SAURASHTRA UNIVERSITY

ACCREDITED GRADE “A” BY NAAC

COURSE DETAILS OF T.Y. B.SC.
INDUSTRIAL CHEMISTRY
(CBCS)

(In Force from June - 2018)

SEMESTER - V
PAPER: BS-IC-501, 502 & 503
PAPER: BS-IC-P-504

&

SEMESTER - VI
PAPER: BS-IC-601, 602 & 603
PAPER: BS-IC-P-604
INDUSTRIAL TRAINING: BS-IC-P-605
SAURASHTRA UNIVERSITY

UNIVERSITY CAMPUS
RAJKOT-5
(GUJARAT) (INDIA)

COURSE DETAILS OF T.Y. B.SC.
INDUSTRIAL CHEMISTRY
(CBCS)
(In Force from June - 2018)

SEMESTER - V
PAPER: BS-IC-501, 502 & 503
PAPER: BS-IC-P-504

&

SEMESTER - VI
PAPER: BS-IC-601, 602 & 603
PAPER: BS-IC-P-604
INDUSTRIAL TRAINING: BS-IC-P-605

CONTENTS

CREDIT SYSTEM & MARKS BS-IC-501/502/503 .................................................. 5
CREDIT SYSTEM & MARKS (theory papers) BS-IC-601/602/603 ..................... 6
CREDIT SYSTEM & MARKS (practical papers) BS-IC-P-504 ............................... 7
CREDIT SYSTEM & MARKS BS-IC-P-604 .......................................................... 7
CREDIT SYSTEM & MARKS (industrial training) BS-IC-P-605 ......................... 7
BS-IC-501 (PHARMACEUTICALS) ................................................................. 8
  UNIT 1 (CREDIT-0.8, LECTURES-12, MARKS-14) ........................................ 8
  INTRODUCTION TO PHARMACOPOEIA & DOSAGE FORMS .......................... 8
  UNIT 2 (CREDIT-0.8, LECTURES-12, MARKS-14) ........................................ 8
  PHYTOCHEMICALS & EVALUATION OF DRUGS ........................................... 8
  UNIT 3 (CREDIT-0.8, LECTURES-12, MARKS-14) ........................................ 9
  PHARMACEUTICAL EXCIPIENTS & SURGICAL DRESSINGS ............................ 9
  UNIT 4 (CREDIT-0.8, LECTURES-12, MARKS-14) ........................................ 9
  PHARMACEUTICAL DRUGS & PHARMACOGNOSY ........................................ 9
  UNIT 5 (CREDIT-0.8, LECTURES-12, MARKS-14) ........................................ 10
  INDUSTRIAL MICROBIOLOGY ...................................................................... 10
BS-IC-502 (POLYMER CHEMISTRY & ANALYTICAL TECHNIQUES) ................. 11

UNIT 1 (CREDIT-0.8, LECTURES-12, MARKS-14) ................................................. 11
POLYMER INTRODUCTION & PROPERTIES ................................................................. 11
UNIT 2 (CREDIT-0.8, LECTURES-12, MARKS-14) ................................................. 11
POLYMERIZATION TECHNIQUES & PROCESSING ............................................... 11
UNIT 3 (CREDIT-0.8, LECTURES-12, MARKS-14) ................................................. 12
POLYMER SYNTHESIS ......................................................................................... 12
UNIT 4 (CREDIT-0.8, LECTURES-12, MARKS-14) ................................................. 12
PHYSICO-CHEMICAL TECHNIQUES ....................................................................... 12
UNIT 5 (CREDIT-0.8, LECTURES-12, MARKS-14) ................................................. 12
CHROMATOGRAPHIC & SPECTROSCOPIC TECHNIQUES ..................................... 12

BS-IC-503 (HEAVY & FINE CHEMICALS) ............................................................ 14

UNIT 1 (CREDIT-0.8, LECTURES-12, MARKS-14) ................................................. 14
NITROGEN, PHOSPHORUS & CARBON DERIVATIVES .......................................... 14
UNIT 2 (CREDIT-0.8, LECTURES-12, MARKS-14) ................................................. 14
HALOGEN DERIVATIVES & CATALYSTS ............................................................... 14
UNIT 3 (CREDIT-0.8, LECTURES-12, MARKS-14) ................................................. 15
FOOD ADDITIVES, ESSENTIAL OILS, SURFACTANTS & EMULSIFIERS .............. 15
UNIT 4 (CREDIT-0.8, LECTURES-12, MARKS-14) ................................................. 15
ALKYL PHOSPHATE, HALOCARBON, ALKYL AMINE & INDUSTRIAL SOLVENTS 15
UNIT 5 (CREDIT-0.8, LECTURES-12, MARKS-14) ................................................. 16
SPECIALTY CHEMICALS ....................................................................................... 16

BS-IC-601 (DYES & INTERMEDIATES) ............................................................... 17

UNIT 1 (CREDIT-0.8, LECTURES-12, MARKS-14) ................................................. 17
INTRODUCTION TO DYES ..................................................................................... 17
UNIT 2 (CREDIT-0.8, LECTURES-12, MARKS-14) ................................................. 17
DYSES, INTERMEDIATES & ANALYTICAL TECHNIQUES .................................. 17
UNIT 3 (CREDIT-0.8, LECTURES-12, MARKS-14) ................................................. 18
AZO DYSES ............................................................................................................ 18
UNIT 4 (CREDIT-0.8, LECTURES-12, MARKS-14) ................................................. 18
DISPERSED DYSES & ETP ................................................................................... 18
UNIT 5 (CREDIT-0.8, LECTURES-12, MARKS-14) ................................................. 19
REACTIVE & VAT DYSES ................................................................................... 19

BS-IC-602 (PETROCHEMICALS & INDUSTRIAL MANAGEMENT) ...................... 20

UNIT 1 (CREDIT-0.8, LECTURES-12, MARKS-14) ................................................. 20
C1 & C2 PETROCHEMICALS ................................................................. 20
UNIT 2 (CREDIT-0.8, LECTURES-12, MARKS-14) ................................................. 20
C3 & C4 PETROCHEMICALS ........................................................................ 20
UNIT 3 (CREDIT-0.8, LECTURES-12, MARKS-14) ................................................. 21
AROMATICS & GASEOUS FUELS .................................................................... 21
UNIT 4 (CREDIT-0.8, LECTURES-12, MARKS-14) ................................................. 21
FUNDAMENTALS OF MANAGEMENT ......................................................... 21
UNIT 5 (CREDIT-0.8, LECTURES-12, MARKS-14) ................................................. 21
PRODUCTION MANAGEMENT ..................................................................... 21

BS-IC-603 (FUNDAMENTALS OF CHEMICAL ENGINEERING) ...................... 22
UNIT 1 (CREDIT-0.8, LECTURES-12, MARKS-14) ................................................. 22
FLUID MECHANICS ..................................................................................... 22
UNIT 2 (CREDIT-0.8, LECTURES-12, MARKS-14) ................................................. 22
HEAT TRANSFER ....................................................................................... 22
UNIT 3 (CREDIT-0.8, LECTURES-12, MARKS-14) ................................................. 23
REFRIGERATION ......................................................................................... 23
UNIT 4 (CREDIT-0.8, LECTURES-12, MARKS-14) ................................................. 23
PROCESS CONTROL .................................................................................. 23
UNIT 5 (CREDIT-0.8, LECTURES-12, MARKS-14) ................................................. 24
INDUSTRIAL SAFETY & DEVELOPMENT OF PROJECT ............................. 24

BS-IC-P-504 .................................................................................................. 25
DYSES PREPARATIONS & DYING ............................................................. 25
POLYMER IDENTIFICATION ....................................................................... 25
POLYMER PREPARATION .......................................................................... 26

BS-IC-P-604 .................................................................................................. 27
PHARMACEUTICAL PREPARATION & ESTIMATION ................................. 27
PETROLEUM ANALYSIS ........................................................................... 27
UNIT OPERATIONS .................................................................................... 28

BS-IC-P-605 .................................................................................................. 30
INDUSTRIAL TRAINING & PROJECT REPORT .......................................... 30

SCHEME OF ASSESSMENT SEMESTER - V: ............................................. 31

SCHEME OF ASSESSMENT SEMESTER - VI: ............................................. 32
### CREDIT SYSTEM & MARKS BS-IC-501/502/503

#### BS-IC-501 (PHARMACEUTICALS)
(Credits: 04, Hours of Instruction: 60)

<table>
<thead>
<tr>
<th>Paper</th>
<th>Unit</th>
<th>Name of Unit</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS-IC-501 PHARMACEUTICALS</td>
<td>1</td>
<td>Introduction to Pharmacopoeia &amp; Dosage Forms</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Phytochemicals &amp; Evaluation of Drugs</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Pharmaceutical Excipients &amp; Surgical Dressings</td>
<td>70 14</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Pharmaceutical Drugs &amp; Pharmacognosy</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Industrial Microbiology</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>100</td>
</tr>
</tbody>
</table>

#### BS-IC-502 (POLYMER CHEMISTRY & ANALYTICAL TECHNIQUES)
(Credits: 04, Hours of Instruction: 60)

<table>
<thead>
<tr>
<th>Paper</th>
<th>Unit</th>
<th>Name of Unit</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS-IC-502 POLYMERIC CHEMISTRY &amp; ANALYTICAL TECHNIQUES</td>
<td>1</td>
<td>Polymer Introduction &amp; Properties</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Polymerization Techniques &amp; Processing</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Polymer Synthesis</td>
<td>70 14</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Physico-Chemical Techniques</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Chromatographic &amp; Spectroscopic Techniques</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>100</td>
</tr>
</tbody>
</table>

#### BS-IC-503 (HEAVY & FINE CHEMICALS)
(Credits: 04, Hours of Instruction: 60)

<table>
<thead>
<tr>
<th>Paper</th>
<th>Unit</th>
<th>Name of Unit</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS-IC-503 HEAVY &amp; FINE CHEMICALS</td>
<td>1</td>
<td>Nitrogen, Phosphorus &amp; Carbon Derivatives</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Halogen Derivatives &amp; Catalysts</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Food Additives, Essential Oils, Surfactants &amp; Emulsifiers</td>
<td>70 14</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Alkyl Phosphate, Halocarbon, Alkyl Amine &amp; Industrial Solvents</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Specialty Chemicals</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>100</td>
</tr>
</tbody>
</table>
### CREDIT SYSTEM & MARKS (THEORY PAPERS) BS-IC-601/602/603

#### BS-IC-601 (DYES & INTERMEDIATES)
(Credits: 04, Hours of Instruction: 60)

<table>
<thead>
<tr>
<th>Paper</th>
<th>Unit</th>
<th>Name of Unit</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>Introduction to Dyes</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Dyes, Intermediates &amp; Analytical Techniques</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Azo Dyes</td>
<td>70, 14, 30</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Dispersed Dyes &amp; ETP</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Reactive &amp; Vat Dyes</td>
<td>14</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

#### BS-IC-602 (PETROCHEMICALS & INDUSTRIAL MANAGEMENT)
(Credits: 04, Hours of Instruction: 60)

<table>
<thead>
<tr>
<th>Paper</th>
<th>Unit</th>
<th>Name of Unit</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>C1 &amp; C2 Petrochemicals</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>C3 &amp; C4 Petrochemicals</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Aromatics &amp; Gaseous Fuels</td>
<td>70, 14, 30</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Fundamentals of Management</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Production Management</td>
<td>14</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

#### BS-IC-603 (FUNDAMENTALS OF CHEMICAL ENGINEERING)
(Credits: 04, Hours of Instruction: 60)

<table>
<thead>
<tr>
<th>Paper</th>
<th>Unit</th>
<th>Name of Unit</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>Fluid Mechanics</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Heat Transfer</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Refrigeration</td>
<td>70, 14, 30</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Process Control</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Industrial Safety &amp; Development of Project</td>
<td>14</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
### CREDIT SYSTEM & MARKS (PRACTICAL PAPERS) BS-IC-P-504

BS-IC-P-504 (INDUSTRIAL CHEMISTRY PRACTICAL SEMESTER-V)  
(Credits: 06, Hours of Instruction: 90)

<table>
<thead>
<tr>
<th>Paper</th>
<th>Unit</th>
<th>Name of Unit</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>Dyes Preparations &amp; Dyeing</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Polymer Identification</td>
<td>105</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Polymer Preparation</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td>150</td>
</tr>
</tbody>
</table>

### CREDIT SYSTEM & MARKS BS-IC-P-604

BS-IC-P-604 (INDUSTRIAL CHEMISTRY PRACTICAL SEMESTER-VI)  
(Credits: 06, Hours of Instruction: 90)

<table>
<thead>
<tr>
<th>Paper</th>
<th>Unit</th>
<th>Name of Unit</th>
<th>Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>Pharmaceutical Preparation &amp; Estimation</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Petroleum Analysis</td>
<td>105</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Unit Operations</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td>150</td>
</tr>
</tbody>
</table>

### CREDIT SYSTEM & MARKS (INDUSTRIAL TRAINING) BS-IC-P-605

BS-IC-P-605 (INDUSTRIAL TRAINING & PROJECT REPORT SEMESTER-VI)

<table>
<thead>
<tr>
<th>Paper</th>
<th>Unit</th>
<th>Name of Unit</th>
<th>External Marks</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>Project Report</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Project submission</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Viva Voce</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td>100</td>
</tr>
</tbody>
</table>
SAURASHTRA UNIVERSITY

THIRD YEAR B.SC. (INDUSTRIAL CHEMISTRY)

Syllabus (CBCS) of BS-IC-501 (PHARMACEUTICALS)

(Effective from June - 2018)

BS-IC-501 (PHARMACEUTICALS)

UNIT 1 (CREDIT-0.8, LECTURES-12, MARKS-14)

INTRODUCTION TO PHARMACOPOEIA & DOSAGE FORMS

Pharmacopoeia: Historical background and development of pharmaceutical industry in India in brief. Pharmacopoeias: Development of Indian pharmacopoeia and introduction to other important pharmacopoeias.

Dosage form & Formulations: Introduction to various types of formulations and roots of administration. Aseptic conditions, Need for dosage form.


BOOKS FOR REFERENCES (SEM-5-PAPER-501-UNIT-1)

1. A Pharmacopoeia of India: (the Indian pharmacopoeia), Indian pharmacopoeia committee.

UNIT 2 (CREDIT-0.8, LECTURES-12, MARKS-14)

PHYTOCHEMICALS & EVALUATION OF DRUGS

Phytochemicals: Introduction to plant classification and crude drugs, cultivation, collection, preparation for the market and storage of medicinal plants.

Evaluation of crude drugs: Moisture content, Extractive value, Volatile oil content, foreign organic matter. Quantitative microscopic exercises, including of starch leaf content (Palisade ratio, stomatal number and index, Vein inlet number and Vein termination number) crude fiber content.

Chromatographic techniques and Isolation of crude drugs: Introduction to chromatographic method for the identification of crude drugs. Various isolation
procedures for active pharmaceutical ingredients with example for alkaloid, sapogenin, & diosgenin.

**BOOKS FOR REFERENCES (SEM-5-PAPER-501-UNIT-2)**

1. Pharmacognosy of Powdered Crude Drugs, M.A. Iyengar
2. Pharmacognosy and Pharmaco biotechnology, Ashutosh Kar
3. Analytical Chromatography book: Dr. G.R. Chatwal

**UNIT 3 (CREDIT-0.8, LECTURES-12, MARKS-14)**

**PHARMACEUTICAL EXCIPIENTS & SURGICAL DRESSINGS**

Pharmaceutical Excipients: Various type of pharmaceutical excipients like: Glidents, Lubricants, Diluents, Preservatives, Antioxidants, Emulsifying agents, Coating agents, Binders, Coloring agents, Flavoring agents, Gelatin and other additives like Saccharin and Sorbitol.

Surgical dressings & Quality control: Surgical dressings like Gauges, Bandages, Sutures and Ligatures with respect to the process, manufacture, methods of sterilization and uses. Pharmaceutical quality control techniques like sterilization and pyrogenic testing, aseptic condition, etc.

**BOOKS FOR REFERENCES (SEM-5-PAPER-501-UNIT-3)**

2. Handbook of Pharmaceutical Excipients, Raymond C. Rowe
3. Surgical Dressings and Wound Management, Steve Thomas

**UNIT 4 (CREDIT-0.8, LECTURES-12, MARKS-14)**

**PHARMACEUTICAL DRUGS & PHARMACOGNOSY**

Pharmaceutical Drugs: Classification of various types of drugs with examples for the following bulk drugs. Antimicrobials: Chloramphenicol, Isoniazid, Na-PAS, etc. Analgesics and Anti-inflammatory: Paracetamol, Phenacetin, Mefenic acid, etc. Barbiturates: Phenobarbitol, Pentobarbitol, Talbutal, Butalbital, etc. Anti-hypertensive & Cardiovascular Agents: Methyl dopa. Blockers: Propanolol, Atenolol, etc. Pharmacognosy: Chemical constituents of plants including carbohydrates, amino acids, proteins, Vitamins, terpenoids, flavonoids, and tannins.

**BOOKS FOR REFERENCES (SEM-5-PAPER-501-UNIT-4)**

2. Practical Pharmacognosy, T.N. Vassudevan

UNIT 5 (CREDIT-0.8, LECTURES-12, MARKS-14)

INDUSTRIAL MICROBIOLOGY

Introduction of micro-organisms and enzyme system: Brief idea of micro-organisms, their structure, growth and usefulness. Enzyme system useful for transformation and Enzyme catalysed transformation.

Products based on Fermentation: Microbial products, General principle of fermentation process and product processing. Manufacturing of antibiotics like Penicillin – G, Penicillin – V, and Tetracycline, ephedrine and Bakery products like Vinegar, Lactic Acid

BOOKS FOR REFERENCES (SEM-5-PAPER-501-UNIT-5)

1. Industrial Microbiology Paperback – 2011, Patel A H
2. Enzyme Technology: Pacemaker of Biotechnology, Prasad N.K
3. Microbiology, Pelczar, Jr., Michael
SAURASHTRA UNIVERSITY

THIRD YEAR B.SC. (INDUSTRIAL CHEMISTRY)

Syllabus (CBCS) of BS-IC-502 (POLYMER CHEMISTRY & ANALYTICAL TECHNIQUES)

(Effective from June - 2018)

BS-IC-502 (POLYMER CHEMISTRY & ANALYTICAL TECHNIQUES)

UNIT 1 (CREDIT-0.8, LECTURES-12, MARKS-14)

POLYMER INTRODUCTION & PROPERTIES

Polymer, Oligomer, Classification of polymer, Functionality concept, Concept of Cross linking. Molecular weight and molecular weight distribution number, Method of determining molecular weight, Mechanical Properties including, Crystallinity, Tensile strength (σt), Elongation (ε) at break, Compressive strength (σc), Abrasive resistance, Coefficient of friction (μ) Thermal Properties including Melting temperature (Tm), Glass transition temperature (Tg) & Factor affecting GTT, Heat deflection temperature.

BOOKS FOR REFERENCES (SEM-5-PAPER-502-UNIT-1)


UNIT 2 (CREDIT-0.8, LECTURES-12, MARKS-14)

POLYMERIZATION TECHNIQUES & PROCESSING

Polymerization techniques including three stage addition polymerization, Condensation, Condensation polymerization, Mechanisms and reaction schemes of different polymerization techniques. Polymer Compounding, Molding, Compression molding, Transfer molding, Injection molding, Extrusion molding, Blow molding.

BOOKS FOR REFERENCES (SEM-5-PAPER-502-UNIT-2)

UNIT 3 (CREDIT-0.8, LECTURES-12, MARKS-14)

POLYMER SYNTHESIS


BOOKS FOR REFERENCES (SEM-5-PAPER-502-UNIT-3)


UNIT 4 (CREDIT-0.8, LECTURES-12, MARKS-14)

PHYSICO-CHEMICAL TECHNIQUES

Introduction, principle, various factors, measurement, application, importance apparatus of following analysis methods: Conductometric titration, pH and its determination, Potentiometric titrations, Refractometry, Colorimetric analysis, Polarimetric analysis.

BOOKS FOR REFERENCES (SEM-5-PAPER-502-UNIT-4)

2. Instrumental Methods of analysis, Skoog and West.
3. Chemical Instrument analysis, B.K. Sharma

UNIT 5 (CREDIT-0.8, LECTURES-12, MARKS-14)

CHROMATOGRAPHIC & SPECTROSCOPIC TECHNIQUES

Chromatography: Sampling procedures, sampling of bulk materials, techniques of sampling for solids, Liquids and gases. Various Chromatographic techniques like Gas liquid chromatography and High performance (Pressure) liquid chromatography, Comparison between various types of Detectors used in Chromatography.

Spectroscopy: Principle, construction, working and Specific applications of UV visible spectroscopy, IR spectroscopy, NMR spectroscopy
BOOKS FOR REFERENCES (SEM-5-PAPER-502-UNIT-5)

1. Chemical Instrument analysis B.K. Sharma
2. Instrumental methods of chemical analysis. Willard, Werrit, Dean Setel.
SAURASHTRA UNIVERSITY

THIRD YEAR B.SC. (INDUSTRIAL CHEMISTRY)

Syllabus (CBCS) of BS-IC-503 (HEAVY & FINE CHEMICALS)

(Effective from June - 2018)

BS-IC-503 (HEAVY & FINE CHEMICALS)

UNIT 1 (CREDIT-0.8, LECTURES-12, MARKS-14)

NITROGEN, PHOSPHORUS & CARBON DERIVATIVES


Phosphorous Chemicals: Phosphorus, Phosphoric acid, ammonium phosphate, superphosphate, triple super phosphate.


BOOKS FOR REFERENCES (SEM-5-PAPER-503-UNIT-1)

1. Industrial Chemistry, B. K. Sharma
3. Applied organic chemistry, Kilner E. and Samual

UNIT 2 (CREDIT-0.8, LECTURES-12, MARKS-14)

HALOGEN DERIVATIVES & CATALYSTS

Halogen Derivatives – Fluorine, Bromine, Iodine, Hydrobromic acid, Sodium chloride, Sodium Sulphate, Sodium Sulphite, Sodium Thiosulphate, Borax, Boric acid.

Industrial Catalysts – Raney nickel, other forms of nickel, palladium, copper chromate, vanadium, platinum based catalyst. Titanium tetrachloride, titanium dioxide.

BOOKS FOR REFERENCES (SEM-5-PAPER-503-UNIT-2)

1. Industrial Chemistry, B. K. Sharma
2. Chemical process industries Shreve R.N.; Mc Graw Hill
3. Applied organic chemistry, Kilner E. and Samual
UNIT 3 (CREDIT-0.8, LECTURES-12, MARKS-14)
FOOD ADDITIVES, ESSENTIAL OILS, SURFACTANTS & EMULSIFIERS

Food additives: Classification, food additive compounds like monosodium glutamate, tartaric acid, citric acid with manufacturing processes.

Essential oils: Composition and production of some essential oils General organic flavour camphor, citrol, citronellol, methanol, vanillin, coumarin, musk embrittle/ ketones.

Surfactants: Classification, Industrial application.

Emulsifiers: Types, HLV concept, Tweens, Spans.

BOOKS FOR REFERENCES (SEM-5-PAPER-503-UNIT-3)

1. Industrial Chemistry, B. K. Sharma
3. Essentials of Medicinal Chemistry, Korolkovas and Burkhater; Wiley Inter science.

UNIT 4 (CREDIT-0.8, LECTURES-12, MARKS-14)
ALKYL PHOSPHATE, HALOCARBON, ALKYL AMINE & INDUSTRIAL SOLVENTS

Alkyl Phosphate & Halocarbon: Raw materials, manufacturing process, flow chart and uses of Triphenyl phosphine, alkylphosphates (methyl, ethyl, propyl, butyl), chlorination of methane, Methyl chloride, dichloromethane, chloroform, carbon tetrachloride, ethanolamine.

Alkyl Amines: Raw materials, manufacturing process, flow chart and uses of Methylamines, ethyl amines, di-, tri-alkyl amines (Methyl, ethyl) Butylamines, propyl amines, ethyl and methyl acetoacetates, acetaldehyde.

Special Industrial Solvents: DMF, DMSO, THF, diethyl ether, dimethoxy ethane, dioxane, N-alkylated ethanol amine.

BOOKS FOR REFERENCES (SEM-5-PAPER-503-UNIT-4)

1. Industrial Chemistry, B. K. Sharma
2. Chemical process industries Shreve R.N.; Mc Graw Hill
3. Applied organic chemistry, Kilner E. and Samual
UNIT 5 (CREDIT-0.8, LECTURES-12, MARKS-14)

SPECIALTY CHEMICALS

Manufacture of the following with reference to raw materials, flow chart, properties and uses; Fischer – Tropsch synthesis, Examples, Application, uses and manufacturing of zeolites. Chemical derived from acetylene, propargyl alcohol, 4-butanediol, vinyl chloride. Pyridine, phenol, acetone, phthalic anhydride, glycerol, melamine, formaldehyde.

Biochemical Reagents: Ninhydrin, Tetrazolium blue.

Fine Chemicals: With reference to raw material production process, quality control and specifications of common industrial compound involving two step reactions, lithium aluminum hydride, sodium amide, sodium ethoxide, sodium methoxide.

BOOKS FOR REFERENCES (SEM-5-PAPER-503-UNIT-5)

1. Industrial Chemistry, B.K.Sharma
2. Chemical process industries Shreve R.N.; Mc Graw Hill
3. Applied organic chemistry, Kilner E. and Samual
SAURASHTRA UNIVERSITY

THIRD YEAR B.SC. (INDUSTRIAL CHEMISTRY)

Syllabus (CBCS) of BS-IC-601 (DYES & INTERMEDIATES)

(Effective from June - 2018)

BS-IC-601 (DYES & INTERMEDIATES)

UNIT 1 (CREDIT-0.8, LECTURES-12, MARKS-14)

INTRODUCTION TO DYES

Introduction to the history of dyes. Important landmarks in the historical development. Ancient and Modern theory based on structure and Chemical constitution. Classification on the basis of natural and synthetic dyes. Structure and the mode of application to the fibers. Fastness properties, optical whiteners and fluorescent brighteners.

BOOKS FOR REFERENCES (SEM-6-PAPER-601-UNIT-1)

3. The Dyeing of Synthetic Polymers and Acetate Fibres.D.M. Rangnekar and P.P. Singh; Himalaya Publication, Bombay

UNIT 2 (CREDIT-0.8, LECTURES-12, MARKS-14)

DYES, INTERMEDIATES & ANALYTICAL TECHNIQUES

Benzene Intermediates, Chloro and nitro benzene, Nitro anilines, P-nitro aniline, Nitro anisole, Toluene and Xylene intermediates, di-amino benzenes etc, Naphthalene Intermediates. H-acid, J-acid, R-acid, NW-acid, Chicago acid, Schaffer’s acid, Naphthol, Naphtholsulphonic acid, Naphthyl amine sulfonic acids.

Anthraquinone Intermediates: 1-Amino and 2-amino Anthraquinone, Bromamine acid, Quinizarin.

Introduction to analytical techniques like TLC and HPLC for dyes and intermediates.
BOOKS FOR REFERENCES (SEM-6-PAPER-601-UNIT-2)

5. Synthetic Dyes, Gurdeep Chatwal.

UNIT 3 (CREDIT-0.8, LECTURES-12, MARKS-14)

AZO DYES


BOOKS FOR REFERENCES (SEM-6-PAPER-601-UNIT-3)


UNIT 4 (CREDIT-0.8, LECTURES-12, MARKS-14)

DISPERSED DYES & ETP

BOOKS FOR REFERENCES (SEM-6-PAPER-601-UNIT-4)


UNIT 5 (CREDIT-0.8, LECTURES-12, MARKS-14)

REACTIVE & VAT DYES

Anthraquinone Vat Dyes: Introduction of Anthraquinone (Vat) dyes: Indanthrene yellow 4GK, Indanthrone Blue, Dibenzathrone, Caledon Jade Green, Flavanthrone, Pyranthrone, Indanthrene Brown RRD, Indanthrene Rubene R.

Indigoid dyes: Synthesis of Indigo, Indigosol-O, Thio-indigo, etc.


BOOKS FOR REFERENCES (SEM-6-PAPER-601-UNIT-5)

2. Synthetic Dyes, Gurdeep Chatwal
4. Chemistry of dyes and intermediates, Cain, Thorpe and Linstend; 1969
SAURASHTRA UNIVERSITY
THIRD YEAR B.SC. (INDUSTRIAL CHEMISTRY)

Syllabus (CBCS) of BS-IC-602 (PETROCHEMICALS & INDUSTRIAL MANAGEMENT)
(Effective from June - 2018)

BS-IC-602 (PETROCHEMICALS & INDUSTRIAL MANAGEMENT)

UNIT 1 (CREDIT-0.8, LECTURES-12, MARKS-14)
C1 & C2 PETROCHEMICALS

Manufacture of the following compounds: Methane, Ethylene, Acetylene
Manufacture of the following compounds from Methane: Methanol, Hydrogen Cyanide, Carbon disulphide. Manufacture of the following compounds from Ethylene: Ethyl chloride, Ethanol, Ethylene oxide, Ethylene glycol, Acetic acid, Styrene, Vinyl Acetate

BOOKS FOR REFERENCES (SEM-6-PAPER-602-UNIT-1)

UNIT 2 (CREDIT-0.8, LECTURES-12, MARKS-14)
C3 & C4 PETROCHEMICALS

Chemicals from C3 Compounds: Manufacture of the following compounds From Propylene: Isopropanol, Cumene, Glycerin, Acrylonitrile, Propylene oxide, Acrylic Acid and Bis-Phenol.

Chemicals from C4 Compounds: Manufacture of the following compounds From C4 hydrocarbons: Butadiene, Isobutane, Butanol, Methaacyrlc acid and Maleic anhydride.

BOOKS FOR REFERENCES (SEM-6-PAPER-602-UNIT-2)
UNIT 3 (CREDIT-0.8, LECTURES-12, MARKS-14)

AROMATICS & GASEOUS FUELS

Manufacture of the following compounds: Benzene, Toluene, Xylene, Naphthalene, Linear alkyl benzenes and their sulphonates, Caprolactum and adipic acid.

Steam reforming: from natural gas and from naphtha. Scheme for CO & H₂ production. SNG production: from naphtha and from via partial oxidation.

BOOKS FOR REFERENCES (SEM-6-PAPER-602-UNIT-3)


UNIT 4 (CREDIT-0.8, LECTURES-12, MARKS-14)

FUNDAMENTALS OF MANAGEMENT

Concept of scientific management in industry, Levels of management, Function of management, Decision making, SWOC & PEST analysis, Planning, Organizing, Directing and control. Inventory Control. Motivation in industries, Maslow’s hierarchy of needs theory. Management of Human Resources selection.

BOOKS FOR REFERENCES (SEM-6-PAPER-602-UNIT-4)

1. Economics of Chemical industry. Hempel E.E.
2. Industrial Organization and management. Behel L.L.

UNIT 5 (CREDIT-0.8, LECTURES-12, MARKS-14)

PRODUCTION MANAGEMENT

Production planning, Plant location, Plant layout, Process layout, Product: Classification, Product Development Stages, Product Life Cycle, Product Mix, Product line. Factors involved in product cost estimation, Methods employed for the estimation of capital investment, Capital formation, Elements of cost accounting, Interest and investment costs, time value and money.

BOOKS FOR REFERENCES (SEM-6-PAPER-602-UNIT-5)

1. Economics of Chemical industry. Hempel E.E.
2. Industrial Organization and management. Behel L.L.
SAURASHTRA UNIVERSITY

THIRD YEAR B.SC. (INDUSTRIAL CHEMISTRY)

Syllabus (CBCS) of BS-IC-603 (FUNDAMENTALS OF CHEMICAL ENGINEERING)

(Effective from June - 2018)

BS-IC-603 (FUNDAMENTALS OF CHEMICAL ENGINEERING)

UNIT 1 (CREDIT-0.8, LECTURES-12, MARKS-14)

FLUID MECHANICS


BOOKS FOR REFERENCES (SEM-6-PAPER-603-UNIT-1)

2. Fluid Mechanics, by AK Mohanty, Printice-Hall of India Publication.

UNIT 2 (CREDIT-0.8, LECTURES-12, MARKS-14)

HEAT TRANSFER


BOOKS FOR REFERENCES (SEM-6-PAPER-603-UNIT-2)

1. Unit Operation - II, by K.A. Gavhane, Nirali Prakashan.

UNIT 3 (CREDIT-0.8, LECTURES-12, MARKS-14)

REFRIGERATION

Definition and importance of refrigeration, COP, Difference between heat engine, refrigerator and heat pump. Air conditioning, characteristics of good refrigerants, classification of refrigerants, Properties of refrigerants, industrially important refrigerants: Ammonia, CO\(_2\), SO\(_2\), Freon-12, Brine, Coding of various types of refrigerants, refrigeration cycles.

BOOKS FOR REFERENCES (SEM-6-PAPER-603-UNIT-3)


UNIT 4 (CREDIT-0.8, LECTURES-12, MARKS-14)

PROCESS CONTROL

Process Control: Control system and its components, Feedback control system, block diagram, Comparison between positive feedback and negative feedback, terminology, Transfer function, Transportation lag, closed and open loop control system. Control valves.

Modes of Control: ON-OFF Control, Proportional Control, Proportional Integral Control, Proportional Integral Derivative Control.

BOOKS FOR REFERENCES (SEM-6-PAPER-603-UNIT-4)

1. Industrial Process Control, by Ghodrat Kalani, GP Publication.
UNIT 5 (CREDIT-0.8, LECTURES-12, MARKS-14)

INDUSTRIAL SAFETY & DEVELOPMENT OF PROJECT

Industrial Safety: Industrial hazards and safety consideration in chemical industries. Principles of safety, Dangerous properties of chemicals, major factors to be considered for safety, effect of chemicals on human body, engineering control of chemical plants hazards, fire and explosion, health hazard, laboratory safety, Color codes for a safety.

Development of Project: Development of the project, Evaluation of process, choice of process, plant design Factors, selection of equipment for chemical plant, Various types of reactor and reaction vessels.

BOOKS FOR REFERENCES (SEM-6-PAPER-603-UNIT-5)

2. Industrial Safety and Environment, by Amit Gupta, Laxmi Publication.
SAURASHTRA UNIVERSITY
THIRD YEAR B.SC. (INDUSTRIAL CHEMISTRY)

Syllabus (CBCS) of BS-IC-P-504 (INDUSTRIAL CHEMISTRY PRACTICAL SEMESTER V)
(Effective from June - 2018)

BS-IC-P-504

DYES PREPARATIONS & DYEING

LIST OF PRACTICALS

1. Preparation of Fast Green-O dye.(Dinitroso resorcinol)
2. Preparation of Lake Red.
3. Preparation of Disperse dye.
4. Preparation of Methyl Orange dye.
5. Preparation of Mordant Yellow dye.
6. Preparation of Butter Yellow.
7. Preparation of Red-2R dye.
8. Preparation of Yellow- 4 G.
10. Dyeing of cotton with Basic dye Methylene blue.
11. Dyeing of cotton with Basic dye Crystal violet.
12. Dyeing of cotton with Aniline Black.
13. Dyeing of cotton with Fast Red A.

LIST OF EQUIPMENTS/INSTRUMENTS/ GLASSWARES:

1. Glassware assembly
2. Ice Bath

POLYMER IDENTIFICATION

LIST OF PRACTICALS

1. To identify the given polymer sample (Poly methyl methacrylate)
2. To identify the given polymer sample (Poly ethylene)
3. To identify the given polymer sample (Poly propylene)
4. To identify the given polymer sample (Poly vinyl acetate)
5. To identify the given polymer sample (Poly vinyl alcohol)
6. To identify the given polymer sample (Poly vinyl chloride)
7. To identify the given polymer sample (Poly styrene)
8. To identify the given polymer sample (Poly acrylonitrile butadiene styrene)
9. To identify the given polymer sample (Poly styrene acrylonitrile)
10. To identify the given polymer sample (Nylon-6,6)

LIST OF EQUIPMENTS/INSTRUMENTS/ GLASSWARES:

1. Glassware assembly
2. Watch glass, Test tube, Copper foil, Melting point assembly, Evaporating dish

POLYMER PREPARATION

LIST OF PRACTICALS

1. Preparation of Glyptal Resin.
2. Preparation of Urea Formaldehyde.
3. Preparation of Melamine Formaldehyde.
4. Preparation of Novolac Resin.
5. Preparation of Resol Resin.
6. Preparation of Cellulose Acetate.

LIST OF EQUIPMENTS/INSTRUMENTS/ GLASSWARES:

1. Glassware assembly
2. Distillation assembly
SAURASHTRA UNIVERSITY

THIRD YEAR B.SC. (INDUSTRIAL CHEMISTRY)

Syllabus (CBCS) of BS-IC-P-604 (INDUSTRIAL CHEMISTRY PRACTICAL SEMESTER VI)

(Effective from June - 2018)

BS-IC-P-604

PHARMACEUTICAL PREPARATION & ESTIMATION

LIST OF PRACTICALS

1. Preparation of Methyl Salicylate.
2. Preparation of Cold Cream.
3. Preparation of Benzilic acid.
5. Preparation of Acetophenone phenyl hydrazone.
6. Preparation of Benzocaine.
7. Preparation of Aspirin.
8. Preparation of 2,3-diphenyl quinoxaline.
9. Determination of % W/W of Lactic acid and Lactide together.
10. Determination of Aspirin content in given sample.
12. Estimation of Neutralization of Antacid (ENO) powder.
13. Determination of assay of Zinc Oxide (ZnO IP-85).
14. Determination of % of Vitamin-C in given tablet.
15. Determination of % of Vitamin-C in given pure powder.
16. Analysis of % of Mg in a given sample of Talcum powder.

LIST OF EQUIPMENTS/INSTRUMENTS/ GLASSWARES:

1. Glassware assembly
2. Titration assembly
3. Distillation assembly

PETROLEUM ANALYSIS

LIST OF PRACTICALS

1. Determination of Penetration number of given bituminous sample.
2. Determination of Softening point of bituminous sample.
3. Determination of the Smoke point of light petroleum products.
4. Determination of the Kinematic Viscosity of an oil sample using Redwood Viscometer.
5. Determination of the Kinematic Viscosity of an oil sample using Saybolt Viscometer.
6. Determination of Flash and Fire point of the given sample by using Cleaveland open cup apparatus.
7. Determination of the % moisture present in a given sample of liquid petroleum by Dean and Stark’s method.
8. Determination of Cloud and Pour point of heavy petroleum product.
9. Determination of Aniline point and Diesel Index of petroleum products and hydrocarbon solvents.
10. Determination of % carbon residue of liquid petroleum products.

**LIST OF EQUIPMENTS/INSTRUMENTS/GLASSWARES:**

1. Distillation assembly
2. Glassware assembly
3. Saybolt Viscometer
4. Redwood Viscometer
5. Smoke Point apparatus
6. Penetrometer
7. Softening Point apparatus
8. Aniline Point apparatus
9. Dean and Stark’s assembly
10. Cloud and Pour apparatus
11. Carbon Residue apparatus
12. Cleaveland open cup apparatus

**UNIT OPERATIONS**

**LIST OF PRACTICALS**

1. Crushing of given raw materials in Jaw Crusher and to determine average particle size and reduction ratio.
2. Crushing of given raw materials in Roll Crusher and to determine average particle size and reduction ratio.
3. Analysis of given sample using Sieve Shaker and find the average particle size.
4. Study the operation of Ball Mill and calculate reduction ratio and find the average particle size.
6. Determination of equilibrium solubility of following system at room temperature and to plot saturation curve on triangular graph paper for CHCl$_3$-H$_2$O-CH$_3$COOH system.
7. Determination of equilibrium solubility of following system at room temperature and to plot saturation curve on triangular graph paper for CCl$_4$-H$_2$O-CH$_3$COOH system.
8. To study Psychrometric property of ambient air using Psychrometric chart and to find out: 1) Dew point  2) Enthalpy  3) Absolute humidity  4) Percentage humidity

LIST OF EQUIPMENTS/INSTRUMENTS/ GLASSWARES:

1. Glassware assembly
2. Size reduction equipment like Jaw Crusher, Roll Crusher, Sieve Shaker, Ball Mill etc.
3. Cyclone Separator
4. Thermometer-Porcelain dish- cotton wick system.
SAURASHTRA UNIVERSITY

THIRD YEAR B.SC. (INDUSTRIAL CHEMISTRY)

Syllabus (CBCS) of BS-IC-P-605 (INDUSTRIAL TRAINING & PROJECT REPORT)

(Effective from June - 2018)

BS-IC-P-605

INDUSTRIAL TRAINING & PROJECT REPORT

Minimum 3 weeks of Industrial training, Project report must be submitted of minimum 50 pages after completion of training.
THIRD YEAR B.SC. (INDUSTRIAL CHEMISTRY)
SCHEME OF ASSESSMENT
(Effective from June - 2018)

SCHEME OF ASSESSMENT SEMESTER - V:

Theory:
Paper carries 70 Marks
Six Lectures/Week
BS-IC-501 (Theory + Internal Theory) (70+30=100)
BS-IC-502 (Theory + Internal Theory) (70+30=100)
BS-IC-503 (Theory + Internal Theory) (70+30=100)

Practical:
Practical carries 35 Marks
Two days/Week
BS-IC-P-504 (Practical + Internal Practical) (105+45=150)

1) Dyes Preparation & Dyeing (35 Marks)
2) Polymer Identification (35 Marks)
3) Polymer Preparation (35 Marks)

<table>
<thead>
<tr>
<th>PAPER NO.</th>
<th>NO. OF PAPER</th>
<th>THEORY EXAM HOURS</th>
<th>PRACTICAL EXAM HOURS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS-IC-501, 502 &amp; 503 &amp; BS-IC-P-504</td>
<td>One</td>
<td>2:30 Hours</td>
<td>3 Hours</td>
</tr>
</tbody>
</table>
SAURASHTRA UNIVERSITY
THIRD YEAR B.SC. (INDUSTRIAL CHEMISTRY)
SCHEME OF ASSESSMENT
(Effective from June - 2018)

SCHEME OF ASSESSMENT SEMESTER - VI:

Theory:
Paper carries 70 Marks

Six Lectures/ Week
BS-IC-601 (Theory + Internal Theory) (70+30=100)
BS-IC-602 (Theory + Internal Theory) (70+30=100)
BS-IC-603 (Theory + Internal Theory) (70+30=100)

Practical:
Practical carries 35 Marks
Two days/Week
BS-IC-P-604 (Practical + Internal Practical) (105+45=150)

1) Pharmaceutical Estimation & Preparation (35 Marks)
2) Petroleum Analysis (35 Marks)
3) Unit Operations (35 Marks)

<table>
<thead>
<tr>
<th>PAPER NO.</th>
<th>NO. OF PAPER</th>
<th>THEORY EXAM HOURS</th>
<th>PRACTICAL EXAM HOURS</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS-IC-601, 602 &amp; 603 &amp; BS-IC-P-604</td>
<td>One</td>
<td>2:30 Hours</td>
<td>3 Hours</td>
</tr>
<tr>
<td>BS-IC-P-605</td>
<td>-</td>
<td>-</td>
<td>VIVA-VOCE</td>
</tr>
</tbody>
</table>