

**III B. Sc – INDUSTRIAL CHEMISTRY MAJOR SYLLABUS SEMESTER- III**  
**COURSE 5: CHEMICAL ANALYSIS**

Total hours of teaching 45 hrs @ 3hrs per week

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**UNIT –I**

9 Hours

**Errors:** Errors in chemical analysis, Errors in measurements, Accuracy, Precision, Statistical treatment of data, average, deviation and probability, rejection of results, significant figures.

**Solvent Extraction:** Introduction, Completeness of extraction, selectivity of extraction, recovery of extracted material, factors favouring solvent extraction, solvent extraction equilibrium, experimental measures, analytical applications.

**UNIT -II**

9 Hours

**Paper chromatography:** Introduction, theory of paper chromatography, operations involved in paper chromatography, quantitative paper chromatography, separation of amino acids, inorganic paper chromatography.

**Column Chromatography:** Introduction, theory, experiment technique and applications of column chromatography.

**UNIT – III**

9 Hours

**Thin Layer Chromatography:** Introduction, theory, technique and applications

Gas Chromatography: Introduction, instrumentation, apparatus and procedure.

**UNIT –IV**

9 Hours

**Potentiometric Measurements:** Introduction, instrumentation of potentiometric titrations, apparatus, procedure and applications, Potentiometric titrations.

**pH Measurements:** Introduction, electrometric determination of hydrogen, quinhydrone, antimony and glass electrodes.

**UNIT – V**

9 Hours

**Conductometric titrations:** Introduction, some fundamental relationships, equivalent and molar conductance, AC conduction, measurement of conductivity and applications of conductometric titrations.

**Visible Spectroscopy and colourimetry:** Nature of radiant energy, electromagnetic spectrum, Absorption methods and terms associated with absorption measurements, laws of absorption, Deviations of Beer's Law, Instrumentation with Special reference to spectrophotometric applications of absorption spectroscopy, qualitative and quantitative, colourimetric determination of ammonia, phosphate, ion simultaneous determination of chromium and manganese in steel.

**Books for Reference:**

Reference Books : Chemical Analysis By PC Jain and Srivastva



## II B.Sc INDUSTRIAL CHEMISTRY - SEMESTER-III

### Paper-III: PRACTICAL CHEMICAL ANALYSIS

Total hours of laboratory Exercises 30hrs @ 2 per week

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1. 1. POTENTIOMETRY: a. Determination of iron (II) with chromium (VI)  
a. b Determination of iron (II) with manganese (VII)
2. 2SPECTROPHOTOMETRY:  
a. Mapping of absorption spectra of aqueous solutions of chromium (VI) and manganese (VII)
3. COLOURIMETRY:  
a. Determination of nitrite in water.  
b. Determination of phosphate in water.
4. CONDUCTOMETRY :  
a. Determination of cell constant.  
b. Titration of a strong acid with a strong base.  
c. Titration of a weak acid with a strong base.  
d. Titration of a mixture of strong acid and weak acid with a strong base.  
e. Titration of a weak base with a strong acid.
5. PH METRY:  
A. Titration of HCl with NaOH.  
B. B. Titration of acetic acid with NaOH.  
C. d. Determination of pH of water samples.

Books Recommended:

1. Quantitative Inorganic analysis by A.I.Vogel.
2. Instrumentation methods of Chemical Analysis by Ewing
3. Vogel's text book of Quantitative Chemical Analysis by G.H. Jeffery, J. Bassett, J.Mendham, R.C.Denny

Practical examination pattern : practical 40marks, Recors +viva=10marks



**II B.Sc., INDUSTRIAL CHEMISTRY- SEMESTER -III**  
**MODEL PAPER III    Chemical Analysis**

Time: 3 hours

Maximum marks: 75

Answer any five questions

5 X 5 =25

1. Define accuracy and precision?
2. What are the factors favoring solvent extraction?
3. What is the theory involved in paper chromatography?
4. Write about retention time and volume?
5. Write about Hydrogen Electrode?
6. Write about AC conduction?
7. Explain about Beer's Lambert's Law?
8. How TLC superior than paper chromatography?

Answer all questions

5 X 10 = 50

9. Explain about errors in chemical analysis? OR  
What are the experimental techniques of solvent extraction?
10. Discuss about the technique of paper chromatography? OR  
Explain the experimental technique of column chromatography?
11. Discuss about the technique of TLC? OR  
Explain the instrumentation of Gas Chromatography?
12. What is the principle of potentiometer and explain the instrumentation ? OR  
Write about quinhydrone electrode and glass electrode?
13. Write about the conductometric titrations? OR  
Explain about the instrumentation of Spectro photo meter?



**III B.Sc.: INDUSTRIAL CHEMISTRY MAJOR SYLLABUS SEMESTER- III**  
**COURSE 6 : CHEMICAL PROCESS INDUSTRIES-2**

Total hours of teaching 45 hrs @ 3hrs per week

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**UNIT – I**

**9 hours**

**Sulphuric Acid:** Process and physico-chemical principles involved in the manufacture of sulphuric acid by chamber process and contact process. Manufacture of sulphuric acid by chamber process. Manufacture of sulphuric acid by contact process, Flow sheet and reaction of chamber process. Sulphuric acid industries in India, Properties and grades of sulphuric acid.

**UNIT II**

**9 hours**

**Fertilizers:** Plant nutrients, fertilizer types, Classification of fertilizers, Nitrogenous fertilizers: ammonium nitrate, ammonium sulphate, calcium ammonium nitrate, urea, nitrogen solutions.

**Phosphate fertilizers:** phosphoric acid, rock phosphate, super phosphate, SSP, TSP, Diammonium phosphate. Potassium fertilizers: Potassium chloride, Potassium sulphate, Muriate of potash, NPK fertilizers, fertilizer industries in India.

**UNIT – III**

**9 hours**

**Alkali and chlorine:** Manufacture of caustic soda: Nelson cell, Hooker cell, Castner – Kellner cell, Modern mercury cell, De Nora cell, lime soda process. Caustic soda industries in India. Manufacture of soda ash by Solvay's process, dual process.

**UNIT – IV**

**9 hours**

**Hydrocarbons from petroleum:** Saturated hydrocarbons from natural gas, uses of saturated hydrocarbons, Unsaturated hydrocarbons: acetylene, ethylene, propylene, butylene, Aromatic hydrocarbons: benzene, toluene, xylene,

chemical processing of paraffin hydrocarbons, ethylene hydrocarbons, acetylene hydrocarbons and aromatic hydrocarbons.

**UNIT – V**

**9 hours**

**Lubricants:** Properties of lubricants, Classification of lubricants, Lubricants of mineral origin, Synthetic lubricants, greases, Solid lubricants, Selection of lubricants, testing of lubricants: Pour point, viscosity index, flash point, cloud point.

**Reference Books:**

Industrial Chemistry by B.K.Sharma, Geol. Publishing House

## **COURSE 5 : Practicals:**

1. Determination of softening point of coal tar
2. Determination of smoke point of kerosene.
3. Determination of cloud point and pour point of lubricants.
4. Determine the % of  $\text{H}_2\text{SO}_4$
5. Determine the % of  $\text{NaOH}$

**Reference Books:** 1. A text book of Engineering Chemistry by S.S. Dara, S.Chand & Co.



**III B.Sc.: INDUSTRIAL CHEMISTRY MAJOR SYLLABUS SEMESTER- III**  
**MODEL PAPER**  
**COURSE 6 : CHEMICAL PROCESS INDUSTRIES-2**

**Time: 3 hours**

**Maximum Marks: 75**

**PART-A**

**Answer Any Five Questions**

**5 X 5 =25**

1. Write grades of H<sub>2</sub>SO<sub>4</sub>?
2. What are uses of saturated hydrocarbons?
3. Explain the preparation of Calcium Ammonium Nitrate?
4. Write about NPK fertilizers
5. Explain the industrial preparation of Soda Ash by dual process?
6. Explain the manufacture of NaOH by Nelson Cell?
7. Explain the classification of lubricants?
8. Write the classification of Lubricants?

**PART -B**

**Answer All Questions**

**5 X 10 = 50**

9. Explain the physico-chemical principles involved in the manufacture of H<sub>2</sub>SO<sub>4</sub> by Chamber process?  
OR  
Explain the physico-chemical principles involved in the manufacture of H<sub>2</sub>SO<sub>4</sub> by Contact Process?
10. Explain briefly on Nitrogenous Fertilizers?  
OR  
Explain briefly on Potash Fertilizers?
11. Explain the manufacture of NaOH by Mercury cells?  
OR  
Explain the manufacture of Soda Ash by Solvay's process?
12. Explain the chemical processing of Aromatic Hydrocarbons?  
OR  
Explain the Industrial preparation of Toluene?
13. Explain the Testing of Lubricants?  
OR  
Explain about lubricants mineral origin and solid lubricants?



### III B. Sc – INDUSTRIAL CHEMISTRY MAJOR SYLLABUS

#### SEMESTER- III : COURSE 7 : CHEMICAL PROCESS INDUSTRIES-3

Total hours of teaching 45 hrs @ 3hrs per week

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#### UNIT – I

9h

**Protective coating:** - Introduction, types of metal coating, coating processes, galvanizing, tinning, metal cladding, electroplating, immersion plating, cementation, metal spraying.

**Pigments:** - Commercial methods of preparation and uses of some important pigments – white lead, zinc oxide, titanium dioxide, chrome green, ultramarine blue, iron blue, red lead, metallic powders as pigments.

#### UNIT-II

9h

**Paints:** - Classification, manufacture of paints, emulsion paints, heat resistant paints, varnishes, enamels, solvents and thinners.

**Paper and pulp:** - manufacture of various pulps, beating, refining, filling, sizing and colouring, manufacture of paper and calendaring.

#### UNIT – III

9h

**SYNTHETIC FIBRES:** - Differences between synthetic and natural fibres, properties of synthetic Fibres, preparation of synthetic fibres – pyroxylin, cuprammonium rayon, acetate rayon, viscose rayon, nylon-66, terylene, Teflon.

#### UNIT – IV

9h

**Rubber:** - Types of rubber, drawbacks of raw rubber, vulcanization of rubber, synthetic rubbers, Buna –s rubber, neoprene rubber, butyl rubber, polyurethane rubber, sponge rubber, foam rubber, rubber cement, thermocole, application of rubber.

#### UNIT-V

9h

**Plastics:** - Introduction, classification and properties of plastics, condensation, polymerisation, addition polymerisation, cross linked polymerisation, co-polymerisation, raw materials for plastic industries, moulding of plastics, Bakelite, poly ethylene, polystyrene, cellulose nitrate, cellulose acetate, urea formaldehyde resin, PVC.

**REFERENCE BOOKS:** industrial Chemistry (including Chemical Engineering )by B.K.Sharma, Goel Publishing house, Meerut.

### **COURSE 7: Practical:**

1. Estimation of Fe(II) by dichrometry.
2. Estimation of Fe(II) by Permananganometry
3. Estimation of ammonia in a given solution.
4. Preparation of green and red pigment.

**Reference Books:** 1. A text book of Engineering Chemistry by S.S. Dara, S.Chand & Co.

Text Book : A Text Book on Experiments and Calculation in Engineering Chemistry by S.S.Dara, S. Chand & Company ltd, Ram nagar, New Delhi.



**III B. Sc – INDUSTRIAL CHEMISTRY MAJOR SYLLABUS**  
**SEMESTER- III : COURSE 7 : CHEMICAL PROCESS INDUSTRIES-3**

Time: 3 hours

Maximum Marks: 75

**PART - A**

**Answer any Five questions**

**5 X 5 = 25**

1. Write the failures of paint?
2. Explain about solvents?
3. Explain the preparation of sulphate pulp?
4. Write the properties of synthetic fibres?
5. Explain the drawbacks of raw rubber?
6. Write the application of rubbers?
7. Define Addition and Condensation polymerizations with suitable examples?
8. What are the raw materials of Plastic Industry?

**PART - B**

**Answer All questions**

**5 X 10 = 50**

- |  |    |
|--|----|
| 9. Write short notes on 1. Galvanizing 2. Electroplating?<br>Explain the commercial preparation White Pigments?  | OR |
| 10. Explain the manufacture of Paints?<br>Explain briefly manufacture of Paper                                   | OR |
| 11. Write short notes on 1. Pyroxylin 2. Viscose rayon?<br>Explain the manufacturing process of Nylon 66?        | OR |
| 12. Briefly explain the manufacture of Buna – S rubber?<br>Write short notes on 1. Sponge rubber 2. Foam rubber? | OR |
| 13. Write briefly on Cross-linked Polymerization?<br>Write short notes on 1. Polystyrene 2. Urea formaldehyde?   | OR |



### **III B. Sc – INDUSTRIAL CHEMISTRY MAJOR SYLLABUS SEMESTER- III**

#### **COURSE 8 : INTRODUCTION TO CHEMICAL ENGINEERING**

Total hours of teaching 45 hrs @ 3hrs per week

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##### **UNIT – I**

**9h**

**Flow of fluids:** -introduction-nature of fluids-viscosity-flow field-flow of fluid past a solid surface-conservation of mass-conservation of energy-Reynold's experiment-friction losses in laminar flow through a circular pipe-Hagen-Poiseuille equation- friction losses in turbulent flow –Fanning equation-pressure drop in a flow through porous media-fluidization-cavitation-water hammer-pumping of fluids.

##### **UNIT – II**

**9h**

**Measuring devices:** density and specific gravity-viscosity-pH-pressure-flowmeters-liquid levels.

##### **UNIT – III: Mass transfer operation I**

**9h**

**Diffusion transfer operations:** -absorption-vapour-liquid equilibrium-relative volatility-distillation-liquid-liquid extraction-extraction schemes-industrial liquid-liquid contactors-selection of liquid-liquid contactors-humidification-dehumidification.

##### **UNIT – IV : Mass transfer operations II**

**9h**

Drying- industrial dryers- crystallization-crystallization equipments-adsorption-adsorption equipment.

##### **UNIT – V**

**9h**

**Pollution and its abatement:** Air pollution- Land pollution- Water pollution

**REFERENCE BOOKS:** Introduction to Chemical Engineering, by Goshal and Sanyal  
Datta, McGraw-Hills Company



## **COURSE 8: INTRODUCTION TO CHEMICAL ENGINEERING: PRACTICALS**

1. Specific gravity of liquids
2. Viscosity of liquids
3. pH meter
4. Distillation
5. Crystallization
6. Adsorption

Text Book: College Industrial Chemistry Practicals by Patel, Turakhia, Puniyani, Himalaya Publishing House, Mumbai



**III B. Sc – INDUSTRIAL CHEMISTRY SYLLABUS SEMESTER-III**  
**MODEL PAPER**

**COURSE 8 : INTRODUCTION TO CHEMICAL ENGINEERING**

Time: 3 hours

Maximum Marks: 75

**PART - A**

**Answer any Five questions**

**5 X 5 = 25**

1. Explain Newtonian and non-Newtonian fluids?
2. Discuss about Reynolds's experiments?
3. Write about adsorption?
4. Discuss about greenhouse effect?
5. Write about pumps?
6. What is water hammer? Define Viscosity?
7. Explain about diffusion?
8. Explain about pyrolysis?

**PART - B**

**Answer All questions**

**5 X 10 = 50**

9. Derive Hagen-Poiseuille Equation? OR
10. Derive Fanning Equation?
11. Explain any two Distillation Equipments? OR
12. What is meant by Extraction? Explain Any two Equipments?
13. What is meant by Drying? Explain any drying equipment? OR
14. Define crystallization? Explain any crystallizer?
15. Write about Rotameters? OR
16. Write about Orifice meter?
17. Write about Air Pollution? OR
18. Write about Sewage Water Treatment?