MANONMANIAM SUNDARANAR UNIVERSITY,
TIRUNELVELI-12

SYLLABUS

UG - COURSES – AFFILIATED COLLEGES

Course Structure for B. Sc. Chemistry
(Choice Based Credit System)
(with effect from the academic year 2023-2024 onwards)

Semester-V				
Part	**Subject Status**	**Subject Title**	**Subject Code**	**Credit**
III	CORE	ORGANIC CHEMISTRY- I		4
III	CORE	INORGANIC CHEMISTRY – I		4
III	CORE	PHYSICAL CHEMISTRY – I		4
III	CORE	PROJECT WITH VIVA VOCE		3
III	ELECTIVE	BIOCHEMISTRY / **NANOSCIENCE**		3
III	ELECTIVE	**INDUSTRIAL CHEMISTRY**/ PHARMACEUTICAL CHEMISTRY		3
IV	NAAN MUDHALVAN	*APPLIED CHEMISTRY		2
		INTERNSHIP / INDUSTRIAL VISIT/ FIELD VISIT/ RESEARCH LB VISIT		2

Total Marks: 100 Internal Exam: 25 marks + External Exam: 75 marks

A. **Scheme for internal Assessment**:
Maximum marks for written test: **20 marks**
3 internal tests, each of **I hour** duration shall be conducted every semester.
To the average of the **best two** written examinations must be added the marks scored in. The **assignment** for 5 marks.

The break up for internal assessment shall be:
Written test- 20 marks; Assignment -5 marks Total - 25 marks

B. Scheme of External Examination
3 hrs. examination at the end of the semester
A – Part : 1 mark question two - from each unit
B – Part : 5 marks question one - from each unit
C – Part : 8 marks question one - from each unit

- **Conversion of Marks into Grade Points and Letter Grades**

S.No	Marks	Letter Grade	Grade point (GP)	Performance
1	90-100	O	10	Outstanding
2	80-89	A+	9	Excellent
3	70-79	A	8	Very Good
4	60-69	B+	7	Good
5	50-59	B	6	Above Average
6	40-49	C	5	Pass
7	0-39	RA	-	Reappear
8	0	AA	-	Absent

- **Cumulative Grade Point Average (CGPA)**

$$\mathbf{CGPA} = \frac{\mathbf{\Sigma\,(GP \times C)}}{\mathbf{\Sigma C}}$$

- **GP** = Grade point, **C** = Credit
- CGPA is calculated only for Part-III courses
- CGPA for a semester is awarded on cumulative basis

- **Classification**
  a) First Class with Distinction : CGPA $\geq$ 7.5*****
  b) First Class : CGPA $\geq$ 6.0
  c) Second Class : CGPA $\geq$ 5.0 and $<$ 6.0
  d) Third Class : CGPA$<$ 5.0

ORGANIC CHEMISTRY-I

Objectives of the course

This course aims to provide an understanding of

- Stereoisomerism in chirals and geometric isomerism in olefins, conformations of ethane and butane
- preparation and properties of aromatic and aliphatic nitro compounds and amines
- preparation of different dyes, food colour and additives
- preparation and properties of five membered heterocycles like pyrrole, furan and thiophene
- preparation and properties of six membered heterocycles like pyridine, quinolone and isoquinoline.

UNIT-I

Stereochemistry

Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions;

Geometrical isomerism: cis–trans, syn-anti isomerism, E/Z notations.

Optical Isomerism: Optical activity, specific rotation, asymmetry, enantiomers, distereoisomers, meso structures –molecules with one and two chiral centres, racemization –methods of racemisation; resolution- methods of resolution. C.I.P rules. R and S notations for one and two chirality (stereogenic) centres.

Molecules with no asymmetric carbon atoms – allenes and biphenyls. Conformational analysis of ethane and butane.

UNIT-II

Chemistry of NitrogenCompounds–I

Nitroalkanes

Nomenclature, isomerism, preparation from alkyl halides, halo acids, alkanes; physical properties; reactions – reduction, halogenations, Grignard reagent, Pseudo acid character.

Nitro-acinitrotautomerism.

Aromatic nitro compounds

Nomenclature, preparation –nitration, from diazoniumsalts, physical properties; reactions –reduction of nitrobenzene in different medium, Electrophilic substitution reactions, TNT.

Amines: Aliphatic amines

Nomenclature, isomerism, preparation – Hofmanns' degradation reaction, Gabriel's phthalimide synthesis, Curtius Schmidt rearrangement.

Physical properties, reactions – alkylation, acylation, carbylamine reaction, Mannich reaction, oxidation, basicity of amines.

UNIT - III

Chemistry of Nitrogen Compounds –II

Aromatic amines – Nomenclature, preparation – from nitro compounds, Hofmann's method; Schmidt reaction, properties - basic nature, ortho effect; reactions – alkylation, acylation, carbylamine reaction, reaction with nitrous acid, aldehydes, oxidation, Electrophilic substitution reactions, diazotization and coupling reactions; sulphanilicacid - zwitter ion formation.

Distinction between primary, secondary and tertiary amines - aliphatic and aromatic Diazonium compounds.

Diazomethane, Benzene diazonium chloride -preparations and synthetic applications.

Dyes

Theory of colour and constitution; classification based on structure and application; preparation–Martius yellow, aniline yellow, methyl orange, alizarin, indigo, malachite green.

Industry oriented content

Dyes Industry, Foodcolour and additives.

UNIT-IV

Heterocyclic compounds

Nomenclature and classification. General characteristics - aromatic character and reactivity.

Five-membered heterocyclic compounds

Pyrrole – preparation - from succinimide, Paal Knorr synthesis; reactions – reduction, basic character, acidic character, electrophilic substitution reactions, ring opening.

Furan – preparation from mucic acid and pentosan; reactions – hydrogenation, reaction with oxygen, Diels Alder reactions, formation of thiophene and pyrrole; Electrophilic substitution reaction.

Thiophene synthesis – from acetylene; reactions–reduction; oxidation; Electrophilic substitution reactions.

UNIT-V

Six-membered heterocyclic compounds

Pyridine – synthesis - from acetylene, Physical properties; reactions - basic character, oxidation, reduction, electrophilic substitution reactions; nucleophilic substitution – uses, Condensed ring systems.

Quinoline – preparation – Skraup synthesis and Friedlander's synthesis; reactions – basic nature, reduction, oxidation; electrophilic substitutions; nucleophilic substitutions – Chichibabin reaction

Isoquinoline – preparation by the Bischler – Napieralski reaction, reduction, oxidation; electrophilic substitution.

Recommended Text

1. M.K. Jain, S.C. Sharma, Modern Organic Chemistry, Vishal Publishing, fourth reprint, 2009.
2. S.M. Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, Macmillan India Ltd., third edition, 2009.
3. Arun Bahl and B.S. Bahl, Advanced organic chemistry, NewDelhi, S. Chand & Company Pvt. Ltd., Multicolour edition, 2012.
4. P. L. Soni and H. M. Chawla, Text Book of Organic Chemistry, Sultan Chand & Sons, New Delhi, twenty ninth edition, 2007.
5. C.N.Pillai,Text Book of Organic Chemistry, Universities Press (India) Private Ltd., 2009.

Reference Books

1. R. T. Morrison and R.N. Boyd, Organic Chemistry, Pearson Education, Asia, sixth edition, 2012.
2. T.W. Graham Solomons, Organic Chemistry,John Wiley &Sons, Eleventh edition, 2012.
3. A. Carey Francis, Organic Chemistry, Tata McGraw-Hill Education Pvt. Ltd., New Delhi, seventhedition, 2009.
4. I. L. Finar, Organic Chemistry, Vol. (1& 2), England, Wesley Longman Ltd, sixth edition, 2006.
5. J.A. Joule, and G. F. Smith, Heterocyclic Chemistry, Wiley, Fifth Edition, 2010.

Web site and e-learning sources

1. www.epgpathshala.nic.in
2. www.nptel.ac.in
3. http:/swayam.gov.in
4. Virtual Text book of Organic Chemistry

INORGANIC CHEMISTRY-I

Objectives of the course

The course aims to provide knowledge on

- nomenclature, isomerism and theory of coordination compounds, and chelate complexes
- crystal field theory, magnetic properties, stability of complexes and Jahn Teller effect
- preparation and properties of metal carbonyls
- Lanthanoids and actinoids
- Preparation and properties of inorganic polymers

UNIT I

Co-ordination Chemistry - I

IUPAC Nomenclature of coordination compounds, Isomerism in coordination compounds.

Werner's coordination theory – effective atomic number –interpretation of geometry and magnetic properties by Pauling's theory–geometry of co-ordination compounds with co-ordination number 4 & 6.

Chelates – types of ligands forming chelates – stability of chelates, applications of chelates in qualitative and quantitative analysis – application of DMG and oxine in gravimetric analysis – estimation of hardness of water using EDTA, metal ion indicators.

Role of metal chelates in living systems – haemoglobin and chlorophyll

Unit-II

Co-ordination Chemistry - II

Crystal field theory –Crystal field splitting of energy levels in octahedral and tetrahedral complexes, Crystal field stabilization energy (CFSE), spectro chemical series – calculation of CFSE in octahedral and tetrahedral complexes - factors influencing the magnitude of crystal field splitting, crystal field effect on ionic radii, lattice energies, heats of ligation with water as a ligand (heat of hydration), interpretation of magnetic properties, spectra of [Ti(H2O)6]3+ - Jahn – Teller effect. Stability of complexes in aqueous solution, stability constants - factors affecting the stability of a complex ion, thermodynamic and kinetic

Stability (elementary idea). Comparison of VBT and CFT.

UNIT-III

Organo metallic compounds

Metal Carbonyls

Mono and polynuclear carbonyls, General methods of preparation of carbonyls – general properties of binary carbonyls – bonding in carbonyls – structure and bonding in carbonyls of Ni, Fe, Cr, Co, Mn, Ru and Os. EAN rule as applied to metal carbonyls.

Ferrocene – Methods of preparation, physical and chemical properties.

UNIT-IV

Inner transition elements (Lanthanoids and Actinoids)

General characteristics of f-block elements - Comparative account of lanthanoids and actinoids - Occurrence, Oxidation states, Magnetic properties, Colour and spectra – Lanthanoids and Actinoids, Separation by ion-Exchange and Solvent extraction methods - Lanthanoids contraction- Chemistry of thorium and Uranium-Occurrence, Ores, Extraction, properties and uses - Preparation, Properties and uses of ceric ammonium sulphate, thorium dioxide and uranyl acetate.

UNIT-V

Inorganic polymers

General properties – classification of inorganic polymers based on element in the

backbone (Si, S, B and P) – preparation and properties of silicones (poly dimethyl siloxane and poly methyl hydro siloxane) phosphorous based polymer (poly phosphazines and poly phophonitrilicchloride), sulphur based polymer (poly sulfide and polymeric sulphur nitride), boron based polymers (borazine polymers) – industrial applications of inorganic polymers.

Recommended Text

1. Puri. B. R, Sharma. L. R, Kalia. K. C. (2011), Principles of Inorganic Chemistry, 31th Edition, Milestone Publishers & Distributors, Delhi.
2. Satya Prakash, Tuli. G.D., Basu.S.K., Madan. R. D. (2009), Advanced Inorganic Chemistry, 18thEdition, S. Chand & Co., New Delhi
3. Lee. J. D,(1991), Concise Inorganic Chemistry, 4th Edition, ELBS William Heinemann, London.
4. W.V. Malik, G. D. Tuli, R. D. Madan, (2000), Selected Topics in Inorganic Chemistry, S.Chand and Company Ltd.
5. A.K. De, Text book of Inorganic Chemistry, Wiley East Ltd, seventh edition, 1992.

Reference Books

1. Madan R. D, Sathya Prakash,(2003), Modern Inorganic Chemistry, 2nded ., S.Chand and Company, New Delhi.
2. Gopalan. R, (2009) Inorganic Chemistry for Undergraduates, Ist Edition, University Press (India) Private Limited, Hyderabad
3. Sivasankar. B, (2013) Inorganic Chemistry. Ist Edition, Pearson, Chennai.
4. Alan . G. Sharp. 1992), Inorganic Chemistry, 3rdEdition, Addition - Wesley, England.
5. Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, Inorganic Chemistry, Oxford University Press, sixth edition, 2014.

Web site and e-learning source

1. www.epgpathshala.nic.in
2. www.nptel.ac.in
3. http:/swayam.gov.in

PHYSICAL CHEMISTRY-I

Objectives of the course

The course aims at providing an overall view of

- Gibbs free energy, Helmholtz free energy, Ellingham's diagram and partial molar properties.
- Chemical kinetics and different types of chemical reactions.
- adsorption, homogeneous and heterogeneous catalysis.
- Colloids and macromolecules.
- photochemistry, fluorescence and phosphorescence.

UNIT-I

Thermodynamics - III

Free energy and work functions – Need for free energy functions, Gibbs free energy, Helmholtz free energy – their variation with temperature, pressure and volume,

criteria for spontaneity; Gibbs-Helmholtz equation – derivations and applications; Maxwell relationships, thermodynamic equations of state; Thermodynamics of mixing of ideal gases, Ellingham Diagram-application.

Partial molar properties – chemical potential, Gibbs Duhem equation, variation of chemical potential with temperature and pressure, chemical potential of a system of ideal gases, Gibbs-Duhem – Margules equation.

UNIT-II

Chemical Kinetics

Rate of reaction – Average and instantaneous rates, factors influencing rate of reaction - molecularity of a reaction - rate equation - order of reaction. Order and molecularity of simple and complex reactions, Rate laws-Rate constants – derivation of rate constants and characteristics for zero, first order, second and third order (equal initial concentration) – Derivation of time for half change with examples. Methods of determination of order of Volumetry, manometry and polarimetry.

Effect of temperature on reaction rate – temperature coefficient – concept of activation energy –Arrhenius equation. Theories of reaction rates – Collision theory – derivation of rate constant of bimolecular gaseous reaction – Failure of collision theory. Lindemann's theory of unimolecular reaction. Theory of absolute reaction rates – Derivation of rate constant for a bimolecular reaction – significance of entropy and free energy of activation. Comparison of collision theory and ARRT.

Complex reactions – reversible and parallel reactions (no derivation and only examples) –kinetics of consecutive reactions – steady state approximation.

UNIT-III

Adsorption – Chemical and physical adsorption and their general characteristics – distinction between them. Different types of isotherms – Freundlich and Langmuir. Adsorption isotherms and their limitations – BET theory, kinetics of enzyme catalyzed reaction – Michaelis-Menten and Briggs - Haldene equation – Line weaver- Burk plot – inhibition – reversible – competitive, noncompetitive and uncompetitive (no derivation of rate equations)

Catalysis – general characteristics of catalytic reactions, autocatalysis, promoters, negative catalysis, poisoning of a catalyst – theories of homogenous and heterogeneous catalysis – Kinetics of Acid–base and enzyme catalysis. Heterogenous catalysis.

UNIT-IV

Colloids and Surface Chemistry

Colloids: Types of Colloids, Characteristicsof Colloids (Lyophilic and Lyophobic sols), Preparation of Sols - Dispersion methods, aggregation methods, Properties of Sols - Optical properties, Electrical properties - Electrical double layer, Electro

Kinetic properties- Electro-osmosis, Electrophoresis,
Coagulation or precipitation, Stability of sols, associated colloids, Emulsions, Gels-preparation of Gels, Applications of colloids,
Macromolecules: Molecular weight of Macromolecules - Number average molecular weight – average molecular weight, Determination of Molecular weight of molecules

UNIT -V

Photo chemistry

Laws of photo chemistry – Lambert – Beer, Grotthus – Draper and Stark – Einstein. Quantum efficiency. Photochemical reactions – rate law – Kinetics of H2-Cl2, H2-Br2and H2-I2reactions, comparison between thermal and photo chemical reactions.
Fluorescence – applications including fluorimetry – sensitizedfluorescence, phosphorescence – applications – chemiluminescence and photosensitisation – examples Chemistry of Vision – 11 cis retinal – vitamin A as a precursor - colour perception of vision.

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,28thedition , 2019, S. Chand & Co.
4. S.K. Dogra and S. Dogra, Physical Chemistry through Problems: New Age International, fourthedition,1996.
5. J.Rajaram and J.C. Kuriacose, Thermodynamics, Shoban Lal. Nagin Chand and CO., 1986.

Reference Books

1. J.Rajaram and J. C. Kuriacose, Chemical Thermodynamics, Pearson, 1stedition, 2013.
2. Keith. J.Laidler, Chemical kinetics, third edition ,Pearson, 2003.
3. P.W. Atkins, and Julio de Paula, Physical Chemistry, Oxford University press, seventh edition, 2002.
4. K.L. Kapoor, A Text book of Physical Chemistry, Macmillan India Ltd, third edition, 2009.
5. B. R. Puri, L. R. Sharma and M. S. Pathania, Principles of Physical Chemistry, Shobanlal Nagin Chand and Co. Jalendhar, forty first, edition, 2001

Web site and e-learning source

1. https://nptel.ac.in
2. https://swayam.gov.in
3. www.epgpathshala.nic.in

ELECTIVE: BIOCHEMISTRY / NANOSCIENCE

BIOCHEMISTRY

Objectives of the Course

The course aims at providing knowledge on

- relationship between biochemistry and medicine, composition of blood.
- Structure and properties of aminoacids, peptides, enzyme, vitamins and proteins.
- Biological functions of proteins, enzymes, vitamins and hormones.
- Biochemistry of nucleic acids and lipids.
- Metabolism of lipids

UNIT- I

Logic of Living Organisms

Relationship of Biochemistry and Medicine

Blood -Composition of Blood, Blood Coagulation –Mechanism. Hemophilia and Sickle Cell Anaemia

Maintenance of Ph of Blood –Bicarbonate Buffer, Acidosis, Alkalosis.

UNIT–II

Peptides and Proteins

Aminoacids– nomenclature, classification – essential and Non- essential; Synthesis – Gabriel Phthalimide, Strecker; properties–zwitter Ion and iso electric point, electrophoresis and reactions.

Peptides – peptide bond – nomenclature – synthesis of simple peptides– Solution and solid phase. Determination ofstructure of peptides, N- Terminalanalysis –Sanger's &Edmann method; C terminal analysis- Enzymic method.

Proteins – classification based on composition, functions and structure; Properties and reactions – colloidal nature, coagulation, hydrolysis, oxidation, denaturation, renaturation; colour tests for proteins; structure of proteins–primary, secondary, tertiary and quaternary. Metabolism of aminoacids–general aspects of metabolism (a brief outline); urea cycle.

UNIT- III

Enzymes and Vitamins

Nomenclature and classification, characteristics, factors influencing Enzyme activity– mechanism of enzyme action–Lock and key hypothesis, Koshland's induced fit model.

Proenzymes, antienzymes, coenzymes and isoenzymes; allosteric enzyme regulation.

Vitamins as coenzymes–functions of TPP, lipoicacid, NAD, NADP, FMN, FAD, pyridoxal phosphate, CoA, folic acid, biotin, cyanocobalamin.

UNIT- IV

Aminoacids

Components of nucleicacids – nitrogenous bases and pentose sugars, Structure of nucleosides and nucleotides, DNA – structure & functions; RNA–types–structure-functions; biosynthesis of proteins

Hormones

Adrenalin and thyroxine—chemistry, structure and functions (No structure elucidation).

UNIT-V

Lipids

Occurrence, biological significance of fats, classification of lipids.

Simple lipids– Oils and fats, chemical composition, properties, reactions – hydrolysis, hydrogenation, trans-esterification, saponification, rancidity; analysis of oils and fats–saponification number, iodine number, acid value, R.M.value. Distinction between animal and vegetable fats.

Compound lipids – Lipoproteins - VLDL, LDL, HDL, chylomicrons– biological significance.

Cholesterol–occurrence, structure, test, physiological activity.

Metabolism of lipids: β-oxidation of fatty acids.

Recommended Text

1. Bahl. B. S.; Bhal. A, Advanced Organic Chemistry, 3rd ed.; S. Chand: New Delhi, 2003.
2. Jain. M.K.; Sharma,S.C, Modern Organic Chemistry, Vishal Publications: NewDelhi, 2017.
3. Shanmugam. A, Fundamentals of Biochemistry for Medical Students, 6th ed.; Published by the author, 1999.
4. Veerakumari. L, Biochemistry,1st ed.; MJP Publications: Chennai, 2004.
5. Jain. J.L.; Fundamentals of Biochemistry, 2nd ed.; S.Chand: NewDelhi, 1983.

Reference Books

1. Conn. E.E.; Stumpf. P.K, Outline of Biochemistry, 5th ed.; Wiley Eastern: NewDelhi, 2002.
2. West. E.S.; Todd,W.R.; Mason,H.S.; Van Bruggen. J.T, Text Book of Biochemistry, 4th ed.; Macmillan: New York, 1970.
3. Lehninger. A.L, Principles of Biochemistry, 2nd ed.; CBS Publisher: Delhi, 1993.
4. Rastogi,.S.C, Biochemistry, 2nd ed.; Tata Mc Graw-Hill: NewDelhi, 2003.
5. Chatterjea. M.N.; Shinde. R., Text book of Medical Biochemistry, 5th ed.; Jaypee Brothers: NewDelhi, 2002.

Website and e-learning source

1. http://library.med.utah.edu/NetBiochem/nucacids.html
2. http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/E/EnzymeKinetics.html
3. https://swayam.gov.in/courses/4384-biochemistryBiochemistry
4. https://onlinecourses.nptel.ac.in/noc19_cy07/previewExperimentalBiochemistry

NANOSCIENCE

Objectives of the course

This course aims at providing knowledge on

- Introduction to nanoparticles/clusters and nanocomposites
- Properties of nanomaterials
- Characterization of nanomaterials by different methods
- Synthesis of carbonnanotubes, graphene, quantumdots, self- assembled nanomaterials
- Applications of nanomaterials as sensors

UNIT I

Introduction to nanoscience

Definition of terms– nanoscience, nanoparticles, clusters, quantumdots, nanostructures and nanocomposites. Electron behavior in free space, bulk material and nanomaterials. Synthesis and stabilization of nanomaterials Top down approach (physical methods), mechanical dispersion–ball milling, methods based on evaporation of a precursor-inert gas condensation, ion sputtering, spray pyrolysis, aerosol synthesis-nanolithography. Bottom–up approach (chemical methods) – solvothermal synthesis, photochemical method, gamma radiolysis, sonochemical synthesis, electro deposition, sol-gel method, nanomaterials via chemical routes- solvents reducing agents, Capping agents-stabilization of nanoparticles-electrostatic and steric stabilization, common stabilizers, nanoparticle grow thin solution, Template growth, Langmuir–Blodgett(L-B)method, reverse micelles- Emulsion method.

Unit II

Properties of materials on a nano scale

Optical properties of metal and semiconductor nanomaterials-surface Plasm on resonance (SPR), surface enhanced Raman spectra(SERS), Quantum on finement effect, tuning of optical spectrum. Magnetic properties-Fe3O4 particle, supramagnetic properties, electronic properties, Chemical properties-chemical process on the surface of nanoparticles, catalysis, mechanical properties.

UNIT III

Techniques employed for characterisation of nanomaterials Spectrocopy–UV- visible, Photoelectron spectroscopy–Electron microscopy–Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Scanning probe microscopy (SPM) – Atomic Force Microscopy (AFM), Scanning Tunneling Microscopy (STM), Optical microscopy–confocal microscopy, X-ray diffraction (XRD)[Principle and Block diagram only].

UNIT IV

Special nanomaterials

Carbon Nano Structures Carbon nanotubes: Introduction-types-zigzag, Armchair,

helical, synthesis by CVD, Functionalization of Carbon Nanotubes, Reactivity of Carbon Nanotubes, Fielde mission, Fuel Cells, Display devices.

Other Important Carbon based materials: Preparation and Characterization Fullerene, Graphene, properties, DLC and Nanodiamonds and Applications

Semiconductor nanoparticles: Quantum dots, synthesis–chemical Synthesis using clusters, properties, poroussilicon–electrochemical etching, aerogel–types silicaaerogel, resorcinol formaldehyde (RF) aerogels, zeolites–applications.

Self Assembled Nanomaterials: Self Assembled Monolayers (SAMS)– inorganic, organic molecules.

UNIT V

Application of nanomaterials

Biomedical Applications - drug, drug delivery, biolabelling, artificial implants, cancer treatment. Sensors– Natural nanoscale sensors, Chemical sensors, biosensors, electronicnoses.

Optics &Electronics–Nanomaterials in the next generation computer technology, high definition TV, flat panel displays, quantum dot laser, Single electron transistors [SET].

Nanotechnology in agriculture–Fertilizer and pesticides nanomaterials For water purification, nanomaterials in food and packaging materials, fabric industry.

Impacts of Nanotechnology–human & environmental safety risks.

Recommended Text

1. Sulabha K. Kulkarni, Nanotechnology: Principles and Practices, Capital Publishing Co., New Delhi.
2. Pradeep. T, Nano: The Essentials, Understanding Nanoscience and Nanotechnology; Tata McGraw-Hill Publishing Company Limited, NewDelhi, 2007.
3. Shah. M.A.; Tokeer Ahmad, Principles of Nanoscince and Nano technology;Narosa PublishingHouse,NewDelhi,2010.
4. Murthy. B.S; Shankar. P, Baldev Raj.; Rath. B.B. James Murday, Textbook of Nanoscience and Nanotechnology; Universities press, India Ltd , Hyderabad. 2012.

Reference Books

1. Sharma. P.K., Understanding Nanotechnology; Vista International Publishing House, Delhi. 2008.
2. Charles P. Poole Jr.; Frank J. Owens. Introduction to Nanotechnology; A John Wiley & Sons, INC., Publication,2003.
3. Viswanathan B., NanoMaterials; Narosa Publishing House, New Delhi, 2009.
4. Edited by C.N.R. Rao; Mu¨ller. A; Cheetham. A.K. Nanomaterials Chemistry Recent Developments and New Directions, WILEY-VCH Verlag GMBH &Co.,KGaA, Darmstad.
5. Jing Zhong Zhang, Optical properties and spectroscopy of Nanomaterials; World Scientific Publishing Pvt. Ltd., Singapore.

Website and e-learning source

1. http://www.nanotechnology.com/docs/wtd015798.pdf
2. http://nccr.iitm.ac.in/Nanomaterials.pdf

ELECTIVE: *INDUSTRIAL CHEMISTRY/ PHARMACEUTICAL CHEMISTRY*

INDUSTRIAL CHEMISTRY

Objectives of the course

This course is designed to provide knowledge on

- Classifications and characteristics of fuels
- Preparation of cosmetics.
- Manufacture of sugar, paper, cement. leather and food processing.
- Applications of abrasives, lubricants and other industrial products.
- Intellectual property rights.

UNIT-I

Survey of Indian Industries and mineral resources in India

Fuels: Classification, characteristics of fuels. Solid fuels: coal - classification; analysis of coal-proximate analysis and ultimate analysis; calorific value - determination, carbonization of coal.

Liquid fuels: Petroleum - characteristics; Gasoline aviation petrol- knocking in internal combustion engines, antiknock agents; unleaded petrol-octane number, cetane number.

Gaseous fuel: advantages over solid and liquid fuels; water gas, producer gas, carbureted watergas - preparations-uses.

Natural gas: LPG-composition, advantages, application; gobar gas- production, composition, advantages, application. Propellants – rocket fuels (basic idea)

UNIT-II

Cosmetics

Skin care: powders, ingredients; creams and lotion-cleansing, moisturising, all purpose shaving cream, sunscreen; make up preparations.

Dentalcare: toothpastes–ingredients.

Haircare: shampoos -types, ingredients; conditioners -types, ingredients. Perfumes: natural – plantorigin – parts of the plant used, chief constituents; animal origin - amber gries, civetone and musk; synthetic classification- esters – amyl salicylate alcohols - citronellol; terpeneols - gereniol and nerol; ketones - muskone, coumarin; aldehydes - vanilin.

Soaps and Detergents

Soaps-properties, manufacture of soap-batch process; types-transparent soap, toilet soap, powder soap and liquid soap – ingredients.

Detergents - definition, properties – cleansing action; soapless detergents - anionic, cationic and non-ionic (general idea only); uses of detergents as surfactants. Biodegradability of soaps and detergents.

UNIT-III

Sugar Industry

Manufacture from sugar cane; recovery of sugar from molasses; testing and estimation of sugar.

Food Preservation and processing

Food spoilage – causes; Food preservation – methods – high temperature, low temperature, drying, radiation; Food additives – preservatives, flavours, colours, anti-oxidants, sweetening agents; hazards of using food additives; Food standards – Agmark and Codex alimentarius.

UNIT-IV

Abrasives

Definition, characteristics, types - natural and synthetic; natural abrasives – diamond, corundum, emery, garnet, quartz – composition, uses; synthetic abrasives – carborundum, aluminium carbide, boron carbide, boron nitride, synthetic graphite – composition and uses.

Leather Industry

Structure and composition of skin, hide; Manufacture of leather–pre- tanning process – curing, liming, beating, pickling; methods of tanning- vegetable, chrome–one bath, two bath process; finishing.

Paper Industry

Manufacture of pulp - mechanical, chemical processes; sulphate pulp, rag pulp; manufacture of paper- beating, refining, filling, sizing, colouring, calendaring; cardboard.

UNIT-V

Lubricants

Definition, classification-liquid, semi-solid, solid and synthetic; properties – viscosity index, flash point, cloud point, pour point, aniline point and drop point; greases - properties, types; cutting fluids, Selection of lubricants.

Cement Industry

Cement – types, raw materials; manufacture –wet process, constituent of cement, setting of cement; properties of cement-quality, setting time, soundness, strength; mortar, concrete, RCC; curing and decay of concrete.

Intellectual Property Rights

Introduction to Intellectual Property Rights – Patents - Factors for patentability - Novelty, Nonobviousness, Industrial applications - Patent offices in India: Trademark - Types of trademarks- Certification marks, logos, brand names, signatures, symbols and service marks.

Recommended Text

1. Sharma, B. K. Industrial Chemistry, 9thed.; Goel Publishing House: Meerut, 1998.
2. Wilkinson. J. B. E, Moore.R. J, Harry's Cosmeticology, 7thed.; Chemical Publishers: NewYork, 1982.
3. Alex. V. Ramani, Food Chemistry, MJ Ppublishers: Chennai,2009.
4. Jaya shree Ghosh, Applied Chemsitry, S. Chand: NewDelhi, 2006.
5. Srilakshmi, B. Food Science, 4thed.; New Age International Publication, 2005.

Reference Books

1. Jain. P.C.; Jain. M, Engineering Chemistry, 16thed.;Dhanapet Rai: Delhi, 1992.
2. George Howard, Principles and Practice of Perfumes and Cosmetics, Stanley Therones, Cheltenham: UK, 1987.
3. Thankamma Jacob, Foods, Drugs and Cosmetics - AConsumer Guide, Macmillan : London, 1997.
4. Shankuntala Manay. N.; Shadakshara swamy. M, Food Facts and Principles, 3rd ed.; New Age Publication, 2008.
5. Neeraj Pandey, Khushdeep Dharni, Intellectual Property Rights,PHI Learning, 2014.

Web site and e-learning source

1. http://www.sciencecases.org/irradiation/irradiation_notes.asp
2. http://discovery.kcpc.usyd.edu.au//9.5.5/
3. https://www.wipo.int/about-ip/en/
4. www.nptel.ac.in
5. http:/swayam.gov.in

PHARMACEUTICAL CHEMISTRY

Objectives of the course

The course aims at providing an overall view of

- Drugs design and drug metabolism
- Important Indian medicinal plants, common diseases and antibiotics
- Drugs for major diseases like cancer, diabetes and AIDS
- Analgesics and antipyretic agents
- Significance of clinical tests

UNIT I

Introduction

Important terminologies – drug, pharmacognosy, pharmacy, pharmacology, pharmacodynamics, pharmacokinetics, clinical pharmacology, pharmacotherapeutics, chemotherapy, toxicology, pharmacophore, antimetabolites, mutation, bacteria, virus, fungi, actinomycetes, vaccines, pharmacopeia, posology and therapeutic index.

Sources of drugs–dosage forms–bioavailability–routes of administration – absorption,

distribution and elimination of drugs–drug metabolism– prescription terms.

Structure and pharmacological activity

Effect of – unsaturation, chain length, isomerism; groups - halogens amino, nitro, nitrite, cyano, acidic, aldehydic, keto, hydroxyl and alkyl groups.

Development of Drugs

Development of a drug– classic steps- lead compounds- comparison of traditional and modern methods of development to drugs–drug design By method of variation– disjunction and conjunction methods.

Unit II

Indian medicinal plants

Some important Indian medicinal plants–tulsi, neem, kizhanelli, mango, semparuthi, adadodai, turmeric and thoothuvalai –uses.

Common diseases and their treatment

Causes, prevention and treatment of the following diseases:

Insect borne diseases– malaria, filariasis, plague; Air borne diseases– diphtheria, whooping cough, influenza, measles, mumps, common cold, tuberculosis; Water borne diseases–cholera, typhoid, dysentery.

Digestive system – jaundice; Respiratory system – asthma; Nervous system – epilepsy.

Antibiotics

Definition – classification – structure and therapeutic uses of chloramphenicol, penicillins , structure activity relationship of chloramphenicol ; therapeutic uses of ampicillin, streptomycin, erythromycin, tetracycline, rifamycin.

UNIT III

Drugs for major diseases

Cancer – common causes – chemotherapy – anti neoplastic agents - classification – adverse effects of cytotoxic agents ; alkylating agents–chlorambucil; antimetabolites– methotrexate, fluouracil;

Vincaalkaloids– vincristine, vinblastine. Diabetes– types– Management of diabetes– insulin ;oral hypoglycemic agents- sulphonyl ureas – chlorpropamide; biguanides - metformin – thiazolidinediones. Cardiovascular drugs– cardio glycosides; anti arrhythmic agents – quinidine, propranolol hydrochloride ; anti- hypertensive drugs - Aldomet, pentoliniumtartarate; vasodilator- tolazolinehydrochloride, sodiumnitroprusside. AIDS–causes, symptoms and prevention–anti HIV drugs-AZT, DDC.

UNIT IV

Analgesics and anti pyreticagents

Classification – action of analgesics – narcotic analgesics –morphine; synthetic analgesics – pethidine, methadone; antipyretic analgesics – salicylic acid derivatives, indolyl derivatives, p-aminophenol derivatives.

Anaesthetics

Definition,characteristics,classification-generalanaesthetics–volatile anaesthetics – nitrous oxide, ethers, cyclopropane, chloroform, halothane, trichloroethylene–storage, advantages and disadvantages; non volatile anaesthetics – thiopental sodium; local anaesthetics – requisites – advantages- esters – cocaine, benzocaine ; amides – lignocaine, cinchocaine.

Blood and haemotological agents

Blood– composition, grouping – physiological functions of plasma proteins – mechanism of clotting; Coagulants – vitamin K, protamine sulphate, dry thrombin; Anti coagulants – coumarins, citric acid and heparin; antifibrinolytic agents – aminocaproic acid and tranexamic acid.

Anaemia–causes, types and control–antianaemic drugs.

UNIT V

Clinical Chemistry

Blood tests–blood count–complete haemotogram– Hb, RBC, GTT, TC, DC, platelets, PCV, ESR; bleeding and clottingtime–-glucose tolerance test.

Significance of Clinical Tests

Serumelectrolytes- blood Glucose-ortho toluidine method; Renal functions tests - blood urea, creatinine; liver function tests - serum proteins, albumin globulin ratio, serum bilirubin, enzymes SGOT, SGPT; lipid profile – cholesterol, triglycerides, HDL, LDL, coronary risk index. Urine examination–Ph, tests for glucose, albumin and bile pigment.

Recommended Text

1. Jayashree Ghosh, (1999), A text book of pharmaceutical chemistry, 2nded., S.Chand & company, New Delhi.
2. LakshmiS, (2004), Pharmaceutical chemistry, 3rd ed., Sultanchand & sons, Delhi.
3. Tripathi KD, (2018), Essentials of medical pharmacology, 8th ed., Jaypee brothers medical publishers (P) Limited, New Delhi.
4. Ashutosh Kar, (2018), Medicinal chemistry, 7th ed., Newage international (P) Limited, Publishers, New Delhi.

Reference Books:

1. Chatwal G R, (2013), Pharmaceutical chemistry, inorganic (vol-I) 6th ed., Himalaya Publishing house, Bombay.
2. Chatwal G.R, (1991), Pharmaceutical chemistry, organic (vol-II)., Himalaya publishing house, Bombay.
3. Patrick G, (2002), Instant Notes Medicinal Chemistry, Viva Books Private Limited, New Delhi.
4. Intellectual Property Rights, Neeraj Pandey, Khushdeep Dharni. Publisher: PHI Learning Pvt. Ltd., 2014 ISBN: 812034989X, 9788120349896.

Website and e-learning source

1. http://www.pharmacy.umaryland.edu/faculty/amackere/courses/phar531_delete/lectures/qsar_1.pdf
2. http://www.indianmedicinalplants.info/
3. https://www.wipo.int/about-ip/en/

Naan Mudhalvan (substitute)
*APPLIED CHEMISTRY

Objectives of the course

The Primary objectives of this course are to

- Gain knowledge on fuels.
- Study about industrially important compounds.
- Acquire knowledge about basic needs of Agriculture developments.
- Learn the substances useful for human life.
- Study on Match and Silicate Industries.

UNIT-I FUEL CHEMISTRY

Fuels- Definition-Classification - Combustion and Chemical Principles - Calorific value-Characteristics of a good fuel. Solid fuel: Coal - Types - Cross and Net colorific values- Proximate and Ultimate analysis of coal - High and low temperature of carbonization - Uses.

Liquid fuels: Petroleum and its Chemical Composition- Cracking of heavy oil residues- Thermal and catalytic cracking, Knocking, Anti-knocking and Chemical structure, Octane and Cetane numbers - Significance - Petroleum products and their applications.

Gaseous fuels: Preparation and Specific uses of Producer gas, Water gas. LPG and Gobar gas.

Advantages and Disadvantages of Solid, Liquid and Gaseous fuels.

Rocket fuels- Classification of Solid Propellants, Liquid Propellants'- Combustion - Spontaneous ignition temperature (SIT) - Combustion calculation.

UNIT- II: PAINTS, LUBRICANTS, ADHESIVES AND PIGMENTS

Paints: Classification- Primary constituents, Manufacturing of paints, Emulsion paint-Constituent and advantages-Latex paints and Fire retardant paints, Solvents and Thinners.

Lubricants: Functions of lubricants-Properties and Classifications - Additives for lubricating oil, Lubricants of mineral origin. Lubricating grease and Solid lubricants.

Adhesives: Classification and preparation of adhesives. Synthetic resin adhesives and Rubber based adhesives -Uses of adhesives.

Pigments: Characteristics and uses of TiO_2, Ultramarine Blue and Red lead.

UNIT -III: AGRICULTURAL CHEMISTRY

Fertilizers: Raw material, manufacture (flow chart)- Chemical process (with equation) of ammonium nitrate, ammonium sulphate, urea, ammonium phosphate, super phosphate, triple super phosphate, NPK fertilizers.

Pesticides: Classificatin of pesticides, examples.
Insecticides: Stomach poisons, Contact insecticides, Fumigants, Manufacture and uses of Insecticides: DDT, BHC, Pyrethrin, Aldrin and Pentachlorophenol.
Fungicides: Bordeaux mixture, Lime sulphur, Creosote oil.

UNIT- IV: OILS, SOAPS AND DETERGENTS
Oils: Definition: Fats and Oils- Constituents- Sources-Difference between oils and fats, Manufacture of Cotton seed oil, Sunflower oil and Soyabean oil.
Soaps: Definition, Manufacture of soaps- Types of soaps -Specific uses.
Detergents: Difference between soapsand detergents, Synthetic detergents- Surface active agents and their classification- Anionic, Cationic and Non -ionic detergents - Applications including cleaning action.

UNIT -V: MATCH AND SILICATE INDUSTRIES
Match Industry; Types of Matches- Composition of match head and strikening surface- Manufacture of safety matches-Coloured matches- Pyrotechniques and explosives, Classification of good explosives TNT, RDX, Gun powder, Ammonium nitrate.
Silicate industry; Cement: Types of cements, composition, manufacture of Portland cement and Setting of cement.
Ceramics: Introduction, Types, Manufacture, and Applications, Refractory materials.
Glass: Definition, Composition, Types, Manufacturing of glass products, Physical and Chemical properties, Applications.

Recommended Text
Text Books

1. B.K. Sharma, Industrial Chemistry, Goel Publishing House, Meerut, 2003.
2. James A. Kent, Riegel's Hand book of Industrial Chemistry, Springer Science, 2013.

Reference Books

1. C.E. Dryden, Outlines Chemical Technology, Gopala Rao, East west Press, New Delhi
2. S. Johnson, N. Saikia, Fatty acids Profile of edible oils and fats in India, Centre for Science and Environment, New Delhi, India.

Website and e-learning source

1. http://fazaia.edu.pk- Library