

# DEPARTMENT OF CHEMISTRY

## COURSE CURRICULUM & MARKING SCHEME

### B.Sc. PART – I (Old Course) Industrial Chemistry

SESSION : 2022-23



ESTD: 1958

## GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG, 491001 (C.G.)

(Former Name – Govt. Arts & Science College, Durg)

NAAC Accredited Grade A<sup>+</sup>, College with CPE - Phase III (UGC), STAR COLLEGE (DBT)

Phone : 0788-2212030

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DEPARTMENT OF CHEMISTRY

GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG

Approved syllabus for B.Sc. INDUSTRIAL CHEMISTRY by the members of  
Board of Studies for the Session

2022-23

The syllabus with the paper combinations is as under

B. Sc. I:

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

B.Sc.II :

Paper I: INDUSTRIAL CHEMISTRY-I	Paper II: INDUSTRIAL CHEMISTRY-II
Paper III : INDUSTRIAL CHEMISTRY-III	Practical: INDUSTRIAL CHEMISTRY

B.Sc. III:

Paper I: CHEMICAL PROCESS AND INDUSTRIAL ECONOMICS	Paper II: PHARMACEUTICALS
Paper III : DRUGS	Practical: INDUSTRIAL CHEMISTRY

**Note:** Industrial visits/ training is mandatory for all students as part of curriculum.

The syllabus for B.Sc. Ind. Chemistry is hereby approved for the session 2022 - 23

NAME AND SIGNATURE:

	Departmental members	
Chairperson /H.O.D ..... <i>Aswini</i> .....		
Subject Expert ..... (University Nominee)	1..... <i>[Signature]</i> .....	8..... <i>[Signature]</i> .....
Subject Expert..... <i>[Signature]</i> <i>S.2</i> <i>[Signature]</i> .....	2..... <i>[Signature]</i> .....	9..... <i>[Signature]</i> .....
Representative ..... (Industry)	3..... <i>[Signature]</i> .....	10..... .....
Representative ..... <i>[Signature]</i> .....	4..... <i>[Signature]</i> .....	11..... <i>[Signature]</i> .....
Representative ..... (Alumni)	5..... <i>[Signature]</i> .....	12..... .....
Representative ..... <i>[Signature]</i> .....	6..... .....	13..... .....
Representative ..... (Professor Science Faculty Other Dept.)	7..... .....	14..... .....
		<i>[Signature]</i>

Student Representative

# DIRECTIVES FOR STUDENTS OF PART-I, II & III

2022-23

## EVALUATION PATTERN

Theory Paper - I : 34 marks; Paper – II & III: 33 marks

Practical: 50 marks

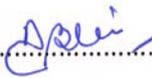
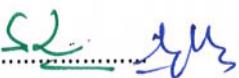
### Question Paper Format and Distribution of Marks for Under Graduate Examination

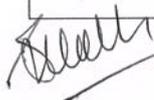
1. The question paper for UG Classes is to be divided into three Sections - A, B & C.
2. Section A shall contain very short answer type questions (answer in one or two sentences) or objective type questions. **(No Multiple choice questions. No 'fill in the blank' type Questions)**
3. Section B shall contain short answer type questions with the limit of 150 words.
4. Section C shall contain long answer/descriptive type questions. The students are required to answer precisely and the answer should not exceed the limit of 350 words.
5. The scheme of marks should be as follows:

Question Type	MM 33 (Marks x No. of Questions)	MM 34 (Marks x No. of Questions)
A (Very short Answer)	8x1 = 08	1x9 = 09
B (Short Answer)	2x5 = 10	2x5 = 10
C (Long Answer)	3x5 = 15	3x5 = 15

6. The half yearly internal examinations will be held for Part-I, Part-II & Part III. 10% out of marks obtained by the students in each paper in internal examinations will be added to 90% of marks obtained in each paper of annual examination.

### NAME AND SIGNATURE:

Chairperson /H.O.D..... 	Departmental members:
Subject Expert..... (University Nominee)	
Subject Expert..... 	
Representative..... 	



Student Representative

## B.Sc. ( with INDUSTRIAL CHEMISTRY)

### Programme Specific Outcome (PSO):

*Upon completion of B.Sc. Degree Programme (with Industrial Chemistry), the students would be able*

PSO1: To have a knowledge of history, development, fundamentals and uses of various aspects in Industrial Chemistry.

PSO2: To explain the concepts and application of chemistry in various industries.

PSO3: To acquaint with the principles/concepts/pre-requisites/management involved in industries.

PSO4: To understand the various processes of industries through theory, project and industrial visits.

PSO5: To get familiarized with safety measures in laboratory and develop skills in proper handling of chemicals and apparatus/instruments.

PSO6: To carry out experiments, record the observations and present the inference/results.

### NAME AND SIGNATURE:

		Departmental members	
Chairperson /H.O.D .....			
Subject Expert .....		1.....	8.....
(University Nominee)		2.....	9.....
Subject Expert.....		3.....	10.....
Representative .....		4.....	11.....
(Industry)		5.....	12.....
Representative .....		6.....	13.....
(Alumni)		7.....	14.....
Representative .....			
(Professor Science Faculty Other Dept.)			

*Student Representative*

**Syllabus and Marking Scheme for First Year**  
**2022-23**  
**[OLD COURSE]**

Paper No.	Title of the Paper	Marks Allotted in Theory	
		Max	Min
I	INDUSTRIAL ASPECTS OF ORGANIC & INORGANIC CHEMISTRY	34	33
II	INDUSTRIAL ASPECTS OF PHYSICAL CHEMISTRY, MATERIAL AND ENERGY BALANCE	33	
III	UNIT OPERATION IN CHEMICAL INDUSTRY AND UTILITIES, FLUID FLOW AND HEAT TRANSPORT IN INDUSTRY	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>

**Note:**

- The half yearly internal examinations will be held. 10% out of marks obtained by the students in each paper in internal examinations will be added to 90% of marks obtained in each paper of annual examination.
- Industrial visits/ training is mandatory for all students as part of curriculum.

The syllabus for B.Sc. Ind. Chemistry is hereby approved for the session 2022 - 23

**NAME AND SIGNATURE:**

<p>Chairperson /H.O.D..... <u>APR</u></p> <p>Subject Expert.....</p> <p>(University Nominee)</p> <p>Subject Expert..... <u>S2</u> <u>gk</u></p> <p>Representative..... <u>May</u></p> <p>(Industry)</p> <p>Representative..... <u>B. Jain</u></p> <p>(Alumni)</p> <p>Student Representative <u>S</u></p>	<p>Departmental members:</p>  <p>Handwritten signatures of departmental members, including names like 'Beel', 'Divastan', and 'pu'.</p>
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**B. Sc. I (INDUSTRIAL CHEMISTRY)**  
**2022-23**  
**PAPER- I**  
**INDUSTRIALASPECTS OF ORGANIC &**  
**INORGANICCHEMISTRY**

**Course Outcome (CO):**

*After completion of the course, the students would be able:*

CO1: To understand about IUPAC nomenclature of organic compound, petroleum and natural gases.

CO2: To have a detailed idea about coal - types, properties, distillation and chemicals derived from coal.

CO3: To know about renewable natural resources.

CO4: To learn about basics of metallurgical operations and the physico-chemical principles of extraction of important metals.

CO5: To gain insight into industrial importance of inorganic materials - alumina, silica, zeolites, mica, clay and carbon.

**NAME AND SIGNATURE:**

	Departmental members	
	Chairperson /H.O.D .....	
Subject Expert ..... (University Nominee)	1. ....	8. ....
Subject Expert .....	2. ....	9. ....
Representative ..... (Industry)	3. ....	10. ....
Representative .....	4. ....	11. ....
Representative ..... (Alumni)	5. ....	12. ....
Representative .....	6. ....	13. ....
Representative ..... (Professor Science Faculty Other Dept.)	7. ....	14. ....

*Student Representative*

## B. Sc. I (INDUSTRIAL CHEMISTRY)

2022-23

[OLD COURSE]

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, hydro forming, 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.

#### REFERENCE BOOKS:

1. Coal Conversion, E.J. Hoggman: The Energon Co., Lavamic Wyomnig,U.S.A.
2. Introduction of petroleum chemicals, H. Steiner, PergamenPress.
3. From Agrocabon to petrochemical, L.F. Hatch & S. Mataram, Gulf Publication Co., Houston.
4. Cotton cellulose: its chemistry & Technology, HallA.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 , ElsevierPublication
14. Ind. Chem, Reigel, ReinholdPublication.



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

**2022-23**

**[OLD COURSE]**

**PAPER- II**

**INDUSTRIAL ASPECTS OF PHYSICAL CHEMISTRY, MATERIAL AND ENERGY BALANCE**

**Course Outcome (CO):**

*After completion of the course, the students would be able:*

- CO1: To have knowledge of classification, types and properties of colloids
- CO2: To gain insight into surface chemistry - surfactants, detergents, micelles and adsorption
- CO3: To understand about catalysts and catalysis, types, factors affecting, mechanism, phase transfer catalysis and enzyme catalysis.
- CO4: To learn about various dimensions and units used for basic chemical calculations.
- CO5: To understand the concept related to material balance for systems with and without chemical reactions.
- CO6: To know about energy balance – heat capacity and enthalpy changes in gaseous and liquid systems.

**NAME AND SIGNATURE:**

	Departmental members	
	1.....	8.....
Chairperson /H.O.D ..... <i>Aswini</i> .....	<i>[Signature]</i>	<i>[Signature]</i>
Subject Expert ..... (University Nominee)	2..... <i>[Signature]</i>	9.....
Subject Expert..... <i>S.2</i> .....	3..... <i>[Signature]</i>	10..... <i>[Signature]</i>
Representative ..... (Industry)	4..... <i>[Signature]</i>	11.....
Representative ..... <i>B. Jay</i> .....	5..... <i>[Signature]</i>	12.....
Representative ..... (Alumni)	6.....	13.....
Representative ..... <i>[Signature]</i> .....	7.....	14.....
Representative ..... (Professor Science Faculty Other Dept.)		<i>[Signature]</i>

*Student Representative*

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

**2022-23**

**[OLD COURSE]**

**PAPER- II**

**INDUSTRIAL ASPECTS OF PHYSICAL CHEMISTRY, MATERIAL  
AND ENERGY BALANCE**

**Max. Marks – 33**

- UNIT-1**      **Surface chemistry and Interfacial Phenomena, Emulsions:** Types, Preparation, Microemulsions
- 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.

**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. Weston & R.A. Ragats, Asia Publication.

**Question Paper Format and Distribution of Marks for Under Graduate Examination**

1. The question paper for UG Classes is to be divided into three Sections - A, B & C.
2. Section A shall contain very short answer type questions (answer in one or two sentences) or objective type questions. **(No Multiple choice questions. No 'fill in the blank' type Questions)**
3. Section B shall contain short answer type questions with the limit of 150 words.
4. Section C shall contain long answer/descriptive type questions. The students are required to answer precisely and the answer should not exceed the limit of 350 words.
5. The scheme of marks should be as follows:

Question Type	MM 33 (Marks x No. of Questions)
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**NAME AND SIGNATURE:**

<p>Chairperson /H.O.D..... <u>Asli</u></p> <p>Subject Expert.....</p> <p>(University Nominee)</p> <p>Subject Expert..... <u>Mitank</u></p> <p>Representative..... <u>B. Jain</u></p>	<p>Departmental members:</p> <p><u>[Signature]</u> <u>[Signature]</u> <u>[Signature]</u></p> <p><u>[Signature]</u> <u>[Signature]</u></p> <p><u>[Signature]</u> <u>[Signature]</u></p> <p style="text-align: right;"><u>[Signature]</u></p> <p style="text-align: right;"><i>Student Representative</i></p>
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B. Sc. I (INDUSTRIAL CHEMISTRY)

2022-23

[OLD COURSE]

PAPER- III

UNIT OPERATION IN CHEMICAL INDUSTRY AND UTILITIES, FLUID FLOW  
AND HEAT TRANSPORT IN INDUSTRY

Course Outcome (CO):

*After completion of the course, the students would be able:*

- CO1: To have knowledge of instruments, principles of distillation and procedure involved for separation and apply to industrial processes.
- CO2: To gain insight into types of absorbents to be utilized in various types of plants and types of evaporators and its application in various industries
- CO3: To understand about filtration methods, filter media and aids, types of filters, drying procedures and their application in various industries
- CO4: To learn about types of fuels, its advantages and disadvantages and developability to characterize the fuels
- CO5: To understand the concept related to fluid flow – types of pumps and its application, types of boilers, its working and importance
- CO6: To know about Working, types of heat exchangers, its application and conservation of energy

NAME AND SIGNATURE:

	Departmental members	
Chairperson /H.O.D .....		
Subject Expert ..... (University Nominee)	1..... 	8..... 
Subject Expert..... 	2..... 	9..... 
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Representative ..... (Industry)	4..... 	11..... 
Representative ..... (Alumni)	5..... 	12.....
Representative ..... (Professor Science Faculty Other Dept.)	6.....	13.....
	7..... 	14..... 

Student Representation

## B. Sc. I (INDUSTRIAL CHEMISTRY)

2022-23

[OLD COURSE]  
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.

#### REFERENCE BOOKS:

1. Introduction Chemical Engineering, W.L. Badger, J.J. Banchemo, McGrawHill.
2. Unit Operation in Chemical Engineering, W.L. McCabe & J.C. Smith, Mc GrawHill.
3. Chemical Engineers Hand book, J.H.Perry, Mc GrawHill.
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.

**Question Paper Format and Distribution of Marks for Under Graduate Examination**

1. The question paper for UG Classes is to be divided into three Sections - A, B & C.
2. Section A shall contain very short answer type questions (answer in one or two sentences) or objective type questions. **(No Multiple choice questions. No 'fill in the blank' type Questions)**
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B (Short Answer)	2x5 = 10
C (Long Answer)	3x5 = 15

**NAME AND SIGNATURE:**

<p>Chairperson /H.O.D..... <i>ADP</i></p> <p>Subject Expert.....</p> <p>(University Nominee)</p> <p>Subject Expert..... <i>S2 - yes</i></p> <p><i>Mary</i></p> <p>Representative..... <i>B. Jay</i></p>	<p>Departmental members:</p> <p><i>[Signatures]</i></p> <p><i>Diastan</i></p> <p><i>[Signature]</i></p>
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*Student Representation*

B.Sc. PART- I

2022-23

[OLD COURSE]

INDUSTRIAL CHEMISTRY

Max. Marks – 50

PRACTICAL

Duration of Examination: 04Hrs.

Description of marks

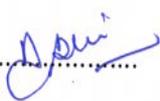
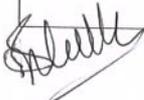
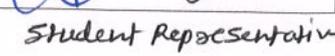
Experiment	30marks
Viva:	05marks
Sessional:	05marks
Project:	10marks
Total:	50 marks

**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 cupronickel.
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.
11. Detection of food adulteration.
12. Preparation of buffers.
13. Preparation of colloids.

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.

**NAME AND SIGNATURE:**

Chairperson /H.O.D..... 	Departmental members: 
Subject Expert..... (University Nominee)	
Subject Expert..... 	
	 Student Representative