

**Department of Chemistry**  
**Scheme of Study**

**Course for Semester 8<sup>th</sup> BS**

**Semester 8<sup>th</sup>**

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)
<b>Total</b>	<b>16</b>

**Note: Courses offered in semester 8<sup>th</sup> are given below.**

**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)
<b>Inorganic Chemistry</b>		
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)
<b>Organic Chemistry</b>		
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)
<b>Biochemistry</b>		
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	<u>Advanced Practicals in Chemistry</u>	4(0-4)
CHM-6862	OR <u>Thesis</u>	4(as per nature)

## Physical Chemistry Courses Detail

### Courses for Semester-VIII

#### **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, stationary

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**

Levine, I.N., "*Quantum Chemistry*" 4<sup>th</sup> Ed., Prentice Hall, New Jersey, and Prentice Hall India 1991.

Hanna, M.W., "*Quantum Mechanics in Chemistry*" 3<sup>rd</sup> Ed., The Benjamin/Cummings Co., California, 1981.

Lowe, J.P., "*Quantum Chemistry*" 2<sup>nd</sup> 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**

Hiementz, PC. and Rajaopalam, R., "*Principles of colloid, & surface Chemistry*" Marcel Dekker, 1997.

Fennel-Fvans, D., "*The colloidal 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**

Bockris, J.M. and Reddy, "*Modern Electrochemistry*" A.K.N. 2 Vols. Plenum Press, New York, 1970.

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, cyclotrons, radiation hazards, nuclear waste and their treatment, uses of traces in chemistry.

#### **Books Recommended**

Friedlander, G. And Kennedy, J.W., “*Nuclear and Radiochemistry*” Others 3<sup>rd</sup> Ed., John Wiley & Sons, New York, 1980.

Arnikar, H.J., “*Essentials of Nuclear Chemistry*” 4<sup>th</sup> Ed. New Age International Publishers Ltd. Wiley Eastern Ltd. New Delhi, 1995.

Spinks, J.W.T. and Woods, R.J., “*An Introduction to Radian Chemistry*” 2<sup>nd</sup> Ed., John Wiley, New York, 1976.

### **Chemical Thermodynamics**

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**

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.

Klotz, I.M., “*Chemical Thermodynamics*” 3<sup>rd</sup> Ed., W.A. Benjamin Inc., California, 1972

Pitzer, K.S., “*Thermodynamics*” 3<sup>rd</sup> Ed., McGraw-Hill, New York, 1995.

### **CHM-6806Catalysis**

**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**

Bond, G.C., “*Heterogeneous catalysis: Principles and Applications*”, 2<sup>nd</sup> Ed., Oxford, Clarendon Press, 1987.

Agrawal, G. L., “*Basic chemical kinetics*” Tata McGraw-Hill Publishing company limited, 1990.

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

**Computer Aided Numerical Methods:** Least square curve fitting method for linear functions and its modified forms for other functions, statistical analysis. Numerical differentiation.

**Geometrical Application of Integration:** 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)**

OR

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

**Organic Chemistry Courses**

**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. **(Mid Term)**
- **Reduction:** Introduction; reduction of hydrocarbons; cycloalkanes; conjugated olefins; alkynes; aromatic rings; hydrogenolysis of aldehydes and ketones.

Aromatic Electrophilic Substitution

ArSE<sub>1</sub>, ArSE<sub>2</sub> and ArSE<sub>3</sub> 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

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III. SN<sup>1</sup>

IV. ANRORC mechanism

V. Radical nucleophilic mechanism **(Terminal)**

**Suggested Readings**

Issac, Neil S., *Physical Organic Chemistry*, Longman Scientific and Technical Publishers, USA.

Handrickson, J. B., Cram, D.J. and Hammond, G.S., *Organic Chemistry*, 3<sup>rd</sup> Ed, MacGraw-Hill, Tokyo, 1970.

Morrison, R.T., and Boyde, R.N., *Organic Chemistry*, 6<sup>th</sup> Ed. Prentice Hall, Englewood Cliffs, New Jersey, 1992.

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

Lowry T.H. & Richardson, K.W., *Mechanism and Theory in Organic Chemistry*, 3<sup>rd</sup> Ed., Harper & Row Publishers, New York, 1987.

Finar, I.L., *Organic Chemistry*, 6<sup>th</sup> Ed., Vol. 1 & 2, Longman, London, 1973.

McMurry, J., *Fundamentals of Organic Chemistry*, 4<sup>th</sup> 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, **(Mid Term)** NMR and Mass spectral information. **(Terminal)**

#### **Suggested Readings**

McMurry, J., *Fundamentals of Organic Chemistry*, 4<sup>th</sup> Ed., Brooks/Cole Publishing Co., California, 1994.

Brown, D.W., Floyed, A. J. and Sainsbury, M., *Organic Spectroscopy*, J. Wiley and sons, Chichester, 1998.

Williams, D.H. & Fleming, I., *Spectroscopic Methods in Organic Chemistry*, 4<sup>th</sup> Ed., McGraw-Hill Book Co., London, 1987.

Hesse, M., Meir, H. and Zech, B., Georg, Thieme *Spectroscopic Methods in Organic Chemistry*, Verlag, Stuttgart, New York, 1997.

Younas, M., *Organic Spectroscopy*, A. H. Publisher, Lahore.

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. **(Mid Term)**

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

Chemistry of Citral,  $\alpha$ -Pinene and Camphor. Biosynthesis of terpenoids.

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

Chemistry of Cholesterol, Vitamin D. Biosynthesis of steroids. **(Terminal)**

#### **Suggested Readings**

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

Finar, I.L., *Organic Chemistry*, 6<sup>th</sup> Ed., Vol. 1 & 2, Longman, London, 1973.

### **CHM-6834 Introduction to Organic Polymers**

**3(3-0)**

Definition; Classification; Types of polymerization reactions; **(Mid Term)** Step-growth and chain-growth polymerization; Polymer characterization and molecular weight determination. **(Terminal)**

#### **Suggested Readings**

Young, R., & Lovell, P.A., *Introduction to Polymers*, Chapman & Hall Publishers, UK.  
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 **(Mid Term)** 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; 1<sup>st</sup> and 2<sup>nd</sup> law of photochemistry; Quantum yield; Norish Type I and Type II reactions; Jablonskii diagram; Phosphorescence; Fluorescence. **(Terminal)**

#### **Suggested Readings**

Woodward & Hoffman, *The Conservation of Orbital Symmetry*, Verlag Chemie, G. Mb. H.  
Hendrickson, J.B., Cram, D.J. , and Hammond, G.S., *Organic Chemsitry*, 3<sup>rd</sup> Ed, MacGraw-Hill, Tokyo, 1970.  
Morrison, R.T. and Boyd, R.N., *Organic Chemistry*, 6<sup>th</sup> Ed. Prentice Hall, Englewood Cliffs, New Jersey, 1992.  
Lowry, T.H., & Richardson, K.W., *Mechanism and Theory in Organic Chemistry*, 3<sup>rd</sup> 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**

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

Advanced Practical will include at least four practicals from each section, i.e. Organic, Inorganic/Analytical, Biochemistry and Physical chemistry.

**Suggested Readings**

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.

Adams, R., Johnson, J.R., & Wilcox Jr., *Laboratory Experiments in Organic Chemistry*, 6<sup>th</sup> Ed., Collier-Macmillan, London, 1970.

(OR)

**CHM-6862 Thesis**

## **Inorganic Chemistry Courses**

**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, **(Mid Term)** Biochemistry of iron. Electron carriers 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. **(Terminal)**

Cotton, F.A. and Wilkinson, "Advanced Inorganic Chemistry", 5<sup>th</sup> Ed, G. John Wiley & Sons, New York, 1988.

James Huheey E., "Inorganic Chemistry, Principles of Structure and Reactivity" 3<sup>rd</sup>. 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 inter-metallic compounds, lattice energy. Born-Haber cycle, application of lattice energy, defect in solid state, Symmetry, **(Mid Term)** unit cells, crystal systems, lattice lattice point and space group X-rays. production and diffraction. Bragg's equation, diffractonal data collection, data reduction. Application of XRD and method towards structure elucidation (including geometry and other parameters) of crystalline solids. **(Terminal)**

Ladd M. F.C. and Paman R.A., "Structure Determination by X-ray Crystallography", 1<sup>st</sup> Ed., Plenum Press, New York, 1977.

Cullity B.D., "Elements of X-ray Diffraction", 2<sup>nd</sup> 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.

Bill Meyer F., *“Text Book of Polymer Science”*, 3<sup>rd</sup> 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. 4<sup>th</sup> 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

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

Austin G.T., *“Chemical Process industries”*, 5<sup>th</sup> 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), **(Mid Term)** Applications of organometallic compounds in synthetic chemistry & industry **(Terminal)**

Cotton G.F.A. and Wilkinson, "Advanced Inorganic Chemistry", 5<sup>th</sup> Ed., New York, John Wiley & Sons.

Huheey, J. E., "Inorganic Chemistry, Principles of Structure and Reactivity", 3<sup>rd</sup>. Ed, Cambridge, Harper International, London, 1983.

Yamamoto A., "Organotransition Metal Chemistry" A. Wiley Interscience 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. NH<sub>3</sub>, liq SO<sub>2</sub> liq HF, liq H<sub>2</sub>SO<sub>4</sub> and liq BF<sub>3</sub>, 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

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)**

OR

**CHM-6862 Thesis**

**4(0-4)**

## Biochemistry Courses

**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, **(Mid Term)** 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. **(Terminal)**

### **Recommended Books**

- Alberts, " *Essential Cell Biology*", 3<sup>rd</sup> Ed., 2010.
- B. Alberts, A. Johnson, J. Lewis, M. Raff, K. Roberts, P. Walter, " *Molecular Biology of the Cell*", 5<sup>th</sup> Ed., Garland Sciences, Taylor and Francis, 2008.
- H. Lodish, A. Berk, L. Zipursky, P. Matsudaira, D. Baltimore, J. Darnell, " *Molecular Cell Biology*", 4<sup>th</sup> Ed., W.H. Freeman, 2000.
- 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. **(Mid Term)**

#### **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. **(Terminal)**

### **Recommended Books**

- E. Benjamini, R. Coico, G. Sunshine, " *Immunology: A short course*", 4<sup>th</sup> Ed., Wiley- Liss Inc., Canada, 2000.
- J. G Cappuccino, N. Sherman, " *Microbiology: A laboratory manual*", 4<sup>th</sup> Ed., Benjamin/Cummings Publishing Co., N. Y., 1996.
- J. Kurby, " *Immunology*", 2<sup>nd</sup> Ed., W. H. Freeman and Co., N. Y., 1994.
- I. Riott, J. Brostoff, D. Male, " *Immunology*", 3<sup>rd</sup> Ed., Mosby-Year Book, Europe Ltd., London, 1993.
- Slonczewski, " *Microbiology: An Evolving Science*", 2008.
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. **(Mid Term)**

Minerals Biochemical role of Calcium, Chromium, Copper, Iron, Iodine, Magnesium, 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 Pantothenic acid, Folic acid, Biotin and Ascorbic acid. **(Terminal)**

**Recommended Books**

R. K. Murray, D. K. Granner, P. A. Mayes, "*Harper's Biochemistry*", Rodwell, 2000.

Wardlaw, Insel, "*perspectives in nutrition*", Mosby, New York, 1999.

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

DNA extraction and purifications.

Preparation of Agarose gel and DNA separation.

Separation of proteins using SDS-PAGE.

Extraction of Acetyl choline esterase from chicken brain.

Enzyme inhibition studies.

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

**OR**

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