

**SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED**

Revised Syllabus of B.Sc. III Year **Industrial Chemistry**  
(Effective from the Academic Year 2010-2011)  
i.e. Since June 2010 & onwards

**B.Sc. III Year Industrial Chemistry**  
(Three Year Degree Course) Year 2010-2011

<b>Year</b>	<b>Paper</b>	<b>Course Name</b>	<b>Periods</b>	<b>Marks</b>
B. Sc. III	VIII	Unit Processes in Organic, Inorganic Synthesis & Industrial Safety	80	100
	IX	Process Equipment Design, Process Instrumentation & Palant Utilities.	80	100
	X	Laboratory Course	120	100
	XI	Laboratory Course	120	100

**B. Sc. Third Year**  
**Paper – VIII [CHIC-301]**  
**Industrial Chemistry**  
**Unit Processes in Organic, Inorganic Synthesis & Industrial Safety**

Periods: 80

Marks: 100

- A. Unit Processes In Organic Synthesis :** (35 hours)
1. **Nitration** :  
Introduction, Nitrating Agents, Aromatic Nitration, Kinetics & Mechanism of Aromatic Nitration, Nitration of Paraffinic hydrocarbons, Nitrate Esters, N-Nitro Compounds, Process Equipment for Technical Nitration, Batch Nitration, Continuous Nitration, Mixed acid compositions, DVS calculations, Typical Industrial Nitration Process- Preparation of Nitrobenzene, Preparation of m-dinitrobenzene
  2. **Amination by Reduction** :  
Introduction & Definitions, Methods of Reduction, Iron & Acid (Bechamp) Reduction-Reaction Mechanism, Chemical & Physical factors, Physical condition of Iron, Amount of water used, Amount of Acid used, Effect of Agitation, Reaction Temperature, Addition of Solvents, Yields of amine. Equipment-Materials of Aniline & Recovery of Aniline, Distillation of Aniline.
  3. **Halogenation** :  
Introduction, Chlorination, Bromination, Fluorination, Iodination.
  4. **Sulfonation & Sulfation** :  
Introduction, Sulfonating & Sulfating agents, Sulfonation of Aromatic compounds, Benzene & its derivatives, Naphthalene & its derivatives, Anthraquinone & its derivatives.
  5. **Polymerization** :  
Introduction, Functionality, Polymerization Reactions, Polycondensation, Addition Polymerization, Free radical polymerization, Ionic Polymerization, Bulk Polymerization, Solution Polymerization, Emulsion Polymerization, Suspension Polymerization.
- B. Unit Process in Inorganic synthesis :** (20 Hours)
1. Industrial Process of Sulfur & Sulfuric acid
  2. Nitrogen Industries : Ammonia, Nitric acid & Urea
  3. Polymer Manufacturing Process :
    1. Polyethylene & Polypropylene
    2. Polyvinyl Chloride
    3. Phenol Formaldehyde
    4. Epoxy Polymers
    5. Butadiene-Styrene Copolymer
- C. Industrial Safety :** (25 Hours)
1. **Introduction :-** Definition & terms used in context of safety, Accident- Non-reportable accidents. Hazard, Risk, Acceptance Physical factors for Accidents- Accident ratio, Safety Training, Role of Supervisor in achieving a high standard of Safety,

Supervisory Training, Motivation for safety-Safety Suggestion Scheme, Safety Committee, Safety Competition-Safety Contests, Safety Drives, Safety Exhibition & Poster.

2. **Fire & Explosion :-** The Chemistry of Fire, Fire triangle, Classification of Fire, Stages of Fire, Causes of Industrial Fire-Electrical Equipment, Smoking, Mechanical Fault, Welding & Gas Cutting, Sparks, Explosives Dusts, Static spark, Runaway Chemical Reaction, Fire Extinguishers-Fixed Fire fighting system. Portable fire Extinguishers-Soda acid type, Dry Chemical Powder type, Carbon dioxide type & Foam type Extinguisher.
3. **Personal Protective Equipment :-** Hand Protection, Foot Protection, Head Protection, Eye Protection, Face Protection, Skin & Body Protection, Protection against Fall, Noise Protection, Respiratory Protection-Care & Precaution, External air supply type & Self-Contained Breathing apparatus (SCBA), Selection of Personal protective equipment.

**Reference Books :**

1. Unit Process in Organic Synthesis – P.H.Groggins.
2. Dryden's Outlines of Chemical Technology – M.Gopal
3. Chemical Process – Srreva
4. Industrial Chemistry – B.K.Sharma
5. Polymer Chemistry – Gowarikar
6. Polymer Chemistry – Billmyer
7. Introduction to Industrial Safety – K.T.Kulkarni (2002) Or Concept & Practices in Industrial Safety – K.T.Kulkarni (2007)
8. Handbook of Fire Technology – Gupta R.S. Orient Longman Publication (1993)
9. Hazards in Chemical Units – Pandya C.L. (Oxford ISH – 1991)

**B. Sc. Third Year**  
**Paper – IX [CHIC-302]**  
**Industrial Chemistry**  
**Process Equipment Design, Process Instrumentation & Plant Utilities**

**Periods: 80**

**Marks: 100**

**A. Process Equipment Design**

**Hours : 25**

1. Distillation & Fractionating Equipment :  
Introduction, Types Coloumn, Stresses in column Shell, Determination of Shell thickness, Determination height "X", Allowable deflection, Coloumn Internal details, Equilibrium stage coloumn, Defferential Column.
2. Agitators :  
Types of Agitators, Baffling.
3. Reaction Vessel :  
Introduction, Materials of Construction, Classification of Reaction Vessels, Heating Systems, Design Considerations.
4. Corrossion :  
Forms of Corrosion, Factors influencing corrosion, Factors preventing corrosion.

**B. Process Instrumentation**

**Hours : 25**

1. Temperature Measurement
  1. Filled-Bulb & Glass-Stem Thermometers.
    - a) Glass-Stem Thermometers
    - b) Filled Thermal Systems
    - c) Liquid-Filled System
    - d) Vapor System
    - e) Gas-Filled System
  2. Bimetallic Thermometers
  3. Resistance Temperature Detector (RTD's)
  4. Radiation & Pyrometers
2. Pressure Measurement
  1. Manometers-U tube, Well, Inclined & Micromanoters.
  2. Bourdon & Helical pressure Sensors-
    - C-bourdon Pressure Sensors
    - Spiral Bourdon Pressure Sensors
    - Helical bourdon Pressure Sensors
  3. Diaphragm or Capsule type sensors
  4. Pressure Gauges
3. Level Measurement
  1. Float Level Switches
  2. Reed Switch Design
  3. Tilt Switch
  4. Continuous Float Indicators – Pressurized Tank
  5. Magnetically coupled indicators.
4. Liquid density Measurement – Hydrometers

## C. Plant Utilities

Hours : 30

### 1. Water

Sources of Water, Hard & Soft water, Causes of Hardness, Disadvantages of hard water, Methods of softening of water, Preboiling of water-Lime soda Process-Ion Exchange process. Essential characteristic of drinking water, purification of water-Screening, Sedimentation, Coagulation, Filtration, Treatment to Boiler Feed Water-Formation of Scale, Corrosion, Priming & Foaming, Caustic embrittlement.

### 2. Insulation

Introduction, Insulating Factors, properties of good insulator, Classification-Glass Wool Properties & application, Cold Insulation, Low Temperature Insulation.

### 3. Steam & Steam Generator

Steam-Formation of Steam at constant Pressure, Enthalpy-Enthalpy of water, Enthalpy of Evaporation, Enthalpy of dry saturated steam, Wet Steam, Superheated Steam, Specific Volume of steam.  
Steam Generator- Classification, Factors for Boiler selection

### 4. Air

Compressed air, Fan air Reciprocating Air Compressors, Multistage Compressors.

## **Reference Books :**

1. Process Equipment – M.V.Joshi
2. Process Instrumentation – Kirk & Remboy
3. Process Measurement & Analysis (Instrument Engineers' Handbook), Third Edn, (Butterworth Heinemann Publication) – Bela G.Liptak
4. Plant Utilities- D.B.Dhone (Nirali Prakashan)- D.B.Dhone

**B. Sc. Third Year  
Paper – X [CHIC-304]  
Industrial Chemistry  
Laboratory Course**

**Periods: 120**

**Marks: 100**

**List of Experiments to be taken**

Experiments on Unit Processes

1. Preparation of P-nitroacetanilide from acetanilide & Calculate % Yield.
2. Preparation of tri-nitrophenol (picric acid) from Phenol & Calculate % Yield.
3. Preparation of m- nitroaniline from aniline & Calculate % Yield.
4. Preparation of P-bromoaniline from aniline from nitrobenzene & Calculate % Yield.
5. Preparation of P-Bromophenacyl bromide from P-bromoacetophenone & Calculate % Yield.
6. Preparation of P-Bromoaniline from p-bromoacetanilide & Calculate % Yield.
7. Preparation of Polystyrene by Bulk/Suspension/Emulsion Polymerization method & Calculate % Yield.
8. Preparation of 6,6 and 6,10 thread by condensation & Calculate % Yield.
9. Preparation of Novalac & Resole – Thermosetting resin & Calculate % Yield.
10. Preparation of Urea formaldehyde resin & Calculate % Yield.
11. Preparation of Polysulphide rubber (Thiokol) & Calculate % Yield.
12. Estimation of Manganese in Pyrolusite ore
13. Estimation of Zinc from Zinc Blend ore
14. Estimation of Antimony in type metal
15. Determination of Copper in brass
16. Determination of percentage of Purity of Aluminium Metal
17. Determination of Nickel in Stainless Steel.
18. Preparation of Orange II dye
19. Preparation of Congo red dye

- Ref. Book-
1. Vogel's Textbook of Practical Organic Chemistry-Brain S. Furniss.
  2. Advanced Practical Organic Chemistry – N.K. Vishnoi.

**B. Sc. Third Year  
Paper – XI [CHIC-305]  
Industrial Chemistry  
Laboratory Course**

**Periods: 120**

**Marks: 100**

**Project Report & Design the Thesis on a Technical Product.**

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| 1. Concepts of Unit Operations & Unit Process  | 20 Marks |
| 2. Industrial Visit & Submission of Visit report   | 20 Marks |
| 3. Preparation & Submission the thesis on Industrial Product   | 20 Marks |
| 4. Synopsis Submission   | 20 Marks |
| Write Brief information about the thesis which includes-<br>Introduction, History, Chemical & Physical Properties, Raw Materials, Methods<br>of Production, Manufacturing process description, Flow sheet, Outlines of<br>material Balance, Plant layout, Plant utility, Industrial safety aspect, Uses of<br>Product, Feasibility of Process-Cost Estimation, Interest, Depreciation,<br>Profitability, references. |          |
| 5. Viva-Voce   | 20 Marks |

**Faculty Of Science**  
**B.Sc. (Third Year) Examination**  
**Industrial Chemistry**  
**Paper – VIII**

**Unit Process in Organic, Inorganic Synthesis and Industrial Safety**

**Time : 3 hours**

**Marks : 100**

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- N.B. i) Attempt all questions  
ii) Each Questions Carries equal Marks  
iii) Draw diagram wherever necessary  
iv) Scientific Calculator and log table is allowed

Q. No. I	Solve Any One	20 Marks
a)		
	or	
Q. No. II	Solve Any One	20 Marks
a)		
	or	
Q. No. III	Solve Any one	20 Marks
a)		
	or	
Q. No. IV	Solve Any Two	20 Marks
a)		
b)		
c)		
Q. No. V	Write Short note on any four	20 Marks
a)		
b)		
c)		
d)		
e)		
f)		

**Faculty Of Science**  
**B.Sc. (Third Year) Examination**  
**Industrial Chemistry**  
**Paper – IX**

**Process equipment, Design, Process Instrumentation & Plant Utilities**

**Time : 3 hours**

**Marks : 100**

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- N.B. i) Attempt all questions  
ii) Each Questions Carries equal Marks  
iii) Draw diagram wherever necessary  
iv) Scientific Calculator and log table is allowed

Q. No. I	Solve Any One	20 Marks
a)		
	or	
Q. No. II	Solve Any One	20 Marks
a)		
	or	
Q. No. III	Solve Any one	20 Marks
a)		
	or	
Q. No. IV	Solve Any Two	20 Marks
a)		
b)		
c)		
Q. No. V	Write Short note on any four	20 Marks
a)		
b)		
c)		
d)		
e)		
f)		