

# Swami Ramanand Teerth Marathwada University, Nanded



## SYLLABUS B. SC. THIRD YEAR (INDUSTRIAL CHEMISTRY) SEMESTER PATTERN

IN FORCE FROM JUNE - 2011

**B. Sc. III Year (Industrial Chemistry)**

<b>SEMESTER</b>	<b>PAPER</b>	<b>COURSE NAME</b>	<b>PERIODS</b>	<b>MARKS</b>
V	XII	Unit process in organic synthesis	45	25
	XIII	Process Equipment Design & Process Instrumentation	45	25
VI	XIV	Unit Process in Inorganic synthesis & Industrial safety	45	25
	XV	Spectroscopy & Plant Utilities	45	25
Laboratory Course (Yearly)	XVI	Laboratory Course I	120	100
	XVII	Laboratory Course II	120	100

**SEMISTER V**  
**B. Sc. Third Year**  
**Paper – XII [CHIC-301]**  
**Industrial Chemistry**  
**Unit Processes in Organic Synthesis**

**Unit Processes In Organic Synthesis :** (45 hours)

**1. Nitration :**

Introduction, Nitrating Agents, Aromatic Nitration, Kinetics & Mechanism of Aromatic Nitration, Nitration of Paraffin 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 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.

**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

**SEMISTER V**  
**B. Sc. Third Year**  
**Paper – XIII [CHIC-302]**  
**Industrial Chemistry**  
**Process Equipment Design, Process Instrumentation**

**Process Equipment Design Hours : 25**

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

**Process Instrumentation.**

Hours : 20

**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

**Pressure Measurement**

1. Manometers-U tube, Well, Inclined & Micromanometers.
2. Bourdon & Helical pressure Sensors-  
Bourdon Pressure Sensors  
Spiral Bourdon Pressure Sensors  
Helical bourdon Pressure Sensors
3. Diaphragm or Capsule type sensors
4. Pressure Gauges.

**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

**SEMISTER VI**  
**B. Sc. Third Year**  
**Paper – XIV [CHIC-303]**  
**Industrial Chemistry**  
**Unit Process in Inorganic synthesis & Industrial safety**

**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

**Industrial Safety : (25 Hours)**

1. **Introduction :-** Definition & terms used in context of safety, Accident- Nonreportable accidents. Hazard, Risk, Acceptance Physical factors for Accidents- Accident ratio, Safety Training, Role of Supervisor in achieving a high standard of Safety,  
3  
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. Chemical Process – Srreva
2. Industrial Chemistry – B.K.Sharma
3. Polymer Chemistry – Gowarikar
4. Polymer Chemistry – Billmyer
5. Introduction to Industrial Safety – K.T.Kulkarni (2002) Or Concept & Practices in Industrial Safety – K.T.Kulkarni (2007)
6. Handbook of Fire Technology – Gupta R.S. Orient Longman Publication (1993)
7. Hazards in Chemical Units – Pandya C.L. (Oxford ISH – 1991)

**SEMISTER VI**  
**B. Sc. Third Year**  
**Paper – XV [CHIC-304]**  
**Industrial Chemistry**

**Spectroscopy & Plant Utilities**

**Spectroscopy**

1. Elementary principles, Instrumentations, sampling methods of UV, IR, NMR, Mass Spectrometry.
2. Introduction and Instrumentation XRD.
3. Instrumentation & Techniques HPLC & HPTLC.

**Plant Utilities**

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

**Reference Books :**

1. Organic Spectroscopy , William Kemp, ILBS 3<sup>rd</sup> edition
2. Spectrometric identification of organic compounds, Silver stein, John willey pub. 6<sup>th</sup> edition
3. Instrumental method of chemical analysis , B.K.Sharma, Goal pub., 26<sup>th</sup> edition.
4. Spectroscopy of organic compounds, P.S.Kalsi, Willey eastern ltd.
5. HPTLC, D.Sethi, CBS 2<sup>ND</sup> edition.
6. Plant Utilities- D.B.Dhone (Nirali Prakashan)- D.B.Dhone

**B. Sc. Third Year**  
**Paper – XVI [CHIC-305]**  
**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 oxalic acid from **cane sugar** & Calculate % Yield.
4. Preparation of benzophenoxine from benzophenone & Calculate % Yield.
5. Preparation of P-Bromoaniline from P-bromoacetanilide & Calculate % Yield.
6. Preparation of Phenyl acetate from phenol & 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. Preparation of Orange II dye
13. Estimation of Glucose.
14. Estimation of Manganese in Pyrolusite ore
15. Estimation of Zinc from Zinc Blend ore
16. Estimation of Antimony in type metal
17. Determination of Copper in brass
18. Determination of percentage of Purity of Aluminium Metal
19. Determination of Nickel in Stainless Steel.
20. Estimation of available oxygen in Hydrogen peroxide.

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 – XVII [CHIC-306]**  
**Industrial Chemistry**  
**Laboratory Course**  
**Periods: 120 Marks: 100**

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

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|---|----------|
| 1. Local Industrial Survey & to conduct the interview of small scale industrialist (only two), industrial training. | 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-

Introduction, History, Chemical & Physical Properties, Raw Materials, Methods of Production, Manufacturing process description, Flow sheet, Outlines of material Balance, Plant layout, Plant utility, Industrial safety aspect, Uses of Product, Feasibility of Process-Cost Estimation, Interest, Depreciation, Profitability, references.

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|--------------|----------|
| 5. Viva-Voce | 20 Marks |
|--------------|----------|

**Faculty of Science**  
**B.Sc. (Third Year) Examination**  
**Industrial Chemistry**  
**SEMISTER V**  
**Paper – XII**  
**Unit Process in Organic Synthesis**

**Time:-**

**Mark:-**

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- N.B. i) Attempt all questions  
ii) Draw diagram wherever necessary  
iii) Scientific Calculator and log table is allowed

- Q. 1. Solve the following 5 Marks  
a)  
b)  
c)  
d)  
e)
- Q. 2. Solve the following any two 10 Marks  
a)  
b)  
c)  
d)
- Q. 3. Solve the following any one 10 Marks  
a)  
b)

**Faculty Of Science**  
**B.Sc. (Third Year) Examination**  
**Industrial Chemistry**  
**SEMISTER V**  
**Paper – XIII**  
**Process Equipment Design, Process Instrumentation**

**Time:-**

**Mark:-**

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- N.B. i) Attempt all questions  
ii) Draw diagram wherever necessary  
iii) Scientific Calculator and log table is allowed

- Q. 1. Solve the following 5 Marks  
a)  
b)  
c)  
d)  
e)
- Q. 2. Solve the following any two 10 Marks  
a)  
b)  
c)  
d)
- Q. 3. Solve the following any one 10 Marks  
a)  
b)

**Faculty Of Science**  
**B.Sc. (Third Year) Examination**  
**Industrial Chemistry**  
**SEMISTER VI**  
**Paper – XIV**  
**Unit Process in Inorganic synthesis & Industrial safety**

**Time:-**

**Mark:-**

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N.B. i) Attempt all questions

ii) Draw diagram wherever necessary

iii) Scientific Calculator and log table is allowed

Q. 1. Solve the following

5 Marks

- a)
- b)
- c)
- d)
- e)

Q. 2. Solve the following any two

10 Marks

- a)
- b)
- c)
- d)

Q. 3. Solve the following any one

10 Marks

- a)
- b)

**Faculty Of Science**  
**B.Sc. (Third Year) Examination**  
**Industrial Chemistry**  
**SEMISTER VI**  
**Paper – XV**  
**Spectroscopy & Plant Utilities**

**Time:-**

**Mark:-**

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N.B. i) Attempt all questions

ii) Draw diagram wherever necessary

iii) Scientific Calculator and log table is allowed

Q. 1. Solve the following

5 Marks

- a)
- b)
- c)
- d)
- e)

Q. 2. Solve the following any two

10 Marks

- a)
- b)
- c)
- d)

Q. 3. Solve the following any one

10 Marks

- a)
- b)

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

**Time:-6 Hours**

**Marks:-100**

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|--|----|
| Q.1. Prepare -----from -----and calculate % yield. | 40 |
| Q.2. Estimate the amount of ----- from ----        | 40 |
| Q.3. Record Book                                   | 10 |
| Q.4. Viva-Voce                                     | 10 |

**Faculty Of Science**  
**B.Sc. (Third Year) Examination**  
**Industrial Chemistry**  
**Paper – XVII**  
**Project Report & Design the Thesis on a Technical Product**

**Time:-6 Hours**

**Marks:-100**

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- Q.1. Local Industrial Survey & to conduct the interview of small scale industrialist (only two) **10** Marks  
Q.2. Industrial Visit & Submission of Visit report **20** Marks  
Q.3. Preparation & Submission the thesis on Industrial Product **30** Marks  
Q.4. Synopsis Submission **20** Marks

Write Brief information about the thesis which includes-  
Introduction, History, Chemical & Physical Properties, Raw Materials, Methods of Production, Manufacturing process description, Flow sheet, Outlines of material Balance, Plant layout, Plant utility, Industrial safety aspect, Uses of Product, Feasibility of Process-Cost Estimation, Interest, Depreciation, Profitability, references.

- Q.5. Viva-Voce **20** Marks