**UNIVERSITY OF POONCH RAWALAKOT**



**AZAD JAMMU AND KASHMIR**

**Scheme of study for BS (4-Years) program (2nd, 4th, 6th and 8th Semester)**

**Semester-II**

|  |  |  |
| --- | --- | --- |
| **Course Code** | **Course Title** | **Credit hours** |
| CHM-3201 | Organic Chemistry | 3(2-1) |
| ISL-3202 | Islamic Studies / Ethics | 2(2-0) |
| BOT-3203 | Botany-II | 3(2-1) |
| ZOO-3204 | Principles of Animal Life-II | 3(2-1) |
| STA-3205 | Statistics | 3(2-1) |
| ENG-3206 | English-II | 3(3-0) |
|  | **Total** | **18** |

**Semester-IV**

|  |  |  |
| --- | --- | --- |
| **Course Code** | **Course Title** | **Credit hours** |
| CHM-4401 | Inorganic Chemistry | 3(2-1) |
| CHM-4402 | Biochemistry | 3(2-1) |
| BOT-4403 | Botany-IV | 3(2-1) |
| ZOO-4404 | Animal Diversity-II | 3(2-1) |
| CHM-4405 | Applied Chemistry | 2(2-0) |
| ARB-4406 | Arabic | 3(3-0) |
|  | **Total** | **18** |

**Semester-VI**

|  |  |  |
| --- | --- | --- |
| **Course Code** | **Course Title** | **Credit hours** |
| CHM-5601 | Physical Chemistry-II | 4(3-1) |
| CHM-5602 | Organic Chemistry-II | 4(3-1) |
| CHM-5603 | Inorganic Chemistry-II | 4(3-1) |
| CHM-5604 | Bio Chemistry-II | 4(3-1) |
|  | **Total** | **16** |

**Semester-VIII**

|  |  |
| --- | --- |
| Specialization (Inorganic/Organic/ Physical/Biochemistry) | Credit hours |
| Paper-I | 3(3-0) |
| Paper-II | 3(3-0) |
| Paper-III | 3(3-0) |
| Elective Course –I (Other than the field of specialization) | 3(3-0) |
| Research project/ advanced Practicals | 4(0-4) |
| **Total** | **16** |

**Semester-VIII**

|  |  |  |
| --- | --- | --- |
| **Physical Chemistry** | |  |
| **Course code** | **Course Title** | **Credit hours** |
| CHM-6801 | Quantum Mechanics | 3(3-0) |
| CHM-6802 | Colloids and Surfactants | 3(3-0) |
| CHM-6803 | Electrochemistry | 3(3-0) |
| CHM-6804 | Nuclear and Radiation Chemistry | 3(3-0) |
| CHM-6805 | Chemical Thermodynamics | 3(3-0) |
| CHM-6806 | Catalysis | 3(0-3) |
| CHM-6807 | Computational Chemistry | 3(0-3) |
| CHm-6808 | Solid State Chemistry | 3(3-0) |
| CHM-6861 | Advanced Practicals in Chemistry | 4(0-4) |
| CHM-6862 | OR Thesis | 4(as per nature) |
| **Inorganic Chemistry** | |  |
| CHM-6816 | Inorganic Chemistry in Biological systems | 3(3-0) |
| CHM-6817 | Chemical Crystallography | 3(3-0) |
| CHM-6818 | Inorganic Polymers | 3(3-0) |
| CHM-6819 | Basics of Nuclear Chemistry | 3(3-0) |
| CHM-6820 | Industrial Chemistry | 3(3-0) |
| CHM-6821 | Organometallic Chemistry | 3(3-0) |
| CHM- 6822 | Advanced Inorganic Chemistry-III | 3(3-0) |
| CHM-6861 | Advanced Practicals in Chemistry | 4(0-4) |
| CHM-6862 | OR Thesis | 4(as per nature) |
| **Organic Chemistry** |  |  |
| CHM-6831 | Reaction Mechanism-II | 3(3-0) |
| CHM-6832 | Spectroscopy-II | 3(3-0) |
| CHM-6833 | Natural Products | 3(3-0) |
| CHM-6834 | Introduction to Organic Polymers | 3(3-0) |
| CHM-6835 | Pericyclic Reactions and Photochemistry | 3(3-0) |
| CHM-6836 | Organic Synthesis-II | 3(3-0) |
| CHM-6837 | Special Topics in Organic Chemistry | 3(3-0) |
| CHM-6861 | Advanced Practicals in Chemistry | 4(0-4) |
| CHM-6862 | OR Thesis | 4(as per nature) |
| **Biochemistry** |  |  |
| CHM-6846 | Cell biology and cell Biosignaling | 3(3-0) |
| CHM-6847 | Microbiology and immunology | 3(3-0) |
| CHM-6848 | Nutrition | 3(3-0) |
| CHM-6860 | Biochemistry Practicals lab IV | 3(3-0) |
| CHM-6861 | Advanced Practicals in Chemistry | 4(0-4) |
| CHM-6862 | OR Thesis | 4(as per nature) |

**DETAIL OF COURSES**

**Course Contents for Semester-II**

**CHM-3201 Organic Chemistry 3(2-1)**

**Properties of Organic Molecules**

Dipole moment; inductive and field effects; resonance; aromaticity; tautomerism; hyperconjugation; hydrogen bonding; acids and bases; factors affecting the strengths of acids and bases.

**Hydrocarbons**

Discussion on the preparation, properties and reactions of alkanes, alkenes, alkynes and aromatics. **Oxygenated Hydrocarbons**

Discussion on the preparation, properties and reactions of alcohols (phenols), ethers, aldehydes, ketones, carboxylic acids and derivatives.

**Introductory Organic Spectroscopy**

Introduction to IR, UV, 1H-NMR and Mass spectrometric methods, and their usage for structure elucidation of some simple organic compounds.

**Practicals:**

* Quantitative analysis of compounds with different functional groups,
* Synthesis of organic compounds using a tool for understanding techniques like reflux, distillation, filtration, recrystallization and yield calculation, organic synthesis may include
* preparation of benzanilide from benzoyl chloride
* preparation of succinic anhydride from succinice acid
* preparation of phthalimide from phthalic anhydride
* preparation of oximes and hydrazine from carbonyl • preparation of ester from a carboxylic acid and alcohol

**Books Recommended:**

1. Furniss, B. S, Hannaford, A. J Smith, P. W. G, Tatchell, A. R Vogel’ S Textbook of practical organic chemistry, 5th ed., Longman, UK, (1989).
2. Pavia, D. L., Kriz, G. S., Lanpman, G. M. and Engel, R. G., A Microscale Approach to organic laboratory techniques, 5th ed., Brooks/Cole Cengage Learning, (2013).
3. Mayo, D. W., Pike, R. M, and Forbes, D. C., Microscale Organic to Laboratory with Multistep and Multisacle Synthesis, 5th ed., John-wile & Sones, Inc., (2011).
4. Gilbert, G. C. and Martin, S. F., Experimental organic chemistry: Aminiscale and Microscale approach 5th ed., Brooks/ Cole Cengage learning, (2010).
5. Brown, W. H., Fotte, C. S., Lverson, B. L. and Anslyn, E. V., organic chemistry, 6th ed., Brooks Cole Cengage learning, (2012).

**COURSES FOR SEMESTER-IV**

**CHM-4401 Inorganic Chemistry 3(2-1)**

* 1. **Introduction to Chemical Bonding**

Attainment of a stable configuration, types of bonds (ionic bonds, covalent bonds, coordinate bonds), oxidation number and formal oxidation number. The localized bonding approach (Introduction to valence bond theory and hybridization. The delocalized bonding approach (MOT applied to homonuclear diatomic molecules).

* 1. **Acids and Bases**

Concepts of acids and bases (Arrhenius, Lowry-Bronsted, Lewis and SHAB concept), relative strength of acids and bases. pH, pKa, pKb and buffer solutions and their significance. Theory of Indicators, solubility, solubility product, common ion effect and their applications.

* 1. **Chemistry of p-block Elements**

General characteristics of the following group of p-block elements with reference to the aspects given against each:

**Boron and Aluminum**

Gradation of the characteristic properties within the group. Structures, properties and applications of electron deficient molecules such as boron hydrides and aluminium hydrides.

**Carbon and Silicon**

Gradation of the characteristic properties within the group). Production of pure silicon for solar energy and silicon chips. Structural aspects of ortho and metasilicates and their industrial applications.

**Nitrogen and Phosphorus**

Gradation of the characteristic properties within the group. Oxides of nitrogen (NO and NO2) and their role in air pollution, oxyacids (HNO2 and HNO3) of nitrogen. Industrial preparation of urea and superphosphate fertilizers.

**Oxygen and Sulfur**

Gradation of the characteristic properties within the group. Role of sulphur dioxide in air pollution. Thionic acids (H2SO3 and H2SO4) and uses of hypo in photography.

**The Halogens**

Gradation of the characteristic properties within the group, anomalous behaviour of fluorine. Preparation of oxyacids of halogens (HClO3 and HClO4) and their uses. Interhalogens, pseudohalogens. **The Noble Gases**

Preparation, properties and uses of xenon fluorides; Commercial uses of noble gases.

1. **Chemistry of d-block Elements**

Electronic configuration and general characteristics of d-block elements. Industrial applications of transition metals. Werner’s concept and nomenclature of coordination compounds.

1. **Introduction to Modern Materials**

Liquid crystals, engineering ceramics, fiber glass and thin films.

**Recommended Books**

* 1. Huheey, J. E., Keiter, E. A. and Keiter, R. L., “Inorganic Chemistry: Principles of Structure and Reactivity”, 4th Ed., Harper and Row, New York, 2001
  2. Cotton, F. A., Wilkinson, G. and Gaus, P. L., “Basic Inorganic Chemistry”, 3rd Ed., Wiley, New York, 1995.
  3. Clyde Day, M. & Selbin, J., “Theoretical Inorganic Chemistry”, 2 Reinhold, 1969.

Van Nustrand

* 1. Lee, J.D., “Concise Inorganic Chemistry”, Chapman and Hall, 5
  2. Shriver, D. F., Atkins, P. W. and Langford, C. H., “Inorganic Chemistry”, Oxford University Press,

2nd Edition, 1994.

* 1. Cartmell E. and Fowles G. W. A. “Valency and Molecular Structure” Adlard and Sons

Limited 3rd Edition (1966)

* 1. Douglas B., McDaniel D. and Alexander J. “Concepts and Models of Inorganic

Chemistry” John Wiley & Sons, Inc. 3rd Edition (1994)

* 1. Harvey K. B. and Porter G. B. “Introduction to Inorganic Physical Chemistry” Addison-

Wesley Publishing Company, Inc. (1963)

* 1. Hill J. W. and Petrucci R. H. “General Chemistry” Prentice-Hall, Inc. (1996)
  2. Marr G. and Rockett B. W. “Practical Inorganic Chemistry” Van Nostrand Reinhold

Company. (1972)

* 1. Miessler G. L. and Tarr Donald A. “Inorganic Chemistry” Prentice-Hall International, Inc.

Prentice-Hall International Edition (1991)

* 1. Moody B. “Comparative Inorganic Chemistry” Routledge, Chapman and Hall, Inc. 3rd

Edition (1991)

* 1. Kennedy, Friedlander, “Nuclear and Radiochemistry” (latest edition).

**PRACTICALS**

1. **Laboratory Ethics and safety measures**

Awareness about the toxic nature of chemicals and their handling, cleaning of glassware, safe laboratory operations

1. **Qualitative analysis**

Analysis of four ions (two anions and two cations) from mixture of salts

1. **Quantitative analysis** 
   1. Acid-Base Titrations (minimum 02)
   2. Redox Titrations (minimum 02)
   3. Complexometric Tirations (minimum 02)
2. **Inorganic Preparations** 
   1. Preparation of Ferrous sulphate
   2. Preparation of Ferric alum
   3. Preparation of Barium silphate

**Recommended Books**

* 1. Bassette, J., Denney, G. H. and Mendham, J., “Vogel’s Textbook of Quantitative Inorganic th

Analysis Including Elementary Instrumental Analysis” English Language Book Society, 4 Edition, 1981.

* 1. Vogel, A. I., “A Textbook of Micro and Semi-micro Qualitative Inorganic Analysis”

Longman Green & Co. 1995.

**CHM-4402 Biochemistry 3(2-1)**

**Carbohydrates:** Nomenclature, steroisomerism, epimerism,. Reactions of monosaccharide, reactions of sugars due to hydroxyl group. Disaccharides, sucrose, lactose, maltose, cellulose, etc. Polysaccharides: starch, glycogen, cellulose, inuline, dextrin, chitin, Agar Mucopoly saccharides like hyaluronic acid, heparin, chondroitin sulphate.

**Lipids:** fatty acids, classification of fatty acids.bile acids and bile salts, triglycerides, hydrolysis of triglycerides, sponification, chararcterization of fats, waxes, behavior of lipids in water. Micelle, chylomicron, VLDL, LDL, HDL. Plasma Lipoproteins.

**Protiens:** Amino acids found in proteins, amino acid used in protein synthesis. Non-protein amino acids, isoelectric point. Classification of proteins, protein sequencing, different levels of protein structure.

**Nucleic acids:** chemical composition, Bases present in nucleic acids: purines and pyrimidines, nucleotids and nucleosides, structure of DNA, base composition of DNA, types of RNA, nucleases. **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”, 3rd Ed., Worth Publishers, New York, 2000.
3. G. Zubay, “Biochemistry”, W. C. B. Publishers, Toronto, 1998.
4. L. Stryer, “Biochemistry” 5th Ed., W. H. Freeman & Co., 2002.
5. R. K. Murray, D. K. Granner, P. A. Mayes, “Harper’s Biochemistry”, Rodwell, 2000.
6. Guyton and Hall, “Text Book of Biochemistry”, Barcourt Brace Asia, 1998.
7. D. E. Schumm, “Essential of Biochemistry”, Medical Edition series New York, 1999. 8. M. Ahmed, “Essentials of Medical Biochemistry”, Merit publishers Faisalabad, 1982.
8. P. C. Champe, A. R. Harvey, “Biochemistry”, Lippincott-Raven Publishers, 1994.
9. G. L. Zubay, “Principles of Biochemisty”, Mc Millan Publishing Co., 1995. 11. L. Stryer, “Biochemistry”, W. H. Freeman & Co., N. Y., 1995.

**Practical Course Outlines**

1. Detection of carbohydrates, monosaccharides and polysaccharides.
2. Detection of lipids on the basis of physical and chemical properties.
3. Qualitative tests for proteins of amins acids.
4. Preparation buffers at different pHs.
5. Precipitation.

**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

**CHM-4405 Applied Chemistry 2(2-0)**

**Fundamentals of Chemical Industry:**

Basic principles and parameters for industrial plant unit operations and unit processes. **Chemical Industries:**

Raw materials, flow sheet diagrams and unit operations and unit processes of sulphuric acid, nitric acid, hydrochloric acid, oxalic acid, formic acid, caustic soda and washing soda, cement industry, petroleum, textile, polymer and fuel industries, applications of these industries.

**COURSES FOR SEMESTER-VI**

**CHM-5601 Physical Chemistry-II 4(3-1)**

* 1. **Quantum mechanics**

Black Body radiations, photoelectric effect, Compton effect, postulates of quantum mechanics, concept of wave functions, operators, eigen and non-eigen functions, derivation of Schrodinger wave equation for one dimension and three dimensions, concept of degeneracy, orthogonal and normalized set of functions, tunneling effect, Pauli exclusion principle.

* 1. **Electrochemistry**

Conductance, resistance, types of electrolytic dissociation, weak and strong electrolytes, activity, activity coefficients and their determination by emf method, Debye-Huckel limiting law, Huckel and Onsager equation on conductance, concept of electrode potential, standard electrode potential, development of cells, calculation of cell constant, change in free energy and entropy of electrochemical cells, electrochemical basis for corrosion.

* 1. **Nuclear Chemistry**

Atomic nucleus, nuclides, nuclear stability, modes of decay, nuclear energetics, , fusion and fission, nonspontaneous nuclear processes, nuclear reactors, beta decay systematic, nuclear spins.

**Books Recommended**

* + 1. Alberty, R.A and Silbey, R.J., “*Physical Chemistry”* John Wiley, New York, 1995.
    2. Atkins, P.W, “*Physical Chemistry”* 5th Ed., W.H. Freeman & Company, New York, 1994.
    3. Barrow, G. M., “*Physical chemistry”* McGraw Hill, Singapore, 1988.
    4. Levine, I.N., “*Quantum Chemistry*” 4th Ed., Prentice Hall, New Jersey, and Prentice Hall India 1991.
    5. Hanna, M.W., “*Quantum Mechanics in Chemistry”* 3rd Ed., The Benjamin/Cummings Co., California, 1981.
    6. Lowe, J.P., “*Quantum Chemistr*y” 2nd Ed. Academic Press. Boston.2 New York, 1993.
    7. Bockris, J.M. and Reddy, A. K. N., “*Modern Electrochemistry”* Plenum Press, New York, 1970.
    8. Bard. A. and Faulkner, L.R., “*Electrochemical Methods Fundamentals and Applications”* John Wiley, New York, 1980.

**Potentiometry**

* 1. Determine the pH of a given solution by buffer solution method.
  2. To find out the strength of HCl solution by titrating it against NaOH solution using pH meter.
  3. Determine the dissociation constant of weak acid using potentiometer.

**Conductometry**

* 1. Conductance measurements.
  2. Find out the strength of HCl solution by titrating it against NaOH solutionconductometrically.

**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.

**CHM -5602 Organic Chemistry-II 4(3-1)**

1) Chemistry of carbonyl compounds with special reference to condensation reactions 2) Active methylene compounds

Alkylation, Arylation of active methylene compounds. Acid and base catalysed aldol condensation.

Conditions, mechanism and synthetic applications of the following reactions:

Claisen- Schmidt reaction, Claisen reaction, knoevenagel reaction, Perkin reaction, Reformatsky reaction, Mannich reaction, Stobbe’s condensation, and Wittig reaction.

3) Basic spectroscopy: introduction; detailed account of ultraviolet and infrared spectroscopy.

# Suggested Readings

1. Handrickson, J. B., Cram, D.J. and Hammond, G.S., *Organic Chemsitry*, 3rd Ed, MacGraw- Hill, Tokyo, 1970.
2. Morrison, R.T., and Boyde, R.N., *Organic Chemistry,* 6th Ed. Prentice Hall, Englewood Cliffs, New Jersey, 1992.
3. March, J., *Advanced Organic Chemistry,* 4th Ed., John Wiley & Sons, New York, 1992.
4. Finar, I.L., *Organic Chemistry,* 6th Ed., Vol. 1 & 2, Longman, London, 1973.
5. Brown, D.W., Floyed, A. J. and Sainsbury, M., *Organic Spectroscopy,* J. Wiley and sons, Chichester, 1998.
6. Williams, D.H. & Fleming, I., *Spectroscopic Methods in Organic Chemistry,* 4th Ed., McGrawHill Book Co., London, 1987.

**Organic Chemistry Laboratory-II**

i) Separation of three component mixtures by chromatographic (CC, TLC) methods. (10 mixtures) ii) Simple preparations: at least four by the choice of teacher concerned.

# Suggested Readings

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

**CHM-5603 Inorganic Chemistry –II 4(3-1)**

1. **Introduction to Coordination Chemistry**

Electronic configuration and oxidation states of transition metals, Werner’s theory for coordination complexes and its comparison with Blomstrand-Jorgensen Chain Theory, ligands, nomenclature of coordination complexes. Bonding Theories (VBT, MOT and CFT) for explanation of coordination bonding. Common geometries of coordination complexes. Chelates and chelate effect. Distortion in Structures. The spectrochemical series, colour of metal complexes. Magnetic properties (diamagnetism, paramagnetism), Isomerism, Stereochemistry.

1. **Pi-Acceptor Ligands**

Introduction Mono-, bi- and polynuclear transition metal carbonyls, bonding nature, general characteristics and reactions. The 18-electron rule as applied to metal carbonyls, Rationalization

of molecular structures, Equation of Structures based on spectroscopic evidence

**Suggested Readings**

* + Cotton, F.A. and Wilkinson G., *“Advanced Inorganic Chemistry”,* 5th Ed, John Wiley & Sons, New York, 1988.
  + James Huheey, E., “*Inorganic Chemistry, Principles of Structure and Reactivity”,* 3rd. Ed., Cambridge, Harper International, London, 1983.
  + Basolo, F. and Johnson, R., *“Coordination Chemistry”,* W.A. Benjamin, Inc., 1964.
  + Zafar Iqbal M., *“Pi-Acceptor Ligands”,* UGC Islamabad, 1982.
  + Kent Murmann R., *“Inorganic complex compounds”,* Reinhold publishing corporation, New

York, 1964.

* + Kamlesh Bansal, *“Coordination Chemistry”,* Campus Books International, New Dehli, 2003.

**Inorganic Chemistry Lab –II**

1. **Complexometric Titrations** 
   * Estimation of Mg+2 and Zn+2 with EDTA (direct Titration).
   * Estimation of Ni+2 with EDTA (Back Titration).
   * Estimation of Ca+2 and Zn+2 in a Mixture (Masking).
   * Estimation of Cd+2 and Zn+2 in a Mixture (Demasking).
   * Estimation of SO4-2 and PO4-3 with EDTA (Indirect Titration)
2. **Redox Titrations**

* + Use of Cerric Sulphate solution for the estimation of Iron in an Iron ore.
  + Use of potassium Iodate for the determination of the following;

(i) Copper (ii) H2O2

**Suggested Readings**

Bassett J., *“Vogel’s text books of quantitative analysis”,* 4th Ed., Longman Group Limited, 1978

**CHM-5604 Biochemistry-II 4(3-1)**

**Biocatalysis and acid-base regulation:**

Body fluids as electrolytes solutions, pH, Henderson-Hesselbalch equation and buffers,. Acid and bases, amino acids as acids and bases, buffring capacity of amino acids, regulation of acid base balance, acidosis, alkalosis, homeostasis, detoxification, circularory system and its role to maintain body homeostasis.

**Enzymes:**

Chemical nature, nomenclature and classification of enzymes. Cofactors, substrate specificity, enzymesubstrate interaction. Kinetics of single substrate reactions, effect of different factors on enzymes activity, enzyme inhibition, regulatory enzymes, allosteric enzymes, multi enzymes system, zymogens and isozymes, immobilized enzymes and their uses. **Recommended Books.**

1. Lehniger, A.L, “Principles of Biochemistry”, Worth Publisher, New York, (2001).
2. Voet, D. and Voit J. G., “Biochemistry”, John Wiley & Sons, New York, (2000).
3. West, Text Book of Biochemistry”, 4th Ed., (2000).
4. Zubay, G., biochemistry, 4th Ed. Macmillan Publishing Co. (1999).
5. Wilheim R. Frisell, “Human Biochemistry”, Macmillan Publishing Co., Inc. New York (1982).
6. Guyoton AC and Hall JE. “Text Book of Medical Physiology”, 9th Ed, W. B. Sauders Company, Tokyo, (1996).

**Biochemistry Laboratory-II**

1. Determination of cholesterol in fluids.
2. Determination of hemoglobin in the fluids.
3. Estimation of ascorbic acid in the given sample.
4. Determination of choloride in fluids.
5. Determination calcium in fluids.
6. Determination of total acidity in the given sample

***Recommended Books***

1. D. T. Plummer, “*An Introduction to Practical Biochemistry”*, Tata Mc Graw-Hill Publishing company Ltd., New Delhi, 1988.
2. K. K. Pillai, J. S. Qadry, “*Biochemistry and Clinical Pathology”* CBS Publishers & Distributors,

1996.

1. S. P. Dandekar, S. A. Rane, “*Practical and viva in Medical Biochemistry”,* Reed Elsevier India PrivateLtd., 2004.

**COURSES FOR SEMESTER-VIII (PHYSICAL SECTION)**

# CHM-6801 Quantum Mechanics 3(3-0)

Operators and their properties, algebra of operators, quantum mechanical operators, complex numbers, well behaved function, probability function and average values, Schrödinger formulation of quantum mechanics, dynamic variables, state functions, the law of quantum mechanics, stationar states, corollaries of quantum mechanics, stationary states, atomic units, derivation of quantum numbers from Schrodinger wave equation, polar co-ordinate system, applications of Schrodinger wave equation for hydrogen and helium atom. **Books Recommended**

1. Levine, I.N., “*Quantum Chemistry”* 4th Ed., Prentice Hall, New Jersey, and Prentice Hall India 1991.
2. Hanna, M.W., “*Quantum Mechanics in Chemistry”* 3rd Ed., The Benjamin/Cummings Co., California, 1981.
3. Lowe, J.P., “*Quantum Chemistry”* 2nd Ed. Academic Press. Boston., New York, 1993.

# CHM-6802 Colloids and Surfactants 3(3-0)

Colloids, difference between colloidal and true solution, types of colloids, phases of colloidal solution, difference between lyophilic and lyophobic colloids, preparation of colloidal dispersion, purification of colloidal solution, properties of colloidal suspension, determination of size of colloidal particles by sedimentation of suspension and ultra centrifuge method, electrokinetic phenomena, electrophoresis, electro osmosis and streaming potential, coagulation of colloids, protection of the colloidal state, gold number, origin of charge on sol particles. Stability of solution, associated colloids, micelles, mechanism of micelle formation. Emulsions, preparation of emulsions, role of emulsifier, properties of emulsion, gel, types of gels, properties of gels, applications of colloids.

**Suggested Readings**

1. Hiementz, PC. and Rajaqopalam, R., “*Principles of colloid, & surface Chemistry”* Marcel Dekker, 1997.
2. Fennel-Fvans, D., “*The collodial Domain”* VCH, 1994.

**CHM- 6803 Electrochemistry 3(3-0)**

Theories of electrolytes, interfacial phenomenon, electrode kinetics, Butter Volmer equation, Nernst equation, acitivity and acitivity coefficient, applications of acitivity coefficients, ionic strength, Kohlrausch’s law of independent migration, standard electrodes, emf of the cell with transference and without transferences, electrolysis, ionic theory of electrolysis, electrochemical series, displacement reactions, batteries and commercial cells, dry cell, lead storage cell, fuel cells,

**Books Recommended**

1. Bockris, J.M. and Reddy, “*Modern Electrochemistry”* A.K.N. 2 Vols. Plenum Press, New York, 1970.
2. Bard. A. and Faulkner, L.R., “*Electrochemical Methods Fundamentals and Application”* John Wiley, New York, 1980.

**CHM-6804 Nuclear and Radiation Chemistry 3(3-0)**

Introduction, composition of the nucleus, natural and artificial radioactivity, radioactive decay, half life, fission and fusion reactions, nuclear reactors, stellar energy, natural and artificial transformation, transuranic elements, acceleration of charged particles (projectiles), linear accelerator, cycloterons, radiation hazards, nuclear waste and their treatment, uses of traces in chemistry.

**Books Recommended**

1. Friedlander, G. And Kennedy, J.W., “*Nuclear and Radiochemistry”* Others 3rd Ed., John Wiley & Sons, New York, 1980.
2. Arnikar, H.J., “*Essentials of Nuclear Chemistry”* 4th Ed. New Age International Publishers Ltd. Wiley Eastern Ltd. New Delhi, 1995.
3. Spinks, J.W.T. and Woods, R.J., “*An Introduction to Radian Chemistry*” 2nd Ed., John Wiley, New York, 1976.

**CHM-6805 Chemical Thermodynamics 3(3-0)**

Thermodynamics of systems of variable composition, dependence of state functions on variables, thermodynamic behaviour of ideal gases, fugacity and determination of fugacity, criteria for equilibrium partial molal quantities, determination of molal quantities, ideal solutions, laws of dilute solutions, activity, activity coefficient and its determination and equilibrium constant, colligative properties, phase rule.

**Books Recommended**

* 1. Alberty, R.A and Silbey, R.J., “*Physical Chemistry”* John Wiley, New York, 1995.
  2. Atkins, P.W., “*Physical Chemistry”* 5th Ed., W.H. Freeman & Company, New York, 1994.
  3. Barrow, G. M., “*Physical chemistry”* McGraw Hill, Singapore, 1988.
  4. Klotz, I.M., “*Chemical Thermodynamics”* 3rd Ed., W.A. Benjamin Inc., California, 1972
  5. Pitzer, K.S., “*Thermodynamics”* 3rd Ed., McGraw-Hill, New York, 1995.

# CHM-6806 Catalysis 3(3-0)

Catalysis, criteria of catalysis or characteristics of catalytic reactions, types of catalysis, promoters, catalytic poisoning and poisoning effect of catalyst, autocatalysis, negative catalysis, and inhibitors, activation energy and catalysis, theories of catalysis, the intermediate compound formation’s theory, the adsorption theory, active centers on catalyst surface, acid base catalysis and its mechanism, heterogeneous catalysis, mechanism of heterogeneous catalysis, kinetics of heterogeneous (surface) catalytic reactions, enzyme catalysis, characteristic of enzyme catalysis, mechanism of enzyme reactions.

**Books Recommended**

1. Bond, G.C., “*Heterogeneous catalysis: Principles and Applications”*, 2nd Ed., Oxford, Clarendon Press, 1987.
2. Agrawal, G. L., “*Basic chemical kinetics”* Tata McGraw-Hill Publishing company limited, 1990.

**CHM-6807 Computational Chemistry 3(3-0)**

**Computer Auded Numerical Methods**: Least square curve fitting method for linear functions and its modified forms for other functions, statistical analysis. Numerical differentiation. **Geometrical Application of Integratio**n: Are under the curves of various natures, calculation of volume, and length of curve line. Numerical integration: Rectangular, trapezoidal and parabolic methods of approximation.

**Molecular Modeling**: Model building using different force field parameters, geometry optimization.

**CHM-6808 Solid State Chemistry 3(3-0)**

**Unit cells and crystal systems:** Lattices and their description: Bravais lattice; Miller indices; unit cell contents. Point groups and their relevant classification based on symmetry. **Space groups and crystal structures:** Close-packed structures (cubic, hexagonal, tetragonal and other packing arrangements). Important structure types (Rutile, Rock Salt, Zinc Blend, Wurtzite, etc.) **Perfect and imperfect crystals:** Types of defects with description. Diffusion of ions in solids; dislocation; mechanical properties and reactivity of solids.

**Theories of electrical conductance:** Different types of solids, metals and non-metals.

**CHM-6861 Advanced Practicals in Chemistry 4(0-4)**

**Contents**

* To determine the composition of binary mixture containing K2Cr2O7  and KMnO4 spectrophotometrically.
* To study the complex formation between Fe (III) and salicyclic acid and to find the formula and stability constant of complex.
* To find out the strength of HCl and CH3COOH in a mixture of both. By titrating it against NaOH solution
* To study the adsorption of acetic acid on charcoal and to prove the validity of Freundlich’s adsorption
* To find partition coefficient of iodine between CCl4 and water.
* To determine the molecular weight of high polymer by means of viscosity measurement.
* Determination of critical solution temperature of phenol water system and triethylamine water system
* Conductometric titrations of mixtures of acid with strong base.

**OR**

**CHM-6862 Thesis 4(0-4)**

**COURSES FOR SEMESTER-VIII (Organic chemistry section)**

**CHM-6831 Reaction Mechanism-II 3(3-0)**

Oxidation & Reduction reactions

* Oxidation: Introduction; oxidation of hydrocarbons; olefinic bonds; oxygenated systems including alcohols, aldehydes and ketones.
* Reduction: Introduction; reduction of hydrocarbons; cycloalkanes; conjugated olefins; alkynes; aromatic rings; hydrgenolysis of aldehydes and ketones.

Aromatic Electrophillic Substitution

ArSE1, ArSE2 and ArSE3 Mechanisms. Brief account of arenium ion mechanism; orientation and reactivity in mono substituted and di substituted benzene; study of halogenation, nitration, sulfonation, formulation Friedel

Craft’s alkylation and acylation reactions.

Aromatic Nucleophilic substitution Study of following mechanisms

i. Intermediate complex mechanism ii. Benzyne mechanism iii. SN1 iv. ANRORC mechanism

v. Radical nucleophilic mechanism

# 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 Chemsitry*, 3rd Ed, MacGrawHill, Tokyo, 1970.
3. Morrison, R.T., and Boyde, R.N., *Organic Chemistry,* 6th Ed. Prentice Hall, Englewood Cliffs, New Jersey, 1992.
4. March, J., *Advanced Organic Chemistry,* 4th Ed., John Wiley & Sons, New York, 1992.
5. Lowry T.H. & Richardson, K.W., *Mechanism and Theory in Organic Chemistry,* 3rd Ed., Harper & Row Publishers, New York, 1987.
6. Finar, I.L., *Organic Chemistry,* 6th Ed., Vol. 1 & 2, Longman, London, 1973.
7. McMurry, J., *Fundamentals of Organic Chemistry,* 4th Ed., Brooks/Cole Publishing Co., California, 1994.

**CHM-6832 Spectroscopy-II 3(3-0)**

Structure elucidation of organic compounds on the basis of UV, IR, NMR and Mass spectral information.

# Suggested Readings

1. McMurry, J., *Fundamentals of Organic Chemistry,* 4th 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,* 4th Ed., McGraw-Hill Book Co., London, 1987.
4. Hesse, M., Meir, H. and Zech, B., Georg, Thieme *Spectroscopic Methods in Organic Chemistry,* Verlog, 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-6833 Natural Products 3(3-0)**

Alkaloids: Introduction, classification, isolation and general methods of structure determination.

Chemistry of Ephedrine, Conine, Nicotine. Biosynthesis of alkaloids.

Terpenoids: Introduction, classification, isolation and general methods of structure determination.

Chemistry of Citral, α-Pinene and Camphor. Biosynthesis of terpenoids.

Steroids: Introduction, classification, isolation and general methods of structure determination. Chemistry of Cholesterol, Vitamin D. Biosynthesis of steroids.

# Suggested Readings

1. March, J., *Advanced Organic Chemistry,* 4th Ed., John Wiley & Sons, New York, 1992.
2. Finar, I.L., *Organic Chemistry,* 6th Ed., Vol. 1 & 2, Longman, London, 1973.

**CHM-6834 Introduction to Organic Polymers 3(3-0)**

Definition; Classification; Types of polymerization reactions; Step-growth and chain-growth polymerization; Polymer characterization and molecular weight determination.

# Suggested Readings

1. Young, R., & Lovell, P.A., *Introduction to Polymers,* Chapman & Hall Publishers, UK.
2. Cowie, J.M.G., *Polymers Chemistry and Physics of Modern Materials,* Billing & Sons Ltd. UK.

**CHM-6835 Pericyclic Reactions and Photochemistry 3(3-0)**

Pericyclic Reactions

Introduction; Classification; Examples of thermal and photochemical electrocyclic, cycloaddition and sigmatropic reactions. Symmetry of orbitals and correlation diagrams. Theories of concerted pericyclic reactions Woodward-Hofmann theory, Fukui’s theory of Frontier Orbital method, Mobius-Huckel

theory. Photochemistry

Introduction; 1st and 2nd law of photochemistry; Quantum yield; Norish Type I and Type II reactions; Jablonskii diagram; Phosphorescence; Fluorescence.

# Suggested Readings

1. Woodward & Hoffman, *The Conservation of Orbital Symmetry,* Verlag Chemie, G. Mb. H.
2. Hendrickson, J.B., Cram, D.J. , and Hammond, G.S., *Organic Chemsitry,* 3rd Ed, MacGraw- Hill, Tokyo, 1970.
3. Morrison, R.T. and Boyde, R.N., *Organic Chemistry,* 6th Ed. Prentice Hall, Englewood Cliffs, New Jersey, 1992.
4. Lowry, T.H., & Richardson, K.W., *Mechanism and Theory in Organic Chemistry,* 3rd Ed., Harper & Row Publishers, New York, 1987.

**CHM-6836 Organic Synthesis-II 3(3-0)**

Introduction to reterosynthesis; Functional Group Interconversion; C-C, C-N and C-O bond formation; Analysis and synthesis of 1,1-, 1,2- and 1,3-difunctionalized compounds.

# Suggested Readings

1. March, J., *Advanced Organic Chemistry,* 4th Ed., John Wiley & Sons, New York, 1992.
2. Norman, R.O.C. and Coxon, J.M., *Principles of Organic Synthesis,* 3rd 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,* 6th Ed., Vol. 1 & 2, Longman, London, 1973.

**CHM-6837 Special Topics in Organic Chemistry 3(3-0)**

Any area of choice of teacher offering the course.

**CHM-6861 Advanced Practicals in Chemistry 4(0-4)**

**Contents**

* + Preparation of Maritus Yellow
  + Synthesis of 5,5-diphenylhydantion
  + Preparation of benzoic acid
  + Preparation of carboxylic acid hydrazide
  + Preparation of n-butyl chloride
  + Preparation of 2-iodobenzoic acid
  + Prepartion of 2,4-dinitrophenylhydrazone
  + Protection of functional group OH group

**Suggested Readings**

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

**(OR)**

**CHM-6862 Thesis 4(0-4)**

**COURSES FOR SEMESTER VIII** (**INORGANIC CHEMISTRY SECTION)**

**CHM-6816 Inorganic Chemistry in Biological systems 3(3-0)**

Essential and trace elements in biological systems, Metallobiomolecules, The classification of biomolecules containing metal ions, Biochemistry of iron. Electron careers and metallo-enzymes, The distribution of dioxygen carriers, Structures of oxygen binding site at Fe(II), Models of dioxygen binding, Photosynthesis and respiration, Metal based drugs. **Suggested Readings**

* Cotton, F.A. and Wilkinson, *“Advanced Inorganic Chemistry”,* 5th Ed, G. John Wiley & Sons, New York, 1988.
* James Huheey E., *“Inorganic Chemistry, Principles of Structure and Reactivity”* 3rd. Ed, Cambridge, Harper International, London, 1983.
* Stake M., *“Bioinorganic Chemistry”,* Discovery publishing house.

**CHM-6817 Chemical Crystallography 3(3-0)**

Structures and energetic of metallic and ionic solids, Packing of solid, polymorphism, alloys and intermetallic compounds, lattice energy. Born-Haber cycle, application of lattice energy, defect in solid state, Symmetry, unit cells, crystal systems, lattice lattice point and space group X-rays, production and diffraction, Bragg’s equation, diffractional data collection, data reduction. Application of XRD and method towards structure elucidation (including geometry and other parameters) of crystalline solids.

**Suggested Readings**

* Ladd M. F.C. and Paman R.A., *“Structure Determination by X-ray Crystallography”,* 1st Ed., Plenum Press, New York, 1977.
* Cullity B.D., *“Elements of X-ray Diffraction”,* 2nd Ed., Addison–Wesley Publishing Company, Ind., 1978.
* Woolfson M. M., *“An Introduction to X-ray Crystallography”,* Cambridge University Press. UK, 1970.
* West A.R., *“Solid state chemistry and its application”,* John. Wiley.
* Rodgers G.E., *“Introduction to coordination, solid state and descriptive Inorganic chemistry”,* Mcgraw Hills, 1994.

**CHM-6818 Inorganic Polymers 3(3-0)**

Introduction of polymer materials, Preparation of polyorganosiloxanes and various systems containing P-N, S-N and transition-metal polymers, Preparation and structures of sulphanes and Borates, Characterization of polymeric materials by using various analytical techniques, Applications.

**Suggested Readings**

* Bill Meyer F., *“Text Book of Polymer Science”,* 3rd Ed; John Wiley &sons.
* Joel R. Fried, *“Polymer Science and Technology”,* Prentice Hall, Inc., 1995.
* Seymour R.B. and Carraher C.E., *“Polymer Chemistry, an Introduction”,* Jr. 4th Ed, Marke Dekker, Inc. New York, 1981.
* J.M.G. Cowie, *Polymers Chemistry and Physics of Modern Materials,* Billing & Sons Ltd. UK.

**CHM-6819 Basics of Nuclear Chemistry 3(3-0)**

The development of Nuclear Chemistry, Fundamental particles and nuclear structure, Radioactivity, types of radioactive decay, half life, nuclear fusion, nuclear fission, nuclear forces, the atomic nucleus, production of isotopes and radio-nuclides, the binding energy, exchange forces, nuclear quantum numbers, the shell model, pairing energy, properties of nuclear radiations, Nuclear Reactions, measurement of radioactivity, types of GM counters, Nuclear Reactors, Applications of Nuclear Isotopes

**Suggested Readings**

* Choppin G.R. and Rydberg J., “*Nuclear Chemistry, Theory and Applications*”,
* Friedlander G., Kewedy J.W., “*Nuclear and Radiochemistry*”, Macias E.S. and Miller J. M., 1989.
* Chase G.D., *“Principles of Radioisotope Methodology”,*
* Fashataziz and Rodges M.A.J., *“Radiation Chemistry, Principles and Applications”*
* Kaplan Oxford *“Nuclear Physics”,* New Dehli. 1954.
* Gilreath E.S., *“Fundamental concepts of Inorganic Chemistry”.* McGraw Hill, 1958.

**CHM-6820 Industrial Chemistry 3(3-0)**

Basic data for the development of the industrial unit e.g. basic chemical data, chemical control, raw materials etc, Chemical processes i.e. unit operations, unit process, Chemistry and technology of industries like water conditioning, cement, glass, ceramic, chloralkali, leather, fertilizers, sugar and starch, steel , petroleum, oil, fats and waxes, soap and detergent , pulp and paper etc **Suggested Readings**

* Austin G.T., *“Chemical Process industries”*, 5th Ed. Publishing by McGraw Hill, International.
* Patry C., *“Industrial Chemistry”,* Oxford publishing, New Dehli, 1988.
* Streven and Brink, *“Chemical process Industries”,* McGraw Hill.
* Buchel, Moretto and Wodith, *“Industrial Inorganic Chemistry”,* John Wiley & Sons.
* Weissermel and Ape, *“Industrial Inorganic Chemistry”,* Verlag Chemie.
* Pandey, *“Text Book of Chemical Technology, Vol. I & II”,* Vikas Publishing Co, New Dehli.
* Crogsins, *“Unit Operation in Organic Synthesis”,* McGraw Hill.
* Sing A., *“Industrial Chemistry, Vol. I & II”,* Ahmed. Publishers. New Dehli.

**CHM-6821 Organometallic Chemistry 3(3-0)**

Nature of metal-carbon bond, chemistry of metal sigma, metal Pi-complexes and their nature of bonding. Synthesis and properties of organometallic compounds (Pi-bonded olefins, cyclopentadienyl, polyenes and acetylenes), Applications of organometallic compounds in synthetic chemistry & industry **Suggested Readings**

* Cotton G.F.A. and Wilkinson, *“Advanced Inorganic Chemistry”,* 5th Ed., New York, John Wiley & Sons.
* Huheey, J. E., “*Inorganic Chemistry, Principles of Structure and Reactivity”,* 3rd. Ed, Cambridge, Harper International, London, 1983.
* Yamamoto A., *“Organotransition Metal Chemistry”* A. Wiley Intersience Publication, London, 1986.
* Crabtree R.H., *“The organometallic chemistry of the Transition Metals”,* John Wiley & sons.

**CHM-6822 Advanced Inorganic Chemistry-III 3(3-0)**

* **Non-Aqueous Solvents**

Introduction, Classification of solvents, Types of reactions in solvents, Effect of Physical and Chemical properties of solvents, Study of reactions in liq. NH3, liq SO2 liq HF, liq H2SO4 and liq BF3, Reactions in molten salt systems.

* **Organic Reagents Used In Inorganic Analysis**

Typical reagents used, their classification and specific nature, methods of application with specific examples, complexometric titration involving the use of EDTA and other chelating agents

**Suggested Readings**

* Holzbecher Z., *“Hand Book of organic reagents in Inorganic Analysis”,* Ellis Harwood Limited, London, 1976.
* Sisler, London H. H., *“Chemistry in Non-Aqueous Solvents’,* Chapman and Hall, 1961.
* Gilreath E. S., *“Fundamental concepts of Inorganic Chemistry”,* McGraw Hill, 1958.

**CHM 6861 Advanced Practicals in Chemistry ………….4(0-4)** **Contents**

* To determine the λmaxof potassium permanganate solution by spectrophotometry
* To Verify Beer,s lambert law and determine the concentration of unknown solution of potassium permanganate solution
* Solvent extraction of Ni as dimethylglyoxime complex using spectrophotometry.
* Determination of the individual concentration of the acids in the given binary mixtures of strong/weak acids vs. a strong/weak base by conductometric titration. ▪ *Conductometric precipitation titration of (NH4)2 SO4 vs. barium acetate* ▪ Preparation of buffer solutions and studying buffering capacity.
* Estimation of Pb2+ and Zn+2 in given sample gravimetrically.
* Gravimetric determination of Ba as BaSO4

**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.

**OR**

**CHM-6862 Thesis 4(0-4)**

**COURSES FOR SEMESTER-VIII (BIOCHEMISTRY SECTION)**

**CHM-6846 Cell biology and cell biosignaling 3(3-0)**

**Cell Biology:**

Introduction to cell theory and structure , chemical composition of cell organelles, their structure and functions. Transportation through plasma membrane, glucose transport channels, nucleus, structure and function, chromosomes gene, the cell cycle, mitosis, meiosis and cytokinesis.

**Biosignaling**

Cell signal transduction, insulin signaling pathway. Distruption of insulin signaling during insulin resistance and diabetes. Leptin signaling to regulate food intake / appetite. Disrutptio of leptin signaling in obesity and leptin resistance.

***Recommended Books***

1. Alberts, “ *Essential Cell Biology”,* 3rd Ed., 2010.
2. B. Alberts, A. Johnson, J. Lewis, M. Raff, K. Roberts, P. Walter, “*Molecular Biology of the Cell*”, 5th Ed., Garland Sciences, Taylor and Francis, 2008.
3. H. Lodish, A. Berk, L. Zipursky, P. Matsudaira, D. Baltimore, J. Darnell, “*.Molecular Cell Biology*”, 4th Ed., W.H. Freeman, 2000.
4. G. Karp John, “*Cell and Molecular Biology: Concepts and Experiments”,* Wiley & Sons, 2008.

**CHM-6847 Microbiology and immunology 3(3-0)**

**Microbiology**

Fundamentals of microbiology: Prokaryotic cell structure and function, Prokaryotic growth and nutrition. Prokaryotic genetics.

Virus and eukaryotic microorganisms: Virus, bacteria, fungi and parasites. Bacterial diseases: Airborne, food borne and waterborne bacterial diseases.

Industrial microbiology and biotechnology: Microorganisms in industry. Alcoholic beverages. Other important microbial products. **Immunology:**

Chemistry of immunoglobulins, myeloma and hybridoma immunoglobulins, immune systems and its abnormalities. Allergy and inflammation. Complement system, peripheral leucocytes and macrophages. Immune disorders: Type I IgE-Mediated hypersensitivity, other types of hypersensitivity, autoimmune disorders, immunodeficiency disorders.

***Recommended Books***

1. E. Benjamini, R. Coico, G. Sunshine, “*Immunology: A short course”*, 4th Ed., Wiley- Liss Inc., Canada, 2000.
2. J. G Cappuccino, N. Sherman, *“Microbiology: A laboratory manual”,* 4th Ed., Benjamin/ Cummings Publishing Co., N. Y., 1996.
3. J. Kurby, “*Immunology*”, 2nd Ed., W. H. Freeman and Co., N. Y., 1994.
4. I. Riott, J. Brostoff, D. Male, “*Immunology*”, 3rd Ed., Mosby-Year Book, Europe Ltd., London, 1993.
5. Slonczewski, “*Microbiology: An Evolving Science”,* 2008.
6. 2. Versalovic , “*Therapeutic Microbiology: Probiotics and Related Strategies”,* 2008.

**CHM-6848 Nutrition 3(3-0)**

Major dietary constituents

Nutritional importance of carbohydrates, proteins and amino acids,lipids and dietary fibers. Energy needs: Assessment and requirement of energy in different age groups.

Nutrition in growth and aging: Nutritional requirement in infancy and childhood. Diet, nutrition and adolescence. Nutrition in the Elderly.

Minerals Biochemical role of Calcium, Chromium, Copper, Iron, Iodine, Magnaesium, phosphorous, Selenium, and Zinc. Their dietary sources, Vitamins Role of vitamins as coenzymes.

Structure, physiological functions, deficiency diseases and recommended dietary allowances of the following vitamins.

Fat Soluble vitamins: A, D, E, and K

Water Soluble vitamins: Thiamine, Riboflavin, Niacin Pantotheric acid, Folic acid, Biotin and Ascorbic acid.

**Recommended Books**

1. R. K. Murray, D. K. Granner, P. A. Mayes, “*Harper’s Biochemistry”*, Rodwell, 2000.
2. Wardlaw, Insel, “*perspectives in nutrition*”, Mosby, New York, 1999.

**CHM-6860 Biochemistry practicals lab IV 3(0-3)**

1. DNA extraction and purifications.
2. Preparation of Agarose gel and DNA separation.
3. Separation of proteins using SDS-PAGE.
4. Extraction of Acetyl choline esterase from chichen brain.
5. Enzyme inhibition studies.

**CHM-6861 Advanced Practicals in Chemistry 4(0-4)**

**Contents**

* Determination of unknown concentration of protein by spectrophotometer
* Enzyme inhibition essay
* Determination of antioxident potential of given sample
* DNA extraction/ protein extraction
* Bradford microassay
* Estimation of acid protease in sample
* Alpha amylase activity at different PH, concentration,temperature
* Iron estimation

**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.

**OR**

**CHM-6862 Thesis 4(0-4)**