

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
CHHATRAPATI SAMBHAJINAGAR.



CIRCULAR NO.SU/PG/College./NEP/19/2024

It is hereby inform to all concerned that, the syllabi prepared by the Board of Studies/ Ad-hoc Boards & recommended by the Dean, Faculty of Science & Technology, **Academic Council at its meeting held on 08 April 2024 has accepted** the following Syllabi under the Faculty of Science & Technology **as per Norms of National Education Policy -2020** run at the Affiliated Colleges, Dr.Babasaheb Ambedkar Marathwada University as appended herewith.

Sr.No.	Courses	Semester
1.	M.Sc.Microbiology	IIIrd & IVth semester
2.	M.Sc.Botany	IIIrd & IVth semester
3.	M.Sc.Environmental Science	IIIrd & IVth semester
4.	M.Sc.Industrial Chemistry	IIIrd & IVth semester
5.	M.Sc.Biochemistry	IIIrd & IVth semester
6.	M.Sc. Chemistry Specialization Analytical Chemistry, Organic Chemistry, Inorganic Chemistry, Physical Chemistry, Polymer Chemistry, Drug Chemistry.	IIIrd & IVth semester
7.	MCA(Science)	IIIrd & IVth semester
8.	M.Sc. Forensic Science	Ist to IVth semester
9.	M.Sc.Forensic Cyber	Ist to IVth semester

This is effective from the Academic Year 2024-25 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Chhatrapati Sambhajanagar.
431 004.

REF.NO.SU/2024/ 2446-54
Date:- 21.06.2024


Deputy Registrar,
Academic Section

Copy forwarded with compliments to :-

- 1] **The Principal of all concerned Colleges,**
Dr. Babasaheb Ambedkar Marathwada University,
- 2] **The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.**

Copy to :-

- 1] **The Director, Board of Examinations & Evaluation,** Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajanagar.
- 2] The Section Officer,[M.Sc.Unit] Examination Branch, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajanagar.
- 3] The Programmer [Computer Unit-1] Examinations, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajanagar.
- 4] The Programmer [Computer Unit-2] Examinations, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajanagar.
- 5] The In-charge,[E-Suvidha Kendra], Rajarshi Shahu Maharaj Pariksha Bhavan, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajanagar
- 6] The Public Relation Officer, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajanagar.
- 7] The Record Keeper, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajanagar.

**DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
CHHATRAPATI SAMBHAJI NAGAR**



NAAC Reaccredited with 'A' Grade

FACULTY OF SCIENCE & TECHNOLOGY

**Two Years P.G. Programme
Subject: Industrial Chemistry**

Effective from Academic Year 2024-25

Proposed NEP-2020 Course Structure

**Illustrative Credit distribution structure for Two Years Programme with Multiple
Entry and Exit options**

Final
Prof. P.S. Mane
Chairman - Ad-hoc BS-Industrial Chemistry

M.Sc. First Year Semester-I Course Structure

Course type	Course Code	Course Name	Teaching Scheme (Hrs./ week)		Credits Assigned			Marks		
			Theor y	Prac tical	Theor y	Practi cal	Total Credi ts	Conti. Inter. Assmen.	End. Sem Exam	Total Marks
Major Mandatory DSC	CHET/MJ/500	DSC-1 Anal. Chem	2	-	2	-	8T	20	30	50
	CHET/MJ/501	DSC-2 Inorg. Chem	2	-	2	-		20	30	50
	CHET/MJ/502	DSC-3 Org. Chem	2	-	2	-		20	30	50
	CHET/MJ/503	DSC-4 Phy. Chem	2	-	2	-		20	30	50
	CHEL/MJ/504	DSC-5 Inorg. Chem. Lab course	-	4	-	2	6L	20	30	50
	CHEL/MJ/505	DSC-6 Org. Chem. Lab course	-	4	-	2		20	30	50
	CHEL/MJ/506	DSC-7 Phy. Chem. Lab course	-	4	-	2		20	30	50
DSE (Choose one from your specialization and any one from remaining three)	CHETE/SE/507	DSE-1 Anal. Chem	2	-	2	-	4T	20	30	50
	CHETE/SE/508	DSE -2 Inorg. Chem	2	-	2	-		20	30	50
	CHETE/SE/509	DSE -3 Org. Chem	2	-	2	-		20	30	50
	CHETE/SE/510	DSE -4 Phy. Chem	2	-	2	-		20	30	50
	CHETE/SE/511	DSE -5 Drug Chem.	2	-	2	-		20	30	50
	CHETE/SE/512	DSE -6 Industrial chem	2	-	2	-		20	30	50
Research methodology	CHE/RM-513	Research methodology	4	-	4	-	4T	40	60	100
Total			16	12	16	06	22	220	330	550

Course Code Nomenclature :

DSC-Discipline Specific Core, DSE- Discipline Specific Elective, T-Theory, L- Laboratory course, CHET- Chemistry Theory Core, CHEL- Chemistry Laboratory Core, CHETE- Chemistry Theory Elective, CHERM- Chemistry Research Methodology

Amal
Prof. P.S. Mane
Chairman - Adhoc-BoS - Industrial Chemistry

M.Sc. First Year Semester-II Course Structure

Course type	Course Code	Course Name	Teaching Scheme (Hrs./ week)		Credits Assigned			Marks		
			Theor y	Prac tical	Theor y	Practi cal	Total Credi ts	Conti. Inter. Assmen.	End. Sem Exam	Total Marks
Major Mandatory DSC	CHET/MJ/550	DSC-1 Anal. Chem	2	-	2	-	8T	20	30	50
	CHET/MJ/551	DSC-2 Inorg. Chem	2	-	2	-		20	30	50
	CHET/MJ/552	DSC-3 Org. Chem	2	-	2	-		20	30	50
	CHET/MJ/553	DSC-4 Phy. Chem	2	-	2	-		20	30	50
	CHEL/MJ/554	DSC-5 Inorg. Chem. Lab course	-	4	-	2	6L	20	30	50
	CHEL/MJ/555	DSC-6 Org. Chem. Lab course	-	4	-	2		20	30	50
	CHEL/MJ/556	DSC-7 Phy. Chem. Lab course	-	4	-	2		20	30	50
DSE (Choose one from your specializati on and any one from remaining three)	CHETE/SE/557	DSE-1 Anal. Chem	2	-	2	-	4T	20	30	50
	CHETE/SE/558	DSE -2 Inorg. Chem	2	-	2	-		20	30	50
	CHETE/SE/559	DSE -3 Org. Chem	2	-	2	-		20	30	50
	CHETE/SE/560	DSE -4 Phy. Chem	2	-	2	-		20	30	50
	CHETE/SE/561	DSE -6 Industrial chem	2	-	2	-		20	30	50
On job training /Field worl d field	CHE/OJT-562	Research methodology	-	8	-	4	4L	40	60	100
	CHE/OJT-563	Field Project	-	8	-	4		40	60	100
Total			12	20	16	10	22	220	330	550

Course Code Nomenclature :

DSC-Discipline Specific Core, DSE- Discipline Specific Elective, T-Theory, L- Laboratory course, CHET- Chemistry Theory Core , CHEL- Chemistry Laboratory Core , CHETE- Chemistry Theory Elective , CHEOJT- Chemistry On job training CHEFP Chemistry Field Project

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Chairman - Adhoc BOS - Industrial Chemistry

Class: M.Sc. Second Year Semester: IIIrd Specialization Subject: Industrial Chemistry

Course type	Course Code	Course Name	Teaching Scheme (Hrs./week)		Credits Assigned			Marks		
			Theory	Practical	Theory	Practical	Total Credits	Cont. i. Eval.	Uni. Exam.	Total Marks
Major Mandatory DSC	INCHTC-600	DSC-15 (Ind. Chem.)	4	-	4	-	10T	40	60	100
	INCHTC-601	DSC-18 (Ind. Chem.)	4	-	4	-		40	60	100
	INCHTC-602	DSC-19 (Ind. Chem.)	2	-	2	-		20	30	50
	INCHLC-603	DSC-20 (Ind. Chem.). Lab course)	-	4	-	2	4P	20	30	50
	INCHLC-604	DSC-21 (Ind. Chem.). Lab course)	-	4	-	2		20	30	50
DSE (Choose any Two from pool of courses)	INCHEC-605	DSE-9 (Ind. Chem.)	2	-	2	-	4T	20	30	50
	INCHEC-606	DSE-10 (Ind. Chem.)	2	-	2	-		20	30	50
	INCHEC-607	DSE-11 (Ind. Chem.)	2	-	2	-		20	30	50
	INCHEC-608	DSE-12 (Ind. Chem.)	2	-	2	-		20	30	50
Research Project	INCHRP-649	Research Project -1	-	8	-	4	4P	40	60	100
Total			14	16	14	08	22	220	330	550

Course code Nomenclature :

DSC-Discipline Specific Core course, DSE- Discipline Specific Elective, T-Theory, L- Laboratory course, INCHTC- Industrial Chemistry Theory Core course , INCHLC- Industrial Chemistry Laboratory Core course, INCHEC- Industrial Chemistry Elective Course, INCHRP- Industrial Chemistry Research Project

Final
Prof. P.S. Mane
 Chairman-Ad-hoc BOS-Industrial Chemistry

Class: M.Sc. Second Year Semester: IVth Semester specialization Subject: Industrial Chemistry

Course type	Course Code	Course Name	Teaching Scheme (Hrs./week)		Credits Assigned			Marks		
			Theory	Practical	Theory	Practical	Total Credits	Cont. Eval.	Uni. Exam.	Total Marks
Major Mandatory DSC	INCHTC-650	DSC-20 (Ind. Chem.)	4	-	4	-	10T	40	60	100
	INCHTC-651	DSC-23 (Ind. Chem.)	4	-	4	-		40	60	100
	INCHTC-652	DSC-24 (Ind. Chem.)	2	-	2	-		20	30	50
	INCHLC-653	DSC-25 (Ind. Chem.. Lab course)	-	4	-	2	2P	20	30	50
DSE (Choose any Two from pool of courses)	INCHEC-654	DSE-13 (Ind. Chem.)	2	-	2	-	4T	20	30	50
	INCHEC-655	DSE-14 (Ind. Chem.)	2	-	2	-		20	30	50
	INCHEC-656	DSE-15 (Ind. Chem.)	2	-	2	-		20	30	50
	INCHEC-657	DSE-16 (Ind. Chem.)	2	-	2	-		20	30	50
Research Project	INCHRP-699	Research Project-2	-	12	-	6	6P	60	90	150
Total			14	16	14	08	22	220	330	550

Course code Nomenclature :

DSC-Discipline Specific Core course, DSE- Discipline Specific Elective, T-Theory, L- Laboratory course, INCHTC- Industrial Chemistry Theory Core course , INCHLC- Industrial Chemistry Laboratory Core course, INCHEC- Industrial Chemistry Elective Course, INCHRP- Industrial Chemistry Research Project,

Dr. P.S. Mane
Prof. P.S. Mane
Chairman-Ad-hoc-BoS-Industrial Chemistry

Semester : III

Course Name: Structural Elucidation by Spectral Methods **Course Code:** INCHTC-600

Course type : DSC-15 **4 Hrs/ Week**

Total contact hours : 60 Hrs **Theory Credit:** 4 **Marks :** 100

Learning outcomes:

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

1. Students will review elementary concepts of nuclear magnetic resonance spectroscopy and delve into spin-spin couplings, factors affecting coupling constants, and spin systems like AB, AX, and ABX.
2. They'll also explore techniques such as INEPT, INADEQUATE, and the Nuclear Overhauser effect.
3. Students will grasp elementary concepts of ¹³C-nuclear magnetic resonance spectroscopy, including chemical shifts for various carbon types and the impact of substituents on these shifts.
4. They'll also address instrumental challenges associated with ¹³C-NMR spectroscopy.
5. Students will understand the fundamentals of mass spectrometry, including ion production methods, ion analysis, factors affecting fragmentation, and the interpretation of mass spectra.
6. They'll explore fragmentation patterns for various functional groups and phenomena like the molecular ion peak and McLafferty rearrangement.
7. Students will grasp the principles of Mössbauer spectroscopy, understanding factors influencing line position and shape, including the isomer effect and quadrupole splitting.
8. They'll also delve into Electron Spin Resonance spectroscopy, analyzing hyperfine splitting, zero field splitting, and instrumentation in varied applications.
9. Students will integrate UV, IR, ¹H NMR, ¹³C NMR, and Mass Spectroscopy data to solve complex problems in structural elucidation and compound identification.

Unit-I : Nuclear Magnetic Resonance Spectroscopy (¹H NMR) 12Hrs

Elementary ideas (Recapitulation); Spin-spin couplings, Different types of couplings, factors affecting on coupling constants, Karplus equation, Spin systems (AB, AX, ABX, AMX), Rate processes, spin decoupling, shift reagents, Nuclear Overhauser effect (NOE), INEPT and INADEQUATE.

Unit-II : ¹³C-Nuclear Magnetic Resonance Spectroscopy 12Hrs

Elementary ideas, instrumental problems, chemical shifts (aliphatic, olefinic, alkyne, aromatic, heteroaromatic and carbonyl carbons); Effect of substituents on chemical shifts.

Unit-III : Mass Spectroscopy

12Hrs

Introduction, ion production (EI, CI, FD and FAB), ion analysis, ion abundance, factors affecting on fragmentation, fragmentation of different functional groups, molecular ion peak, isotopic peaks, metastable peak, Nitrogen rule, McLafferty rearrangement, Retro-Diels-Alder reaction.

Unit-IV :

12Hrs

Problems based on joint applications of UV, IR, ^1H NMR, ^{13}C NMR and Mass spectroscopy.

Unit- V : Mossbauer Spectroscopy

12Hrs

Principle, factors affecting the line position and shape, isomer effect and Quadrupole splitting iron salt like compounds, complexes, carbonyl compounds (temperature dependence of isomer shift and Quadrupole splitting in simple compound and coordination, polynuclear complexes), Numericals.

Electron Spin Resonance Spectroscopy: Introduction, principle of ESR spectroscopy, presentation of spectrum, hyperfine splitting in various structures, hyperfine splitting diagram of representative examples, factors affecting the magnitude of 'g' values, Zero field splitting, Kramer's degeneracy, Anisotropy in the hyperfine coupling constant, electron delocalization, instrumentation and applications.

References Books

1. Introduction to Spectroscopy: D. L. Pavia, G. M. Lampman, G. S. Kriz
2. Spectrometric Identification of Organic Compounds: R. M. Silverstein & F. X. Webster
3. ^{13}C NMR Spectroscopy: G. C. Levy, R. L. Lichter, G. L. Nelson
4. Spectroscopic Methods in Organic Chemistry: D. H. Williams & I. Fleming
5. Organic Structure Analysis: Philips Crews
6. Structural Methods in Inorganic Chemistry: E. A. V. Ebsworth & D. W. H. Rankin
7. Physical Methods for Chemistry: R. S. Drago
8. Coordination Chemistry vol. I: E. Martell
9. Coordination Chemistry by Experimental Methods: K. Barger
10. Mass Spectrometry: K. G. Das & James
11. Absorption Spectroscopy of Organic Compounds: V. M. Parikh

Semester : III

Course Name: Equipment Designing

Course Code: INCHTC-601

Course type : DSC-16

4 Hrs/ Week

Total contact hours : 60 Hrs Theory Credit: 4

Marks : 100

Learning outcomes:

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

- 1 Students will learn about basic conditions for equipment design
- 2 Design pressure vessels
- 3 To construct reaction vessels constructing
- 4 Design agitators and will be able to select suitable dryers

Basic Consideration in Process Equipment design

10H

Introduction, General Design Procedure, Computer Aided Design, Fabrication Techniques, Equipment Classifications, Power for Rotational Motion, Driver for Process Equipment

Pressure Vessels

10H

Introduction, Operating Conditions, Pressure Vessels Code, Selection of Materials, Design of Shell and Its Components, Supports

Reaction Vessels

10H

Introduction, Materials of Construction, Agitation, Classification of Reactions Vessels, Heating System, Design Considerations, Numerical Problem

Distillation and Absorption Towers / Columns

10H

Introduction, Basic Features of Towers / Columns, Towers / Column Internals, Stresses in Column Shell, Determination of Shell Thickness (At Different Height) Allowable Deflection

Agitators

10H

Introduction, Types of Agitators, Baffling, Power Requirements for Agitation

Dryers

10H

Introduction, Types of Dryers, Batch Type Dryers, Continuous Dryers

Books:

1. Process equipment design, M.V. Joshi
2. Chemical Engineering Hand Book R.H. Perry Chilton.

Semester : III

Course Name: Process Control

Course Code:INCHTC-602

Course type : DSC-17

2 Hrs/ Week

Total contact hours : 30 Hrs **Theory Credit:** 2

Marks : 50

Learning outcomes:

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

- 1 apply method for measurements of controls
- 2 select suitable technique for measuring of industrial controls
- 3 acquire knowledge about automatic controls.

Process – Control

15H

The Art and Science of Controls, Measurement, Control Process, Measuring Means of Industrial Control : Controlled Variable's Pressure, Thermometer, Thermal – Electrical Primary Elements, Millivolt meter, Potentiometer, Flow meter, Pressure Gage, Liquid Level Meter, Characteristic of Measuring Means, The Element in Measurement, Temperature Measuring Element, Pressure Measuring Means Galvanometer Characteristics.

Modes of Automatic Control

15H

Two position and multi position modes, two position controller, single speed and multi speed floating control pneumatic proportional controller, theory of continuous controllers.

25% weight-age should be given to problems

Books:-

1. Instrumental methods of chemical analysis (Skoog & West)
2. Instrumental methods of analysis (Willard, Merit & Dean)
3. Organic Spectroscopy (William Kemp)
4. Biophysical Chemistry (Upadhaya & Nath)
5. Organic Spectroscopy (Dani)
6. Analytical Chemistry (G.D. Christian)
7. Spectroscopic Identification of organic compounds (Silverstein)
8. Principles of Industrial Process Control (D.P. Eckman.)
9. Process System Analysis and Control (Coughner & Keppel)
10. Perry.

Course Code: INCHLC-603

Lab course

Course type DSC 18

Marks : 50 4 Hrs/ Week

Learning outcomes:

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

1. Students will develop practical skills in various analytical techniques.
2. They will determine COD, BOD, and dissolved oxygen in wastewater, separate and estimate cadmium and zinc, and estimate nitrogen in fertilizers via the Kjeldahl method.
3. They will assess saponification, acid, and iodine values of oils, determine vitamin C in samples, and measure blood glucose levels.
4. Students will estimate APIs in pharmaceuticals, phenol/aniline, chloride in food, sodium carbonate, and moisture content.

List of experiments

1. Determination of COD, BOD and dissolved oxygen from waste water sample.
2. Separate and estimate the amount of cadmium and zinc using ion exchange resin.
3. Estimation of Nitrogen from given sample of fertilizer by Kejalda method.
4. Determination of saponification, acid and Iodine value of oil.
5. Determination Vitamin –C from given sample of Juice/ tablet using dichlorophenol indophenols by volumetric method.
6. Estimation of blood glucose by Folin Wu method.
7. Estimation of API in the pharmaceutical sample.
8. Estimation of phenol/aniline by bromination method.
9. Estimation of chloride from food sample by Volhard titration method.
10. Determination of sodium carbonate in washing soda.
11. Determination of volume strength of commercial hydrogen peroxide using KMnO_4

Semester : III

Course Code: INCHLC-604

Course Type **DSC 19**

Lab course

4 Hrs/ Week 2 Credit

Marks 50

Learning outcomes:

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

-
1. Students will develop practical skills in techniques for isolation.
 2. To use potentiometric methods for assay of drug substances
-

- 1) Study of adsorption isotherm by activated carbon.
- 2) Isolation of nicotine from tobacco leaves.
- 3) Determination of pesticide content in the soil.
- 4) Isolation and estimation of active ingredient in available in pesticides.
- 5) Potentiometric assay of pilocarpine nitrate tablet (I P 1996 P-596)
- 6) Potentiometric assay of chloroquine phosphate (I P 1996 P- 172)
- 7) Potentiometric of diclofenac sodium (I P 1996 P-242)
- 8) Colorimetric assay of rifampicin tablet. (I P 1996 P-666)
- 9) Polarimetric assay of dextrose (I P 1996, P –239)
- 10) Titrimetric estimation of sulphacetamide.

Semester : III

Course Name: Polymers

Course Code:INCHEC-605

Course type : DSE-9

2 Hrs/ Week

Total contact hours : 30 Hrs **Theory Credit:** 2

Marks : 50

Learning outcomes:

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

1. Apply basic knowledge about polymers and polymerisation
2. Determine molecular weight by different methods
3. Prepare different polymers .

Types of Polymerization:

10H

Addition polymerization (mechanism of free-radical, anionic and cationic polymerization), initiators, inhibitors, retarders, living polymers, condensation polymerization, co-polymerization, coordination polymerization (bulk, suspension emulsion, solution).

Molecular weight and molecular weight determination:

10H

Average molecular weight number-average and weight-average molecular weight, sedimentation and viscosity average, molecular weight practical significance of molecular weight and molecular weight distribution, size of polymer molecular, determination of molecular weight (viscosity & light scattering).

Synthesis, properties and application

10H

Synthesis, properties and applications of polyethylene, polypropylene, polytetrafluoroethylene polystyrene, polyvinyl chloride. Polybutadiene, neoprene, buna-N, buna-s, phenol formaldehyde ureaformaldehyde, polyurethanes, epoxides, silicones, polyamides, cellulose, reclaimed, rubber recycling of plastics

Semester : III

Course Name: Dye and Dye Intermediate	Course Code: INCHEC-606
Course type : DSE-10	2 Hrs/ Week
Total contact hours : 30 Hrs Theory Credit: 2	Marks : 50

Learning outcomes:

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

- 1 Apply suitable methods for analysis of dyes
- 2 To apply proper method for dyeing
- 3 Test and evaluate for liquid films dry films

Analysis & applications of dyes

6H

Different methods used in analysis, Nitrate value determination, coupling, value, titanous chloride reduction, metal estimations – Cu, Ni, etc.

Dyeing methods:

6H

Dyeing methods for direct, Acid, reactive, dispersed, vat, cationic, sulphur, Indigo and azo-dye.

Introduction of paints.

6H

Ingredients and Classification of Paints. New Technologies, scope in India, Industrial Paint applications.

Pigments:

6H

General Physical Properties, Properties of coatings solvents. Plasticizers, dyes bioactive additives. Decorative and Building Paints. Paints for industrial structure of individual buildings.

Testing and Evaluation.

6H

Tests on Liquid Films, Dry films. Application and performance and weathering test. World standard specifications for Paints and materials. Common faults and remedies.

Books:-

1. Paint manufacture by JR.Kapuria, SBP consultant and Engineering Pvt.
2. Outline of Paints Technology by W.M. Morgans, CBS publishers and Distributors, New Delhi.
3. Industrial Paint, Application by W.H. Tatlon and E.W. Drew, Geogee Newness limited, London.
4. Paint Formulation by Bexall and Von Fraunhofer, George Godwin limited, London.
5. Dryden's outline of chemical technology.

Semester : III

Course Name: Pharmaceuticals I

Course Code:INCHEC-607

Course type : DSE-11

2 Hrs/ Week

Total contact hours : 30 Hrs **Theory Credit:** 2

Marks : 50

Learning outcomes:

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

- 1 Classify drugs,
- 2 Use suitable processes, raw materials for sulpha drugs, analgesics
- 3 acquire knowledge about automatic controls.

Classification of various types of drugs with examples

5H

Raw materials, process of manufacture, handing etc of the following bulk drugs. 25H

- i) Sulpha drugs: sulphaguandine, sulphamethoxazole.
- ii) Antimicrobial: chloramphenicol, firazoil-dine, mercurochrome, isoniazid, Na-PAS.
- iii) Analgesic-Antipyretics- salicylic acid its derivatives, Ibuprofen, mefenamic acid.
- iv) Steroidal harmones-Progesterone, Testosterone, methyl testerone.
- v) Vitamins-Vit-A, Vit -B₆,Vit-C.

Semester : III

Course Name: Petrochemicals

Course Code:INCHEC-608

Course type : DSE-12

2 Hrs/ Week

Total contact hours : 30 Hrs **Theory Credit:** 2

Marks : 50

Learning outcomes:

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

- 1 Students will understand the concepts and significance of petroleum products and their handling processes
- 2 They will master calibration and analyse the petroleum.
- 3 They will gain proficiency in processes used in petroleum industry.

Petrochemicals:-

10H

Introduction to crude oil, explanatory methods, oil reservoirs, transportation of crude oil, constitution of crude oil, natural gas-constituents.

Distillation of crude oil, separation of natural gas and different fractions, basic on relative composition of different distillates.

Meaning of terms such as pour point depressants, drag reducers, viscosity reducers, ignition point, point, octane number, doctor solution. Types of hydrocarbon fuels and their characteristics.

Detailed discussion of the following operations:

10H

With respect to process, mechanism catalysts and application: Cracking catalytic hydro cracking, Isomerization, Reforming, Isomerization and Alkylation.

Sulhur, hydrogen, petroleum coke and nitrogen compounds from petroleum. 10H

General discussion of the following reactions with respect of mechanism and Manufacturer of the following compounds: Methane, ethylene, propylene, higher olefins.

Semester : III

Course Name: Research project-I

Course Code:INCHRP-649

Course type : Research project

8 Hrs/ Week

Total contact hours : 120 Hrs

Theory Credit: 4

Marks : 100

Learning outcomes:

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

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

1. Know how to carry out literature survey by using various search engines and database
2. Handle various chemicals, solvents, instruments and others
3. Perform reactions, monitoring by Instruments reading
4. Purification techniques
5. Understand the structure of organic compounds by using spectral techniques

Class: M.Sc. Second Year Semester: IVth Semester specialization Subject: Industrial Chemistry

Course type	Course Code	Course Name	Teaching Scheme (Hrs./ week)		Credits Assigned			Marks		
			Theory	Practical	Theory	Practical	Total Credits	Conti. Eval.	Uni. Exam.	Total Marks
Major Mandatory DSC	INCHTC-650	DSC-20 (Ind. Chem.)	4	-	4	-	10T	40	60	100
	INCHTC-651	DSC-21 (Ind. Chem.)	4	-	4	-		40	60	100
	INCHTC-652	DSC-22 (Ind. Chem.)	2	-	2	-		20	30	50
	INCHLC-653	DSC-23 (Ind. Chem.. Lab course)	-	4	-	2	2P	20	30	50
DSE (Choose any Two from pool of courses)	INCHEC-654	DSE-13 (Ind. Chem.)	2	-	2	-	4T	20	30	50
	INCHEC-655	DSE-14 (Ind. Chem.)	2	-	2	-		20	30	50
	INCHEC-656	DSE-15 (Ind. Chem.)	2	-	2	-		20	30	50
	INCHEC-657	DSE-16 (Ind. Chem.)	2	-	2	-		20	30	50
Research Project	INCHRP-699	Research Project-2	-	12	-	6	6P	60	90	150
Total			14	16	14	08	22	220	330	550

Course code Nomenclature :

DSC-Discipline Specific Core course, **DSE**- Discipline Specific Elective, **T**-Theory, **L**- Laboratory course, **INCHTC**- Industrial Chemistry Theory Core course , **INCHLC**- Industrial Chemistry Laboratory Core course, **INCHEC**- Industrial Chemistry Elective Course, **INCHRP**- Industrial Chemistry Research Project,

Semester : IV

Course Name: Waste management and Effluent treatment

Course Code:INCHTC-650

Course type : DSC-20

4 Hrs/ Week

Total contact hours : 60 Hrs Theory Credit: 4

Marks: 100

Learning outcomes:

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

1. Students will understand the concepts and significance of quality control and assurance, utilizing statistical techniques like quality control charts.
2. They will master calibration and maintenance of laboratory instruments.
3. They will gain proficiency in documentation for quality assurance, including handling raw data, sampling methods, and analytical reporting.
4. The course covers establishing a quality assurance program, writing standard operating procedures, and monitoring quality assurance data.

Unit – 1

10H

Different water quality requirements of various industries for different pressure boiler feed waters, cooling water and process water, waste generation and characterization from different industries like paper and pulp, breweries and distilleries tanneries, textile, diary, fertilizer, sugar mill, steel, oil refinery petrochemical industries.

Unit – 2

10H

Treatment methods for water and waste: Volume reduction, strength reduction, Neutralization, equalization and precipitation, Basic Processes of Treatment Pretreatment – Primary Treatment, Sedimentation, Floatation, Secondary Treatment, Design of Conventional biological treatment, Activated sludge, Tricking freckling filter, Sludge digestion, Disposal of treated effluent and sludge.

Unit – 3

10H

Tertiary Treatment, Removal of Dissolved Solids, Nitrogen, Phosphorus,

Unit – 4

10H

Generation of Air Pollutants, Characterization, Stack height, Dispersal mechanics

Unit – 5

10H

Control, methods-sources, correction methods-cleaning of gaseous effluents, particulate emission control-gravitational settling chambers – cyclone separators, fabric filter electrostatic precipitator-wet, scrubbers-selection a particulate collector-control of gaseous, emission, adsorption by solids, adsorption by liquids combustion.

Unit – 6

10H

Generation and treatment of sludge and solid wastes, identification of hazardous waste disposal methods. TSDF cradle to grave concept, waste minimization and environmental facility assessment and audit.

Books:-

1. Waste Water Treatment, M.N. Rao and A.K. Dutta, 1987, Oxford & IBH Pub. Co.
2. Environmental Pollution Control C.S. Rao, 1993, Wiley Estern Ltd.
3. Industrial Wasters their disposal and treatment, W.. Rudolfs 1997
4. Industrial Environment, Assessment and Strategies S.K. Agrwal 1996.
5. Hazardous waste management, Charles, A. Wertz 2nd edition.
6. Integrated solid waste management George tehobanoglous, Hilary theisen & Samuel A. Vigit.
7. Hazardous waste Management Micheal La. Carge, Philip Buckingham, Jeffery Evans.

Semester : IV

Course Name: Quality Assurance Techniques

Course Code:INCHTC-651

Course type : DSC-21

4 Hrs/ Week

Total contact hours : 60 Hrs **Theory Credit:** 4

Marks: 100

Learning outcomes:

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

1. Students will understand the concepts and significance of quality control and assurance, utilizing statistical techniques like quality control charts.
2. They will master calibration and maintenance of laboratory instruments.
3. They will gain proficiency in documentation for quality assurance, including handling raw data, sampling methods, and analytical reporting.
4. The course covers establishing a quality assurance program, writing standard operating procedures, and monitoring quality assurance data.
5. Students will explore laboratory accreditation, its international aspects, criteria, and benefits.
6. They will learn about ISO 9000 standards, their evolution, and implementation, including QMS documentation, quality policies, and the significance of ISO 9001, 9002, 9003, and 9004.

Unit-I :Quality Assurance:

12Hrs

Introduction to Quality Control and quality assurance: Concepts and significance. Quality control and statistical techniques: Quality control charts, the X-quality control chart, the R-quality control chart and its interpretation, spiked sample control charts, use of blind samples in quality control, use of proficiency evaluations in quality control.

Unit-II : Calibration and maintenance of Instruments

12Hrs

Calibration and maintenance of Instruments : Instrument calibration – linear calibration curves, equipment calibration, frequency of calibration, calibration of common laboratory instrument and equipment (Analytical balances, volumetric glassware, ovens, furnaces, UV / Visible spectrophotometer, pH meter, conductivity meter, IR spectrophotometers, AAS, GC, HPLC etc.,). Maintenance of instruments and equipment

Unit-III :Documentation for quality assurance and Raw Data:

12Hrs

Type of notebooks, control of notebook distribution and data entry. General Reagents and volumetric reagents.

Sampling – sampling methods, sample labelling, and sample log-in/register. Sample analysis, reporting, recording and personal training. Instrument calibration and maintenance. Analytical report. Personnel, training, records - professional personnel, technician personnel. Filing quality assurance

documentation. Good laboratory practices and personnel, Quality Programme, Instrument and Organisation calibration, Customer satisfaction.

Unit-IV : Computers and quality assurance

12Hrs

Computers and quality assurance: Sample handling. Data Acquisition. Quality control data and calculations. Computer generated analytical reports. Security considerations. Hardware and software. Establishing a Quality Assurance program: Management commitment. Define the quality assurance program. Writing standard operating procedures. Topics for standard operating procedures. Consolidating the programme. Monitoring the program – monitoring quality assurance data, reporting quality assurance problems. Writing the quality assurance manuals. AC(CB1)-4: Quality Accreditation

Unit-V : Quality Accreditation:

12Hrs

Laboratory Accreditation: Need for laboratory accreditation. International aspects of laboratory accreditation and in India. Criteria for laboratory accreditation. Benefits of laboratory accreditation, Evolution and significance of Quality Management, Background to ISO 9000, comparison between ISO-9001, ISO-9002 & ISO-9003., ISO 9000-2000 series of standards on quality management system, - evolution of series of standards, introduction to ISO organization, Registration / certification - benefits of QMS certification. Structure of ISO 9000-2000 family of standards. 124 Advantages of ISO 9000-2000. Requirements of ISO 9001-2000 QMS and applications, Steps for effective implementations. Significance of ISO - 9001, 9002, 9003& 9004. Requirements of ISO9000/IS14001. Concepts of OHSMS (BS 8800) Quality Management Principles in QMS, QMS documentation, Quality Manual, Quality policy, conformities and Non-conformities

References Books

1. Handbook of Quality Assurance for the analytical chemistry laboratory, James P. Dux, Van Nostrand Reinhold, New York, 1986.
2. Applying ISO-9000 Quality Management Systems, International Trade Centre Publishing, UNCTAD/WTO. Geneva, Switzerland, Indian Edition Printed by D.L.Shah Trust.
3. How to practice GLP, PP Sharma, Vandana Publications, 2000, New Delhi
4. Training manuals on ISO 9000 / 2000 PQM, Girdhar J Gyani, Raj Publishing House, 2001
5. Quality Assurance in Analytical Chemistry, B.W. Wenclawiak, Springer,India, 2004.

Semester : IV

Course Name: Process Economy & Industrial Organization

Course Code:INCHTC-652

Course type : DSC-22

2 Hrs/ Week

Total contact hours : 30 Hrs Theory Credit: 2

Marks: 50

Learning outcomes:

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

1. Students will understand the concepts and significance of chemical process economics
2. They will master in industrial management .

Chemical Process Economics:

15 H

Factors involved in project cost estimation methods employed for the estimation of capital investment, methods of determining depreciation, competitive & monopoly markets some aspects of marketing profitability criterion, economics of selecting alternatives, break even point, production scheduling.

Industrial Management:-

15H

Concept of scientific management in industry, functions of management: Decision making planning, organizing, material management, inventory control, information system and decision making.

Books:-

1. Plant design and economic for chemical engineer for Max. S. Peters, Klaus D. Timmerhuas.
2. Engineering Chemistry by Dr. S.S. Dara
3. Text Book Industrial Chemistry, Pragati Agencies Pune – 2
4. Economic of Chemical Industry, Hempel E.M.
5. Industrial Organization & Management, Bethal L.L.

Course Code: INCHLC-653

Course Type **DSC 23**

Lab course

4 Hrs/ Week 2 Credit

Marks 50

Learning outcomes:

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

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1. Students will develop practical skills in techniques for isolation, assay and analysis.
 2. To use instrumental methods for water analysis
 3. Master in assay of industrial and food products
-
- 1) Estimation of D O by Winkler's method.
 - 2) Determination of C O D of water sample.
 - 3) Estimation of Nitrate in the given water sample calorimetrically.
 - 4) Removal of heavy metals using (Column Chromatography)
 - 5) Batch Adsorption studies of acetic acid by silica.
 - 6) Determination of Hammett constant for substituted benzoic acids.
 - 7) Determination of sodium and potassium in the given sample by flame photometry.
 - 8) To detect adulterant present in fat, sugar, chili powder, turmeric powder, pepper etc.
 - 9) Estimation of iron in cement sample (Titration)
 - 10) Estimation of calcium in cement (Redox titration)
 - 11) Estimation of Mn in steel (colorimetrically)
 - 12) Estimation of calcium in dolomite (Complexo-metrically)
 - 13) Estimation of aluminum in Bauxite (Gravimetrically)
 - 14) Estimation of MnO₂ in pyrolusite
 - 15) Three step preparation of organic compound (any three)

Semester : IV

Course Name: Pharmaceuticals II

Course Code:INCHEC-654

Course type : DSE-13

2 Hrs/ Week

Total contact hours : 30 Hrs **Theory Credit:** 2

Marks : 50

Learning outcomes:

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

- 1 Apply knowledge of processes, raw materials for manufacture of barbiturates blockers and cariocascular agents
- 2 acquire knowledge about formulation of ointment creams emulsions, pastes powder.

Raw materials, process of manufacture, handling etc of the following bulk drugs 15Hr

- i) Barbiturates Pentobarbital
- ii) Blockers-propranolol, atenolol
- iii) Cardiovascular agent-methyl-dopa
- iv) Antihistamines-chloropheneramine Maleate, products based on ferment process.

Formulation for external use:-

15 Hr

Ointment creams, emulsions, pastes Powder, parenteral dosage form: inject-able products-different routes of administration viz, intramuscular, intravenous, subcutaneous etc.

Semester : IV

Course Name: Insecticides

Course Code:INCHEC-655

Course type : DSE-14

2 Hrs/ Week

Total contact hours : 30 Hrs Theory Credit: 2

Marks : 50

Learning outcomes:

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

- 1 Apply knowledge of processes, raw materials for manufacture of barbiturates blockers and cardiocascular agents
- 2 acquire knowledge about formulation of oinment creams emulsions, pastes powder.

Inorganic insecticides :-

15 Hr

Arsenic insecticides, flure insecticides, Insect-ides of plant origins: Nicotine, nor nicotine, pyrethoroides, reatenoids, anal-gin, allethrin, Chlorinated hydrocarbons:- DDT, dilan suphenex, DFDT, endosulphan.

Organophosphours Insecticides: -

15 Hr

Dithiophoshoric acid derivatives:- Melathion, dimecron, **Diphosphoric acid derivatives:-** Parathion, methyl parathion, thippfos, chlorthion,paraoxen. Phrophosphoric acid derivatives. Sulphotepp, sobhradan. Other organophosphorus insecticides. Isopertox, trichlorofin. Carbamate insecticides. Carang, isolom, phyrolan, baygon.

Semester : IV

Course Name: Fungicides

Course Code:INCHEC-656

Course type : DSE-15

2 Hrs/ Week

Total contact hours : 30 Hrs **Theory Credit:** 2

Marks : 50

Learning outcomes:

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

- 1 Apply knowledge of processes, raw materials for manufacture inorganic fungicides
- 2 acquire knowledge about formulation of organomercuric fungicides

Fungicides:- Preparation & properties of

Inorganic Fungicides:-

15 Hr

Sulphur, Limesulphur, copper sulphaaate, Bordeaux paste, Bordeaux paint, Nurgudy, copper oxychloride.

Organomeruric Compounds:-

15 Hr

Ethyl mercuric chloride, ceream Dithiocarbamates-Ziram, thiram, zinc, Captan.

Misc. fungicides:- Polpet, Bavistin.

Semester : IV

Course Name: Cosmetics

Course Code:INCHEC-657

Course type : DSE-16

2 Hrs/ Week

Total contact hours : 30 Hrs **Theory Credit:** 2

Marks : 50

Learning outcomes:

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

- 1 Apply knowledge of processes, raw materials for manufacture of cosmetics
- 2 acquire knowledge about formulation of hair products.

UNIT I

15 Hours

Classification of cosmetic and cosmeceutical products

Definition of cosmetics as per Indian and EU regulations, Evolution of cosmeceuticals from cosmetics, cosmetics tis quasi and OTC drugs

Cosmetic excipients: Surfactants, rheology modifiers, humectants emollients, preservatives. Classification and application

Skin: Basic structure and function of skin.

UNIT II

15 Hours

Principles of formulation and building blocks of skin care products:

Face wash,

Moisturizing cream, Cold Cream, Vanishing cream and their advantages and

Principles of formulation and building blocks of Hair care products:

Conditioning shampoo, Hair conditioner, anti-dandruff shampoo.

Principles of formulation and building blocks of oral care products:

Toothpaste for bleeding gums, sensitive teeth. Teeth whitening, Mouthwash.

Semester : IV

Course Name: Research project-2

Course Code:ACHERP-699

Course type : Research project

12 Hrs/ Week

Total contact hours : 180Hrs

Theory Credit: 6

Marks : 150

Learning outcomes:

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

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

6. Know how to carry out literature survey by using various search engines and database
7. Handle various chemicals, solvents, instruments and others
8. Perform reactions, monitoring by TLC
9. Purification techniques
10. Understand the structure of organic compounds by using spectral techniques