



Shri Vaishnav Vidhyapeeth Vishwavidhyalaya, Indore
B.Sc. Chemistry Honours

Semester-VI

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY		PRACTICAL		
							SEM University	Two Term	Practicals	SEM University	Practicals
BSHCH604(I)	DE	Effluent treatment and waste management	3	1	0	4	60	20	20	0	0

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; Q/A – Quiz/Assignment/Attendance, MST Mid Sem Test.

Teacher Assessment shall be based following components: Quiz/Assignment/Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives

1. To impart knowledge on sources and characteristics of various industrial wastes and strategies for its prevention and control.
2. To develop the understanding of industrial wastes various process.

Course Outcomes:-

The students completing the course will have

an insight into the pollution from major industries including the sources and characteristics of pollutants

- ability to plan minimization of industrial wastes
- ability to design facilities for the processing and reclamation of industrial waste water.

UNIT I : INTRODUCTION

Types of industries and industrial pollution – Characteristics of industrial wastes – Population equivalent – Bioassay studies – effects of industrial effluents on streams, sewer, land, sewage treatment plants and human health Environmental legislations related to prevention and control of industrial effluents and hazardous wastes

UNIT II : CLEANER PRODUCTION

Waste management Approach – Waste Audit – Volume and strength reduction – Material and process modifications – Recycle, reuse and byproduct recovery – Applications.

UNIT III : POLLUTION FROM MAJOR INDUSTRIES

Sources, Characteristics, waste treatment flow sheets for selected industries such as Textiles, Tanneries, Pharmaceuticals, Electroplating industries, Dairy, Sugar, Paper, distilleries, Steel plants, Refineries, fertilizer.

UNIT IV : TREATMENT TECHNOLOGIES

Equalisation – Neutralisation – Removal of suspended and dissolved organic solids – Chemical oxidation – Adsorption – Removal of dissolved inorganics – Combined treatment of industrial and municipal wastes – Residue management – Dewatering – Disposal

UNIT V : HAZARDOUS WASTE MANAGEMENT

Hazardous wastes – Physico chemical treatment – solidification – incineration – Secure land fills

REFERENCES:

- Rao M. N. & Dutta A. K. , “Wastewater Treatment”, Oxford – IBH Publication, 1995.
- Eckenfelder W.W. Jr., “Industrial Water Pollution Control”, McGraw Hill Book Company, New Delhi, 2000.
- Patwardhan. A.D., “Industrial Wastewater Treatment”, Prentice Hall of India, New Delhi 2010.
- Shen T.T., “Industrial Pollution Prevention”, Springer, 1999.
- Stephenson R.L. and Blackburn J.B., Jr., “Industrial Wastewater Systems Hand book”, Lewis Publisher, New York, 1998
- Freeman H.M., “Industrial Pollution Prevention Hand Book”, McGraw Hill Inc., New Delhi, 1995.
- Bishop, P.L., “Pollution Prevention: Fundamental & Practice”, McGraw Hill, 2000.
- Pandey, “Environmental Management” Vikas Publications, 2010.
- Industrial Wastewater Management, Treatment and Disposal”,(WEF – MOP – FD3) McGraw Hill, 2008.



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							THEORY		PRACTICAL		
							SEM University	Two Term	s Assessm	SEM University	s Assessm
BSHCH602	DC	Unit Operation in Chemicals Industry	3	1	0	4	60	20	20	0	0

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical;
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Paper-Unit Processes in Organic Chemistry Manufacture-II

Course Objectives

- 1.To give knowledge of Unit Processes in Organic Chemicals Manufacture.
- 2.To develop the understanding of various organic synthesized process.

Course Outcomes:-

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes. The student will

demonstrate capability of CO1. Theoretical understanding of Organic Chemicals Manufacture.

CO2. Became aware of various organic synthesized process.

UNIT-I Alkylation and Halogenation:

Alkylation: Introduction, types of alkylation, alkylating agents, mechanism of alkylation reactions, manufacture of phenyl ethyl alcohol.

Halogenation: Introduction, reagents for halogenations, halogenations of aromatics – side chain and nuclear halogenations, commercial manufacture of chlorobenzene, chloral.

UNIT-II Nitration and Sulphonation:

Nitration: Introduction, nitrating agents, mechanism and nitration of paraffin hydrocarbons - benzene to nitrobenzene, m-dinitrobenzene, chlorobenzene to o & p-nitrochlorobenzenes.

Sulphonation: Introduction, sulphonating agents, chemical and physical factors in sulphonation, mechanism of sulphonation, commercial sulphonation of benzene, naphthalene.

UNIT-III Oxidation and Hydrogenation:

Oxidation: Introduction, types of oxidation reactions, oxidizing agents, mechanism of oxidation, liquid phase oxidation and vapour phase oxidation, commercial manufacture of benzoic acid, acetic acid.

Hydrogenation: Introduction, catalysts for hydrogenation reactions, hydrogenation of vegetable oil, manufacture of methanol from carbon monoxide and hydrogen, catalytic reforming.

UNIT-IV Esterification and Hydrolysis:

Esterification: Introduction, esterification by organic acids, by addition of unsaturated compounds, esterification of carboxy acid derivatives, commercial manufacture of ethyl acetate.

Hydrolysis: Introduction, hydrolyzing agents, mechanism of hydrolysis.

UNIT-V Amination:

By reduction: Introduction, methods of reduction, metal and acid, catalytic sulfide, electrolytic, metal and alkali sulfites, metal hydrides, sodium metal, conc. Caustic oxidationreduction. Commercial manufacture of, m-nitroaniline, p-aminophenol.

By aminolysis: Introduction, aminating agents, factors affecting.

REFERENCES

P. H. Groggins: Unit Processes in Organic Synthesis (MGH).

F. A. Henglein: Chemical Technology (Pergamon).

M. G. Rao and M. Sittings: Outlines of Chemical Technology (EWP) .

Clausen, Mattson: Principles of Industrial Chemistry.

.H A. Lowenheim and M. K. Moran: Industrial Chemicals .

Kirk and Othmer: Encyclopedia of Chemical technology.

Kent, Riegel's Industrial Chemistry (N-R).

S. D. Shukla and G. N. Pandey: A Textbook of Chemical Technology, Vol-II

J. K Stille: Industrial Organic Chemistry (P.I I.).



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							THEORY		PRACTICAL		
							SEM University	Two Term	s Assessm	SEM University	s Assessm
BSHCH603	DC	Quantum Chemistry & Photochemistry	3	1	0	4	60	20	20	0	0

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; Q/A – Quiz/Assignment/Attendance, MST Mid Sem Test.

Teacher Assessment shall be based following components: Quiz/Assignment/Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives:-

- 1.To give basic knowledge of concept of quantum Chemistry and Photochemistry.
- 2.To develop the understanding of Quantum Chemistry and Photochemistry.

Course Outcomes:-

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes. The student will demonstrate capability of CO1. Theoretical understanding of concept concept of quantum mechanics CO2. Became aware of Quantum Chemistry and Photochemistry.

Unit I: Quantum Chemistry

Postulates of quantum mechanics, quantum mechanical operators, Schrödinger equation and its application to free particle and “particle-in-a-ox” (rigorous treatment).

Unit II: Quantum Chemistry

Quantization of energy levels, zero-point energy and Heisenberg Uncertainty principle; wave functions, probability distribution functions, nodal properties, Extension to two and three dimensional boxes, separation of variables, degeneracy.

Unit III: Quantum Chemistry

Qualitative treatment of simple harmonic oscillator model of vibrational motion: Setting up of Schrödinger equation and discussion of solution and wave functions. Vibrational energy of diatomic molecules and zero-point energy. Rigid rotator model of rotation of diatomic molecule.

Unit IV: Photochemistry

Laws of photochemistry: Grotthus-Draper law, Stark-Einstein law of photochemical equivalence and Lambert-Beer's law; quantum yield and its measurement for a photochemical process,

Unit V: Photochemistry

Actinometry. Photostationary state. Photosensitized reactions. Kinetics of HI decomposition, H_2 - Br_2 reaction, dimerisation of anthracene.

REFERENCES

1. Elementary Quantum Chemistry by F. L. Pilar, Dover Publications, Inc. NY, 1990. 2nd Ed.
2. Molecular Quantum Mechanics by P. W. Atkins and R. S. Friedman, 3rd Ed., Oxford Univ. Press, 1997.
3. Quantum Chemistry by Ira N. Levine, Prentice Hall,
4. Introduction to Quantum Chemistry by A. K. Chandra, Tata McGraw Hill.

5. Carey F.A., and Sundberg, R.J., Advanced Organic Chemistry, Part B: Reactions and synthesis, 5th edition, 2007.
6. Fleming, Pericyclic Reactions, Oxford University Press, Oxford, 1999.
7. Mukherjee, S.M. and Singh, S.P., Pericyclic Reactions, MacMillan India, New Delhi.
8. Sankararaman, S., Pericyclic Reactions -Applications and Theory, Wiley –VCH, 2005.



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Semester-VI (Elective-A)

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY		PRACTICAL		
							SEM University	Two Term	s Assessm	SEM University	s Assessm
BSHCH604(III)	DE	Current Trends in Organic Synthesis	3	1	0	4	60	20	20	0	0

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; Q/A – Quiz/Assignment/Attendance, MST Mid Sem Test.

Teacher Assessment shall be based following components: Quiz/Assignment/Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives

- 1.To give knowledge of Current Trends in Organic Synthesis.
- 2.To develop the understanding of various organic synthesized process.

Course Outcomes:-

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes. The student will demonstrate capability of CO1. Theoretical understanding of current trends

in Organic synthesis .CO₂. Became aware of various organic synthesized process.

Unit-I Addition to carbon-carbon multiple bond:

Mechanistic and stereochemical aspects of addition reaction involving electrophiles, nucleophiles and free radicals, regio and chemoselectivity, Orientation and stereochemistry,

Unit-II Addition to carbon-hetero atom multiple bond:

Addition to cyclopropanes, Hydrogenation of double bond and triple bonds. Hydrogenation of aromatic rings, hydroboration, Michael reaction, Mechanism of metal hydride reduction of saturated and unsaturated carbonyl compounds, acids, esters, and nitriles, Addition of Grignard reagents, organozinc and organolithium reagents to carbonyls and unsaturated carbonyl compounds,

Unit-III Mechanism of molecular rearrangement-I:

Classification and General mechanistic treatment of electrophilic, nucleophilic and free radical molecular rearrangement. Mechanism of the following rearrangement –Wagner-Meerwin, Pinacol-Pinacolone, benzil-benzilic acid, Favorski, Wolff, Arndt-Eistert synthesis, Curtius Lossen, Beckman, Hoffman, Schmidt rearrangement.Elimination reactions:.

Unit IV: Mechanism of molecular rearrangement-II:

The E1, E2 and E1cB mechanisms and orientation of the double bond, Saytzeff and Hoffman's rule, Effect of substrate structure, attacking base, leaving group and medium, Mechanism and orientation in pyrolytic elimination Free radical reactions: Generation of free radicals, Type of free radical reactions, free radical substitution mechanism at an aromatic substrate, aliphatic substrate,

Unit V: Synthesis involving basic principles of green chemistry:

Neighbouring group assistance, reactivity for aliphatic and aromatic substrates, reactivity in attacking radicals, effect of solvent on reactivity. Halogenation at an alkyl carbon, allylic carbon (NBS), hydroxylation at an aromatic carbon by means of Fenton's reagent. Auto-oxidation, chlorosulphonation (Reed Reaction) Coupling of alkynes and arylation of aromatic compounds by diazonium salts, Sandmeyer reaction.

Text books

- 1] A Textbook of organic chemistry -R.K. Bansal
- 2] New trends in green chemistry –V.K. Ahluwalia and M. Kidwai, Anamaya publishers New Delhi
- 3] Heterocyclic Chemistry, John Joule, Oxford University Press
- 4] New trends in green chemistry –V.K. Ahluwalia and M. Kidwai, Anamaya publishers New Delhi
- 5] Heterocyclic Chemistry, John Joule, Oxford University press.



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Semester-VI (Elective-B)

COURSE CODE	CATEGORY	COURSE NAME	L	T	P	CREDITS	TEACHING & EVALUATION SCHEME				
							THEORY		PRACTICAL		
							SEM University	Two Term	Assessments	SEM University	Assessments
BSHCH604(II)	DE	Environmental Chemistry	3	1	0	4	60	20	20	0	0

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit; Q/A – Quiz/Assignment/Attendance, MST Mid Sem Test.

Teacher Assessment shall be based following components: Quiz/Assignment/Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objectives

- 1.To give knowledge of Environmental Chemistry.
- 2.To develop the understanding of various process.

Course Outcomes:-After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes. The student will demonstrate capability of CO1. Theoretical understanding of Environmental chemistry.

ENVIRONMENTAL CHEMISTRY

UNIT-I

Environmental segments, evolution of earth's atmosphere. Air pollution : Air pollutants, prevention and control, Green house gases and acid rain. Carbon monoxide, industrial sources and transportation sources. SO_x- sources, ambient concentration, test methods, control techniques - scrubbing, , limestone injection process.

UNIT-II

Ozone hole and CFC's. Photochemical smog and PAN. NO_x - Sources, ambient concentration, test methods, thermodynamics and NO_x, control techniques.

Particulates : Size distribution, , particulate collection - settling chambers, centrifugal separators, wet scrubbers, electrostatic precipitators & fabric filters. Catalytic converters for mobile sources. Bhopal gas tragedy.

UNIT-III

Hydrologic cycle, sources, chemistry of sea water, criteria and standards of water quality- safe drinking water, maximum contamination levels of inorganic and organic chemicals, radiological contaminants, turbidity, microbial contaminants.

Public health significance and measurement of colour, turbidity, total solids, acidity, alkalinity, hardness, chloride, residual chlorine, sulphate, fluoride, phosphate and different forms of nitrogen in natural and polluted water. Chemical sources of taste and odour, treatment for their removal, sampling and monitoring techniques.

UNIT-IV

Determination and significance of DO, BOD ,COD and TOC. Water purification for drinking and industrial purposes, disinfection techniques, demineralization, desalination processes and reverse osmosis .

UNIT – III

Toxic chemicals in the environment, impact of toxic chemicals on enzymes.

Detergents- pollution aspects, eutrophication. Pesticides- pollution of surface water. Sewage and industrial effluent treatment, heavy metal pollution. Chemical speciation- biochemical effects of pesticides, insecticides, particulates, heavy metals (Hg, As, Pb, Se), carbon monoxide, nitrogen oxides, sulphur oxides, hydrocarbon, particulates, ozone, cyanide and PAN. Solid pollutants and its treatment and disposal. Radioactive waste management.

REFERENCES :

1. A.K. De : Environmental Chemistry, (Wiley Eastern).
2. S.K.Banerji : Environmental Chemistry, (Prentice Hall India), 1993.
- 3 S.D. Faust and O.M. Aly : Chemistry of Water Treatment, (Butterworths),1983.
4. Sawyer and McCarty, Chemistry for Environmental Engineering(McGraw Hill) 1978
5. I.Williams, Environmental Chemistry, John Wiley, 2001
6. S.M.Khopkar, Environmental Pollution Analysis, (Wiley Eastern).

