

Sant Gadge Baba Amravati University Amravati
Syllabus Prescribed for Three Years UG Program
Program B.Sc. with Industrial Chemistry
Semester 3
3S Industrial Chemistry (Regular/Vocational)
Unit Processes and Process Equipments

Total Lectures: 84

Marks :80

Code of the Course/Subject	Title of the Course/Subject	(Total Number of Periods)
INC (3S) T	Industrial Chemistry 3S	84

COs

By the end of the course, the student will be able to:

1. Differentiate between Batch wise and Continuous Industrial Processes.
2. Identify various nitrating agents, Sulphonating agents, Halogenating agents, Oxidizing agents, and their activities,
3. Compare Various organic Processes.
4. Identify uses and mechanism of various industrial equipments.
5. Aware about hazards of Biomedical waste and its management
6. Apply basic concepts to prevent corrosion.

Unit	Content
Unit I	<p>A) Nitration: Introduction, nitrating agents, nitration of i) Benzene to nitrobenzene and m-dinitrobenzene. ii) Chlorobenzene to <i>o</i> and <i>p</i>-nitro-chlorobenzenes iii) Acetanilide to p-nitro-acetanilide. Continuous and batch nitration.</p> <p>B) Amination by Reduction: Introduction, methods of reduction, Bechamp Reduction (Iron and Acid Reduction), sulphide reduction, alkali sulphite reduction, metal hydrides, cathodic reduction. Factors affecting amination. Manufacturing of aniline, m-nitroaniline, p-amino phenol.</p> <p>C) Alkylation: Introduction, alkylating agents, mechanism of alkylation. Manufacturing of alkylbenzene, ethylbenzene. (14 Periods)</p>
Unit II	<p>A) Sulphonation: Introduction, sulphonating agents, factors affecting sulphonation. Sulphonation of benzene, naphthalen. Batch and Continuous sulphonation.</p> <p>B) Halogenation: Introduction, halogenating agents, nuclear and side chain aromatic halogenation. Manufacturing of chlorobenzene, chloral, mono-chloro acetic acid.</p> <p>C) Hydrolysis: Introduction, mechanism and thermodynamics of hydrolysis, various hydrolyzing agents. (14 Periods)</p>

<p>Unit III</p>	<p>A) Oxidation: Introduction, various hydrolyzing agents, types of oxidative reactions, mechanism of oxidation, liquid and vapour phase oxidation. Manufacturing of benzoic acid, acetaldehyde and acetic acid.</p> <p>B) Hydrogenation: Introduction, various catalysts used for hydrogenation, Manufacturing of methanol from carbon-monoxide and hydrogen, hydrogenation of vegetable oil.</p> <p>C) Esterification: Introduction, esterification of organic acids using unsaturated compounds. Manufacturing of ethyl acetate, vinyl acetate, cellulose acetate.</p> <p style="text-align: right;">(14 Periods)</p>
<p>Unit IV</p>	<p>Process Equipments</p> <p>A) Thermometer: Glass, bimetallic, pressure spring, resistance and radiation pyrometer.</p> <p>B) Pressure: Manometer, barometer, pressure gauge, diaphragm, McLeod and Pirani gauge.</p> <p>C) Liquid level: Direct and indirect liquid level measurement, float type liquid level gauge, ultrasonic level gauge, and bell type liquid level gauge.</p> <p style="text-align: right;">(14 Periods)</p>
<p>Unit V</p>	<p>A) Corrosion: Introduction, types of corrosion (galvanic, open air, underwater & underground). Mechanism of corrosion. Factors affecting corrosion.</p> <ul style="list-style-type: none"> • Passivity: Introduction, chemical and mechanical passivity, oxide film • Theory of passivity. <p>B) Methods adopted for preventing corrosion (metal coating processes):</p> <ol style="list-style-type: none"> i) Galvanizations of iron (ii) Electroplating (iii) Painting (iv) Plastic coating <p>Corrosion inhibitor.</p> <p>C) Oil Paints and Varnishes: Introduction, manufacture and their applications in preventing Corrosion.</p> <p style="text-align: right;">(14 Periods)</p>
<p>Unit VI</p>	<p>A) Industrial solid waste and Treatment processes</p> <p>Introductions, types of solid wastes, methods of industrial solid waste treatment & disposal.</p> <ol style="list-style-type: none"> i) Composting, ii) Sanitary Landfills, iii) Thermal process (Incineration & pyrolysis) iv) Recycling & reuse. <p>B) Hazards waste: Types, radioactive waste, biomedical waste and non-radioactive waste containing toxic and heavy metals. Methods of their disposal.</p> <p style="text-align: right;">(14 Periods)</p>

<p>*SEM-III</p> <ol style="list-style-type: none"> 1.To prepare comparative chart for Batch and Continuous Industrial Operations. 2.To prepare model for Biomedical Waste Management. 3.To Prepare chart of any organic Process. 	
<p>COs:</p> <p>By the end of this module, student will be able to:</p> <ol style="list-style-type: none"> 1. Understand Waste Management Processes 2. Understand Industrial Processes. 3. Flow-sheet diagram analysis. 	
<p>**Activities</p>	<p>Class tests, assignments, Flow diagram of processes, Project, Survey, Group discussion, Industrial visit, or any other innovative pedagogical method. Any two activities be conducted from above. Class tests are compulsory. Equal weightage for each activity.</p>

Course Material/Learning Resources

Text books:

- 1.Environmental Chemistry –S.S.Dara
- 2.Environmental Chemistry-A.K.De
- 3.Environmental Chemistry-Tyagi & Mehara
- 4.Industrial Chemistry–B.K.Sharma
- 5.Environmental Chemistry-S.S.Dara
- 5.Environmental Chemistry-Shashi Chawala, Dhanpat Rai co.
- 6.Process instrumentation & control-A.P. Kulkarni

Reference Books:

- 1.Industrial Chemistry–D.P.Eckman, Jon-Wiley & Sons.
- 2.Instrumentation and Control for the process Industries–S.Sorer, Elsevier applied Science.
- 3.Unit processes in Organic Synthesis–P.H.Groggins.
- 4.Industrial Organic Chemistry-Peter Weismann (Elsevier publication)

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Syllabus Prescribed for Three Years UG Program
Program: B.Sc. with Industrial Chemistry
Semester 3
3S Industrial Chemistry (Regular/Vocational)

Code of the Course/Subject	Title of the Course/Subject	Number of Lectures/Week
INC (3S) PR	Industrial Chemistry 3S	06

COs:

By the end of the laboratory/Practical Course students will able to

1. Estimate the component gravimetrically.
2. Synthesis various organic Compounds.
3. Understand the various organic processes.
4. Understand the mechanism of the organic processes.

List of Practical

Sr. No.	Exercise 1
1	Preparation of Benzoic acid from Benzaldehyde by Oxidation Method.
2	Preparation of Benzoic acid from Benzamide by Hydrolysis Method.
3	Preparation of m-nitroaniline from m-di-nitrobenzene. (Reduction Method).
4	Preparation of Iodoform from Ethanol.
5	Preparation of p- bromo acetanilide from Acetanilide by Halogenation Method.
6	Preparation of Sulphanic acid from Aniline by Sulphonation Process.
7	Preparation of p-nitro acetanilide from Acetanilide by Nitration Method.

Sr. No.	Exercise 2
1	Preparation of m-di-nitro benzene from Benzene by Nitration Method.
2	Preparation of Acetanilide from Aniline.
3	Preparation of Acetyl salicylic acid (aspirin) from Salicylic acid.
4	Preparation of Nitrobenzene from Benzene.
5	Determination of free Chlorine in Water sample.
6	Determination of permanent hardness by alkali mixture (NaOH + Na ₂ CO ₃) method.
7	Determination of Iron in water sample by colorimetry.

Distribution of Marks for Practical Examination

Time: 04 hours (One Day Examination)

Total Practical Marks 50, Duration of Exam 04 Hours	
Internal Practical Exam (25 Marks)	External Practical Exam (25 Marks)
Attendance, Students Performance, Acctivity, Practical Record Book /Laboratory Manual/Journal Report : 20 Internal Viva/Assignment / Quiz/Test : 05	Experiment 1 Performance/Demonstration : 10 Experiment 2 Performance/Demonstration : 10 External Viva (by External and Internal Examiner) : 05
Total : 25	Total : 25

Sant Gadge Baba Amravati University Amravati
Syllabus Prescribed for Three Years UG Program
Program B.Sc. with Industrial Chemistry
Semester 4
4S Industrial Chemistry (Regular/Vocational)
Material Science and Industrial Pollution

Total Lectures :84

Marks :80

Code of the Course/Subject	Title of the Course/Subject	Total number of Lectures
INC (4S) T	Industrial Chemistry 4S	84

COs

By the end of course, student will be able to:

1. Understand the industrial processes of manufacturing of ceramics, glass and refractories.
2. Understand the mechanism of setting and hardening of cement.
3. Compare various industrial polymers and their industrial uses.
4. Identify various sources of water pollution and its prevention.
5. Find out root causes air pollution its prevention

Unit	Content
Unit I	<p>A) Ceramics: Introduction, Types, raw materials, manufacturing processes. Properties and applications.</p> <p>B) Refractories: Introduction, classification, manufacture, properties and applications of fire clay bricks, and high alumina bricks.</p> <p>C) Glasses: Introduction, types, compositions, manufacturing process. Properties and applications.</p> <p style="text-align: right;">(14Periods)</p>
Unit II	<p>Cement : Introduction, types of cement, raw materials, manufacturing processes:- Wet, dry and semi-dry process. Setting and hardening of cement. Properties of cement. Specifications and testing of cement (tensile, compression, fineness, specific gravity). Additives for cement. Major engineering problems in cement manufacturing.</p> <p style="text-align: right;">(14 Periods)</p>
Unit III	<p>Polymers: Introduction, classification (Natural, artificial, inorganic, organic, thermo-setting, thermo-plastic). Classification of polymerization processes (addition and condensation polymerization without mechanism).</p> <p>Manufacturing processes, properties and applications of:-polyethylene, polystyrene, polyvinyl chloride (PVC), polyester (PET), nylon, teflon, phenol, phenol formaldehyde and urea formaldehyde resins.</p> <p style="text-align: right;">(14 Periods)</p>

<p>Unit IV</p>	<p>Water pollution due to Industrial Effluents</p> <p>A) Classification of water: Sea water, surface water (river, lake, pond) and ground water (well, tube-well, stream); their properties in brief.</p> <p>B) Water quality parameters: pH, hardness, alkalinity, acidity, TDS, DO, COD, BOD. IS and WHO standards of water quality.</p> <p>C) Inorganic Pollutants: Heavy metals, Pb, Hg, As, Cd, Cr, Ni, Cu, mineral acids, alkalis and their sources (inorganic based industries)</p> <p>D) Organic Pollutants: Phenols, detergents, dyes, plastics, oils, greases etc. and their sources (organic based industries). Effects of these pollutants on water quality. Water pollution due to paper and sugar industries. (14 Periods)</p>
<p>Unit V</p>	<p>Water and Waste Water Treatment</p> <p>Water Treatment: Methods for water treatment-Sedimentation, filtration, coagulation and sterilization.</p> <p>A) Waste Water Treatment: Industrial and sewage water treatments: Primary, secondary and tertiary treatment.</p> <p>B) Biological Methods: Aerobic, anaerobic, trickling Filter and activated sludge.</p> <p>C) Chemical Methods For Inorganic Chemicals-Precipitation, electrolysis, ion-exchange, evaporation and adsorption. (14 Periods)</p>
<p>Unit VI</p>	<p>A) Air Pollution due to Industries</p> <p>Classification of Air Pollutants: Primary and secondary pollutants e.g. oxides of carbon, sulphur, nitrogen, hydrocarbon and particulates.</p> <p>B) Industries as Source of Air Pollution: Steel Industries, Fertilizer Industries, Thermal Power Plants, Refineries, paper and pulp industries, metallurgical and mining operations.</p> <p>C) Methods of Control of Air Pollution: Electrostatic precipitators, scrubbing, filters mist eliminator. Harmful Effects of Air Pollutants on human being, plants and materials. Green House Effect (Global Warming).</p> <p>D) Air Pollution Monitoring: Methods of collection of air samples, SPM and determination of air pollutants like SO₂, NO_x, and solid particulate matter (SPM). Sources of noise pollution, units of noise level and control. (14 Periods)</p>
<p>*SEM- IV</p> <ol style="list-style-type: none"> 1. To prepare flow chart for manufacturing of Cement/Glass/Ceramics. 2. To prepare model for Industrial waste management. 3. To prepare chart for water quality parameter as per Indian Standard. 	
<p>COs:</p> <p>By the end of this module student will be able to:</p> <ol style="list-style-type: none"> 1. Understand Industrial Waste Management 2. Find out the Sources of Industrial Waste. 3. Apply Knowledge to find out Engineering Problems in Manufacturing Processes. 	

**Activities	Class tests, assignments, Flow diagram of processes, Project, Survey, Group discussion, Industrial visit or any other innovative pedagogical method. Any two activities be conducted from above. Class tests are compulsory. Equal weightage for each activity.
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Course Material/Learning Resources

Text Books:

- 1) Engineering Materials– Rangwala
- 2) Material Science and Metallurgy–O.P. Khanna
- 3) A Text Book of Engineering Chemistry–S.S. Dara, S. Chand and Co.
- 4) Industrial Chemistry–B.K. Sharma
- 5) Dryden’s Outline of Chemical Technology – M. Gopalrao and Marshall Sittig
- 6) Environmental Chemistry–S.S. Dara, S. Chand and Co.
- 7) Environmental Chemistry–Moor and Moor
- 8) Pollution Monitoring and Control–Dr. Priyaranjan Trivedi

Reference Books:

- 1) Unit Process in Organic Synthesis–P.H. Groggins
- 2) A Text Book of Engineering Chemistry–Shashi Chawala, Dhanpat Rai and Co.
- 3) Systems Approach to Air pollution Control –R.J. Bibbero and J.G. Young
- 4) Air Pollution Vol.I-IV–A.C. Stern
- 5) NEERI Manual.
- 6) A Text Book of Environmental Chemistry O.D. Tyagi and M. Mehara, Anmol Publication Pvt. Ltd.

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Semester 4
4S Industrial Chemistry (Regular/Vocational)

Code of the Course/Subject	Title of the Course/Subject	Number of Lectures/Week
INC (4S) PR	Industrial Chemistry 4S	06

COs:

By the end of the laboratory/Practical Course students will able to

1. Apply basic concepts to determine temporary hardness of water.
2. Estimate component gravimetrically.
3. To prepare various polymers.

4S Industrial Chemistry Practical

List of Experiments

Sr. No.	Exercise 1
1	To determine temporary and permanent hardness of water sample.
2	To determine total dissolved solids, (TDS) of water sample.
3	To determine acidity of water sample.
4	To determine Calcium in Dolomite.
5	To find out dissolved oxygen (DO) of given water sample.
6	To find biological oxygen demand (BOD) of given water sample.
7	To find out chemical oxygen demand (COD) of given water sample.

Sr. No.	Exercise 2
1	To determine SiO ₂ in cement by gravimetric method.
2	To determine Fe in cement gravimetrically.
3	Determination of SO ₂ in air sample by colorimetry.
4	Determination of SPM in a sample using high volume sampler.
5	Determination of Acid value of a Plastic material.
6	Preparation of Urea formaldehyde Resin.
7	Preparation of Phenol Formaldehyde Resin.

Distribution of Marks for Practical Examination

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Total : 25	Total : 25