

ETCH-105

ENGINEERING CHEMISTRY

UNIT I: WATER TECHNOLOGY

(8 lectures)

Introduction and specifications of water, Hardness and its determination (EDTA method only), Alkalinity, Boiler feed water, boiler problems – scale, sludge, priming & foaming: causes & prevention, Boiler problems – caustic embrittlement & corrosion : causes & prevention, Removal of silica & dissolved gases; carbonate & phosphate conditioning, Water softening processes : Lime – soda process, Ion exchange method, colloidal conditioning & calgon treatment , Water for domestic use.

UNIT II: FUELS

(8 lectures)

Classification, calorific value of fuel, (gross and net), Determination of calorific value of fuels, bomb calorimeter, Boy's Gas calorimeter, Solid fuels - Proximate and ultimate analysis, High & Low temperature carbonisation, manufacture of coke (Otto-Hoffmann oven), Liquid Fuels – Petroleum-Chemical composition, fractional distillation, Cracking - Thermal & catalytic cracking, Octane & Cetane No. and its significance, Power Alcohol, Analysis of flue gases (Orsat's apparatus).

UNIT III: GASEOUS STATE

(5 lectures)

Gas Laws and Kinetic Theory of gases, Distribution of molecular velocities, Mean free path, Real gases-non ideal behaviour, Causes of deviation from ideal behaviour, Vander Waal's equation, liquefaction of gases.

UNIT IV: THERMOCHEMISTRY

(2 lectures)

Hess's Law, Heat of Reaction, Heat of dilution, Heat of Hydration, Heat of neutralization and Heat of Combustion, Effect of temperature on heat of reaction at constant pressure (Kirchoff's equation), Flame Temperature

UNIT V: THE PHASE RULE

(3 lectures)

Definition of various terms, Gibb's Phase rule, Application of phase rule to one component system- The water system and sulphur system, Two component system- Lead-Silver, FeCl_3 - water, Na_2SO_4 – water.

UNIT VI: CATALYSIS

(4 lectures)

Characteristics, types and theories of catalysis, concept of promoters, inhibitors and poisons, Homogenous catalysis (mechanisms of acid-base and Enzyme), catalysis by metal salts, Heterogenous catalysis (mechanism of surface reactions).

REFERENCE BOOKS:

1. Chemistry in Engineering & Technology (Vol I & II) (Latest ed.), By J.C. Kuriacose & J. Rajaram
2. Principles of Physical Chemistry, (Latest ed.), Puri B.R., Sharma L.R. and Pathania, M.S.
3. Text book of Engg. Chemistry, S. Chand & Co., (Latest ed.), S.S. Dara.

UNIT-I: MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES

Definition, scope and importance, need for public awareness, introduction to concept of green technology. **(2 lectures)**

UNIT-II: ENVIRONMENTAL CONSERVATION AND MANAGEMENT**(7 lectures)**

Forest resources: Use and over-exploitation, deforestation, Timber extraction, mining, dams and their effects on forest and tribal people.

Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources.

Food resources: World food problems, changes caused by agriculture and over-grazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity.

Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources-green fuel.

Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Resource Management-Sustainable development.

UNIT-III: ENVIRONMENTAL POLLUTION & CONTROL**(7 lectures)**

Air Pollution - Types of pollutants, source, effects, sink & control of primary pollutants—CO, NO_x, HC, SO_x and particulates, effect of pollutants on man & environment: photochemical smog, acid rain and global warming, CO₂ Sequestration.

Water Pollution - Classification of Pollutants, their sources, waste water treatment (domestic and industrial).

Soil Pollution – Composition of soil, classification and effects of solid pollutants and their control.

Solid Waste Pollution – Classification, waste treatment and disposal methods; composting, sanitary land filling, thermal processes, recycling and reuse methods.

Hazardous wastes - Classification, radioactive, biomedical & chemical, treatment and disposal- Physical, chemical and biological processes.

Marine Pollution – Causes, effects and control of marine pollution, coastal zone management.

UNIT-IV: CHEMICAL TOXICOLOGY**(4 lectures)**

Toxic chemicals in the environment, Impact of toxic chemicals on enzymes, biochemical effects of arsenic, cadmium, lead, chromium, mercury, biochemical effects of pesticides.

Contd.

UNIT-V: ECO-FRIENDLY POLYMERS

(3 lectures)

Polymer synthesis, Environmental degradation of polymers, photodegradable polymers, hydrolysis and hydro-biodegradable polymers, biopolymers and bioplastics, thermal degradation of plastics during recycling.

UNIT-VI: ENVIRONMENTAL BIOTECHNOLOGY

(2 lectures)

Bioaccumulation, biodegradation, bioremediation, bioleaching, Biomethanation,

UNIT-VII: GREEN TECHNOLOGY

(3 lectures)

Introduction, Basic principles of green technology, concept of Atom economy, Tools of Green technology, zero waste technology.

UNIT-VIII: ENVIRONMENTAL MANAGEMENT SYSTEMS

(3 lectures)

Objectives, Components, Environmental Impact Assessment, Some important Environmental laws, Green bench, Carbon Credits, Environmental Management System standards-ISO 14000 series.

REFERENCE BOOKS:

1. Roger Perman et. al., Natural Resources & Environmental Economics, 2nd Ed., Longman, USA, 2000
2. Stern, A.C. (1980), Air Pollution, Vol. 1-VIII, Academic Press.
3. James M., Lynch & Alan Wiseman, Environmental Bio-monitoring : The Biotechnology Ecotoxicology Interface, Cambridge University Press, 1998.
4. John Glasson, Riki Therivel and Andrew Chadwick, Introduction to Environmental Impact Assessment, 2nd Ed., UCL Press, Philadelphia, USA, 1994.
5. Richard K. Morgan, Environmental Impact Assessment: A methodological perspective, Kluwer Academic Publications, Boston, 1998.
6. Gabriel Bitton, Wastewater Microbiology, 2nd Ed., Wiley-Liss, New York, 1999.
7. Environmental Chemistry & Pollution Control, S. Chand & Co. (Latest ed.), By S.S. Dara
8. Environmental Chemistry, I.K. Publishers, 2007, Balaram Pani
9. Environmental Chemistry, New Age Int. Publ. (Latest ed.), A.K. De.
10. Environmental Studies, S.K. Kataria Publ. . (Latest ed.), S.K. Dhamija.
11. A text book in Environmental Science, Narosa Publ. 2007, V. Subramanian.

1. Determine the percentage composition of sodium hydroxide in the given mixture of sodium hydroxide and sodium chloride.
2. Determine the amount of Oxalic acid and Sulphuric acid in one litre of solution, given standard sodium hydroxide and Potassium Permanganate.
3. Determine the amount of copper in the copper ore solution, provided hypo solution.
4. Argentometric titration one each by Vohlard's method and by Mohr's method.
5. Complexometric titrations.
6. Determine the heat of neutralization of strong acid with strong base.
7. Determine the surface tension of a liquid using drop weight method.
8. Determine viscosity of a given liquid (density to be determined).
9. Determine the reaction rate constant for the 1st order reaction.
10. Determine the cell constant of a conductivity cell and titration of strong acid/strong base conductometrically.

REFERENCE BOOKS:

1. Vogel's Textbook of Quantitative Chemical Analysis, Revised by G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denney.
2. Applied Chemistry: Theory and Practice by O.P. Vermani and A.K. Narula.
3. Laboratory Manual on Engg. Chemistry by S.K. Bhasin and Sudha Rani.