FACULTY OF SCIENCES

SYLLABUS

FOR

Interdisciplinary Course (UG & PG)

(Under Credit Based Continuous Evaluation Grading System)

Session: 2013-14

GURU NANAK DEV UNIVERSITY

AMRITSAR

CYL-001 General Chemistry (UG)

Credit: 4-0-0

1. Introduction
Chemistry in everyday living
Branches of chemistry

2. Nature and Composition of Matter
Matter and energy
Separation of mixtures
Atomic theory of matter
Atoms and molecules
Formulae
Chemicals equations
Avogadro's Hypothesis
Mole concept
Chemical equation

3. Structure of an Atom
Atomic structure
Electrons, Protons and Neutrons
Models of an atom
Atomic number and mass number
Isotopes, Isobars, Isotones, Isodiaphers and Isosteres
Theories of radiation
Quantum numbers
Configuration of atoms

4. Radioactivity
Discovery of Radioactivity
Nuclear Disintegration
Nuclear Reactor
Application of Radioactive Isotopes

5. Periodic Classification of Elements
Modern Periodic table
Gradation of Properties in groups and periods

6. Chemical Bonding
Chemical Bond
Causes of Chemical Combinations
Types of Bonding

7. Chemical Reactions

Introduction
Types of chemical reactions
Speed of reactions and catalysts
Rate of chemical reactions
Energies involved in a reactions
Electrochemicals cells
Metallic corrosion

8. Oxidation and Reduction

Oxidation and reduction
Oxidation Reduction
Reaction / Redox Reaction
Oxidation Number

9. Metals & Non Metals

Occurrence of Metals
Properties of Metals
Properties of Non-Metals

10. Carbon

Introduction
Allotrophy of crabon

11. Solutions

Components of solutions
Concentrations of solutions
Solubility of gases
Solid solutions
Raoult's Law
Osmosis

12. Acids, Bases and Salts

Acid and Base
Salts
The pH scale
The pH of solution
Buffer solutions

13. Chemistry in Service of Man

Polymers
Natural Rubber
Plastics

14. Fertilizers and Pesticides
Fertilizers
Pesticides

15. Cement and Glass
Cement
Glass

Books:

1. General Chemistry by Darrel D. Ebbing and Steven D. Gammon, 9th Edition, Houghton Mifflin Company, Boston, New York.
2. Principles of General Chemistry by Martin S. Silberberg, Publisher McGraw-Hill.
3. Engineering Chemistry by Jain and Jain, Dhanpat Rai Publishing Co.
4. Modern ABC of Textbook Chemistry, Vol. I & II, For Class 11 and 12 by Dr. S.P. Jauhar Modern Publishers Books, New Delhi.
5. Pradeep New Course Chemistry Vol. I & II, For Class 11 and 12 by S. N. Dhawan, S. C. Kheterpal & P. N. Kapil, Pradeep Publication, Jalandhar.

CYL-002: Physical Chemistry (UG)

Credit: 3-0-0 **Course Hrs. 45**

Statistical Thermodynamics: **(20 Hrs)**

The thermodynamic probability of a system, Types of statistics; Maxwell- Boltzmann distribution law, Fermi- Dirac and Bose- Einstein distribution laws and their comparison.Systems of independent particles. The energy of a system: Ensembles; canonical, microcanonical and grand canonical ensemles. The partition function. Separation of partitionfunctions into translational, rotational, vibrational and electronic partition functions. Relation between partition function thermodynamic functions. Statistical calculation of equilibriumconstants. Relation between entropy and thermodynamic probability.

Chemical Bonding: **(25 Hrs)**

Hamiltonian for diatomic molecules, Born oppenheimer approximation, understanding chemical bonding through molecular orbital treatment of H_2^+, Bonding and antibonding molecular orbitals, Molecular orbital configurations of homonuclear diatomic molecular, molecular electronic terms, the Valence bond and molecular orbital treatment of hydrogen molecule. Comparison of molecular orbital and valence bond treatments. The Hartree Fock method for molecules. TheVirial theorem, the Hellman Feynman theorem, the electrostatic theorem. The free electron molecular orbital method, the Huckel m.o method HMO treatment of butadiene, benzene Extended Huckel method**.**

Books Suggested:

1. Quantum Chemistry, Ira N. Levine Prentice Hall.
2. Introduction to Statistical Thermodynamics, T.l. Hill.

CYL-051: Bio-physical Chemistry (PG)

Credits: 3-0-0

UNIT-I

(23 Hrs)

Biological Cell and its Constituents: Biological Cell, structure and functions of proteins, enzymes,DNA and RNA in living systems. Helix coil transition.

Bioenergetics: Standard free energy change in biochemical reactions, exergonic, endergonic, Hydrolysis of ATP, synthesis of ATP from ADP, coupled reactions, degree of coupling.

Statistical Mechanics in Biopolymers: Chain configuration of macromolecules, statistical distribution end to end dimensions, calculation of average dimensions for various chain structures. Polypeptide and protein structures, introduction to protein folding problem.

Biopolymer Interactions: Forces involved in biopolymer interactions, Electrostatic charges and molecular expansion, hydrophobic forces, dispersion force interactions. Multiple equilibria and various types of binding processes in biological systems. Hydrogen ion titration curves.

Thermodynamics of Biopolymer Solutions: Thermodynamics of biopolymer solutions, osmoticpressure, membrane equilibrium, muscular contraction and energy generation in mechanochemicalsystem.

Cell Membrane and Transport of Ions: Structure and functions of cell membrane. Active transport across cell membrane, irreversible thermodynamics treatment of membrane transport.

UNIT- II

(22 Hrs)

Bio-polymers and their Molecular Weights: Evaluation of size, shape, molecular weight and extent of hydration of biopolymers by various experimental techniques.
Viscosity: Measurement, relation to geometry and correlation with hydrodynamic properties.
Diffusion: Fick's Law of diffusion, diffusion coefficient and its interpretation, frictional coefficient.
Ultracentrifugation: Svedberg equation, sedimentation equilibrium, density gradient sedimentation.
Electrophoresis: General principles, Double layer techniques, moving boundary electrophoresis, zonal electrophoresis, isoelectric focusing.
Osmotic Pressure: Second virial coefficient, Donnan effect, molecular mass and geometry from O.P. data.
Optical properties of Biomacromolecules: Light Scattering, fundamental concepts, Rayleigh Scattering, Scattering by Larger particles.

Books Recommended:

1. Principles of Biochemistry, A.L. Lehninger, Worth Publishers.
2. Biochemistry, L. Stryer, W.H. Freeman.
3. Biochemistry, Voet and Voet, John Wiley.
4. Macromolecules: Structure and Function, F.Wold, Prentice Hall.
5. Text Book of Polymer Science, F.W. Billmeyer.
6. Physical Chemistry of Polymers, A. Tager.

Interdisciplinary Courses
CHEMISTRY (UG & PG)

Molecular Spectroscopy (PG)

Paper: CYL-052

Credits: 4-0-0

1. General Features of Spectroscopy: (5 Hrs.)

Units and conversion factors. Introduction to spectroscopy, Nature of radiation. Energies corresponding to various kinds of radiation, Experimental techniques, intensities of spectrallines, Selection rules and transition moments, Line widths, Broadening.

2. Nuclear Magnetic Resonance Spectroscopy: (35 Hrs.)

PMR: Natural abundance of $_{13}C$, $_{19}F$ and $_{31}P$ nuclei; The spinning nucleus, effect of externalmagnetic field, precessional motion and frequency, Energy transitions, Chemical shift and itsmeasurements. Factors influencing chemical shift, anisotropic effect; Integrals of protons,proton exchange, spin-spin coupling- splitting theory, one, two and three bond coupling,virtual, long range and allylic coupling, magnitude of coupling constant; factors affecting thecoupling constant, Chemical and magnetic equivalence, First and second order spectra, A_2,AB, AX, AB_2, AX_2, A_2B_2 and A_2X_2 spin systems, Simplification of complex spectra (solventeffect, field effect, double resonance and lanthanide shiftreagents),CWandFTNMR,Relaxationprocesses,T1andT2measurements, Applications of PMR in structuralelucidation of simple and complex compounds.

$_{13}C$-NMR: Resolution and multiplicity of $_{13}C$ NMR, $_{1}H$-decoupling, noise decoupling, broadband decoupling; Deuterium, fluorine and phosphorus coupling; NOE and origin of nuclearoverhauser effect. off-resonance, proton decoupling, Structural applications of $_{13}C$-NMR.,pulse sequences, pulse widths, spins and magnetization vectors, DEPT, INEPT,Introduction to 2D-NMR, COSY, NOESY, HSQC spectra.

3. Mass Spectra: (10 Hrs.)

Introduction, methods of ionization EI & CI, Brief description of LD, FAB, SIMS, FD etc.,Ion analysis methods (in brief), isotope abundance, Metastable ions, general rules predictingthe fragmentation patterns. Nitrogen rule, determination of molecular ion peak, index of Hdeficiency, fragmentation patterns for aliphatic compounds, amines, aldehydes, Ketons,esters, amides, nitriles, carboxylic acids ethers, aromatic compounds etc.

4. **UV and Visible Spectroscopy of organic molecules: (10 Hrs.)**

Measurement techniques, Beer – Lambert's Law, molar extinction coefficient, oscillator strength and intensity of the electronic transition, Frank Condon Principle, Ground and firstexcited electronic states of diatomic molecules, relationship of potential energy curves toelectronic spectra, Chromophores, auxochromes, blue shift, red shift, hypo and hyperchromic effect, - *, - *, n- * transitions in organic molecules, Woodward rules for conjugated dienes and , - unsaturated carbonyl groups, extended conjugation and aromatic sterically hindered systems, Quantitative applications.

Books Recommended:

1. Pavia, Lampman & Kriz, Introduction to Spectroscopy.
2. C.N Banwell, "Fundamentals of Molecular Spectroscopy".
3. R. M. Silverstein, G.C.Bassler, T.C. Morrill, "Spectrometic Identification of Organic Compounds.
4. W. Kemp, "Organic Spectroscopy".
5. D.H. Williams, I. Fleming, "Spectroscopic Methods in Organic Chemistry".
6. D.H. Williams, I. Fleming, "Spectroscopic Problems in Organic Chemistry", 1967.
7. R.C. Banks, E.R. Matjeka, G. Mercer, "Introductory Problems in Spectroscopy", 1980.
8. G.M. Barrow, "Introduction to Molecular Spectroscopy".

Interdisciplinary Courses
PHYSICS (UG & PG)

GENERAL PHYSICS-I (UG)
(Odd Semester)

Course No.	**LTP**
PHL-001	**3 0 0**

Electrostatics : Electric Charges; Coulomb's law, forces between multiple charges; Electrical field, electric field due to a point charge, electric-field lines; electric dipole, torque on a dipole in uniform electric field. Electric flux, Gausss's theorem and its applications to find field due to infinitely long straight wire, uniformly charged infinite plane sheet and uniformly charged thin spherical shell; Electric potential, potential difference, electric potential due to a point charge and system of charges; electrical potential energy of a system of charges. Capacitors and capacitance, combination of capacitors, capacitance of a parallel plate capacitor, energy stored in a capacitor. Electric current, drift velocity, mobility, Ohm's law, electrical resistance, electrical energy and power, electrical resistivity and conductivity, combinations of resistors; temperature dependence of resistance, Superconductor

Magnetostatics: Concept of magnetic field, Biot-savart law and its application, Ampere's law and its applications, Force on a moving charge in uniform magnetic and electric fields. Force on a current-carrying conductor in a uniform magnetic field, Force between two parallel current-carrying conductors, definition of ampere, Electromagnetic induction, Faraday's laws, induced emf and current, Lenz's Law.

Electronic Devices: Semiconductors, Intrinsic/Extrinsic semiconductor, P.N. Junction, Characteristic of p n junction diode, pn junction as rectifier, zener diode and its characteristics, photodiode, LED and solar cells, Integrated Circuits, Bipolar junction transistor, CB, CE, CC configuration, Transistor as amplifier, oscillator and switch, logic gates: AND,OR, NOT, NAND, NOR, XOR.

Text and Reference Books:

1. Fundamentals of Physics 8th Edition: Resnick Halliday Walker
2. University Physics 12th Edition: Hugh D. Young , Roger A. Freedman , Lewis Ford
3. Concepts of Physics: H. C. Verma
4. Electrodynamics: Grifths
5. Integrated Electronics: J.Millman and C.C.Halkias
6. Digital Principles & Applications: P. Malvino & Leach

GENERAL PHYSICS-II (UG)
(Even Semester)

Course No.	**LTP**
PHL-002	**3 0 0**

1. **Quantum Mechanics:** Wave-particle dualitiy; Schroedinger equation and expectation values; Uncertainty principle; Solutions of the one-dimensional Schroedinger equation for a free particle, particle in a box, particle in a finite well, linear harmonic oscillator; Reflection and transmission by a step potential and by a rectangular barrier; Particle in a three dimensional box.

2. **Atomic and Molecular Physics:** Stern-Gerlach experiment, electron spin, fine structure of hydrogen atom; L-S coupling, J-J coupling; Spectroscopic notation of atomic states; Zeeman effect; Elementary theory of rotational, vibratonal and electronic spectra of diatomic molecules; Raman effect and molecular structure; Raman spectroscopy.

3. **Solid State Physics:** Crystalline and amorphous structure of matter; Different crystal systems, space groups; Methods of determination of crystal structure; X-ray diffraction, scanning and transmission electron microscopies; Thermal properties of solids, specific heat, Debye theory, Magnetism: dia, para and ferromagnetism; Elements of superconductivity, Meissner effect, BCS theory, Elementary ideas about high temperature superconductivity.

Text and Reference Books:

1. Concepts of Modern Physics - Arthur Beiser
2. Quantum Mechanics - P T Mathews
3. Introduction to Quantum Theory -R Dicke and J Wittke
4. Quantum Mechanics - Ghatak and Loknatham
5. Introduction to Atomic Spectra - H. E. White
6. Atomic Spectra and Atomic Structure by Gerhard Herzberg
7. An Introduction to Solid State Physics - C. Kittel.
8. Solid State Physics - A.J. Dekkar.

CHARACTERIZATION TECHNIQUES (PG)
(Even or Odd Semester)

Course No.	**LTP**
PHL-051	**3 0 0**

Scanning electron microscopy, Transmission electron microscopy, Scanning tunneling microscopy, Atomic force microscopy, Optical microscopy.

X-ray diffraction, data manipulation of diffracted X-rays for structure determination; X-ray fluorescence spectrometry for element detection with concentration; Auger electron spectroscopy (AES), X-ray photoelectron spectroscopy (XPS), Secondary ion mass spectroscopy (SIMS) techniques for the analysis of surfaces, DTA, TGA and DSC measurements and analysis of the curves.

Infrared, ultra-violet, visible and Raman spectroscopy. Electrical measurements: Two probe, Four probe and Vander Pauw techniques, Hall effect. Impedence spectroscopy.

Recommended Books:

1. Methods of Surface Analysis (Techniques and Applications), J.M. Walls, Cambridge University Press, 1989.
2. Culity
3. Science of Engineering Materials, C.M. Srivastava and C. Srinivasan – New Age International Ltd.(P), 2005.
4. The Principles and Practice of Electron Microscopy– Ian.M.Watt- Cambridge University Press, 1997.
5. Modern Techniques for Surface Science– D.P. Woodruff and T.A. Delchar –Cambridge University Press, 1994.
6. Materials Science, Testing and Properties for Technicians. W.O. Fellers – Prentice Hall, 1990.
7. Dielectric Relaxation in Solids-A.K. Jonscer–Chelrea Dielectrics Press London, 1983.

Food Science & Technology

FTL-001: Food Hygiene and Sanitation (Odd)

Credits: 3-0-0

Note: Students can use the Non-Programmable scientific calculator.

Unit - I

General principles of food hygiene.
Personal hygiene.
Food handling habits, water sources and impurities in water supply and treatment.
Sanitation facilities and procedures in food plant operation.

Unit - II

Quality standards for potable water supply.
Microbial standards for foods.
Sanitation in food service institution.

Unit - III

Method of cleaning and disinfection.
Detergents and Sanitizer.

Recommended Books:

1. Guide to Improving Food Hygiene - Ed Gaston and Tiffney.

2. Practical Food Microbiology and Technology (2nd edition) - J. Mountney and W.A. Gould.

3. Food Poisoning and Food Hygiene (3rd Edition) - Betty C. Hobbs.

Food Science & Technology

FTL-002: Introduction to Food Science and Nutrition (Even)

Credits: 3-0-0

Note: Students can use the Non-Programmable scientific calculator.

Unit - I

Basic terms of food science and technology, Principles of processing and preservation, Food poisoning: its causes and symptoms, Food safety, adulteration and food laws, Status of food industry in India.

Unit - II

Introduction to human nutrition. The functions of foods. Food groups and concept of balanced diet. The need for energy, basal energy metabolism. Calorific value of foods, Dietary allowances for different age groups, nutritive value of foods, Dietary interrelationship.

Unit - III

Classification, physiological functions, dietary sources, deficiency diseases, role in metabolism and daily requirement of following: carbohydrates, lipids, proteins, vitamins and minerals.

Recommended Books:

1. Food Science by Norman N. Potter.
2. Lehninger: Principles of Biochemistry by David L. Nelson and Micheal M. Cox.
3. Biochemistry by Jeremy M. Berg, John L Tymoczko and Lubert Stryer.
4. Essentials of Food Nutrition by Dr. M Swaminathan.

Food Science & Technology

FTL-051: Introduction to Food Processing (Odd)

Credits: 3-0-0

Note: Students can use the Non-Programmable scientific calculator.

Unit - I

Food: definition, groups of foods.
Objectives of food processing.
Constituents of food: carbohydrates, proteins, fats, vitamins and minerals, pigments, enzymes.
Food processing operations: Cleaning, separating, heating, cooling, evaporating, drying, packaging.

Unit – II

Food spoilage: Microorganisms, insects, parasites and rodents, natural food enzymes, temperature, moisture, oxygen, light and time.
Application of heat in processing: pasteurization, sterilization, blanching, conduction and convection heating, canning, aseptic processing.
Applications of low temperature in food processing: refrigeration, freezing

Unit – III

Food dehydration and concentration: significance of moisture, water activity, factors affecting moisture removal from foods, types of driers, freeze drying, concentration of foods using evaporators.
Fermented foods: pickles, yoghurt and wine.
Food packaging: importance, objectives and functions.

Recommended Book:

1. Food Science by Norman N. Potter.
2. Food Engineering Operations by JG Brennan, JR Butters, ND Cowell and AEV Lilly.

Food Science & Technology

FTL-052: Technology of Processed Foods
(Even)

Credits: 3-0-0

Note: Students can use the Non-Programmable scientific calculator.

Unit - I

Production, composition and structure of wheat and rice, Milling of wheat and rice, Manufacture of cereal products: bread, cookies and biscuits, cakes, pasta and noodles, corn flakes and extruded snacks.

Unit – II

Chemical composition and nutritive value of milk. Processing of milk and milk products: standardized pasteurized milk, flavoured milk, yoghurt, dahi, paneer and cheese, ice cream, milk powder.

Unit – III

Egg: structure and composition, quality factors, storage and egg preservation. Poultry processing: slaughtering to packaging, comminuted meat products. Processing of fruits in juices, aseptic packaging, squash, jams and marmalades. Drying and canning of vegetables. Packaging of fresh fruits and vegetables.

Recommended Books:

1. Technology of Cereals by N. L. Kent.
2. Preservation of Fruits and Vegetables by Girdhari Lal, G. S. Siddappa, G. L. Tandon.
3. Meat Handbook by Albert Lovie.
4. Poultry Products Technology by G.J. Mountney.
5. Outlines of Dairy Technology by Sukumar De.

Interdisciplinary Courses
TEXTILE CHEMISTRY (UG & PG)

B.Tech. (Textiles Chemistry) (Semester-I)

TCL- 001 INTRODUCTION TO TEXTILES

Credits/L/T/P: 4/3/1/0

Section –A:

- **Introduction:**

What are textiles, types of fibers, yarn, fabric, Garment

- **Color:**

Introduction to color, types of colorants, natural colourants

- **Introduction to Colouration:**

Application methods on different types of textiles, method of colour measurements.

Section –B:

- **Quality Assurance of Textiles:**

All types of fastness properties, physical and chemical properties of textiles, designs and pattern of weave, print and garment

Section –C:

- **Processing:**

Pretreatment, dyeing, printing and finishing.

Section –D:

- **Process flows:**

Process flow of natural fibers like cotton, wool, silk. Process flow of synthetic fibers like polyester, nylon.

Books: Colourants and Auxiliaries Vol 1, John Shore, SDC Publishers, UK, 2001.

B.Tech. (Textiles Chemistry) (Semester-II)

TCL-002 TEXTILE CARE

Credits: 3/1/0

Chapter 1: Introduction

Types of textile fibers; cotton, polyester, silk, nylon, wool etc., General introduction to production route for textile fibre, Application areas for textile materials,

Chapter 2: Care Labeling

Care Label, Basic care label symbols, Care symbols for washing, bleaching, drying, ironing, dry-cleaning, International standards on care labels.

Chapter 3: Stains

Classifications of Stains and their removal, Techniques used for stain removal, Stain removal products, Unidentifiable stains.

Chapter 4: Denim Washing

Definition of Denim, Basic information on Indigo: the dye used for denim, Different types of denim washes; stone wash, acid wash and enzyme wash.

Chapter 5: Quality Assurance in Textile Apparel

Quality assurance in apparel manufacturing, Quality assurance for knits, Fabric inspection system, Types of defects (Yarn, fabric and seams).

Books:

Booklets of Textile Association of India, Ahmedabad.

Interdisciplinary Courses
MATHEMATICS (UG & PG)

Under Graduate level course
Odd/Even semester

MTL 001 NUMERICAL METHODS

L-T-P
4-0-0

Unit-I

Error Analysis (Relative error, Truncation error, Roundoff error, order of approximation, order of convergence, Propagation, solution of Non-linear equations, Bracketting method, Bisection method of Balzeno, Method of false position and convergence, Newton Raphson Method, , Secout Method, Accelerated convergence.

Unit-II

Interpolation and Polynomial Approximation, Lagrange's Method, Newton's polynomials, Runge's Phenomenon, orthogonal property, Chebychev approximation, Pade's Approximation, Methods of Curve fitting.

Unit-III

Numerical Integration: Quadrature, Simpson's Rules, Trapezoidal Rule, Error Analysis, Romberg Integration, Gauss Legendre Integration.

Solution of differential equations: Euler's method, Henn's method, Taylor Series method, Runge Kutta method, Milne's Simpson method, Adam's Basufertn method System of differential equations.

Reference Books:

1. Numerical Methods of Scientists and Engineers, Madhumangal Pal (Narosa).
2. Numerical Methods unsing Matlab, Mathews and Fink.
3. Introductory methods of Numerical Analysis, S.S. Sastry.

Post Graduate level course
Odd/Even semester

MTL 051 APPLIED STATISTICS

L-T-P
4- 0-0

Note:

1. The scope of the contents restricted to applications only given in the recommended books.
2. The mathematical derivations, in any case, are excluded.

UNIT-I

Empirical Models, Simple linear regression, properties of the least square estimators, Hypothesis tests in simple linear regression, prediction of new observation, adequacy of the regression model.

Multiple linear regression model: least square estimations of the parameters, properties of the least squares estimators. Test for significance of regression, prediction of new observations, Model adequacy checking.

UNIT-II

Design and analysis of single-factor experiments: Designing engineering experiments, analysis of variance for CRD with fixed effect model, Analysis of variance for RCBD with fixed effect model.

Design of experiments with several factors: Factorial experiments, two factor factorial experiments, general factorial experiment, 2^k factorial designs and its blocking and confounding, and fractional replication.

UNIT-III

Non-parametric statistics: Sign test, wilcoxon signed-rank test, Wilcoxon rank-sum test. Reliability, Failure time distribution, exponential model in reliability and life testing.

Books Recommended:

1. Montgomery, D.C. and Runger,G.C.(2003): Applied Statistics and Probability for engineers, 3rd edition, John Wiley & sons, Inc [Chapters 11,12,13,14,15].
2. Johnson, R. A. and Gupta, C.B. (2006): Probability and Statistics for Engineers, 7th Edition, Pearson Education, [Ch. 15].