

# **DEPARTMENT OF CHEMISTRY**

**GOVT. DIGVIJAY PG AUTONOMOUS  
COLLEGE, RAJNANDGAON (C.G.)**



## **SYLLABUS**

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

**2018 -19**

**DEPARTMENT OF CHEMISTRY**  
**GOVT. DIGVIJAY PG AUTONOMOUS COLLEGE, RAJNANDGAON**

**Approved syllabus for B.Sc. INDUSTRIAL CHEMISTRY by the members  
of Board of Studies for the Session  
2018 -19**

The syllabus with the paper combinations is as under

**B.Sc. I:**

<b>Paper I: INDUSTRIAL ASPECTS OF ORGANIC &amp; INORGANIC CHEMISTRY</b>	<b>Paper II: INDUSTRIAL ASPECTS OF PHYSICAL CHEMISTRY, MATERIAL AND ENERGY BALANCE</b>
<b>Paper III: UNIT OPERATION IN CHEMICAL INDUSTRY AND UTILITIES, FLUID FLOW AND HEAT TRANSPORT IN INDUSTRY</b>	<b>Practical : INDUSTRIAL CHEMISTRY</b>

**B.Sc.II :**

<b>Paper I: MATERIAL SCIENCE AND ENVIRONMENTAL STUDIES</b>	<b>Paper II: ORGANIC CHEMICALS MANUFACTURING AND WASTE MANAGEMENT</b>
<b>Paper III : ORGANIC SYNTHESIS AND INDUSTRIAL INSTRUMENTATIONS</b>	<b>Practical: INDUSTRIAL CHEMISTRY</b>

**B.Sc. III:**

<b>Paper I: CHEMICAL PROCESS AND INDUSTRIAL ECONOMICS</b>	<b>Paper II: PHARMACEUTICALS</b>
<b>Paper III : DRUGS</b>	<b>Practical: INDUSTRIAL CHEMISTRY</b>

The syllabus for B.Sc. Ind. Chemistry is hereby approved for the session 2018 -19  
In case any change or modification is prescribed by Central Board of Studies or Higher Education Department, Govt. of Chhattisgarh with respect to content or distribution of marks for undergraduate syllabi, it will be implemented accordingly.

**Syllabus and Marking Scheme for B.Sc. (Industrial Chemistry) First Year**

**2018-19**

Paper No.	Title of the Paper	Marks Allotted in Theory	
		Max	Min
I	<b>INDUSTRIAL ASPECTS OF ORGANIC &amp; INORGANIC CHEMISTRY</b>	34	33
II	<b>INDUSTRIAL ASPECTS OF PHYSICAL CHEMISTRY, MATERIAL AND ENERGY BALANCE</b>	33	
III	<b>UNIT OPERATION IN CHEMICAL INDUSTRY AND UTILITIES, FLUID FLOW AND HEAT TRANSPORT IN INDUSTRY</b>	33	
IV	<b>Practical</b>	50	17
	<b>Total</b>	<b>150</b>	

<b>03 Theory papers</b>	-	<b>100</b>
<b>01 Practical</b>	-	<b>50</b>
<b>Total Marks</b>	-	<b>150</b>

**Syllabus and Marking Scheme for B.Sc. (Industrial Chemistry) Second Year  
2018-19**

Paper No.	Title of the Paper	Marks Allotted in Theory	
		Max	Min
I	<b>MATERIAL SCIENCE AND ENVIRONMENTAL STUDIES</b>	34	33
II	<b>ORGANIC CHEMICALS MANUFACTURING AND WASTE MANAGEMENT</b>	33	
III	<b>ORGANIC SYNTHESIS AND INDUSTRIAL INSTRUMENTATIONS</b>	33	
IV Practical		50	17
<b>Total</b>		<b>150</b>	

<b>03 Theory papers</b>	-	<b>100</b>
<b>01 Practical</b>	-	<b>50</b>
<b>Total Marks</b>	-	<b>150</b>

**Syllabus and Marking Scheme for B.Sc. (Industrial Chemistry) Third Year  
2018-2019**

Paper No.	Title of the Paper	Marks Allotted in Theory	
		Max	Min
I	CHEMICAL PROCESS AND INDUSTRIAL ECONOMICS	34	11
II	PHARMACEUTICAL CHEMISTRY	33	11
III	DRUGS	33	11
IV	Practical	50	17
	<b>Total</b>	<b>150</b>	

<b>03 Theory papers</b>	-	<b>100</b>
<b>01 Practical</b>	-	<b>50</b>
<b>Total Marks</b>	-	<b>150</b>

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2. Section A shall contain very short answer type questions (One or two line answer) or objective type questions (fill in the blank). (**no multiple choice questions**)
3. Section B shall contain short answer type questions with maximum limit of 150 words.
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5. The students are required to study the content mentioned in the curriculum exhaustively.

### EVALUATION PATTERN

➤ **Theory Paper – I : 34 marks**

**Paper - II & III: 33 marks**

➤ **Practical: 50 marks**

Question Type	MM 34 Paper - I (Marks x No. of Q.)	MM 33 Paper – II & III (Marks x No. of Q.)
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<b>B (Short Ans.)</b>	<b>2 x 5 = 10</b>	<b>2 x 5 = 10</b>
<b>C (Long Ans.)</b>	<b>3 x 5 = 15</b>	<b>3 x 5 = 15</b>

<b>Name and Signatures</b>	Departmental members
Chairperson /H.O.D .....	<b>Name and Signatures</b>
Subject Expert ..... (University Nominee)	1. ....
Subject Expert.....	2. ....
Representative ..... (Industry)	3. ....
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Representative ..... (Professor Science Faculty Other Dept.)	5. ....
	6. ....

**DEPARTMENT OF CHEMISTRY**  
**GOVT. DIGVIJAY PG AUTONOMOUS COLLEGE, RAJNANDGAON**  
**B.Sc. I (INDUSTRIAL CHEMISTRY)**  
**2018-2019**

**PAPER- I**  
**INDUSTRIAL ASPECTS OF ORGANIC & INORGANIC CHEMISTRY**

**Max. Marks – 34**

- UNIT-1**      1. Nomenclature, generic names, trade names  
                  2. Raw material for organic compounds: Petroleum, natural gas, fractional distillation of crude oil
- UNIT-2**      1. Petroleum: Cracking, reforming, hydroforming, isomerisation  
                  2. Coal: Types, Structure, Properties, distillation of coal, chemicals derived from coal
- UNIT-3**      1. Renewable natural resources: cellulose, starch, properties, modification, important industrial chemicals derived from them, Alcohol and alcohol based chemicals, oxalic acid, Furfural.  
                  2. Basic metallurgical operations: pulverization, calcination, roasting and refining
- UNIT-4**      Physico chemical principles of extraction of Iron, Copper, Lead, Silver, Sodium, Aluminium, Magnesium, Zinc, Chromium.
- UNIT-5**      Inorganic materials of industrial importance: their availability, forms, Structure and modification. Alumina, Silica, Silicates, Clays, Mica, Carbon, Zeolites.

**LIST OF REFERENCE BOOKS:**

1. Coal Conversion, E.J. Hoggman: The Energon Co., Lavamic Wyomnig, U.S.A.
2. Introduction of petroleum chemicals, H. Steiner, Pergamen Press.
3. From Agrocabon to petrochemical, L.F. Hatch & S. Mataram, Gulf Publication Co., Houston.
4. Cotton cellulose: its chemistry & Technology, Hall A.G.
5. Methods in Carbohydrate chemistry, Vol.3 – Cellulose, Whistler, R.L.
6. Chemistry of cellulose, Heuser, E.
7. Chemistry & Industry Of Strach, Kerr, R.W.
8. Modified Starches: Properties & Uses, Wurzburg, O.B.
9. Principle of Extractive Metellurgy. Herbashi, Vol. I & II.
10. Theory of Metallurgical Processes, Volsky, A.&. Sergievskaya.F
11. Text Book of Metallurgy, Baiky, A.R.
12. Clays, H. Reis, John Wileys & Sons.
13. Unit process of Extractive Metallurgy, Pehike , Elsevier Publication
14. Ind. Chem, Reigel, Reinhold Publication.

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**B. Sc. I (INDUSTRIAL CHEMISTRY)**  
**2018-2019**

**PAPER- II**  
**INDUSTRIAL ASPECTS OF PHYSICAL CHEMISTRY,**  
**MATERIAL AND ENERGY BALANCE**

**Max.Marks – 33**

- UNIT-1**      **Surface chemistry and Interfacial Phenomena, Emulsions:** Types, Preparation, Micro emulsions  
**Gels:** Classifications, preparations, properties, Application  
**Sols:** Properties, Stability  
**Micelles:** Types of micelles, structure, solubilization, uses  
**Aerosols:** Classification, properties  
**Surfactants:** Types, Detergent effect, Hydrotropes  
**Adsorption:** Types, Adsorption Isotherm
- UNIT-2**      **Catalysts:** Introduction, Types, Homogeneous and Heterogeneous, Basic principles, Mechanisms, factors affecting the performance. Introduction to phase transfer catalysis.
- UNIT-3**      1. **Enzyme catalysed reactions** - Rate model, industrially important reactions.  
2. **Material Balance without chemical reactions:** flow diagram for material balance, simple material with or without recycle or by-pass for chemical engineering operations such as distillation, crystallization, evaporation, extraction, etc.
- UNIT- 4**      1. **Dimensions and units:** Basic chemical calculations- Atomic weight, molecular weight, equivalent weight, mole composition of (i) liquid mixture (ii) gaseous mixture.  
2. **Material balance involving chemical reaction:** concept of limiting reactant, conversion, yield liquid phase reaction, gas phase reactions with / without recycle or by-pass.
- UNIT-5**      **Energy balance:** Heat capacity of pure gases and gaseous mixture at constant pressures, sensible heat changes in liquids, Enthalpy changes.

**LIST OF REFERENCE BOOKS:**

1. Aerosol science & technology, Shepherd, H.R.
2. Catalysis, Homogeneous & heterogeneous Delmon, Elsevier Science Publication.
3. Catalysis, Science & Technology, Anderson, J.
4. Catalysis in Macromolecular systems, Fendler & Fendler.
5. Phase Transfer Catalysis Principle & Techniques, Strles, C.
6. Surface Chemistry, J.J. Bikermann, Academic Press.



7. Physical Chemistry of surfaces by A. W. Admson.
8. Stoichiometry, B.I. Bhatt & S.M. Vora.
9. Chemical Process Principle – Part I, B.A. Hougen, K.M. Waston & R.A. Ragats, Asia Publication.

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**DEPARTMENT OF CHEMISTRY**  
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**B. Sc. I (INDUSTRIAL CHEMISTRY)**  
**2018-2019**

**PAPER- III**  
**UNIT OPERATION IN CHEMICAL INDUSTRY AND UTILITIES,**  
**FLUID FLOW AND HEAT TRANSPORT IN INDUSTRY**

**Max. Marks – 33**

- UNIT- 1**      1. **Distillation**-Introduction; Batch & continuous distillation, separation of azeotropes, plate columns and packed columns  
2. **Absorption** - Introduction, Equipments - Packed columns, spray columns, bubble columns, packed bubble columns, mechanically agitated contractors.
- UNIT- 2**      1. **Evaporation** - Introduction, Equipments short tube (standard) evaporator, forced circulation evaporators, falling film evaporators, climbing film (Upward flow) evaporators, wiped (agitated) film evaporators.  
2. **Filtration**- Introduction, filter media and filter aids, equipments – plate and frame, filter Press, notch filter, rotatory drum filter, sparkler filter, candle filter, bag filter, and centrifuge.  
3. **Drying** – Introduction, free moisture, bound moisture, drying curve, Equipments, tray dryer, flash dryer, fluid bed dryer, drum dryer, spray dryer.
- UNIT- 3**      Utilities in Chemical Industry  
**Fuel** - Types of fuels, advantages and disadvantages, combustion of fuels, calorific value, specification for fuel oil.  
**Boilers**- Types of boilers and their functioning  
**Water**- Specification for industrial use, various water treatments  
**Steam**- Generation and uses  
**Air** - Specifications for industrial use, processing of air
- UNIT- 4**      **Fluid Flow**: Fans, blowers, compressors, vacuum pumps, ejector.  
**Pumps**: Reciprocating pumps, Gear pumps, centrifugal Pumps.
- UNIT- 5**      **Heat Exchangers**: Shell and tube type, finned tube heat exchangers, plate heat exchangers, refrigeration cycles.

## LIST OF REFERENCE BOOKS:

1. Introduction Chemical Engineering, W.L. Badger, J.J. Banchero, McGraw Hill.
2. Unit Operation in Chemical Engineering, W.L. McCabe & J.C. Smith, Mc Graw Hill.
3. Chemical Engineers Hand book, J.H.Perry, Mc Graw Hill.
4. Unit Operations- I & II, D.D. Kale, Pune, Vidyarthi Griha Prakashan, Pune.
5. Unit Operations of Chemical Engineering, Vol. I, P. Chattopadhyaya Khanna Publishers, Delhi.

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**DEPARTMENT OF CHEMISTRY**  
**GOVT. DIGVIJAY PG AUTONOMOUS COLLEGE, RAJNANDGAON**  
**B.Sc. PART– I**  
**INDUSTRIAL CHEMISTRY**  
**PRACTICAL**

**Max. Marks – 50**

Duration of Examination: 04Hrs.

**Description of marks**

Experiment	30 marks
Viva:	05 marks
Sessional:	05 marks
Project:	10 marks
Total:	50 marks

**EXPERIMENTS TO BE PERFORMED:**

1. Simple laboratory techniques crystallization, Fractional Crystallization, Distillation, Fractional Distillation, Boiling Point Diagram.
2. Extraction Processes- Phase diagram, partition coefficient.
3. Preparation of standard solutions , primary and secondary standards, Determination of  $H_2SO_4$  and  $H_3PO_4$  in a mixture.
4. Calibration of Thermometers.
5. Acquaintance with safety measures in a laboratory. Hazards of chemicals.
6. Depression and elevation in b.p./m.p. of solids and liquids.
7. Chromatography – column, paper, thin, layer.
8. Ore analysis dolomite, limestone- calcite, Analysis of alloys such as cupro-nickel.
9. Determination of Physical constants: refractive-index, surface tension, effect of surfactants, on surface tension, viscosity, fluids, polymer solutions effect of additives on viscosity, optical rotation.
10. Study, experiments/ demonstration experiments

Note: Any two experiments have to be carried out by the students in the Examination. A Minimum of 60% of the experiments has to be conducted by the students.

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**DEPARTMENT OF CHEMISTRY**  
**GOVT. DIGVIJAY PG AUTONOMOUS COLLEGE, RAJNANDGAON**  
**B. Sc. II (INDUSTRIAL CHEMISTRY)**  
**2018-2019**  
**PAPER- I**  
**MATERIAL SCIENCE AND ENVIRONMENTAL STUDIES**

**Max.Marks – 34**

**UNIT- 1 Material science:**

Mechanical Properties of material and change with respect to temperature.

**Material of constructions used in Industry:**

**Metals and Alloys:**

Important metals alloys, iron, copper, aluminium, lead, nickel, titanium and their alloys- mechanical and chemical properties and their applications.

**Cement:**

Types of cement, composition, manufacturing process, setting of cement.

**Ceramic:**

Introduction, Types, Manufacturing process, Applications, Refractories.

**UNIT- 2 Polymeric materials:**

Industrial polymer and composite materials. their constitution, chemical and physical properties, industrial applications.

**UNIT- 3 Glass:**

Types, composition, manufacture, physical and chemical properties, Applications.

**Corrosion:**

Various types of corrosion relevant to chemical industry-mechanism and preventive method.

**UNIT- 4 Pollution:**

Air, oxygen, nitrogen cycle, water, biosphere, flora and fauna, energy, Soil. Pollutants and their statutory limits, pollution evaluation methods.

**UNIT- 5 Air pollution:**

Various pollutants, water pollution - organic/inorganic pollutants, noise pollution, sewage analysis, pesticide pollution, radiation pollution, green house effect, future.

**LIST OF REFERENCE BOOKS:**

1. Pollution control in chemical & allied industries, S.P. Mahajan.
2. Pollution Control in Industries, A Series of Books by Jones H.P.
3. Air Pollutions –Vol. 1to 4, Editor Stern, A.C. Academic Press.



4. Environmental Engineering, G.N. Pandey, Tata Mc Graw, Hill.
5. Hand Book of Air Pollution, A. Parker, Tata Mc Graw, Hill.
6. Science of Ceramic chemical processing, Hench L.L.
7. Science of Ceramics, Stewarts G.H.
8. Chemistry of Cement
9. Properties of Glass, Morcy G.W.
10. Chemistry of Glasses, Paul A.
11. Corrosion-causes and prevention, Spellur F.N.

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**B. Sc. II (INDUSTRIAL CHEMISTRY)**  
**2018-2019**  
**PAPER- II**  
**ORGANIC CHEMICALS MANUFACTURING AND WASTE MANAGEMENT**

**Max. Marks – 33**

**UNIT- 1** Unit processes in organic chemicals manufacture-  
**Nitration:** Introduction, Nitrating agents, kinetics and mechanism of nitration processes such as nitration of:

- i Paraffinic hydrocarbons
- ii Benzene to nitrobenzene and m-dinitrobenzene
- iii. Chlorobenzene to o- and p- nitrochloro benzenes
- iv. Acetanilide to p-nitro acetanilide.
- v. Toluene

Continuous vs. batch nitration.

**UNIT-2** **Halogenation:**  
Introduction – kinetics of halogenation reactions, reagents for halogenations, Halogenation of aromatic-side and nuclear halogenations, commercial manufacture of chlorobenzenes, chloral, monochloroacetic acid and chloromethane, dichlorodifluoro methane.

**UNIT-3** **Sulphonation:**  
Introduction, sulphonating agents, chemical and physical factors in sulphonation. Kinetics and mechanism of sulphonation reaction, Commercial sulphonation of benzene, naphthalene, alkyl benzene, batch vs. continuous sulphonation.

**UNIT- 4** **Effluent treatment and waste management:**  
Principles and equipments for aerobic, anaerobic treatment adsorption, filtration, sedimentation.

**UNIT- 5** Bag filters, electrostatic precipitator, mist eliminators, wet scrubbers, absorbers, solid waste management Industrial safety.

**LIST OF REFERENCE BOOKS:**

1. Unit process in Organic synthesis P.M. Groggins, McGraw Hill.
2. Effluent Treatment in process Industries - Inst. of Chem. Engg.
3. Effluent Treatment and waste Disposal –Inst. of Chem. Engg.
4. Effluent Treatments and Disposal –Inst. of Chem. Engg.

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**2017-2018**  
**PAPER- III**  
**ORGANIC SYNTHESIS AND INDUSTRIAL INSTRUMENTATIONS**

**Max. Marks – 33**

**UNIT-1      Oxidation:**

Introduction, Types of oxidation reactions, oxidizing agents, kinetics and mechanism of oxidation of organic compounds liquid phase oxidation, vapour phase oxidation, commercial manufacture of benzoic acid, maleic anhydride, phthalic anhydride, acrolein, acetaldehyde, acetic acid.

**UNIT-2      Hydrogenation:**

Introduction, kinetics and thermodynamics of hydrogenation reactions, catalysts for hydrogenation reactions, hydrogenation of vegetable oil. Manufacture of methanol from carbon monoxide and hydrogen, hydrogenation of acid and esters to alcohols, catalytic reforming.

**Alkylation:**

Introduction; Types of alkylation, alkylating agents. Thermodynamics and mechanism of alkylation reactions, manufacture of alkyl benzene (for detergent manufacture), ethyl benzene, phenyl ethyl alcohol, N-alkyl anilines (mono and di methyl anilines)

**UNIT- 3      Esterification :**

Introduction, hydrodynamics and kinetics of esterification reactions, Esterification by organic acids, by addition of unsaturated compounds, esterification of carboxy acid derivatives, commercial manufacture of ethyl acetate, dioctyl phthalate, vinyl acetate, cellulose acetate.

**Amination**

**(A) By reduction:** Introduction , methods of reduction - metal and acid, catalytic, sulfide, electrolytic, metal and alkali sulfites, metal hydrides, sodium metal, concentrated caustic oxidation, reduction, commercial manufacture of aniline, m-nitro aniline, p- aminophenol.

**(B) By aminolysis:** Introduction, aminating agents, factors affecting aminolysis.

**Hydrolysis:** Introduction, hydrolyzing agents, kinetics, thermodynamics and mechanism of hydrolysis.

#### **UNIT-4 Process Instrumentation:**

Concept of measurement and accuracy, principle, construction and working of following measuring instruments.

##### **Temperature:**

Glass thermometers, bimetallic thermometer, pressure spring thermometer, vapour filled thermometers, resistance thermometers, radiation pyrometers.

**Pressure:** Manometers, barometers, bourdon pressure gauge, bellow type, diaphragm type pressure gauges, Macleod gauges, pirani gauges, etc.

**UNIT- 5 Liquid level:** Direct-indirect liquid level measurement, Float type liquid level gauge, ultrasonic level gauges, bubbler system, density measurement, viscosity \measurement.

#### **LIST OF REFERENCE BOOKS:**

1. Unit process in organic synthesis, P.M. Groggins, Mc Graw Hill.
2. Industrial Instrumentation, Bekmen, D. P. John Wileys.
- 3 Applied Instrumentation in process Industries, Vol. I, II & III Andrew, W. G. Gulf Publication.
- 4 Instrumentation and Control for the process Industries, Borer, S.E levier Applied Science Publishers.
- 5 Chemical Engineer's Hand book, Perry, J.H. and Green, D. Mc Graw Hill.

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## EVALUATION PATTERN

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**Paper - II & III: 33 marks**

➤ **Practical: 50 marks**

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Chairperson /H.O.D .....	1. ....
Subject Expert ..... (University Nominee)	2. ....
Subject Expert.....	3. ....
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**DEPARTMENT OF CHEMISTRY**  
**GOVT. DIGVIJAY PG AUTONOMOUS COLLEGE, RAJNANDGAON**  
**B. Sc. II (INDUSTRIAL CHEMISTRY)**  
**2018-2019**  
**PRACTICAL**

Duration of Examination: 04Hrs.

**Max. Marks – 50**

**UNIT PROCESS:**

One to two examples of each of the following.

Nitration, Sulphonation, Friedel-crafts reaction, Esterification, Hydrolysis, Oxidation, Halogenation, Chloro-Sulphonation, Reduction, Polymerisation, Reaction of diazonium salts.

**INSTRUMENTAL METHODS OF ANALYSIS:**

Use of colorimeter, pH meter, Potentiometer, Conductometer, Refractometer, Polarimeter.

**MATERIAL TESTING :**

Testing of alloys, Identification of plastics/rubber, estimation of yield point, Young's modulus, flaredness; Optical, Thermal, Mechanical and Electrical properties.

**PROCESS INSTRUMENTATION:**

Transducers of different types, use of Transducers for measuring flow control. Determination of flash point and ignition points of liquids.

**WATER ANALYSIS:**

Solid contents, hardness, COD and other tests as per industrial specifications.

**FLOW MEASURING DEVICES:** Floats

Monographs of representative raw materials such as sulphuric acid, toluene, sodium carbonate, sodium hydroxide, carbon tetra chloride, benzoic acid (5-6 compounds).

Limit tests for heavy metals Pb, As, Hg, Fe and ash content.



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**B. Sc. III (INDUSTRIAL CHEMISTRY)**

**2018-2019**

**PAPER- I**

**CHEMICAL PROCESS AND INDUSTRIAL ECONOMICS**

**Max. Marks – 34**

- UNIT - 1**
1. Factors involved in project cost estimation, methods employed for the estimation of capital investment.
  2. Capital formation, elements of cost accounting.
- UNIT -2**
1. Interest & investment cost, time value of money equivalence.
  2. Depreciation, method of determining depreciation, taxes.
  3. Some aspects of marketing, pricing policy.
- UNIT -3**
1. Profitability criteria, economics of selecting alternatives
  2. Variation of costs with capacity. Break - even point, optimum batch sizes, Production, scheduling etc.
  3. Sampling of Bulk materials, techniques of sampling of solids, liquids and gases.
  4. Collection & processing data.
  5. Particle size determination.
  6. Rheological properties of liquids, plastics and their analysis.
- UNIT - 4**      **Industrial Organization**
1. Concept of scientific management in industry.
  2. Functions of management, decision making, planning, organizing, directing & control.
  3. Location of industry.
- UNIT-5**
1. Materials management.
  2. Inventory control.
  3. Management of human resources - Selection, incentives, Welfare & safety.

**LIST OF REFERENCE BOOKS:**

1. Industrial Organization & Management, Bethal , L.L.
2. Industrial Organization & Management, Tarachand , Vol. I&II.
3. Book on Management , Khandelwal, O. P.
4. Rheology Theory & Application, Vol , 5, Elrich , R.F.
5. Economics of Chemical Industry, Hempel , E.H.

6. Plant Design & Economics for Chemical Engineers , Peter Time Rhaus, Mc Graw Hill.
7. I.C.M.A. Booklets -9 &10

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**2018-2019**  
**PAPER- II**  
**PHARMACEUTICALS**

**Max.Marks – 33**

- UNIT- 1**
1. Historical background & development of pharmaceutical industry in India in brief.
  2. **Pharmacopoeias** - Development of Indian pharmacopoeia & introduction of B.P., U.S.P., E.P., N.F & other important Pharmacopoeias.
  3. Introduction to various types of formulations & routes of administration.
  4. Aseptic conditions, need for sterilization, various methods of sterilization.
- UNIT- 2**
1. Various types of pharmaceutical excipients, their chemistry, process of manufacture & quality specifications. Glidants, lubricants, diluents, preservatives, antioxidants, emulsifying agents, coating agents, binders, coloring agents, flavouring agents, gelatin and other additives, sorbitol, mannitol, viscosity builders etc.
  2. Surgical dressing, sutures, ligatures with respect to the process, equipments used for manufacture, method of sterilization and quality control.
- UNIT- 3**
1. Pharmaceutical packaging introduction, package selection, packaging materials, ancillary materials, packaging machinery, quality control of packaging materials.
  2. F.D.A. Important schedules & some legal aspects of drugs.
  3. Pharmaceutical quality control (other than analytical methods covered under core subject) sterility testing, pyrogenic testing, glass testing, bulk density of powders etc.
- UNIT- 4**
1. **Evaluation of crude drugs** - Moisture content, extractive value, volatile oil content, foreign organic matter, quantitative microscopic exercises, including starch, leaf content, (palisade ratio stomatal number & index vein, islet number & vein termination number) crude fiber content introduction to chromatographic method for identification of crude drugs.
  2. **Chromatography**: Paper chromatography, TLC, HPLC, GLC.

3. Ion chromatography.

## **UNIT-5 INSTRUMENTATION**

1. UV-Visible spectroscopy
2. IR- Spectroscopy non - dispersive IR
3. NMR Spectroscopy
4. Atomic absorption & Flame photometry
5. X-Ray Fluorescence
6. Ion Selective Electrodes
7. Neutron Diffraction

### **LIST OF REFERENCE BOOKS :**

1. Instrumental methods of analysis, Willard, Merit, Dean.
2. Introduction to instrumental methods of analysis, Braun , R.D. Mc Graw Hill.
3. Analytical chemistry, J.B. Dick , McGraw . Hill.
4. Quantitative Inorganic analysis, A.Vogel.
5. Instrumental methods of analysis, Skoog & West.
6. Instrumental methods of analysis, B.K. Sharma.
7. Practical Pharmacognosy, T.B. Wills
8. Practical Pharmacognosy, T.N. Vasudevan
9. Modern Pharmacognosy Remstad, Mc Graw Hill
10. Indian Pharmacopoeia, 1985
11. British Pharmacopoeia, 1990
12. Hand Book of Drugs and Cosmetic Act., Mehrotra
13. Pharmaceutical excipients
14. Pharmaceutical Dosage forms.

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**2017-2018**  
**PAPER- III**  
**DRUGS**

**Max.Marks – 33**

- UNIT- 1**
1. Phytochemicals - Introduction to plant classification & crude drugs, cultivation, collection, preparations for the market & storage of medicinal plants.
  2. Classification of various types of drugs with examples.
  3. Raw materials, process of manufacture, effluent handling, etc of the following bulk drugs: Sulpha drugs - sulphaguanidine, sulphamethoxazole.
- UNIT- 2**
1. Chemical constitution of plants including carbohydrates, amino acids, proteins, fats, waxes, volatile oils, terpenoids, steroids, saponins flavonoids, tannins, glycosides, alkaloids.
  2. Various isolation procedures for active ingredients with examples for alkaloids reserpine, one for steroids - sapogenin, diosgenin, diogron.
- UNIT- 3**
1. Antimicrobial: Chloramphenicol, Furazolidne, Mercurochrome, isoniazid, Na-PAS.
  2. Analgesic - Antilnflammatory: Salicylic acid and its derivatives, Ibuprofen, Mefenamic acid.
  3. Steroidal Hormones: Progesterone, Testosterone, Methyl testosterone
- UNIT - 4**
1. Vitamins: Vit. A, Vit.-B6 and Vit - C
  2. Barbiturates: Pentobarbital
  3. Blockers – Propranolol Atenolol
  4. Cardiovascular Agent - Methyldopa
  5. Antihistamins - Chloropheneramine melate
- UNIT - 5**
1. Products based on fermentation processes: Brief idea of micro organisms, their structure, growth & usefulness. Enzyme systems useful for transformation, microbial products.
  2. General principles of fermentation processes & product processing.
  3. Manufacture of antibiotics - Penicillin - G & semi synthetic penicillin, Rifamycin, Vitamin -B 12
  4. Bio transformation process for prednisolone, 11- hydroxylation in steroids.
  5. Enzyme catalysed transformation, manufacture of ephidrine.



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6. Hand Book of Drugs and Cosmetic Act., Mehrotra
7. Pharmaceutical excipients
8. Pharmaceutical Dosage forms.
9. Principles of Medicinal Chemistry, W.O. Foye, Lea & Febigen, Publication Philedelphia.
10. Essentials of Medicinal Chemistry, Korolkovas & Burkhatler, Wiley Interscience.
11. Text book of Organic Medicinal and Pharmaceutical Chemistry, Wilson, Gisvold, Derge, Lippinett-Toppan.

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**PRACTICAL**

Duration of Examination: 08 hrs. spread over two days

**Max.Marks – 50**

**Two experiments have to be performed**

1. Synthesis of common industrial compounds involving two - step reactions.  
4- bromoaniline, 3-Nitro aniline, Sulphanilamide, 4- Aminobenzoic acid , Nitrobenzoic acid , dihalobenzenes, Nitrohalobenzenes.
2. Industrial analysis of common raw materials as per industrial specification:  
Phenol, Aniline, Formaldehyde, Hydrogen peroxide, Acetone, Epoxide, Olefins, oils etc.
3. Demonstration of various pharmaceutical packaging materials, quality control tests of some materials, - A1 Strips, Cartons, Glass bottles
4. Limit tests for chlorine, heavy metals, arsenic etc. of two representative bulk drug.
5. Demonstration of various pharmaceutical products.
6. Active ingredient analysis of few types of formulations representing different methods of analysis - acidimetry, alkalimetry, non aqueous.
7. Determination of sulphate ash, loss of drying & other tests of bulk drugs, complete I P monograph of three drugs representing variety of testing methods.
8. Evaluation of crude drugs - macroscopic examination, determination & identification of starch granules, calcium oxalate.
9. Palisade ratio, stomatal index -determination and identification of few drugs, TLC method for identification.
10. Microbiological testing determination of mic of some antibacterial drugs by zone /cup plate method

**Distribution Marks**

1	EXPERIMENT NO . 1	-	20
2	EXPERIMENT NO. 2	-	10
3.	VIVA	-	05
4 .	SESSIONAL	-	05
5	PROJECT WORK	-	10
	<b>TOTAL</b>	<b>-</b>	<b>50</b>

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