

UNIVERSITY OF POONCH RAWALAKOT  
DEPARTMENT OF CHEMISTRY

**SCHEME OF STUDY FOR BS (1<sup>st</sup>,3<sup>rd</sup>,5<sup>th</sup> and 7<sup>th</sup> SEMESTERS)**

**Course Contents of BS (1<sup>st</sup> semester)**

Semester	Course Code	Course Title	Credit Hrs.	Category
1 <sup>st</sup>	GEN-3101	Functional English	3(3-0)	General
	GEN-3102	Environmental Science	3(2-1)	General
	GEN-3103	Quantitative Reasoning –I	3(3-0)	General
	BOT-3104	Introduction to Plant Sciences	3(2-1)	Interdisciplinary
	ZOO-3105	Principles of Animal Life-I	3(2-1)	Interdisciplinary
	<b>Semester Total Credit Hours</b>			<b>15</b>

**COURSE CONTENTS**

**GEN: 3101**

**Functional English**

**Credit Hrs: 3(3-0)**

**Course Objectives:** The course is developed to enhance the language skills and critical thinking of students by

- Enabling them to correct use of grammar and language structures
- Enabling them to communicate effectively

**Course Contents:**

Grammar:

- Basics of grammar
- Parts of speech and their use in communication
- Sentence structure
- Correct use of Tenses
- Active and passive voice
- Practice in unified sentences (unity and coherence)
- Analysis of Phrase, Clause and sentence structures
- Transitive and Intransitive Verbs
- Punctuation and Spellings

Reading skills:

- Comprehension skills
- Literal understanding of text, reading between lines (interpret text), reading beyond lines ( to assimilate, integrate knowledge)
- Answers to the questions on a given text

Discussion:

- General topics and everyday conversation (topics for discussion to be at the discretion of the teacher keeping in view the level of the students)
- Introducing ourselves, describing things, recounting past events, agreeing and disagreeing, compare and contrast

Listening:

- To be improved by showing documentaries/ films carefully selected by subject teacher
- Listening and note taking

Translation Skills:

- Urdu to English

Writing Skills:

- Paragraph Writing  
Basic structure of paragraph and guidelines for writing an effective paragraph

Speaking Skills:

- Presentation Skills
- Introduction (types of presentation, structure of presentation)
- Prepared and unprepared talks

*Note: Extensive reading is required for vocabulary building*

**Recommended Books:**

1. **Functional English**

a) Grammar

1. Practical English Grammar by A. J. Thomson and A. V. Martinet. Exercises 1. Third edition. Oxford University Press. 1997. ISBN 0194313492
2. Practical English Grammar by A. J. Thomson and A. V. Martinet. Exercises 2. Third edition. Oxford University Press. 1997. ISBN 0194313506

b) Writing

1. Writing. Intermediate by Marie-Christine Boutin, Suzanne Brinand and Françoise Grellet. Oxford Supplementary Skills. Fourth Impression 1993. ISBN 0 19 435405 7 Pages 20-27 and 35-41.

c) Reading/Comprehension

1. Reading. Upper Intermediate. Brain Tomlinson and Rod Ellis. Oxford Supplementary Skills. Third Impression 1992. ISBN 0 19 453402 2.
- d) Speaking
- 1) Ellen, K. 2002. Maximize Your Presentation Skills: How to Speak, Look and Act on Your Way to the Top
  - 2) Hargie, O. (ed.) Hand book of Communications Skills
  - 3) Mandel, S. 2000. Effective Presentation Skills: A Practical Guide Better Speaking
  - 4) Mark, P. 1996. Presenting in English. Language Teaching Publications

**GEN-3102 Environmental Science**

**Credit Hrs: 3 (2-1)**

**Objectives:**

- ❖ To understand and provide updated knowledge of environmental problems
- ❖ To provide a basic introduction sustainable environmental management.

**Course Contents**

**Unit I.** The human environment, the litho, bio and hydrospheres, the nature and composition of natural waters,

**Unit II.** Pollution: definition, classification and impact on habitats

- i. Air pollution: Sources and effect of various pollutants (inorganic, organic), control, remediation. Photochemical smog. Smog. Acid rain: 1. Theory of acid rain, 2. Adverse effects of acid rains. Chlorofluorocarbons and its effects.
- ii. Water pollution: Major sources of water pollution its impact. Prevention, control remediation, Heavy metal pollution. Tanneries. Hospital waste. Treatments of sewage, sludge, and polluted waters.
- iii. Soil pollution: major sources of soil pollution and its impact. Prevention, control remediation.
- iv. Noise pollution.

**Unit III.** Ozone layer:

- i. Formation
- ii. Mechanism of depletion
- iii. Effects of ozone depletion

**Unit VI.** Greenhouse effect: causes, impacts.

**Practical:**

Examination of water for

- i. Total dissolved solids.
- ii. pH and Conductance.
- iii. Alkalinity.
- iv. Hardness of water
- v. Determination of phosphates and sulphates

**Recommended Books:**

1. Newman, E.I. 2001. Applied Ecology. Blackwell Science. UK
2. Mooney, H.A. and Saugier, B. 2000. Terrestrial Global Productivity. Academic Press, UK.
3. Eugene, E.D. and Smith, B.F. 2000. Environmental Science: A study of interrelationships. McGraw Hill. USA.
4. French, H. 2000. Vanishing Borders: Protecting the Planet in the Age of Globalization. W.W. Norton and Company, NY.
5. Hall, C.A.S. and Perez, C.L. 2000. Quantifying Sustainable Development. Academic Press, UK.
6. Bazzaz, F.A. 2004. Plants in changing environments: Linking physiological, population, and community ecology. Cambridge Univ. Press.
7. Bush, M.B. 1997. Ecology of a changing planet. Prentice Hall, UK.
8. Marsh, M.W. and Grossa Jr., J.M. 1996 Environmental geography: Science, land use, and earth systems. John Wiley and Sons.
9. Lambers, H., T. L. Pons and F. Stuart. 2008. Plant Physiological Ecology

**GEN-3103**

**Quantitative Reasoning-I**

**Credit Hrs: 3(3-0)**

**Objectives:** Students will get familiarized with the importance of quantitative reasoning skills in the modern age.

**Course Contents:**

**1. Numerical Literacy**

- Number system and basic arithmetic operations;
- Units and their conversions, dimensions, area, perimeter and volume;
- Rates, ratios, proportions and percentages;
- Types and sources of data;
- Measurement scales;
- Tabular and graphical presentation of data;
- Quantitative reasoning exercises using number knowledge.

**2. Fundamental Mathematical Concepts**

- Basics of geometry (lines, angles, circles, polygons etc.);
- Sets and their operations;
- Relations, functions, and their graphs;
- Exponents, factoring and simplifying algebraic expressions;
- Algebraic and graphical solutions of linear and quadratic equations and inequalities;
- Quantitative reasoning exercises using fundamental mathematical concepts.

**3. Fundamental Statistical Concepts**

- Population and sample;
- Measures of central tendency, dispersion and data interpretation;
- Rules of counting (multiplicative, permutation and combination);
- Basic probability theory;
- Introduction to random variables and their probability distributions;
- Quantitative reasoning exercises using fundamental statistical concepts.

**Recommended Books:**

1. "Quantitative Reasoning: Tools for Today's Informed Citizen" by Bernard L. Madison, Lynn and Arthur Steen.
2. "Quantitative Reasoning for the Information Age" by Bernard L. Madison and David M. Bressoud.
3. "Fundamentals of Mathematics" by Wade Ellis.
4. "Quantitative Reasoning: Thinking in Numbers" by Eric Zaslow.
5. "Thinking Clearly with Data: A Guide to Quantitative Reasoning and Analysis" by Ethan Bueno de Mesquita and Anthony Fowler.
6. "Using and Understanding Mathematics: A Quantitative Reasoning Approach" by Bennett, J. O., Briggs, W. L., & Badalamenti, A.
7. "Discrete Mathematics and its Applications" by Kenneth H. Rosen.
8. "Statistics for Technology: A Course in Applied Statistics" by Chatfield, C.
9. "Statistics: Unlocking the Power of Data" by Robin H. Lock, Patti Frazer Lock, Kari Lock Morgan, and Eric F. Lock.

**BOT-3104**  
**Objectives**

**Introduction to Plant Sciences**

**Credit Hrs: 3(2-1)**

To help participants understand basic plant science fundamentals through a variety of hands-on activities and resources.

**Course Contents**

- 1. History and the importance of plant sciences.** Scope of plant sciences. Renewable and non-renewable resources. Traditional uses and potentials: sources of food (cereals, legumes, root and tuber crops, vegetable crops, fruits), drug discovery and medicinal plants.
- 2. Plants and SDGs:** The need for a focus on plant, SDG 1 No poverty (Use of plant to end poverty), SDG 2 Zero hunger (Role of plants to end hunger, achieve food security and improved nutrition and promote sustainable agriculture, SDG 3 Good health and well-beings (use of plants to ensure healthy life and promote well-being), SDG 13 Climate action (Role of plants to combat climate change and its impacts), SDG 15 Life on land (Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification and halt and reverse land degradation and halt biodiversity loss).

**Practical**

1. Identify local ethnobotanically useful species.
2. Survey of medicinally important plants and their products
3. Medicinal plant description and processing
4. Preparation of decoctions, syrups, ointments, and dried plants for domestic medicinal use
5. Field exercises on medicinal plant specimen collection, documentation, storage and gardening

**Recommended Readings**

1. Simpson B., Ogorzaly M. (2000). Economic Botany: Plants in our world. McGraw-Hill Education.
2. Plant Science: Growth, Development, and Utilization of Cultivated Plants, 4th edition (McMahon et al., 2007).

3. Sharrock, S., & Jackson, P. W. (2016). Plant Conservation and the Sustainable Development Goals. Global Partnership for Plant Conservation. Missouri: Botanical Gardens Conservation International.
4. Odum, E. P. Fundamentals of Ecology. 3<sup>rd</sup> Edition. 1994. W.B. Saunders. Philadelphia.

**ZOO-3105**

**Principles of Animal life-I**

**Credit Hrs: 3(2-1)**

### **Objectives**

The course aims to impart knowledge and understanding of:

1. The concept and status of Zoology in life sciences.
2. The common processes of life through their chemistry, biochemical and molecular processes.

### **Course Contents**

#### **1. Scope of Zoology:**

- a) Introduction.
- b) Significance and applications of zoology
- c) Animal diversity.
- d) The scientific method.
- e) Environment and world resources.

#### **2. Chemical Basis of Animal Life:**

Brief introduction to bio molecules.

- a) Carbohydrates, b) lipids, proteins, c) nucleic acids.

#### **3. Cellular Organization:**

- a) Structure of animal cells,
- b) cell membrane,
- c) cytoplasm and its organelles:  
ribosomes, endoplasmic reticulum, Golgi apparatus, lysosomes, mitochondria, cytoskeleton, cilia and flagella, centrioles and microtubules, vacuoles; ribosomes, endoplasmic reticulum, the nucleus: nuclear envelope, chromosomes and nucleolus.

#### **4. Animal tissues:**

- a) Types: epithelial, connective, muscle and nervous tissue.
- b) organs and organ systems.



## **5. Enzymes:**

a) Structure, b) types; c) function and factors affecting their activity; d) cofactors and coenzymes.

## **6. Energy Harvesting:**

a) Aerobic and anaerobic respiration: glycolysis, citric acid Cycle and electron transport chain; fermentation, the major source of ATP.

## **7. Reproduction and Development:**

a) Types; asexual and sexual,

b) gamete to genesis, fertilization, metamorphosis, zygote and early development.

## **8. Ecological Concepts:**

a) Individuals and Populations: Animals and their abiotic environment; populations and limiting factors.

b) Communities and Ecosystems: Community structure and diversity; interspecific interactions. Ecosystem, types, homeostasis, biomes, food chain, food web, energy flow and thermodynamics; biogeochemical cycles.

c) Ecological problems; human population growth, pollution, resource depletion and biodiversity.

## **Practical**

1. Tests for different carbohydrates, proteins and lipids.

Note: Emphasis on the concept that test materials have been ultimately obtained from living organisms and constituted their body.

2. Study of the prepared slides of epithelial tissue (squamous, cuboidal, columnar), connective tissue (adipose, cartilage, bone, blood), nervous tissue and muscle tissue (skeletal, smooth and cardiac).

Note: Prepared microscopic and/or projection slides and/or CD ROM computer projections must be used.

3. Preparation of blood smears.

4. Plasmolysis and deplasmolysis in blood.

5. Protein digestion by pepsin.

6. Ecological notes on animals of a few model habitats.

7. Field observation and report writing on animals in their ecosystem (a terrestrial and aquatic ecosystem study).

### **Recommended Books**

1. Hickman, C.P., Roberts, L.S., Keen L.S., Larson, A., l'Anson, H. and Eisenhour, D.J., Integrated Principles of Zoology, 14<sup>th</sup> Edition (International), 2004. Singapore: McGraw Hill.
2. Miller, S.A. and Harley, J.B. Zoology, 10th Edition (International), 2016. Singapore: McGraw Hill.
3. Campbell, N.A. Biology, 6 th Edition. 2002. Menlo Park, California: Benjamin/Cummings Publishing Company, Inc.
4. Miller, S.A. General Zoology Laboratory Manual. 7th Edition (International), 2013. New York: McGraw Hill.
5. Hickman, C.P. and Kats, H.L., Laboratory Studies in Integrated Principles of Zoology. 2000. Singapore: McGraw Hill.
6. Molles, M.C. Ecology: Concepts and Applications. 9th Edition. 2022. McGraw Hill, New York, USA.



# UNIVERSITY OF POONCH RAWALAKOT

AZAD JAMMU AND KASHMIR

## Scheme of study for BS 3rd-Semester (Chemistry)

### Semester-III

Course Code	Course Title	Credit hours.
CHM-4301	Physical Chemistry	3(2-1)
CHM-4302	Analytical Chemistry	3(2-1)
PKS-4303	Pakistan Studies	2(2-0)
ENG-4304	English-III (Report writing)	3(3-0)
BOT-4305	Botany-III	3(2-1)
ZOO-4306	Animal Diversity-1	3(2-1)
	<b>Total</b>	17

### **Quantum theory and structure of atom**

Bohr's atomic model, defects of Bohr's atomic model, classical mechanics, failure of classical mechanics, quantum mechanics, dual nature of matter, de-Broglie's equation, Heisenberg's uncertainty principle, limitation of Heisenberg's uncertainty principle, concept of atomic orbitals, quantum numbers, Pauli exclusion principle, electronic distribution of elements.

### **Physical states of matter**

#### **Gases**

General characteristics of gases, Gay Lussac's law, ideal gas equation, kinetic molecular theory of gases, molecular velocities (average velocity, mean square velocity, root mean square velocity, most probable velocity), ideal and real gases, deviation of gas from ideality, derivation of kinetic gas equation, molecular collisions, collision diameter, critical phenomenon of gases, liquefaction of gases, mean free path, Vander Waal's equation for real gases.

#### **Liquid**

General characteristics of liquids, physical properties like surface tension, viscosity, parachor value, rheochor value and their applications, refractive index, specific and molar refraction and their applications, optical activity, specific rotation, dipole moment and molecular structure.

#### **Solids**

General characteristics of solids, types of solids, isotropy and anisotropy, habit of a crystal, crystal lattice and unit cell, crystal systems and Bravis lattices.

### **Chemical Thermodynamics**

Introduction, thermodynamic terms like system, surrounding, boundary of system, states and state function, internal energy, extensive and intensive properties, first law of thermodynamics, enthalpy of a system, relationship between free energy change and enthalpy change, heat capacity of gases at constant volume and at constant pressure, heat capacities relationship, 2<sup>nd</sup> law of thermodynamics, change in free energy and equilibrium constant.

### **Chemical Kinetics**

Introduction, concept of rate of chemical reaction, rate law, velocity constant, elementary and complex reaction, order and molecularity of reaction, zero, first and second order reactions, derivation of kinetic equation for first order and 2<sup>nd</sup> order reaction when initial concentration of both reactants is same, various methods for determining the rate of chemical reaction, Arrhenius equation, Lindemann's theory for unimolecular reaction, introduction to transition state theory, transition state theory for bimolecular reaction.

### **Basic Electrochemistry**

Introduction, conductors and insulators, electrolytic and electronic conduction, specific conductance, measurement of specific conductance, cell constant and its determination, Ostwald's dilution law (dependence of degree of dissociation constant on dilution), electrochemical cells, types of cells, EMF and its measurement.

### **Solutions**

Introduction, types of solution, concentration units, ideal and non-ideal solutions, Raoult's law, molecular interactions in solution, colligative properties (lowering of vapour pressure, elevation of

boiling point, depression of freezing point, osmotic pressure and their determination), concept of zeotropic and azeotropic mixture.

### **Surface Chemistry**

Absorption and adsorption, types of adsorption, characteristics and factors which affect adsorption, applications of adsorption, catalysis, types of catalysis, enzyme catalysis, characteristics of catalysis.

### **Books Recommended**

Alberty, R.A and Silbey, R.J., "*Physical Chemistry*" John Wiley, New York, 1995.

Atkins, P.W, "*Physical Chemistry*" 5<sup>th</sup> Ed., W.H. Freeman & Company, New York, 1994.

Barrow, G. M. "*Physical chemistry*" McGraw Hill, Singapore, 1988.

### **Practicals:**

Determination of viscosity and parachor values of liquids.

Determination of percent composition of liquid solutions viscometrically.

Determination of refractive index and molar refractivity.

Determination of percent composition of liquid solutions by refractive index measurements.

Determination of molecular weight of a compound by elevation of boiling point (ebullioscopic method).

Determination of molecular weight of a compound by lowering of freezing point (cryoscopic method).

Determination of heat of solution by solubility method.

Determination of heat of neutralization of an acid with a base.

### **Books Recommended**

Daniel, F. and et al, "*Experimental physical chemistry*" New York McGraw Hill, New York.

Findlay, A. and Kitchner, J.A, "*Practical physical Chemistry*" Longman, Green and Co, 1976.

Shoemaker, D.P. and Garland, C., *Experiments in physical chemistry*, McGraw Hill, New York.

## **CHM-4302 Analytical Chemistry**

**3(2-1)**

Introduction to Analytical Chemistry; Precision, Accuracy, Signal-to-noise ratio, Limits of detection, Errors; Measuring apparatus, Sampling; Expression of quantities and concentrations (Molarity, Normality, Molality, ppm and ppt solutions, percent solutions (w/v, v/w, w/w and v/v) and use of primary and secondary standards; Basic approach to equilibrium. Acid-base, complexometric and redox titrations, gravimetric analysis.

### **Suggested Readings**

"Fundamentals of Analytical Chemistry" by Skoog, West, Holler and Crouch.

"Analytical Chemistry: An Introduction" by Gary Holmes and Laurie D. D. Kasper. "Principles of Instrumental Analysis" by Douglas A.

### **Practicals**

- Calibration of glassware (pipette, burette and flask) used for volumetric analysis.
- Use of analytical balance and calculation of standard deviation.
- Constructing a calibration curve from a given analytical data using spread sheet software,
- Calculation of variance, mean, median, coefficient of variance of the data.
- Determination of hardness of water using EDTA

- Determination of chloride in water sample

**RECOMMENDED BOOKS:**

Vogels, s Text Book of Quantitative Inorganic Analysis by J. Bassett. 4<sup>th</sup> Ed., The English Language Book Society and Longman. 1978.



UNIVERSITY OF POONCH RAWALAKOT

AZAD JAMMU AND KASHMIR

**Scheme of study for BS 5<sup>th</sup> Semester (Chemistry)**

**Semester-V**

Course Code	Course Title	Cr.Hrs.
CHM5501	Physical Chemistry-I	4(3-1)
CHM-5502	Organic Chemistry-I	4(3-1)
CHM-5503	Inorganic Chemistry-I	4(3-1)
CHM-5504	Biochemistry-I	4(3-1)
	<b>Total</b>	<b>16</b>

**1. Chemical Kinetics**

Brief reference to the first and second order rate law, details of third order rate law, half life period and order of reaction, measurement of the rate of chemical reaction, factors effecting the rate of chemical reaction, Arrhenius theory, theories of reaction rates for unimolecular, bimolecular and termolecular reactions, transition state theories, comparison of collision and transition state theories, Complex reactions.

**2. Chemical Thermodynamics**

First law of thermodynamics, reversibility and maximum work, enthalpy, heat capacity. Joule Thomson effect, effect of temperature on change in enthalpy (Clausius-Claperon equation), second law of thermodynamics, entropy and its calculations, dependence of free energy on pressure and temperature, free energy relationship with equilibrium constant for chemical reactions and other thermodynamic functions, third law of thermodynamics, unattainability of absolute zero of temperature.

**3. Kinetic Theory of Gases**

Ideal and real gases, equations of state for real gases (Beatte-Bridgeman and Varial equation), Maxwell law of molecular velocities, calculations of molecular velocities, Maxwell and Boltzman law of energy distribution, molecular collisions, viscosity of gases and distribution.

**4. Molecular Spectroscopy**

Introduction to spectral Terms, Rotational, vibrational, Electronic Spectroscopy.

**Books Recommended**

1. Alberty, R.A and Silbey, R.J., "*Physical Chemistry*" John Wiley, New York, 1995.
2. Atkins, P.W, "*Physical Chemistry*" 5<sup>th</sup> Ed., W.H. Freeman & Company, New York, 1994.
3. Barrow, G. M. "*Physical chemistry*" McGraw Hill, Singapore, 1988.
4. Klotz, I.M, "*Chemical Thermodynamics*" 3<sup>rd</sup> Ed., W.A. Benjamin Inc., California, 1972.
5. pitzer, K.S, "*Thermodynamics*" 3<sup>rd</sup> Ed., McGraw-Hill, New York, 1995.
6. Latham, J.L. & Burgess, A.E, "*Elementary Reaction Kinetics*" 3<sup>rd</sup> Ed., Butterworths,London, 1977.

**Physical Chemistry Lab-I****Refractometry**

1. To find out the refractive index of the given liquid and also find its molecular refractivity.
2. To calculate the composition of the liquid C which is a mixture of liquids A and B.

**Polarimetry**

1. To find out the specific and molecular rotation of the cane sugar polarimetrically.
2. Determination of concentration of optically active substances in solutions.

**Colorimetry**

1. To verify Beer's Law for solution of KMnO<sub>4</sub> or K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> using colorimeter.
2. Determine the concentration of unknown solution by using colorimeter.

**Books Recommended**

1. Daniel, F. and et al, "*Experimental physical chemistry*" New York McGraw Hill, New York.
2. Findlay, A.and Kitchner, J.A, "*Practical physical Chemistry*" Longman, Green and Co, 1976.
3. Shoemaker, D.P. and Garland, C., Experiments in physical chemistry, McGraw Hill, New York.



- 1) IUPAC Nomenclature
- 2) Basic concepts of organic chemistry: Atomic orbitals; hybrid orbitals and bonds; organic structures; inductive effect; resonance; mesomerism; hyperconjugation; hydrogen bonding; aromaticity.
- 3) Acids and Bases: concept of weak acids and bases; organic acids and bases; scale of acidity and basicity; pKa values; effect of resonance, induction, electrostatic, steric and hydrogen bonding on strength of acids and bases; linear free energy relationships- Hammett, and Taft equations.
- 4) Organic chemical reactions and their mechanistic classification.  
Brief and Introductory description of:  
Substitution Reaction: Free radical, Electrophilic, and Nucleophilic substitution reactions  
Addition Reactions: Addition to C-C multiple bonds, C-O double bonds  
Elimination Reaction: E1 and E2 reactions
- 5) Basics of stereochemistry: structure; chirality; enantiomers, optical activity; R/S-convention of configuration; racemic mixture and their resolution.

### Suggested Readings

1. Handrickson, J. B., Cram, D.J. and Hammond, G.S., *Organic Chemistry*, 3<sup>rd</sup> Ed, MacGraw-Hill, Tokyo, 1970.
2. Morrison, R.T., and Boyd, R.N., *Organic Chemistry*, 6<sup>th</sup> Ed. Prentice Hall, Englewood Cliffs, New Jersey, 1992.
3. March, J., *Advanced Organic Chemistry*, 4<sup>th</sup> Ed., John Wiley & Sons, New York, 1992.
4. Finar, I.L., *Organic Chemistry*, 6<sup>th</sup> Ed., Vol. 1 & 2, Longman, London, 1973.

### Organic Chemistry Laboratory-I

- a) Functional Group Analysis of organic compounds.
- b) Analysis of three component mixtures by solubility methods. (5 mixtures at least)
- c) Introduction to basic lab techniques: distillations; recrystallization; solvent extraction; chromatography (PC, TLC).

### Suggested Readings

1. Furniss, B.S., Hannaford, A.J., Smith, P.N.G., & Taldull, A.R., *Vogel's Textbook of Practical Organic Chemistry*, 5<sup>th</sup> Ed., Longman Scientific & Technical, London, 1989.
2. Adams, R., Johnson, J.R., & Wilcox Jr., *Laboratory Experiments in Organic Chemistry*, 6<sup>th</sup> Ed., Collier-Macmillan, London, 1970.

**CHM-5503 Inorganic Chemistry-I****4(3-1)****1. Theories of Covalent Bonding (Structure of Molecules)**

A brief history of concept of chemical bond. Nature and types of chemical bonding, Lewis concepts, ionic, covalent, coordinate covalent bond. VSEPR model followed by VB theory (Hybridization and Resonance concept) to explain the structure of molecules of various types. Molecular orbital approach as applied to diatomic and polyatomic molecules. Bonding in electron deficient compounds. Hydrogen bonding. Theories of metal bonds, conductors, semi-conductors and insulators. Effect of temperature and impurities on conductivity.

**2. Chemistry of Lanthanides and Actinides Elements**

Electronic structure, position in the periodic table, oxidation states, occurrence, extraction-separation, General properties, complex formation, Lanthanide and Actinide contraction, Applications

**Suggested Readings**

- Lee J.D., "*Concise Inorganic Chemistry*", 5<sup>th</sup> edition, Black Well Science, 1996.
- James Huheey E., "*Inorganic Chemistry, Principles of Structure and Reactivity*", 3<sup>rd</sup>. Ed. Cambridge, Harper International, London, 1983.
- Machay K. M. and Machev R. A., "*Introduction to modern Inorganic Chemistry*", 3<sup>rd</sup> Ed. International text book company London, 1981.
- Green wood, "*Chemistry of the elements*", 2<sup>nd</sup> Ed., Jordan, Hill oxford, 1997.

**Inorganic Chemistry Lab -I**

1. Separation of metal ions by paper chromatography and their identification with the help of locating agents and comparison of R<sub>f</sub> values.
2. Estimation of pair of metal ions such as Cu<sup>+2</sup>/Ni<sup>+2</sup>, Al<sup>+3</sup>/Fe<sup>+3</sup>, Ca<sup>+2</sup>/Ba<sup>+2</sup>
3. Aqueous Acid-Base Titration
  - Estimation of CO<sub>2</sub>.
  - Determination of %age Purity of (NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub> using cation exchanger.

**Suggested Readings**

- Bassett J., "*Vogel's text books of quantitative analysis*", 4<sup>th</sup> Ed., Longman Group Limited, 1978.

**CHM-5504 Biochemistry-I****4(3-1)****Carbohydrates metabolism:**

Digestion, absorption and transport of sugars into cells, glycolysis, TCA cycle, Gluconeogenesis, glycogenesis, glycogenolysis. HMP pathway, uronic acid pathway,

**Lipids Metabolism :**

Digestion, absorption and transport of lipids, oxidation of saturated and unsaturated fatty acids, biosynthesis of fatty acids, triglycerides, phospholipids, steroids, bile acids and ketone bodies.

**Protein Metabolism:**

Digestion of proteins, absorption and transport of amino acids to cells. Decarboxylation, deamination, transamination, metabolism of essential amino acids. Urea cycle, creatine and uric acids synthesis. Bioenergetics, Oxidative and Substrate level phosphorylation, electron transport chain, chemiosmotic theory.

**Nucleic acid metabolism:**

Biosynthesis and catabolism of purines, pyrimidines and their regulation.

### Recommended Books

1. D. Voet, J. G. Voet, C. W. Pratt, "*Biochemistry*", John Wiley & Sons, New York, 1999.
2. A. L. Lehninger, D. L. Nelson, M. M. Cox, "*Principles of Biochemistry*", 3<sup>rd</sup> Ed., Worth Publishers, New York, 2000.
3. G. Zubay, "*Biochemistry*", W. C. B. Publishers, Toronto, 1998.
4. L. Stryer, "*Biochemistry*" 5<sup>th</sup> Ed., W. H. Freeman & Co., 2002.
5. R. K. Murray, D. K. Granner, P. A. Mayes, "*Harper's Biochemistry*", Rodwell, 2000.
6. T. M. Devlin, "*Text book of Biochemistry with Clinical Correlations*", 2<sup>nd</sup> Ed., John Wiley & Sons, New York, 1982.

### **Biochemistry Laboratory-I**

1. Determination of the amount of reducing sugar in the biological fluids.
2. Estimation of non-reducing sugars.
3. Determination of saponification value of fats.
4. Determination of Iodine value of fats.
5. Determination of the acid value of fats.
6. Determination of Lactose in milk.

### Recommended Books

1. D. T. Plummer, "*An Introduction to Practical Biochemistry*", Tata Mc Graw-Hill Publishing company Ltd. New Delhi, 1988.
2. G. Rajagopal, S. Ramakrishnan, "*Practical Biochemistry for Medical Students*", Orient Longman Ltd., Hyderabad, 1983.
3. S. P. Singh, "*Manual of Biochemistry*", CBS Publishers, New Delhi, 1988.



# UNIVERSITY OF POONCH RAWALAKOT

AZAD JAMMU AND KASHMIR

## Scheme of study for BS 7<sup>th</sup> (Chemistry)

### Semester-VII

Specialization (Inorganic/Organic/ Physical/Biochemistry)	Credit hours
Paper-I	3(3-0)
Paper-II	3(3-0)
Paper-III	3(3-0)
Practical-III	3(0-3)
Elective Course –I (Other than the field of specialization)	3(3-0)
<b>Total</b>	<b>15</b>

**Note: Courses offered in semester VII.**

### Semester-VII

Physical chemistry		
Course code	Course title	Credit Hours
CHM-6701	Chemical Kinetics	3(3-0)
CHM-6702	Surface Chemistry	3(3-0)
CHM-6703	Photochemistry	3(3-0)
CHM-6704	Molecular Spectroscopy	3(3-0)
CHM-6705	Polymer Chemistry	3(3-0)
CHM-6706	Solution Chemistry	3(3-0)

CHM-6707	Statistical Mechanics	3(3-0)
CHM-6715	Physical Chemistry Laboratory-III	3(0-3)
<b>Inorganic Chemistry</b>		
CHM-6716	Instrumental Methods	3(3-0)
CHM-6717	Introduction to Environmental Chemistry	3(3-0)
CHM-6718	Elementary group theory	3(3-0)
CHM-6719	Thermal Method of Analysis	3(3-0)
CHM-6720	Advance coordination chemistry	3(3-0)
CHM-6721	Introduction to Inorganic Reaction Mechanism	3(3-0)
CHM-6730	Inorganic Chemistry Laboratory-III	3(0-3)
<b>Organic Chemistry</b>		
CHM-6731	Reaction Mechanism-I	3(3-0)
CHM-6732	Spectroscopy-I	3(3-0)
CHM-6733	Introductory Stereochemistry	3(3-0)
CHM-6734	Name Reactions in Organic Chemistry	3(3-0)
CHM-6735	Chemistry of Heterocyclic Compounds	3(3-0)
CHM-6736	Organic Synthesis-I	3(3-0)
CHM-6737	Organic Chemistry Laboratory-III	3(0-3)
<b>Biochemistry</b>		
CHM-6746	Body organs' structure and physiology	3(3-0)
CHM-6747	Biochemical Techniques	3(3-0)
CHM-6748	Molecular Biology	3(3-0)
CHM-6760	Biochemistry Laboratory-III	3(3-0)

## Courses for Semester-VII

### Courses for Physical Chemistry

#### **CHM-6701 Chemical Kinetics**

**3(3-0)**

Higher order kinetics and their half life period, cause of higher order rarity, method of studying reaction kinetics, physical and chemical methods, review of common experimental methods, measurement of pressure at constant volume, measurement of volume at constant pressure, conductometric method, potentiometric methods, treatments of kinetic data by Powell's plot method, Guggenheims method, Ostwald isolation method and differential method, kinetics of some parallel, opposing and consecutive reactions, steady state approximation, surface reactions, correlations of physical properties with concentration, gas phase reactions, reaction in solution phase, conductometric, dilatometric and spectrophotometric method, kinetics of thermally excited chain reactions of hydrogen and Bromine, fast reactions and their method of study by flow techniques, plug flow technique and relaxation method, mechanism of chain and photochemical reactions.

#### **Books Recommended**

1. Alberty, R.A and Silbey, R.J., "*Physical Chemistry*" John Wiley, New York, 1995.
2. Atkins, P.W., "*Physical Chemistry*" 5<sup>th</sup> Ed., W.H. Freeman & Company, New York, 1994.
3. Latham, J.L. & Burgess, A. E., "*Elementary Reaction Kinetics*" 3<sup>rd</sup> Ed., Butterworths, London, 1977.

#### **CHM-6702 Surface Chemistry**

**3(3-0)**

History of adsorption, adsorption, absorption, sorption and desorption, characteristics of adsorption, difference between adsorption and absorption, adsorbant and adsorbate, mechanism of adsorption and their comparison, factors effecting adsorption, specific surface area and its determination, forces involved in adsorption, types of adsorption curve, enthalpy of adsorption and thermodynamics, types of enthalpy of adsorption, desorption and activation energies. classical Freundlich adsorption isotherm, test of Freundlich adsorption isotherm, limitations of Freundlich's equation, Langmuir

adsorption isotherm, gas adsorption isotherms, Henry's equation, fundamental equation for surface layer, Gibbs adsorption equation and its applications, adsorption of mixture of gases, application of adsorption.

#### **Books Recommended**

1. Rosen, Milton J., "*Surfactants and Interfacial Phenomena*" John Wiley, New York, 1978.
2. Hiementz, P. C. and Rajaqopalam, R., "*Principles of Colloid & Surface Chemistry*" Marcel Dekker, 1997.
3. Fennel-Evans, D., "*The Colloidal Domain*" VCH, 1994.
4. Hiementz, P.C., and Rajagopalan, R., "*Principles of Colloid & Surface Chemistry*" Marcel Dekker, Inc., New York, Basel, Hong Kong, 1997.

**CHM-6703    Photochemistry****3(3-0)**

Kinds of chemical reactions, demonstration of photochemical reactions, characteristic of photochemical reactions, difference between dark and photochemical reactions, types of photochemical reactions, sources of photochemical radiations, mechanism of photochemical reaction, laws of photochemistry, basic laws of photochemistry, Lambert-Beer's law, limitations of Lambert-Beer's law, photochemical equilibrium and equilibrium constant, quantum efficiencies, experimental determination of quantum yield, deviations in the law of photochemical equivalence, low quantum yield reactions, high quantum yield reactions, small integer quantum yield reactions, factors affecting quantum yield, types of photochemical reactions, kinetics of photochemical rate law, kinetics of photochemical dissociation of HI reactions which do not involve chain (kinetics of photochemical reactions of Hydrogen with Chlorine), Phosphorescence, fluorescence, chemiluminescence, luminescence, photosynthesis.

**Books Recommended**

1. Cox, A., Kemp, T.J., "Introduction of Photochemistry" McGraw- Hill, London, 1971.
2. Calvert, J.G., Pitts, J.N., "Photochemistry" John Wiley New York, 1966.

**CHM-6704    Molecular Spectroscopy****3(3-0)**

Spectroscopy, electromagnetic radiations, classification of spectroscopy, electromagnetic spectrum, regions of electromagnetic spectrum, experimental techniques, microwave spectroscopy, rotation of linear system, Rotation of rigid rotors, rotation of non-rigid rotors, rotation of symmetric Tops, rotation of Asymmetric tops, kinetic energies of the system, quantum mechanical treatment of linear system, symmetric top molecules and asymmetric tops, rotation spectrum and selection rules for linear system, symmetric and asymmetric tops, applications of microwave spectroscopy, infra red spectroscopy, simple harmonic oscillator, difference in energy levels, anharmonic oscillators, selection rules for simple harmonic oscillator, selection rules for anharmonic oscillators, U.V. spectroscopy, electronic spectroscopy, absorption laws, instrumentation (U.V.), Frank condon principle.

**Books Recommended**

1. Barrow, G.M. Mc Graw-Hill, "Introduction to Molecular Spectroscopy" Auckland, Singapore, London, 1962.
2. Banwell, C.N., "Fundamentals of Molecular Spectroscopy" 2<sup>nd</sup> Ed., McGraw-Hill, London, N.Y., 1972.
3. King, G.W., Holt, Rinchert & Winston, "Spectroscopy and Molecular Structure" New York, 1964

**CHM-6705    Polymer Chemistry****3(3-0)**

Basic concept of polymers, classification of polymers, texture and solubility, nomenclature of polymers, molecular forces and chemical bonding in polymers, kinetics of chain polymerization, free

radical polymerization, kinetics of step growth polymerization, acid catalyzed, externally catalyzed and self catalyzed polymerization, copolymerization, types of copolymers, composition and kinetics, crystallinity of polymers, glass transition temperature in polymers, effect of structure and cross linking on transition temperature, molecular weight determination of polymers.

### **Books Recommended**

1. Raymond Seymors, B., "Introduction to polymer chemistry" McGraw Hill, New York,
2. Joel R. Fried, "Polymer Science and technology" Prentice-Hall of India, New Delhi, 1995.
3. Billmeyer, F. W, "Text book of polymer Science" John Wiley and sons, New York, 1994.
4. Ravue, "Principles of Polymer Chemistry" Plenum Publishers, New York, 2000.

### **CHM-6706 Solution Chemistry**

**3(3-0)**

**Solutions:** Their role in Chemistry; classification; concept of solute and solvent interactions; mixtures and their importance. **Interactions in solutions:** Solvent-solvent interactions; solute-solvent interactions. **Electrolyte solution:** Ion-ion interactions; ion-pairing; structure of solvates. **Measurement:** Microscopic and macroscopic properties; transport properties.

### **CHM-6707 Statistical Mechanics**

**3(3-0)**

**Historical background and basics:** Probability; description of various systems; ensembles; concepts of states and accessible states; distribution of energy; Maxwell-Boltzmann's Statistics (MBS) of the systems of independent particles. **Partition functions:** Derivations and determinations of independent particles. **Statistical thermodynamics:** correlation of partition and thermodynamic functions. **Applications:** To chemical Equilibrium and chemical kinetics; Fermi-Diarc's (FD) and Bose-Einstein's (BS) statistics.

### **CHM-6715 Physical Chemistry Lab. III**

**3(0-3)**

1. Determination of specific rate constant for the saponification of ethyl acetate conductometrically.
2. Determination of Equilibrium constant for the reversible reaction.
3. Determination of heat of solution of oxalic acid by solubility method using Van't Hoff equation.
4. Acid Base conductometric titration
5. Obtain a spectral absorption curve of a given substance using a spectrophotometer and also find the wave length of maximum absorption.
6. Verify Beer's law for given solution, also measure the unknown concentration.

### **Books Recommended**

1. Sing, A., "Advanced experimental physical chemistry" 1<sup>st</sup> Ed., Campus Book international, New Delhi, 2005.
2. Findlay, A. and Kitchner, J.A., "Practical physical Chemistry" Longman, Green and Co, 1976.
3. Shoemaker, D.P. and Garland, C., "Experiments in physical chemistry" McGraw Hill, New York.

## **COURSES FOR INORGANIC CHEMISTRY**

### **CHM-6716 Instrumental Methods**

**3(3-0)**

Methodology in spectrochemical analysis, optical components of spectrometers, spectroscopic measurements, atomic absorption, emission ICP and fluorescence spectroscopy.

### **Suggested Readings**

- Daniel C. Harris, "Quantitative Chemical Analysis" 5<sup>th</sup> Ed., Freeman and Company, N.Y., 1999.
- Ewing G.W., "Instrumental Methods of Chemical Analysis" 5<sup>th</sup> Ed., McGraw Hill Publisher, 1985.
- Skoog D.A. and Leary J.J., "Principles of Instrumental Analysis" 4<sup>th</sup> Ed., Saunders College



Publishing, 1992.

- Willard H.H., Merritt L.L. (Jr), Dean J.A., and Settle F.A., “*Instrumental methods of Analysis*” 7<sup>th</sup> Ed., Wadsworth Publishing Co., 1988.
- Christian, G.D., “*Analytical Chemistry*”, 5<sup>th</sup> Ed., John Wiley and Sons, 1994.

### **CHM- 6717 Introduction to Environmental Chemistry**

**3(3-0)**

The human environment, the litho, bio and hydrospheres, the nature and composition of natural waters, water pollution, chemistry of soil, composition of the atmosphere, oxides of carbon, sulphur and nitrogen in air pollution, atmospheric monitoring, instrumental methods of environmental chemistry.

#### **Suggested Readings**

- Bockris R., McMillan, “*Environmental Chemistry*”, USA, 1995.
- Manahan S.E. and Milled Grant Press, “*Environmental Chemistry*”, 8<sup>th</sup> Ed., CRC Press, New York, 2005.
- Mone and Mone, “*Environmental Chemistry*”, Academic Press,
- Bokrin, “*Environmental Chemistry*”, Ploniusm Press,
- De A.K., Willey Eastern, “*Environmental Chemistry*”, New Dehli, 1990.
- Analysis, Mass and Everser, “*Environmental Chemistry*”, International Text Book Co., Glasgow.
- Gilbert M., “*Introduction to Environmental Science and Technology*”, John Wiley and Sons.
- Forstner U. and Wittman G., “*Metal Pollution in Aquatic Environment*”, Springer Verlag, New York, 1989.

### **CHM-6718 Elementary Group Theory**

**3(3-0)**

Russel and Saunder Coupling, (J.J. coupling, L.S coupling) ground state and excited states determination. Symmetry, symmetry elements and operations, point groups, group representations and character table, reducible and irreducible representations, Application of group theory to valence bond, molecular orbital, crystal field theories and IR spectra

#### **Suggested Readings**

- Ferguson J.E., “*Stereochemistry and bonding in Inorganic Chemistry*”, Prentice-Hall, New Jersey, 1974
- Vincent, “*Molecular Symmetry and Group Theory: A Programmed Introduction to Chemical Applications*”, London A., John Wiley and Sons, 1977.
- Molloy K.C., “*Group Theory for Chemists*”, Horwood Publishing, Chichester, UK.
- Ogden, J.S., *Symmetry, “Introduction to Molecular”*, Oxford Higher Education, 2001.
- Drago R.S., “*Physical Methods in Inorganic Chemistry*”, Chapman and Hall Ltd. London.
- Drago R.S., “*Physical Methods for Chemists*”, 2<sup>nd</sup> Ed., Saunders College Publishing, Mexico, New York, 1992.

### **CHM-6719 Thermal Method of Analysis**

**3(3-0)**

Theory and instrumentation of thermogravimetry, differential thermal analysis and differential scanning calorimeter. Quantitative interpretation of TGA, DTA and DSC curves, Applications of DTA, TGA in cement, catalysts, clays, minerals

#### **Suggested Readings**

- James D.W., “*Thermal Methods, Analytical Chemistry by open learning*”, John Wiley and Sons, 1987.
- Hatakeyama T and Quinn F. X., “*Thermal Analysis, Fundamentals and Applications to*

**CHM-6720 Advanced Coordination Chemistry 3(3-0)**

Important concepts of complex chemistry (EAN rule, electroneutrality principle, isoelectronic principle). Crystal field effects in various environments, pairing energies, evidence for crystal field stabilization, octahedral VS tetrahedral co-ordination, tetragonal distortion for octahedral symmetry, square planer coordination, ligand field theory, metal-metal bonding, metal clusters with pi-acceptor ligands. Absorption spectra and magnetic properties (magnetic susceptibility, ferromagnetism, antiferromagnetism, ferrimagnetism) of complexes. Preparation and reactions of coordination compounds, kinetics and mechanisms of reactions of complexes, stability, factors that influence complex stability, determination of stability constants, applications of coordination compounds in various fields.

**Suggested Readings**

- Cotton F.A. and Wilkinson G., “*Advanced Inorganic Chemistry*”, 5<sup>th</sup> Ed., John Wiley & Sons, 1988.
- James Huheey E., “*Inorganic Chemistry, Principles of Structure and Reactivity*”, 3<sup>rd</sup> Ed., Cambridge, Harper International, London, 1983.
- Basolo F. and Johnson R., “*Coordination Chemistry*”, W.A. Benjamin Inc., New York, 1964.
- Day M. C. and Selbin J., “*Theoretical Inorganic Chemistry*”, 2<sup>nd</sup> Ed. East-West. Press, New Dehli, 1977.
- Miessler G. L. and Tarr D., “*Inorganic Chemistry*”, 3<sup>rd</sup> Ed., Pearson Education, Delhi, 2004.

**CHM-6721 Introduction to Inorganic Reaction Mechanism 3(3-0)**

Introduction to Kinetics, rate of reaction and rate laws, Inert and Labile Complexes, classification of Mechanisms, Reaction Mechanisms of metal complexes e.g., substitution and oxidation-reduction (Redox) reactions.

**Suggested Readings**

- Cotton F.A. and Wilkinson G., “*Advanced Inorganic Chemistry*”, 5<sup>th</sup> Ed, John Wiley & Sons, New York, 1988.
- Benson D., “*Mechanisms of Inorganic Reactions in Solution*”, McGraw Hill, London, 1969.
- Atwood J.D., “*Inorganic and organometallic reaction mechanism*”, Brook/ Cole publishing company, California, 1985.

### Practical's

#### 1. Preparation of inorganic compounds

- To prepare co-ordination compound of  $[\text{Cu}(\text{NH}_3)_4]\text{SO}_4$
- To prepare a pure sample of  $\text{FeSO}_4(\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$

#### 2. Conductometric titrations

- To determine the strength of strong acid/weak acid by conductometric titration with strong base
- To determine the strength of strong acid/weak by conductometric titration with weak base

#### 3. Potentiometric titrations

- To determine the concentration of a strong acid using potentiometric titration method.
- To determine the concentration of a weak acid using potentiometric titration method.

#### 4. Gravimetry

- Gravimetric determination of calcium as calcium oxalate
- Gravimetric determination of Iodide by using silver nitrate

### Suggested Readings

- Bassett J., "Vogel's text books of quantitative analysis", 4 th Ed., Longman Group Limited, 1978.
- Harris D.C., "Quantitative Chemical Analysis", 5 th Edition, Freeman and Company, N.Y, 1999.
- Willard H.H., Merritt (Jr) L. L., Dean J.A., and Settle F.A., "Instrumental methods of Analysis", 7 th Ed., Wadsworth Publishing Co., 1988.

## **COURSES FOR ORGANIC CHEMISTRY**

### **CHM-6731 Reaction Mechanism-I**

**3(3-0)**

Determination of Organic Reaction Mechanism by Kinetic and Non-kinetic Methods

Concept of mechanism; requirement of a reaction; Kinetic approach measurement of rates, order and molecularity of reactions, use of steady state approximation, kinetic isotope effects; Non-kinetic approach---- identification of product, testing, trapping and physical detection of intermediates evidences for reaction catalysis; crossover experiments, isotopic labelling; stereochemical studies.

Aliphatic Nucleophilic Substitution Reactions.

Study of  $S_N1$ ,  $S_N2$ ,  $S_Ni$ ,  $S_N1'$ ,  $S_N2'$ , Ionpair mechanism; study of effects of substrate, leaving group, attacking nucleophile, solvent system on mechanism and rates of reaction.

Elimination Reactions

Study of  $E_1$ ,  $E_2$  and  $E1_{CB}$ ; study of effects of substrate, leaving group, attacking nucleophile, solvent system on mechanism and rates of reaction; orientation of double bond and competition between substitution and elimination reactions.

#### **Suggested Readings**

1. Issac, Neil S., *Physical Organic Chemistry*, Longman Scientific and Technical Publishers, USA.
2. Handrickson, J. B., Cram, D.J. and Hammond, G.S., *Organic Chemistry*, 3<sup>rd</sup> Ed, MacGraw-Hill, Tokyo, 1970.
3. Morrison, R.T., and Boyd, R.N., *Organic Chemistry*, 6<sup>th</sup> Ed. Prentice Hall, Englewood Cliffs, New Jersey, 1992.
4. March, J., *Advanced Organic Chemistry*, 4<sup>th</sup> Ed., John Wiley & Sons, New York, 1992.
5. Lowry T.H. & Richardson, K.W., *Mechanism and Theory in Organic Chemistry*, 3<sup>rd</sup> Ed., Harper & Row Publishers, New York, 1987.
6. Finar, I.L., *Organic Chemistry*, 6<sup>th</sup> Ed., Vol. 1 & 2, Longman, London, 1973.
7. McMurry, J., *Fundamentals of Organic Chemistry*, 4<sup>th</sup> Ed., Brooks/Cole Publishing Co., California, 1994.

### **CHM-6732 Spectroscopy-I**

**3(3-0)**

Theory, principles, instrumentation, spectral parameters and spectral study of

- Nuclear Magnetic Resonance Spectroscopy
- Mass Spectrometry

#### **Suggested Readings**

1. McMurry, J., *Fundamentals of Organic Chemistry*, 4<sup>th</sup> Ed., Brooks/Cole Publishing Co., California, 1994.
2. Brown, D.W., Floyed, A. J. and Sainsbury, M., *Organic Spectroscopy*, J. Wiley and sons, Chichester, 1998.
3. Williams, D.H. & Fleming, I., *Spectroscopic Methods in Organic Chemistry*, 4<sup>th</sup> Ed., McGraw-Hill Book Co., London, 1987.
4. Hesse, M., Meir, H. and Zech, B., Georg, Thieme *Spectroscopic Methods in Organic Chemistry*, Verlag, Stuttgart, New York, 1997.
5. Younas, M., *Organic Spectroscopy*, A. H. Publisher, Lahore.
6. Atta-ur-Rehman, *NMR Spectroscopy*, Vol. 1, National Academy of Higher Education, University Grants Commission Islamabad.

**CHM-6733 Introductory Stereochemistry****3(3-0)**

Structure and symmetry; Symmetry elements and point groups; Relative and absolute configurations; Conformation and conformational analysis of ethane, propane and butane; Geometric Isomerism Stereochemical nomenclature, Stereochemical reactions; Asymmetric synthesis; Reactions and resolution of enantiomers.

**Suggested Readings**

1. March J., *Advanced Organic Chemistry*, 4<sup>th</sup> Ed., John Wiley & Sons, New York, 1992.
2. Eliel, E.L., Wilen S.H., and Mander, L.N., *Stereochemistry of Carbon Compounds*, 4<sup>th</sup> Ed., John Wiley & Sons, New York, 1994.
3. Eliel, E.L., Wilen S.H., and Mander, L.N., *Stereochemistry of Organic Compounds*, 4<sup>th</sup> Ed., John Wiley & Sons, New York, 2002.

**CHM-6734 Name Reactions in Organic Chemistry****3(3-0)**

Detailed study of at least twenty name reactions including Arndt-Eistert Synthesis; Blaise Reaction; Bouveault-Blanc Reaction; Hel-Volhard-Zelinsky reaction; Meerwein-Ponndorf-Verley Oxidation; Mannich Reaction; Schotten-Baumen Reaction; Mitsunobu Coupling; Suzuki Coupling; Wittig reaction. Heck reaction, Pollazari reaction, Corey-House synthesis, Simmon-Smith reaction, Strecker synthesis, Micheal reaction, Williamson ether synthesis, Prins reaction, Wurts reaction, Robinson annelation reaction, Hinsberg reaction

**Suggested Readings**

1. March, J., *Advanced Organic Chemistry*, 4<sup>th</sup> Ed., John Wiley & Sons, New York, 1992.

**CHM-6735 Chemistry of Heterocyclic Compounds****3(3-0)**

Introduction; Nomenclature; Synthesis and chemistry of upto six membered heterocycles, containing one heteroatom like nitrogen, oxygen and sulphur.

**Suggested Readings**

1. Young, D.W., *Heterocyclic Chemistry*,
2. Palmer, M. H., *Chemistry of Heterocyclic Compounds*, Edward Arnold Publishers, London, 1967.

**CHM-6736 Organic Synthesis-I****3(3-0)****Reactive intermediates**

Study of carbenes, nitrenes and benzyne with respect to their structure generation, important reactions and synthetic applications.

**Introduction to Protecting groups**

Introduction conditions and requirements of a good protecting group Protection of hydroxyl, Amino, Aldehyde and Carboxylic acid.

**Molecular Rearrangements**

Introduction to basic concepts; study of following rearrangements:

- C-C: Wagner-Meerwein rearrangement; pinacol-pinacolone rearrangement; Favorskii rearrangement; benzilic acid rearrangement; benzidine rearrangement.  
: Hoffmann rearrangement; Beckmann rearrangement; Curtius rearrangement; Losen rearrangement; Wolf rearrangement; Schmidt rearrangement.

: Baeyer-Villiger rearrangement; dienone- phenol rearrangement; Dakin rearrangement; cumene-hydroperoxide rearrangement.

### **Suggested Readings**

1. March, J., *Advanced Organic Chemistry*, 4<sup>th</sup> Ed., John Wiley & Sons, New York, 1992.
2. Norman, R.O.C., and Coxon, J.M., *Principles of Organic Synthesis*, 3<sup>rd</sup> Ed., Blackie Academic and Professional, London, 1993.
3. Warren, S., *Organic Synthesis, The Disconnection Approach*, John Wiley & Sons, Chichester, 1992.
4. Finar, I.L., *Organic Chemistry*, 6<sup>th</sup> Ed., Vol. 1 & 2, Longman, London, 1973.

## **CHM-6737 Organic Chemistry Laboratory- III**

**3(0-3)**

### **Preparation**

Aromatic nitration reactions; Reduction of aromatic nitro compounds; Diazotization reactions; Esterification reactions; Aldol condensation; Benzaldehyde to benzilic acid synthesis; synthesis of benzopinacol; Pinacol-Pinacolone rearrangement; HNO<sub>3</sub> oxidation; Polymerization reaction; any other preparation by teacher's choice (Minimum 8)

### **Isolation**

- a) Caffeine from tea leaves
- b) Lycopenes/ carotene from tomatoes.

### **Suggested Readings**

1. Furniss, B.S., Hannaford, A.J., Smith, P.N.G., & Taldull, A.R., *Vogels Textbook of Practical Organic Chemistry*, 5<sup>th</sup> Ed., Longman Scientific & Technical, London, 1989.
2. Adams, R., Johnson, J.R., & Wilcox Jr., *Laboratory Experiments in Organic Chemistry*, 6<sup>th</sup> Ed., Collier-Macmillan, London, 1970.
3. Pavia, D. L., Lampmann, G. M., Kriz, G. S., *Introduction to Organic Laboratory Techniques—A Microscale Approach*, 3<sup>rd</sup> Ed., Saunders College Publishing, New York, 1999.
4. Fieser, L. F., Williamson, K. L., *Organic Experiments*, 7<sup>th</sup> Ed., D. C. Heath & Co., New York, 1994.

## **COURSES FOR BIOCHEMISTRY**

### **CHM-6746 Body organs' structure and physiology**

**3(3-0)**

Structure and function of liver, lungs, pancreas, kidney, heart, skeletal muscles and adipose tissues. Blood and other body fluids. General composition of blood, function of blood, blood plasma, plasma protein, composition and functions. Composition, development and functions of red blood cells, white blood cells and platelets.

Haemoglobin, chemistry, properties, synthesis, functions and derivatives. Coagulation and clotting of blood. Blood pressure. Blood groups. Composition of urine, extra cellular fluids like cerebrospinal fluid.

### **Recommended Books**

1. Guyton and Hall, "*Text Book of Biochemistry*", Barcourt Brace Asia, 1998.
2. M. Gerhard, W. H. Sinsons, "*Principles of Medical Biochemistry*", 2<sup>nd</sup> Ed., Mosby, N. Y., 2006.
3. R. R. Seeley, D. Trent, "*Anatomy and Physiology*", 4<sup>th</sup> Ed., Mosby-Year Book, Inc., USA., 1998.

4. J. W. Hole, "Essential of Human Anatomy Physiology", 4<sup>th</sup> Ed., Collin. H. Wheatley. Win. C. Brown Publishers, USA., 1992.
5. Hoffbrand, "Essential Haematology" 5<sup>th</sup> Ed., 2006.
6. 2. Ersalovic, "Therapeutic Microbiology: Probiotics and Related Strategies", 2008.
7. A. Richard, Mc Pherson, R. Mathew, "Clinical Diagnosis and Management by Laboratory Method", 21<sup>st</sup> Ed., Elsevier New Delhi, 2007.

### **CHM-6747 Biochemical Techniques**

**3(3-0)**

#### **Extraction, Fractions and purification of macromolecules**

Homogenization, solubilization and concentration including ultrasonication, lyophilization, ultracentrifugation, purification based on differential solubility techniques. Ion-exchange chromatography, Gel chromatography, Affinity chromatography. Paper and thin layer chromatography and HPLC.

**Electrophoresis:** Paper and gel electrophoresis. SDS-PAGE, IEF, Two-dimensional electrophoresis. Capillary electrophoresis.

**Centrifugation:** Principle, preparative centrifugation. Application of density gradient and differential centrifugation. Ultracentrifugation. Sedimentation equilibrium and sedimentation velocity methods applications of analytical centrifugation.

**Tracer Techniques:** Detection and measurement of radioactivity, Application of radioisotopes in biological system

**UV & Visible spectroscopy:** Basic principle, instrumentation and application.

#### **Recommended Books**

1. The tools of Biochemistry by Cooper
2. Principles and techniques of practical Biochemistry by William Edward and Arnold
3. Qualitative problems in Biochemistry by Dawas
4. A Biologist's Physical chemistry by J. Gareth Morris
5. Protein purification, principle and practice by Robert. K. Scope.

### **CHM-6748 Molecular Biology**

**3(3-0)**

DNA, the primary genetic material. Structure, replication in prokaryotes and comparison with eukaryotes. DNA sequencing. Chemical synthesis of polynucleotides. DNA repair and recombination.

Control dogma of molecular biology.

Different types of RNA and their role in protein synthesis. Transcription and its regulation. Lac-operon model Genetic code, post transcriptional processing, structure of transfer RNA. Protein synthesis inhibitor. Post translational modification.

Plasmids, vector and cosmids. In vitro mutagenesis: deletion, insertion and substitution. Recombination DNA and genetic diseases.

#### **Recommended Books**

1. Griffiths, J. F. Anthony. *et. al.*, "Modern genetic analysis: integrating genes and genomes", 2<sup>nd</sup> Ed., W. H. Freeman, New York, 2002.
2. G. Karp, "Cell and Molecular Biology: Concepts & Experiments", 3<sup>rd</sup> Ed., John Wiley Sons, Inc., N.Y., 2002.
3. F. Weaver, F. Robert F, "Molecular biology", Mc Graw-Hill, Boston, 1999.
4. Garrett, H. Reginald, M. Charles, "Molecular aspects of cell biology", Saunders College Publishing, Fort Worth, 1995.
5. T. Strachen, A. P. Read, "Human Molecular Genetics", 2<sup>nd</sup> Ed., BIOS Scientific Publications Ltd., 2000.

1. Estimation of protein by Kjaldahl's method.
2. Determination of protein by spectrophotometrically.
3. Estimation of creative and creation in different biofluids.
4. Effect of pH, temperature, metal ions and time on enzyme activity and stability.
5. Determination of oils and fats using soxhlet apparatus.

**Recommended Books**

1. D. T. Plummer, "*An Introduction to Practical Biochemistry*", Tata Mc Graw-Hill Publishing company Ltd. New Delhi, 1988.
2. G. Rajagopal, S. Ramakrishnan, "*Practical Biochemistry for Medical Students*", Orient Longman Ltd., Hyderabad, 1983.
3. S. P. Singh, "*Manual of Biochemistry*", CBS Publishers, New Delhi, 1988.
4. A. L. Lehninger, D. L. Nelson, M. M. Cox, "*Principles of Biochemistry*", 3<sup>rd</sup> Ed., Worth Publishers, New York, 2000.
5. G. Zubay, "*Biochemistry*", W. C. B. Publishers, Toronto, 1998