

NANO SCIENCE AND ENGINEERING CHEMISTRY-I

Subject Code	CH-SCT 1.6.2	IA Marks	30
No. of Lecture Hrs./Week	04	Exam Hours	03
Total No. of Lecture Hours	52	Exam Marks	70

UNIT-I: The big world of Nanomaterials:

History and scope, how small things make a big difference, classification of Nano structured materials, fascinating Nano structures, applications of Nano materials, nature : the best nanotechnologist, challenges and future prospects, microstructure and defects in Nanocrystalline materials, effects of Nano-dimensions on material behavior.

UNIT-II: Applications of Nanomaterials:

Nano electronics, micro and Nano-electromechanical systems (MEMS/NEMS), Nano-sensors, Nano catalysts, food and agriculture industry.

UNIT-III: Fuels and combustion

Types of fuels, calorific values of fuels, combustion of fuels, combustion equation for a hydrocarbon fuel, fuel gas analysis, conversion of gravimetric analysis to volumetric analysis and vice versa, carbon burnt to carbon di oxide and CO, excess air, supplied, enthalpy of formation, energy balanced for a reactive system, enthalpy and internal energy of combustion, actual combustion process.

UNIT-IV: Gas power cycle:

Air cycles, assumptions made, Carnot cycle, Otto cycle, diesel cycle, dual combustion cycle, comparison : Otto, diesel & dual cycles, comparison: Otto and diesel cycles, sterling cycle, gas turbine cycle Vapour Power cycle, Carnot cycle, Rankine cycle, types of feed water heaters, reheat cycle, regenerative cycle

BOOKS RECOMMENDED:

1. Text book of Nanoscience and technology by B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday Universe press.
2. Chemistry for engineering students by B. S. Jai Prakash, R. Venugopal, Shiva Kumaraih, Puspha Jyngar.
3. Applied thermodynamics by R. K. Hegde, Niranjan Murthy.
4. Engineering chemistry second edition by R. V. Gadag, A. Nityananda Shetty I. K. International publishing House Pvt.Ltd.

ANALYTICAL CHEMISTRY-I

Subject Code	CH-SCT 1.6.1	IA Marks	30
No. of Lecture Hrs./Week	04	Exam Hours	03
Total No. of Lecture Hours	52	Exam Marks	70

UNIT-I: Data handling & spreadsheets in Analytical Chemistry: 13Hrs

Accuracy & precision, determinate errors, indeterminate errors, significant figures, standard deviation, propagation of errors, significant figures & propagation of errors, the confidence limit, test of significance, statistics for small data sets, linear least squares, correlation coefficient and coefficient of determination, slope intercept and coefficient of determination.

UNIT-II: Acid base titrations, complexometric reactions & titrations, gravimetric analysis & precipitation equilibria: 13Hrs

Strong acid versus strong base, standard acid & base solutions, weak acid versus strong base titration of sodium carbonate, titration of amino acids, mixtures of acids and bases, kjeldahl analysis, complexes and formation constants, chelates, EDTA, metal EDTA titration curves, detection of end point, fraction of dissociating species in polyligand complexes, beta values, gravimetric analysis with examples, gravimetric calculations, precipitation equilibria, the diverse ion effect on solubility (K^0 and activity coefficients)

UNIT-III: Solvent extraction-I: 13Hrs

General discussion principle, factors affecting solvent extraction, quantitative treatment of solvent extraction synergistic extraction ion association complex, extraction reagents acetyl acetone, 8-hydroxyquinoline dimethylglyoxime, 1-nitroso 2-naphthal cupferron dithiazole, sodium diethyl dithiocarbamate, ammonium pyrrolinedithiocarbamate, tri-n-butylphosphate poly compounds cetyltrimethyl ammonium bromide. Some practical considerations: choice of the solvent extraction. Some applications: Determination of iron as 8-hydroxy quinolate, determination of lead by dithiazone method, determination of molybdenum by thiocyanate method.

UNIT-IV: ION EXCHANGE METHODS: 13Hrs

Introduction, definitions principle cation exchangers, anion exchangers and their synthesis, regeneration ion exchange columns used in chromatographic separation, selection of suitable systems, ion exchange capacity ion exchange technique batch method column method. Application of ion exchangers: separation of similar ion from one another removal of interfering radicals, softening of hard water complete demineralization of water separation of lanthanides, separation of actinides, purification of organic compounds extracted in water separation sugars, separation of amino acids, preparation of pure reagents hydro metallurgy.

BOOK RECOMMENDED:

1. Analytical chemistry by G.D.Christian.
2. Fundamental of analytical chemistry, D.A.Skoog D.M.West, Holler and Crouch 8th edition 2005, Saunders college publishing new York.
3. Analytical chemistry principles, John H. Kennedy, 2nd edition saunders college publishing California, 1990.
4. Instrumental methods of chemical analysis Chatwal and Anand-5th edn
5. Chromatography E.Heftman 5th edition part A and part B. Elsevier science publishers 1992.
6. Chromatography today, C.F.Poole and S.K.Poole Elsevier science publishers
7. Analytical chemistry by alka L. Gupta A pragathi edition
8. Separation methods by M.N.Sastri, Himalaya publisher.
9. Modern analytical chemistry Harvey Harcourt publishers.
10. An introduction to chromatography theory and practical V.K Srivastav and K.K.srivastav
11. Instrumental methods of chemical analysis, Gurudeep R Chatwal, Sharma K Anand. Himalaya publishers.
12. Chromatography by B.K.Sharma, GOEL publishers
13. Basic concepts of analytical chemistry, S.M.Khopkar, New age International publications 3rd edition.

GENERAL CHEMISTRY-I

Subject Code	CH-SCT 1.6.3	IA Marks	30
No. of Lecture Hrs./Week	04	Exam Hours	03
Total No. of Lecture Hours	52	Exam Marks	70

UNIT-I:

Atmosphere:

13Hrs

Composition of the atmosphere, atmosphere structure, evolution of the atmosphere, earth's radiation balance, particles, ions & radicals in the atmosphere, chemical & photochemical reactions in the atmosphere (oxygen & ozone chemistry, sulphur dioxide, nitrogen oxides & organic compounds), greenhouse effect, ozone hole, human activities & meteorology, the earth's mechanism & global climate, El Nino phenomenon, Asian brown cloud

UNIT-II:

13Hrs

- i) **Lithosphere**-Composition of lithosphere/soil, water & air in soil, inorganic & organic components in soil, acid base and ion exchange reactions in soil, micro & macro nutrients, nitrogen pathways & NPK in soil, water and pollutants in soil.
- ii) **Hydrosphere**-Water resources (hydrologic cycle), physical chemistry of sea water decomposition, complexation on natural water and waste water, sea water equilibrium, pH, PE, sea water model, micro organisms.

UNIT-III:

Metals and metallurgical methods:

13Hrs

Occurrence of elements, minerals & ores, refractory materials, minerals wealth of India, rare minerals, oil, different metals ores, metallurgical principles. For different ores (for sulphide ores, halide ores, oxides ores), processes involved in metallurgy (crushing & pulverization, ore dressing or concentration, gravity separation, hydraulic classifier, froth flotation, calcinations & roasting reaction of free metals, reduction to metallic state, smelting), flux, types of fluxes, amalgamation.

UNIT-IV:

Fuels and Furnaces:

13Hrs

Modern definition, requirements of a fuel, no by products, calorific value, fuel cost, supply position, moderate velocity of composition, highest pyrometric effect, proper ignition point, types of fuels, uses of water gas ($\text{CO} + \text{H}_2$), water gas generator, superheater, purifier, composition & uses, producer gas (properties), solid fuels, coal, types of coal, types of furnaces (kilns, blast furnace, reverberatory furnace, muffle furnace, electric furnace, open hearth furnace), solvent extraction, choice of solvent, ionexchange method.

BOOKS RECOMMENDED:

1. Environmental chemistry -By A.K.De 5th edition
2. Industrial chemistry-By Ayodhya Singh

SECOND SEMESTER

ORGANIC CHEMISTRY-II

Subject Code	CH-HCT 2.1	IA Marks	30
No. of Lecture Hrs./Week	04	Exam Hours	03
Total No. of Lecture Hours	52	Exam Marks	70

UNIT-I: Heterocyclic Compound

13Hrs

Nomenclature, structure, reactivity, synthesis and chemical reactions of indole, quinoline, sesquinoxalines, pyrazole, imidazole, benzimidazole, α -pyrone, γ -pyrone, coumarins.

UNIT-II: Synthetic Polymers

13Hrs

Classification of Polymers, Addition or chain growth polymerization, Some important Vinyl polymers (Polyethylene, Polypropylene, polyvinylchloride, polyesterene, polyvinyl acetate, Acrylonitrile, tetrafluoroethylene), Condensation or step growth polymerization (polyesters, polyamides, phenol, Urea, melamine, silicon resins, polyurathanes), Natural and Synthetic Rubber; Structure and isolation of rubber, Vulcanization, Non-Sulphur Vulcanization, polyisoprene, polyisobutylene, polybutadiene, polychloroprene, SBS, Buna-N.

UNIT-III:

13Hrs

i) Aliphatic Nucleophilic substitution

SN1 mechanism, SN2 mechanism, SNi mechanism, mixed SN1 & SN2 mechanism, the SET mechanism, esterification & ester hydrolysis.

ii) Aliphatic Electrophilic Substitution

Unimolecular mechanism (SE1), Bimolecular mechanism (SE2 & SEi), aliphatic diazonium coupling, diazo transfer reaction.

UNIT-IV:

13Hrs

Oxidations, Reductions and reagents:

Oxidations: Oxidations of organic compounds using, OsO₄, SeO₂, and Oppenauer oxidation.

Reductions: Reductions of organic compounds using the following reagents: LiAlH₄, NaBH₄, Birch reduction and Wolff-Kishner reduction.

Reagents: Methods of preparation, mechanism of reaction and applications of the following reagents in organic synthesis: DCC, 1,3-Dithiane, LDA, DDQ, Wilkinson catalyst, Crown ether.

BOOK RECOMMENDED:

1. Advanced organic chemistry by Dr. Jagdamba Singh, Dr. LDS Yadav A Pragati edition
2. Text book of Organic Chemistry-Vol III - By: V. K. Ahluwalia.
 1. Organic chemistry Vol-II, III-S.M.Mudherji, S.P.singh and R.P.Kapoor, new age international, Ltd new Delhi
 2. Organic chemistry Vol-I,II-I.L.finar, 6th edition ELBS London
 3. Heterocyclic chemistry - T.L.Gilchrist, 3rd edition Pearson education delhi
 4. Heterocyclic chemistry - J.A.Joule and G.F.smith, 2nd edition, van nostrand London
 5. Heterocyclic chemistry R.K.Bansal, 3rd edition, new-age international, new delhi,
 6. Stereochemistry of organic compounds, E. L. eliel et. Al John wiley and sons inc.

NANO SCIENCE AND ENGINEERING CHEMISTRY-II

Subject Code	CH-SCT 2.6.2	IA Marks	30
No. of Lecture Hrs./Week	04	Exam Hours	03
Total No. of Lecture Hours	52	Exam Marks	70

UNIT-I:

Unique properties of Nanomaterials:

13Hrs

Microstructure and Defects in Nanocrystalline materials, effects of Nano-dimensions on material behavior.

Synthesis Routes:

Bottom-Up approach, Top-Down approach, Consolidation of Nanopowders.

UNIT-II:

Applications of Nanomaterials:

13Hrs

Applications to Cosmetics and consumer Goods, Structure and Engineering, Automotive Industry, Water treatment and the environment, Nano-medical applications, Textiles, paints, energy, Defence and space applications, Structural applications.

UNIT-III:

Electrochemical cells:

13Hrs

Introduction, electro chemical cells, galvanic cell, electromotive force of the cell, single electrode potential, Nernst equation, electrochemical conventions, electrochemical series, types of electrodes, reference electrodes, ion selective electrodes, concentration cells.

UNIT-IV:

Metal Finishing:

13Hrs

Introduction, technological importance of metal finishing, electroplating, polarization, decomposition potential & overvoltage, theory electroplating, electroplating process, characteristics of a good deposit, methods of cleaning the metal surface to be coated, factors influencing the nature of deposit, requirements of an electrolyte solution for electroplating, applications of electroplating, electroplating of gold, Nickel, Copper.

BOOKS RECOMMENDED:

1. Text book of Nanoscience and technology by B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday Universe press.
2. Chemistry for engineering students by B. S. Jai Prakash, R. Venugopal, Shiva Kumaraih, Puspaha Jyrngar.
3. Applied thermodynamics by R. K. Hegde, Niranjan Murthy.
4. Engineering chemistry second edition by R. V. Gadag, A. Nityananda Shetty I. K. International publishing House Pvt.Ltd.

GENERAL CHEMISTRY-II

Subject Code	CH-SCT 2.6.2	IA Marks	30
No. of Lecture Hrs./Week	04	Exam Hours	03
Total No. of Lecture Hours	52	Exam Marks	70

UNI-I:

Chemical Toxicology:

13Hrs

Toxic chemicals in the environment, impact of toxic chemicals on enzymes, biochemical effects of Arsenic, cadmium, lead, mercury, carbon monoxide, nitrogen oxides, sulphur dioxide, ozone and PAN, cyanide, pesticides, carcinogens, bio warfare agents, environment and public health, pollution and public health issues

UNIT-II:

Air Pollution:

13Hrs

Air pollutants (carbon monoxide, nitrogen oxides, hydrocarbons, sulphur dioxide, acid rain, particulates, and radioactivity), effects of atmospheric pollution, some air pollutant accidents, air quality standards, sampling, monitoring, instrumental techniques for air pollution.

UNIT-III:

Water Pollution:

13Hrs

Aquatic environment, water pollutants (organic pollutants, Pesticides, organochlorine insecticides, detergents, marine pollution, oil pollution), path ways of oil spill on marine environmental and Impact on the environment, Toxic organic chemicals, Inorganic pollutants, sediments, Radioactive materials, Thermal pollution, Coral-reef crisis, waste water treatment, Trace element in water, The River systems and Riverine environment, Arsenic contamination in ground water, water quality parameters.

UNIT-IV:

Natural Resources, Energy and Environment:

13Hrs

Mineral Resource: Metals & Non-metals, Wood-a major renewable resources, Fuel & energy resources (Coal, Petroleum, Natural gas, Nuclear fission, Nuclear fusion, Solar energy, Hydrogen, Gasohol) World energy resources-Consumption and conservation, Environmental management

BOOKS RECOMMENDED:

1. Environmental Chemistry by A .K. De, S5th Edition, New age International.

NANO SCIENCE AND ENGINEERING CHEMISTRY-III

Subject Code	CH SCT 3.5.2	IA Marks	30
No. of Lecture Hrs./Week	04	Exam Hours	03
Total No. of Lecture Hours	52	Exam Marks	70

UNIT-I:

Characterization of Nanomaterials:

13Hrs

By X-ray diffraction(XRD), Small angle X-ray scattering (SAXS), Scanning Electron microscopy (SEM), Transmission electron microscopy (TEM), Atomic force microscopy(AFM), Scanning Tunnelling microscope(STM), Nanoindentation.

UNIT-II:

Nanostructured Materials With High Application Potentials:

13Hrs

Quantum Dots, Carbon Nanotubes, GaN Nano Wires, Nanocrystalline ZnO, Nanocrystalline Titanium Oxide, Multilayered Films.

UNIT-III:

Refrigeration and Psychometrics:

13Hrs

Coefficient of performance, units of refrigeration, properties of a good refrigerant, important refrigerants, air-refrigeration, vapour compression cycle, vapour absorption cycle, steam jet refrigeration, definitions and brief explanation of superheated vapour, saturated vapours, dew point temperature,(DBT,WBT), Dalton's law of partial pressure, relative humidity degree of saturation, enthalpy of moist air, psychometric charts, psychometric processes, comfort air conditioning, summer air conditioning systems, winter air conditioning systems.

UNIT-IV:

Water Technology:

13Hrs

Introduction, impurities in natural water, chemical analysis of water, determination of hardness of water including alkalinity, chloride, nitrates, sulphates using gravimetric method, determination of dissolved oxygen (DO) by iodometric method, pot able water, electro dialysis, water pollution (sources, sewage), BOD(Biological Oxygen Demand), COD (Chemical Oxygen Demand),treatment of domestic sewage, Hazardous chemicals with its effects.

BOOKS RECOMMENDED:

1. Text book of Nanoscience and technology by B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday Universe press.
2. Chemistry for engineering students by B. S. Jai Prakash, R. Venugopal, Shiva Kumaraih, Pusppha Jyrngar.
3. Applied thermodynamics by R. K. Hegde, Niranjan Murthy.
- 4.Engineering chemistry second edition by R. V. Gadag, A. Nityananda Shetty I. K. International publishing House Pvt.Ltd.

ANALYTICAL CHEMISTRY-III

Subject Code	CH-SCT 3.5.1	IA Marks	30
No. of Lecture Hrs./Week	04	Exam Hours	03
Total No. of Lecture Hours	52	Exam Marks	70

UNIT-I: **Basic concepts of chromatography:**

General description, definition, terms and parameters used in chromatography. Classification of chromatographic methods. Criteria for selection of a stationary and mobile phase, nature of adsorbents, factors influencing the adsorbents, nature and types of mobile phases.

Elution chromatography: theories: rate theory, band broadening, eddy diffusion, longitudinal diffusion and resistance to mass transfer. Column efficiency: plate theory and rate theory approach. Vandimeter's equation and its modern version. Inter relationship capacity factor, selectivity factor and column resolution.

UNIT-II:

13 Hrs

- i) **Thin layer chromatography:** principle, methodology, determination of R_f value and its significance, variables that affect R_f value and applications.
- ii) **Gas Chromatography:** Performing GC separations, GC Columns, GC Detectors, Temperature selections, quantitative measurements, Head space analysis, Thermal desorption, Purging and trapping, Small and fast GC-Mass spectroscopy.
- iii) **Liquid Chromatography:** High Performance Liquid Chromatography (HPLC), Size exclusion Chromatography, Ion exchange Chromatography, ion Chromatography.

UNIT-III:

13 Hrs

- i) **Partition chromatography:** Principles of Liquid-liquid partition chromatography, reversed phase partition chromatography, applications of extraction chromatography paper chromatography, techniques in paper chromatography, Ion-pair chromatography.
- ii) **Supercritical Fluid chromatography and Extraction:** Characteristics of supercritical fluid, mechanism of working of SFC, comparison with other chromatographic techniques, selection of super critical fluid for SFC, application of super critical fluid chromatography, super critical fluid extraction (SFE), selection of supercritical fluid for extraction, applications of super critical fluid extraction.

UNIT-IV:

13 Hrs

- iii) **Exclusion chromatography:** Gel permeation chromatography, applications of gel permeation chromatography, ion exclusion, mechanism of the ion exclusion process, merits and demerits of the ion exclusion techniques, applications of ion exclusion techniques, ion retardation inorganic molecular sieves.
- iv) **Electro chromatography:** Principles of electro chromatography, instrumentation, certain electro chromatography, applications of electro chromatography, reverse osmosis, electro dialysis.

BOOKS RECOMMENDED:

1. Analytical chemistry by G. D. Christian.
2. Basic concepts of Analytical Chemistry by S. M. Khopkar.
3. Fundamentals of analytical chemistry D.A.Skoog, D.M.west , holler and crouch 8th edition 2005 saunders college publishing new York.

GENERAL CHEMISTRY-III

Subject Code	CH-SCT 3.5.3	IA Marks	30
No. of Lecture Hrs./Week	04	Exam Hours	03
Total No. of Lecture Hours	52	Exam Marks	70

UNIT-I: 13Hrs

Body fluids: Composition and detection of abnormal level of certain constituents leading to diagnosis, sample collection and preservation of physiological fluids,

Blood: Estimation of glucose, cholesterol, urea, hemoglobin and bilirubin.

Enzymes: Biological significance, analysis and assay of enzymes (pepsin, tyrosinase), vitamins (thiamine, ascorbic acid, vitamin A) and hormones (progesterone, oxytocin, insulin), chemical, instrumental and biological assay to be discussed wherever necessary.

UNIT-II: 13Hrs

Automated systems: An over view, definition, distinction between automatic and automated systems, advantages disadvantages by automation, types automated techniques. Non-discrete techniques. Segmented flow methods and basic equipment, special techniques and devices, theoretical considerations and problems, applications. Single channel and multi channel auto analyser, BUN analysers, automatic glucose analysers and ammonia in water analyser, COD analyser, CFA in industry.

UNIT-III: 13Hrs

Food Analysis: Historical perspectives, objectives of food analysis. Sampling procedures. General methods for the determination of moisture, crude fibre and ash contents of foods. Analysis of foods for minerals-phosphorus, sodium, potassium and calcium. Food additives. Chemical preservatives-inorganic preservatives-sulphur dioxide and sulphites, their detection and determination. Organic preservatives- benzoic acid and benzoates, their detection and determination. Pesticide residues in foods.

UNIT-IV: 13Hrs

Radioanalytical methods:

Radioactive tracers, principles and applications, Isotopic dilution analysis-direct and inverse; special analytical applications and radiometric titrations. Neutron activation analysis: Principle, instrumentation, application and limitations.

Thermal methods:

Thermogravimetry- instrumentation, factors affecting thermogram, applications. Differential thermal analysis (DTA)-theories, Apparatus and applications. Differential scanning calorimeter (DSC)- introduction, instrumentation and applications.

BOOKS RECOMMENDED:

- 1) Pharmaceutical analysis. T. Higuchi and E.B.Hanssen., John-wiley and sons.
- 2) Quantitative analysis of drugs. P.D.Sethi, 3rd edition. CBS publishers delhi.
- 3) Practical clinical biochemistry methods and interpretations. R. Chatwal, J.P. Brothers medical publishers.
- 4) Laboratory manual in biochemistry. J. Jayaraman, New Age international
- 5) Pharmaceutical analysis. Modern methods- Part-A and B, edited by James W Munson
- 6) Hawks Physiological chemistry. Edited by B.L.Oser. 14th edition Tata-McGraw Hill.

CH OET-3.6 – BIO-CHEMISTRY

Subject Code	CH-OET 3.6	IA Marks	30
No. of Lecture Hrs./Week	04	Exam Hours	03
Total No. of Lecture Hours	52	Exam Marks	70

UNIT-I:

Chemical Constituents of Life:

13Hrs

Introduction, structure, classification, Functions, and Nomenclature of Biomolecules, Carbohydrates, Lipids, Proteins and Amino acids, Nucleic acids and nucleotides, Enzymes, Vitamins,

UNIT-II:

Clinical Biochemistry and Nutrition:

13Hrs

Hormones: Classification, mechanism of hormones action, Growth hormones, Biochemical functions, Thyroid hormones.

Organ Function Test: Liver function test, Kidney function test, Gastric function test, pancreatic function test. Water, Electrolytes and Acid-Base balance.

UNIT-III:

Basics to learn Biochemistry:

13Hrs

Introduction to Bioorganic chemistry: Introduction, Isomerism, Asymmetric Carbon, Optical activity, Configuration of chiral molecules.

Overview of Biophysical chemistry: Introduction, Structure of Water, Acids and Bases, Buffers, Solutions, Colloidal state, Diffusion, Osmosis, Viscosity, Surface Tension, Adsorption and isotopes.

UNIT-IV:

Tools of Biochemistry:

13Hrs

Introduction, Chromatography: Principle and classification, Electrophoresis: Types, Photometry-Colorimeter and Spectrophotometer.

Immunology:

Immune System, Complement system, Immune response, Cytokines, immunity in health and diseases.

Genetics:

Brief history and development of Genetics, Inheritance, Genetic Diseases in Humans.

BOOKS RECOMMENDED:

1. Biochemistry, By- U.Satyanarayana and U.Chakrapani, 3rd Edition, Books and Allied (P) Ltd.
2. Text book of Biochemistry, By-DM Vasudevan, Sreekumari S, Jaypee Brothers, Medical Publishers (P) LTD.

ANALYTICAL CHEMISTRY-IV

Subject Code	CH SCT 4.4.3	IA Marks	30
No. of Lecture Hrs./Week	04	Exam Hours	03
Total No. of Lecture Hours	52	Exam Marks	70

UNIT-I:

13Hrs

Air pollution, analysis and control:

Air pollution, analysis and control: Historical overview global implications of air pollution sources of pollutants, classification pollutants. Sources and effects of particulates, carbon monoxide sulphur oxides, nitrogen oxides hydrocarbons and photochemical oxidants on human health vegetation and material standards for air pollutants. Air quality monitoring: Sampling methods and devices for particulates and gaseous pollutants. SO₂: ambient air measurements and stack gas measurements turbid metric, colorimetric conductometric and volumetric methods. NO_x: Griess-olovay and Jacobs-hockheiser colorimetric methods, chemiluminiscent technique. CO: NDIR, amperometric, FID and catalytic oxidation methods. Hydrocarbons: total and individual hydrocarbons by gas chromatography. Air pollution control: Atmospheric cleaning processes, approaches to contaminant control detection and control at source.

UNIT-II:

13Hrs

Water pollution and analysis: Water resources, origin of wastewater, types of water pollutants of their sources and effects, chemical analysis for water pollution control objectives of analysis parameters of analysis sample collection and preservation. Measurement of color turbidity, total solids, acidity, alkalinity, hardness, chloride, residual chlorine, chlorine demand, sulphate, fluoride, phosphates and different forms of nitrogen in natural and in water/polluted waters, heavy metal pollution, measurement of DO, BOD, COD, TOD, and TOC, phenols, pesticides, surfactants tannin and lignin as water pollutants and their determination.

UNIT-III:

13Hrs

Waste water treatment: Waste water characteristics, effluent standards, terminology in waste water treatment. Treatment of domestic waste water – preliminary treatment. Primary treatment: sedimentation equalization neutralization Secondary treatment: Aerated lagoons, trickling filters, activated sludge process, oxidation ditch, oxidation pond and anaerobic digestion. Sludge treatment and disposal Tertiary treatment: Evaporation ion-exchange, adsorption electro dialysis electrolyte recovery and reverse osmosis. Advanced waste water treatment: Nutrient removal –nitrogen and phosphorous removal solid removal. Waste water disposal and reuse. Industrial waste water and its treatment 29

UNIT-IV:

13Hrs

Soil analysis: Inorganic and organic components of soil collection and preparation of soil samples for analysis. Measurements of soil pH and nitrogen nitrate nitrogen, nitrite nitrogen available phosphorus and sulphur, their determination. Analysis of soil for sodium, potassium, calcium and magnesium. Micronutrient elements and their analysis. Iron, molybdenum, copper, zinc, Pesticide residues in soil, their separation and determination soil pollution and control. Fuel analysis: Characteristics of fuels sampling proximate and ultimate analysis of coal and determination of

calorific value. Liquid fuels; determination flash point fire point aniline point kocking of petrol and diesel octance and cetenennumbers, carbon residue. Gaseous fuels-analysis of coal gas water gas producer gas, gobar gas and blast furnace gas. Calorific value, determination of Junkers gas calorimeter.

BOOKS RECOMMENDED:

1. Standard menthods of chemical analysis A.J.welher , Robert E.Kriengor publishing Co., USA 1975
2. Environmental chemistry S.E.Manahan, Willard grants press London
3. Envirnmental chemical analysis . Iain L Marr and Malconms cresses, blackie and son Ltd., London
4. Chemistry for environmental engineering chair N.Sawyer and perry L.M Canty McGraw Hill Book Co., New York
5. The air pollution hand book richardmabey, penguin
6. The pollution hand book Richardmabey penguin
7. Soil chemical analysis M.L.Jackson prentice hall of India Pvt,Ltd., New Delhi
8. Experiments in environmental chemistry P.D.Woweler D.W.counel pergamon press Oxford
9. Manual soil laboratrory testing vol-I K.H.Head,Pentech Press, London
10. A text book of environmental chemistry and pollution control S.S.Dara S.Chand and co,Ltd.New Delhi.
11. Instrumental methods for automatic air monitoring systems in air pollution control part-III edn, by W.stranss,John – wiley and sons , New York
12. Air pollution Vol-IIedn.A.C.Stern,Academic press new York
13. Analysis of air pollutions P.O.Warner,John wiley and sons, New York.
14. The chemical analysis air pollutants interscience New York
15. The analysis of air pollutats .W.Liethe ann Arbor Science pub Inc Michigan
16. Environmental chemistry A.K.De. New age international (p) Limited publishers

BOOKS RECOMMENDED:

1. Standard menthods of chemical analysis A.J.welher , Robert E.Kriengor publishing Co., USA 1975
2. Environmental chemistry S.E.Manahan, Willard grants press London
3. Envirnmental chemical analysis . Iain L Marr and Malconms cresses, blackie and son Ltd., London
4. Chemistry for environmental engineering chair N.Sawyer and perry L.M Canty McGraw Hill Book Co., New York
5. The air pollution hand book richardmabey, penguin
6. The pollution hand book Richardmabey penguin

3. Applied thermodynamics by R. K. Hegde, Niranjana Murthy.
 4. Engineering chemistry second edition by R. V. Gadag, A. Nityananda Shetty I. K. International publishing House Pvt.Ltd.

GENERAL CHEMISTRY-II

Subject Code	CH SCT 2.6.2	IA Marks	30
No. of Lecture Hrs./Week	04	Exam Hours	03
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UNIT 1:

Chemical Toxicology:

13Hrs

Toxic chemicals in the environment, impact of toxic chemicals on enzymes, biochemical effects of Arsenic, cadmium, lead, mercury, carbon monoxide, nitrogen oxides, sulphur dioxide, ozone and PAN, cyanide, pesticides, carcinogens, bio warfare agents, environment and public health, pollution and public health issues

UNIT 2:

Air Pollution:

13Hrs

Air pollutants (carbon monoxide, nitrogen oxides, hydrocarbons, sulphur dioxide, acid rain, particulates, and radioactivity), effects of atmospheric pollution, some air pollutant accidents, air quality standards, sampling, monitoring, instrumental techniques for air pollution.

UNIT 3:

Water Pollution:

13Hrs

Aquatic environment, water pollutants (organic pollutants, Pesticides, organochlorine insecticides, detergents, marine pollution, oil pollution), path ways of oil spill on marine environmental and Impact on the environment, Toxic organic chemicals, Inorganic pollutants, sediments, Radioactive materials, Thermal pollution, Coral-reef crisis, waste water treatment, Trace element in water, The River systems and Riverine environment, Arsenic contamination in ground water, water quality parameters.

UNIT 4:

Natural Resources, Energy and Environment:

13Hrs

Mineral Resource: Metals & Non-metals, Wood-a major renewable resources, Fuel & energy resources (Coal, Petroleum, Natural gas, Nuclear fission, Nuclear fusion, Solar energy, Hydrogen, Gasohol) World energy resources-Consumption and conservation, Environmental management

Books Recommended:

1. Environmental Chemistry by A .K. De, S5th Edition, New age International.
2. Environmental Chemistry- By, H.Kaur- Pragati Prakashan.
3. Environmental chemistry S.E.Manahan, Willard grants press London

THIRD SEMESTER

atomic absorption spectroscopy – Introduction, principle, flames ,Comparative study of the basic components and difference in the instrumental design for atomic absorption and flame photometry Principles of plasma spectroscopy process of atomization and excitation plasma as an excitation source, inductively coupled plasma source ICP-AES instrumentation application of plasma spectroscopy, comparison of ICP-AES with AES, comparison of AFS, AAS and ICP – AES. ➔

BOOK RECOMMENDED: 1. Basic concepts of analytical chemistry by S. M. Khopkar New Age International. 2. Principles of instrumental analysis D.S.Kooj. 3. Fundamentals of analytical chemistry-skoog & west holler 7th edition Harcourt agra publication harcourt publishers.

NANO SCIENCE AND ENGINEERING CHEMISTRY-II

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Total No. of Lecture Hours	52	Exam Marks	70

UNIT I:

Unique properties of Nanomaterials:

13Hrs

Microstructure and Defects in Nanocrystalline materials, effects of Nano-dimensions on material behavior.

Synthesis Routes:

Bottom-Up approach, Top-Down approach, Consolidation of Nanopowders.

UNIT II:

Applications of Nanomaterials:

13Hrs

Applications to Cosmetics and consumer Goods, Structure and Engineering, Automotive Industry, Water treatment and the environment, Nano-medical applications, Textiles, paints, energy, Defence and space applications, Structural applications.

UNIT III:

Electrochemical cells:

13Hrs

Introduction, electro chemical cells, galvanic cell, electromotive force of the cell, single electrode potential, Nernst equation, electrochemical conventions, electrochemical series, types of electrodes, reference electrodes, ion selective electrodes, concentration cells.

UNIT IV:

Metal Finishing:

13Hrs

Introduction, technological importance of metal finishing, electroplating, polarization, decomposition potential & overvoltage, theory electroplating, electroplating process, characteristics of a good deposit, methods of cleaning the metal surface to be coated, factors influencing the nature of deposit, requirements of an electrolyte solution for electroplating, applications of electroplating, electroplating of gold, Nickel, Copper.

Books Recommended:

1. Text book of Nanoscience and technology by B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday Universe press.
2. Chemistry for engineering students by B. S. Jai Prakash, R. Venugopal, Shiva Kumaraih, Pusphpa Jyrngar.

CHEMISTRY IN DAY TODAY LIFE

Subject Code	CH-OET 4.5	IA Marks	30
No. of Lecture Hrs./Week	04	Exam Hours	03
Total No. of Lecture Hours	52	Exam Marks	70

UNIT-I:

Environment:

13Hrs

Scope of Environmental Chemistry, Environmental pollution, Environmental segments, Vertical temperature, vertical structure of the atmosphere.

Biogeochemical cycles in the environment: Oxygen, Carbon, Nitrogen cycles. Biodistribution of elements.

UNIT-II:

Ozone Layer-The Earth's Protective Umbrella:

13Hrs

Creation of Ozone layer, mechanism of ozone formation and depletion, probing the ozone shield, ozone hole over Antarctica, Effects of ozone depletion.

Chlorofluro Carbon:Harmful effects of CFCs, remedial steps and control strategies.

UNIT-III:

Smog and Acid rain:

13Hrs

Sulphurous or London smog, Photochemical or Los Angeles smog, Mechanism of smog formation, Adverse effects of photochemical smog, Control of photochemical smog pollutants.

Introduction to Acid rain, Theories of acid rains, Adverse effects of acid rains, Control of acid rains.

UNIT-IV:

Green House effect and Global Warming:

13Hrs

Green house effect and Green house gases, Sources, earth's mechanism and global climate, and its causes.

Global warming and climate changes: Implications of climate change, consequences, Control measures of green house effect, El Nino and La Nina Phenomenon. Asian and Malasian brown clouds.

BOOKS RECOMMENDED:

1. Environmental Chemistry- By, H.Kaur- Pragati Prakashan.
2. Environmental chemistry S.E.Manahan, Willard grants press London

UNIT-IV:**13Hrs****Soil analysis:**

Inorganic and organic components of soil collection and preparation of soil samples for analysis. Measurements of soil pH and nitrogen nitrate nitrogen, nitrite nitrogen available phosphorus and sulphur, their determination. Analysis of soil for sodium potassium calcium and magnesium. Micronutrient elements and their analysis. Pesticide residues in soil, their separation and determination soil pollution and control.

Fuel analysis:

Characteristics of fuels sampling proximate and ultimate analysis of coal and determination of calorific value. Liquid fuels; determination flash point fire point aniline point kocking of petrol and diesel octance and cetenennumbers, carbon residue. Gaseous fuels-analysis of coal gas water gas producer gas, gobar gas and blast furnace gas. Calorific value, determination of Junkers gas calorimeter.

BOOKS RECOMMENDED:

1. Standard methods of chemical analysis A.J.welher , Robert E.Kriengor publishing Co., USA 1975
2. Environmental chemistry S.E.Manahan, Willard grants press London
3. Environmental chemical analysis . Iain L Marr and Malconms cresses, blackie and son Ltd., London
4. Chemistry for environmental engineering chair N.Sawyer and perry L.M Canty McGraw Hill Book Co., New York
5. The air pollution hand book richardmabey, penguin
6. The pollution hand book Richardmabey penguin
7. Soil chemical analysis M.L.Jackson prentice hall of India Pvt,Ltd., New Delhi
8. Experiments in environmental chemistry P.D.Woweler D.W.counel pergamon press Oxford
9. Manual soil laboratroy testing vol-I K.H.Head,Pentech Press, London
10. A text book of environmental chemistry and pollution control S.S.Dara S.Chand and co,Ltd.New Delhi.
11. Instrumental methods for automatic air monitoring systems in air pollution control part-III edn, by W.stranss,John – wiley and sons , New York
12. Air pollution Vol-IIedn.A.C.Stern,Academic press new York
13. Analysis of air pollutions P.O.Warner,John wiley and sons, New York.
14. The chemical analysis air pollutants interscience New York
15. The analysis of air pollutats .W.Liethe ann Arbor Science pub Inc Michigan
16. Environmental chemistry A.K.De.New age international (p) Limited publishers