Course No: CH17001GE
Title: Chemistry of the Environment (02 Credits)

Max. Marks: *50* ***Duration:*** *32 Contact hours*
Ist Unit Exam: *25 marks* ***IInd Unit (Term end) Exam:*** *25 marks*

Unit-I Soil and Hydrosphere (16 Contact hours)

Soil: Nature and Composition of soil – Air, Water, Inorganic components, organic matter and humus. Acid – Base and Ion exchange reactions in soil.

Wastes and pollutants in soil: Chemical degradation, photochemical reactions and biodegradation. Desertification, Deforestation and soil erosion.

Hydrosphere: Chemical Composition of Water Bodies: Lakes & rivers, Factors determining composition (thermal stratification, acid-base, pE concept).

Aquatic pollution: Inorganic, Organic, Pesticide, Agricultural, Industrial and Sewage.

Water quality parameters: Dissolved oxygen, Metals, Content of Chloride, Phosphate, Nitrate, and Microorganisms. Water quality standards.

Analytical Methods for determining BOD, DO, COD, and choice of methods for determining metals (As, Cd, Hg, Pb & Se).

Purification and treatment of water: Chlorination, Ozonation, UV radiation.

Unit-II Atmosphere (16 Contact hours)

Chemical Composition of the Atmosphere: Particles, ions, radicals and their formation. Vertical profile of the atmosphere, Heat budget of earth's atmospheric system. Chemical and photochemical reactions in atmosphere, photochemical smog formation.

Oxides of N, C, S and their effects.

Ozone layer: Formation of ozone and mechanism of ozone depletion.

Pollution by chemicals: Chlorofluorocarbons, hydrocarbons and ozone.

Green house effect: Cause, source and impact on global climate.

Consequences of Green house effect and remedial measures.

Acid rain: Chemical aspects, adverse effects and control.

Books Recommended

1. Environmental Chemistry; 5th edn; Colin Baird; Freeman & Co; 2012.
2. Environmental Chemistry; 9th edn.S.E.Manahan; Lewis Publishers;2009
3. A Textbook of Environmental Chemistry; O.D.Tyagi & M.Mehra; Anmol Publishers; 1990.
4. Environmental Chemistry; A.K.De; Wiley Eastern; 1995.
5. Environmental pollution Analysis; S. M.Khopkar; Wiley Eastern.
6. Environmental pollution; B.K.Sharma & H.Kaur; Goel Publishcrs;1996.
7. Environmental Chemistry; Nigel. J.Bunce; Wurez Publishers; 1991.
8. Environmental Toxicology; Ed.Rose; Gordon & Breach Science Publishers.

Course No: CH17001OE
Title: Chemistry in Everyday Life (02 Credits)

Max. Marks: *50* ***Duration:*** *32 Contact hours*
Ist Unit Exam: *25 marks* ***IInd Unit (Term end) Exam:*** *25 marks*

Unit-I **(16 Contact hours)**

(a) Water- An Amazing Chemical Stuff

Molecular structure and its unique properties. Composition of natural water.
Hard and Soft water. Standards for drinking water. Major causes of water pollution. Methods of treatment of water for domestic purposes including Reverse Osmosis.

(b) Household Chemicals

Chemistry of Soaps, Detergents, Optical Brighteners and Bleaching agents, Shampoos, Conditioners , Dyes, Hair Curling and Permanents, Deodorants and Antiperspirants, Perfumes, Tooth Pastes and Sunscreen Lotions. Disinfectants and moth repellents.

Unit-II

(a) Polymers and Plastics **(16 Contact hours)**

Characteristics and Types of Polymers.
The big six of Polymer: Low Density Polyethylene (LDPE) , High Density Polyethylene (HDPE), Polypropylene PP), Polystyrene (PS), Polyvinyl Chloride (PVC) and Polyethylene - Tetra phthalate (PET or PETE)- their chemical characteristics and uses.

(b) Oil & Natural Gases

Composition & Chemical structures of Petroleum Products. Refining of Petroleum, Cracking & Catalytic Reforming. Octane & Cetane rating of fuels. Diesel engine fuel, Kerosene and Gasoline. Lead in Petrol: Its role, disadvantages & alternatives. LPG & CNG as fuel. Addition of mercaptanes to Natural gases for safety reasons.

Books Recommended

1. Principles of Modern Chemistry; 2nd edn; Oxtoby and Nachtrieb; Saunders College Publications; 1987.
2. Chemistry Fundamentals An Environmental Prospective; 2nd edn; Buell and Girad; Jones and Barlett; 2013.
3. www.chemistryincontext; (American Chemical Society)

Course No: CH17307GE
Title: Industrial Pollution and Green Chemistry (02 Credits)

Max. Marks: *50* ***Duration:*** *32 Contact hours*
Ist Unit Exam: *25 marks* ***IInd Unit (Term end) Exam:*** *25 marks*

Unit-I Industrial Pollution and Environmental Toxicology (16 Contact hours)

Industrial Pollution: Cement, Sugar, Drug, Paper and pulp. Thermal power plants, Nuclear power plants and Polymers.

Radio nuclide analysis: Disposal of wastes and their management.

Principles of Toxicology, Dose Response Relationship, risk assessment and management.

Organochlorine Compounds: Accumulation and fate in biological systems. Toxicology of PCBs. Dioxins and Furans, Health effects in humans.

Environmental Estrogens.

Unit-II Green Chemistry (16 Contact hours)

Introduction, Need for Green Chemistry and the role of chemists. Principles of Green Chemistry.

Tools of Green Chemistry: Selection of starting materials, Catalysts, Alternative Solvents, Appropriate reagents, Percentage atom utilization. Microwaves and Sonication.

Green Solvents and Reaction conditions: Supracritical fluids, aqueous reaction conditions, immobilized Solvents and irradiative reaction conditions.

Examples of Green materials, reagents and some specific reactions.

Books Recommended

I. Environmental Chemistry; 8th edn.; S. E. Manahan; CRC Press; 2005.
II. Chemistry of the Environment; IInd edn.; T. G. Spiro and W. M. Stigliani; Prentice Hall; 2002.
III. Environmental Chemistry; IInd edn.; Colin Baird; Freeman & Co.; 1991.
IV. Chemistry of the Environment; IInd Edn. R. A. Bailey; H. M. Clark; J. P. Ferris; S. Krause & R. L. Strong; Elsevier; 2005.
V. Environmental Chemistry; IInd edn.; Samir K. Banergi; Prentice- Hall; 2001.
VI. Green Chemistry- Environment Friendly Alternatives; Rashmi Sangh & M. M Srivastava; Narosa; 2007.
VII. Green Chemistry- An Introductory Text; IInd Edn.; Mike Lancaster; RSC; 2010.
VIII. Green Chemistry- Theory and Practice; P. T. Anastas and J. C. Warner; oxford; 2000.
IX. Green Chemistry; Ist Edn.; Samuel Delvin; IVY Publishing House; 2008.
X. Green Chemistry- Environmentally Benign Reactions; V. K. Ahluwalia; Ane Books; 2006.

Course No: CH17309OE
Title: Philosophy of Science (02 Credits)

Max. Marks: *50* ***Duration:*** *32 Contact hours*
Ist Unit Exam: *25 marks* ***IInd Unit (Term end) Exam:*** *25 marks*

Unit-I Representation (08 contact hours)

Laws of nature**:** Knowledge**, S**ources of knowledge, The rationalists, The empiricists, The Mathematical knowledge, Synthetic Knowledge, Science as knowledge source, Religion and science The Method of science, Induction versus deduction, Representation and reason, Probabilistic laws, Basic and derived laws,

Realism: Realism and its critics, Instrumentalism, Constructive empiricism, Laws and antirealism, Anti-realism and structure of science.

Unit-II Reason (08 contact hours)

Inductive Scepticism: Theory and observation, Dissolving the problem of Induction, Probability
and scientific inference, Kinds of Probability,

Inductive Knowledge: Reliabilist epistemology, reasoning with induction, Innate epistemic capacities and reasoning about induction, Internalism and justification.

Method and Progress: Methodology of scientific research programmes, Clinical trials and the scientific method, The content of discovery and the context of justification, Science without the scientific method, Method and the development of sciences, Paradigms and Progress.

Unit-III Classical Determinism and Probabilistic world (08 contact hours)

The Classical Mechanics: Mechanistic determinism, General principles; Action at a distance, Electric and magnetic forces, Failures of the classical mechanics;
Atomic structure, problem of radiation.

The birth of modern science**:** The photo-electric effect**,** The atomicity of radiation, Particle wave duality, waves of probability, Uncertainty principle, subject versus object, the fundamental laws of radioactivity, The new Quantum theory, wave mechanics, Diracs Quantum mechanics, The new philosophical principles, the probabilistic reasoning.

Unit-IV The Dawn of Modern Thinking (08 contact hours)

The arrow of Time: From Descarts to quantum theory, the relation of quantum theory to other natural sciences. Language and reality in modern science. The role of modern science in the present development of human thinking.

Books Recommended:

A. Philosophy of science; Alexander Bird; McGill-Queen's University Press.
B. Physics and Philosophy; W. Heisenberg; Harper Perennial Modern Classics.
C. Physics and Philosophy; Sir James Jeans; Cambridge University Press.
D. Reconstruction of religious thought in Islam; Muhammad Iqbal; Adam Publishers & Dodo Press.
E. Philosophy of natural science; Carl G. Hempel**;** Pearson.
F. The philosophy of science; David Papineaus; Oxford University Press.

G. Reality and Representation; David Papineaus; Blackwell Publication.
H. Belief, truth and knowledge; D.M. Armstrong; Cambridge University Press.
I. Modern epistemology; Nicholas Everitt and Alec Fisher; McGraw-Hill Higher Education.
J. The structure of scientific revolution; Thomas S. Kuhn; The University of Chicago Press

Course No: CH17419OE

Title: Food Chemistry (02 Credits)

Max. Marks: *50* ***Duration:*** *32 Contact hours*

Ist Unit Exam: *25 marks* ***IInd Unit (Term end) Exam:*** *25 marks*

Unit-I ***(16 Contact hours)***

(a) Food Components

Chemistry of different components of food: Composition and functions of Sugars, Polysaccharides, Lipids, Proteins, Vitamins and Minerals.

(b) The Chemistry of Food Colours and flavours

Introduction. Pigments in animal and plant tissues: Chlorophyll, Carotenoids, Anthocyanins and other Phenols. Natural and artificial food colorants.

Definition of flavor. Classification of food flavors. Chemical components responsible for the following: Sweetness, Saltiness, Sourness, Bitterness, Astringency, Pungency, Meatiness and Fruitiness. Synthetic flavouring.

Unit-II ***(16 Contact hours)***

(a) The Chemistry of Food Preservatives:

Introduction. Basis of Food Preservation. Food additives: Sodium Chloride, Nitrites, Smoke, SO_2, Benzoates and other Organic acids.

(b) The Undesirables in Food Stuff

Autooxidation and antioxidants. Modified atmosphere and vacuum packaging. Toxins of plant foods. Toxins of animal foods. Toxic agriculture residue Toxic metal residue. Toxins generated during heating and packaging of food. Environmental pollutants of food stuff.

Books Recommended

1. Food Chemistry; Owen R. Fennema; 3rd Ed.; Marcel Dekker, Inc. NY; 2005.
2. Food: The Chemistry of its components; T.P. Coultate; 3rd Ed.; RSC Paperbacks; 1996.
3. Food Flavours; Biology and Chemistry; Carolyn Fisher and Thomas R Scott; RSC Paperbacks; 1997.
4. Food Preservatives; H.J. Russell and G. W. Gould; 2nd ed.; Springer International Edition; 2005.