SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

[M.Sc. Industrial Chemistry] Semester-II

Course Type	Course Code	Course Title	Teaching-Learning Scheme	Total Notional Hours	Course Credits
			L-P-T		
DSC	P2S02NCICH01	Pharmaceutical Chemistry-II	4-0-1	120	04

- **Course Learning Outcomes (CLOs)**

On completion of this course, students will be able to:

CLO1: Analyze different types of impurities present in pharmaceutical preparations and understand their effects on quality and safety.

CLO2: Apply the basic principles of pharmaceutical formulation design in the development of pharmaceutical dosage forms.

CLO3: Understand and interpret the role of pharmacopoeias in pharmaceutical formulation and quality control.

CLO4: Examine various novel drug delivery systems and understand their pharmaceutical applications, advantages, and limitations.

Unit	Course Content	Learning Pedagogies*	CLO(s)
I	**Impurities in Pharmaceutical Substances** History of Pharmacopoeia, Sources and types of impurities, Principles involved in limit tests for Chloride, Sulphate, Iron, Arsenic, Lead and Heavy metals, Modified Limit test for Chloride and Sulphate. General method of preparation: Assay, properties, and medicinal uses of inorganic pharmaceutical compounds, Sodium chloride, Calcium gluconate, Ammonium chloride, Sodium bicarbonate, Copper sulphate, Sodium thiosulphate, Ferrous sulphate. **Ancient methods for identification of impurities in medicine and purification for therapeutic uses.**	Classroom Learning (CL), ICT-enabled Learning (ICT), Problem-Based Learning (PBL)	CLO1, CLO3
II	**Pharmaceutical Formulation** General terminology, Factors influencing pharmaceutical formulation, Crystallinity, Particle Size, dissolution, stability. Excipients, Types of excipients, Drug–excipient compatibility, Dissolution study of drug: Objective, equipment and significance. Stability studies of drugs: Concept and Objective, shelf life and half-life of pharmaceutical formulation, Applications of stability testing. **Natural binders and their types used in Ayurvedic formulary in India.**	Classroom Learning (CL), ICT-enabled Learning (ICT), Problem-Based Learning (PBL)	CLO2, CLO3
III	**Pharmaceutical Dosage form** Introduction to pharmacopoeias: IP, BP, USP, and Extra Pharmacopoeia. Introduction to dosage form, need for dosage forms, classification of different dosage forms, classification of different dosage form, Routes of drug administration. Definition, Classification, Advantages, Disadvantages of solid dosage forms, Liquid dosage form, Suspension, Emulsion Semi-solid dosage forms, ointments, creams, and gels. **Various type of dosage forms in Ancient Indian medicine.**	Classroom Learning (CL), ICT-enabled Learning (ICT), Problem-Based Learning (PBL)	CLO2, CLO4

IV	**Novel Drug Delivery Systems** Introduction, types of drug delivery systems, Polymers used in drug formulations. Definition, advantages, disadvantages of following drug delivery system: Controlled drug delivery systems, Microencapsulation, Mucosal, Transdermal, Targeted drug delivery, Sustained-release drug delivery systems. **Traditional methods and modern techniques of herbal drug delivery system.**	Classroom Learning (CL), ICT-enabled Learning (ICT), Problem-Based Learning (PBL)	CLO1, CLO4

- **Assessment Methodologies**

(A) Internal Assessment

a. Internal Formative assessment

(a) Assignments/Continuous Assessment (10%)
(b) Quizzes (10%)
(c) Attendance (5%)

b. Internal Summative Assessment

(a) Mid-term tests (25%)

(B) Weightage of Learning Efforts for External Assessment

Unit	Aligned COs	Total Learning Hours	Approximate Weightage (Marks) According to Learning Levels (BT)			Total Marks
			Remember (R)	Understanding (U)	Application/ Analysis and Above (A)	
I	CLO1	30	1	2	10	13
II	CLO2	32	1	1	10	12
III	CLO3	28	1	2	10	13
IV	CLO4	30	1	1	10	12
		120	**04**	**06**	**40**	**50**

- **Assessment and Evaluation**

Sr. No.	Assessment/Evaluation	Component	Weightage
1.	Continuous Internal Examination	Written Exam 25 %, Assignment / Continuous Assessment 10 %, Quizzes 10 % Attendance 5 %	50 %
2.	University Examination	Written Examination	50 %

(C) CLOs – PLOs Matrix

CLO	PLO						
	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**
CLO1	**3**	**2**	**2**	**2**	**3**	**-**	**1**
CLO2	**3**	**3**	**2**	**1**	**2**	**2**	**3**
CLO3	**3**	**2**	**2**	**3**	**3**	**1**	**1**
CLO4	**3**	**2**	**1**	**1**	**2**	**2**	**3**

Values to **CLO-PLO** matrix are assigned by judging the importance of the particular **CLO** in relation to the **PLOs**.

CLO – PLO correlation	Value
Strong	3
Moderate	2
Low	1
No correlation	-

- **Suggested Learning Materials Books:**

Sr. No.	Title	Author(s)	Edition/Year	Publisher
1	Synthetic Drugs	Gurdeep R. Chatwal and M. Arora,	2nd Edition,	Himalaya Publishing House.
2	Good Manufacturing Practices for Pharmaceuticals: A Plan for Total Quality Control	Sidney H. Willig, Murray M. Tuckerman & William S. Hitchings IV,	Volume 16,	Marcel Dekker.
3	Pharmaceutical Preformulation and Formulation: A Practical Guide from Candidate Drug Selection to Commercial Dosage Form	Mark Gibson	2nd Edition,	CRC Press/ Informa Healthcare.
4	Pharmaceutical Manufacturing Handbook	Shayne Cox Gad,	2008	John Wiley & Sons.
5	Controlled Drug Delivery Systems	Robinson and Vincent H. L. Lee,	Second Edition,	Marcel Dekker
6	Modern Pharmaceutics	Gilbert S. Banker and Christopher T. Rhodes,	4th Edition,	Marcel Dekker
7.	Advances in Novel and Controlled Drug Delivery	N. K. Jain	2017,	CBS Publishers & Distributors.
8.	Hand book of Pharmaceutical Manufacturing: Production and Processes	Shayne Cox Gad	2007	Willey.

- **Online Resources (Open Source)**

Sr. No.	Description of Resource(s)	Weblink
1	e-PG pathshala Pharmaceutical Science	https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=WR+tSjp4YS3g7BIFEffOcw==
2	Indian Pharmacopeia Commission	https://www.ipc.gov.in/e-resources.html
3	Pharmaceutical Formulation	https://www.ebooks.com/en-vn/book/211250816/pharmaceutical-formulation/geoffrey-d-tovey/
4	Pharmaceutical Manufacturing	https://gmpua.com/Process/RegulationsAndQuality.pdf
5	Novel Drug Delivery Systems	https://www.scribd.com/document/688340045/Novel-Drug-Delivery-Systems-Nirali-Prakashan

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NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

[M.Sc. Industrial Chemistry] Semester-II

Course Type	Course Code	Course Title	Teaching-Learning Scheme	Total Notional Hours	Course Credits
			L-P-T		
DSC	P2S02NCICH02	Polymer Chemistry	4-0-1	120	04

Course Learning Outcomes (CLOs)

At the end of the course, students will be able to:

CLO1: Describe step-growth and chain-growth polymerization with respect to synthesis, mechanisms, and kinetics.

CLO2: Explain crystalline melting temperature and glass transition temperature, including the influence of kinetics.

CLO3: Analyse the flow properties of polymer melts and polymer solutions with respect to temperature and molecular weight.

CLO4: Evaluate the enthalpic and entropic contributions to polymer crystallization and the effects of polymer structure, molecular weight, branching, and dilution on crystallinity.

Unit	Course Content	Learning Pedagogies*	CLO(s)
I	Introduction, Classification of polymers, Free radical polymerization, Ionic polymerization, **TYPES OF POLYMERS AND POLYMERIZATION:** Thermoplastics and thermosetting polymers, functionality concept, Concept of cross-linking: linear, branched, and cross-linked polymers, Branched and cross-linked polymers. Addition, Condensation, Ionic, Co-ordination, Addition polymerization mechanism, (Initiation, propagation and termination processes), Initiators, Inhibitors, Mechanism of ionic polymerization. **METHODS OF POLYMERIZATION:** Bulk, Suspension, Emulsion, Solution. Necessity of copolymers and copolymerization, Block and graft copolymers. **Chemistry in Rasarnava and the Tantric Period.**	Classroom Learning (CL), ICT-enabled Learning (ICT), Problem-Based Learning (PBL)	CLO1, CLO3
II	Molecular weight and molecular weight distribution: number-average, weight-average, and viscosity-average molecular weights of polymers, Molecular weight and molecular weight distribution-Number, Weight and Viscosity average molecular weight of polymers, Methods for determining molecular weight. **PROPERTIES OF POLYMERS:** Viscosity, Solubility, Optical, Electrical, Thermal and mechanical properties of polymers. **POLYMER PROCESSING:** Compression moulding, casting, Extrusion, Fibre spinning, Injection moulding, Thermoforming, Vulcanization of elastomers. **Works in the Iatrochemical Period.**	Classroom Learning (CL), ICT-enabled Learning (ICT), Problem-Based Learning (PBL)	CLO2, CLO3

III	Introduction, Concepts of polymerization kinetics and related relationships, Glassy state, Glass transition temperature, Thermogravimetric analysis (TGA), Factors affecting glass transition temperature (Tg), Crystallinity in polymers. Degradation of polymers by thermal, oxidative, mechanical and chemical methods. Detailed study of the following elastomers and thermosetting polymers with respect to synthesis, chemistry, properties and applications: (i) Elastomers- Polybutylene, Polyisobutylene, Polyisoprenes, Polybutadienes, Polychloroprene and Polysulfides. (ii) Phenol-Formaldehyde resins. (iii) Amino resins: Urea-formaldehyde and melamine-formaldehyde reaction, polyurethanes. (iv) Epoxy resins: Grades of epoxy resins, curing process and its importance with mechanism. Organometallic polymers of Silicon, Tin and Titanium. **Composition and Properties of Gems.**	Classroom Learning (CL), ICT-enabled Learning (ICT), Problem-Based Learning (PBL)	CLO2, CLO4
IV	Detailed study of the following thermoplastic polymers with respect to synthesis, chemistry, properties and applications: (i) Poly olefins : Polyethylenes, Polypropylene, Ethylene-Propylene copolymers. (ii) Polystyrene, Polyacrylonitrile, Polymethylmethacrylate and Polyesters. (iii) Poly formaldehyde, Polyparaphenylene, Polycarbonates and Poly sulfones. (iv) Polyimides, Polyamides, Polyurethanes and Polyureas. (v) Polyethylene and propylene glycols, Polyacrylic acid and Polymethacrylic acid. (vi) Polyvinyl acetate, Polyvinyl alcohol, Polyvinyl acetals and Polyvinyl carbonate. (vii) Polyvinyl Chlorides, Polyvinyl fluoride, Polyvinylidenefluoride, Polytetrafluoroethylene and Polyvinylcarbazole and analogous polymers. (viii) Cellulosic such as esters, ethers, acetates, butyrates, nitrates, CMC regenerated celluloses.	Classroom Learning (CL), ICT-enabled Learning (ICT), Problem-Based Learning (PBL)	CLO1, CLO4

- **Assessment Methodologies**

(D) Internal Assessment

a. Internal Formative assessment

(d) Assignment/Continuous Assessment (10%)
(e) Quizzes (10 %), Attendance (5 %)

b. Internal Summative Assessment

(b) Mid -term tests (25 %)

(E) Weightage of Learning Efforts for External Assessment

Unit	Aligned COs	Total Learning Hours	Approximate Weightage (Marks) According to Learning Levels (BT)			Total Marks
			Remember (R)	Understanding (U)	Application/ Analysis and Above (A)	
I	CLO1	30	1	2	10	13
II	CLO2	32	1	1	10	12
III	CLO3	28	1	2	10	13
IV	CLO4	30	1	1	10	12
		120	**04**	**06**	**40**	**50**

- **Assessment and Evaluation**

Sr. No.	Assessment/Evaluation	Component	Weightage
1.	Continuous Internal Examination	Written Exam, 25 % Assignment / Continuous Assessment 10 %, Quizzes 10 %, Attendance 5 %	50 %
2.	University Examination	Written Exam	50 %

(F) CLOs – PLOs Matrix

CLO	PLO						
	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**
CLO1	**3**	**3**	**1**	**-**	**1**	**2**	**1**
CLO2	**3**	**2**	**1**	**-**	**1**	**1**	**-**
CLO3	**2**	**3**	**1**	**1**	**2**	**2**	**1**
CLO4	**3**	**3**	**1**	**-**	**1**	**2**	**2**

Values to **CLO-PLO** matrix are assigned by judging the importance of the particular **CLO** in relation to the **PLOs**.

CLO – PLO correlation	Value
Strong	3
Moderate	2
Low	1
No correlation	-

- **Suggested Learning Materials Books:**

Sr. No.	Title	Author(s)	Edition/Year	Publisher
1	Polymer Science	V. R. Gowariker, N. V. Viswanathan and Jayadev Sreedhar	Reprint 2005,	CRC Press, Taylor & Francis Group.
2	Introduction to Polymers	R. J. Young and P. A. Lovell	3rd Edition,	CRC Press, Taylor and Francis Group
3	Principles of Polymer Science	P. Bahadur and N. V. Sastry	2nd Edition	Narosa Publishing House, New Delhi.
4	Principles of Polymer Systems	F. Rodriguez,	2nd Edition	Hemisphere Publishing Corporation, Washington, DC.
5	Textbook of Polymer Science	F. W. Billmeyer Jr.	3rd Edition (1984)	Wiley – Inter science, New York.
6	Polymer Chemistry : An Introduction	Malcom P. Stevens,	1990	Oxford University Press.

- **Online Resources (Open Source)**

Sr. No.	Description of Resource(s)	Weblink
1	e-PG pathshala	https://epgp.inflibnet.ac.in/
2	Principles of Polymerization	https://unpa.edu.mx/~aramirez/Principles%20of%20polymerization.pdf
3	Introduction to Polymer Science and technology	https://womengovtcollegevisakha.ac.in/departments/introduction-to-polymer-science-and-technology.pdf
4	Polymer Chemistry	https://earthwormexpress.com/wp-content/uploads/2020/07/seymour-carrahers-polymer-chemistry.pdf

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NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

[M.Sc. Industrial Chemistry] Semester-II

Course Type	Course Code	Course Title	Teaching-Learning Scheme	Total Notional Hours	Course Credits
			L-P-T		
DSC	P2S02NCICH03	Industrial Safety Management-II	4-0-1	120	04

- **Course Learning Outcomes (CLOs)**

On completion of this course, students will be able to:

CLO1: Analyze industrial incidents and recommend corrective safety measures.

CLO2: Explain Good manufacturing practices/Good laboratory practices and safety management systems used in industries.

CLO3: Apply ergonomic principles for improving workplace safety, efficiency, and worker comfort in industrial environments.

CLO4: Demonstrate knowledge of emergency response procedures and prevention for industrial accidents.

Unit	Course Content	Learning Pedagogies*	CLO(s)
I	**Hazard and Risk Identification, Assessment and Control Techniques** Safety Appraisal, Analysis and Control Techniques: Safety Inventory System, Standard Operating Procedures (SOPs), Safety Codes and Standards, Plant Safety Inspection: Safety Checklists, Safety Survey, Good Manufacturing Practice (GMP), Accident Investigation, Analysis and Reporting, Process and Types of Investigation, Hazard and Operability (HAZOP) Study, Hazards, Risks and Detection Techniques, Major Accident Hazard (MAH) Control, Need and Types of Emergency Plans. **Alchemy of Danger: Identifying Industrial and Chemical Risks in Ancient India.**	Classroom Learning (CL), ICT-enabled Learning (ICT), Problem-Based Learning (PBL)	CLO1, CLO2
II	**Industrial Hygiene and Occupational Health** Industrial Hygiene: Difference between Industrial Hygiene & Occupational Health, Occupational Health Hazards, Routes of Entry & Toxic Effects, Air Sampling, Types of Monitoring, Occupations Involving Risks of Occupational Diseases and Their Diagnostic Methods. Evaluation of injuries, Occupational Health Services & Medical Examinations. **Indian Perspectives of Industrial Hygiene and Health**	Classroom Learning (CL), ICT-enabled Learning (ICT), Problem-Based Learning (PBL)	CLO1, CLO2

III	**Physiology of Work and Ergonomics** Physiology of Respiration, Assessment of Workload based on Physiological Reaction Physiological Safe Limit for Continuous work, Assessment of Work Capacity, Introduction to Ergonomics & it Constituents, Application of Ergonomics for Safety, Hand Tools and Their use, Workstation Design, Worked Examples	Classroom Learning (CL), ICT-enabled Learning (ICT), Problem-Based Learning (PBL)	CLO3
IV	**Theory and Prevention of Accidents** Definition, Basics of accidents, Theory of accidents, Structure, Type of Personal accidents- Near miss, Minor injury, Serious injury, Fatal accident, Analysis of industrial accidents Case Study- Bhopal gas Disaster, Flixborough Disaster in England.	Classroom Learning (CL), ICT-enabled Learning (ICT), Problem-Based Learning (PBL)	CLO4

- **Assessment Methodologies**

(G) Internal Assessment

a. Internal Formative assessment

(f) Assignment/Continuous Assessment (10%)
(g) Quizzes (10%) and Attendance (5%)

b. Internal Summative Assessment

(c) Mid -term tests

(H) Weightage of Learning Efforts for External Assessment

Unit	Aligned COs	Total Learning Hours	Approximate Weightage (Marks) According to Learning Levels (BT)			Total Marks
			Remember (R)	Understanding (U)	Application/ Analysis and Above (A)	
I	CLO1	30	1	2	10	13
II	CLO2	32	1	1	10	12
III	CLO3	28	1	2	10	13
IV	CLO4	30	1	1	10	12
		120	**04**	**06**	**40**	**50**

- **Assessment and Evaluation**

Sr. No.	Assessment/Evaluation	Component	Weightage
1.	Continuous Internal Examination	Written Exam 25 %, Assignment/Continuous Assessment 10%, Quizzes 10%, Attendance 5%	50 %
2.	University Examination	Written Examination	50 %

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[M.Sc. Industrial Chemistry] Semester-II

(I) CLOs – PLOs Matrix

CLO	PLO						
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7
CLO1	2	3	3	2	2	1	1
CLO2	2	2	2	3	2	1	1
CLO3	2	3	3	2	1	2	2
CLO4	2	3	3	2	1	1	1

Values to **CLO-PLO** matrix are assigned by judging the importance of the particular **CLO** in relation to the **PLOs**.

CLO – PLO correlation	Value
Strong	3
Moderate	2
Low	1
No correlation	-

- **Suggested Learning Materials Books:**

Sr.No.	Title	Author(s)	Edition/Year	Publisher
1	Industrial Safety and Health Management	C. Ray Asfahl and David W. Rieske,	6th Edition,	Pearson Education.
2	Fundamentals of Industrial Safety and Health	Dr. K. U. Mistry	2008	Siddharth Prakashan.
3	Fundamental Principal of Occupational Health and Safety	Benjam O. Alli	2nd Edition,	International Labour Organization (ILO), Geneva.
4	Safety and Hazard Management in Chemical Industries	M. N. Vyas	2013	Atlantic Publishers & Distributors (P) Ltd.
5	Prevention of Accidents and Unwanted Occurrences	Urban Kjellen and Eirik Albrechtsen	2nd Edition (2017)	Taylor and Francis

- **Online Resources (Open Source)**

Sr.No.	Description of Resource(s)	Weblink
1	Risk Assessment	https://download.e-bookshelf.de/download/0000/8064/73/L-G-0000806473-0002312176.pdf
2	Industrial Safety and Health Management	https://nibmehub.com/opac-service/pdf/read/Industrial%20Safety%20and%20Health%20Management.pdf
3	Industrial Hygiene and Occupational Health	https://qcfibhilai.in/S_material/Industrial%20Hygiene%20Ocupational%20Health%20-Module%205.pdf
4	Safety Analysisfor Accident Prevention	https://www.irisk.se/sabook/SA-book1.pdf
5	Work Study and Ergonomics	https://assets.cambridge.org/97811075/03366/frontmatter/9781107503366_frontmatter.pdf

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[M.Sc. Industrial Chemistry] Semester-II

Course Type	Course Code	Course Title	Teaching-Learning Scheme	Total Notional Hours	Course Credits
			L-P-T		
DSC	P2S02NCICH04	Industrial Chemistry Practical-I	0-8-0	120	04

- **Course Learning Outcomes (CLOs)**

On completion of this course, students will be able to:

CLO1: Apply the principles of qualitative and quantitative analysis in pharmaceutical substances.

CLO2: Prepare various industrial and polymeric products using suitable raw materials and methodologies.

CLO3: Follow laboratory safety protocols and maintain accuracy in measurements and observations.

CLO4: Develop teamwork and communication skills through group experiments and scientific discussions.

Sr No	Course Content	Learning Pedagogies*	CLO(s)
Part-I	**Limit Tests in Pharmaceuticals and Quantitative Analysis** - Limit test for chloride (Cl^-). - Limit test for sulphate (SO_4^{2-}). - Determination of paracetamol content in pharmaceutical formulations. - Determination of glucose/dextrose by iodimetry. - Determination of the acid value of oil.	Experimental Learning (EL), Reflective Learning	CLO1, CLO3, CLO4,
Part-II	**Preparations and Polymer Analysis** - Preparation of urea-formaldehyde resin. - Preparation of melamine-formaldehyde resin. - Preparation of Glyptal resin. - Determination of acid value of polymer samples. - Determination of molecular weight of polymer by viscometry.	Experimental Learning (EL), Reflective Learning	CLO1, CLO2, CLO3, CLO4,

- **Assessment Methodologies**

(J) Internal Assessment

a. Internal Formative assessment

(a) Laboratory Journal/Record & Method of Working (15%)
(b) Attendance and Laboratory Discipline (10%)

b. Internal Summative Assessment

(d) Practical Examination and Viva Voce Examinations (25%)

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[M.Sc. Industrial Chemistry] Semester-II

(K) Weightage of Learning Efforts for External Assessment

Unit	Aligned Cos	Total Learning Hours	Approximate Weightage (Marks) According to Learning Levels (BT)			Total Marks
			Remember (R)	Understanding (U)	Application/ Analysis and Above (A)	
I	CLO1, CLO3, CLO4	60	5	5	15	25
II	CLO1, CLO2 CLO3, CLO4	60	5	5	15	25
		120	**10**	**10**	**30**	**50**

(c) Assessment and Evaluation

Sr. No.	Assessment/Evaluation	Component	Weightage
1.	Continuous Internal Examination	Internal Examination (Internal Practical Examination 20%; Viva-Voce 5%, Lab Journal/Record and Method of Working 15%, Attendance and Laboratory Discipline 10%)	50 %
2.	University Examination	Practical Examination and Viva Voce Examination	50 %

(L) CLOs – PLOs Matrix

CLO	PLO						
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7
CLO1	**2**	**3**	**1**	**-**	**3**	**1**	**1**
CLO2	**2**	**3**	**1**	**-**	**2**	**2**	**2**
CLO3	**1**	**3**	**2**	**3**	**1**	**1**	**1**
CLO4	**1**	**2**	**1**	**3**	**1**	**1**	**1**

Values to **CLO-PLO** matrix are assigned by judging the importance of the particular **CLO** in relation to the **PLOs**.

CLO – PLO correlation	Value
Strong	3
Moderate	2
Low	1
No correlation	-

(d) Suggested Learning Materials Books:

Sr. No.	Title	Author(s)	Edition/Year	Publisher
1	The Elements of Polymer Science and Engineering	Alfred Rudin and Phillip Choi,	3rd Edition (2012)	Academic Press/ Elsevier.
2	Polymer Science	V. R. Gowariker, N. V. Viswanathan and Jayadev Sreedhar,	Reprint (2005)	New Age International Publishers.
3	Water Analysis: A Practical Treatise on the Examination of Potable Water	James Alfred Wanklyn and Ernest Theophron Chapman.	2010 Edition	Nabu Press.
4	Water Quality : An Introduction	Claude E. Boyd	2nd Edition (2015)	Springer.
5	Comprehensive Practical Organic Chemistry: Preparations and Quantitative Analysis	V. K. Ahluwalia and Renu Aggarwal	2004	Universities Press (Orient Blackswan)
6	Vogel's Textbook of Practical Organic Chemistry	A. I. Vogel, B. S. Furniss, A. J. Hannaford, P. W. G. Smith, and A. R. Tatchell,	5th Edition (1989/1996),	Pearson Education/Prentice Hall.

(e) Online Resources (Open Source)

Sr. No.	Description of Resource(s)	Web link
1	Comprehensive Practical Organic Chemistry: Preparations and Quantitative Analysis	https://books.google.co.in/books?id=906Ye4nM9A4C&printsec=copyright#v=onepage&q&f=false
2	Pharmaceuticals Chemical Analysis	https://books.google.co.in/books?id=CTriuh4qjiAC&printsec=frontcover#v=onepage&q&f=false
3	Limit Test in Pharmaceuticals Analysis	https://www.bspublications.net/downloads/059cc8f84560f2_Ch-1_Subba%20Rao_Practical%20Pharmaceutical%20In-organic%20Chemistry.pdf
4	Hand Book of Polymer Synthesis, Characterization, and Processing	https://download.e-bookshelf.de/download/0000/8147/06/L-G-0000814706-0002366960.pdf

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NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

[M.Sc. Industrial Chemistry] Semester-II

Course Type	Course Code	Course Title	Teaching-Learning Scheme	Total Notional Hours	Course Credits
			L-P-T		
DSC	P2S02NCICH05	Industrial Chemistry Practical-II	0-8-0	120	04

- **Course Learning Outcomes (CLOs)**

On completion of this course, students will be able to:

CLO1: Apply synthetic techniques for the preparation of industrially important organic compounds.

CLO2: Analyze the reaction mechanisms, properties, and applications of prepared dyes and organic compounds.

CLO3: Prepare and maintain laboratory documentation and related industrial records systematically.

CLO4: Demonstrate the preparation and interpretation of Material Safety Data Sheets (MSDS) and evaluate safety parameters such as cloud point, pour point, smoke point, flash point, and fire point of industrial materials.

Sr No	Course Content	Learning Pedagogies*	CLO(s)
Part-1	Preparation of the following compounds: - p-Nitroaniline from p-Nitroacetanilide. - Methyl Orange from Sulphanilic Acid. - p-Iodonitrobenzene from p-Nitroaniline. - p-Nitroacetanilide from Acetanilide. - Benzoic Acid from Benzaldehyde. - p-Nitroso-N,N-dimethylaniline from N,N-dimethylaniline. - Dibenzalacetone from benzaldehyde.	Experimental Learning (EL), Reflective Learning	CLO1, CLO2
Part-II	- To prepare Material Safety Data Sheet (MSDS) for Hazardous material used in industries (solid/liquid/gas). - Determination of the cloud and pour point of a given sample. - Determination of smoke point of a given sample. - To use the Cleveland Open Cup apparatus for the determination of the flash point and fire point of flammable substances.	Experimental Learning (EL), Reflective Learning	CLO3, CLO4

- **Assessment Methodologies**

(M) Internal Assessment

a. Internal Formative assessment

(a) Laboratory Journal/Record & Method of Working (15%)
(b) Attendance and Laboratory Discipline (10%)

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[M.Sc. Industrial Chemistry] Semester-II

b. Internal Summative Assessment

(e) Practical Examination and Viva Voce Examinations (25%)

(N) Weightage of Learning Efforts for External Assessment

Unit	Aligned COs	Total Learning Hours	Approximate Weightage (Marks) According to Learning Levels (BT)			Total Marks
			Remember (R)	Understanding (U)	Application/ Analysis and Above (A)	
I	CLO1, CLO2	60	5	5	15	25
II	CLO3, CLO4	60	5	5	15	25
		120	**10**	**10**	**30**	**50**

- **Assessment and Evaluation**

Sr. No.	Assessment/Evaluation	Component	Weightage
1.	Continuous Internal Examination	Internal Examination (Internal Practical Examination 20%, Viva-Voce 05%), Lab Journal/Record & Method of Working 15% and Attendance & Laboratory Discipline 10%	50 %
2.	University Examination	Practical Exam/Viva-Voce Exam	50 %

(O) CLOs – PLOs Matrix

CLO	PLO						
	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7
CLO1	**2**	**3**	**1**	**-**	**2**	**1**	**1**
CLO2	**2**	**3**	**1**	**-**	**2**	**2**	**2**
CLO3	**2**	**2**	**1**	**1**	**1**	**1**	**1**
CLO4	**2**	**3**	**1**	**-**	**2**	**2**	**1**

Values to **CLO-PLO** matrix are assigned by judging the importance of the particular **CLO** in relation to the **PLOs**.

CLO – PLO correlation	Value
Strong	3
Moderate	2
Low	1
No correlation	-

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NAAC 'A' Grade (10-01-2023 To 09-01-2028)

NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

[M.Sc. Industrial Chemistry] Semester-II

- **Suggested Learning Materials Books:**

Sr. No.	Title	Author(s)	Edition/Year	Publisher
1	The Elements of Polymer Science and Engineering	Alfred Rudin.	2nd Edition (1999)	Elsevier Science.
2	Polymer Science	V. R. Gowariker, N. V. Viswanathan and Jayadev Sreedhar	Reprint (2005)	New Age International Publishers.
3	Water Analysis: A Practical Treatise on the Examination of Potable Water	James Alfred Wanklyn and Ernest Theophron Chapman	Reprint Edition (2010)	Nabu Press.
4	Water Quality : An Introduction	Claude E. Boyd	2nd Edition (2015)	Springer.
5	Comprehensive Practical Organic Chemistry: Preparations and Quantitative Analysis	V. K. Ahluwalia and Renu Aggarwal	2004	Universities Press (Orient Blackswan).
6	Vogel's Textbook of Practical Organic Chemistry	A. I. Vogel, B. S. Furniss, A. J. Hannaford, P. W. G. Smith, and A. R. Tatchell,	5th Edition (1989/1996),	Pearson Education/Prentice Hall.

- **Online Resources (Open Source)**

Sr. No.	Description of Resource(s)	Weblink
1	Virtual Textbook of Organic Chemistry	https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/intro1.htm
2	Handbook on Synthetic Organic Chemistry	https://ndl.ethernet.edu.et/bitstream/123456789/7571/1/Michael%20C.%20Pirrung_2016.pdf
3	Flash Point determination	https://egyankosh.ac.in/bitstream/123456789/28480/1/Unit-6.pdf
4	Manual on Flash Point Standard	https://ndl.ethernet.edu.et/bitstream/123456789/27252/1/472.pdf

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[M.Sc. Industrial Chemistry] Semester-II

Course Type	Course Code	Course Title	Teaching-Learning Scheme L-P-T	Total Notional Hours	Course Credits
DSE	P2S02NEICH01	Selected Topics in Organic Chemistry- II	2-0-1	60	02

- **Course Learning Outcomes (CLOs)**

On completion of this course, students will be able to:

CLO1: Understand the **important name reactions in organic chemistry and their mechanisms.**

CLO2: Summarize the utility of different name reactions and methods used for the preparation of organic compounds.

CLO3: Understand basic concepts of stereochemistry and explain the three-dimensional structure of compounds.

CLO4 : Apply the concepts of stereochemistry and stereoisomerism to interpret the effect of conformation on the reactivity of organic molecules

Unit	Course Content	Learning Pedagogies*	CLO(s)
I	**Selected Name Reactions** Strok Enamine Reaction, Michael Addition, Mannich Reaction, Sharpless Asymmetric Epoxidation, Barton Reaction, Claisen Condensation, Pechmann Condensation, Perkin Reaction, Bamford-Stevens Reaction. Sodium borohydride ($NaBH_4$), Lithium aluminum hydride (LiAlH□), Meerwein-Ponndrof-Verley reduction (MPV), Hydroboration **(BH_3).** **From atom to Arks: the evolution of isolation chemistry of heterocycles in India.**	Classroom Learning (CL), ICT-enabled Learning (ICT), Problem-Based Learning (PBL)	CLO1, CLO2
II	**Stereochemistry** Introduction to basic concepts of Stereochemistry: Isomers, constitutional isomers, Stereo-isomers, Thero and Erythro, Chirality, Sterocenters, Specific rotation and example, Optical isomerism, Geometrical isomerism, conventions for configuration - D/L and R/S systems, E- and Z- Nomenclature, Resolution of racemic modification, Chirogenic center and nomenclature, Fisher projection: rules and limitation, Axial chirality (Allenes and Biphenyls), Planar Chirality, Helical chirality, Chirality involving atoms other than carbon atom. **Concept of Chirality in Ayurvedic Medicine.**	Classroom Learning (CL), ICT-enabled learning (ICT), Problem-Based Learning (PBL)	CLO3, CLO4

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- **Assessment Methodologies**

(P) Internal Assessment

a. Internal Formative assessment

(h) Assignment/Continuous Assessment (10%)

(i) Quizzes (10 %) and Attendance (5 %)

b. Internal Summative Assessment

(f) Mid-term tests (25%)

(Q) Weightage of Learning Efforts for External Assessment

Unit	Aligned Cos	Total Learning Hours	Approximate Weightage (Marks) According to Learning Levels (BT)			Total Marks
			Remember (R)	Understanding (U)	Application/ Analysis & Above (A)	
I	CLO1, CLO2	30	2	3	8	13
II	CLO3, CLO4	30	2	2	8	12
		60	**4**	**5**	**16**	**25**

- **Assessment and Evaluation**

Sr. No.	Assessment/Evaluation	Component	Weightage
1.	Continuous Internal Examination	Written Exam 25 %, Assignment / Continuous Assessment 10 %, Quizzes 10 %, Attendance 5 %	50 %
2.	University Examination	Written Exam	50 %

(R) CLOs – PLOs Matrix

CLO	PLO						
	PLO1	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**
CLO1	**3**	**2**	**-**	**-**	**1**	**-**	**-**
CLO2	**3**	**2**	**1**	**-**	**1**	**-**	**1**
CLO3	**3**	**1**	**-**	**-**	**2**	**-**	**-**
CLO4	**3**	**2**	**1**	**2**	**2**	**1**	**1**

Values to **CLO-PLO** matrix are assigned by judging the importance of the particular **CLO** in relation to the **PLOs**.

CLO – PLO correlation	Value
Strong	3
Moderate	2
Low	1
No correlation	-

- **Suggested Learning Materials Books:**

Sr. No.	Title	Author(s)	Edition/Year	Publisher
1	Organic Reaction Mechanism	V. K. Ahluwalia and Rakesh Kumar Parashar	4th Edition	Narosa Publishing House.
2	Organic Reactions and Their Mechanisms	P. S. Kalsi,	5th Edition	New Age International Publishers.
3	Stereochemistry of Organic Compounds: Principles and Applications	D. Nasipuri	3rd Edition	New Age International Publishers.
4	Stereochemistry: Conformation and Mechanism	P. S. Kalsi	8th Edition	New Age International Publishers.
5	Organic Chemistry	R. T. Morrision, R. N. Boyd and S. K. Bhattacharya	7th Edition	Pearson Education.

- **Online Resources (Open Source)**

Sr. No.	Description of Resource(s)	Weblink
1	Stereochemistry	https://download.e-bookshelf.de/download/0000/5697/96/L-G-0000569796-0002357431.pdf
2	Advance organic chemistry NPTEL lecture	https://swayam.gov.in/NPTEL
3	Name Reactions and Reagents in Organic Synthesis	https://download.e-bookshelf.de/download/0000/5849/11/L-G-0000584911-0002361047.pdf