MANONMANIAMSUNDARANARUNIVERSITY-TIRUNELVELI

UG **PROGRAMMES**

OPENANDDISTANCELEARNING(ODL)PROGRAMMES

(FORTHOSEWHOJOINEDTHEPROGRAMMESFROMTHEACADEMICYEAR2023-2024ONWARDS)

B.SC CHEMISTRY

Semester	Course	Title of the Course	Course Code	Course Type	Credits
VI	Core–XIII	Organic Chemistry –II	JMCH61	Theory	3
	Core–XIV	Inorganic Chemistry–II	JMCH62	Theory	3
	Core–XV	Physical Chemistry-II	JMCH63	Theory	3
	Core- XVI	Physical Chemistry Practical	JMCHP5	Practical	3
	Elective– VII	Fundamentals of Spectroscopy	JECH61	Theory	3
	Elective– VIII	Agro Chemistry	JECH62	Theory	3
	NMC/Substitute Paper	Textile Chemistry	JNCH61	Theory	3

ORGANIC CHEMISTRY -II

UNIT-I

Alkaloids

Classification, isolation, general properties- Hofmann Exhaustive Methylation; Structure elucidation – Coniine, piperine, nicotine.

Terpenes: Classification, Isoprene rule, isolation and structural elucidation of Citral, alpha terpineol, Menthol, Geraniol and Camphor.

UNIT-II

Carbohydrates

Definition and Classification of Carbohydrates with examples. Relative configuration of sugars. Determination of configuration (Fischer's Proof). Definition of enantiomers, diastereomers, epimers and anomers with suitable examples.

Monosaccharides–configuration–DandLhexoses–aldohexoses and ketohexoses. Glucose, Fructose–Occurrence, preparation, properties, reactions, structural elucidation, uses.
Interconversions of sugar series–ascending, descending, aldose to ketose and ketose to aldose.

Disaccharides–sucrose, lactose, maltose- preparation, properties and uses (no structural elucidation).

Polysaccharides–Source, constituents and biological importance of homo polysaccharides–starch and cellulose, hetero polysaccharides– Hyaluronic acid, heparin.

UNIT-III

Molecular rearrangements:

Molecular Rearrangement: Type of rearrangements, Mechanism for Benzidine, Favorskii, Clasien, Fries, Hofmann, Curtius, Schmidt and Beckmann, Pinacol-pinacolone rearrangement

UNIT-IV

Special reagents inorganic synthesis

AIBN,9BBN,BINAP/BINOL,BOC,DABCO,DCC,DIBAL, DMAP, NBS/NCS, NMP, PCC,

TBHP,TEMPO

Organo metallic compounds in Organic Synthesis

Preparation, Properties and applications: Grignard Reagents, Organo Lithium Compounds, Ziegler–Natta, Wilkinson, Metal Carbonyl, Zeiss's Salt

UNIT-V

Green Chemistry: Principles, chemistry behind each principle and applications in chemical synthesis. Green reaction media–green solvents, green reagents and catalysts; tools used like microwave and ultra-sound in chemical synthesis.

Recommended Text

1. M.K. Jain, S.C. Sharma, Modern Organic Chemistry, Vishal Publishing,4th reprint, 2009.
2. S.M. Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, Macmillan India Ltd., 3rdedition,2009
3. Arun Bah land B. S. Bahl, Advanced organic chemistry, New Delhi, S. Chand& Company Pvt. Ltd., Multi colour edition, 2012.
4. P.L. Soni and H.M. Chawla, Text Book of Organic Chemistry, Sultan Chand & Sons, New Delhi,29th edition, 2007.

5.C Bandyopadhya;An Insight into Green Chemistry; Published on 2020

INORGANIC CHEMISTRY – II

UNIT-I

Bioinorganic Chemistry

Essential and trace elements: Role of Na^+, K^+, Mg^{2+}, Ca^{2+}, Fe^{3+},Cu^{2+} and Zn^{2+}in biological systems. Effect of excess intake (Toxicity) of Metal ions – trace elements - As, Cd, Pb, Hg.

UNIT-II

Metal ion transport and storage

Iron–storage, transport-Transfer in and Ferretin; Iron-porphyrins–myoglobin, hemoglobin –oxygen transport -Bohr effect; Sodium/potassium pump, calcium pump; transport and storage-copper and zinc.

UNIT-III

Metallo enzymes

Isomerase and synthetases, structure of cyanocobalamin (VitaminB12), nature of Co-C bond; Metallo enzymes - functions of carboxy peptidase A, zinc metallo enzyme – mechanism and uses, Zn-Cu enzyme – structure and function, carbonic anhydrase, Vitamin B-12 as transferase and isomerase - Iron-Sulphur proteins - 2Fe-2S – rubredoxin, 4Fe-2S – ferredoxin, Iron Sulphur cluster enzymes.In vivo and Invitro nitrogen fixation–biological functions of nitrogenase and molybdo enzymes.

UNIT-IV

Silicates

Introduction – general properties of silicates, structure – types of silicates – ortho silicates(zircon), pyro silicates (thortveitite), chain silicates(pyroxenes), ring silicates(beryl), sheet silicates(talc, mica, asbestos), silicates having three dimensional structure (feldspars, zeolites, ultramarines)

UNIT-V
Industrial Applications of Inorganic Compounds

Refractories, pyrochemical, explosives. Alloys, Paints and pigments - requirements of a good paint; classification, constituents of paints – pigments, vehicles, thinners, driers, extenders, anti-knocking agents, anti- skinning agents, plasticizers, binders-application; varnishes- oils, spirit; enamels.
Nano composite Hydrogels: synthesis, characterization and uses.

Industrial visits and internship are mandatory.

Recommended Books

1.Puri BR, Sharma LR, Kalia KC (2011), Principles of Inorganic Chemistry, 31thed., Milestone Publishers & Distributors, Delhi.

2. Satya Prakash, Tuli G. D., Basu S.K., Madan R.D. (2009), Advanced Inorganic Chemistry,18th Edition, S.Chand & Co., New Delhi
3. Lee JD, (1991), Concise Inorganic Chemistry, 4thed., ELBS William Heinemann, London.
4. WV Malik, GD Tuli, RD Madan, (2000), Selected Topics in Inorganic Chemistry, Sch and Company Ltd.
5. A.K. De, Textbook of Inorganic Chemistry, Wiley East Ltd, seventh edition, 1992

PHYSICAL CHEMISTRY - II

UNIT-I

Phase rule

Definition of terms; derivation of phase rule; application to one component systems–water and Sulphur- super cooling, sublimation; two component systems–solid liquid equilibria–simple eutectic (lead-silver and bismuth - cadmium), freezing mixtures (potassium iodide- water), compound formation with- congruent melting points (magnesium–zinc and ferric chloride–water system), peritectic

Change (sodium–potassium), Solid solution (gold-silver); copper sulphate–water system.

UNIT-II

Chemical equilibrium

Law of mass action–thermodynamic derivation–relationship between K_p and K_c –application to the homogeneous equilibria – dissociation of PCl_5 gas, N_2O_4 gas –equilibrium constant and degree of dissociation - formation of HI, NH_3 ,and SO_3–heterogeneous equilibrium – decomposition of solid calcium carbonate– Lechatelier principle –van't Hoff reaction isotherm–temperature dependence of equilibrium constant – van't Hoff reaction isochore – Clayperon equation – Clausius Clayperon equation and its applications

UNIT-III

Binary liquid mixtures

Ideal liquid mixtures–non ideal solutions–azeotropic mixtures– Fractional distillation partially miscible mixtures–phenol-water, Triethyl amine-water,nicotine-water effec to f impurities on critical solution temperature; immiscible liquids- steam distillation; Nernst Distribution law–applications.

UNIT-IV

Electrical Conductance and Transference

Arrhenius theory of electrolytic dissociation – Ostwald's dilution law, limitations of Arrhenius theory; behavior of strong electrolytes – interionic effects – Debye Huckel theory –Onsager equation (no derivation), significance of Onsager equation, Debye Falkenhagen effect, Wien effect. Ionic mobility – Discharge of ions on electrolysis (Hittorf's theoretical device),transport number–determination–Hittorf's method, moving boundary method–factors affecting transport number – determination of ionic mobility; Kohlrausch's law- applications; molar ionic conductance and viscosity (Walden's rule); applications of conductance measurements–determination of- degree of dissociation of weak electrolyte, dissociation constant of weak acid and weak base, ionic product of water, solubility and solubility product of sparingly soluble salts-conducto metric titrations–acid base titrations.

UNIT-V

Galvanic Cells and Applications Galvanic cell, representation, reversible and irreversible cells, EMF and its measurement–standard cell; relationship between electrical energy and chemical energy; sign of EMF and spontaneity of are action, Thermodynamics and EMF–calculation of ΔG, ΔH, and ΔS from EMF data; reversible electrodes, electro depotential, standard electrode potential, primary and secondary reference electrodes, Nernst equation for electrode potential and cell EMF; types of electrodes–metal/metal ion, metal amalgam/metal ion, metal, insoluble salt/anion, gas electrode, redox electrode; electrochemical series – applications of electro chemical series. Chemical cells with and without transport, concentration cells with and without transport;

Applications of EMF measurements

Applications of EMF measurements–determination of activity

Coefficient of electrolytes, transport number, valency of ions, solubility product, pH using hydrogen gas electrode, quinhydrone electrode and glass electrode, potentiometric titrations – acid base titrations, redox titrations, precipitation titrations, ionic product of water and degree of hydrolysis; redox indicators - use of diphenyl amine indicator in the titration of ferrous iron against dichromate.

Industrial component

Galvanic cells-lead storage, Ni-Cd, Li and Zn-air, Al-air batteries Fuel cells – H_2-O_2 cell efficiency of fuel cells. corrosion–mechanism, types and methods of prevention.

Recommended Text

1. B.R. Puri and L.R. Sharma, Principles of Physical Chemistry, Shoban Lal Nagin Chand and Co., forty eighth edition, 2021.
2. Peter Atkins, and Julio de Paula, James Keeler, Physical Chemistry, Oxford University press, International eleventh edition, 2018.
3. Arun Bahl, B.S. Bahl, G.D. Tuli Essentials of physical chemistry,28th edition 2019, S, Chand &Co.
4. S. K. Dogra and S. Dogra, Physical Chemistry through Problems: New Age International, fourth edition,1996.
5. J. Rajaramand J.C. Kuriacose, Thermodynamics, Shoban Lal Nagin Chand and CO., 1986.

PHYSICAL CHEMISTRY PRACTICAL

UNIT-I

Thermometric experiments

1. Determination of molecular weighto fan organic compound by Rast method using naphthalene or diphenyl as solvent
2. Determination of molecular weight of organic compound by transition temperature method.
3. Simple eutectic-determination of eutectic temperature and composition of naphthalene- Diphenyl amine or naphthalene-diphenyl system.
4. Determination of upper critical solution temperature of phenol– water system; Study of the effect of impurity on CST and determination of the strength of unknown

UNIT-II

Chemical kinetics

5. Determination of rate constant of acid catalyzed hydrolysis of an ester- methyl acetate.
6. Determination of or dero freaction between iodide and persulphate (initial rate method).
7. Polarimetry: Determination of rate constant of acid catalysed inversion of cane sugar

Thermo chemistry

8. Determination of heat of neutralization of a strong acid by a strong base.
9. Determination of heat of hydration of copper sulphate.

UNIT-III

Electrochemistry–Conductance measurements

10. Conducto metric titration of hydrochloric acid against sodium hydroxide
11. Potentiometric titration offers rousion against potassium dichromate using quinhydronde electrode.

Adsorption

12. Construction of Freund lichiso therm for the adsorption of acetic acid on activated charcoal.

Experiments for demonstration:

Distribution law

1. Determination of the distribution co-efficient of iodine between carbon tetrachloride and water.

2. Determination of equilibrium constant of the reaction $I_2 + I^- \rightarrow I_3^-$

Determination of concentration of the given potassium iodide solution using the above equilibrium constant.

Electro chemistry

3. Determination of cell constant and molar conductance of strong electrolyte.
4. Determination of dissociation constant of acetic acid. Colorimetry
5. Determination of concentration of copper sulphate solution.

.

.

FUNDAMENTALS OF SPECTROSCOPY

UNIT-I

Electrical and Magnetic properties of molecules

Dipole moment–polar and non-polar molecules–polarizability of molecules. Application of dipole moments in the study of organic and Inorganic molecules.

Magnetic permeability, volume susceptibility, mass susceptibility and Molar susceptibility; diamagnetism, para magnetism–determination of Magnetic susceptibility using Guoy balance, ferro magnetism, anti ferromagnetism

Micro wave spectroscopy

Rotation spectra-diatomic molecules (rigid rotator approximation) selection rules determination of bond length, effect of isotopic substitution–instrumentation and applications

UNIT-II

Ultraviolet and Visible spectroscopy

Electronic spectra of diatomic molecules (Born Oppenheimer approximation)-vibrational coarse structure–rotational fine structure of Electronic vibration transitions–Frank Condon principle–dissociation in Electronic transitions–Birg Sponer method of evaluation of dissociation energy–pre-dissociation transition-σ-σ*, π-π*, n-σ*, n-π*transitions. Applications of UV-Woodward–Fieser rules as applied to conjugated Dienes and α, β-unsaturated ketones. Elementary Problems.

Colorimetry–principle and applications (estimation of Fe^{3+})

UNIT-III

Infrared spectroscopy

Vibration spectra–diatomic molecules–harmonic oscillator and Anharmonic oscillator; Vibration–rotation spectra–diatomic molecule As rigid rotator and anharmonic oscillator (Born-Oppenheimer Approximation oscillator)-selection rules, vibrations of polyatomic molecules–stretching and bending vibrations–applications– Determination of force constant, moment of inertia and internuclear distance–isotopic shift–application of IR spectrato simple organic And inorganic molecules– (group frequencies)

Raman Spectroscopy

Rayleigh scattering and Raman scattering of light–Raman shift– Classical theory of Raman effect–quantum theory of Raman effect– Vibrational Raman spectrum–selection rules–mutual exclusion principle–n instrumentation (block diagram)–applications.

UNIT-IV

Nuclear magnetic resonance spectroscopy:

PMR–theory of PMR–instrumentation-number of signals–chemical

shift–peak area sand proton counting–spin-spin coupling–
applications. Problems related to shielding and de shielding of protons, Chemical shifts of protons in hydrocarbons, and in simple Monofunctional organic compounds; spin-spin splitting of neighbouring Protons in vinyl and allyl systems.

UNIT-V

Mass spectrometry

Principle–different kinds of ionisation–instrumentation–the mass spectrum–types of ions–determination of molecular formula-Fragmentation and structural elucidation–Mc Lafferty rearrangement; Retro Diels Alder reaction-illustrations with simple organic molecules.

Solving structure elucidation problems using multiple spectroscopic Data (NMR, MS, IR and UV-Vis).

Recommended Text

1. Gopalan, R.; Subramaniam, P.S.; Rengarajan, K. *Elements of Analytical Chemistry*; S Chand: New Delhi, 2003.
2. Usharani, S. *AnalyticalChemistry*,1st ed.; Macmillan: India,2002.
3. Banwell, C.N.; Mc Cash, E. M. *Fundamentals of Molecular Spectroscopy*, 4th ed.; Tata Mc Graw Hill, New Delhi,2017.
4. U.N. Dash, Analytical Chemistry Theory and Practice, Sultan Chand &Sons, 2nd Ed., 2005
5. B.K. Sharma, Spectroscopy, 22nd ed., Goel Publishing House,2011.

AGRO CHEMISTRY

UNIT- 1 Fertilizers

Classification, macronutrients -role of nitrogen, potassium and phosphorus on plant growth - manufacture of urea, muriate potash and triple superphosphate. Complex fertilizers, mixed fertilizers & biofertilizers -their composition. Micronutrients- their role in plants. Manures: Bulky organic manures - Farm yard manure - oil cakes - blood meal - fish manures - Composting process - handling and storage

UNITII Pesticides

Definition - Classification of Pesticides based on the use and chemical composition - examples - general methods of application - Benefits of pesticides - Potential hazards. Safety measures-first aid Insecticides: Plant products - Nicotine, pyrethin- Inorganic pesticides - borates. Organic pesticides- D.D.T. and BHC. Fungicide: Sulphur compounds, Copper compounds, Bordeaux mixture. Herbicides: Acaricides - Rodenticides. Attractants - Repellants.

UNIT-III Soil

Origin of soil - definition of soil - rock system - weathering of rocks and minerals-main components of soil - organic, inorganic constituents - soil formation -factors favouring soil formation.

UNIT-IV Characteristics of soil

Physical aspects - soil texture - pore space - bulk density, particle density - soil colour- surface area - soil colloids - plasticity, shrinkage - flocculation and deflocculation, soil air, soil temperature and their importance in plant growth. Acid, alkaline and saline soils - diagnosis - Methods of reclamation and after care.

UNIT-V Soil testing

Concept and objectives - soil sampling, tools, collection, processing, and dispatch of soil sample. Estimation of total organic compound, available nitro genand phosphorus in the soil sample. Determination of pH, EC, moisture content, bulk density and particle

Density of the soil sample.

Recommended Text

1. A textbook of Soil Science-Daji. A, Asia Publishing House, Madras1970.
2. Textbook of soil Chemical Analysis-Hesse, P.R.Ajohn Murray Newyork,1971

*TEXTILE CHEMISTRY

UNIT-I: TEXTILE FIBERS

Introduction to textiles and essential requirements of textile fibres - Classification of textile fibres - Natural and Man-made fibres - Characteristics of textile fibres. Advantanges and Disadvantages of natural and man- made fibres.

Impurities in fibres-General principle of removal of impurities in fibres - singeing - Scouring - Bleaching – De sizing – Kier boiling - Chemicking - Deguming. Flowcharts showing the process involved in textile industry.

UNIT-II: NATURAL FIBRES

Natural fibres- Types of natural fibres - Natural Cellulosic fibres: Cotton and Jute - Natural protein fibres: Wool and Silk.

Cellulosic fibres: Cotton fibres Geographical distribution, Structure, Physical and Chemical properties, Grading of cotton fibres - Uses of cotton. **Protein fibres**: Silk fibre -Study of life cycle of silk warm - Extraction of silk fibre - Properties of silk fibre - Special features of silk fibre - Uses of silk- Wool- origin, different types of wool properties wool - Process involved in the removal of impurities from raw wool- Uses of wool.

Bast and leaf fibres - Types of bast fibres: Sisal and Ramie - Geographical distribution - Extraction - Properties of major bast fibres - Uses- Introduction to Coir, Hemp and Banana fibres.

UNIT-III: MAN-MADE FIBRES

Man- made fibres: General principle of manufacturing of Man-made fibres

-Types of Man-made fibres comparison of Man-made fibres with narural fibres.

Regenerated fibres– Cellulose fibres (Rayon and Acetate fibres) - Protein fibres (Azlons) – Production - Properties and Uses

Synthetic fibres-Polyamide fibres (nylons)-Polyester fibres– Polynosic fibres, Poly acrylic fibres–PolyUrethane-Polypropylene- polyolefins -Important Physical and Chemical properties and applications.

UNIT-IV : DYES AND DYEING OF FIBRES

Introduction of dyes - Classification, Properties and Uses of dyes - Dyeing of textile materials (Cotton, Wool and Silk) by direct, acid, basic, vat, disperse and reactive dyes - Fastness of properties of Dyed materials. Finishes given to fabrics - Methods used to process of mercerizing anticrease and Anti shrink finishes water proofing.

UNIT-V: TEXTILE PRINTING

Textile printing - Difference between dyeing and printing – Different steps involved in printing: Preparation of materials, Preparation of printing paste, Different thickeners, drying of printing - Washing and drying of printed material - Printing procedure of fibres, Printing with direct and azoic colours.

Recommended Text

1.Chemical Technology of Fibrous Materials, F.Sadov, M.Kovchagin and A. Mateshy Mir Publishers, Moscow,1978.
2. Dyeing and Chemical technology of textile fibres-5th edition, E.R. Trotman Charless - Griffin and CoLtd,1975
3. A Textbook of Fibre and Science and Technology, S.P. Mishra, New Age International (P) Lid-2000.
4. James Ronald, Printing and Dying of Fabrics and Plastics, Maharajan Book Distributors, 1996