Amrita University's Amrita Values Programme (AVP) is a new initiative to give exposure to students about richness and beauty of Indian way of life. India is a country where history, culture, art, aesthetics, cuisine and nature exhibit more diversity than nearly anywhere else in the world.

Amrita Values Programmes emphasize on making students familiar with the rich tapestry of Indian life, culture, arts, science and heritage which has historically drawn people from all over the world.

Students shall have to register for any two of the following courses, one each in the third and the fourth semesters, which may be offered by the respective school during the concerned semester.

Courses offered under the framework of Amrita Values Programmes I and II

Message from Amma’s Life for the Modern World

Amma’s messages can be put to action in our life through pragmatism and attuning of our thought process in a positive and creative manner. Every single word Amma speaks and the guidance received in on matters which we consider as trivial are rich in content and touches the very inner being of our personality. Life gets enriched by Amma’s guidance and She teaches us the art of exemplary life skills where we become witness to all the happenings around us still keeping the balance of the mind.

Lessons from the Ramayana

Introduction to Ramayana, the first Epic in the world – Influence of Ramayana on Indian values and culture – Storyline of Ramayana – Study of leading characters in Ramayana – Influence of Ramayana outside India – Relevance of Ramayana for modern times.

Lessons from the Mahabharata

Introduction to Mahabharata, the largest Epic in the world – Influence of Mahabharata on Indian values and culture – Storyline of Mahabharata – Study of leading characters in Mahabharata – Kurukshetra War and its significance – Relevance of Mahabharata for modern times.

Lessons from the Upanishads

Introduction to the Upanishads: Sruti versus Smrti - Overview of the four Vedas and the ten Principal Upanishads - The central problems of the Upanishads – The Upanishads and Indian Culture – Relevance of Upanishads for modern times – A few Upanishad Personalities: Nachiketas, Satyakama Jabala, Aruni, Shvetaketu.

Message from the Bhagavad Gita

Introduction to Bhagavad Gita – Brief storyline of Mahabharata - Context of the Bhagavad Gita – Karma Yoga, Jnana Yoga and Bhakti Yoga - Theory of Karma and Reincarnation – Concept of Dharma – Concept of Avatar - Relevance of Mahabharata for modern times.

Life and Message of Swami Vivekananda

Brief Sketch of Swami Vivekananda’s Life – Meeting with Guru – Disciplining of Narendra - Travel across India - Inspiring Life incidents – Address at the Parliament of Religions – Travel in United States and Europe – Return and reception India – Message from Swamiji’s life.

Life and Teachings of Spiritual Masters India

Sri Rama, Sri Krishna, Sri Buddha, Adi Shankaracharya, Sri Ramakrishna Paramahamsa, Swami Vivekananda, Sri Ramana Maharshi, Mata Amritanandamayi Devi.

Insights into Indian Arts and Literature

The aim of this course is to present the rich literature and culture of Ancient India and help students appreciate their deep influence on Indian Life - Vedic culture, primary source of Indian Culture – Brief introduction and appreciation of a few of the art forms of India - Arts, Music, Dance, Theatre.

Yoga and Meditation

The objective of the course is to provide practical training in YOGA ASANAS with a sound theoretical base and theory classes on selected verses of Patanjali’s Yoga Sutra and Ashtanga Yoga. The coverage also includes the effect of yoga on integrated personality development.

Kerala Mural Art and Painting

Mural painting is an offshoot of the devotional tradition of Kerala. A mural is any piece of artwork painted or applied directly on a wall, ceiling or other large permanent surface. In the contemporary scenario Mural painting is not restricted to the permanent structures and are being done even on canvas. Kerala mural paintings are the frescos depicting mythology and legends, which are drawn on the walls of temples and churches in South India, principally in Kerala. Ancient temples, churches and places in Kerala, South India, display an abounding tradition of mural paintings mostly dating back between the 9th to 12th centuries when this form of art enjoyed Royal patronage. Learning Mural painting through the theory and practice workshop is the objective of this course.

Course on Organic Farming and Sustainability

Organic farming is emerging as an important segment of human sustainability and healthy life. ‘Haritamritam’ is an attempt to empower the youth with basic skills in tradition of organic farming and to revive the culture of growing vegetables that one consumes, without using chemicals and pesticides. Growth of Agriculture...
through such positive initiatives will go a long way in nation development. In Amma’s words “it is a big step in restoring the lost harmony of nature”.

Benefits of Indian Medicinal Systems
Indian medicinal systems are one of the most ancient in the world. Even today society continues to derive enormous benefits from the wealth of knowledge in Ayurveda of which is recognised as a viable and sustainable medicinal tradition. This course will expose students to the fundamental principles and philosophy of Ayurveda and other Indian medicinal traditions.

Traditional Fine Arts of India
India is home to one of the most diverse Art forms world over. The underlying philosophy of Indian life is “Unity in Diversity” and it has led to the most diverse expressions of culture in India. Most art forms of India are an expression of devotion by the devotee towards the Lord and its influence in Indian life is very pervasive. This course will introduce students to the deeper philosophical basis of Indian Art forms and attempt to provide a practical demonstration of the continuing relevance of the Art.

Science of Worship in India
Indian mode of worship is unique among the world civilisations. Nowhere in the world has the philosophical idea of reverence and worshipfulness for everything in this universe found universal acceptance as it in India. Indian religious life even today is a practical demonstration of the potential for realisation of this profound truth. To see the all-pervading consciousness in everything, including animate and inanimate, and constituting society to realise this truth can be seen as the epitome of civilizational excellence. This course will discuss the principles and rationale behind different modes of worship prevalent in India.

15CHY101
GENERAL CHEMISTRY I
3 1 0 4

Unit 1 Atomic Structure I
Dalton's atomic theory and its failure, sub atomic particles - e/m ratio of an electron - Thomson’s experiment charge on electron - Millikan’s Oil Drop Technique - atomic number - Chadwick’s experiment and the neutron, Rutherford’s and Bohr’s model of atom - limitations of Rutherford’s model - Maxwell’s electromagnetic theory of radiation and s model, Bohr’s model of hydrogen atom - Bohr’s theory and Ritz combination principle, spectra – emission and absorption - Hydrogen spectrum, Bohr-Sommerfeld theory.

Unit 2 Atomic Structure II
Planck’s quantum theory of radiation, dual character of electrons - de Broglie’s equation and experiment-Heisenberg’s uncertainty principle - photoelectric effect, Compton, Zeeman and Stark effects, Schrodinger wave equation, eigen values, significance of wave function (ψ and ψ2) and quantum numbers, Schrodinger wave equation for hydrogen and hydrogen-like systems (no derivations, only the final equation), probability distribution of electrons around the nucleus - distribution of 1s, 2s & 2p electrons or orbitals, shapes of atomic orbitals - s, p, d and f, aufbau principle, Hund’s rule, Pauli’s exclusion principle, electronic configuration of elements.

Unit 3 Chemical Bonding I
Electrovalency and ionic bond formation, ionic compounds and their properties, lattice energy Born equation and its application, Born-Haber cycle and its application, solvation enthalpy and solubility of ionic compounds, covalent bond, covalency, formation of H2 in terms of decrease of energy, orbital theory of covalency - sigma and pi bonds - formation of covalent compounds and their properties.

Unit 4 Chemical Bonding II
Hybridization and geometry of covalent molecules - VSEPR theory - polar and non-polar covalent bonds, polarization of covalent bond - polarizing power, polarisability of ions and Fajan’s rule, dipole moment, percentage ionic character from dipole moment, dipole moment and structure of molecules, co-ordinate covalent compounds and their characteristics, metallic bond - free electron, valence bond and band theories, weak chemical bonds – inter and intra molecular hydrogen bond - van der Waals forces.

Unit 5 Chemical analysis and stoichiometric calculation

TEXTBOOKS:

REFERENCES:

15CHY111
GENERAL CHEMISTRY II
3 1 0 4

Unit 1 Nuclear Chemistry
Size, structure and stability of the nucleus - n/p ratio, packing fraction, mass defect and binding energy - nuclear fission and fusion, hydrogen and atom bombs – radioactivity, alpha, beta particles and gamma radiation - Soddy-Fajan displacement
law, half and average life period - Geiger-Muller Counter and Wilson Cloud Chamber.
applications of radioactivity - in medicine, agriculture, carbon and fossil dating - isotopes, isobars, isotones, isodihaphe and nuclear isomers - natural and artificial radioactivity, artificial transmutation of elements, induced radioactivity, preparation of transuranic elements, Q values, nuclear coulombic barrier.

Unit 2 Solid State
Crystalline and amorphous solids, isotropy and anisotropy, elements of symmetry in crystal systems indices - Miller indices, space lattice and unit cell, Bravais lattices, the seven crystal systems and their Bravais lattices, X-ray diffraction - Bragg's equation and experimental methods (powder method and rotating crystal technique), types of crystals - molecular, covalent, metallic and ionic crystals - close packing of spheres – hexagonal, cubic and body centered cubic packing, interstices in packing - types of crystals – molecular, covalent, metallic crystals - defects in crystals – stoichiometric, non-stoichiometric, extrinsic and intrinsic defects - semi and super conductors - liquid crystals.

Unit 3 Acids, Bases and Non-aqueous solvents
Concepts of acids and bases – hard and soft acids and bases - Pearson's concept, HSAB principle and its application - bases for hard - hard and soft - soft interactions - non-aqueous solvents - general characteristics of non-aqueous solvent - melting point, boiling point, latent heat of fusion and vaporization, and dielectric constant - reactions such as complex formation, redox, precipitation and acid base type in non-aqueous solvents like liquid ammonia, liquid SO2 and liquid HF.

Unit 4 Introduction to nanostate of materials

Unit 5 Water Technology

TEXTBOOKS:

REFERENCES:

TEXTBOOKS:

REFERENCES:

TEXTBOOKS:

REFERENCES:
calculating molecular velocities (average rms and most probable velocity and average kinetic energy) - Collision diameter, mean free path and viscosity of gases including their pressure and temperature dependence – Relation between mean free path and coefficient of viscosity – behaviour of real gases – deviation of gases from ideal behaviour – compressibility factor – van der Waals’ equation of state - its derivation and application in explaining ideal gas behaviour – virial equation of state – van der Waals’ equation expressed in virial form and calculation of Boyle temperature – Isotherms of real gases and their comparison with van der Waals’ isotherms – Determination of molecular mass by limiting density method – critical phenomena – critical constants and determination.

Unit 2 First law of thermodynamics and Thermo chemistry
System and surrounding – isolated, closed and open systems - state of the system - Intensive and extensive variables. Thermodynamic processes - reversible and irreversible, isothermal and adiabatic processes - state and path functions - exact and inexact differentials, concept of heat and work. First law of thermodynamics - statement. Relation between Cp and Cv, calculation of w, q, dE and dH for expansion of ideal and real gases under isothermal and adiabatic conditions of reversible and irreversible processes. Thermochemistry Enthalpy change of a reaction and different enthalpy changes - relation between enthalpy of reaction at constant volume (qv) and at constant pressure(qp) - temperature dependence of heat of reaction - Kirchoffs equation - of solution and dilution bond energy and its calculation from thermo chemical data - Integral and differential heats.

Unit 3 Second and Third laws of Thermodynamics
Second law of thermo dynamics - different statements of the law - Carnot’s cycle and efficiency of heat engine - Carnot’s theorem - thermodynamic scale of temperature - concept of entropy - definition and physical significance of entropy - entropy as a function of P, V and T - entropy changes during phase changes - entropy of mixing - entropy criterion for spontaneous and equilibrium processes in isolated system - Gibb’s free energy (G) and Helmholtz free energy (A) - variation of A and G with P, V and T - Gibb’s - Helmholtz equation and its applications - thermodynamic equation of state - Maxwell’s relations. Introduction to Third Law of Thermodynamics and its applications, exceptions to the third law, chemical potential and its physical significance, Gibbs-Duhem equation, fugacity and fugacity coefficient, activity and activity coefficient.

Unit 4 Chemical equilibria
color – magnetic properties – reducing properties – catalytic properties – Non stoichiometric compounds – complex formation – alloy formation – difference between first row and other two rows. Chemistry of Zr, Ti, V and Mo compounds.

Unit 4 f block elements
Position in the Periodic Table - General characteristics of Lanthanides and Actinides - Lanthanide contraction and its consequences. Isolation of Lanthanides from Monazite including the ion exchange resin method. Actinides - occurrence and preparation, comparison with lanthanides. Chemistry of Thorium and Uranium - Important compounds - preparation, properties and uses of Uranyl nitrate, Uranium hexafluoride, Thorium dioxide.

Unit 5 Metallurgy

TEXTBOOKS:

REFERENCE BOOKS:

15CHY211 PHYSICAL CHEMISTRY II 3 1 0 4
Unit 1 Phase Equilibria
Definition of terms: Phase, components and degrees of freedom – Derivation of Gibbs phase rule - application of phase rule to one component system: Water, carbondioxide and sulphur system – Reduced phase rule - Two component system: Simple eutectic system: Pb-Ag system, Pattinson’s process. Thermal analysis and cooling curves, Compound formation with incongruent melting point Na – K system. Metal systems forming continuous solid solutions and solid solutions with minimum and maximum melting points.

Unit 2 Chemical Kinetics
Molecularity and order of a reaction, rate law expression and rate constant - first, second, third and zero order reactions, pseudo-first order reactions (pseudo-unimolecular reactions), complex reactions - equilibrium and steady state approximations - mechanism of these reactions - effect of temperature on reaction rates - Arhenius equation and its derivation, activation energy, characteristics of activated complex Theories of reaction rates – collision theory – derivation of rate constant of bimolecular gases reaction – failure of collision theory – Lindemann’s theory of unimolecular reaction. Theory of absolute reaction rates – derivation of rate for a bimolecular reaction – significance of entropy and free energy of activation.

Unit 3 Catalysis

Unit 4 Electrochemistry I
Electrolysis, Faraday’s laws of electrolysis, strong and weak electrolytes specific, equivalent and molar conductance, equivalent conductance at infinite dilution and their measurement - Kohrausch’s law and its applications - calculation of equivalent conductance at infinite dilution for weak electrolytes, degree of dissociation of weak electrolytes - Modern theory of strong electrolytes (concept only) - Debye–Huckel Onsagar equation (no derivation) - solubility of sparingly soluble salts - applications of conductivity measurement - conductometric titrations - acid-base precipitation and complexometric titrations, Ostwald’s dilution law and its limitations, common ion effect and its application, concept of pH, indicators, theories of indicators – buffers and their pH - Henderson equation, hydrolysis and example of hydrolysis - relation between Kh, Kb and Kw, transport number (Hittorf number) and its experimental determination - Hittorf’s method and moving boundary method.

Unit 5 Electrochemistry II
Potential and its origin – electrical double layer and equilibrium – single electrode potential, standard hydrogen electrode - EMF series and its significance – Galvanic cells, IUPAC notation - reversible and irreversible cells, electrodes, calomel and Sg/AgCl reference electrodes - indicator and ion selective (pungor) electrodes and their applications, Computation of cell EMF, Calculation of thermodynamic quantities of cell reactions (\( \Delta G, \Delta H \) and \( K \)) Concentration cell with and without transference, liquid junction potential and its elimination – variation of potential with concentration, Nernst equation and its applications, potentiometric titrations – acid-base, redox and precipitation titrations. Concept of overpotential - AOP, COP, IROP - Butler–Volmer equation - (derivation not required), Tafel experiment and Tafel plot and its significance.
Syllabi

15CHY213 ORGANIC CHEMISTRY I 3 1 0 4

Unit 1 Basic concepts in Organic Chemistry
Composition of organic compounds – detection and estimation of elements – carbon, hydrogen, nitrogen, oxygen, sulphur, phosphorous, halogens – Calculation of empirical and molecular formula - determination of molecular weights – physical and chemical methods - empirical formula and molecular formula – Classification and Nomenclature of organic compounds.

Unit 2 Organic reactions and their mechanisms

Unit 3 Isomerism and Stereochemistry

Unit 4 Alkanes, cycloalkanes, alkenes and alkynes

Unit 5 Homocyclic Aromatic compounds and Aromaticity
SYLLABI  5yr Integrated M.Sc. Chemistry  2015 admissions onwards

TEXTBOOKS:

REFERENCES:

SYLLABI  5yr Integrated M.Sc. Chemistry  2015 admissions onwards

forms of the wave, node) and utility of this model, application of quantum mechanics to problems in chemistry - quantum chemistry (mention a few applications).

Unit 2 Basics of group theory
Symmetry elements and symmetry operation - group postulates and types of groups - Abelian and non Abelian-symmetry operation of H2O molecule - illustration of group postulates using symmetry operations of H2O molecule - construction of multiplication table for the operation of H2O molecule - point group - definition – elements (symmetry operations) of the following point groups: Cn (C2, C3) Sn (S1, S2), C1V (C2V, C3V) and C2R. group theory and optical activity.

Unit 3 Irreversible and Statistical Thermodynamics
Reversible and irreversible thermodynamics, examples for irreversible processes, postulate or assumption of local equilibrium, entropy production - entropy production in heat flow and in matter flow, forces and fluxes, introduction to statistical thermodynamics, system, assembly, ensemble, canonical and micro canonical ensemble, Boltzmann distribution law (no derivation), partition function, qualitative and basic ideas of Maxwell-Boltzmann statistics, Bose-Einstein statistics and Fermi-Dirac statistics, bosons and fermions.

Unit 4 Photochemistry

Unit 5 Surface Chemistry and Colloids
Absorption – physical and chemical - adsorption isotherms, Freundlich and Langmuir isotherms, positive, negative and electrostatic adsorption, applications of adsorption, colloidal state, dispersed phase, dispersion medium, types of colloidal systems, sols, gels and foams - lyophobic and lyophilic colloids, preparation by mechanical and electrical dispersion and chemical methods, purification by electro dialysis, and ultrafiltration, properties - colour, optical and electrical properties, qualitative idea of electrical double layer (Helmholtz-Perrin theory, Gouy-Chapman theory, Stern's theory), stability of lyophobic and lyophilic sole, isoelectric point, protection of colloids - protective colloids, Gold Number, Hofmeister series, coagulation or flocculation - addition of electrolytes, continuous dialysis and salting out, Hardy-Schulze law, coacervation, sensitization, micelle and critical micellisation concentration, application of colloids.
SYLLABI  
Syr Integrated M.Sc Chemistry  
2015 admissions onwards

TEXTBOOKS:

REFERENCES:
1. Donald A. McQuarrie, “Quantum Chemistry”, Viva Books Private Ltd.

15CHY302  INORGANIC CHEMISTRY II  3 1 0 4

Unit 1 Coordination Chemistry I

Unit 2 Coordination Chemistry II

Unit 3 Organometallic compounds

SYLLABI  
Syr Integrated M.Sc Chemistry  
2015 admissions onwards

Unit 5 Bioinorganic Chemistry

TEXTBOOKS:

REFERENCE BOOKS:

15CHY303  ORGANIC CHEMISTRY II  3 1 0 4

Unit 1 Alkyl Halides, aryl halides and Organometallic compounds

Unit 2 Alcohols and Phenols

Phenols: Preparation, properties, reactions (oxidation) to quinones, Rieemer-Tiemann reaction – Bromination, Nitration, Liebermann’s nitroso reaction, preparation of phenolphthalein, Kolbe’s reaction – Pinacol–Pinacolone rearrangement. Industrial importance of picric acid, quinol and nitro phenols.

Esters: Nomenclature, preparation and reactions - Claisen rearrangement, Zeisel’s method – crown ether structure.

Thioalcohols - general physical and chemical characteristics.
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Unit 3 Aldehydes and Ketones
Nomenclature, classification and preparation of aldehydes and ketones – reactivity of carbonyl groups – acidity of alpha H. Reactions – Oxidation, reduction, metal hydride reduction, nucleophilic addition, Wittig reaction, Grignard reagent, Michael addition, Cannizaro, Aldol, Perkin, Knoevenagel, Benzoin, Claisen, Reformatsky, Beckmann rearrangement, stobbe condensation (with mechanism).

Unit 4 Carboxylic acids, Acid derivatives and Active methylene compounds

Dicarboxylic acids – preparation of oxalic, malonic, succinic, glutaric, adipic, phthalic acids and unsaturated acids (acrylic, crotonic and cinnamic, maleic and fumaric).

Active methylene compounds: Synthesis and application of ethyl acetoacetate, diethyl malonate and cyano aceto esters.

Acid derivatives: Preparation/reaction of acid chlorides, acid anhydrides, amides, esters, acid/alkaline hydrolysis of esters, trans-esterification.

Derivatives of carbonic acids: Preparation, properties and structure of urea, manufacture of urea and thiourea, preparation and basicity of guanidine.

Unit 5 Organic compounds containing Nitrogen

Diazonium salts – preparation and reactions. Diazokanes and azides Cyan compounds.

TEXTBOOKS:

REFERENCES:

SYLLABI
Syr Integrated M.Sc Chemistry 2015 admissions onwards

15CHY311
BASICS OF ANALYTICAL CHEMISTRY
3 0 0 3

Unit 1 Theoretical principles of qualitative and quantitative analysis
Types of analytical methods - Importance of analytical methods in qualitative and quantitative analysis - chemical and instrumental methods - advantages and limitations of chemical and instrumental methods. Data Analysis - Types of errors, minimization of errors, propagation of errors, accuracy and precision, least square analysis, average standard deviation, coefficient of variance, significant figures.

Unit 2 Chromatographic Techniques
Theory of separation, chromatographic separation, chromatographic techniques - Column chromatography, thin layer chromatography, Paper chromatography, Ion-exchange chromatography, gas chromatography - principle, Significance of RF-values. HPLC, GC-MS, bioseparation - electrophoresis, centrifugation, DNA/protein separation, purification, polymer separation, green separation process, separation using zeolite and polymer membranes.

Unit 3 Thermal Analysis
Principle of thermo gravimetry (TGA), differential thermal analysis (DTA), differential scanning calorimetry (DSC) - Instrumentation and Characteristics of TGA and DTA curves, factors affecting TGA and DTA curves. Applications - TGA of calcium oxalate monohydrate, DTA of calcium acetatemonohydrate - determination of purity of pharmaceuticals by DSC, Thermometric titrations.

Unit 4 Electroanalytical Techniques
Conductometry - ion selective electrodes. Potentiometry, Amperometry, coulometry, polarography, voltametry - cyclic voltametry and anodic stripping voltametry - Principle and analysis of samples.

Unit 5 Crystallographic and Microscopic Techniques

TEXTBOOKS:

REFERENCES:
15CHY312  ORGANIC CHEMISTRY III  3 1 0 4

Unit 1 Polycyclic and Heterocyclic Aromatic Compounds

Unit 2 Carbohydrates

Unit 3 Amino acids, Proteins, vitamins and Nucleic acids

Unit 4 Alkaloids, terpenes, enzymes and Photochemistry

Unit 5 Synthetic polymers, oils, fats and detergents

References:
SYLLABI 5yr Integrated M.Sc Chemistry 2015 admissions onwards


REFERENCE BOOKS:

REFERENCES:

15CHY331 BATTERIES AND FUEL CELLS 3 0 0 3

Unit 1 Background Theory
Origin of potential - electrical double layer - reversible electrode potential - standard hydrogen electrode - emf series - measurement of potential - reference electrodes (calomel and silver/silver chloride) indicator and ion selective electrodes - Nernst equation - irreversible processes - kinetic treatment - Butler-Volmer equation - Overpotential, activation, concentration and IR overpotential - its practical significance - Tafel equation and Tafel plots - exchange current density and transfer coefficients.

Unit 2 Batteries: Primary Batteries
The chemistry, fabrication and performance aspects, packing classification and rating of the following batteries: (The materials taken their function and significance, reactions with equations, their performance in terms of discharge, capacity, and energy density to be dealt with). Zinc-carbon (Leclanche type), zinc alkaline (Duracell), zinc/air batteries; Lithium primary cells - liquid cathode, solid cathode and lithium-ferrous sulphide cells (comparative account).

Unit 3 Secondary Batteries
Lead acid and VRLA (vanadium regulated (sealed) lead acid), nickel-cadmium, nickel-zinc, nickel-metal hydride batteries, lithium ion batteries, ultrathin lithium polymer cells (comparative account) Advanced Batteries for electric vehicles, requirements of the battery - sodium-beta and redox batteries.

Unit 4 Fuel Cells
Description, working principle, anodic, cathodic and cell reactions, fabrication of electrodes and other components, applications, advantages, disadvantages and environmental aspects of the following types of fuel cells: Proton Exchange Membrane Fuel Cells, alkaline fuel cells, phosphoric acid, solid oxide, molten carbonate, direct methanol fuel cells. Membranes for fuel cells: Nafion – Polymer blends and composite membranes; assessment of performance – recent developments.

Unit 5 Fuels for Fuel Cells
Hydrogen, methane, methanol - Sources and preparation, reformation processes for hydrogen – clean up and storage of the fuels – use in cells, advantages and disadvantages of using hydrogen as fuel.

TEXTBOOKS:

REFERENCES:

15CHY332 CORROSION SCIENCE 3 0 0 3

Unit 1 Introduction to corrosion
Mechanisms of Chemical corrosion, electrochemical corrosion, Concentration cell corrosion, Pitting corrosion, Intergranular corrosion, Waterline corrosion, Stress corrosion.

Unit 2 Cathodic protection
Basis of cathodic protection, working of cathodic protection, electrochemical theory of cathodic protection, design parameters in cathodic protection, cathodic protection interferences.

Unit 3 Corrosion kinetics
SYLLABI
Syr Integrated M.Sc Chemistry 2015 admissions onwards

Unit 4 Corrosion prevention by design
Corrosive environment, Stages in design processes, Soldering and threading, crevices, flowing water systems, design for liquid containers, design in packaging, coating and design, storage of combat vehicles.

Unit 5 Selection of materials for corrosive environment
Factors affecting the performance of materials, Materials classification, materials and fluid corrosivity, Corrosion behavior of several materials.

TEXTBOOKS:

REFERENCES:

15CHY333 GREEN CHEMISTRY 3 0 0 3

Unit 1 Introduction to Green Chemistry
Introduction - inception and evolution of green chemistry - principles of green chemistry - the green chemistry expert systems - the measure of greenness - safety and risk indices - the hierarchical approach - green chemistry and sustainable development - pollution control to pollution prevention - Indian perspective on green chemistry - information technology and sustainable development.

Unit 2 Green reagents
Green reagents - safer solvents - green solvents - water as a solvent - solvent free conditions - supports reagents - ionic liquids and their applications - supercritical systems (CO2) as green solvents - hydrogen peroxide in green oxidation reactions - dimethyl carbonate, a green solvent and an ambient reagent.

Unit 3 Green chemical techniques I
Environmentally benign technologies by green chemistry (with examples) - microwave assisted synthesis - electro-organic synthesis - photochemical degradation as a green approach for waste treatment - catalysis and green chemistry - supported catalysts and reagents for green chemistry - heterogenized reactions for green chemistry - oxidation technology for waste water treatment - green chemistry using biocatalytic reactions.

Unit 4 Green chemical techniques II
Aqueous phase reactions, solid state reactions, enzymatic transformations, sonicated reactions - usual organic reactions (Benzoin condensation, Michael Addition, Heck Reaction, Darzen reaction, Heck reaction, Claisen arrangement) in a greener way.

REFERENCES:

15CHY334 INDUSTRIAL CATALYSIS 3 0 0 3

Unit 5 Green industrial processes and operations
Cleaner production - industrial perspectives - reactions and reactor designs - micromixers - unit operations - reactions with separation processes alternate energy resources - inherent safety - green chemistry and industries - the pharmaceutical industries and green chemistry - the polymer industry - pesticides, antifoulants, and herbicides - solvents and green chemistry - the food and flavor industry - the maleic anhydride manufacturing process - chelants - the surfactant industry - industries in need of support to go green - the semiconductor manufacture industry - the dye industry - the textile industry - the tannery industry - the sugar and distillery industries - the paper and pulp industry - the paint industry - Green chemistry in future.

TEXTBOOKS:
SYLLABI
Syr Integrated M.Sc Chemistry  2015 admissions onwards

Unit 4 Catalysis by Metals, Metal Oxides and Supported Metals
Electronic factors in catalysis by metals, valence bond and electron theories, electronic factors in catalysis by semiconductors, co-operative electronics interactions and catalysis, localized interactions and catalysis, surface states and catalysis, role of supports, preparation and structure of supports, silica, alumina, silica-alumina, carbon, monolithic supports, surface properties, catalyst manufacture, catalyst size and shape, pretreatments, deactivation processes, sintering, poisoning and catalyst fouling.

Unit 5 Industrially Important Catalytic Processes
Catalysis and green chemistry, catalysis by ionic liquids, catalytic reforming, catalytic cracking, hydrotreatment, steam cracking, Fisher Tropsch process, mobil process for conversion of methanol to gasoline hydrocarbons, catalysis for environmental protection, removal of pollutants from exhausts, mobile and static sources, effluent clean up analysis, applications in the production of fertilizers, acetic acid, formaldehyde, washing powder additives, pharmaceuticals.

REFERENCES:

SYLLABI  Syr Integrated M.Sc Chemistry  2015 admissions onwards

Unit 1 Introduction to Food Chemistry
Introduction: Definition of Food, major components of food, Physical States of Food
- Dispersions true solutions, colloidal, emulsions, foam and gel, factors affecting stable dispersion of food ingredients, functions of emulsifiers and stabilizers. Water - Functions of water in food systems, hydrogen bonds, permanent dipole moment dielectric constant, theories of solvent action, water activity and food stability, absorption isotherm curve, roles of water in physical properties and chemical reactions in food theories and applications of different moisture determination methods.

Unit 2 Proteins and Carbohydrates
Protein - Classifications, nomenclature, and structures of aminoacids, basic properties of protein, structure of proteins, protein functional groups and their chemical, hydrophobic, and hydrophobic properties, isoelectric point and solubility as a function of pH, protein denaturation and its effects on food systems, nutritional quality of protein, theories & applications of analytical methods for protein and amino acids determination. Carbohydrates - Classification, nomenclature, and structures of Carbohydrates, isomers and absolute configurations of Carbohydrates, physical – chemical properties of Carbohydrates, sweetness of Carbohydrates, functions of Carbohydrates in foods, chemical reactions of Carbohydrates, analytical methods for Carbohydrate determination.

Unit 3 Lipids and minerals
Lipids - Nomenclature and structures of fatty acids, classifications of lipids, physical and chemical characteristics of different fats, relationship between chemical structure and fat melting properties, analytical methods for determining different physical and chemical characteristics of fat, lipid oxidation mechanisms, principles and applications of analytical methods for the determination of fat content and fatty acid compositions of foods. Minerals - Ash determination methods, principles and applications of different methods for determining individual minerals – atomic absorption and flame spectrometry’s, and chemical methods.

Unit 4 Vitamins
Vitamins - Water soluble and fat soluble vitamins, chemical reactions and losses of vitamins during processing and storage. Principles and techniques for the determination.

Unit 5 Pigments in food flavours, browning reaction in foods, Enzymes in foods, and food industry, bio-deterioration of foods, food contaminants, Food additives and toxin.

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SUGGESTED READINGS

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Unit 1 Introduction to polymers and polymerization
History of polymer Science. Concept of macromolecules, Nomenclature and Classification, Polymer, monomer, oligomer, repeating unit, degree of polymerization, functionality, copolymer - random, alternating, graft, block, Tacticity. Polymerization
Unit 2 Polymer Stereochemistry and characterization

Unit 3 Polymer Solutions

Unit 4 Polymer additives, blends and composites

Unit 5 Industrial and speciality polymers

REFERENCES:
determination, degree of polymerization and molecular weight, non-convertible and convertible film formers, linear, branched and cross linked film formers, homopolymers and copolymers - Manufacture, chemistry and applications of alkyd resins, Polyester resins, Phenolic Resins, amino resins, epoxy resins, polyamide resins, polyurethanes, silicone resins, vinyl and acrylic resins - emulsions - polystyrene and styrene-acrylic emulsions. Solvents, dryers, surfactants and other additives in paints.

Unit 4 Paint Formulation, Manufacture and application techniques
Principles of paint formulation, formulation elements, mathematics & steps: PVC, CM, P/B ratio, Sp gravity, etc; Typical formulations of primers, undercoats and finish coats - Steps in paint manufacturing, phenomenon of wetting, grinding and dispersion, important considerations in pigment dispersion and rheology - different milling and mixing techniques - factors affecting effectiveness of milling such as size, speed and type of mill; volume, composition, size and shape of grinding medium - mill base. Surface preparation techniques - Physical and chemical surface treatment techniques - Common application techniques - packaging technology.

Unit 5 Colour Technology, Paint properties and Quality Control in Paint Industries
Colour science and technology - light spectrum, primary and complementary colours, colour mixing, dimensions of colour and colour systems, colour measurements, computer colour matching - colour coding system - General properties of paints, classification of paint properties - adhesion and cohesion properties, factors affecting adhesion wetting power, optical properties; colour, gloss, hiding, etc, physical, chemical and mechanical properties of paint films - factors affecting coating properties - rheological properties - Newtonian and non-Newtonian liquids, thixo-tropy, factors affecting viscosity, objectives of paint testing - Quality control procedures, standard specifications and test methods - tests on liquid paints density, dispersion, viscosity and consistency, wet opacity and dry hiding, spreading capacity and spreading rim, wet and dry rim thickness, drying time, etc. - Tests of dried coatings, colour and colour fastness, light fastness, gloss, flexibility, adhesion impact test, hardness mar resistance, abrasion resistance water and moisture resistance; water vapour transmission, PAC and salt spray test resistance, resistance to chemicals and solvents, resistance to heat and fire, air permeability - evaluation of water based paints, biological effects on paint films. Analysis of paints and varnishes; volatile and nonvolatile matter pigment content, binder or solid vehicle content, water content, ash content, pigment binder and solvent analysis - Ageing properties of coatings, weatherometry, natural outdoor durability test accelerated outdoor weathering, artificial weathering tests, defects observed in paint film on exposure.

TEXTBOOKS:

REFERENCES:
2. Phase diagram of simple eutectic system.
3. To determine the molecular weight of a high polymer by viscosity method.
4. To determine the molecular weight of a solute by Rast method using naphthalene or diphenyl as solvent using Beckmann thermometer.
5. To determine the solubility of benzoic acid at different temperatures and to determine $\Delta H$ of the dissolution process.
6. Determination of rate constant of acid catalyzed hydrolysis of an ester.
7. To study the adsorption of acetic acid from its aqueous solution by charcoal.
8. To determine the distribution coefficient of iodine between water and carbon tetrachloride.
9. Determination of transition temperature of the given salt hydrate.

**TEXTBOOKS:**

**REFERENCE BOOKS:**

15CHY385 ORGANIC SYNTHESIS AND ESTIMATION LAB. 0 0 2 1

1. Basic concepts on theoretical yield, practical yield, samples % conversion etc,
   Organic preparations including recrystallisation,
2. Synthesis of a) Acetanilide to p-nitroacetanilide b) Acetanilide to p-bromoacetanilide c) Benzyl chloride to Benzoic acid, d) Nitrobenzene to dinitrobenzene e) Ester hydrolysis f) Benzoylation (phenol to phenyl benzoate);
3. Separation Techniques: Thin Layer Chromatography, Column chromatography or diphenyl as solvent using Beckmann thermometer.

15CHY386 PHYSICAL CHEMISTRY LAB. – INSTRUMENTAL 0 0 3 1

1. Determination of cell constant and equivalent conductivities of different electrolyte by conductometrically.
2. Determination of the strength of strong and weak acids in a given mixture conductometrically.
3. Determination of the velocity constant, order of the reaction and energy of activation for specification of acetate by sodium hydroxide conductometrically.
4. Determination of solubility and solubility product of sparingly soluble salt by conductometrically.
5. Determination of the strength of strong and weak acids in a given mixture using a potentiometer.
6. Determination of the strength of strong and weak acids in a given mixture using a pH meter.
7. Determination of unknown concentration using photoelectric calorimeter.
9. Determination of concentration of an electrolyte by Nernst equation.
10. Determination of concentration of ions by spectrophotometer.
11. Determination of concentration of potassium and sodium ion by flame photometry.
12. Determination of transport number of silver ion.

**TEXTBOOKS:**
15CHY390 LIVE-IN-LAB. 3 cr

This initiative is to provide opportunities for students to get involved in coming up with solutions for societal problems. The students shall visit villages or rural sites during the vacations (after second semester or fourth semester) and if they identify a worthwhile project, they shall register for a 3-credit Live-in-Lab project, in the fifth semester. The objectives and projected outcome of the project should be reviewed and approved by the Dept. Chairperson and a faculty assigned as the project guide. On completion of the project, the student shall submit a detailed project report. The report shall be evaluated and the students shall appear for a viva-voce test on the project.

15CHY399 PROJECT (for Exit-option students) 6 cr

Students who want to exercise the exit option at the end of the sixth semester shall decide on it at the end of the fourth semester. These students shall execute a project and earn six credits.

The proposed project work shall get started at the beginning of the fifth semester and is to be credited during the sixth semester. The project work involves simple experimental techniques in chemistry for solving minor problems faced in various processing industries or on improving the existing experimental techniques followed at present in chemistry laboratories. The project work will be supervised by a faculty from chemistry department and periodical reviews of the work accomplished will be done by a panel involving a minimum of 3 chemistry faculty members. Also the student should give a presentation of the project at the end of the sixth semester to a panel of faculty members/ external experts.

15CHY501 GROUP THEORY AND QUANTUM CHEMISTRY 3 1 0 4

Unit 1 Quantum Chemistry I

Origin of quantum mechanics, de Broglie relationship, postulates of quantum mechanics, operators and eigen functions, operators for momentum, energy and angular momentum, expectation values, time dependent and independent Schrodinger equation, stationary states, the uncertainty principle (no derivation), application of Schrodinger wave equation to particle in one dimensional box and three dimensional box, degeneracy, application of Schrodinger wave equation to harmonic oscillator, free particles, quantum entanglement, quantum dots.

Unit 2 Quantum Chemistry II

Application of Schrödinger wave equation to rigid rotator and H atom, shapes of atomic orbitals from solutions of H atom, many electron atoms, approximation methods, independent particle model, variation methods, perturbation methods, application to the ground state of Helium atom, SCF method, the exclusion principle, chemical bonding: Hydrogen molecule ion and hydrogen molecule from molecular orbital and valence bond theory, homo and hetero nuclear diatomic molecules from VB and MO theory, the concept of directed valences and hybridization, HMO methods, pi bonds and treatment of delocalization.

Unit 3 Introduction to Computational Quantum Chemistry

Hartree Fock SCF method, electronic structure of molecules, the basis sets, STOs and GTOs, nomenclature of basis sets, semi empirical and ab-initio methods, calculations of molecular properties like atomic charges, dipole moments, electronic distributions, vibration frequencies, NMR chemical shift etc using Gaussian program, specification of molecular geometry using Cartesian coordinates and internal coordinates, Z-matrix, Z-matrix of some simple molecules, structure of a Gaussian input file.

Unit 4 Group Theory I

Symmetry in molecules, elements of symmetry, point groups, matrix representation of symmetry operations, character, application of group theory to symmetry properties of molecules, definition of a mathematical group, abelian group, cyclic group, symmetry operations as group elements, similarity transformation and classes, group multiplication table, symmetry classification of molecules into point groups (Schoenflies symbol), reducible and irreducible representations, great orthogonality theorem and its consequences, character tables, reduction formula, construction of character tables for point groups with order ≤6, interpretation of character tables.

Unit 5 Group Theory II

Wave functions as bases for irreducible representations, construction of hybrid orbitals for AB3 (planar), AB4 (Td), AB5 (D3h) and AB6 (Oh) type of molecules, symmetry adapted linear combinations, projection operators, application of projection operators to pi-bonding in ethylene, cyclopropenyl systems and benzene, application of symmetry to predict polar and chiral compounds, chemical applications of group theory for molecular vibrations, selection rules and applications to IR and Raman spectra, applications of group theory to electronic spectra.

REFERENCES:

### SYLLABI

**SYLLABUS**

**5yr Integrated M.Sc Chemistry**

**2015 admissions onwards**


**15CHY502 CHEMICAL THERMODYNAMICS AND EQUILIBRIA** 3 1 0 4

**Unit 1 Chemical Thermodynamics**

First and second laws of thermodynamics, thermodynamic functions, heat capacity, thermo chemistry, need for second law of thermodynamics, entropy and free energy functions, calculation of changes in thermodynamic function for ideal and non-ideal gases in isothermal and adiabatic process, relation between thermo dynamic functions - Maxwell relations, Joule Thomson effect, coefficient of thermal expansion and compressibility factor, applications of free energy function to physical and chemical changes, equilibrium in chemical reactions, third law of thermodynamics - need for third law, calculation of absolute entropy, unattainability of absolute zero, thermodynamic systems of variable composition - fugacity functions, partial molar quantities, thermodynamics of ideal solutions, real solutions and regular solutions, dilute solutions of nonelectrolytes, Henry’s law, Raoult’s law, Gibbs-Duhem equations, Gibb’s-Duhem-Margules equations, and activity and standard states of non electrolytes.

**Unit 2 Irreversible Thermodynamics**

Examples for irreversible process, entropy production, non-equilibrium, steady state and near equilibrium conditions, linear relation, phenomenological coefficients, Onsager reciprocal relations, one component systems with heat and matter transport, application of irreversible thermodynamics to thermal diffusion, thermal osmosis etc., electro kinetic effects, the Glansdorf-Pregorine equation.

**Unit 3 Statistical Thermodynamics**

Statistical concept, probability and thermodynamic states, entropy and probability, canonical ensemble, Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein Statistics, electron gas concept, Bose-Einstein condensation, relation among MB, FD & BE Statistics, partition function, partition function for free linear motion, free motion in a shared space, linear harmonic vibration, translational, rotational and vibrational partition function, molecular partition functions, partition functions and thermodynamic properties, calculation of equilibrium constant, heat capacity of gases, mono atomic solids, Einstein’s and Deby’s theory.

**Unit 4 Equilibrium**

Gibb’s free energy, direction of spontaneous change of a reaction, chemical potential, chemical potential and equilibrium, $\Delta G$ in terms of K, equilibrium constants - real gases and real reactions, equilibrium respond to catalyst, temperature, pressure and PH, application of $\Delta G$ and K – extraction of metals from their oxides, Ellingham diagram, and thermodynamics of ATP & respiration, biological energy conversion.

**SYLLABUS**

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**5yr Integrated M.Sc Chemistry**

**2015 admissions onwards**

**Unit 5 Phase Equilibrium**

Gibb’s Phase rule, one component system, two component systems, vapor pressure diagrams and their interpretation, lever rule, temperature-composition diagrams, liquid-liquid phase diagrams, distillation of partially miscible liquids, azoetropes, liquid-solid phase diagrams, phase diagram for the system Na/K/Na2K, phase diagram - steel, alloys, Fe-C system, zone refining, three component system, triangular coordinates, three component system – partially miscible liquids - H2O/CHCl3/CH3COOH, phase diagram - NH4Cl/(NH4)2SO4/H2O.

**REFERENCES:**


**TEXTBOOKS:**


**15CHY503 MOLECULAR SPECTROSCOPY** 3 1 0 4

**Unit 1 Rotational and Vibrational Spectroscopy**

Introduction to spectroscopy, rotation spectra - diatomic and polyatomic molecules, selection rules, intensities of spectral lines, stark effect, instrumentation of micro wave spectroscopy, applications and structural determinations, vibration spectra of diatomic molecules, harmonic and anharmonic vibrations, diatomic vibrating rotor, selection rule, breakdown of Born Oppenheimer approximation, rotational character of vibration spectra, different modes of vibrations, vibration-rotation spectra, Fermi resonance, vibration spectra of polyatomic molecules, IR spectra of organic and inorganic compounds, phase, temperature and solvent dependence, FTIR technique, instrumentation, Raman spectra (including the use of laser) - theory, relation with IR spectroscopy, mutual exclusion principle, resonance Raman, stimulated hyper and inverse Raman effects, instrumentation and applications of Raman spectroscopy.

**Unit 2 UV-Visible and Fluorescence Spectroscopy**

Electronic spectra of atoms - single and multi electron systems, $j$-$j$ and L-S coupling, electronic spectra of diatomic and polyatomic molecules, its relation to electronic arrangement and symmetry of molecules, application of group theory in electronic spectra, selection rules, nature of electronic excitation, principles of absorption spectroscopy, Beer-Lambert law, presentation of spectra, chromophores, forbidden transition, different types of electronic transitions, p-p*, n-p* etc transitions, nature of transitions in carbonyl compounds, the effect of conjugation, effect of conjugation

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**Arts and Sciences**

**AMRITA VISHWA VIDYAPEETHAM**

**S 35**

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**Arts and Sciences**

**AMRITA VISHWA VIDYAPEETHAM**

**S 36**
Unit 3 NMR Spectroscopy
Nuclear magnetic resonance phenomenon - theory, relaxation effects, NMR uses active nuclei, Fourier Transformation in NMR, measurement of relaxation time, chemical shift, magnetic anisotropic effect, multiplets in NMR, spin-spin splitting, n + 1 rule, Pascal’s triangle, tree-diagram, spin-spin splitting constant, J, 2J and 3J and long-range coupling, measurement of J, Karplus relationship, first and second order spectra, AX, AB, AX2, AX3, A2X3, AMX type spectra, double resonance and spin tickling, chemical shift reagents, spectra in higher fields, spectra of conformational isomers, homotopic, enantiotropic and diastereotropic systems, C13 spectra, factors related to C13 spectra, H1 coupled C13 spectra, H1 decoupled C13 spectra, chemical shift values, nuclear Overhauser effect (NOE), cross-polarization, off-resonance resonance decoupling, application of H1 and C13 NMR spectroscopy for the structural elucidation of organic compounds, B11, N15, F19 and P31 NMR spectra, spectra of paramagnetic complexes, magnetic susceptibility, contact shift, fluxional molecules and their studies using NMR, solid state NMR.

Unit 4 ESR, NQR and Mossbauer Spectroscopy
ESR spectroscopy - theory, hyperfine and superfine splitting, ESR active simple organic systems, ESR of inorganic systems like Cu2+ and VO2+ complexes, ‘g’ markers like DPPH and TCNE, evaluation of spin Hamiltonian like A, g11, g2, covalency factor in Cu2+ complexes, analysis of ESR spectra of VO2+ compounds, NQR spectroscopy - theory, relationship between electric field gradient and molecular structure, quadrupole coupling constant and structural information of compounds, Mossbauer spectroscopy, principle, Doppler effect, isomer shift, Zeeman splitting, quadrupole splitting, application of Mossbauer spectroscopy for studying Fe and Sn compounds and phase transformation, application of ESR spectroscopy.

Unit 5 Mass Spectroscopy and PES
Mass spectroscopy, base peak and molecular ion peak, isotope ratio data, fragmentation patterns of alkanes, alkenes, alkynes, aromatic hydrocarbons, alcohols, phenols, aldehydes, ketones, esters, carboxylic acids, amines, methods of desorption and ionization (EI, CI, CI, ID, MALDI, PD, FAB, SIMS), MS/MS and determination of molecular formula, metastable ions and their significance, study of fragmentation pattern, application of MS in structural elucidation and other frontiers of science, application of MS for quantitative analysis, photoelectron spectroscopy (PES), principle, application of PES.

Unit 3 Inorganic materials I
Alkali and alkaline earth metals, their compounds, crown ethers and cryptands as complexing agents for alkali metal ions, Be and Mg compounds, boron cage compounds, boron hydrides, structure and bonding, 3-centre-2-electron bonds, styx numbers, the importance of icosahedral frame work of boron atoms in boron chemistry, closo, nido and arachno structure, carboranes, metalloocene carboranes, B-N compounds, interstitial compounds, metal carboxides, nitrides and hydrides, fullerences, functionalized fullerenes, C-nanotubes

Unit 4 Inorganic materials II
Inorganic chains and polymers, rings, cages, and clusters, sulphur-nitrogen compounds, polymeric sulphur nitride, isopoly anions, heteropoly anions, Keggin and Dawson polyoxometalates, borazines, metal clusters, nature of Si-Si bonds, silicates, silicates with zero-, one-, two- and three-dimensional structures, structure of elemental P, phosphonitrilic compounds, polymers with P-N bonds, interhalogen and pseudo halogens, intercalation chemistry, intercalation in layered materials like graphite, xenon fluorides & other xenon compounds.
Unit 5 Chemistry of f-block elements
The lanthanides and actinides, stable oxidation states, the lanthanide and actinide contractions, the f-orbitals, spectral and magnetic properties - comparison with inner transition and transition metals, separation of lanthanides, use of lanthanide compounds as shift reagents, photo-emission of lanthanide compounds, organometallic compounds of lanthanides and actinides and their structural features, reactions of lanthanide and actinide compounds, mineral sands of south west India - Ilmenite, Monazite, etc.

TEXTBOOKS:

REFERENCES:

15CHY512  REACTION STRATEGIES AND FUNCTIONAL GROUP INTERCONVERSIONS  3 1 0 4

Unit 1 Pericyclic Reactions

Unit 2 Synthetic Strategies
Synthetic strategies: Introduction to retrosynthetic analysis, protecting groups, functional group equivalents, reversal of reactivity (Umpolung), Introduction to combinatorial chemistry.

Unit 3 Organometallic reagents
Reagents based on chromium, nickel, palladium, silicon, and boron, Gilman reagent, phase transfer catalysts, Gilman’s reagent - Lithium dimethyl cuprate, lithium disopropyl amide (LDA), 1,3-dithiane, trimethyl silyl iodide, tri-n-butyl tin hydride, phase transfer catalysis, crown ethers and Merrifield resin, Petersens olefination, Baker-yeast.

Unit 4 Reagents for oxidation and reduction
PCC, DDQ, osmium tetroxide, ruthenium tetroxide, selenium dioxide, peracids, hydrogen peroxide, singlet oxygen, aluminum isopropoxide, periodic acid, lead tetraacetate, Swern oxidation, Oppeneur oxidation, Woodward and Prevost hydroxylation, Sharpless asymmetric epoxidation, catalytic hydrogenations (heterogeneous and homogeneous), Clemmensen, Wolff Kishner and MPV reductions, metal hydrides, Birch reduction, hydrazine and diimide reduction.

Unit 5 Base catalyzed reactions
Reactivity of carbonyl groups in aldehydes, ketones, carboxylic acids, esters, acyl halides, amides. Substitution at a-carbon, aldol and related reactions, Claisen, Darzen, Dieckmann, Perkin, Stobbe, Baeyer-Villiger reaction, Prins, Mannich, Stork-ename reactions. Conjugate additions, Michael additions and Robinson annulations, Reformatsky and Grignard reactions, Reaction with phosphorus and sulfur ylides, Wittig and other ylide reactions.

TEXTBOOKS:

REFERENCES:

15CHY521  AROMATICITY, STEREOCHEMISTRY AND REACTION MECHANISM  3 1 0 4

Unit 1 Aromaticity and Structure Activity Relationship
Bronsted and Lewis acids and bases, pH and pKa, Hückel’s rule and modern theories of aromaticity and anti-aromaticity with suitable examples, study of [n]annulenes, fullerenes, nonbenzenoid aromatics, catenanes and rotaxanes, structure activity relationships with special emphasis on the effect of structure on acidity and basicity, solvent effects, linear free energy relationships, mechanisms and methods of determining them (kinetic and nonkinetic methods), application of frontier orbital theory in organic reactions, molecular orbitals and frontier orbitals, application in studying radical and ionic reactions, HSAB concept, Mobius strip, aromaticity in transition state.

Unit 2 Stereochemistry
Optical and geometrical isomerism, absolute and relative configuration, Cahn-Ingold-Prelog system, prochirality, prochiral centre, atoms, groups and faces, designations, asymmetric synthesis, stereospecific and stereoselective synthesis, regioselective and regiospecific reactions, atropisomerism, optical isomerism in biphenyls, allenes, spirans and “ansa” compounds, compounds containing chiral nitrogen and sulfur atom, geometrical isomerism of cyclic compounds, cumulenes and oximes.
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Unit 3 Conformational Analysis
Conformational analysis of cyclic and acyclic systems with special emphasis on six
membered rings, conformational effects on the reactivity of acyclic and cyclic systems
- elimination, substitution and addition, strain, structure and stability of small, medium,
and large rings, anomer effect - cyclizations and cycloalkynes, stereochemistry
of SN1, SN2, SNi, E1 and E2 - kinetically and thermodynamically favoured products.

Unit 4 Active Reaction Intermediates and Mechanisms
Generation, structure and reactivity of carbocations (including non-classical
carbocations), carbanions, carbon radicals, radical ions, Baldwin ring-closure rules,
generation, structure and reactivity of carbones, nitrones, arynes, nitrelius ions,
mechanism of nucleophilic, electrophilic and free radical substitutions on aliphatic
carbons (saturated and unsaturated) and on aromatic carbon, benzyne mechanism,
addition and elimination reactions and their mechanisms, ylide chemistry.

Unit 5 Rearrangements Involving Electron Deficient Carbon, Nitrogen & Oxygen
Wagner-Meerwein, Pinacol, Demyanov, diene-phenol, Favorskii, Wolff, Hofmann,
Curtius, Lossen, Schmidt, Beckmann, benzidine, and Hofmann-Loffler rearrangements
and their mechanisms, olefin metathesis.

TEXTBOOKS:

REFERENCES:

15CHY522 COORDINATION CHEMISTRY 3 1 0 4
AND ORGANOMETALLICALCS

Unit 1 Theories and Concepts
Introduction - ligands, nomenclature of coordination compounds, coordination
compounds of transition metal ions with 2, 3, 4, 5, 6, 7 and 8 coordination numbers.
Werner's theory, Valence bond theory (VBT), Crystal field theory (CFT), CFSE,
effects of CFSE on hydration energies, types of ligands and spectro-chemical series,
spectral and magnetic properties, spin-only magnetic moments, nephelauxetic effect,
states, polynuclear carbonyls with and without bridging groups, IR spectra of terminally bound and bridging type CO’s, carbonyl hydrides, metal nitrosyls, dinitrogen complexes, isocyanide, tertiary phosphines and ternary arsenic complexes of transition metals, metal dioxigen and dinitrogen complexes, structural features of the above compounds, co-ordination compounds containing SO2, CO2 and N-heterocycles, complexes with weakly co-ordinating anions, 7, 8 and 9 co-ordination complexes, organometallic compounds with metal-metal bonds and containing metal clusters, metal-carbon sigma-bond, complexes with chain pi-donor ligands, structures of olefines, acetylenes and pi-allyl complexes, complexes with cyclic pi-donors, cyclopentadiene, benzene, cycloheptatriene, cyclobutadiene and cyclooctatetraene.

Unit 5 Bonding and Structural features of Organometallic Compounds
Fragment molecular orbitals (FMO) of various organic moiety/fragments like CH3, CH2, CH, BH2, BH, NH2, NH, FMO’s (p-orbitals) of C3H5, C4H4, C4H6, C5H5, C6H6, C8H8 etc and various inorganic of the type MLn, isolobal concept, iso-electronic and isolobal relationships between various organic and inorganic (MLn) fragments, setting up of MO level diagrams and discussion of structure and bonding in various organometallic compounds like metal-olefins, MLn-cyclobutadiene, MLn-carbene, MLn-carbyne, sandwich and half-sandwich compounds, stable metal carbonyls, low and high nuclearity clusters, stereochemically non-rigid molecules, fluxional nature of organometallic compounds, nature of non-rigidity and their characterization by NMR spectroscopy, activation of small molecules by metal ions.

TEXTBOOKS:

REFERENCES:

15CHY581 INORGANIC SEMI-MICRO QUALITATIVE ANALYSIS LAB. 0 0 6 2

Semi-micro analysis of mixtures
The mixture will include 4 cations including two common (eg. Cations of metals like Cu, Mn, Zn, Ni, Ca, Ba, Mg etc) and two less common cations (eg. Cations of metals like Ti, Zr, V, W, Li, Ce, Th etc).
(The student has to successfully analyze a minimum of 10 mixtures.)
2. Thin layer chromatography to determine Rf values of compounds
   (a) 2-nitroaniline
   (b) 4-nitroaniline
   (c) Cinnamic acid and 2-nitroaniline
   (d) Acetophenone
   (e) Ethyl benzoate

3. Simple column chromatography to separate the components of binary mixtures
   (a) Hydrocarbon and ester
   (b) Aldehyde and amine

REFERENCES:

15CHY586 ORGANIC QUANTITATIVE ANALYSIS LAB.

A. Estimations:
1. Estimation of equivalent weight of an acid
2. Estimation of glucose
3. Estimation of phenol
4. Estimation of acetone
5. Estimation of acid value of an oil
6. Estimation of iodine value and sap value of an oil
7. Estimation of Nitrogen – Kjeldahl method
8. Estimation of formaldehyde
9. Estimation of aniline
10. Estimation of ester

B. Preparations of Organic Compounds
   Double stage preparations
   (a) m-nitro benzoic acid from ethyl benzoate

15CHY601 PHYSICAL METHODS IN CHEMISTRY

Unit 1 Ultraviolet and Visible spectroscopy
Orbitals involved in electronic transition, effect of solvents on the absorption of molecules, applications of electronic spectroscopy to conjugated compounds, a, ß unsaturated carbonyl compounds, aromatic compounds and heterocyclic systems, effects of substituents on the electronic spectra of aromatic compounds, electron releasing and electron withdrawing effects, substituents capable of p-conjugation, disubstituted benzene derivatives, stereo chemical factors in electronic spectroscopy, model compound studies, the nature of structural information that can be obtained from electronic spectroscopy, application of UV-visible spectroscopy for structural characterization of organic compounds.
Unit 2 Infrared Spectroscopy
The IR absorption process, instrumentation details, dispersive IR spectrometer, FTIR spectrometer, sample preparations, stretching and bending modes of various groups and corresponding IR absorptions, combination bands, difference bands, bond properties and absorption trends, the effect of reduced mass on the IR absorptions, correlation charts, characteristic group absorption of organic molecules and identification of functional groups, C-H stretching mode, O-H vibrations, C-H bending, C=C stretching, conjugation effect, ring-size effect, IR spectra of compounds containing substituted double bonds, carbonyl compounds, factors influencing C=O stretching vibrations, study of the IR spectra of normal, branched and cyclic alkenes, alkanes, alkenes, aromatic compounds, alcohols, phenols, ethers, epoxides, peroxides, aldehydes, ketones, carboxylic acids and derivatives and compounds containing N, P and S, IR spectra of inorganic systems, IR of anions like NO3-, ClO4-, SO42- in ionic form and also in coordinated forms due to symmetry, application of IR spectra for structural characterization.

Unit 3 NMR and ESR spectroscopy
Instrumentation details, factors influencing chemical shift, integrals in proton NMR spectra, splitting of NMR signals, magnitude of coupling constants, AMX, ABX and ABC systems, factors influencing geminal and vicinal coupling, heteronuclear coupling, chemical and magnetic equivalence, deuteration exchange, lanthanide shift reagents, peak assignments in 13C NMR, 13C - 1H spin coupling, DEPT, 2D NMR - shift correlation spectra - COSY HETCOR and HMQC, structural applications of 1H and 13C NMR techniques, CIDNP, spectra of compounds containing other important nuclei like 19F, 31P, 15N, 17O and 29Si, ESR spectroscopy, derivative curves, g values, hyperfine (hf) and superfine (shf) splitting, hf and shf splitting constants, structure and bonding parameters from ESR spectra.

Unit 4 Mass Spectrometry
Instrumentation details, structure and recognition of the molecular ion, molecular formula from the molecular ion, nature of metastable ion, calculation of m/z values, significance of metastable ions, basic fragmentation types and rules, fragmentation associated with functional groups, nitrogen rule, nature of fragment ions for alkanes, alkenes, alkynes, aromatic hydrocarbons, alcohols and phenols, ethers, aldehydes, ketones, esters, carboxylic acids, amines, S and N compounds, nitro compounds, isotope substitution by mass spectrometry, time of flight, quadrupole and tandem mass spectrometry, GC-MS, HPLC-MS, application of MS for structural characterization of organic compounds. Conjoint IR, UV/VIS, NMR and MS problems, applications of spectroscopic techniques in organic and inorganic chemistry, structural elucidation by using several spectroscopic techniques, aliphatic compounds, aromatic compounds, distinguishing structural isomers from spectral techniques, CD spectra and its applications.

Unit 5 Analytical Chemistry
(a) Complexometric Titrations
Classical methods of analysis, titrimetric analysis, theory of indicators, acid-base equilibrium in non-aqueous solvents, buffers, titration curves, titration in non-aqueous solvents, complexometry, factors favoring complexation, theory of complexometric titrations, metal-ion indicators, masking and demasking, applications of complexometric titrations, solubility product, gravimetric determination.

(b) Separation Techniques
Distribution law, liquid-liquid extractions, factors favoring solvent extraction, synergistic extraction, countercurrent extraction, super critical fluids, electrophoresis - theory and applications, chromatography, theory, instrumentation and applications of column, paper, TLC, HPLC, GPC and ion exchange chromatography, gas chromatography, CHN analysis by GC.

(c) Thermal, Diffraction and Electroanalytical Techniques
Theory, instrumentation and applications of TG, DTA, DSC, XRD, electron diffusion, and neutron diffusion, theory, instrumentation and applications of conductometry, potentiometry, amperometry, voltammetry, polarography, electrogravimetry, coulometry and ion selective electrodes.

(d) Miscellaneous Techniques
Refraclometry and interferometry, polarimetry, CD and ORD, nephelometry and turbidimetry, atomic absorption and flame emission spectrometry, XRF, chemical analysis of surfaces - ISS, SIMS, AES, ESCA.

TEXTBOOKS:

REFERENCES:

15CHY602 ELECTROCHEMISTRY, ENERGY SYSTEMS AND KINETICS

Unit 1 Surface Chemistry
Different types of interfaces, molecular and atomic surface structure, surface chemical...
reactions, surface tension of solutions, surface excess, thermodynamics of surfaces, Gibbs equation and its derivation, surface films, surface potential, adsorption by solids, Langmuir isotherm - its kinetic and statistical derivation, Freundlich equation, multilayer adsorption, BET isotherm - its kinetic derivation, measurement of surface area, colloids - their preparation, purification, stability & electro kinetic phenomena, Donnan membrane equilibrium, micro and nano emulsions, surface analysis using photoelectron spectroscopy, surface imaging techniques like SEM, TEM, AFM etc., sputter coating, ion beam principles, design of surfaces with novel properties.

Unit 2  Electrochemistry I
Faraday’s law, conductivity of electrolytes, applications of conductivity measurements, ionic mobility, transference number, Debye-Huckel-Onsagar equation of conductivity and its validity for aqueous and nonaqueous solutions, deviations from the Onsager equation, activity and activity coefficients in electrolytic solution, Debye-Huckel theory and its tests and improvements, Onsager equation, electrochemical potential, electric potential at interfaces.

Unit 3  (a) Electrochemistry II
Electrochemical cells, standard electrode potentials, reversible cell, concentration cells with and without transference, energetic of cell reactions, effect of ionic concentration, pressure and temperature on the energetic of cell reactions, applications of e.m.f. measurements, potentiometric measurement of pH, glass electrode and its structure, performance and limitations, double layer, charge transfer across interfaces, polarisation, concentration polarisation, decomposition potential, over potential (hydrogen, oxygen and metal decomposition over voltage), theories of over voltage, electrode kinetics - Butler Vrommer equation, Tafel equation, power generation, storage cells, theories of corrosion, fuel cells, diffusion potential, liquid junction potential, Henderson’s equation, electron transfer kinetics - Marcus theory, electrochemical impedance spectroscopy, electro organic chemistry - electro oxidation, electro reduction, electro polymerisation.

Unit 3  (b) Batteries and Fuel Cells
Primary, secondary and reserve batteries, chemistry, fabrication, performance aspects, packing classification and rating of Zn-C, Mg, alkaline manganous dioxide, mercuric oxide, silver oxide batteries, Zn/air and Li button cells, solid electrolyte cells, secondary batteries - lead-acid, Ni-Cd, Ni-Zn, Li and Li+ batteries, rechargeable Zn-alkaline batteries, reserve batteries – zinc-silver oxide, lithium anode cell, thermal batteries, advanced batteries for electric vehicles – metal/air, Zn-Br, sodium-beta and lithium/iron sulphide batteries, Fuel Cells – carbon, hydrogen-oxygen, methanol, molten carbonate, solid polymer electrolyte and biochemical fuel cells, alkaline fuel cells, phosphoric acid fuel cells, solid oxide fuel cells, proton exchange membrane fuel cells, solar cells – photovoltaic and photo electrochemical cells, photo biochemical conversion cell.

REFERENCES:

REFERENCES:

15CHY611  COMPUTATIONAL CHEMISTRY  2 1 0 3

Unit 1
Models, Approximation and Reality - Fundamental principles - energy, electrostatics, atomic units, thermodynamics, quantum mechanics, statistical mechanics.

Unit 2
Computational methods - Ab initio techniques - semiempirical methods - density functional theory - molecular mechanics - molecular dynamics, montecarlo simulations.

Unit 3
Computing molecular geometries, potential energy surfaces, Z matrices - basis sets - molecular vibrations - population analysis - chemical properties by computational methods.

Unit 4
Computing the transition states, reaction co-ordinates, reaction rates, solvation,
electronic excited states, structure property relations, computing NMR chemical shifts, Band structures, Meso scale dynamics, synthesis route prediction.

Unit 5
Periodic table, Molecular modeling, modeling of biomolecules, simulating liquids, polymers, solids and surfaces the software packages.

TEXTBOOKS:

REFERENCES:

15CHY612 HETEROCYCLIC AND NATURAL PRODUCTS 3 1 0 4 CHEMISTRY

Unit 1
Photochemistry - Principles and Reactions
Introduction to unimolecular and bimolecular processes, Stern Volmer equation, Jablonski diagram, cis-trans isomerisation, Paterno-Buchi reaction, Norrish Type I and II reactions, photo reduction of ketones, di-pimethane rearrangement, photochemistry of arenes, Hoffmann Loffler Freytag reaction, Barton reaction, photochemistry of cyclodextrinones, determination of photochemical reaction mechanism.

Unit 2
Heterocyclic Compounds
Nomenclature and general characteristics of heterocyclic compounds, study of three and four-membered ring heterocycles containing one heteroatom, structure and synthesis of penicillin and cephalosporin-C, structure and synthesis of reserpine, heteroaromatic compounds (five and six-membered rings) containing one and two heteroatoms, fused ring compounds - indole, quinoline, isooquinoline, coumarin, flavones, purine and pyrimidine, bases present in nucleosides.

Unit 3
Carbohydrates
Structure of ribose, glucose, fructose, maltose, sucrose, lactose, starch, cellulose and cyclodextrins, preparation of alditols, glycosides (O, C and N), deoxysugars, synthesis of vitamin C from glucose, structure and synthesis of nucleic acids, genetic code, recombinant DNA, biosynthesis of shikimic acid.

Unit 4
Chemistry of Natural Products
Alkaloids - classification, structure elucidation based on degradative reactions (quinine and atropine), Terpenoids - classification, structure elucidation and synthesis of abietic acid, Steroids - classification, structure of cholesterol, conversion of cholesterol to progesterone, androsterone and testosterone, classification, structure and synthesis of prostaglandins, biosynthesis of fatty acids, prostaglandins, terpenoids and steroids.

Unit 5
Amino acids, Peptides and Enzymes
Synthesis of amino acids - Strecker and azalactone synthesis, enantioselective synthesis of amino acids, reactions of amino acids, structure of proteins, introduction to enzymes and coenzymes with special reference to the function of chymotrypsin, NAD, thiamine, pyridoxal, in vitro and in vivo synthesis of peptides, solid phase synthesis, biosynthesis of quinine and papaverine.

TEXTBOOKS:

REFERENCES:

15CHY613 SOLID STATE AND BIOINORGANIC CHEMISTRY 3 1 0 4

Unit 1
Introduction to Crystal Systems
Introduction to solids - solid state chemistry, close packing, hcp, fcc, density, coordination numbers, tetrahedral and octahedral holes, body centered and primitive structures, symmetry, proper rotation, mirror planes, inversion, improper axis symmetry elements, symmetry in crystals, Schoenflies and Hermann-Mauguin notations, unit cells, glide plane, screw axis, three-dimensional unit cells, seven crystal systems/classes, space groups, Miller indices, Bravais lattices, reciprocal lattice, inter-planar spacing in different crystal systems, fractional coordinates, ionic solids, structures of CsCl, NaCl, NiAs, zinc blende and wurtzite structures, MX2 type solids, fluorite and antifluorite structures, CdCl2 and CdI2 structures, rutile and anti-rutile, ReO3, spinel and inverse spinel, pervoskite structures, ionic radii, crystal radii, radius ratio, Extended covalent array, diamond, graphite.

Unit 2
Bonding in Solids and Electronic properties
Bonding in crystals, metallic bonding, ionic bonding, covalent bonding, silicates, Born-Haber cycle, Hess’s law, lattice energy (L) and calculation of L, free electron theory, density of states, electronic conductivity, molecular orbital theory, overlap and bonding, linear chain of H atoms, LCAO, Fermi Level, conductors, insulators and semiconductors, n- and p-type semiconductors, bands in compounds, electrical conductivity, photo-conductivity, bands in d-block compounds, band-gap measurements, conductivity, GaAs, magnetic and optical properties of solids.
SYLLABI  
Syr Integrated M.Sc Chemistry  
2015 admissions onwards

Unit 3 Magnetic and Optical Properties of Solids
Behavior of substances in magnetic field, effects of temperature (Curie & Curie-Weiss laws); magnetic moments, mechanism of ferro- and antiferromagnetic ordering, super exchange, luminescence and phosphorescence, phosphors, lasers, non-stoichiometry in solids, electronic properties of non-stoichiometric oxides, defects in solids, Schottky defects, Frenkel defects, doping in crystals and color features, ruby, diamond, conducting organics, organic conductors, preparation, mechanism of conduction in organic semiconductors, photoconductivity of polymers, high Tc superconductors.

Unit 4 Bioinorganic Chemistry I
Inorganic chemistry and biochemistry – fundamentals, essential chemical elements, metals in biological systems, biological metal ion complexation, thermodynamics and kinetics. Transport of ions across biological membranes, role of alkali and alkaline metal ions in biological systems, ionophores and passive transport, sodium-potassium pump and active transport, structural role of Ca, transport of Ca, electron transport in biology, oxygen carriers - myoglobin and hemoglobin structure of prosthetic group and functions, mechanism for reversible binding of dioxygen and co-operativity of oxygen binding, behaviour of dioxygen bound to metals, model compounds, cobalt containing model compounds, iron containing model compounds, binding of CO to hemoglobin and myoglobin.

Unit 5 Bioinorganic Chemistry II

REFERENCES:

SYLLABI  
Syr Integrated M.Sc Chemistry  
2015 admissions onwards

15CHY631  
APPLIED ELECTROCHEMISTRY

Unit 1 Electrodes

Unit 2 Quantum oriented electrochemistry
Chemical potentials and energy state of electronics in the solution potential energy surfaces and electrode kinetics. A quantum mechanical description of electron transfer. Electron transfer, the frank-Condon principle in electron transfer, the primacy of Tafel's law in experimental electrode kinetics.

Unit 3 Electrochemical energy systems
Electrochemical process, Primary, secondary and reserve batteries, fuel cells, solar cells.

Unit 4 Electrochemical sensors
Potentiometric sensors, solid state Potentiometric chemical sensors, polymeric membrane sensors, ion selective field effect transistor, application, Hydrovolomeric technique - hydrodynamic voltametry - application, voltametric sensors - electrode modification application, optical sensors - bioamperometric titration. Methods involving forced convection - hydrodynamic methods.

Unit 5 Biosensors

REFERENCES:
SYLLABI 3yr Integrated M.Sc Chemistry 2015 admissions onwards

15CHY632 BIOANALYTICAL CHEMISTRY 300 3

Unit 1 Enzymes
Enzyme nomenclature, Enzyme commission numbers, Enzymes in bioanalytical chemistry, Enzyme kinetics - Enzyme activators, Enzyme inhibitors.

Unit 2 Quantification of Enzymes and their substrates

Unit 3 Immobilized enzymes
Immobilization methods - nanopolymerizing covalent immobilization, Crosslinking with bifunctional reagents. Properties of immobilized enzymes, immobilized enzyme reactions, theoretical treatment of packed bed enzyme reactors.

Unit 4 Antibodies
Structural and functional properties of antibodies, Polyclonal and monoclonal antibodies - Antibody-antigen interactions, analytical application of secondary antibody-antigen.

Unit 5 Biosensors

TEXTBOOKS:

REFERENCE:

15CHY633 CHEMISTRY OF BIOMOLECULES 300 3

Unit 1 Amino acids, Proteins and Peptides
Classification, Stereochemical aspects, physical properties, Ionic properties, spectral properties, chemical reactions of amino acids, Industrial preparation and chemical synthesis of amino acids, Ionic properties of proteins, protein structure, protein purification, protein structure determination, proteomics and protein function, solid phase peptide synthesis, biologically important peptides.

SYLLABI 3yr Integrated M.Sc Chemistry 2015 admissions onwards

Unit 2 Enzyme chemistry
Introduction to Enzymes, Classification of enzymes, mechanism of enzyme action, immobilized enzymes and enzyme technology, enzyme analog built polymers, design of molecular clefts, enzymes in synthetic organic chemistry.

Unit 3 Molecular biology and bioinformatics
Structure of nucleic acids, genes and genome complexity, functions of nucleic acids, isolation and separation of nucleic acids, molecular analysis of nucleic acid sequences, nucleotide sequencing of DNA.

Unit 4 Immunochemical techniques
Production of antibodies, purification and fragmentation of immunoglobulins, immunoprecipitation, labeling antibodies, immunoblotting, immunoassays, immunohisto/cytomage.

Unit 5 Recombinant DNA and genetic analysis
Constructing gene libraries, cloning vectors, hybridization and gene probes, application of gene cloning, expression of foreign genes, pharmacogenomics.

REFERENCES:

15CHY634 INDUSTRIAL CHEMISTRY 300 3

Unit 1 Water treatment
Softening of water, Ion exchange process, Lime soda process, Modified Lime soda process, Zeolite process, Chemical and physical method of sterilization, Desalination, Boiler problems. Corrosion of boiler units, industrial water treatment, water analysis.

Unit 2 Fuels
Calorific value, determination of Calorific value, classification of fuels, Solid fuels, Properties of fuels, classification of coal, coking and non-coking coals, advantages and disadvantages of solid fuels. Liquid fuels, gaseous fuels, analysis of fuel gases, Distillation of petroleum. Processing & purification of petroleum and petroleum products, Flash point, Fire point, Knocking, antiknocking, Cetane number, octane number, natural gasoline, cracking, polymerization, alkylation, isomerisation, rocket fuels, fossil fuels, nuclear fuels.

Unit 3 Energy resources
Renewable and non renewable sources of energy, conventional and non conventional sources of energy, solar energy, solar technology, solar photovoltaic cell - application, PV lantern system, Radiotelephone system, Application of solar
energy, Environmental implication, Nuclear energy, nuclear fuel cycle in India, Energy conservation and waste heat boilers, Fuel cells, hydrogen cells.

Unit 4 Paints and Pigments
White pigment, blue, green, yellow, black and red pigments - manufacture, physical properties, characteristics. Manufacture of paints, setting of paints, requirement for good paints, emulsion paint, latex paint, luminescent paint, fire retardant paints, heat resistant paints, varnishes, manufacture of varnishes, enamels, lacquers.

Unit 5 Explosives and Toxic Chemical Weapons
Introduction, Classification. Deflagrating or low explosives. Characteristics of explosives, nitrocellulose, PETN, DNB, TNB, TNT, Picric Acid, Nitroglycerine, Dynamite, Cirdite, Gun powder, RDX, EDNA, HMX, Tetryl, Pentryl, Hexyl, Dinol. Toxic chemical weapons, screening smokes, Incendiaries, Pyrotechniques, Explosives in India.

TEXTBOOKS:

REFERENCES

15CHY635 INDUSTRIAL STOICHIOMETRY 3 0 0 3

Unit 1
Introduction to process calculation - dimensions and systems of units - fundamental quantities of units, derived quantities, definition and units of force, volume, pressure, work, energy, power, heat-unit conversions in FPS, MKS and SI systems.

Unit 2

Unit 3
Description and simple material balance calculation of physical processes such as drying, distillation, absorption, mixing, crystallization, Evaporation.

SYLLABI Syr Integrated M.Sc Chemistry 2015 admissions onwards

Unit 4 Single stage material balance calculation of leaching and extraction, calculations involving recycling and by passing operation - limiting reactant, excess reactant, conversion, yield and selectivity - simple numerical for finding yield, conversion and composition.

Unit 5 Calculation of material and energy balance based on reactions involving heat capacity and specific heat - mean heat capacity of gases - heat capacity of gas mixture and liquid mixture. Calculations of heat capacity by integral equation up to three terms - sensible and latent heats of fusion, sublimation, vaporization. Calculations of standard heat of formation from heat of combustion data. Calculations for heat of reaction from heat of formation and heat of combustion data – Fuels - calorific values proximate and ultimate analysis - air requirement and composition of flue gases.

TEXTBOOKS:

REFERENCE BOOKS:

15CHY636 MATERIAL SCIENCE AND NANOCHEMISTRY 3 0 0 3

Unit 1 Introduction to Nanomaterials
Introduction to Material Science, Interdisciplinary nature, Structure of nanomaterials, Length scales, de-Broglie wavelength & exciton Bohr radius, Foundations of Quantum Mechanics: wave function, Schrödinger equation, uncertainty principle, quantum wells, quantum wires, quantum dots, articles.

Unit 2 Nanomaterials: Synthesis, Properties
Size effect and properties of Nanoparticles - Particle size - Particle shape - Particle density, Specific surface area and pore - Composite structure, Crystal structure - Functionality of nanostructures and their characteristic evaluation - Optical properties - Catalytic property; Synthesis - Methods and Strategies, Top-down and bottom-up approaches, Chemical vapor deposition, Laser ablation, Electric-arc, Sol-Gel Processing, Lithography - Surface modification of inorganic nanoparticles by organic functional groups.

Unit 3 Surface Science and Characterization of Nanomaterials
Electron Microscopy, MFM, SNOM, SEM, TEM, EDAX, X-ray Diffraction and Electron
diffraction, Atomic Force Microscopy, Scanning Tunneling Microscopy, Spectroscopy: UV-Visible spectroscopy, Photoluminescence spectroscopy, IR spectroscopy, FTIR and ATR, Raman spectroscopy, Self-Assembled Monolayers.

Unit 4 Nanotechnology: Applications and Devices
Nanoscale materials, Nano transfer printing, Biomaterials applications, MEMS and NEMS, selforganisation, nanoscale (opto) electronics, Fullerenes, Devices - Actuators and motors for nanodisplacements, Nanosensors, development of optical memory using semiconductor nanoparticles - Nozzle-free inkjet technology - Dendrimers and their application to organic electronics devices - Nanomedicines, Bio-imaging with quantum dots.

Unit 5 Environmental Issues in Nanotechnology
Nanoparticles and environment - Nanoparticles in atmosphere - Ground water, exhaust gases - wastewater and Indoor environments; Safety of nanoparticles - Problems caused by nanoparticles, Safety assessment for the nanoparticles; Removal of nanoparticles.

REFERENCES:

TEXTBOOKS:

15CHY637 MEDICINAL CHEMISTRY 3 0 0 3

Unit 1 Physicochemical properties of drugs in relation to biological action
Acid-Base Properties, Water solubility, Partition coefficient, drug administration, drug distribution, metabolism (Phase I and Phase II) and toxicity of drug receptor interaction, conformational flexibility and multiple mode of action, optical isomerism and biological activity, selected physico-chemical properties (Ionization, hydrogen bonding and biological action, chelation and biological action, oxidation - reduction potential and biological action, absorption and orientation at surfaces) Enzymes, hormones and Vitamins - representative cases, nomenclature, classification and characteristics of enzymes, mechanism of enzyme action, factors affecting enzyme action, co-factors and co-enzymes, enzymes in organic synthesis, mechanism of enzyme catalysis, enzyme inhibition.
Drugs targeting DNA: Bleomycin, Anthracyclines and Enediyne anti-tumor agents (Calicheamicins and Dynemicin A).

B) Nervous System and neurotransmitters. Acetylcholine analogs as Agonists and antagonists with examples.

**TEXTBOOKS:**

**REFERENCES**
2. V.K.Ahuwalia, Lalita S.Kumar and Sanjiv Kumar, ‘Chemistry of Natural Products’; Ane Books India.

**SYLLABI**

**15CHY638 SUPRAMOLECULAR CHEMISTRY 3 0 0 3**

**Unit 1** Introduction to Supramolecular Chemistry
From molecular to supramolecular chemistry: Factors leading to strong binding, hydrogen bonding and stacking interactions, Bottom-up approach, Top-Down Approach, Energy and Signals Semiochemistry, photo switching devices, electro switching devices, mechanical switching processes,

**Unit 2** Processing of Energy and Signals by Molecular and Supramolecular system
Fundamental principles of photo induced electron and energy transfer, Molecular electronics, Molecular photonics, Molecular Chemionics, Molecular electro photonics, Molecular Photochemionics.

**Unit 3** Molecular Recognition

**Unit 4** Electrochemistry of Supramolecular Systems
Electroluminescent systems as sensors and devices, Redox controlled molecular switches, Biophyrid electrochemical devices, Dendrimers as multielectron storage devices, Redox-active Metal-Polypyridine dendrimers as light harvesting antennae.

**Unit 5** Molecular Scale Mechanical Devices
Introduction to mechanical devices, Spontaneous mechanical like motions, Allosteric movements, Tweezers and Harpoons, A natural proton pump, Twisters, Tweezers, Threading-Dethreading movements, Ring switching processes in Rotaxanes and Catenanes, Molecular valves, Molecular Muscles.

**TEXTBOOKS:**

**REFERENCES:**
3. Jean-Marie Lehn, ‘Supramolecular Chemistry; RCS pubs., 2005

**15CHY639 NANOMATERIALS FOR BIOMEDICAL APPLICATIONS 3 0 0 3**

**Unit 1** Introduction to Nanomaterials: Size dependence of properties – Surface to volume ratio and Quantum confinement; Microscopic techniques to study nano structures - SEM, AFM – TEM and STM; Spectroscopic techniques to characterize nanostructures - Raman, XPS, Auger, EDAX;

**Unit 2** Synthetic approaches: Colloidal, Self-Assembly (Self-assembled monolayers - SAMs) and electrostatic self-assembly, electrochemical methods (cathodic and anodic processes), sol-gel, Langmuir-Blodgett (LB) technique, chemical vapour deposition, plasma arcing and ball milling, lithography;

**Unit 3** Electrical, optical, mechanical, chemical and magnetic properties of nanomaterials; Carbon Clusters: Synthesis, properties and biomedical applications of Fullerenes, Carbon nanotubes and Graphenes.

**Unit 4** Quantum Dots, wells and wires (metallic and semiconducting) - Preparation, properties and biomedical applications; Dendrimeric structures and their applications;

**Unit 5** Biofunctionalisation of nanomaterials - Surface Plasmon resonance – Fluorescence Resonance energy transfer (FRET).
SYLLABI Sr Integrated M.Sc Chemistry 2015 admissions onwards

TEXTBOOKS/REFERENCES:


15CHY640 INDUSTRIAL METAL FINISHING PROCESSES 3 0 0 3

Unit 1
Background Theory: Review of reversible and irreversible processes - electrodes, indicator and reference - Nernst and Butler-Vohmer equation - phenomenon of polarization - factors influencing - Tafel experiment and Tafel plot - Significance.

Properties of deposits: Tests for adhesion, hardness, thickness, uniformity and corrosion resistance of the electro deposits.

Electroless deposition: Nickel, copper, gold on metal components – bath composition and operating conditions - immersion plating - plating on plastics – pre-treatment processes – long duration plating – electroforming, operating conditions and sequence.

Unit 3

Nanooxidizing of titanium, aluminium and tantalum - application to sensor field.

Plasma electrolytic oxidation: power supply requirements – baths used – process sequence for aluminium, magnesium and titanium – properties of the coating and industrial applications.

Unit 4
Electropolishing: Mechanism of electropolishing – electropolishing of ferrous and non-ferrous metals – industrial baths used – operating conditions and sequence - industrial applications.

SYLLABI Sr Integrated M.Sc Chemistry 2015 admissions onwards

Unit 5
Electrochemical etching: Etching of ferrous and non-ferrous metals – special properties of matt and satin finish – DC and AC processes – operating conditions and sequence.

Special Topics: Electrochemical and chemical metal colouring of ferrous and non-ferrous metals.


TEXTBOOK:

REFERENCES:


15CHY681 ADVANCED PHYSICAL CHEMISTRY LAB. 0 0 5 2

1. To construct the phase diagram for three component system.
2. Determination of equivalent conductance at infinite dilution of weak electrolytes.
3. Determination of order of reaction for ion exchange reaction.
4. Extraction efficiency of solute from a solution by immiscible solvent method.
5. Determination of calorific value using Bomb calorimeter.
7. Determination of the formation constant of silver-ammonia complex and stoichiometry of the complex potentiometrically.
8. Determination of flash point, fire point of a lubricant.
9. Determination of cloud point and pour point of a lubricant.

TEXTBOOKS:
Syllabi

**Reference Books:**

**15CHY682 Instrumental and Analytical Methods Lab.** 0 0 5 2

1. Determination of strengths of halides in a mixture potentiometrically.
2. To find the redox potential of the given sample using cyclic voltammetry.
3. Determination of half wave potential of Cd & Zn by polargraphy.
4. Determination of pKa of an indicator in aqueous and micellar medium using UV-Vis spectroscopy.
5. Determination of stoichiometry and stability constant of inorganic (ferric-salicylic acid) and organic (amine iodine) complexes using UV–Vis spectroscopy.
6. Determination of copper and cadmium in a mixture by electrogravimetry.
7. Determination of rate constant for enzyme kinetics-inversion of sucrose.

**Textbooks:**

**Reference Books:**

**15CHY696 Dissertation** 10 cr

The students shall carry out a major project starting from ninth semester and submit thesis/dissertation at the end of the tenth semester. This carries 10 credits. Necessarily the project work should involve a research component and reflect the original thinking of the student. Main focus will be on identifying chemistry oriented in-house problems and offering solutions to these problems. Similar problems will be chosen from in and around chemical processing industries and work will be carried out internally or in the respective industry. The project work will be done individually under the supervision of a chemistry faculty. Starting from ninth semester monthly reviews shall be conducted by a panel of chemistry faculty. At the end of the tenth semester the student shall submit a detailed report of the work done and also give a power point presentation before a panel of chemistry faculty and external experts in the respective field as a viva-voce examination. The 10 credits shall be awarded based on the dissertation, presentation and viva-voce.

**15CSA100 Problem Solving and Computer Programming** 3 0 0 3

**Unit 1**

**Unit 2**
C Fundamentals: structure of C program: directives, functions, statements, printing strings, comments; compilation and execution, Programming errors and debugging. Variables and assignment, reading input; data types, constants, identifiers, keywords, operators - arithmetic, logical, relational, assignment; expressions - precedence and associativity, type cast-implicit and explicit

**Unit 3**
Selection statements: if, if else, nested if, if else ladder, switch. Case. Iterative structures: entry controlled and exit controlled loop, exiting from a loop: break, continue, goto; nested loops.

**Unit 4**
Functions: library functions user defined functions: defining and calling functions, function declaration, passing arguments to a function, returning values from function. Storage classes - auto, extern, static, register variables, scope of a variable. Recursion.

**Unit 5**

**Textbook:**

**Reference:**

**15CSA116 Advanced Computer Programming** 3 0 0 3

**Unit 1**
Structures: structures variables - declaration, bit fields, initialization and operation on structures, typedef, nested arrays and structures: arrays in structures, nested structures, arrays of structures.
SYLLABI
Syr Integrated M.Sc Chemistry
2015 admissions onwards

Unit 2
Pointers – Declarations, Passing arguments by call by reference, Functions returning
pointer, Pointer Arithmetic, Pointer to pointer, Pointers and Arrays – pointer to array,
array of pointers, Dynamic memory allocation – malloc(), calloc(), deallcation:
free(), dangling pointers.

Unit 3
Pointers and structures, structures and functions: passing structure as argument
and returning structure from functions, self-referential structure, unions.

Unit 4
Files - file pointers, standard streams and redirection, text files, binary files, file
operations: open, mode, close; Input and output - character I/O, line I/O, formatted
I/O. Random file access, Command line arguments.

Unit 5
Preprocessor – Macros. User defined libraries and headers, introduction to the
graphics library.

TEXTBOOK:
Jeri Hanly and Elliot Koffman, “Problem solving and program design in C”, Fifth Edition, Addison
Wesley (Pearson), 2007.

REFERENCE:

15CSA180 PROBLEM SOLVING AND COMPUTER PROGRAMMING LAB.
Basic Linux commands, programs using input/output statements, operators, control
structures and loops. Programs using functions and recursions. Programs using numeric
one-dimensional array, two-dimensional array. Programs using strings, string handling
functions and string arrays. Programs using passing arrays and strings to functions.

15CSA187 ADVANCED COMPUTER PROGRAMMING LAB. 0 0 2 1
Programs to demonstrate functions cal by reference and returning values by
reference. Programs using pointer arithmetic operations and handling pointers.
Programs to demonstrate dynamic memory allocation and de-allocation. Programs
to show structure and union operations. Programs using files, command line
arguments and macros. Programs using user defined libraries and graphics library.

SYLLABI
Syr Integrated M.Sc Chemistry
2015 admissions onwards

15CUL101 CULTURAL EDUCATION I 2 0 0 2

Unit 1
Introduction to Indian Culture - Introduction to Amma’s life and Teachings - Symbols
of Indian Culture.

Unit 2
Science and Technology in Ancient India - Education in Ancient India - Goals of Life
– Purusharthas - Introduction to Vedanta and Bhagavad Gita.

Unit 3
Introduction to Yoga - Nature and Indian Culture - Values from Indian History - Life
and work of Great Seers of India.

TEXTBOOKS:
1. The Glory of India (in-house publication)
2. The Mother of Sweet Bliss, (Amma’s Life & Teachings)

15CUL111 CULTURAL EDUCATION II 2 0 0 2

Unit 1
1. Relevance of Sri Rama and Sri Krishna in this Scientific Age
2. Lessons from the Epics of India
3. Ramayana & Mahabharata

Unit 2
4. Who is a Wise Man?
5. A Ruler’s Dharma
6. The Story of King Shibi

Unit 3
7. Introduction to the Bhagavad Gita
8. Bhagavad Gita – Action without Desire

Unit 4
9. Role and Position of Women in India
10. The Awakening of Universal Motherhood

Unit 5
11. Patanjali’s Astanga - Yoga System for Personality Refinement
12. Examples of Heroism and Patriotism in Modern India

TEXTBOOKS:
Common Resource Material II (in-house publication)
Sanatana Dharma - The Eternal Truth (A compilation of Amma’s teachings on Indian Culture)
SYLLABI  Syr Integrated M.Sc Chemistry  2015 admissions onwards

15ENG101 COMMUNICATIVE ENGLISH  2023

Objectives: To help the student to obtain ability to communicate in English; to impart an aesthetic sense and enhance creativity.

Unit 1
Parts of Speech, Tenses, Prepositions, Determiners - Agreement (Subject – Verb, Pronoun - Antecedent), Phrasal Verbs, Modifiers, Linkers/ Discourse Markers, Question Tags.

Unit 2
Paragraph writing – Cohesion - Development: definition, comparison, classification, contrast, cause and effect - Essay writing: Descriptive and Narrative.

Unit 3
Letter Writing - Personal (congratulation, invitation, felicitation, gratitude, condolence etc.) Official (Principal/ Head of the department/ College authorities, Bank Manager, Editors of newspapers and magazines).

Unit 4

Unit 5
Prose: R. K. Narayan’s Fifteen Years - A.P.J. Abdul Kalam’s Wings of Fire (Parts I - 3)
Short Stories: Katherine Mansfield’s A Cup of Tea – Kishori Charan Das’s Death of an Indian.
Poems: Maya Angelou’s I Know Why the Caged Bird Sings - Sri Aurobindo’s The Tiger and the Deer.

REFERENCES:
5. Murphy, Raymond, Murphy’s English Grammar, CUP, 2004
7. Seely, John, Writing and Speaking, OUP, 1998

SYLLABI  Syr Integrated M.Sc Chemistry  2015 admissions onwards

15ENG121 PROFESSIONAL COMMUNICATION  1022

Objectives: To convey and document information in a formal environment; to acquire the skill of self projection in professional circles; to inculcate critical thinking and to improve aesthetic sense.

Unit 1

Unit 2
Instruction, Suggestion & Recommendation - Graphical Interpretation: Extracting data from charts and graphs - Essay writing: Analytical and Argumentative.

Unit 3
Circulars, Memos – Business Letters – e-mails.

Unit 4

Unit 5
Listening and Reading Practice - Book Review.

REFERENCES:
1. Felixx Eskey Tech Talk, University of Michigan. 2005

15ENV300 ENVIRONMENTAL SCIENCE AND SUSTAINABILITY  3003

Unit 1
State of Environment and Unsustainability, Need for Sustainable Development, Traditional conservation systems in India, People in Environment, Need for an attitudinal change and ethics, Need for Environmental Education, Overview of International Treaties and Conventions, Overview of Legal and Regulatory Frameworks.

Environment: Abiotic and biotic factors, Segments of the Environment, Biogeochemical Cycles, Ecosystems (associations, community adaptations, ecological succession, Food webs, Food chain, ecological pyramids), Types of Ecosystems – Terrestrial ecosystems, Ecosystem Services, Economic value of ecosystem services, Threats to ecosystems and conservation strategies.
SYLLABI
Syr Integrated M.Sc. Chemistry 2015 admissions onwards

Biodiversity: Species, Genetic & Ecosystem Diversity, Origin of life and significance of biodiversity. Value of Biodiversity, Biodiversity at Global, National and Local Levels, India as a Mega-Diversity Nation (Hotspots) & Protected Area Network, Community Biodiversity Registers. Threats to Biodiversity, Red Data book, Rare, Endangered and Endemic Species of India. Conservation of Biodiversity. People’s action.

Impacts, causes, effects, control measures, international, legal and regulatory frameworks of: Climate Change, Ozone depletion, Air pollution, Water pollution, Noise pollution, Soil/ land degradation/ pollution

Unit 2
Linear vs. cyclical resource management systems, need for systems thinking and design of cyclical systems, circular economy, industrial ecology, green technology. Specifically apply these concepts to: Water Resources, Energy Resources, Food Resources, Land & Forests, Waste management.

Discuss the interrelation of environmental issues with social issues such as: Population, Illiteracy, Poverty, Gender equality, Class discrimination, Social impacts of development on the poor and tribal communities, Conservation movements: people’s movements and activism, Indigenous knowledge systems and traditions of conservation.

Unit 3

Global and national state of housing and shelter, Urbanization, Effects of unplanned development case studies, Impacts of the building and road construction industry on the environment, Eco-homes/ Green buildings, Sustainable communities, Sustainable Cities.

Ethical issues related to resource consumption, Intergenerational ethics, Need for investigation and resolution of the root cause of unsustainability. Traditional value systems of India, Significance of holistic value-based education for true sustainability.

TEXTBOOKS/ REFERENCES:

SYLLABI
Syr Integrated M.Sc. Chemistry 2015 admissions onwards

15HIN101  HINDI I  1 0 2 2

Objectives: To teach Hindi for effective communication in different spheres of life: Social context, Education, governance, Media, Business, Profession and Mass communication.

Unit 1
Introduction to Hindi Language - National Language, Official Language, link Language etc. Introduction to Hindi language, Devanagari script and Hindi alphabet.

Shabda Bhed, Roopantar ki Drishti se - Bhasha – Paribhasha aur Bhed - Sangya - Paribhusha Aur Bhed - Sangya ke Roopantar - kriya.

Unit 2
Common errors and error corrections in Parts of Speech with emphasis on use of pronouns, Adjective and verb in different tenses – Special usage of adverbs, changing voice and conjunctions in sentences, gender & number - General vocabulary for conversations in given context – understanding proper pronunciation – Conversations, Interviews, Short speeches.

Unit 3
Poems – Kabir Ist 8 Dohas, Surdas 1st 1 Pada; Tulsidas 1st 1 Pada; Meera 1st 1 Pada.

Unit 4

Unit 5
Kahani – Premchand: Kafan, Abhilasha, Vidroh, Poos ki rath, Juloos.

TEXTBOOKS:
1. Prem Chand Ki Srvashrestha Kahaniyam: Prem Chand; Diamond Pub Ltd. New Delhi
2. Vyavahark Hindi Vyakaran, Anuvad thaha Rachana: Dr. H. Parameswaran, Radhakrishna publishing House, New Delhi

15HIN11  HINDI II  1 0 2 2

Objectives: Appreciation and assimilation of Hindi Literature both drisya & shravya using the best specimens provided as anthology.

Unit 1
SYLLABI  
Syr Integrated M.Sc. Chemistry  
2015 admissions onwards

Unit 2  
Communicative Hindi - Moukhik Abhivyakthi.

Unit 3  
Audio-Visual – Media in Hindi – Movies like Tare Zameen par, Paa, Black etc., appreciation and evaluation. News reading and presentations in Radio and TV channels in Hindi.

Unit 4  
Gadya Manjusha – Budhapara, Kheesa, Sadachar ka Thavis.

Unit 5  

TEXTBOOKS:  
Kavay Tarang: Dr. Niranjan, Jawahar Pusthakalay, Mathura.  
Gadya Manjusha: Editor: Govind, Jawahar Pusthakalay, Mathura

KANNADA I  
1 0 2 2

Objectives: To enable the students to acquire basic skills in functional language; to develop independent reading skills and reading for appreciating literary works; to analyse language in context to gain an understanding of vocabulary, spelling, punctuation and speech.

Unit 1  
Adalitha Kannada: bhashe, swaroopa, belavaniyega kiru parichaya  
Paaribhaashika padagalu  
Vocabulary Building

Unit 2  
Prabhanda – Vyaaghra Geethe - A. N. Murthy Rao  
Prabhanda – Barreddi...baredidi, Baduku mugiyuvudilla allige... - Nemi Chandra  
Paragraph writing – Development: comparison, definition, cause & effect  
Essay – Descriptive & Narrative

Unit 3  
Mochi – Bharateepriya  
Mosarina Mangamma – Maasti Venkatesh Iyengar  
Kamalaapuruda Hotelnaili – Panje Mangesh Rao  
Kaakike – B.M.Shree  
Geleyanobbanige bareda Kaagada – Dr.G.S.Shivarudrappa  
Moodala Mane – Da.Ra.Bendre  
Swathantryada Hanate – K.S.Nissaar Ahmed

SYLLABI  
Syr Integrated M.Sc. Chemistry  
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Unit 4  
Letter Writing - Personal: Congratulation, thanks giving, invitation, condolence

Unit 5  
Reading Comprehension; nudigattu, gaadegalu  
Speaking Skills: Prepared speech, pick and speak

REFERENCES:  
1. H.S.Krishna Swami Iyangar – Adalitha Kannada – Chetana Publication, Mysuru  
2. A.N.Murthy Rao – Aleyuva Mana – Kuvempu Kannada Adyayana Samste  
3. Nemi Chandra – Baddhuku Badalisabahudu – Navakarnataka Publication  
4. Sanna Kathegalu - Prasaranaga, Mysuru University, Mysuru  
5. B.M.Shree – Kannada Basvata – Kannada Sahitya Parishattu  
6. K.S.Nissar Ahmed – 75 Bhaavageetegalu – Sapna Book House (P) Ltd  
7. Dr.G.S.Shivarudrappa – Samagra Kavya – Kamadhenu Pustaka Bhavana

KANNADA II  
1 0 2 2

Objectives: To enable the students to acquire basic skills in functional language; to develop independent reading skills and reading for appreciating literary works; to develop functional and creative skills in language; to enable the students to plan, draft, edit & present a piece of writing.

Unit 1  
Official Correspondence: Adhikrutha patra, prakatane, manavi patra, vanijya patra

Unit 2  
Nanna Hanate - Dr.G.S.Shivarudrappa  
Ella Marethiruvaga - K.S.Nissaar Ahmed  
Saviraru Nadigalu – S Siddalingayya

Unit 3  

Unit 4  
Sarva Sollegala turtu Maha Samelana - Beechi  
Swarthakkaagi Tyaga - Beechi

Unit 5  
Essay writing: Argumentative & Analytical  
Précis writing
SYLLABI
Syr Integrated M.Sc Chemistry 2015 admissions onwards

REFERENCES:
1. H.S.Krishnaswami Iyengar – Adalitha Kannada – Chetan Publication, Mysuru
2. Dr.G.S.Shivarudrappa – Samagra Kavya. - Kamadhenu Pustaka Bhavana
5. Dr.Da.Ra.Bendre – Saayo Aata – Shri Maata Publication

15MAL101 MALAYALAM I 1022

Objectives: To appreciate the aesthetics & cultural implications; to enhance creative thinking in mother-tongue; to learn our culture & values; to equip students read & write correct Malayalam; to correct the mistakes in pronunciation; to create awareness that good language is the sign of complete personality.

Unit 1
Ancient poet trio: Adhyatmaramayanam, Lakshmana Swanthanam (valsa soumitre... mungikidakayal), Ezhuthachan - Medieval period classics – Jnanappana (kalaminnu... vlasangalingane), Poonthanam.

Unit 2

Unit 3
Short stories from period 1/2/3, Poovanpazham - Vaikaom Muhammed Basheer - Literary & Cultural figures of Kerala and about their literary contributions.

Unit 4
Literary Criticism: Ithihasa studies - Bharatha Paryadanam - Vyasante Chiri - Kuttikrishna Mararu - Outline of literary Criticism in Malayalam Literature - Introduction to Kutti Krishna Mararu & his outlook towards literature & life.

Unit 5
Error-free Malayalam: 1. Language; 2. Clarity of expression; 3. Punctuation.
Thettillatha Malayalam – Writing - a. Expansion of ideas; b. Precis Writing; c. Essay Writing; d. Letter writing; e. Radio Speech; f. Script/ Feature/ Script Writing; g. News Editing; h. Advertising; i. Editing; j. Editorial Writing; k. Critical appreciation of literary works (Any one or two as an assignment).

REFERENCES:

15MAL111 MALAYALAM II 1022

Objectives: To appreciate the aesthetics & cultural implications; to enhance creative thinking in mother-tongue; to learn our culture & values; to equip students read & write correct Malayalam; to correct the mistakes in pronunciation; to create awareness that good language is the sign of complete personality.

Unit 1
Ancient poet trio: Kalayanasougandhikam, (kallum marangalun... namukkennarika vrikodara) Kunjan Nambiar - Critical analysis of his poetry - Ancient Drama: Kerala Sakunthalam (Act 1), Kalidasan (Translated by Attor Krishna Pisharody).

Unit 2

Unit 3

Unit 4
Part of an autobiography/ travelogue: Kannerum Kinavum, V. T. Bhattathiripadu - Socio-cultural literature - historical importance.

Unit 5
Error-free Malayalam: 1. Language; 2. Clarity of expression; 3. Punctuation.
Thettillatha Malayalam – Writing - a. Expansion of ideas; b. Precis Writing; c. Essay Writing; d. Letter writing; e. Radio Speech; f. Script/ Feature/ Script Writing; g. News Editing; h. Advertising; i. Editing; j. Editorial Writing; k. Critical appreciation of literary works (Any one or two as an assignment).

REFERENCES:
SYLLABI  
Syr Integrated M.Sc Chemistry  
2015 admissions onwards

15MAT105  
INTRODUCTION TO CALCULUS  
AND MATRIX THEORY  
3 1 0 4

Unit 1
Calculus on a Single variable (Based on Textbook 1)

Unit 2
Continuous Functions, Discontinuities. Applications of Derivative - Extreme values of functions, Concavity and Curve Sketching.

Unit 3
Integration - Definite Integrals, Properties of definite integrals. Integration techniques. Numerical Methods - Trapezoidal and Simpson’s rules. (Sections: 1.3, 1.5, 2.3, 2.4, 2.5, 2.6, 4.1, 4.4, 5.3, 5.4, 8.7)

Unit 4
Matrix Eigen Value problems (Based on Text book 2)
- Linear Independence and rank of a matrix, Eigen values and Eigen vectors-Definitions and properties.

Unit 5
Some applications of eigenvalue problems, Symmetric, Skew Symmetric and Orthogonal matrices, Eigenbases, Diagonalization, Quadratic forms. (Sections: 8.1-8.4)

Numerical Methods - Power Method for Eigen Values and Eigen Vectors. (Sections: 20.8)

TEXTBOOKS:

REFERENCE BOOKS:
Unit 3

Unit 4
Testing of Hypothesis: Central limit theorem, large sample tests for mean, variance and proportions - small sample tests for mean and variances – tests based on Chi-square distribution (tests for independence of attributes and goodness-of-fit).

Unit 5

TEXTBOOKS:

REFERENCE BOOKS:

15MA T236 INTEGRAL TRANSFORMS 3 1 0 4

Unit 1

Unit 2
Differentiation and Integration of Transforms. Convolution, Integral Equations, Partial Fractions, Differential Equations, Systems of Differential Equations. (Sections: 6.1 to 6.7)

Unit 3

Unit 4
15PHY113  ELECTRICITY AND MAGNETISM  3 1 0  4

Unit 1 Electric forces and fields
Electric forces, charges, conservation of charge, superposition of electric forces; electric fields, calculation of electric fields of static discrete and continuous charge distributions; Gauss’ law and determination of electric fields of simple symmetric charge distributions.

Unit 2 Electric potential and Capacitors
Electrical potential energy and electric potential of discrete and continuous distributions of charges; calculating electric field from potential; potential energy of system of point charges; capacitors and dielectrics.

Unit 3 Magnetostatics
Force due to magnetic fields, Hall effect, circular and helical orbits, magnetic force on a current carrying wire, torque on a current loop, magnetic dipole moment; calculation of magnetic field from current sources using Biot-Savart’s law and Ampere’s law; solenoids and toroids.

Unit 4 Changing magnetic fields
Faraday’s law, Electromagnetic Induction, Self & mutual inductance; Magnetism in matter and Maxwell’s equations.

Unit 5 DC and AC Circuits
Electric current, resistance, resistivity, microscopic view; DC circuits involving resistance and capacitance; AC Circuits, RLC circuits, transformers.

TEXTBOOK:

REFERENCES:
2. Young and Freedman, University Physics, 11th Ed, Dorling Kindersley India, 2006
Unit 3
Transistors - npn and pnp, transistor characteristics - CB, CE and CC configurations, relation between a, b and g, transistor switch, transistor biasing. Feedback circuits. Transistor action, emitter follower, Transistor applications as amplifier. RC coupled amplifier.

Unit 4
Transistor as an oscillator, FET, JFET, MOSFET, etc. Operational amplifiers; differential amplifier, inverting and non-inverting amplifiers. Op-amp applications-integrator, differentiator, adder etc. ICs – examples.

Unit 5
Digital electronics: Digital versus analog, logic gates, truth table, discrete circuits for gates, logic identities, minimization and Karnaugh maps.

TEXTBOOK:

REFERENCES:
3. Horowitz and Hill, The art of Electronics (Cambridge University press)

15PHY214 WAVES AND OPTICS 3 1 0 4

Unit 1

Unit 2
Wavemotion: Simple Harmonic Oscillation (SHO), differential equation for SHO and its general solution, super position of two or more SHOs, Damped and forced oscillators, resonance. Wave equation, travelling and standing waves in one dimension, energy density and energy transmission in waves, Group velocity and phase velocity.

Unit 3
Interference: Wave nature of light, Spatial and temporal coherence, coherent sources, interference of light by division of wave front: Fresnel’s biprism, interference of light by division of amplitude: interference in thin films, fringes of equal inclination, air-wedge, Newton’s rings and Michelson's interferometer. Multiple beam Interference - Fabry-Perot interferometer, multilayer thinfilms: AR and HR coatings.

SYLLABI 5yr Integrated M.Sc Chemistry 2015 admissions onwards

Unit 4
Diffraction: Fresnel and fraunhofer diffraction, diffraction grating, Rayleigh criterion and resolving power.

Polarisation: linear, circular and Elliptic polarization, double refraction and optical rotation. Propagation of light through matter, dispersion and absorption, Nonlinear optics, second harmonic generation, integrated optics (qualitative only).

Unit 5
Fiber optics: Introduction to optical fiber, the numerical aperture, coherent bundle, pulse dispersion in step index fiber, graded index fiber, single mode fiber, multimode fiber, fiber optic sensors - examples - fiber optic communication (qualitative), Advantages of fiber optic communication system.

REFERENCES:

15PHY314 BASIC SPECTROSCOPIC TECHNIQUES 3 1 0 4

Unit 1 - Electromagnetic spectrum
Introduction – Definition of spectrum - Electromagnetic radiation - regions of spectrum, quantization of different forms of energies in molecules (translational, rotational, vibrational and electronic) - Born Oppenheimer approximation.

Unit 2 - Electronic Spectroscopy

Unit 3 - Vibrational Spectroscopy

Unit 4 - NMR Spectroscopy
Principle of nuclear magnetic resonance – basic instrumentation - number of signals
SYLLABI  
Syr Integrated M.Sc. Chemistry  
2015 admissions onwards

Unit 5 - Mass spectrometry
Basic principles - instrumentation - molecular ion peak, base peak, metastable peak, isotopic peak their uses. Fragmentation pattern – Nitrogen rule - determination of molecular formulae – Types of mass analysis. Interpretation of mass spectra of simple organic compounds such as Acetone, Anisole, Benzaldehyde, Ethyl acetate, Ethylamine, Ethyl Bromide, Toluene and Isopropyl phenyl ketone.

ESSENTIAL READINGS:
1. Praveshaha; Publisher: Samskrita bharati, Aksharam, 8th cross, 2nd phase, girinagar, Bangalore-560 085
2. Sanskrit Reader I, II and III, R. S. Vadhyar and Sons, Kalpathi, Palakkad
3. Prakriya Bhashyam written and published by Fr. John Kunnappally
4. Sanskrit Primer by Edward Delavan Perry, published by Ginn and Company Boston
5. Sabdamangalan, R. S. Vadyar and Sons, Kalpathi, Palakkad
6. Namalinganusasanam by Amarasimha published by Travancore Sanskrit series

15SAN101  
SANSKRIT I  
2 0 0 2

Objectives: To familiarize students with Sanskrit language and literature; to enable them to read and understand Sanskrit verses and sentences; to help them acquire expertise for self-study of Sanskrit texts and communication in Sanskrit; to help the students imbibe values of life and Indian culture as propounded in scriptures.

Unit 1
Introduction to Sanskrit language, Devanagari script - Vowels and consonants, pronunciation, classification of consonants, conjunct consonants, words – nouns and verbs, cases – introduction, numbers, Pronouns, communicating time in Sanskrit. Practical classes in spoken Sanskrit.

Unit 2
Verbs - Singular, Dual and plural – First person, Second person, Third person.

Tenses – Past, Present and Future – Atmanepadi and Paramaipadi - karthariprayog.

Unit 3
Words for communication, slokas, moral stories, subhashithas, riddles (from the books prescribed).

SYLLABI  
Syr Integrated M.Sc. Chemistry  
2015 admissions onwards

Unit 4
Selected slokas from Valmiki Ramayana, Kalidasa’s works and Bhagavad Gita.

Ramayana – chapter VIII - verse 5; Mahabharata - chapter 174, verse 16; Bhagavad Gita – chapter IV - verse 8; Kalidasa’s Sakuntalam - Act IV – verse 4.

Unit 5
Translation of simple sentences from Sanskrit to English and vice-versa.

Objectives: To familiarize students with Sanskrit language and literature; to enable them to read and understand Sanskrit verses and sentences; to help them acquire expertise for self-study of Sanskrit texts and communication in Sanskrit; to help the students imbibe values of life and Indian culture as propounded in scriptures.

Unit 1
Seven cases, indeclinables, sentence making with indeclinables, Saptha karakas.

Unit 2
Ktavatu Pratyaya, Upasargas, Ktvanta, Tumunnanta, Lyabanta.

Three Lakaras – brief introduction, lot lakara.

Unit 3
Words and sentences for advanced communication. Slokas, moral stories (Panchatantra) Subhashitas, riddles.

Unit 4
Introduction to classical literature, classification of Kayyas, classification of Dramas - The five Mahakayyas, selected slokas from devotional kayyas - Bhagavad Gita – chapter II verse 47, chapter IV verse 7, chapter VI verse 5, chapter VIII verse 6, chapter XVI verse 21, Kalidasa’s Sakuntala act IV verse 4, Isavasypanthan 1st Mantra, Mahabharata chapter 149 verses 14 - 120, Neetisara chapter – III.
Unit 5
Translation of paragraphs from Sanskrit to English and vice-versa.

ESSENTIAL READINGS:
1. Praveshaha; Publisher: Samskrita bharati, Aksharam, 8th cross, 2nd phase, girinagar, Bangalore-560 085
2. Sanskrit Reader I, II and III, R. S. Vadyar and Sons, Kalpathi, Palakkad
3. Prakriya Bhashyam written and published by Fr. John Kunnappally
4. Sanskrit Primer by Edward Delavan Perry, published by Ginn and Company Boston
5. Sabdamaniyari, R. S. Vadyar and Sons, Kalpathi, Palakkad
6. Namalinganusasanam by Amarasimha published by Travancore Sanskrit series

15SSK201 LIFE SKILLS I

Soft skills and its importance: Pleasure and pains of transition from an academic environment to work-environment. Need for change. Fears, stress and competition in the professional world. Importance of positive attitude, self motivation and continuous knowledge upgradation.

Self Confidence: Characteristics of the person perceived, characteristics of the situation, Characteristics of the Perceiver. Attitude, Values, Motivation, Emotion Management, Steps to like yourself, Positive Mental Attitude, Assertiveness.

Presentations: Preparations, Outlining, Hints for efficient practice, Last minute tasks, means of effective presentation, language, Gestures, Posture, Facial expressions, Professional attire.

Vocabulary building: A brief introduction into the methods and practices of learning vocabulary. Learning how to face questions on antonyms, synonyms, spelling error, analogy etc. Faulty comparison, wrong form of words and confused words like understanding the nuances of spelling changes and wrong use of words.

Listening Skills: The importance of listening in communication and how to listen actively.

Prepositions and Articles: A experiential method of learning the uses of articles and prepositions in sentences is provided.

Problem solving; Number System; LCM &HCF; Divisibility Test; Surds and Indices; Logarithms; Ratio, Proportions and Variations; Partnership; Time speed and distance; work time problems;

Data Interpretation: Numerical Data Tables; Line Graphs; Bar Charts and Pie charts; Caselet Forms; Mix Diagrams; Geometrical Diagrams and other forms of Data Representation.

TEXTBOOKS:

REFERENCES:
1. Quantitative Aptitude, by R S Aggarwal, S Chand Publ.
3. Data Interpretation, R S Aggarwal, S Chand Publ.
4. Nova GRE, KAPAL GRE, Barrons GRE books;
5. Quantitative Aptitude, The Institute of Chartered Accountants of India.
7. The BBC and British Council online resources
8. Owl Purdue University online teaching resources
9. www.thegrammarbook.com online teaching resources
10. www.englishpage.com online teaching resources and other useful websites.

15SSK211 LIFE SKILLS II


Group Discussions: Advantages of Group Discussions, Structured GD – Roles, Negative roles to be avoided, Personality traits to do well in a GD, Initiation techniques, How to perform in a group discussion, Summarization techniques.

Listening Comprehension advanced: Exercise on improving listening skills, Grammar basics: Topics like clauses, punctuation, capitalization, number agreement, pronouns, tenses etc.

Reading Comprehension advanced: A course on how to approach middle level reading comprehension passages.

Problem solving – Money Related problems; Mixtures; Symbol Based problems; Clocks and Calendars; Simple, Linear, Quadratic and Polynomial Equations; Special
Equations; Inequalities; Functions and Graphs; Sequence and Series; Set Theory; Permutations and Combinations; Probability; Statistics.

Data Sufficiency: Concepts and Problem Solving.
Non-Verbal Reasoning and Simple Engineering Aptitude: Mirror Image; Water Image; Paper Folding; Paper Cutting; Grouping of Figures; Figure Formation and Analysis; Completion of Incomplete Pattern; Figure Matrix; Miscellaneous.

Special Aptitude: Cloth, Leather, 2D and 3D Objects, Coin, Match Sticks, Stubs, Chalk, Chess Board, Land and geodesic problems etc., Related Problems

TEXTBOOKS:
3. The Hard Truth about Soft Skills, by Amazon Publication.

REFERENCES:
1. Speed Mathematics, Secrets of Lightning Mental Calculations, by Bill Handley, Master Mind books;
2. The Trachtenberg Speed System of Basic Mathematics, Rupa & Co., Publishers;
5. Quick Arithmetic, by Ashish Agarwal, S Chand Publ.;
7. The BBC and British Council online resources 9. Owl Purdue University online teaching resources
8. www.englishpage.com online teaching resources and other useful websites.

15SSK301 LIFE SKILLS III 1 0 2 2

Team Work: Value of Team work in organisations, Definition of a Team, Why Team, Elements of leadership, Disadvantages of a team, Stages of Team formation, Group Development Activities: Orientation, Internal Problem Solving, Growth and Productivity, Evaluation and Control. Effective Team Building: Basics of Team Building, Teamwork Parameters, Roles, Empowerment, Communication, Effective Team working, Team Effectiveness Criteria, Common characteristics of Effective Teams, Factors affecting Team Effectiveness, Personal characteristics of members, Team Structure, Team Process, Team Outcomes.

Facing an Interview: Foundation in core subject, Industry Orientation/ Knowledge about the company, Professional Personality, Communication Skills, activities before interview, upon entering interview room, during the interview and at the end. Mock interviews.

Advanced Grammar: Topics like parallel construction, dangling modifiers, active and passive voices, etc.

TEXTBOOKS:
3. The Hard Truth about Soft Skills, by Amazon Publication.

REFERENCES:
1. Speed Mathematics, Secrets of Lightning Mental Calculations, by Bill Handley, Master Mind books;
2. The Trachtenberg Speed System of Basic Mathematics, Rupa & Co., Publishers;
5. Quick Arithmetic, by Ashish Agarwal, S Chand Publ.;
7. The BBC and British Council online resources 9. Owl Purdue University online teaching resources
8. www.englishpage.com online teaching resources and other useful websites.
SYLLABI

Medieval Literature: bārātiyari kaṇṇaṅ pāṭṭu (eḻ viḷaiyāṭṭu pillai) – bārātiyai
kutumpavilakkam (tāḷīṭṭu tāḷāṭṭu).

Unit 3
Novel: Jeyakāntaṉ “kuru pīṭṭam”
Ecoy: Aṇṇā “ō tāḷāṅ tamijakāṁī”

Unit 4
Tiruvāṉa campground – tirunāṉuvakkaracar – cuntarar – māṇikka vācakar – āṇṭāl –
tirumalar – kulācēkara āḷyār – cītalaic cāṭṭār toṭāṣūrti ceyṭikai, mēḻkkal marjum
çāṭṭappu peyankai.

Unit 5
Tamil Cramer: Ool velaikal – vēṟṟumai urupukal – viḷaiḷom miṟuṟum mēḻkkai-
tam(putturci) – illakkannakurippu.

Practical skills: Listening, speaking, writing and reading.

TEXTBOOKS:
Aṇṇā “ō tāḷāṅ tamijakāṁī” naṅkiraṅ paḷṭikāṭaṅ.
Cakkittaiṅ “naṅkiraṅ kulēṭṭam oruṟum” mufai paḷṭippakam, 2008
Na. Pāṭṭārcaṅ “puttuṉṟiṟṟu cītalaic” paḷṭippalaiyam. 1977 27/01
puliyur kēkaiṅ “kulēṭṭam oruṟum oruṟum” āṟṟappiṟu, 2010.

15TAM111
TAMIL II

Objectives: To learn the history of Tamil literature; to analyze different styles, language training, to
strengthen the creativity in communication, Tamil basic grammar, Computer and its use in Tamil
language.

Unit 1
The history of tamil literature: Naṟṟuṟṟappu pāṭṭaiṟu, katakkai, pāḷamojkai -
cītalaic kulēṭṭam oruṟum valarcoyim, cītalaic kulēṭṭam. Kalinkattup pāṇiṟu (pōṟṟaiyatu)-
mukkuṟṟa pṟṟalu 35.
Kāppiyankai: Cītalaic kulēṭṭam - māṇimēṟkaḷ naṟṟaiyai ayuṟu marjum aimperum -
aiṟṟiṟṟu kāppiyankai toṭāṣūrti ceyṭikai