

Swami Ramanand Teerth Marathwada University,  
Nanded



स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड.

B. O. S. IN CHEMISTRY  
B. SC. THIRD YEAR (INDUSTRIAL CHEMISTRY)  
SEMESTER- V & VI  
CBCS Course  
Effective from JUNE – 2018

Swami Ramanand Teerth Marathwada University, Nanded  
Choice Based Credit System (CBCS) Course  
Structure Faculty of Science  
B. Sc. Third Year Syllabus  
Semester Pattern effective from June 2018  
Subject: Industrial Chemistry

| Semester                        | Course No   | Name of the course  | Instruction Hrs/Week | Total Period           | CA (Int.) | ESC (Ext.) | Total Marks      | Credits  |
|---------------------------------|---|---|----------------------|------------------------|-----------|------------|------------------|----------|
| V                               | DSEIC V (Section A)                                   | Theory Paper-XII Unit processes in Organic Synthesis (P-XII)                                | 03                   | 45                     | 10        | 40         | 50               | 02       |
|                                 | DSEIC V [(Section B) Elective]                        | Theory Paper-XIII Process Equipment & Design & Process Instrumentation (P-XIII)- B1         | 03                   | 45                     | 10        | 40         | 50               | 02       |
|                                 |   | OR<br>(Elective Paper)<br>Chemical Engineering Thermodynamics (P-XIII) (P-XIII) B2          | 03                   | 45                     | 10        | 40         | 50               |          |
|                                 | DSEICP- IV [DSIC V & VI (Section A)]                  | Practical's based on P-XII & P-XIV (P-XVI) OR   | 04                   | Practicals<br>08<br>08 | 05<br>05  | 20<br>20   | 25<br>25         | 01<br>01 |
|                                 |   | (Elective Paper)<br>Practical's based on Elective   | 04                   | 16                     | 10        | 20         | 50               |          |
| DSEICP III SEC III (Skill)      | Fermentation ,Pesticides &Cosmetics Perfumes Industry | 02+01=03  | 45                   | 25                     | 25        | 50         | (02)*            |          |
| VI                              | DSEIC VI (Section B)                                  | Theory Paper-XIV Unit Process in Inorganic Synthesis, Drug ,Dyes & Industrial Safety (P-XV) | 03                   | 45                     | 10        | 40         | 50               | 02       |
|                                 | DSEIC VI [(Section A) Elective]                       | Theory Paper-XV Spectroscopy & Chromatography , Plant Utilities (P-XV) B1                   | 03                   | 45                     | 10        | 40         | 50               | 02       |
|                                 |   | OR (Elective Paper)<br>Plant Design & Economics for Chemical Engineers Chemistry (P-XV) B2  | 03                   | 45                     | 10        | 40         | 50               |          |
|                                 | DSEICP- IV [DSIC V & VI (Section B)]                  | Practical's based on P-XIII & P-XV (P-XVII) OR  | 04                   | Practicals<br>08<br>08 | 05<br>05  | 20<br>20   | 25<br>25         | 01<br>01 |
|                                 |   | Practical's based on Elective   | 04                   | 16                     | 10        | 20         | 50               |          |
| DSEIC IV SEC IV (Skill)         | Industrial Skill for Data Analysis                    | 02+01=03  | 45                   | 25                     | 25        | 50         | (02)*            |          |
| Total credits semester V and VI |   |   |                      |                        |           |            | 12 (04)*<br>= 16 |          |

DSEIC: Discipline Subject Elective, in Industrial chemistry  
DSEICP: Discipline Subject Elective practical, in Industrial chemistry,  
ESE: End of Semester Examination,  
CA: Continuous Assessment, SECC: Skill Enhancement Course Chemistry.

Distribution of Credits: 80% of the total Marks for ESE and 20% for CA.

- CA of Marks 10 : 10 Marks for test.
- CA of 25 Marks : 15 Marks for Seminar & 10 Marks for test.

Swami Ramanand Teerth Marathwada University Nanded  
 Choice Based Credit System (CBCS) Course Structure (New scheme)  
 B. Sc. Third year (Semester- V)  
 Semester Pattern effective from-2018  
 Industrial Chemistry  
 DESIC V  
 (Section-A)  
 Unit Process in Organic Synthesis  
 (P-XII)

Unit Processes In Organic Synthesis : (45 hours)

1. Nitration : (10 hours)

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 : (10 hours)

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 : (10 hours)

Introduction, Chlorination, Bromination, Fluorination, Iodination.

4. Sulfonation & Sulfation : (05 hours)

Introduction, Sulfonating & Sulfating agents, Sulfonation of Aromatic compounds, Benzene & its derivatives, Naphthalene & its derivatives, Anthraquinone & its derivatives.

5. Polymerization : (10 hours)

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

|                   |   |
|-------------------|---|
| Objective (S)     | To acquire basic knowledge about Synthesis of Organic Products by Nitration, Amination by Reduction, Halogenation, Sulphonation, Sulfation, & Polymerization. |
| Course Outcome(S) |   |
| CO1               | To learn the various Organic Methods for Industrial synthesis of Nitro Derivative & Methods of Nitration.   |
| CO2               | Explain the Various Industrial Methods of reduction of Nitro Compounds to Amine.  |
| CO3               | Intercepts the theoretical & Experimental Methods of Chlorination, Bromination, Fluorination, & Iodinations.  |
| CO4               | To Illustrate the synthesis & reaction Mechanism method of Sulfonation & Sulfation of Benzene, Naphthalene, Anthraquinone.                                    |
| CO5               | Know the application, types & Industrial Synthesis Method of Polymerization.  |

Swami Ramanand Teerth Marathwada University Nanded  
Choice Based Credit System (CBCS) Course Structure (New scheme)  
B. Sc. Third year (Semester- VI)  
Semester Pattern effective from-2018  
Industrial Chemistry  
DESIC VI(Section B)

Process Equipment Design, Process Instrumentation(P-XIII)

UNIT I

Credits:02 ,Hours :45

Process Equipment Design

Hours :10

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.

1. Agitators :Types of Agitators, Baffling.

2. Reaction Vessel :Introduction, Materials of Construction, Classification of Reaction Vessels, Heating Systems, Design Considerations

UNIT-III

Hours :05

1. Corrosion :Forms of Corrosion, Factors influencing corrosion, Factors preventing corrosion.

UNIT-IV

Hours :10

Process Instrumentation.

1. Temperature Measurement

i. Filled-Bulb & Glass-Stem Thermometers Glass-Stem Thermometers Filled Thermal System

Liquid-Filled System, Vapor System

e) Gas-Filled System

ii. Bimetallic Thermometers

iii. Resistance Temperature Detector (RTD's)

iv. Radiation & Pyrometers

2. Pressure Measurement

i. Manometers-U tube, Well, Inclined & Micromanometers.

ii. Bourdon & Helical pressure Sensors- bourdon Pressure Sensors Spiral Bourdon Pressure Sensors Helical bourdon Pressure Sensors

iii Diaphragm or Capsule type sensors

iv. 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

4. Hazards in Chemical Units – Pandya C.L. (Oxford ISH – 1991)

|                   |  |
|-------------------|--|
| Objective (S)     | To enable students to acquire basic knowledge in scope of equipment design & process Instrumentation.          |
| Course Outcome(S) |  |
| CO1               | Know the importance of distillation process, types of distillation & different types Fractionating Column.     |
| CO2               | Understand the basic types of Agitators, Baffling & classification of Reaction Vessel.                         |
| CO3               | Study the Corrosion.   |
| CO4               | Introduction & Application of Various types of Thermometers, Radiation & Pyrometers                            |
| CO5               | Introduction & Application of Various types of Manometers, Diaphragm or Capsule type sensors, Pressure Gauges. |

OR  
(Elective)

Swami Ramanand Teerth Marathwada University Nanded  
Choice Based Credit System (CBCS) Course Structure (New scheme)  
B. Sc. Third year (Semester- V)  
Semester Pattern effective from-2018  
Industrial Chemistry  
DESIC V (Section B)  
Chemical Engineering Thermodynamics (P-XIII) 45 Hours

Credits:02

UNIT –I

1.1 The Scope of Thermodynamics

Dimensions & Units, Measures of amount or Size Force, Temperature, Pressure, Work, Energy, Heat, 10 Hours  
The First Law & Other basic concepts, Joule's Experiments, Internal Energy, the First Law of thermodynamics  
Energy Balance for closed systems, Thermodynamic state & state functions, Equilibrium, The phase rule,  
The Reversible Process, constant-V & Constant -P processes, Enthalpy, Heat capacity, Mass & Energy Balances for  
open Systems, Solve problem on unit First

2.1 Volumetric Properties of Pure Fluids

PVT Behavior of pure substances, virial Equations of states, The Ideal gas, Applications of the virial Equations,  
Cubic Equations of states, Generalized correlations for Gases, Generalized correlations for Liquids, sensible  
Heat effects, Latent Heat of pure substances, standard heat of reactions, standard heat of formations, standard heat  
Of Combustion Temperature dependence of  $\Delta H^0$ , Heat effects of Industrial reactions.  
Solve Problems of Unit second.

UNIT -3

10Hours

3.1 The Second Law of Thermodynamics,

Statements of second law, Heat Engines, Thermodynamic temperature Scales, Entropy, Entropy changes of an  
Ideal Gas, Mathematical statement of the Second Law, Entropy balance for open Systems, Calculation of Ideal  
work, Lost Work, the Third Law of thermodynamics, Entropy from the Microscopic Viewpoint, Property  
relations for homogeneous phases, residual properties, residual properties by Equations of State, Two- Phase  
Systems, Thermodynamic Diagrams, Tables of Thermodynamic properties, generalized property Correlations for  
gases. solve problems on unit third

UNIT -4

05 Hours

4.1 Applications of thermodynamics to flow processes, duct flow of compressible fluids, Turbines (Expanders)

Compressions processes, production of power from Heat, the steam power plant, Internal -combustion Engines, Jet  
Engines, Rocket Engines Solve Problems on Unit Four.

Reference Books

Chemical Engineering thermodynamics by JM Smith, HC Van Ness, MM Abbott Adopted by B I Bhatt.

|                   |  |
|-------------------|--|
| Objective (S)     | To enable the students to acquire basic knowledge in scope of thermodynamics & Classification of Energy                                  |
| Course Outcome(S) |  |
| CO1               | To understand the basic concepts of Thermodynamics, Physical Parameters like Pressure, Volume, temperature etc & Laws of Thermodynamics. |
| CO2               | Analyze the PVT Behavior of pure substances various types of Reactions & Standard heat of formation.                                     |
| CO3               | Know the theory & application of thermodynamics, thermodynamic properties  |
| CO4               | To illustrate the Classification of Various Combustion Engines, JET Engines, Rocket Engines.   |
| CO5               | Calculation of Enthalpy, Work done etc.  |

# Swami Ramanand Teerth Marathwada University Nanded

Choice Based Credit System (CBCS) Course Structure (New scheme)

B. Sc. Third year (Semester- IV)

Semester Pattern effective from-2018

Industrial Chemistry

DESICP-II(CCIC-V& VI)

(section A)

Practical's based on P-XII&P-XIV(Paper – XVI)

Credits: 02

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 percentage of Purity of Aluminium Metal
18. Determination of Nickel in Stainless Steel.
19. 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

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Choice Based Credit System (CBCS) Course Structure (New scheme)

B. Sc. Third year (Semester- IV)

Semester Pattern effective from-2018

Industrial Chemistry

DESICP-II(CCIC-V& VI)

(section A)

Practical's based on P-XII&P-XIV(Paper – XVI)

Credits: 02

List of Experiments to be taken.

1. Determination of Acid Value of Plastics.
2. Determination of Saponification value of Plastics.
3. Determination of Hydroxyl value of plastics.
4. Proximate analysis of Coal.
5. Ultimate analysis of Coal.
6. Determination of Calorific value of solid or liquid.
7. Determination of iron in water sample by Colorimetric.
8. Determination of sodium & Potassium by flame photometry.
9. Determination of Aniline point of lubricant oil.
10. Separation of metal ions by paper Chromatography.
11. Determination of molecular weight of polymer.
12. Separation of sugars by paper chromatography.
13. Thermometric titration of Boric acid with NaOH.
14. Surface tension determination by stalagmometer.
15. Separation of Fe & Mg by solvent.
16. To determine the solubility of given salt at a room temperature & also to draw its solubility Curve

Ref. Book:-

1. Experiments & Calculations in Engineering Chemistry – S.S Dara ( S Chand publication)
2. Experimental in Chemistry – D.V.Jahagirdar ( Himalaya Publication)
3. Advanced Practical Chemistry – Jagdamba Singh ( Pragati Prakashan)
4. Advanced experimental Chemistry J.N.Gurtu & R.Kapoor

# Swami Ramanand Teerth Marathwada University Nanded

## Choice Based Credit System (CBCS) Course Structure (New scheme) B. Sc. Third year (Semester- III) DSICP II

SEC III ( Skill)

Semester Pattern effective from-2018

### Industrial Chemistry

DESICP-II(DSIC-V),(Skill)

(section A)

(section-A) SEC III Fermentation ,Pesticides &Cosmetics Perfumes Industry

#### 1. Cosmetics and Perfumes

General study including preparation and uses of the following Hair dye, hair spray, suntan lotions, face powder, cosmetics, talcum powder, nail enamel, creams, Artificial flavours artificial oils & their importance in cosmetic industries  
With reference to Geraniol, sandalwood oil, rose oil, jasmine, civatone, muscone

#### 2. Pesticides

General introduction to pesticides, benefit & adverse effects, changing concepts of pesticides, structure activity relationship, synthesis & technical manufacture & uses of representative pesticides in following classes organochlorine(, DDT, Gamahexane) Organophosphates, (malathion, Parathion) Carbamates, (Carbofuran & Carbaryl) Quinone (chloranil), Anilides (Alachlor & Butachlor)

#### 3. Fermentation Industries

Aerobic & anaerobic Fermentation, production of (1) Ethyl alcohol & citric acid, (2) Antibiotics, penicillin, Cephalosporin, Chloromycetin & Streptomycin, (3) Lysine, Glutamic acid, Vitamin B2, Vitamin B12, Vitamin C

#### Reference Books:

- 1 Industrial Chemistry – B.K. Sharma

|                   |   |
|-------------------|---|
| Objective (S)     | To acquire basic knowledge about Synthesis of Industrial products Fermentation, Pesticides, & Cosmetics Perfumes Industry                                     |
| Course Outcome(S) |   |
| CO1               | To learn the various Organic Methods for Industrial synthesis of Cosmetics & Perfumes & extraction of Various Oils like Geraniol, Sandalwood, Jasmine, Muskon |
| CO2               | Explain the Various Industrial Methods of Synthesis Types, Benefits of Pesticides like Organochlorine, Quinone, Anilides etc.                                 |
| CO3               | Intercepts the theoretical & Experimental Methods of Fermentation Industries<br>Explain types Antibiotics etc.  |



Swami Ramanand Teerth Marathwada University Nanded  
 Choice Based Credit System (CBCS) Course Structure (New scheme)  
 B. Sc. Third year (Semester- VI)  
 Semester Pattern effective from-2018  
 Industrial Chemistry  
 DESIC VI (Section B)  
 Unit Process in Inorganic synthesis & Drugs, Dyes, Industrial safety Credits:02

UNIT-I

Unit Process in Inorganic synthesis, : (15Hours)

1. Industrial Process of Sulfur & Sulfuric acid  
 2. Nitrogen Industries : Ammonia, Nitric acid & Urea .  
 Polymer Manufacturing Process :  
 1. Polyethylene & Polypropylene                      2. Polyvinyl Chloride  
 3. Phenol Formaldehyde                                      4. Epoxy Polymers  
 5. Butadiene-Styrene Copolymer  
 UNIT-II

Drugs : (10Hours)

Introduction, Disease Classification, Drug Definition, types Of Drugs. Sulfa Drugs or Sulfonamides & Antibiotics.

UNIT-III

Dyes & Dye Intermediates: (10Hours)

Introduction, Colour & constitution, methods of Dyeing, classification of Dyes according to Their modes Based on chemical constitution & application.

UNIT-IV

Industrial safety : (10Hours)

Introduction ,Fire & explosion , Personal Protective Equipment Fire causes of Industrial Fire Electrical Equipment Fire Extinguishers-Fixed Fire fighting system. Portable fire Extinguishers –Soda acid type, Dry Chemical Powder type, Carbon dioxide type & Foam type Extinguisher. 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. (OxfordISH-1991)
8. Industrial chemistry – J.S. Jangwan ,A.S. Mathuria (Pragati Prakashan)

|                   |   |
|-------------------|---|
| Objective (S)     | Creative awareness among students about the importance of various unit process in Inorganic Synthesis                                   |
| Course Outcome(S) |   |
| CO1               | Know the importance synthesis of ammonia ,Nitric acid & Urea & various polymer, polyvinyl Chloride ,Phenol formaldehyde & Epoxy Polymer |
| CO2               | Explain the Various Industrial Methods of reduction of Nitro Compounds to Amine.  |
| CO3               | Understand the classification , types & Synthesis of Drugs.   |
| CO4               | Study the applications ,Classification & application of Dyes.   |
| CO5               | Analyse the Application of Industrial Safety various types of Fire Extinguisher   |

Swami Ramanand Teerth Marathwada University Nanded  
 Choice Based Credit System (CBCS) Course Structure (New scheme)  
 B. Sc. Third year (Semester- VI)  
 Semester Pattern effective from-2018  
 Industrial Chemistry  
 Theory Paper-XV DDIC VI (Section B)  
 Spectroscopy Chromatography & Plant Utilities(P-XV) B1

|                         |  |            |
|-------------------------|--|------------|
| UNIT-I                  |  | credits:02 |
| Spectroscopy            |  | 10         |
|                         | Elementary principles, Instrumentations, sampling methods of UV,IR, NMR, Mass Spectrometry. Introduction and Instrumentation XRD. Instrumentation & Techniques HPLC & HPTLC.   |            |
| UNIT-II                 |  | 05         |
| Chromatography:         |  |            |
|                         | Column chromatography, Paper Chromatography, TLC, calculate RF values  |            |
| UNIT-III                |  | 10         |
| Plant Utilities         |  |            |
| Water                   |  |            |
|                         | Sources of Water, Hard & Soft water, Causes of Hardness, Disadvantages of hardwater, Methods of softening of water, Preboiling of water-Lime soda Process-IonExchange 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 embitterment. |            |
| UNIT-IV                 |  | 10         |
| 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 3rd edition   |            |
|                         | 2. Spectrometric identification of organic compounds, Silver stein, John willey pub. 6th edition   |            |
|                         | 3. Instrumental method of chemical analysis , B.K.Sharma, Goal pub., 26th edition.   |            |
|                         | 4. Spectroscopy of organic compounds, P.S.Kalsi, Willey eastern ltd.   |            |
|                         | 5. HPTLC, D.Sethi, CBS 2ND edition.  |            |
|                         | 6. Plant Utilities- D.B.Dhone (Nirali Prakashan)- D.B.Dhone  |            |
|                         | 7. Advanced Practical Organic Chemistry – N.K. Vishnoi   |            |

|                   |   |
|-------------------|---|
| Objective (S)     | To Familiarize the students with the concepts & Principle of Spectroscopy ,Chromatography & Plant Utilities |
| Course Outcome(S) |   |
| CO1               | To learn the basic concepts of Electromagnetic Waves & study of UV, IR, NMR, Mass spectroscopy              |
| CO2               | Understanding the Column Chromatography ,Paper Chromatography, TLC, Calculate RF Values                     |
| CO3               | Know the sources of Water, Industrial Treatment of Water  |
| CO4               | Explain the types, Classification of Industrial Steam generator   |
| CO5               | Explain the types, Classification of Industrial Boiler  |

OR (Elective Paper)

Theory Paper-XV

Swami Ramanand Teerth Marathwada University Nanded

Choice Based Credit System (CBCS) Course Structure (New scheme)

B. Sc. Third year (Semester- VI)

Semester Pattern effective from-2018

Industrial Chemistry

DESIC VI (Section B)

Plant Design & Economics for Chemical Engineers Theory Paper-XV credits:02

UNIT-1

(10Hours)

Prologue –The International System of units (SI)  
Introduction, Chemical Engineering plant Design ,Process Design Development ,General Design considerations, cost Estimation ,factors affecting profitability of Investments, Optimum Design,  
UNIT-2

(10Hours)

Process Design Development  
Introduction ,Design Process Procedure ,Type of Design ,Feasibility Survey Process development ,Design ,Construction & operation,  
Design Information from the literature,  
Flow Diagrams ,the preliminary Design  
UNIT-3 (10Hours) General design Consideration

plant Location ,Plant Layout, Utilities ,Structural Design ,storage ,Waste Disposal Cost asset accounting Outline of accounting procedure ,Basic relationship of accounting ,the balance sheet ,the income statement, maintaining accounting Record  
UNIT-4 (10Hours)

Cost Estimation

Cash flow for Industrial Operations, Cumulative cash positions Factors affecting investment & productions cost, Governmental Policies, Capital Investments, estimation of Capital Investments  
Interest & Investments Costs,  
Types of Interest, Compound Interest ,Nominal &  
Effective interest rates ,Continuous interest Present Worth & Discount ,Annuities  
Reference Books –

Plant Design & Economics for Chemical Engineers by Max S. Peters & Klaus .D.Timmerhaus

|  |  |
|--|--|
| Objective (S) To study the Plant Design & Economics for Chemical Engineers |  |
| Course Outcome(S)  |  |
| CO1  | To learn the International System of Units   |
| CO2  | Explain the process Design Development. To Know the Design Information the Literature.               |
| CO3  | Intercepts the theoretical Knowledge Plant Location, Plant Layout Structural Design                  |
| CO4  | To Illustrate the Cash Flow for Industrial Operations ,Cost Estimation, Interest & Investment Cost . |

Swami Ramanand Teerth Marathwada University Nanded  
Choice Based Credit System (CBCS) Course Structure (New scheme)  
B. Sc. Third year (Semester- VI)  
Semester Pattern effective from-2018  
Industrial Chemistry  
DESICP-IV(DSIC-V& VI)  
(section-B)  
Practical's based on P-XIII&P-XV(P-XVII)

Credit:-02

Project Report & Design the Thesis on a Technical Product.

1. Industrial Visit & Submission of Visit report
2. Preparation & Submission the thesis on Industrial Product
3. Synopsis Submission

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.

5. Viva-Voce

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DESICP-IV(DSIC-V& VI)  
(section-B)  
Practical's based on P-XIII&P-XV(P-XVII)

Credit:-02

1. Visit Small scale Industry & submission visit report
2. Visit large scale Industry & submission visit report
3. Group Discussion on basis of Current situation of Industrial marketing.
4. Synopsis submission .
5. Viva voce.

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Choice Based Credit System (CBCS) Course Structure (New scheme)

B. Sc. Third year (Semester- IV)

Semester Pattern effectivefrom-2018

Industrial Chemistry

DESICP-III (DDIC-VI),

(section B)

(SEC IV) -Industrial Skill for Data Analysis.

1. Replicate analysis of reliability of analytical Data.
2. Illustration of Precision & Accuracy. & Solve Problem on It
3. Concepts of Errors & Solve Problem on It
4. Test for Rejection of Data. & Solve Problem on It
5. Methods of Averages. & Solve Problem on It

Reference Book

Analytical Chemistry by Gurudeep Raj

Analytical Chemistry by Verma

|                   |  |
|-------------------|--|
| Objective (S)     | To acquire basic knowledge about Analysis of Data.         |
| Course Outcome(S) |  |
| CO1               | To replicate analysis of analytical Data.                  |
| CO2               | Explain the Precision & Accuracy & solve problem on it     |
| CO3               | To Illustrate Concept of Error & solve problem on it       |
| CO4               | Learn the Test for Rejection of Data & Solve problem on it |
| CO5               | Know the averages. & Solve Problem on it.                  |