

## Bachelor of Science (Program)

Industrial Chemistry Vocational  
(Effective from Academic Year 2021-22)

### Program Specific Outcomes

- To understand Chemistry and its application at industrial level through theory and practical exposure.
- To explain an application of chemistry & chemical engineering for production at industrial scale. Also, to explain nomenclature, stereochemistry, structures, reactivity and mechanism of the chemical reactions.
- To develop knowhow of various concepts of chemical engineering as well as various applicability of chemistry in varied industries like polymers, petroleum, fine chemicals, pharmaceuticals etc.
- To study of various chemical reactions and analytical procedures by performing them in laboratory.
- To develop a texture of chemical industries, a six week in-plant training, industrial visit, project and in class presentations are the part of curriculum. Exposure to various routine as well as specialized instruments utilized at industrial and research level.
- To increase the understanding towards chemical hazards, safety and laboratory practices.
- To develop skill to be an entrepreneur.





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Vallabh Vidyanagar, Gujarat  
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Syllabus with effect from the Academic Year 2021-2022

(Bachelor of Science) (Industrial Chemistry Vocational)  
(B.Sc.) (UG) Semester (II)

Course Code	US02CICV51	Title of the Course	Process Calculations and Mechanical Operations
Total Credits of the Course	04 (Four)	Hours per Week	04(Four)

Course Objectives:	Studying this paper will make students understand the basic calculations related to chemistry and chemical process. The students will learn the concepts of units and dimensions as well as basics of thermo dynamics which are used routinely in the industries. The students will also get exposed to various mechanical operations employed in chemical industries and will gain knowledge about the use and application of such mechanical concepts at various levels of chemical processes.
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Course Content		
Unit	Description	Weightage* (%)
1.	Units and dimensions, Units for composition of systems, Ideal gas equation, behaviour of gaseous mixture, Roul't's Law, Henry's Law, vapour pressure of liquids and solutions. Elementary Concepts of Unit operations and Unit processes, Preparation of flow diagrams, Concepts of material balance, material balance problems, Strategy for material balance calculation for the processes without and with reactions.	25%
2.	Concept of energy balance forms of energy, energy balance equations for batch and steady state flow processes, Heat capacity and specific heat, Enthalpy change calculations for non-reactive and reactive systems. Combustion and combustion reactions, Calculation of air requirement and flue gas composition, Flue gas analysis, Calorific value of fuels, Psychometry, Humidification & Dehumidification operations, Humidity and Saturation, Psychometric chart	25%
3.	Filtration-Introduction, Rate equation, Filter media & filter aids, Industrial filter, sand filter, Plate and & frame filter, leaf filter, Rotary drum filter, Sparkler filter, Nutsche filter, Centrifugal filtration, Basket centrifuge Sedimentation-Batch & continuous sedimentation, thickeners, Separation of Solids based on specific properties, Clarification and Clarification equipment's, Cyclones, Froth flotation and Jigs.	25%



4.	Mixing, Introduction, mixing liquids with liquids, mixing solids with solids, Mixing viscous mass. Conveyors & elevators-Introduction Belt conveyor, Screw conveyor, Pneumatic conveyor. Size reduction and size separation – Introduction, primary and secondary crushers, fine grinders, Methods of operating crushers, laws of crushing, Industrial Screens.	25%
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Teaching-Learning Methodology	Class room teaching using ICT facilities with audio and video presentation black board teaching method including industrial visit to observe the applicability of the subject. Student's seminars and presentation. Assignments per units.
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Internal Written / Practical Examination (As per CBCS R.6.8.3)	15%
2.	Internal Continuous Assessment in the form of Practical, Viva-voce, Quizzes, Seminars, Assignments, Attendance (As per CBCS R.6.8.3)	15%
3.	University Examination	70%

Course Outcomes: Having completed this course, the learner will be able to	
1.	Students will learn about units & dimension, Ideal gas equation & concept of material balance.
2.	Learn about Concept of energy balance, humidification & dehumidification operation & psychometric chart.
3.	Students will learn about Filtration (different types of filter) and sedimentation
4.	Students will learn about mixing, Conveyors & elevators, Size reduction and size separation

Suggested References:	
Sr. No.	References
1.	Unit operation Volume I. K.A.Gavhane (Nirali Prakashan)
2.	Introduction to Chemical Engineering. W.L.Badger & J.I. Banchero (McGraw Hill)



3.	Unit operation in chemical engineering. W.L.Mccabe & J.C.Smith
4.	Unit operation, Volume II.Coulson & Richardson
5.	Stoichiometry, B.I. Bhatt & S.M. Vora (Tata McGraw Hill Co).
6.	Chemical process principles, (Part I). C.A. Haugen, K.M. Wastson, R.A. Ragatz (Asia Publishing House).
7.	Process calculations (Stoichiometry) K.A. Ghavane (Nirali Prakashan).
8.	Basic Principles & Calculations in Chemical Engineering, David M. Himmelblau (Prentice Hall).
9.	Chemical Engineering thermodynamics, J.M. Smith & Vanners (MacGraw Hill).
10.	Fuel and Combustion, Samir Sarkar (Orient Longman Ltd).
11.	Fuel and Combustion, S.P. Sharma & Chandra Mohan (Tata McGraw Hill Co.).

On-line resources to be used if available as reference material

On-line Resources: Google books, INFLIBNET, PDF Drive, Swayam, NPTEL.

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Course Code	US02CICV52	Title of the Course	LABORATORY
Total Credits of the Course	02 (Two)	Hours per Week	04 (Four)

Course Objectives:	In this practical course students will learn about hands on training of various mechanical operations like size reduction, solid-solid separation, mixing, filtration etc. Also, they will learn the calculations related to process parameters used in chemical industries.
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Unit	Description
1.	Determination of melting point. Boiling point, surface tension, and refractive index. Determination of material balance of given compound & understanding of calculations regarding material & Energy Balance.
2.	Introduction and practical applications of Psychometric chart will do, Study of Humidification & Dehumidification, Moisture content etc.
3.	Practical concept of various unit operations like Filtration and Separation.
4.	Hand on practice on Jaw Crusher, Roll Crusher, Ball mill, Cyclone separator and Sieve Analysis.

Teaching-Learning Methodology	Hands on training of Practicals. Courses for B. Sc. Industrial Chemistry programme are delivered through classroom, laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (PowerPoint presentations, audio visual resources, e-resources, seminars, workshops, models).
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Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	University Examination: Practical Examination (As per CBCS R.6.8.3) Viva-voce, Journal and Attendance.	100%

Course Outcomes: Having completed this course, the learner will be able to
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1.	Learn about material balance, psychometric chart, moisture content etc.
2.	Students will learn about Unit operation Practicals like filtration, sedimentation & mechanical operations.

Suggested References:

Sr. No.	References
1.	Unit Operations in Chemical Engineering, McCabe Smith, McGraw Hill.
2.	Chemical engineers Hand Book, Perry R. H. And Chilton C. H., McGraw Hill.
3.	Literature available any laboratory manual of mechanical operations, NPTL
4.	Chemical engineering Volume 2, Coulson and Richardson, Butterworth Heinemann Pub.
5	Introduction to Stoichiometry, K A Gavhane, Nirali Publication.

On-line resources to be used if available as reference material, Massachusetts Institute of Technology (MIT) Open course lecture available on the internet.

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Syllabus for B. Sc. (Semester-III & IV)  
Industrial Chemistry Vocational

Courses	Course Code	Title Of Paper	Credit	Marks External / Internal	Exam Duration	Contact Hours /Week
Core Courses – I	US03CICV51	Chemical Plant Auxiliaries & Manufacturing	04	70 / 30	03 Hrs	04
Core Courses – II	US03CICV52	Fundamentals Of Organic Chemistry	04	70 / 30	03 Hrs	04
Practical	US03CICV53	Practical (All Core Courses)*	04	100 / --	04 Hrs*	08
Skill Enhancement Elective Course (Any One)	US03SICV51	Industrial Pollution Its Control and Safety	02	50 / --	02 Hrs	02

\* Practical examination comprises all parts/papers of syllabus on equal weightage basis (As per “Details of the Evaluation”).

Courses	Course Code	Title Of Paper	Credit	Marks External / Internal	Exam Duration	Contact Hours/Week
Core courses – I	US04CICV51	Fluid Mechanics and Heat Transfer	04	70 / 30	03 Hrs	04
Core courses – II	US04CICV52	Basic Analytical Chemistry	04	70 / 30	03 Hrs	04
Practical	US04CICV53	Practical (All Core Courses)*	04	100 / --	04 Hrs*	08
Skill Enhancement Elective Course (Any One)	US04SICV51	Green Chemistry	02	50 / --	02 Hrs	02

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Syllabus for B. Sc. (Semester-V)  
Industrial Chemistry Vocational

Courses	Course Code	Title Of Paper	Credit
Core courses-I	US05CICV51	Organic Chemistry	04
Core courses-II	US05CICV52	Technology of Petroleum & Petroleum Products	04
Core courses-III	US05CICV53	Heavy & Fine Chemicals	04
Core courses-IV	US05CICV54	Mass Transfer	04
Practical	US05CICV55	Practical (All Core Courses)*	06
Discipline Specific Elective	US05DICV51	Specialty Chemicals – I	02
Discipline Specific Elective	US05DICV52	Occupational Health & Industrial Hygiene - I	02

Courses	Course Code	Credit	Marks			
			External	Exam Time	Internal	Total
Core courses – I	US05CICV51	04	70	3 Hrs	30	100
Core courses – II	US05CICV52	04	70	3 Hrs	30	100
Core courses – III	US05CICV53	04	70	3 Hrs	30	100
Core courses – IV	US05CICV54	04	70	3 Hrs	30	100
Practical	US05CICV55	06	105	12Hrs*	45	150
Discipline Specific Elective Any One	US05DICV51 US05DICV52	02	50	2 Hrs	--	50

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Syllabus for B. Sc. (Semester-VI)  
Industrial Chemistry Vocational

Courses	Course Code	Title Of Paper	Credit
Core courses-I	US06CICV51	Synthetic Dyes and Drugs	04
Core courses-II	US06CICV52	Polymer Science and Technology	04
Core courses-III	US06CICV53	Industrial Management & Economics	04
Core courses-IV	US06CICV54	Separation Techniques, Plant design & Control	04
Practical	US06CICV55	Laboratory (All Core Courses)*	06
Discipline Specific Elective	US06DICV51	Specialty Chemicals – II	02
Discipline Specific Elective	US06DICV52	Occupational Health & Industrial Hygiene - II	02

Courses	Course Code	Credit	Marks			
			External	Exam Time	Internal	Total
Core courses – I	US06CICV51	04	70	3 Hrs	30	100
Core courses - II	US06CICV52	04	70	3 Hrs	30	100
Core courses – III	US06CICV53	04	70	3 Hrs	30	100
Core courses – IV	US06CICV54	04	70	3 Hrs	30	100
Practical	US06CICV55	06	105	12 Hrs*	45	150
Discipline Specific Elective Any One	US06DICV51 US06DICV52	02	50	2 Hrs	--	50

\* Practical examination comprises all parts/papers of syllabus on equal weightage basis (As per “Details of the Evaluation”).

