

Department of Higher Education, Government of Madhya Pradesh

B.Sc. I year

Industrial Chemistry Syllabus

CBCS Annual Pattern

INDUSTRIAL CHEMISTRY-CORE (THEORY)

Part A- Introduction			
Program-CERTIFICATE		Class- B.Sc.	Year- FIRST
Session: 2021-2022			
Subject - Industrial Chemistry			
1	Course Code	S1-ICHEIT	
2	Course Title	Industrial Aspects of Fossil Fuels, Inorganic Chemicals and Metallurgy	
3	Course Type	Core Course (Paper -1)	
4	Pre-requisite (if any)	To study this course our students must have had the subject <u>Chemistry</u> in 12 th Class.	
5	Course Learning Outcomes (CLO)	<p>By the end of the course, the students will:</p> <ul style="list-style-type: none"> • Be aware of various types of fossil fuels. • Know about the uses of Petroleum products in various field. • Understand the production of important Industrially produced chemicals. • Get knowledge of industrially important raw materials. • Understand the fundamentals of various metallurgical processes • Gain knowledge about the process of glass manufacturing. 	
6	Credit Value	Theory - 04	
7	Total Marks	Maximum Marks: Total - 100 University Exam (UE)- 75, CCE-25	Minimum Passing Marks: 33
Part B- Content of the course			
Total No. of Lectures-Tutorials-Practical (In hours per week): 02			
L-T-P: 60-0-0 (Total Hours)			
Unit	Topic		No. of Lectures
1	<p>Indian Industries : A Historical Perspective Historical perspectives of Indian Industries, Review of Fossil (Renewable and Nonrenewable) fuels, Historical knowledge of coal mining</p> <p>Petroleum and Petrochemicals Industry: Introduction, Occurrence, Composition of crude Petroleum, Origin, Refining of Petroleum, Different type of petroleum products and their applications, Fractional Distillation, Cracking, Reforming and Hydroforming, Flash point, Knocking and Octane Number, Petrochemicals: Vinyl acetate, Propylene oxide, Isoprene, Butadiene, Toluene and Xylene</p> <p>Keywords: Indian Industries, Fossil fuels, petroleum, Refining. Octane Number,</p>		14

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	Petrochemicals	
	Coal : Types, Composition, Structure, Classification and Properties of Coal, Distillation of Coal, Low and high temperature Carbonation of coal, Calorific Value and Analysis of Coal, Composition and uses of Coal gas, producer gas and water gas, Keywords: Calorific value, Carbonation, Analysis of Coal, Coal gas, Producer gas	10
3	Inorganic Chemicals : Industrial preparation with the help of flowchart, applications, analysis and hazards in handling the following chemicals: Hydrochloric acid, Nitric acid, Sulphuric acid, caustic soda, common salt, borax, bleaching powder, sodium thiosulphate, hydrogen peroxide, potash alum, chrome alum, potassium dichromate and potassium permanganate Keywords: Inorganic Chemicals, Acids, Bleaching Powder, Alum, Borax	12
4	Basic Metallurgical operations: Pulverization, calcination, roasting, refining of metals Physicochemical principles of Extraction of: Iron, Copper, Lead, Silver, Sodium, Aluminum and Zinc Keywords: Pulverization, Calcination, Refining, Roasting, Extraction	12
5	A. Inorganic Materials of Industrial Importance: Availability, forms, structure and modifications of – alumina, silicates, clays, mica, carbon, zeolites. B Glass: Definition and composition of Glass, physical and chemical properties, raw materials for manufacture of glass, manufacture of glass, special glasses, optical safety, fibre glass, glass wool and coloured glasses, Bangles (Glass) industry in India. Keywords: Alumina, Mica, Zeolites, Glass, Glass Wool	12

Part C - Learning resources

Text Books, Reference Books, Other Resources

Suggested Reading:

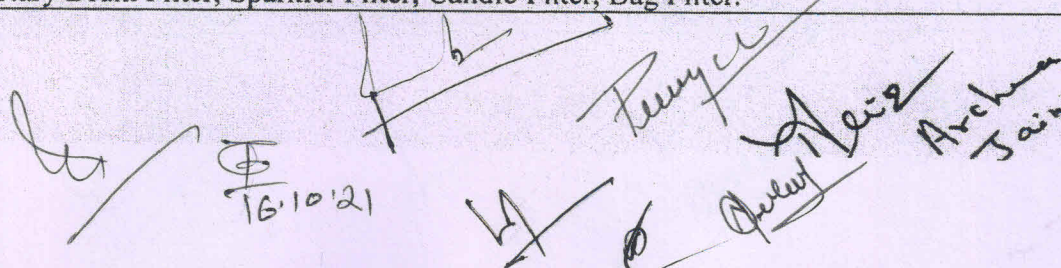
Books & Reference Books

1. Sharma, B.K., "Industrial Chemistry", Goel publishing House, Meerut.
2. Jain, P.C., Jain, P., "Engineering Chemistry", Dhanpat Rai Publishing Company, New Delhi.
3. Lahiri, A.K., "Applied Metallurgy and Corrosion Control: A Handbook for the Petrochemical Industry", (Indian Institute of Metals Series), Springer, 1st ed. 2017 Edition.
4. Jha, D.P, Science & technology (coal mining) in India in eighteenth nineteenth century", Indian school of mines, Dhanbad.
5. Palmer, A., "Introduction to Petroleum Exploration and Engineering", World Scientific,

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 INDUSTRIAL CHEMISTRY-CORE (THEORY)

Part A- Introduction			
Program-CERTIFICATE		Class- B.Sc.	Year- FIRST
Session: 2021-2022			
Subject – Industrial Chemistry			
1	Course Code	S1-ICHE2T	
2	Course Title	Unit Operations and Utilities in Chemical Industries	
3	Course Type	Core (Paper – 2)	
4	Pre-requisite (if any)	To study this course our students must have had the subject <u>Chemistry</u> in 12 th Class.	
5	Course Learning Outcomes (CLO)	<p>By the end of the course, the students will be able to:-</p> <ul style="list-style-type: none"> • Learn broader aspects of principle, theory and technique of various unit operations related to Industrial Chemistry. • Gain knowledge of various industrial operations & how can they be performed efficiently. • Understand difference between absorption and adsorption Processes.. • Understand the importance of proper mixing of various compounds. • Get knowledge about Drying and Evaporation operations in different Industries. • Understand various utilities that provide mechanical support to the industries. 	
6	Credit Value	Theory - 04	
7	Total Marks	Maximum Marks: University Exam (UE)- 75, CCE-25	Minimum Passing Marks: 33

Part B- Content of the course		
Total No. of Lectures-Tutorials-Practical (02 hours per week):		
L-T-P: 60-0-0 (Total Hours)		
Unit	Topic	No. of Lectures
1	Historical development of unit operations in Industries of India Distillation: Introduction, batch and continuous distillation, separation of azeotropes, plate columns and packed columns . Filtration: Introduction, Equipments, Plate and Frame Filter Press, Nutch Filter, Rotary Drum Filter, Sparkler Filter, Candle Filter, Bag Filter.	14



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	Keywords: Azeotropes, Plate Coulmn, Filter press, Sparkle Filter, Rotatory Drum Filter.	
2	<p>Evaporation: Introduction, equipments, short tube evaporator, forced circulation evaporators, falling film evaporators (agitated) film evaporators.</p> <p>Absorption: Introduction, equipments, packed columns, spray columns, bubble columns,.</p> <p>Adsorption: Mechanism, Types, and Applications of Adsorption Difference Between Absorption and Adsorption ,Factors affecting Adsorption</p> <p>Ke words: Evaporators, Spray and Bubble Column, Adsorption</p>	10
3	<p>Drying: Introduction, free moisture, bound moisture, drying curve, equipments - tray dryer, rotary dryer, flash dryer, fluid bed dryer, drum dryer, spray dryer.</p> <p>Mixing: Mixing of gases, solid-solid, liquid-solid and liquid - liquid systems</p> <p>Keywords: Free Moisture, Drum Drier, Rotary Dryer, Bound Moisture Mixing</p>	12
4	<p>Crystallization: Solubility, Super saturation definition, nucleation, crystallization. Equipment - tank crystallizer and circulating liquid evaporator crystallizer.</p> <p>Extraction: Extraction Equipments: spray column and packed column extraction, rotating disc column extractors and mixer-settler</p> <p>Keywords: Super Saturation, Nucleation, Tank Crystallizer ,Rotating Disc Column Extractor</p>	12
5	<p>Utilities in Industries: A brief idea about fans, blowers, compressors and pumps used in chemical industries.</p> <p>Boilers: Types of boilers and their functions</p> <p>Water: Specifications for Industrial use, various water treatment.</p> <p>Steam: Generation and use.</p> <p>Air: Specifications for Industrial use, processing of air</p> <p>Keywords: Boiler, Compressor, Blowers, Steam Generation, Air Specification.</p>	12

Part C -Learning resources

Text Books, Reference Books, Other Resources

Suggested Reading:

Books & Reference Books

1. Brown, G. G., "Unit Operations", CBS Publishers.
2. Gavhane, K.A., "Unit operations volume I", Nirali Prakashan, Pune.
3. Gavhane, K.A., "Unit operations volume II", Nirali Prakashan, Pune.
4. Jain, P.C., Jain, P., "Engineering Chemistry", Dhanpat Rai Publishing Company, New Delhi..
5. Coulson J.M., Richardson, J.F., "Unit Operations in Chemical Engineering", McGraw -Hill 1993.

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Department of Higher Education Madhyapradesh (4)

Unified Syllabus

Class - B.Sc. IIrd Year
Subject - Industrial Chemistry
Paper - First

Max. Marks : 42^{1/2}

Unit: - 1:- Cement: Types of cement, composition, manufacturing processes, setting of cement. **Ceramic:** Introduction, types, manufacturing processes, applications, refractory materials.
Polymeric materials: Introduction, Mechanism of polymerisation, plastic., Preparation, Properties and uses of polythene, PVC, Bakelite, Nylon 66, industrial applications.

Unit:-2:- Glass: Types, composition, manufacturing- physical and chemical properties, applications. **Corrosion:** Various types of corrosion relevant to chemical industry, mechanism, protection against corrosion.

Unit:-3:- Nitration: Introduction, nitrating agents, kinetics and mechanism of nitration processes such as nitration of :-

- 1:- Paraffinic hydrocarbon.
- 2:- Benzene to nitrobenzene and m-dinitrobenzene.
- 3:- Acetanilide.

Halogenation:- Introduction, kinetics of halogenation reactions, reagents for halogenation reactions, halogenation of aliphatic and aromatic hydrocarbons (Nuclear & side chain halogenation)

Halogenation of aliphatic hydrocarbons with special reference to energy profile diagram. Halogenations of aromatic hydrocarbons- types of reagents & their kinetics. Commercial manufacturing of dichlorobenzene.

Unit:-4 Sulphonation: Introduction .sulphonating agents sulphonation of aliphatic and aromatic hydrocarbons, Mechanism of sulphonation reaction, reversibility of sulphonation concept of reversibility of sulphonation.

Unit:-5 Industrial Pollution : Introduction to industrial pollution with reference to water and air-Statutory limits of air and water pollutants.

- Books :-**
- 1:- Unit process of organic synthesis vol. 1&2 P.H.Gs
 - 2:- Industrial chemistry: - B.K.Sharma.
 - 3:- Environmental chemistry: - B.K.Sharma.
 - 4:- Environmental chemistry: - A.K.Day
 - 5:- Unit operations vol.1&2:- :- K.A.Gauhane
 - 6:- Engineering Chemistry :- P.C. Jain & Monika Jain

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Department of Higher Education Madhyapradesh

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Unified Syllabus

Class - B.Sc. IIrd Year
Subject - Industrial Chemistry
Paper - Second

Max. Marks : 42^{1/2}

Unit - I **Concept of measurement and accuracy principle, construction and working of instruments for the measurement of following parameters.**

1. Temperature:- Glass thermometer, vapor filled spring thermometer, radiation pyrometer.
2. Pressure: - Manometer, Barometer, Pressure gauge, Pirani gauges, Diaphragm type.
3. Liquid Level:- Float type liquid level gauge.
4. Density.
5. Viscosity.

Unit - II **Oxidation**- Introduction-Types of oxidising agents, kinetics and mechanism of oxidation, vapour phase oxidation, commercial manufacturing of acetic acid, benzoic acid, maleic anhydride, phthalic anhydride, acrolein and acetaldehyde.

Reduction-Introduction, methods of reduction, commercial manufacturing of aniline, nitroaniline, p-amino phenol.

Unit-III **Hydrogenation**:-Introduction- kinetics and thermodynamics of hydrogenation, reaction catalysis of hydrogenation reaction, hydrogenation of vegetable oil, manufacturing of methanol from carbon monoxide and hydrogen.

Esterification:-Introduction, esterification by organic acids, commercial manufacturing of ethyl acetate, diacetyl phthalate, vinyl acetate and cellulose acetate.

Unit-IV **Solid waste management, industrial safety, removal of solid contaminants from waste water by coagulation, incineration, fuel palatization, soil conditioning and green house effect, ozone depliction, carbon credits,**

Unit-V: Principle and equipments of aerobic, anaerobic treatment such as adsorption, filtration, sedimentation, bag filters, electrostatic precipitators mist eliminators wet scrubbers.

- Books:** - 1:- Unit process of organic synthesis vol. 1&2 P.H.Gs
2:- Industrial chemistry: - B.K.Sharma.
3:- Environmental chemistry: - B.K.Sharma.
4:- Environmental chemistry: - A.K.Dây

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Department of Higher Education Madhyapradesh ⑦

Unified Syllabus

Class - B.Sc. IIIrd Year
Subject - Industrial Chemistry
Paper - First

Max. Marks : 42^{1/2}

Unit - I Factors involved in project cost estimation Methods employed for the estimation of capital investment. Capital formation, Elements of cost accounting., Interst and investment costs. Time value of money-equivalence. Depreciation, methods of determinig depreciation, Taxes, Some aspect of marketing.

Unit - II Pricing Policy : Profitability criteria, Economics of selecting alternatives. Variation of cost with capacity, Break even point, optimum batch sizes, production scheduling etc.

Unit - III Concept of scientific management in industry, Functions of mangement decision making and planning organizing, location of industry, directingand control inventory control, management of human resources selectionincentives. Concept of welfare and safety in industries.

Unit - IV Modern Instrumental methods of analysis. Chromatography, paper chromatography, TLC, GLC, HPLC. UV-visible spectroscopy, Beer lamberts law, IR Spectroscopy, roatetional vibrational and transitional spectra.

Unit - V Sampling procedures, sampling of bulk materials, Techniques of sampling solids liquids and gases, Collecting and processing of data. NMR-Spectroscopy, Atomic Adsorption, Flame Photometry. Neutron diffraction, X-ray fluorescence.

Books : 1- Instrumental Methods of Chemical analysis : B.K. Sharma

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Department of Higher Education Madhyapradesh

Unified Syllabus

Class - B.Sc. IIIrd. Year
Subject - Industrial Chemistry
Paper - Second

Theory : 42^{1/2}

UNIT- I **Physical and Chemical processes used for the recovery of important compounds** : - Adsorption, Evaporation, Distillation, Centrifugation, Coagulation, Osmosis, reverse osmosis and electro dialysis.

UNIT- II **Need for waste recycles** : - limitation of raw material resources, waste elimination, conversion of waste -into useful products. Domestic and agro waste, feasibility of recycle, separation of waste- solid, liquid and gases.

UNIT- III **Synthetic Fibers** : Introduction, important requirements of a fiber, difference between natural fibers and artificial or synthetic fibers, properties of synthetic fibers, method of spinning, application of synthetic fibers, rayon.

UNIT-IV **Characterization of waste management and recovery of important compound from the waste of the following industries.** Slaughter houses, rubber, sugar, heavy chemicals, fermentation, thermal power station, electroplating and paper.

UNIT-V **Recovery of compound from oil industries, dyestuff industries, fertilizers industries, textile industries. Soap and plant.**
Small Scale Units : Agarbatics, wax candelas, shoe polish, chalk crayons, plaster of paris and safety matches.

- Books:** - 1:- Unit process of organic synthesis vol. 1&2 P.H.Gs
2:- Industrial chemistry: - B.K.Sharma.
3:- Environmental chemistry: - B.K.Sharma.
4:- Environmental chemistry: - A.K.Day
5:- Unit operations vol.1&2:- : - K.A.Gauhane

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