
3. Principles of Physical Chemistry by B.R. Puri, L.R. Sharma, Madan S. Pathania, Vishal Publishing Company, 2008.
4. Physical Chemistry (Vol. 1 & 2), Ira N Levine, Macmillan, 2001.
5. Atkins Physical Chemistry, Peter Atkins & Julio D Paula, Oxford University Press, 2006.
6. Polymer science: V.R. Gowariker, N.V. Viswanathan & T. Sreedhar, (Wiley Eastern) New Delhi, 1990.
7. Text book of polymer science: F.W. Billmeyer, (John.Wiley), London, 1994.

B.Sc.(CHEMISTRY)

FIRST YEAR DETAILED

SYALLBUS PAPER – 104

PRACTICAL

Course Outcome (COs): In Chemistry Lab students should be able to-
Analyze the given inorganic mixture of cations and anions of different group, detection of different functional groups and also able to learn different laboratory techniques.

The duration of practical examination will be of six hours. M M =50

Distribution of Marks

Inorganic experiments (mixture+titration)12+8=20
Organicexperiments10marks
Physical experiments 10 marks
Record 5 marks Viva
5 marks

Inorganic Chemistry

Inorganic mixture analysis(preferably by semi micro method)–The mixture will have six ions, preferably three cations and three anions. It may contain ions of the same group and an interfering anion such as phosphate, oxalate, borate and fluoride. Not more than one interfering anion is to be given. The formal group analysis will be done for these parathion and identification of cations of Group I to VI.

Two marks will be awarded for each correction with proper tests. One mark will be deducted for each incorrect ion reported. Not more than 50% marks will be awarded if proper tests are not given.
Volumetric analysis: Any four double titrations from acid-base, redox and complexometric types.

Organic Chemistry

Qualitative Organic Analysis

Detection of extra elements (N, S and halogens) and functional groups (alcoholic, phenolic,aldehydic,ketonic,carbonyl,carboxylic,esters,carbohydrates,amines, amides, nitro and anilide) in simple organic compounds.

Laboratory Techniques

Calibration of thermometer:80-82^{0}C(Naphthalene),113.5-114^{0}C(Acetanilide), 132.5133^{0}C(Urea), 100^{0}C (DistilledWater).

Determinationofmeltingpoint:Naphthalene80-82^{0}C,Benzoicacid121.5-122^{0}C, Urea 132.5-
133^{0}C, Succinic acid 184.5-185^{0}C, Cinnamic acid 132.5-133^{0}C, Sallicylic acid 157.5158^{0}C, Acetanilide 113.5-114^{0}C, m-initrobenzene 90^{0}C, p- ichlorobenzene 52^{0}C, Aspirin135^{0}C.

Determination of boiling point:Ethanol78^{0}C,Cyclohexane81.4^{0}C,Toluene 110.6^{0}C, Benzene80^{0}C.

Mixed melting point determination: Urea-Cinnamicacidmixtureofvarious compositions (1:4, 1:1,4:1).

Distillation:Simpledistillationofethanol-watermixtureusingwatercondenser. Distillationofnitrobenzeneandanilineusingaircondenser.

Crystallization: Conceptofinductionofcrystallization.Phthalicacidfromhot water(usingflutedfilterpaperandsteamlessfunnel).Acetanilidefromboiling water.Naphthalenefromethanol.Benzoicacidfromwater.

Decolorisation and crystallization using charcoal::::Decolorationofbrownsugar (sucrose) with animal charcoal using gravity filtration. Crystallization and decolorisationofimpurenaphthalene(100gofnaphthalenemixeswith0.3gof CongoRedusing1gdecolorizingcarbon)fromethanol.
Sublimation (simple and vacu)::::: Camphor,Naphtalene,Phthalicacidand Succinic acid.

Physical Chemistry

ChemicalKinetics

1. To determine the specific reaction rate of the hydrolysis of methyl acetate/ethylacetatecatalyzedbyhydrogenionsatroomstemperature
2. Tostudytheeffectofacidstrengthonthehydrolysisofanester
3. To compare the strengths of HCl and H_2SO_4 by studying the kinetics of hydrolysis of ethylacetate
4. TostudykineticallythereactionrateofdecompositionofiodidebybyH_2O_2

DistributionLaw

1. TostudythedistributionofiodinebetweenwaterandCCl_4

2. Tostudythedistributionofbenzoicacidbetweenbenzeneandwater

Coolloids

1. Topreparearsenioussulphidesolandcomparetheprecipitatingpowerof mono-,biandtrivalentanions

Viscosity,SurfaceTension

1. Todeterminethepercentagecompositionofagivenmixture(non-interacting systems) by viscositymethod
2. To determine the viscosity of amyl alcohol in water at different concentrationsandcalculatetheexcessviscosityofthesesolutions
3. To determine the percentage composition of a given binary mixture by surfacetensionmethod(acetone&ethyl-methyl ketone

J.S. UNIVERSITY, SHIKOHABAD

B.Sc.(CHEMISTRY)

SECOND YEAR DETAILED SYALLBUS

PAPER 201

Inorganic Chemistry

After completing this course, students will be able to:

CO1: Students will be able to describe the properties of first, second and third transition series. **CO2**: Students will be able to elaborate the nomenclature of the coordination complex, isomerism in coordination compounds, valence bond theory of transition metal complexes.
CO3: Students will be able to explain the chemistry of Lanthanide and Actinide elements.
CO4: Students will be able to illuminate the Arrhenius Bronsted-Lowry and Lux-Flood
CO5: Students will be able to define Non-aqueous Solvents and Electrode potential, electrochemical series

60hrs(2hrs/week)

Unit I

I. **Chemistry of Elements of First Transition Series 10hrs**
Chemistry of Elements of First Transition Series, Characteristic and properties of the elements of the first transition series, their complexes illustrating relative stability of their oxidation states, coordination number and geometry.

II. **Chemistry of Elements of Second and Third Transition Series 10 hrs**
Chemistry of Elements of Second and Third Transition Series, General characteristics, comparative treatment with their 3d-analogues in respect of ionic radii, oxidation states, magnetic behavior, spectral properties and stereochemistry.

Unit II

III. **Coordination Compounds 10hrs**
Werner's coordination theory, IUPAC nomenclature of coordination compounds, Classification of ligands, Chelates, isomerism in coordination compounds, Effective atomic number (EAN) concept of valence bond theory of transition metal complexes.

Unit III

IV. **Chemistry of Lanthanide Elements 6 hrs**
Electronic structure, oxidation states, ionic radii, lanthanide contraction, complex formation, occurrence and isolation, Lanthanide contraction and its causes, Ceric ammonium sulphate and its analytical uses.

V. **Chemistry of Actinides 4hrs** Electronic configuration, oxidation states and magnetic properties, chemistry of separation of Np, Pu and Am from U. Comparative study of properties of Lanthanide and Actinides.

Unit IV

VI. **Oxidation and Reduction 8hrs**
Types of electrodes, standard electrode potential, electrochemical series and its applications. Principles involved in the extraction of the elements.

VII. **Acids and Bases 6hrs**
Arrhenius, Bronsted-Lowry, the Lux-Flood, solvent system and Lewis concept of acids and bases. A Generalized Acid Base Concept.

VIII. **Non-aqueous Solvents 6hrs**
Physical properties of a solvent, types of solvents and their general characteristics. Reactions in non-aqueous solvents with reference to liquid NH_3 and Liquid SO_2.

Reference Books

1. Concepts of Models of Inorganic Chemistry , B. Douglas, D. Mc. Daniel and J. Alexander, John Wiley
2. Inorganic Chemistry, D. E. Shriver, P.W. Atkins and C.H. Langford, Oxford
3. Basic Inorganic Chemistry, F.A .Cotton, G. Wilkinson and P. L. Gaus, Wiley
4. Concise Inorganic Chemistry, J.D. Lee
5. Inorganic Chemistry, W.W. Porter field Addition, Wesley
6. Inorganic Chemistry, A.G. Sharpe, ELBS
7. Inorganic Chemistry, G. L. Miessler and D. A. Tarr, Prentice Hall

B.Sc.(CHEMISTRY)

SECOND YEAR DETAILED SYALLBUS

PAPER 202

Organic Chemistry

CO1: Student will able to understand the Ultraviolet (UV) Absorption and Infrared Spectroscopy
CO2: Student will able to enlighten the chemistry of Alcohol and phenol
CO3: Student will able to explain the preparation and chemical reactions of ether, epoxides, aldehyde and ketones.
CO4: Student will able to describe the Carboxylic acids and its derivatives.
CO5: Student will able to define the Organic compounds of Nitrogen and amines.

60hrs(2hrs/week)

Unit I

I. Electromagnetic Spectrum : Absorption Spectra 10 hrs

The electromagnetic spectrum interaction of radiant energy with molecules, absorption of UV and visible radiation, Beer-Lambert's Law, molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts, Concept of chromophore and auxochrome.

Infrared (IR) absorption spectroscopy – Molecular vibrations, Hooke's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, finger print region, characteristic absorptions of various functional groups and interpretation of IR spectra of simple organic compounds. **Unit II**

II. Alcohols 6hrs

Nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding, Acidic nature, Reactions ofalcohols, Nomenclature, methods of formation of dihydric alcohols, chemical reactions of vicinal glycols, oxidative cleavage [$Pb(OAc)_4$ and HIO_4] and pinacol- pinacolone rearrangement, nomenclature, methods of formation trihydric alcohols, chemical reactions of glycerol, synthesis of glycerol.

III. Phenols 6hrs

Nomenclature, structure and bonding, preparation of phenols, physical properties, acidity of phenols and factors affecting their acidity, Comparative acidic strength of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols–Directive influence of OH group and Electrophilic substitution reactions, viz. nitration, halogenation, sulphonation, Reimer-Tiemann reaction, Gattermann–Koch reaction, Houben-Hoesch condensation, reaction due to OH group: Schotten-Baumann reaction.

Unit III

IV. Ethers and Epoxides 3hrs

Nomenclature of ethers and methods of their formation, physical properties. Chemical reactions–cleavage and autoxidation, Ziesel's method, Preparation and reactions with acids. Reactions of epoxides with alcohols, ammonia and $LiAlH_4$.

V. Aldehydes and Ketones 14hrs

Nomenclature and structure of the carbonyl groups, Synthesis of aldehydes and ketones by oxidation of alcohols, reduction of acid chloride (Friedel-Craft acylation) and by reaction of acid chloride with organocopper compounds Physical properties.

Mechanism of nucleophillic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensations, Condensation with ammonia and its derivatives. Wittig reaction, Mannich reaction.

Baeyer-Villiger oxidation of ketones, Cannizzaro reaction, Clemmensen, Wolff-Kishner, $LiAlH_4$ and $NaBH_4$ reductions. Halogenation of enolizable ketones.

Unit IV

VI. Carboxylic Acids 6hrs

Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids. Reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction. Reduction and decarboxylation.

VII. Carboxylic Acid Derivatives 3hrs

Structure and Preparation of acid chlorides, ester, amides and acid anhydrides, Relative stabilities, interconversion of acid derivatives. Mechanism of esterification and hydrolysis (acidic and basic).

VIII. Organic Compounds of Nitrogen 12 hrs

Preparation of nitroalkanes and nitroarenes. Chemical reactions of nitroalkanes.Mechanismsofnuclephilcsubstitutioninnitroarenesandtheir Reductions in acidic, neutral and alkaline media. Picricacid. Halonitroarenes:

Reactivity.

Amines: Preparation of amines (alkyl & aryl). Structural features affecting basicity of amines, Reactions of amines, electrophilic aromatic substitution in aryl amines, reactions of amines with Nitrous acid, Synthetic transformation of aryl diazonium salts, azo coupling.

Reference Books

1. Organic Chemistry, Morrison and Boyd, Prentice Hall
2. Organic Chemistry, L. G. Wade Jr, Prentice Hall
3. Fundamentals of Organic Chemistry, Solomons, JohnWiley
4. Organic Chemistry, Vol. I, II& III, S. M. Mukherji, S.P.Singh and R.P.Kapoor, Wiley Eastern Ltd (New Age International)
5. Organic Chemistry, F. A. Carey, Mc. Graw-Hill
6. A Textbook of Organic Chemistry, Arun Bhal and B.S. Bahl

PAPER 203

Physical Chemistry

CO1: Student will able to understand the concept of Thermodynamics.
CO2: Student will able to enlighten the theoretical and practical application of thermodynamics.
CO3: Student will able to explain the concept of chemical equilibrium and Solutions.
CO4: Student will able to describe the cell reactions and electrochemistry. **CO5:**
Student will able to define the phase equilibrium.

Unit I

I. Thermodynamics–I 12hrs

Definitions of Thermodynamic Terms

System, surroundings, Types of systems, intensive and extensive properties, State and path functions and their differentials. Thermodynamic process, Concept of heat and work.

First Law of Thermodynamics

Concept of heat (Q), work (W), internal energy (U) and statement of first law; enthalpy (H), relation between heat capacities, Joule Thompson Porous Plug experiment, Nature of Joule Thompson coefficient, calculations of Q, W, ΔU and ΔH for reversible, irreversible and free expansion of gases (ideal and Van der Waals) under isothermal and adiabatic conditions.

Thermochemistry

Enthalpy of reactions: standard states; enthalpy of neutralization, enthalpy of hydration, enthalpy of formation and enthalpy of combustion and its applications, bond dissociation energy and bond enthalpy; effect of temperature (Kirchhoff's equations) on enthalpy of reactions.

II. Thermodynamics–II 13hrs

Second Law of Thermodynamics

Concept of entropy; statement of the second law of thermodynamics, Carnot cycle, Calculation of entropy change for reversible and irreversible processes (for ideal gases). Free Energy Functions: Gibbs and Helmholtz energy; variation of S, G, A with T, V, P, Free energy change and spontaneity (for ideal gases). Relation between Joule-Thomson coefficient and other thermodynamic parameters, inversion temperature, Gibbs-Helmholtz equation, Maxwell relations, thermodynamic equation of state.

Third Law of Thermodynamics

Statement of third law, unattainability of absolute zero, calculation of absolute entropy of molecules, concept of residual entropy, calculation of absolute entropy of solid, liquid and gases.

Unit II

III. Chemical Equilibrium 5hrs

Criteria of thermodynamic equilibrium, degree of advancement of reaction, Chemical equilibria in ideal gases, Thermodynamic derivation of relation between Gibbs free energy of a reaction and reaction quotient, Equilibrium constants and their dependence on temperature, pressure and concentration,

Le Chatelier's Principle (Quantitative treatment), Free energy of mixing and spontaneity, Equilibrium between ideal gases and a pure condensed phase

IV. Solutions 5hrs

Liquid-liquid mixtures: Ideal liquid mixtures, Raoult's and Henry's law. Nonideal system: Azeotropes, HCl-H_2O and ethanol-water systems.

Partially miscible liquids: Phenol-water, trimethylamine-water, nicotine- water systems, immiscible liquids, steam distillation.

Unit III

V. Electrochemistry–I 10hrs

Electrical transport: Conduction in metals and in electrolyte solutions, specific conductance molar and equivalent conductance, measurement of equivalent conductance, variation of molar, equivalent and specific conductance with dilution.

Migration of ions and Kohlrausch law, Arrhenius theory of electrolyte dissociation and its limitations. Weak and strong electrolytes. Ostwald's dilution law, its uses and limitations. Debye-Huckel-Onsager equation for strong electrolytes (elementary treatment only). Transport number, definition and determination by Hittorf method and moving boundary method.

Applications of conductivity measurements: Determination of degree of dissociation, determination of K_a of acids, determination of solubility product of a sparingly soluble salt, conductometric titrations.

Unit IV

VI. Electrochemistry–II 10hrs

Types of reversible electrodes – Gas-metal ion, metal-metal ion, metal-insoluble salt-anion and redox electrodes. Electrode reactions, Nernst equation, derivation of cell EMF and single electrode potential, standard hydrogen electrode-reference electrodes and their applications, standard electrode potential, sign conventions, electrochemical series and its significance.

Electrolytic and Galvanic cells–Reversible and irreversible cells, conventional representation of electrochemical cells.

EMF of a cell and its measurements. Computation of cell EMF. Calculation of thermodynamic quantities of cell reactions (ΔG, ΔH and K).

Concentration cell with and without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titrations.

Definition of pH and pK_a, determination of pH using hydrogen, quinhydrone and glass electrodes by potentiometric methods.

Buffers – Mechanism of buffer action, Henderson-Hazel equation, application of buffer solution. Hydrolysis of salts.

VII Phase Equilibrium
5hrs

Phases, components and degrees of freedom of system, criteria of phase equilibrium. Gibbs Phase Rule and its thermodynamic derivation. Derivation of Clapeyron equation and its importance in phase equilibria. Phase diagrams of one-component systems (water and sulphur) and two component systems involving eutectics, congruent and incongruent melting points (lead-silver, Cd-Mg).

Reference Books

1 Physical Chemistry, G. M. Barrow, International Student Edition, Mc Graw Hill
2 Basic Programming with Application, V. K. Jain, Tata Mc Graw Hill
3 Computers and Common Sense, R Hunt and Shelly, Prentice Hall 4 Physical Chemistry, R. A. Alberty, Wiley Eastern Ltd.
5 The Elements of Physical Chemistry, P.W. Atkins, Oxford.
6 Physical Chemistry Through Problems, S.K. Dogra and S. Dogra, Wiley Eastern Ltd.

PAPER 204

PRACTICAL

After completing this course, students will be able to:

CO1: Students will be able to execute Volumetric and Gravimetric Analysis.
CO2: Students will be able to perform qualitative organic analysis
CO3: Students will be able to understand the importance of chromatography technique and implement the experiments.
CO4: Students will be able to determine the transition temperature of the given substance by thermometric /dialometric methods.
CO5: Students will be able to determine the enthalpy of neutralization .

The duration of practical examination will be of six hours.

Distribution of marks: Total marks 50 will have inorganic gravimetric of 12 marks, volumetric 8 marks, organic exp. 10 marks, physical exp. 10 marks, record 5 marks and viva of 5 marks.

Inorganic Chemistry

Calibration of fractional weights, pipettes and burettes. Preparation of standards solutions. Dilution – 0.1 M to 0.001 M solutions.

Quantitative Analysis

Volumetric Analysis

(a) Determination ofacetic acid in commercial vinegar using NaOH.

(b) Determination of alkali content of antacid tablet using HCl.

(c) Estimation of calcium content in chalk as calcium oxalate by permanganometry.

(d) Estimation of hardness of water by EDTA

(e) Estimation of ferrous and ferric by dichromate method

(f) Estimation of copper using thiosulphate

Gravimetric Analysis

Analysis of Cu as CuSCN, Ni as Ni (dimethylgloxime)and Ba as $BaSO_4$.

Organic Chemistry

Systematic Qualitative Organic Analysis

Identification of an organic compound through the functional group analysis, determination of melting point and preparation of suitable derivatives

Laboratory Techniques

A. Thin Layer Chromatography

Determination of R_f values and identification of organic compounds:

(a) Separation of green leaf pigments (spinach leaves may be used)

(b) Preparation of separation of 2,4-dinitrophenylhydrazones of acetone, 2-butanone, hexane-2-one and hexane- 3-one using toluene and light petroleum (40:60)

(c) Separation of a mixture of dyes using cyclohexane and ethyl acetate (8.5 : 1.5)

B. Paper Chromatography: Ascending and Circular

Determination of R_f values and identification of organic compounds:

(a) Separation of a mixture of phenylalanine and glycine. Alanine and aspartic acid. Leucine and glutamic acid. Spray reagent – Ninhydrin.

(b) Separation of a mixture of D, L – alanine, glycine and L-leucine using n-butanol : acetic acid : water (4: 1: 5). Spray reagent – Ninhydrin.

(c) Separation of monosaccharides – a mixture of D-galactose and D- fructose using n-butanol: acetone: water (4:5:1). Spray reagent – Aniline hydrogen phthalate.

Physical Chemistry

Transition Temperature

1. Determination of the transition temperature of the given substance by thermometric /dialometric method (e.g. $MnCl_2.4H_2O/SrBr_2.2H_2O$)

Phase Equilibrium

2. To study the effect of a solute (e.g. NaCl, succinic acid) on the critical solution temperature of two partially miscible liquids (e.g. phenol- water system) and to determine the concentration of that solute in the given phenol-water system
3. To construct the phase diagram of two component (e.g. diphenylamine – benzophenone) system by cooling curve method

Thermochemistry

1. To determine the solubility of benzoic acid at different temperatures and to determine ΔH of the dissolution process.

2. To determine the enthalpy of neutralization of a weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionization of the weak acid/weak base.

3. To determine the enthalpy of solution of solid calcium chloride and calculate the lattice energy of calcium chloride from its enthalpy data using Born-Haber cycle.

Reference Books

1. Vogel's Qualitative Inorganic Analysis, revised, Svehla, Orient Longman

2. Vogel's Textbook of Quantitative Inorganic Analysis, revised, J. Bassett, R. C. Denney, G.H. Jeffery and J. Mendham, ELBS. 3. Standard Methods of Chemical Analysis, W. W. Scott, The Technical Press.

4. Experimental Inorganic Chemistry, W.G. Palmer, Cambridge

5. Hand book of Preparative Inorganic Chemistry, Vol I &II, Brauer, Academic Press. 6. Inorganic Synthesis, Mc Graw Hill.

7. Experimental Organic Chemistry,Vol I &II, P. R. Singh, D.S. Gupta and K.S. Bajpai, Tata Mc. Graw. Hill. 8. Laboratoy Manual in Organic Chemistry, R.K. Bansal,Wiley Eastern.

9. Vogel's Textbook of Practical Organic Analysis, B. S. Furniss, A. J. Hannaford, V. Rogers, P. W. G. Smith and A. R. TatchellELBS

10. Experiments in General Chemistry, C.N.R. Rao and U.C. Agarwal, East-West Press

11. Experiments in Physical Chemistry, R. C. D. as and B. Behra, Tata Mc. Graw Hill.

12. Advanced Practical Physical Chemistry, J.B. Yadav, Goel Publishing House.

13. Advanced Experimental Chemistry, Vol I–Physical, J.N. Gurtu and R. Kapoor, S Chand &Co. 14. Selected Experiments in Physical Chemistry, N. G. Mukherjee, J. N. Ghosh &Sons.

15. Experiments in Physical Chemistry, J. C. Ghosh, Bharati Bhawan.

B.Sc.(CHEMISTRY)

THIRD YEAR DETAILED SYALLBUS

PAPER 301

Inorganic Chemistry

Course Outcome (COs): Students will be able to understand and solve the problems of inorganic chemistry through transition metal complex, thermodynamics of metal complexes, magnetic properties, importance of organometallic compound and bioinorganic chemistry.

CO1: To give the knowledge of coordination between metal and ligand and thermo kinetics of transition metal complexes.
CO2: To give the knowledge of metal complex in respect of magnetism and transition spectra.
CO3: To give the knowledge of organometallic compounds for catalyst and synthesis of silicones and Phosphazene compound.
CO4: To give the knowledge of importance of acid and base in synthetic inorganic chemistry and biological importance of transition element.

Unit I

I. Metal-ligand bonding in Transition Metal Complexes 10 hrs Bonding in transition metal compounds, Valence Bond Theory, An elementary idea of crystal-field theory. Crystal field splitting in octahedral, tetrahedral and square planar complexes

II. Thermodynamic and Kinetic Aspects of Metal Complexes 5hrs
A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, stability constants of complexes and their determination, substitution reactions of square planar complexes.

Unit II

III. Magnetic Properties of Transition Metal Complexes 7 hrs
Types of magnetic behaviour, methods of determining magnetic susceptibility, spin- only formula, correlation of μs and μ_{eff} values, orbital contribution to magnetic moment

IV. Electronic spectra of Transition Metal Complexes 7 hrs Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series. Orgel-energy level diagram for d1 and d9 states, discussion of the electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion. **Unit III**

V. Organometallic Chemistry 10hrs

Organometallic Chemistry Definition, nomenclature and classification of organometallic compounds. Preparation, properties, bonding and applications of alkyls and aryls of Al, metal ethylenic complexes.

VI. Silicones and Phosphazenes 4hrs

Silicones and phosphazenes as inorganic polymers: structure and bonding of triphosphazene, Silicones and their uses.

Unit IV

VII. Hard and Soft Acids and Bases (HSAB) 7 hrs

Classification of acids and bases as hard and soft. Pearson's HSAB concept, acid-base strength and hardness and softness. Symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and softness.

VIII. Bioinorganic Chemistry 10hrs

Metal ions present in biological systems, classification of elements according to their action in biological system. Geochemical effect on the distribution of metals. Sodium / K-pump, carbonic anhydrase and carboxypeptidase. Excess and deficiency of some trace metals. Toxicity of metal ions (Hg, Pb, Cd and As), reasons for toxicity, Use of chelating agents in medicine, Cisplatin as an anti-cancer drug.

Book/ References

1. Lee, J.D. Concise Inorganic Chemistry, Pearson Education 2010
2. Huheey, J.E., Keiter, E.A., Keiter, R. L., Medhi, O.K. Inorganic Chemistry, Principles of Structure and Reactivity, Pearson Education 2006.
3. Douglas, B.E. and Mc Daniel, D.H., Concepts & Models of Inorganic Chemistry, Oxford, 1970
4. Shriver, D.D. & P. Atkins, Inorganic Chemistry 2nd Ed., Oxford University Press, 1994.
5. Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications 1962.

B.Sc.(CHEMISTRY)

THIRD YEAR DETAILED

SYALLBUSPAPER302

Organic Chemistry

Course Outcome (COs): Upon successful completion of B.Sc. third year Programme students should be able to understand Spectroscopy, organometallic and organosulphur compounds, Heterocyclic compounds, Carbohydrates, Amino Acids, Peptides, Proteins and Nucleic Acids, Fats, Oils and Detergents, Polymers, Synthetic dyes and Organic Synthesis.

CO1: To give the knowledge of spectroscopic technics to identify the chemical compounds by NMR, UV and IR spectroscopy.
CO2: To give the knowledge of organometallic compounds and its use as a catalyst in chemical synthesis and about synthesis and chemical reactivity of heterocyclic compound.
CO3: To give the knowledge and importance of carbohydrate, amino acid, nucleoid and peptides in our daily life.
CO4: Explanation and knowledge about fats, oils, use of prepared catalyst in synthetic polymers.

60hrs (2hrs/week)

Unit I

(i) Spectroscopy 10hrs

Nuclear magnetic resonance (NMR) spectroscopy: Proton magnetic resonance (^{1}H NMR) spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constants, areas of signals, interpretation of ^{1}H NMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2tribromoethane, ethyl acetate, toluene and acetophenone.

IR Spectroscopy: Fundamental and non-fundamental molecular vibrations; IR absorption positions of O, N and S containing functional groups; Effect of Hbonding, conjugation, resonance and ring size on IR absorptions; Fingerprint region and its significance; application of IR in functional group analysis.

Unit II

(ii) Organometallic Compounds **4 hrs** Organomagnesium compounds: the Grignard reagents-formation, structure and chemical reactions. Organo-zinc compounds: formation and chemical reactions. Organo-lithium compounds: formation and chemical reactions.

(iii) Organosulphur Compounds 4hrs

Nomenclature and structural features. Methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, sulphonamides and sulphaguanidine.

(iv) Heterocyclic Compounds 8hrs

Introduction: Molecular orbital picture and aromatic characteristics of Pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and Pyrrole.

Introduction to condensed five and six- membered heterocycles. Preparation and reactions of indole, quinoline and isoquinoline with special reference to Fisher indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis. Mechanism of electrophilic substitution reactions of indole, quinoline and isoquinoline.

Unit III

(v) Carbohydrates 8hrs

Classification and nomenclature. Monosaccharaides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erythro and threodiastereomers. Conversion of glucose into mannose. Formation of glycosides, ethers and esters. Determination of ring size of monsaccharides. Cyclic structure of D(+)-glucose. Mechanism of mutarotation.

Structure of ribose and deoxyribose. An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.

(vi) Amino Acids, Peptides, Proteins and Nucleic Acids 6 hrs

Classification, structure and stereochemistry of amino acids, Acid-base behaviour, isoelectric point and electrophoresis. Preparation using HellVolhard-Zeliensky reaction, Streker synthesis, amidomalonate synthesis, biosynthesis. Resolution of R and S amino acids, Reactions of α-amino acids.

Structure and nomenclature of peptides and proteins. Classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical peptide synthesis, solid-phase peptide synthesis. Levels of protein structure. Protein denaturation/renaturation. Nucleic acids: Introduction. Constituents of nucleic acids. Ribonucleosides and ribonucleotides. The double helical structure of DNA.

Unit IV

(vii) Fats, Oils and Detergents 2hrs

Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils, Saponification value, iodine value, and acid value, Soaps, synthetic detergents, alkyl and aryl sulphonates, Phospholipids and essential oils.

(viii) Synthetic Polymers 4hrs

Addition or chain-growth polymerization. Free radical vinyl polymerization, ionic vinyl polymerization, Ziegler-Natta polymerization and vinyl polymers. Condensation or step growth polymerization. Copolymers, polyesters, polyamides, phenol formaldehyde resins, urea formaldehyde resins, epoxy resins and polyurethanes, Natural and synthetic rubbers, Biodegradable polymers.

(ix) Synthetic Dyes 8hrs

Relationship between colour and constitution (electronic concept), Classification of dyes, Chemistry and synthesis of representative dyes:

(i) Azo dyes: Methyl orange, Congo red.

(ii) Triphenylmethane dyes: Malachite green, Crystal violet (iii)

Phenolphthalein and xanthene dyes: Phenolphthalein, Fluorescein

(iv) Niro and nitroso dyes: Martius yellow, Fast green O

(v) Antraquinone dye: Alizarin

(vi) Indigo dye: Indigo

(vii) Fluorescent brightening agents: Synthesis of Blankophor-R and Blankophor-WT

X. Organic Synthesis via Enolates 6 hrs

Acidity of α-hydrogens, alkylation of diethyl malonate and ethyl Aceto acetate. Synthesis of ethyl acetoacetate: the Claisen condensation. Ketoenol tautomerism of ethyl acetoacetate.

Alkylation of 1, 3-dithianes. Alkylation and acylation of enamines.

Book/ Reference

1. Singh J., Yadav L.D.S., Advanced Organic Chemistry, Pragati Edition
2. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Carey, F. A., Guiliano, R. M.Organic Chemistry, Eighth edition, McGraw Hill Education, 2012.
4. Loudon, G. M. Organic Chemistry, Fourth edition, Oxford University Press, 2008.
5. Clayden, J., Greeves, N. &Warren, S. Organic Chemistry, 2 nd edition, Oxford University Press, 2012.
6. Graham Solomons, T.W., Fryhle, C. B. Organic Chemistry, John Wiley & Sons, Inc.
7. Sykes, P. A guidebook to Mechanism in Organic Chemistry, Pearson

Education, 2003
8. Francis, P. G. Mathematics for Chemists, Springer, 1984.

B.Sc.(CHEMISTRY)

THIRD YEAR DETAILED

SYALLBUSPAPER303

Physical Chemistry

Course Outcome (COs): After completion of B.Sc. third year programme students should be able to understand Quantum Mechanics, Rotational and Vibration spectrum, Physical Properties and Molecular Structure Gaseous States, Photochemistry, Solutions, Dilute Solutions and Colligative Properties, Solid state, Chemical Kinetics and Catalysis.
CO1: Explanation and brief details of quantum mechanics in molecules.
CO2: To give the knowledge spectroscopic technics to confirm the chemical structure of compounds.
CO3: Explanation of molecular structure and photochemistry.
CO4: Explanation and knowledge about postulates of solutions, Dilute Solutions and Colligative Properties.

Unit I

(i) Elementary Quantum Mechanics 15 hrs

Black-body radiation, Planck's radiation law, photoelectric effect, heat capacity of solids, Bohr's model of hydrogen atom (no derivation) and its defects, Compton effect. De Broglie hypothesis, the Heisenberg's uncertainty principle, Sinusoidal wave equation, Hamiltonian operator, Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a one dimensional box, Schrodinger wave equation for H-atom, separation into three equations (without derivation), quantum numbers and their importance, hydrogen like wave functions, radial wave functions, angular wave functions.

Unit II

(ii) Spectroscopy 15hrs

Introduction: Electromagnetic radiation, regions of the spectrum, basic features of different spectrometers, statement of the Born-Oppenheimer approximation, degrees of freedom.

Rotational Spectrum

Diatomic molecules. Energy levels of a rigid rotor (semi-classical principles), selection rules, spectral intensity, distribution using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotor, isotope effect.

Vibrational Spectrum

Infrared Spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups.

Raman spectrum: Concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules.

Electronic Spectrum

Concept of potential energy curves for bonding and anti-bonding molecular orbitals, qualitative description of selection rules and Franck-Condon principle.

Qualitative description of σ, π and η MO, their energy levels and the respective transition.

Unit III

(iii) Physical Properties and Molecular Structure 7.5 hrs

Optical activity, polarization–(Clausius-Mossotti equation), orientation of dipole sin an electric field, dipole moment, induced dipole moment, measurement of dipole moment-temperature method and refractivity method, dipole moment and structure of molecules, magnetic properties-paramagnetism, diamagnetism and ferromagnetism, Magnetic susceptibility, its measurements and its importance.

(iv) Photochemistry 7.5hrs

Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry: Grothus-Dropper law, Stark -Einstein law. Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-

radiative processes (internal conversion, intersystem crossing), quantum yield, photosensitized reactions - energy transfer processes (simple examples).

Unit IV

(v) Solutions, Dilute Solutions and Colligative Properties 15hrs

Thermodynamics of ideal solution and Raoult's law, deviations from Raoult's law – non- ideal solutions. Partial miscibility of liquids: Critical solution temperature; Nernst distribution law and its applications, Ideal and non-ideal solutions, methods of expressing concentrations of solutions, activity and activity coefficient, Problems.

Dilute solution, Colligative properties, relative lowering of vapour pressure, law of osmotic pressure and its measurement, Elevation of boiling point and depression of freezing point.

Book/Reading Reference: 1. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry Ed., Oxford University Press 13 (2006).
2. Ball, D. W. Physical Chemistry Thomson Press, India (2007).
3. Castellan, G. W. Physical Chemistry 4th Ed. Narosa (2004).
4. Cotton, F.A, Wilkinson, G and Gaus, P. L., Basic Inorganic Chemistry,3rd Edition ,Wiley 1995
5. Lee, J.D, Concise Inorganic Chemistry 4th Edition ELBS,1977
6. Douglas, B, McDaniel ,D and Alexander, J ,Concepts of Models of Inorganic Chemistry, John Wiley & Sons;
3rd edition, 1994
7. Shriver, D. E. Atkins, P.W. and Langford, C. H. , Inorganic Chemistry ,Oxford University Press, 1994.
8. Porterfield, W.W, Inorganic Chemistry, Addison Wesley 1984.
9. Sharpe,A .G, Inorganic Chemistry, ELBS,3 RD edition ,1993
10. Miessler, G.L, Tarr, D.A, Inorganic Chemistry, 2nd edition, Prentice Hall, 2001

B.Sc.(CHEMISTRY)

THIRD YEAR DETAILED

SYALLBUS PAPER 304

PRACTICAL

The duration of practical examination will be of six hours. MM =50

Distribution of marks: One inorganic experiment of 10 marks, one instrumentation experiment of 10 marks, one organic experiment of 10 marks and one physical experiment of 10marks will be given in the annual practical examination. 5 marks are for record and 5 marks are for viva.

Course Outcome (COs): After completion of B.Sc. third year Programme students should be able to understand experiment of inorganic, organic and physical chemistry to predict the unknown compound and salts.
CO1: Explanation and brief details of synthesis of metal complexes.
CO2: To give the knowledge titration by calorimetric, solvent and extraction method. **CO3:** Quantitative experiment of organic compounds.

Inorganic Chemistry

Synthesis and Analysis

a. Preparation of sodium trioxalatoferrate(III), $Na_3[Fe(C_2O_4)_3]$ and determination of its composition by permanganometry
b. Preparation of Ni-dmg complex,$[Ni(dmg)_2]$
c. Preparation of copper tetra ammine complex.$[(Cu(NH_3)_4]SO_4$
d. Preparation of *cis*- and *trans*-bisoxalato di aquo chromate(III)ion.

Instrumentation

Colorimetry

(a) Job's method (b) Mole-ratio method
(c) Adulteration of food stuffs (d) Effluent analysis, water analysis

Solvent Extraction

Separation and estimation of Mg(II) and Fe(II)

Ion Exchange Method

Separation and estimation of Mg(II) and Zn(II)

Organic Chemistry

Qualitative Analysis

Analysis of an organic mixture containing two solid components using water, $NaHCO_3$, NaOH for separation and preparation of suitable derivatives

Synthesis of Organic Compounds

(a) Acetylation of salicylic acid, aniline, glucose and hydroquinone.
Benzoylation of aniline and phenol

(b) Aliphatic electrophilic substitution
Preparation of iodo form from ethanol and acetone

(c) Aromatic electrophilic substitution Nitration
Preparation of m-dinitrobenzene Preparation of p-nitro acetanilide
Halogenation
Preparation of p-bromo acetanilide Preparation of 2,4,6-tribromophenol

(d) Diazotization/coupling
Preparation of methyl orange and methyl red

(e) Oxidation
Preparation of benzoic acid from toluene

(f) Reduction
Preparation of aniline from nitrobenzene Preparation of m-nitro aniline from m-dinitrobenzene

Laboratory Techniques

Steam Distillation

Naphthalene from its suspension in water Clove oil from cloves
Separation of *o*- and *p*-nitrophenol **Column Chromatography**

Separation of fluorescein and methylene blue Separation of leaf pigments from spinach leaves Resolution of racemic mixture of (±) mandelic acid

Stereo-chemical Study of Organic Compounds via Models

R and S configuration of optical isomers
E, Z configuration of geometrical isomers
Co formational analysis of cyclo hexanes and substituted cyclohexane's

Physical Chemistry Electro-chemistry

1. To determine the strength of the given acid conductometrically using standard alkali solution
2. To determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically
3. To study the saponification of ethyl acetate condutometrically.
4. To determine the ionization constant of a weak acid condutometrically.
5. To titrate potentiometrically the given ferrous ammonium sulphate solution using

$KMnO_4/K_2Cr_2O_7$ as titrant and calculate the redox potential of Fe^{2+}/Fe^{3+}system on the hydrogen scale

Refractrometry, Polarimetry

1. To verify law of refraction of mixtures (e.g. of glycerol and water)using Abbe's refractometer
2. To determine the specific rotation of a given optically active compound
3. To determine stoichiometry and stability constant of complexes

Molecular Weight Determination

1. Determination of molecular weight of a non-volatile solute by Rast method/ Beckmann freezing point method
2. Determination of the apparent degree of dissociation of an electrolyte (e.g. NaCl) in aqueous solution at different concentrations by ebullioscopy

Colorimetry

To verify Beer-Lambert law for $KMnO_4/K_2Cr_2O_7$ and determine the concentration of the given solution of the substance from absorbance measurement

Books Suggested for Practical/Laboratory Courses

1. Vogel'sQualitativeInorganicAnalysis,revised,Svehla,Orient Longman.

2. Vogel'sTextbookofQuantitativeInorganicAnalysis,revised,JBassett,RC Denney, GH Jeffery and J Mendham, ELBS

3. Standard Methods of Chemical Analysis, WW Scott, The Technical Press

4. Experimental Inorganic Chemistry, WG Palmer, Cambridge

5. Hand book of Preparative Inorganic Chemistry, VolI & II, Brauer, Academic Press

6. Inorganic Synthesis, McGraw Hill

7.ExperimentalOrganicChemistry,VolI&II,PRSingh,DSGuptaandKSBajpai,Tata McGraw Hill

8. Laboratoy Manualin Organic Chemistry, RK Bansal, Wiley Eastern

9. Vogel'sTextbookofPracticalOrganicAnalysis,BSFurniss,AJHannaford,V Rogers, PWG Smith and AR Tatchell, ELBS

10. Experiments in General Chemistry, CNR Rao and UC Agarwal, East-West Press

11. Experiments in Physical Chemistry, RC Das and B Behra, Tata McGraw Hill

12. Advanced Practical Physical Chemistry, JB Yadav, Goel Publishing House

13. Advanced Experimental Chemistry, VolI–Physical, JN Gurtu and R Kapoor, S chand &Co.

14. Selected Experiments in Physical Chemistry, NG Mukherjee, JN Ghosh & Sons

15. Experiments in Physical Chemistry, JC Ghosh, Bharati Bhawan.