

DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM & MARKING SCHEME

B.Sc. I, II, III, IV Semester
INDUSTRIAL CHEMISTRY
(Based on Choice Based Credit System)

SESSION : 2023-24



ESTD : 1958

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

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

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

Phone : 0788-2212030

Website - www.govtsciencecollegedurg.ac.in, Email – autonomousdurg2013@gmail.com

Syllabus

DEPARTMENT OF CHEMISTRY

COURSE CURRICULUM & MARKING SCHEME

B.Sc. I & II Semester

INDUSTRIAL CHEMISTRY

(Based on Choice Based Credit System)

SESSION : 2023-24



ESTD : 1958

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

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Syllabus approved by members of Board of study

DEPARTMENT OF CHEMISTRY

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

Approved Revised syllabus for

B.Sc. INDUSTRIAL CHEMISTRY by the members of Board of Studies for
Session 2023-2024

Scheme and Syllabus for B.Sc. Year 1 (Semester I & II)

Scheme for B.Sc. Program with Industrial Chemistry - First Year

(with 3 Subjects A, B*, C* Subject A- Industrial Chemistry)

Semester	Discipline Specific Course/ Core Course DSC (Credit-4)	Generic Elective Course GEC (Credit-4)	Skill Enhancement Course SEC (Credit-2)	Ability Enhancement Course AEC (Credit-2)	Value Added Course VAC (Credit-2)	Total Credits
1	Industrial Chemistry -I Industrial Technology, Metallurgy and Surface Chemistry (Th=3, P=1)	Choose any one course other than DSC (Th=3, P=1)	Choose 1 from pool of SEC (Th=1, P=1)	Hindi Language (Th-2)	Sports (Th=1, P=1)	22
	Subject B1 (Th=3, P=1)					
	Subject C1(Th=3, P=1)					
2	Industrial Chemistry -II Industrial Operations, Fuels and Aspects of Physical Chemistry (Th=3, P=1)	Choose any one course other than DSC (Th=3, P=1)	Choose 1 from pool of SEC (Th=1, P=1)	English Language(T h-2)	Yoga (Th=1, P=1)	22
	Subject B2 (Th=3, P=1)					
	Subject C2(Th=3, P=1)					
Students on exit shall be awarded undergraduate certificate (in the field of Multidisciplinary Study)						

after securing the requisite 44 credits in semester I and II

*Maths/Physics/Botany/Zoology/Microbiology/Zoology/Geology/Biotechnology/Biochemistry/Industrial Chemistry/Anthropology

**COURSES OFFERED BY DEPARTMENT OF CHEMISTRY LIST OF
For students opting B.Sc. with Industrial Chemistry (First Year)**

Discipline Specific Courses/Core Papers DSC (Credits: 04 each; T= Theory. P = Practical)

1. CZIC/CMIC 101: Industrial Chemistry -I (T- 3, P- 1)
2. CZIC/CMIC 201: Industrial Chemistry - II (T- 3, P-1)

Skill Enhancing Courses SEC (Credits:02)

1. CZIC/CMIC 01: Good lab practices in Chemistry (T- 1, P- 1)
2. CZIC/CMIC 02: Water remediation and conservation studies (T- 1, P- 1)

For students opting UG without Industrial Chemistry

Generic Electives Courses GEC (Credits: 04 each; T= Theory. P = Practical)

1. CZIC/CMIC 101: Fundamentals of Chemistry - I (T- 3, P- 1)
2. CZIC/CMIC 201: Fundamentals of Chemistry - II (T- 3, P-1)

DEPARTMENT OF CHEMISTRY

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

Approved Revised syllabus for

B.Sc. INDUSTRIAL CHEMISTRY by the members of Board of Studies for the
Session 2023-24

Scheme and Syllabus for B.Sc. Year 1 (Semester I & II)

**Courses and Marking Scheme for First-year B.Sc. with
Industrial Chemistry**

Year	Sem.	Course Code	Paper Title	Theory/ Practical	Credits	Marks	Sem End	IA	
Certificate in Science									
Discipline Specific Courses – DSC (Core Courses)									
1	I	CZIC/CMI C 101	Fundamentals of Chemistry - I	Theory	3	75	60	15	
		CZIC/CMI C 101	Lab Course - 1	Practical	1	25			
	II	CZIC/CMI C 201	Fundamentals of Chemistry - I	Theory	3	75	60	15	
		CZIC/CMI C 201	Lab Course -2	Practical	1	25			
	Skill Enhancement Courses - SEC								
	I	CZIC/CMI C 01	Good lab practices in Chemistry	Theory	1	25	20	05	
				Practical	1	25			
	II	CZIC/CMI C 02	Water remediation and conservation studies	Theory	1	25	20	05	
Practical				1	25				

Note: Semester End – 80% and Internal Assessment (IA) – 20% (Weightage of marks internal examinations will be included as per guidelines of Autonomous Examination Cell)

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**

2023-24

The syllabus with the paper combinations is as under

B.Sc. I: (INDUSTRIAL CHEMISTRY) SEMESTER – I

CORE COURSE	INDUSTRIAL CHEMISTRY - I
TITLE	Industrial Technology, Metallurgy and Surface Chemistry
PAPER CODE	CZIC/CMIC 101
PRACTICAL	LAB COURSE INDUSTRIAL CHEMISTRY-I
PAPER CODE	CZIC/CMIC 01

The syllabus for B.Sc. Industrial Chemistry SEMESTER-I is hereby approved for the session 2022-23. 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.

B.Sc. INDUSTRIAL CHEMISTRY SEMESTER - I

SESSION: 2023-24

DIRECTIVES FOR STUDENTS OF B.Sc. INDUSTRIAL CHEMISTRY SEMESTER - I

EVALUATION PATTERN

- Theory Paper : 60 marks
- Internal ; 15 marks
- Practical [lab course-I] : 25 marks

Question Paper Format and Distribution of Marks for

B.Sc. (Industrial chemistry) Semester-I

1. The question paper will 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 60 (Marks x No. of Questions)
A (Very short Answer)	1x10 = 10
B (Short Answer)	3 x 5 = 15
C (Long Answer)	7 x 5 = 35

6. The scheme of marks for Assignment should be as follows :

Question Type	MM 75 (Marks x No. of Questions)
A (Very short Answer)	0.5 x5= 2.5
B (Short Answer)	1x5 = 05
C (Long Answer)	1.5x5= 7.5
Total	15

Syllabus and Marking Scheme for First SEMESTER

(INDUSTRIAL CHEMISTRY)

SESSION: 2023-24

Paper No.	Title of the Paper	Marks Allotted
		Max
I	Industrial Technology, Metallurgy and Surface Chemistry	60
II	INTERNAL	15
II	LAB COURSE INDUSTRIAL CHEMISTRY - I	25
	TOTAL	100

Lab Course		
Duration: 5 Hrs	TWO EXPERIMENTS	15
Total Marks: 25	VIVA	03
	PROJECT/FIELD WORK	04
	SESSIONAL	03

01	Theory paper	-	60
01	Internal	-	15
01	Practical	-	25
	Total Marks	-	100

B.Sc.- I Semester (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 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 the 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.

INDUSTRIAL CHEMISTRY
B. Sc. Semester I & II
SESSION: 2023-24
Industrial Chemistry- I
(Industrial Technology, Metallurgy and Surface Chemistry)

Course Outcome (COs):

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	<i>Aslwan</i>		
Subject Expert	<i>H. Mahaney</i>	1. <i>Creeft</i>	8. <i>[Signature]</i>
(University Nominee)	<i>S. S.</i>	2. <i>[Signature]</i>	9. <i>[Signature]</i>
Subject Expert.....		3. <i>[Signature]</i>	10.
Representative		4.	11. <i>[Signature]</i>
(Industry)		5. <i>[Signature]</i>	12. <i>[Signature]</i>
Representative	<i>Agaswal</i>	6. <i>[Signature]</i>	13.
(Alumni)		7. <i>[Signature]</i>	14.
Representative	<i>[Signature]</i>		
(Professor Science Faculty Other Dept.)			

DEPARTMENT OF CHEMISTRY
Govt. V. Y. T. PG Autonomous College, Durg (CG)
INDUSTRIAL CHEMISTRY
Semester wise Syllabus B.Sc. - Industrial Chemistry
SESSION: 2023-2024
B.Sc. - Industrial Chemistry FIRST YEAR SYLLABUS
SEMESTER- I

Industrial Chemistry I: Industrial Technology, Metallurgy and Surface Chemistry

Max. Marks – 60

UNIT-1 Metallurgical Operations: 12Hrs.
[A] Basic metallurgical operations: pulverization, calcination, roasting and refining

[B] Physico-chemical principles of extraction of Lead, Silver, Aluminium, Magnesium, Zinc, Chromium

UNIT-2 Metals and Alloys: 12Hrs.

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

Inorganic materials of industrial importance:

Their availability, forms, structure and modification. Alumina, Silica, Silicates, Clays, Mica, Carbon, Zeolites.

UNIT-3 Chemical Technology - I 12Hrs.

[A] **Distillation**-Introduction: Batch & continuous distillation, separation of azeotropes, plate columns and packed columns.

[B] **Absorption** - Introduction, Equipments - Packed columns, spray columns, bubble columns, packed bubble columns, mechanically agitated contractors.

UNIT-4 Chemical Technology – II 12Hrs.

[A] **Evaporation**-Introduction, Equipments short tube (standard) evaporator, forced circulation evaporators, falling film evaporators, climbing film (Upward flow) evaporators, wiped (agitated) film evaporators.

[B] **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.

[C] **Drying** – Introduction, free moisture, bound moisture, drying curve, Equipments, tray dryer, flash dryer, fluid bed dryer, drum dryer, spray dryer.

UNIT-5 Surface Chemistry and Interfacial Phenomena 12Hrs.

Emulsions: Types, Preparation

Gels: Classifications, preparations, properties, Applications

Micelles: Types of micelles, structure, solubilization, uses

Aerosols: Classification, properties

Surfactants: Types, Detergent effect

Adsorption: Types, Adsorption Isotherm

Suggested Readings:

1. Theory of Metallurgical Processes, Volsky, A. & Sergievskaya F.
2. Text-Book of Metallurgy, Baiky, A. R.
3. Inorganic Chemistry, Puri and Sharma.
4. Introduction Chemical Engineering, W.L. Badger, J.J. Banchemo, McGraw Hill.
5. Unit Operations of Chemical Engineering, Vol. I, P. Chattopadhyaya, Khanna Publishers, Delhi
6. Surface Chemistry, J.J. Bikermann, Academic Press.
7. Physical Chemistry of surfaces by A. W. Admson.
8. A Text Book of Engineering Chemistry, S. S. Dara, S Chand & Co. Ltd, New Delhi.

DEPARTMENT OF CHEMISTRY
Govt. V. Y. T. PG Autonomous College, Durg (CG)
INDUSTRIAL CHEMISTRY
SESSION: 2023-2024
B.Sc. - Industrial Chemistry FIRST YEAR SYLLABUS
SEMESTER- I
INDUSTRIAL CHEMISTRY PRACTICAL

Duration of Examination: 04Hrs.

Description of marks

	Marks	Max. Marks	Passing Marks
Experiment	15	25	09
Viva	05		
Sessional	05		
Total	25		

EXPERIMENTS TO BE PERFORMED

1. Acquaintance with safety measures in a laboratory. Hazards of chemicals
2. Preparation of standard solutions, primary and secondary standards, Determination of H_2SO_4 and H_3PO_4 in a mixture.
3. Calibration of Thermometers
4. Preparation of buffers
5. Chromatography –
column, paper, thin layer
6. 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

B.Sc. (INDUSTRIAL CHEMISTRY)

SESSION: 2023-24

Skill Enhancement Course – 1

ICHS 01: GOOD LAB PRACTICES IN CHEMISTRY THEORY AND PRACTICAL

Credits -02, 30 hrs.]

Course outcome:

After completing the course students will be able to:

CO1: Understand general laboratory practices

CO2: Prepare solutions

CO3: Handle glasswares and chemicals

CO4: Explore various research issues and their solutions

CO5: Apply practical skills in chemistry

- A. Technique and uses of handling glasswares; calibrations, knowledge about common toxic chemicals and safety measures in their handling.
- B. Common calculations in chemistry laboratories. Understanding the details on the label of reagent bottles.

Inorganic and organic reagents (Baeyer's reagent, nessler's reagent, fehling solution A and B, shiff reagents, Tollen's reagent, Mollish's reagent, Neutral ferric chloride, Nitrating Mixture, Aqua regia, Dimethyl glyoxime, H₂S gas); chemicals such as acids, bases, indicators, etc. used in chemistry lab for qualitative analysis .

- C. Molarity and normality of common acids and bases. Preparation of solutions – solid and liquids, Molar, molal and normal solutions, Dilutions. Percentage solutions.
- D. **Qualitative test of CO₃²⁻, CH₃COO⁻, SO₄²⁻, Cl⁻, NO₃⁻, NH₄⁺, Cu₂⁺, Fe³⁺, Ni²⁺, Ba²⁺, Mg²⁺.**

Qualitative elemental analysis for Nitrogen, Sulphur, Halogen in organic compounds.

Reference Books:-

1. Seiler, J.P. (2005). Good Laboratory Practices: the why and how. Springer-Verlag Berlin and Heidelberg GmbH & Co. K; 2nd ed.
2. Garner, W.Y., Barge M.S., Ussary. P.J. (1992). Good Laboratory Practice Standards: Application for field and Laboratory studies. Wiley VCH.

NAME AND SIGNATURE:

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

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**

2023-24

The syllabus with the paper combinations is as under

B.Sc. I: (INDUSTRIAL CHEMISTRY) SEMESTER – II

CORE COURSE	INDUSTRIAL CHEMISTRY - II
TITLE	INDUSTRIAL OPERATIONS, FUELS AND ASPECTS OF PHYSICAL CHEMISTRY
PAPER CODE	[CZIC & CMIC: 201]
PRACTICAL	LAB COURSE INDUSTRIAL CHEMISTRY-II
PAPER CODE	CZIC & CMIC 02

The syllabus for B.Sc. Industrial Chemistry SEMESTER-II is hereby approved for the session 2022-23. 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.

B.Sc. – INDUSTRIAL CHEMISTRY SEMESTER - II

2023-24

DIRECTIVES FOR STUDENTS OF B.Sc. – INDUSTRIAL CHEMISTRY SEMESTER - II

EVALUATION PATTERN

- Theory Paper : 60 marks
- Internal ; 15 marks
- Practical [lab course-I] : 25 marks

Question Paper Format and Distribution of Marks for

B.Sc.- (INDUSTRIAL CHEMISTRY) Semester-II

1. The question paper will 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 60 (Marks x No. of Questions)
A (Very short Answer)	1x10 = 10
B (Short Answer)	3 x 5 = 15
C (Long Answer)	7 x 5 = 35

6. The internal examinations will be held for core course.
7. The scheme of marks for **Assignment** should be as follows :

Question Type	MM 75 (Marks x No. of Questions)
A (Very short Answer)	0.5 x5 = 2.5
B (Short Answer)	1x5 = 05
C (Long Answer)	1.5x5= 7.5
Total	15

Syllabus and Marking Scheme for SECOND SEMESTER (INDUSTRIAL CHEMISTRY)

SESSION: 2023-24

PAPER NO.	TITLE OF THE PAPER	WEIGHTAGE
I	INDUSTRIAL OPERATIONS, FUELS AND ASPECTS OF PHYSICAL CHEMISTRY	60
II	INTERNAL	15
II	LAB COURSE INDUSTRIAL CHEMISTRY - II	25
	TOTAL	100

Lab Course		
Duration: 5 Hrs	TWO EXPERIMENTS	15
Total Marks: 25	VIVA	03
	PROJECT/FIELD WORK	04
	SESSIONAL	03

01	Theory paper	-	60
01	Internal	-	15
01	Practical	-	25
	Total Marks	-	100

DEPARTMENT OF CHEMISTRY
Govt. V. Y. T. PG Autonomous College, Durg (CG)
INDUSTRIAL CHEMISTRY
SESSION: 2023-2024

Semester wise Syllabus B.Sc. Industrial Chemistry
FIRST YEAR SYLLABUS
SEMESTER- II

Industrial Chemistry II: Industrial Operations, Fuels and Aspects of Physical Chemistry

Maximum Marks – 60

UNIT-1 Fuel Chemistry: 12Hrs.

[A] **Fuel** - Types of fuels, advantages and disadvantages, combustion of fuels, calorific value

[B] **Petroleum**: Composition of crude petroleum, refining and petroleum products and their applications, fractional distillation of crude oil, natural gas, non petroleum fuels- CNG, LNG, biogas, fuels from biomass and wastes. Cracking, reforming, hydro forming, isomerisation

UNIT-2 12Hrs.

[A] **Coal**: Types, structure, properties, distillation of coal, chemicals derived from coal

[B] **Boilers** - Types of boilers and their functioning

UNIT-3 10Hrs.

[A] **Fluid Flow**: Fans, blowers, compressors, vacuum pumps, ejector.

[B] **Pumps**: Reciprocating pumps, Gear pumps, centrifugal Pumps.

UNIT-4 14Hrs.

[A] **Catalysis**: Introduction, Types, Homogeneous and Heterogeneous, Basic principles, mechanisms, factors affecting the performance.

[B] **Enzyme catalysis** - Rate model, industrially important reactions

UNIT-5 Energy Balance: Hess's law, Heat capacity of pure gases and gaseous mixture. Enthalpy changes 12Hrs.

Suggested Readings:

1. Introduction of petroleum chemicals, H. Steiner, Pergamen Press.
2. Industrial Chemistry, O. P. Vermani, A. K. Narula, Galgotia Publications Pvt. Ltd., New Delhi.
3. Chemical Process Industries, Vol. I & II, S.C. Bhatia, CBS Publishers, New-Delhi.
4. Engineering Chemistry, P.C. Jain , M. Jain, Dhanpat Rai & Sons Delhi
5. Engineering Chemistry, R. Gopalan, D. Venkappayya. S. Nagarajan, Vikas Publication, New Delhi
6. Engineering Chemistry, B. K. Sharma , Goel Publishing House , Meerut
7. Industrial Chemistry, B. K. Sharma , Goel Publishing House , Meerut
8. Physical Chemistry, Puri & Sharma , Goel Publishing House , Meerut

NAME AND SIGNATURE:

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

DEPARTMENT OF CHEMISTRY
Govt. V. Y. T. PG Autonomous College, Durg (CG)
INDUSTRIAL CHEMISTRY
SESSION: 2023-2024
B.Sc. - Industrial Chemistry FIRST YEAR SYLLABUS
SEMESTER- II
INDUSTRIAL CHEMISTRY PRACTICAL

Duration of Examination: 05Hrs.

Description of marks

	Marks	Max. Marks	Passing Marks
Experiment	15	25	09
Viva	05		
Sessional	05		
Total	25		

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. Depression and elevation in B.P. /M.P. of solids and liquids.
4. Ore analysis dolomite, limestone- calcite, Analysis of alloys such as cupro-nickel.
5. 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.
6. Study, experiments/ demonstration experiments.
7. Detection of food adulteration.

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.

B.Sc. (INDUSTRIAL CHEMISTRY)

SESSION: 2023-24

Skill Enhancement Course – 2

ICHS 02: WATER REMEDIATION AND CONSERVATION STUDIES

THEORY & PRACTICAL [Credits -02, 30 hrs.]

Course outcome:

After completing the course students will be able to:

CO1: Understand about Sources and Effect Water Pollution

CO2: Learn about various control technique

Water Pollution

Sources of water pollutants, pollutants, Industrial and human contribution, WHO recommendation about potable water, current scenario of drinking water quality.

Remediation Techniques

Remediation, techniques involved such as adsorption, coagulation-filtration, Nalgonada techniques, reverse osmosis, activated charcoal detoxification, mechanisms of detoxification, bio-remediation, need of green chemistry, future scope.

Water Conservation

Introduction to water conservation and erosion of soil, forms of water erosion, factors affecting water erosion, types of water erosion, mechanics of water erosion control,

PRACTICALS

Water analysis (pH, Conductivity, hardness, Acidity, Alkalinity etc.)

Case study/Project

Case study/Project on water pollution, water conservation and water quality.

Recommended Books/References:

1. Cittenden J. C. , Trussell J. R., Hand D. W., Howe K. J., Tchobanoglous G. , Water treatment: Principles and Design MWH publication.
2. De A. K. Environmental Chemistry, Wiley Eastern
3. Clarson D., Dara S. S. A text book of Environmental chemistry and pollution control, S Chand Co. Soil and water analytical method
4. Edzwald J., Water Quality & Treatment: A Handbook on Drinking Water (Water Resources and Environmental Engineering Series)

NAME AND SIGNATURE:

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

SYLLABUS

DEPARTMENT OF CHEMISTRY
COURSE CURRICULUM & MARKING SCHEME

B.Sc. III & IV Semester

INDUSTRIAL CHEMISTRY

(Based on Choice Based Credit System)

SESSION: 2023-24



ESTD : 1958

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

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

NAAC Accredited Grade A+ with CPE-Phase III (UGC), STAR COLLEGE (DBT)

Phone : 0788-2212030

Website – www.govtsciencecollegedurg.ac.in. Email-autonomousdurg2013@gmail.com

DEPARTMENT OF CHEMISTRY
GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG(CG)

Approved Revised syllabus for
B.Sc. INDUSTRIAL CHEMISTRY by the members of Board of Studies for
Session 2023-2024

Scheme and Syllabus for B.Sc. Year 2 (Semester III & IV)

Scheme for B.Sc. Program with **INDUSTRIAL CHEMISTRY** - Second Year
(with 3 Subjects A, B*, C* Subject A- Industrial Chemistry)

Semester	Discipline Specific Course/ Core Course DSC (Credit-4)	Generic Elective Course GEC (Credit-4)	Skill Enhancement Course SEC (Credit-2)	Ability Enhancement Course AEC (Credit-2)	Value Added Course VAC (Credit-2)	Total Credits
III	Industrial Chemistry--III Polymeric materials and unit processes in organic chemicals manufacture (Th=3, P=1)	Choose any one course other than DSC (Th=3, P=1)	Choose 1 from pool of SEC (Th=1, P=1)	Hindi Language (Th-2)	Sports (Th=1, P=1)	22
	Subject B1 (Th=3, P=1)					
	Subject C1(Th=3, P=1)					
IV	Industrial Chemistry -IV Unit processes, Instrumentation and industrial safety measures (Th=4, P=2)	Choose any one course other than DSC (Th=3, P=1)	Choose 1 from pool of SEC (Th=1, P=1)	English Language(Th-2)	Yoga (Th=1, P=1)	22
	Subject B2 (Th=4, P=2)					
	Subject C2(Th=4,P=2)					

Students on exit shall be awarded undergraduate certificate (in the field of Multidisciplinary Study) after securing the requisite 44 credits in semester III and IV

*Maths/Physics/Botany/Zoology/Microbiology/Zoology/Geology/Biotechnology/Biochemistry/Industrial Chemistry/Anthropology

LIST OF COURSES OFFERED BY DEPARTMENT OF CHEMISTRY

For students opting B.Sc. with Industrial Chemistry (Second Year)

Discipline Specific Courses/Core Papers DSC (Credits: 04 each; T= Theory. P = Practical)

1. CZIC/CMIC 301: Industrial Chemistry -III (T- 3, P- 3)
2. CZIC/CMIC 401: Industrial Chemistry - IV (T- 4, P-4)

Skill Enhancing Courses SEC (Credits:02)

CZIC/CMIC 03: Unit processes and qualitative analysis (P-3)

CZIC/CMIC 04: Instrumental methods of analysis and material testing (P-4)

For students opting UG without Industrial Chemistry

Generic Electives Courses GEC (Credits: 04 each; T= Theory. P = Practical)

1. CZIC/CMIC 101: Fundamentals of Chemistry - I (T- 3, P- 1)
2. CZIC/CMIC 201: Fundamentals of Chemistry - II (T- 3, P-1)

DEPARTMENT OF CHEMISTRY
GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG(CG)
Approved Syllabus for

B.Sc. INDUSTRIAL CHEMISTRY by the members of

Board of Studies for the Session 2023-24

Scheme and Syllabus for B.Sc. Year 2 (Semester III & IV)

Courses and Marking Scheme for Second year

B.Sc. with Industrial Chemistry

Year	Sem.	Course Code	Paper Title	Theory/ Practical	Credits	Marks	Sem End	IA	
Certificate in Science									
Discipline Specific Courses – DSC (Core Courses)									
1	III	CZIC/CMI C 301	Analytical methods in Chemistry - III	Theory	3	75	60	15	
		CZIC/CMI C 301	Lab Course - 3	Practical	1	25			
	IV	CZIC/CMI C 401	Molecules of Chemistry - IV	Theory	3	75	60	15	
		CZIC/CMI C 401	Lab Course -4	Practical	1	25			
	Skill Enhancement Courses - SEC								
	III	CZIC/CMIC 03	Good lab practices in Chemistry	Theory	1	25	20	05	
				Practical	1	25			
	IV	CZIC/CMIC 04	Water remediation and conservation studies	Theory	1	25	20	05	
Practical				1	25				

Note: Semester End – 80% and Internal Assessment (IA) – 20% (Weight age of marks internal examinations will be included as per guidelines of Autonomous Examination Cell)

The revised syllabus for B.Sc. (Industrial Chemistry) Semester III & I is hereby approved for the session 2022-23

DEPARTMENT OF CHEMISTRY
GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG(CG)

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

2023-24

The syllabus with the paper combinations is as under

B.Sc. – III Semester (INDUSTRIAL CHEMISTRY)

CORE COURSE	INDUSTRIAL CHEMISTRY - III
TITLE	Polymeric materials and unit processes in organic chemicals manufacture
PAPER CODE	CZIC/CMIC 301
PRACTICAL	LAB COURSE INDUSTRIAL CHEMISTRY-III
PAPER CODE	CZIC/CMIC 03

The syllabus for B.Sc. Industrial Chemistry SEMESTER-III is hereby approved for the session 2023-24. 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.

DEPARTMENT OF CHEMISTRY
GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG(CG)
B.Sc. INDUSTRIAL CHEMISTRY SEMESTER - III
SESSION: 2023-24

Directives for students of B.Sc. INDUSTRIAL CHEMISTRY SEMESTER - III

EVALUATION PATTERN

- Theory Paper : 60 marks
- Internal ; 15 marks
- Practical [lab course-III] : 25 marks

Question Paper Format and Distribution of Marks for

B.Sc. (Industrial chemistry) Semester- III

1. The question paper will 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 60 (Marks x No. of Questions)
A (Very short Answer)	1x10 = 10
B (Short Answer)	3 x 5 = 15
C (Long Answer)	7 x 5 = 35
Total Marks	60

DEPARTMENT OF CHEMISTRY
GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG(CG)
Syllabus and Marking Scheme for Third SEMESTER
(INDUSTRIAL CHEMISTRY)

SESSION: 2022-23

Paper No.	Title of the Paper	Marks Allotted
		Max
I	Polymeric materials and unit processes in organic chemicals manufacture	60
II	INTERNAL	15
II	LAB COURSE INDUSTRIAL CHEMISTRY - I	25
	TOTAL MARKS	100

Lab Course		
Duration: 5 Hrs	TWO EXPERIMENTS	15
Total Marks: 25	VIVA	03
	PROJECT/FIELD WORK	04
	SESSIONAL	03

01	Theory paper	-	60
01	Internal	-	15
01	Practical	-	25
	Total Marks	-	100

DEPARTMENT OF CHEMISTRY
GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG(CG)
B.Sc. (with INDUSTRIAL CHEMISTRY)

Programme Specific Outcome (PSO):

Upon completion of the B.Sc. Degree (with Industrial Chemistry), the students will be able to:

PSO1: Understand the fundamentals/concepts/theories in various branches of *Industrial* chemistry.

PSO2: Compare and justify various aspects, deduce and derive expressions, reaction mechanisms.

PSO3: Apply the principles/concepts and rules in finding their solutions.

PSO4: Carry out experiments, record the observations, understand handling of apparatus/instruments.

**DEPARTMENT OF CHEMISTRY
GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG(CG)**

**B.Sc. III- SEMESTER (INDUSTRIAL CHEMISTRY)
2023-24**

**PAPER TITLE:- Polymeric materials and unit processes in organic chemicals
manufacture**

Course Outcome (CO):

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

- CO1:** To have basic idea of materials, cement and ceramics, nature of materials their properties, applications, manufacturing of quality products and its economic relevance.
- CO2:** To understand about polymeric material, glasses and composites, their properties, formation, crystallization and structure with wide industrial applications.
- CO3:** To acquire basic electrochemical knowledge of corrosion processes, corrosion forms and their repercussions and able to apply corrosion protection measures.
- CO4:** To understand about unit processes in organic chemicals manufacture involving nitration, halogenations, chloro-compounds, sulphonation and mechanism of processes.
- CO5:** To understand about oxidation reaction, commercial manufacture of important organic compound by oxidation with mechanism.

NAME AND SIGNATURE:

Departmental members	
Chairperson /H.O.D <i>A. S. S.</i>	
Subject Expert (University Nominee)	1. <i>[Signature]</i>
Subject Expert..... <i>M. M. Babey</i>	2. <i>[Signature]</i>
Representative (Industry)	3.....
Representative (Alumni)	4.....
Representative (Professor Science Faculty Other Dept.)	5.....
	6.....
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B. Sc. III SEMESTER
(INDUSTRIAL CHEMISTRY)

2023-24

PAPER : Polymeric materials and unit processes in organic chemicals manufacture

Max. Marks – 60

UNIT- 1 Material Science:

Mechanical properties of material and change with respect to temperature.

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.

Glass:

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

Corrosion:

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

UNIT- 3 Nitration:

Introduction, Nitrating agents, mechanism of nitration processes

such as nitration of:- Paraffinic hydrocarbons, Benzene to nitrobenzene and m-dinitrobenzene, Chlorobenzene to o- and p- nitrochloro benzenes, Acetanilide to p-nitroacetanilide, Toluene

UNIT- 4 Halogenation:

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

Sulphonation:

Introduction, sulphonating agents, chemical and physical factors in sulphonation.

Mechanism of sulphonation reaction, Commercial sulphonation of benzene, naphthalene, alkyl benzene.

UNIT- 5 Oxidation:

Introduction, Types of oxidation reactions, oxidizing agents, 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.

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. Science of Ceramic chemical processing, HenchL.L.
4. Science of Ceramics, Stewarts G.H.
5. Properties of Glass, Morcy G. W.
6. Chemistry of Glasses, Paul A.
7. Corrosion-causes and prevention, Spellur F.N.

DEPARTMENT OF CHEMISTRY
GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG(CG)
B.Sc. III- SEMESTER
(INDUSTRIAL CHEMISTRY)

2023-24

LAB COURSE: 03

Duration of Examination: 04Hrs.

Max. Marks: 25

EXPERIMENTS:-

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.

PROCESS INSTRUMENTATION:

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

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.

Reference Books

1. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)
2. Furniss, B.S., Hannaford, A.J., Smith, P.W.G. & Tatchell, A.R. Practical Organic Chemistry, 5th Ed. Pearson (2012)
3. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000). 22
4. Ahluwalia, V.K. & Dhingra, S. Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press (2000).

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	(Marks × No. of Questions)
A (Very Short Answer)	2x5 = 10
B (Short Answer)	4x5 = 20
C (Long Answer)	6x5 = 30
TOTAL	60 (Max. Marks)

NAME AND SIGNATURE:

	Departmental members	
Chairperson /H.O.D <i>ADW</i>		
Subject Expert (University Nominee)	1.....	8.....
Subject Expert..... <i>21.57.2014 by</i>	2.....	9.....
Representative (Industry)	3.....	10.....
Representative (Alumni)	4.....	11.....
Representative (Professor Science Faculty Other Dept.)	5.....	12.....
	6.....	13.....
	7.....	14.....

DEPARTMENT OF CHEMISTRY
GOVT. V.Y.T. PG AUTONOMOUS COLLEGE, DURG(CG)
B.Sc. IV- SEMESTER
(INDUSTRIAL CHEMISTRY)

2023-24

PAPER TITLE:- Unit processes, Instrumentation and industrial safety
Course Outcome (CO):

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

- CO1:** To gain knowledge about hydrogenation reaction, catalysts for hydrogenation, alkylation, alkylating agents, manufacture and mechanism of organic compounds.
- CO2:** To understand about esterification and hydrolysis reaction, hydrolyzing agents, mechanism of hydrolysis.
- CO3:** To understand about aminolysis, aminating agents, amination reaction and their mechanism.
- CO4:** To understand concept of construction, principle and working of temperature and pressure measuring instruments.
- CO5:** To know about liquid level measurement, density, viscosity filters, precipitators, eliminators, scrubbers, absorbers and industrial safety measures.

NAME AND SIGNATURE:

Departmental members	
Chairperson /H.O.D <i>ASIC</i>	
Subject Expert (University Nominee)	1. <i>Deepti</i>
Subject Expert <i>M. Babey</i>	2. <i>M</i>
Representative (Industry)	3.
Representative (Alumni)	4.
Representative (Professor Science Faculty Other Dept.)	5.
	6.
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	13.
	14.

B. Sc. - IV SEMESTER (INDUSTRIAL CHEMISTRY)

2023-24

PAPER TITLE:- Unit processes, Instrumentation and industrial safety

Max. Marks – 60

UNIT-1 Hydrogenation:

Introduction, mechanism 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. Mechanism of alkylation reactions, manufacture of alkyl benzene (for detergent manufacture), ethyl benzene, phenyl ethyl alcohol, N-alkyl anilines (mono and di methylanilines)

UNIT-2 Esterification:

Introduction, hydrodynamics and mechanism 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.

Hydrolysis: Introduction, hydrolyzing agents, mechanism of hydrolysis.

UNIT-3 Amination

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.

By aminolysis: Introduction, aminating agents, factors affecting aminolysis.

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.

Bag filters, electrostatic precipitator, mist eliminators, wet scrubbers, absorbers, Industrial safety.

REFERENCE BOOKS:

1. Unit process in Organic synthesis P.M. Groggins, McGraw 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.
Elevier Applied Science Publishers.
5. Chemical Engineer's Hand book, Perry, J.H. and Green, D. Mc Graw Hill.

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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Question Type	(Marks × No. of Questions)
A (Very Short Answer)	2x5 = 10
B (Short Answer)	4x5 = 20
C (Long Answer)	6x5= 30
TOTAL	60 (Max. Marks)

NAME AND SIGNATURE:

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

B.Sc. IV- SEMESTER
(INDUSTRIAL CHEMISTRY)2023-24
LAB COURSE -04

Duration of Examination: 04Hrs.

Max. Marks – 25

EXPERIMENTS:-

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.

WATER ANALYSIS:

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

DEPARTMENT OF CHEMISTRY
Govt. V. Y. T. PG Autonomous College, Durg (CG)
INDUSTRIAL CHEMISTRY
SESSION: 2022-2023
B.Sc. - Industrial Chemistry SECOND YEAR SYLLABUS
SEMESTER- III & IV
INDUSTRIAL CHEMISTRY PRACTICAL



Duration of Examination: 04Hrs.

Max. Marks: 25

Description of marks

	Marks	Max. Marks	Passing Marks
Experiment	15	25	09
Viva	05		
Sessional	05		
Total	25		

NAME AND SIGNATURE:

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

B.Sc. Semester - III (INDUSTRIAL CHEMISTRY)

2023 -24

Discipline Specific Elective Course - 1

CZIC/CMIC 301: Analytical Methods in Chemistry

Course Outcome (CO):

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

CO1: Understand and perform experiment with accuracy and precision.

CO2: Explain and develop methods of analysis for different samples independently.



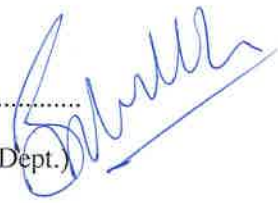
CO3: Describe Thermal methods of analysis and treatment process.

CO4: Understand the electro analytical methods.

CO-5: Understand basic principle of UV-vis spectrophotometer and quantitative analysis

CO6: Explain the various separation techniques like extraction, chromatography etc.

NAME AND SIGNATURE:

Chairperson /H.O.D 	Departmental members:
Subject Expert	
(University Nominee)	
Subject Expert.....	
Representative.....	
(Industry)	
Representative.....	
(Alumni)	
Representative	
(Professor Science Faculty Other Dept.) 	

B.Sc. Semester - III (INDUSTRIAL CHEMISTRY)

2023 -24

Discipline Specific Elective Course –1

(Theory)

CZIC/CMIC301: Analytical Methods in Chemistry

[Credits -03]

UNIT- 1 Qualitative and quantitative aspects of analysis:

Sampling, evaluation of analytical data, errors, accuracy and precision, methods of their expression. Normal law of distribution of indeterminate errors, statistical test of data; F, Q and t test, rejection of data, and confidence intervals.

UNIT- 2 Optical methods of analysis

Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, UV-Visible Spectrometry: Basic principles of instrumentation (choice of source, monochromator and detector) for single and double beam instrument; Transmittance.

Absorbance and Beer-Lambert law, Basic principles of quantitative analysis: estimation of metal ions from aqueous solution, geometrical isomers, keto-enol tautomers.

UNIT- 3 Thermal methods of analysis:

Theory of thermogravimetry (TG) and basic principle of instrumentation of thermal analyser. Techniques for quantitative estimation of Ca and Mg from their mixture.

UNIT- 4 Electro analytical methods

Classification of electro analytical methods, basic principle of pH metric, potentiometric and conductometric titrations. Techniques used for the determination of equivalence points.

UNIT- 5 Separation techniques

Solvent extraction: Classification, principle and efficiency of the technique.

Mechanism of extraction: extraction by solvation and chelation, Technique of extraction: batch, continuous and counter current extractions, Qualitative and quantitative aspects of solvent extraction:

Chromatography: Classification, principle and efficiency of the technique, Mechanism of separation:

Recommended books/Reference Books:

1. Willard, H.H.(1988),Instrumental Methods of Analysis, 7th Edition, Wardsworth Publishing Company.
2. Christian, G.D.(2004),Analytical Chemistry, 6th Edition, John Wiley & Sons, New York.
3. Harris, D. C.(2007),Quantitative Chemical Analysis,6th Edition, Freeman.
4. Khopkar, S.M. (2008), Basic Concepts of Analytical Chemistry, New Age International Publisher.
5. Skoog, D.A.; Holler F.J.; Nieman, T.A. (2005), Principles of Instrumental Analysis, Thomson Asia Pvt. Ltd.

B.Sc. Semester - III (INDUSTRIAL CHEMISTRY)

2023 -24

Discipline Specific Elective Course - 1(Practical)

CZIC/CMIC 301: ANALYTICAL CHEMISTRY -1

[Credits -01]

List of Experiments

1. Separation of mixtures by paper chromatography and reporting the R_f values:
 - (i) Ions or dyes mixture
 - (ii) Amino acids present in the given mixture.
2. Solvent Extractions
 - (i) To separate a mixture of Ni²⁺ & Fe²⁺ by complexation with DMG and extracting the Ni²⁺ DMG complex in chloroform, and determine its concentration by spectrophotometry.
3. Analysis of soil:
 - (i) Determination of pH of soil.
 - (ii) Total soluble salt
 - (iii) Estimation of calcium and magnesium
 - (iv) Qualitative detection of nitrate and phosphate
5. Spectrophotometry
 - (i) Verification of Lambert-Beer's law and determination of concentration of a coloured species (CuSO₄, KMnO₄, K₂ Cr₂ O₇)

Recommended books/Reference Books:

1. R.M. Felder, R.W. Rousseau: Elementary Principles of Chemical Processes, John Wiley & Sons, Inc. Publishers, New Delhi.(2005 edition).
3. J. A. Kent: Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi.
4. S. S. Dara: A Textbook of Engineering Chemistry, S. Chand & Company Ltd. New Delhi.
5. Jeffery, G.H.; Bassett, J.; Mendham, J.; Denney, R.C.(1989), Vogel's Textbook of Quantitative Chemical Analysis, John Wiley and Sons.

B.Sc. Semester - IV (INDUSTRIALCHEMISTRY)

2023 -24

Discipline Specific Elective Course - 2(Theory)

INDUSTRIALCHEMISTRY –DSE-4

CZIC/CMIC 401: Molecules of Life

[Credits -03]

Course Outcome (CO):

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

CO1: Understand and perform experiment with accuracy and precision.

CO2: Explain and develop methods of analysis for different samples independently.





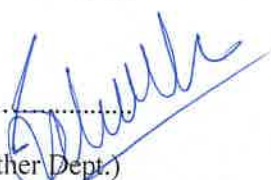
CO3: Describe Thermal methods of analysis and treatment process.

CO4: Understand the electro analytical methods.

CO-5: Understand basic principle of UV-vis spectrophotometer and quantitative analysis

CO6: Explain the various separation techniques like extraction, chromatography etc.

NAME AND SIGNATURE:

Chairperson /H.O.D 	Departmental members:
Subject Expert (University Nominee)	
Subject Expert.....	
Representative..... (Industry)	
Representative..... (Alumni)	
Representative  (Professor Science Faculty Other Dept.)	

B.Sc. Semester - IV (INDUSTRIAL CHEMISTRY)

2023 -24

Discipline Specific Elective Course –2

INDUSTRIAL CHEMISTRY –DSE-4 (Theory)

CZIC/CMIC 401: Molecules of Life

[Credits -03]

UNIT –I : Carbohydrates

Classification of carbohydrates, reducing and non-reducing sugars, biological functions, general properties and reactions of glucose and fructose, their open chain structure, epimers, mutarotation and anomers, reactions of monosaccharides, determination of configuration of glucose (Fischer proof), cyclic structure of glucose. Haworth projections. Cyclic structure of fructose. Linkage between monosaccharides.

UNIT –II : Amino Acids, Peptides and Proteins

Classification of amino acids and biological uses of amino Acids, peptides and proteins. Zwitterion structure, isoelectric point and correlation to acidity and basicity of amino acids. Determination of primary structure of peptides, determination of N-terminal amino acid (by DNFB and Edman method) and C-terminal amino acid (by thiohydantoin and with carboxypeptidase enzyme). Synthesis of simple peptides (up to dipeptides) by N-protection (t-butyloxy carbonyl and phthaloyl) & C-activating groups and Merrifield solid phase synthesis, Overview of primary, secondary, tertiary and quaternary structure of proteins,

UNIT –III : Enzymes

Classification of enzymes and their uses (mention Ribozymes). Mechanism of enzyme action, factors affecting enzyme action, Coenzymes and cofactors and their role in biological reactions, specificity of enzyme action (including stereo specificity), enzyme inhibitors and their importance, phenomenon of inhibition (Competitive and non-competitive inhibition including allosteric inhibition).

UNIT –IV : Nucleic Acids

Components of Nucleic acids: Adenine, guanine, thymine, cytosine and uracil (structure only), other components of nucleic acids, nucleosides and nucleotides (nomenclature), structure of polynucleotides. Structure of DNA (Watson-Crick model) and RNA (types of RNA), difference between DNA and RNA, genetic code, biological roles of DNA and RNA: replication, transcription and translation.

UNIT –V: Lipids

Introduction to lipids, classification. Oils and fats: Common fatty acids present in oils and fats, Omega-3 & 6 fatty acids, trans fats, hydrogenation, hydrolysis, acid value, saponification value, iodine number. Biological importance of triglycerides, phospholipids, glycolipids, and steroids (cholesterol).

Reference Books:-

1. Finar, I. L. Organic Chemistry (Volume 1 & 2), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Morrison, R. N.; Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Berg, J. M.; Tymoczko, J. L.; Stryer, L.(2002),Biochemistry, W. H. Freeman

B.Sc. Semester - IV (INDUSTRIAL CHEMISTRY)

2023 -24

Discipline Specific Elective Course - 2

CZIC/CMIC 401: LAB COURSE- 2

[Credits -01]

List of Experiments

1. Separation of amino acids by paper chromatography
2. Study of titration curve of glycine and determination of its isoelectric point.
3. Estimation of proteins by Lowry's method
4. Action of salivary amylase on starch
5. Effect of temperature on the action of salivary amylase on starch.
6. To determine the saponification value of an oil/fat.
7. To determine the iodine value of an oil/fat
8. Qualitative tests for carbohydrates- Molisch test, Barfoed's reagent test, rapid furfural test,
Tollen's test and Fehling solution test
9. Qualitative tests for proteins
10. Extraction of DNA from onion/cauliflower

Reference Books:

1. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. (2012), Vogel's Textbook of Practical Organic Chemistry, Pearson.
2. Seiler, J.P. (2005). Good Laboratory Practices: the why and how. Springer-Verlag Berlin and Heidelberg GmbH & Co. K; 2nd ed.
3. Garner, W.Y., Barge M.S., Ussary. P.J. (1992). Good Laboratory Practice Standards: Application for field and Laboratory studies. Wiley VCH.





Distribution of Marks

Total Marks: 25 (80% End Semester Exam and 20% Internal Assessment)

Internal assessment – Assignment of 25 marks, Out of 10, five questions to be attempted

(Weightage of marks internal examinations will be included and Question Paper pattern as per guidelines of Autonomous Examination Cell)

NAME AND SIGNATURE:

Chairperson /H.O.D 	Departmental members:
Subject Expert (University Nominee)	
Subject Expert.....	
Representative..... (Industry)	
Representative..... (Alumni)	
Representative  (Professor Science Faculty Other Dept.)	

B.Sc. (INDUSTRIAL CHEMISTRY)

2023-24

Skill Enhancement Course – 2

CZIC/CMIC 02: WATER REMEDIATION AND CONSERVATION STUDIES

THEORY AND PRACTICAL

[Credits -02 (Th-01, PR-01) 30 hrs.]

Course outcome:

After completing the course students will be able to:

CO1: Understand about Sources and Effect of Water Pollution

CO2: Learn about various control technique

THEORY:

Water Pollution

Sources of water pollutants, pollutants, Industrial and human contribution, WHO recommendation about potable water, current scenario of drinking water quality.

Remediation Techniques

Remediation, techniques involved such as adsorption, coagulation-filtration, Nalgonada techniques, reverse osmosis, activated charcoal detoxification, mechanisms of detoxification, bio-remediation, need of green chemistry, future scope.

Water Conservation

Introduction to water conservation and erosion of soil, forms of water erosion, factors affecting water erosion, types of water erosion, mechanics of water erosion control,

PRACTICAL:

Water analysis (pH, Conductivity, hardness, Acidity, Alkalinity etc.)

Case study/Project

Case study/Project on water pollution, water conservation and water quality.

Recommended Books/references:

- 1. CITTENDEN J. C. , TRUSSELL J. R., HAND D. W., HOWE K. J., TCHOBANOGLIOUS G. , WATERTREATMENT: Principles and Design MWH publication.
- 2. DE A. K. Environmental Chemistry, Wiley Eastern
- 3. CLARSON D., DARA S. S. A text book of Environmental chemistry and pollution control, S. Chand Co. Soil and water analytical method
- 4. EDZWALD J., Water Quality & Treatment: A Handbook on Drinking Water (Water Resources and Environmental Engineering Series)

Distribution of Marks

Total Marks: 25 (80% End Semester Exam and 20% Internal Assessment)
Internal assessment – Assignment of 25 marks, Out of 10, five questions to be attempted

(Weightage of marks internal examinations will be included and Question Paper pattern as per guidelines of Autonomous Examination Cell)

The revised syllabus for B.Sc. (Chemistry) Semester III & IV is hereby approved for the Session 2023-24

NAME AND SIGNATURE:

Chairperson /H.O.D	Departmental members:
Subject Expert (University Nominee)	
Subject Expert.....	
Representative..... (Industry)	
Representative..... (Alumni)	
Representative (Professor Science Faculty Other Dept.)	