SHIVAJI UNIVERSITY, KOLHAPUR

DEAPRTMENT OF CHEMISTRY

Academic Year 2018-2019

PART – A

Name of Department: Department of Chemistry

Department Vision: Engender Human Resource to Lead the Competitive Science World for Nation Building

Department Mission: Impart most advanced scientific knowledge and training to the students so that genuine researchers and skilled scientists of world standard will be made available for the advancement of national science and technology programs as well as to cater the needs of industrial and pharma sectors

Name of Program: **M.Sc. Industrial Chemistry**

The Indian chemical industries occupy a unique position in the Indian economy interms of contribution to employment and export potential. In spite of a strong natural resource based India's share in the global market is meager one. The experts in Industrial Chemistry have emphasized the need for capital infusion capacity, modernization and up gradation in various segments of industrial processes to bring about efficiencies and economies of scale in order to achieve in global markets. Keeping in view the need of Indian industries, Shivaji University has started M.Sc. course in Industrial Chemistry from academic year 1993-1994 in the Chemistry Department to educate and training the science graduates in industrial chemistry to serve the industrial sector as a technical, R & D and quality control production personnel to manage the industrial production and contribute to the development of nation. One of the objectives of the M.Sc. Industrial Chemistry Course is to attain new hights in teaching and research and to provide trained young graduate for development of various industries. M.Sc. course in industrial chemistry is a potential base provided by the Shivaji University on the University campus to educate the students from rural area who will get employment on large scale in Indian Chemical industries. Since last twenty-seven (27) years, M.Sc. industrial chemistry students have obtained employment on large scale in Indian chemical industries.

Program Outcomes (POs)

PO1 To apply the basic and fundamental knowledge of chemistry and industrial chemistry specialized to solve the complex problems.

PO2 Development of solutions for complex chemistry related problems and processes that meet the essential needs like public health and safety, the cultural, community and environmental considerations.

PO3 Share the awareness with understanding of the industrial chemistry and management skills and apply to one's own work, as member and leader in team to mange industrial projects.

PO4 Demonstrate leadership and entrepreneurship skills by incorporating organization goals and providing facilities for peer members.

PO5 Enhance the scientific temper as well as industrial training programmes to the students so as develop a research culture and implementation of the policies to tackle the burning issues at global and local level.

PO6 Execute procedures as per laboratory standards in the areas of organic, industrial, natural products, paint, pharmaceuticals, petroleum, and dyes industries

Program Specific Outcomes (PSOs)

PS01 An ability to show the fundamental, practical, theoretical concepts, analysis real problems, and to develop modified solutions by utilizing the gained knowledge of chemistry especially industrial chemistry.

PSO2 Demonstrate their professional accomplished skills to build careers in various industry or higher education and widen to develop their professional knowledge in area like Research and Development, administration, teaching and small scale industry establishment.

PSO3 To adapt and migrate to transformation of interdisciplinary based recent technologies to provide spontaneous solutions.

Year of Implementation of this syllabus:

First Year: 2018

Second Year: 2019

Part B

Semester-wise courses, their COs and Mapping Matrices

Semester: M. Sc- I &II, Semester- I, II, III and IV

Course Code and Name of Course:

Course Code	Paper Code
IND-1.1	Inorganic Chemistry – I
IND -1.2	Organic Chemistry – I
IND -1.3	Physical Chemistry – I
IND -1.4	Analytical Chemistry – I
IND -P1.1	Practical – I
IND -P1.2	Practical – II
IND-2.1	Inorganic Chemistry – II
IND -2.2	Organic Chemistry – II
IND -2.3	Physical Chemistry – II
IND -2.4	Analytical Chemistry – II
IND -P2.1	Practical – III
IND -P2.2	Practical – IV
IND-3.1	Organic Chemical Industries-I
IND -3.2	Inorganic Chemical Industries-I
IND -3.3	Methods of Analysis in Industries
IND –E01	General Chemical Technology
IND –P3.1	Practical V
IND –P3.2	Practical VI
IND-4.1	Drugs and Pharmaceuticals
IND -4.2	Inorganic Chemical Industries-II
IND -4.3	Selected Topics in Industrial Chemistry
IND –E04	Environmental Chemistry
IND –P4.1	Practical VII
IND –P4.2	Practical VIII

Syllabus Structure: Annexure – I
Semester-wise courses, their COs and Mapping Matrices

Semester: I

Courses:

IND-1.1: Inorganic Chemistry – I

IND -1.2: Organic Chemistry – I

IND -1.3: Physical Chemistry – I

IND -1.4: Analytical Chemistry – I

IND -P1.1: Practical – I

IND -P1.2: Practical – II

IND -1.1: Inorganic Chemistry – I

Course Outcomes (COs)

CO1: Students will be able to explain the basic chemistry of transition metals and its compounds, spectroscopic characteristics of such compounds, nomenclature, reactions and applications.

CO2: Students will obtain knowledge about Preparation, structure, physical and chemical properties of metal carbonyls of transition metals.

CO3: Students will be able to understand the all aspects of synthesis, bonding, structure and reactivity of organometallic compounds and their applications in homogenous catalysis.

CO4: Student will be able determine the stability of the complexes and will be able to explain the nuclear stability and reactions.

(C_1) COs – POs & PSOs mapping matrix (1-Low, 2-Medium, 3-High, 0-No correlation)

PO→ CO↓	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	3	2	3	3	3	3	1
CO2	2	2	3	2	2	3	3	2	3
CO3	3	3	3	2	2	2	3	1	3
CO4	3	2	3	1	1	1	3	2	2
Total	11	9	12	7	8	9	12	8	9
Average (C_1)	2.8	2.2	3	1.8	2	2.2	3	2	2.2

IND – 1.2: Organic Chemistry – I

Course Outcomes (COs)

CO1: Students will able to differentiate between various organic reactive intermediates.

CO2: Students can recognize, classify, explain, and apply fundamental organic reactions.

CO3: Students will have ability to distinguish between different kinds of isomers.

CO4: Course will develop interest in writing and finding mechanisms of new reactions.

(C_2) COs – POs& PSOs mapping matrix (1-low, 2-medium, 3-high, 0-No correlation)

POs→ / COs ↓	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	3	2
CO2	3	3	3	3	3	3	3	3	2
CO3	3	2	2	3	3	3	3	3	2
CO4	3	1	2	3	3	3	3	3	2
Total	12	9	10	12	12	12	12	12	8
Average(C_2)	3	2.2	2.5	3	3	3	3	3	2

IND -1.3: Physical Chemistry – I

After completing this course, students will be able to understand basic principles of thermodynamics and statistical mechanics required to learn more advanced topics like quantum statistics and molecular dynamic simulation methods.

Course Outcomes (COs)

CO1: Students will be able to understand basic principles of thermodynamics and statistical mechanics

CO2: Able to learn advanced topics like quantum statistics and molecular dynamic simulation methods.

CO3: Develop abilities to understand how to estimate and analyze the physicochemical properties of condensed and gas phase materials.

CO3: Able to utilize spectral data to estimate molecular thermodynamic properties through partition function calculations.

CO4: Understand properties of detergents and colloidal materials

CO5: Learns the principles and techniques to understand gas and liquid adsorptions on solid surfaces

CO6: Can learn spectral techniques to study surface adsorption phenomena.

CO7: Learn principles and techniques for estimation of average molecular weight of a polymer or biological macromolecules

CO8: Develop abilities to characterize polymers through understanding theories of virial coefficients, concepts of glass transition temperatures, etc.

(C_3) COs – POs& PSOs mapping matrix (1-low, 2-medium, 3-high, 0-No correlation)

POs→ / COs ↓	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	1	3	3	3	2	2	3
CO2	2	2	1	3	2	3	1	2	1
CO3	3	3	2	3	3	3	3	3	3
CO4	3	3	2	3	3	2	1	2	2
CO5	3	1	0	3	3	1	1	1	3
CO6	3	3	1	3	3	1	2	1	3
CO7	3	3	1	3	3	3	1	2	3
CO8	3	3	0	3	3	2	1	2	3

Total	23	20	8	24	23	18	12	15	21
Average(C_3)	2.9	2.5	1	3	2.9	2.2	1.5	1.9	2.6

IND-1.4: Analytical Chemistry-I

Course Outcomes (COs)

CO1: Students would acquire the knowledge about the fundamentals of Analytical Chemistry including the sampling, sample pretreatment, basic techniques, methods and data handling, processing and statistical analysis of the same.

CO2: Students would acquire the knowledge and understand the scope of Analytical Chemistry spanning various fields. The students will learn fundamentals of qualitative analysis using conventional techniques

CO3: Students will learn the chromatographic techniques, choice of chromatographic techniques and tuning of the chromatographic technique as per the need based on the samples to deal with, learn electroanalytical techniques and computation chemistry which would groom them for alternative analytical strategies which form one of the important components of analytical chemistry.

CO4: Students will learn about referring to the standard reference books and infer information from the same. Analytical case study problems would be discussed to familiarize with the scope and advantages of Analytical Chemistry.

(C_4) COs – POs& PSOs mapping matrix (1-low, 2-medium, 3-high, 0-No correlation)

POs→ / COs ↓	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	3	2
CO2	3	3	3	3	3	3	3	3	2
CO3	3	2	2	3	3	3	3	3	2
CO4	3	1	2	3	3	3	3	3	2
Total	12	9	10	12	12	12	12	12	8
Average(C_4)	3	2.2	2.5	3	3	3	3	3	2

IND -P1.1: Practical – I

Course Outcomes (COs)

CO1: Ability in professional sampling and sample treatment before actual analysis

CO2: Ability to treat and evaluate the results of analysis

CO3: Understanding and capability of performing basic chemical processes in a chemical laboratory

CO4: Capability of performing measurements on basic analytical instruments (photometers, spectrometers, chromatographs, ion-selective electrodes)

(C_5) COs – POs & PSOs mapping matrix (1-Low, 2-Medium, 3-High, 0-No correlation)

PO→ CO↓	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	3	3	2	3	3	2	3	3
CO2	2	3	3	2	3	3	3	3	3
CO3	2	2	2	2	3	3	1	3	3

CO4	2	3	3	2	3	3	2	3	3
Total	8	11	11	8	12	12	8	12	12
Average(C_5)	2	3	3	2	3	3	2	3	3

IND -P1.2: Practical – II

Course Outcomes (COs)

CO1: Students can be able to prepare various concentration solutions like molar, normal, ppm.

CO2: Determine the rate constants of various first order and second order reactions

CO3: Determine the redox potential of a system, relative strength of acid etc using potentiometer, conductometer

CO4: Know the formation of alloys like Brass, Bronze, phase diagram for binary and ternary systems studied in details like a composition, critical temperature, etc

CO5: Validity of Freundlich adsorption isotherms to remove toxic material such as dye, acetic acid, and other industrial effluents

(C_6) Cos – Pos & PSOs mapping matrix (1-Low, 2-Medium, 3-High, 0-No correlation)

PO→ CO↓	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	3	3	2	3	3	2	3	3
CO2	2	3	3	2	3	3	3	3	3
CO3	2	2	2	2	3	3	1	3	3
CO4	2	3	3	2	3	3	2	3	3
CO5	2	2	2	1	2	1	2	2	1
Total	10	13	13	9	14	13	10	14	13
Average(C_6)	2	2.6	2.6	1.8	2.8	2.6	2	2.8	2.6

M. Sc.- I, Semester: II

Courses:

IND-2.1: Inorganic Chemistry – II

IND -2.2: Organic Chemistry – II

IND -2.3: Physical Chemistry – II

IND -2.4: Analytical Chemistry – II

IND -P2.1: Practical – III

IND -P2.2: Practical – IV

IND -2.1: Inorganic Chemistry – II

Course Outcomes (COs)

CO1: Students will get the knowledge of the basic chemistry of non-transition elements and their compounds, synthesis and structural features, and applications.

CO2: To be able to explain the structures of inorganic compounds based on different theories. Student will understand the chemistry of various types of solvents.

CO3: Be well versed with the knowledge about the chemistry of Lanthanides and Actinides with respect to occurrence, separation, compounds and applications.

CO4**:** To understand the three dimensional structures of solid-state materials of industrial importance and to get the knowledge of bio-inorganic Chemistry.

(C_7) COs – POs & PSOs mapping matrix (1-Low, 2-Medium, 3-High, 0-No correlation)

PO→ CO↓	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	2	3	3	3	3	3	1	3
CO2	3	1	3	3	2	3	2	2	3
CO3	2	2	2	3	3	3	3	2	3
CO4	3	3	3	3	3	3	1	3	3
Total	11	8	11	12	11	12	9	8	12
Average(C_7)	3	2	3	3	3	3	2	2	3

IND -2.2: Organic Chemistry – II

Course Outcomes (COs)

CO1: Illustration of modern synthetic methods and applications of reagents.

CO2: Provide knowledge of different organometallic compounds and various coupling reactions.

CO3: Understand principle and applications of protection and deprotection of various functional groups.

CO4: It will elaborate to understand the concept of chemoselectivity, regioselectivity and enantioselectivity.

(C_8) COs – POs& PSOs mapping matrix (1-low, 2-medium, 3-high, 0-No correlation)

POs→ COs ↓	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	3	1
CO2	3	3	2	3	3	3	3	2	2
CO3	3	2	2	3	2	3	3	3	2
CO4	3	1	2	3	3	3	3	3	2
Total	12	9	9	12	12	12	12	11	7
Average(C_8)	3	2.2	2.2	3	3	3	3	2.7	1.7

IND 2.3: Physical Chemistry – II

Students will learn the fundamentals of quantum mechanics and how to solve the Schrodinger wave equation for some simple systems as well as derive selection rules for such systems. Knowledge gained through this course will help students to learn more advanced topics in quantum mechanics and hence becomes the basis or essential requirement for the course "Advanced Quantum Chemistry"

Course Outcomes (COs)

CO1: Students will learn basics of quantum mechanics.

CO2: Knowledge of the course will form the basis or essential requirement for the course "Advanced Quantum Chemistry"

CO3: Able to understand selection rules and to predict the electronic spectra of conjugated organic molecules.

CO4: Able to study photochemical and photophysical phenomena

CO5: Capable of qualitative and quantitative analysis of various ingredients from industrial, food and pharma samples using techniques of emission spectroscopy.

CO6: Capable of understand the electrochemical aspects of materials, ionic processes and electrochemical sensors, battery materials and characterizations etc.

CO7: Able to study electrokinetic effects and their applications in the field of protein separation, characterization etc.

CO8: Understanding the molecular dynamics through kinetic studies. Applications to explore reaction pathways, protein-ligand binding rates, etc. will help to understand life governing processes.

(C_9) COs – POs& PSOs mapping matrix (1-low, 2-medium, 3-high, 0-No correlation)

POs→ / COs ↓	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	3	1	3	3	2	3	2	3
CO2	3	2	1	3	3	2	3	2	3
CO3	3	3	1	3	3	0	3	1	3
CO4	3	3	0	3	3	3	2	2	3
CO5	2	3	0	3	3	3	2	0	2
CO6	2	3	3	2	3	0	3	1	2
CO7	3	3	3	3	1	2	1	1	2
CO8	3	2	1	3	2	3	1	3	2
Total	22	22	10	23	21	15	18	12	20
Average(C_9)	2.7	2.7	1.2	2.9	2.6	1.9	2.2	1.5	2.5

IND 2.4: Analytical Chemistry-II

Course Outcomes (COs)

CO1: Students will acquire the knowledge of spectroscopic tools/instruments used in chemical analysis and interpretation of the data. The scope and limitations of the spectroscopic tools would be discussed so that the students learn about the type of samples which could be analyzed by these tools offering choices among the spectroscopic tools.

CO2: Students will learn about the simple and advanced instruments used for analysis like NMR, MS, AAS, ICP and thermal analysis (TGA, DTA, DSC etc.) techniques spanning wide variety of samples to be considered for analysis.

CO3: Students will learn about the instrumentation, sample preparation and handling of sample, analysis and data interpretation and structural elucidation.

CO4: Learning about different instruments will give them idea about appropriate choice of the

instrument for analysis based on the source and type of analyte(s) in the sample under consideration.

(C_{10}) COs – POs& PSOs mapping matrix (1-low, 2-medium, 3-high, 0-No correlation)

POs→ / COs ↓	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	3	3	1
CO2	3	3	2	3	3	3	3	2	2
CO3	3	2	2	3	2	3	3	3	2
CO4	3	1	2	3	3	3	3	3	2
Total	12	9	10	12	12	12	12	12	8
Average(C_{10})	3	2.2	2.5	3	3	3	3	3	2

IND -P2.1: Practical – III

Course Outcomes (COs)

CO1: Students developed for precise sample solution preparation and sample treatment before actual analysis.

CO2: Students can be able to perform the calculations and error analysis

CO3: Develop understanding of basic chemical processes and deciding methods of analysis.

CO4: Capability of performing measurements on basic analytical instruments (photometers, spectrometers, chromatographs, high end thermometers, refractometer, pH meter etc.)

(C_{11}) COs – POs & PSOs mapping matrix (1-Low, 2-Medium, 3-High, 0-No correlation)

PO→ CO↓	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	3	3	2	3	3	2	3	3
CO2	2	3	3	2	3	3	3	3	3
CO3	2	2	2	2	3	3	2	3	3
CO4	2	3	3	2	3	3	2	3	3
Total	8	11	11	8	12	12	9	12	12
Average(C_{11})	2	3	3	2	3	3	2.2	3	3

IND-P2.2: Practical – IV

Course Outcomes (COs)

CO1: Students can be able to prepare various concentration solutions like molar, normal, ppm.

CO2: Determine the unknown concentration and thermodynamic parameters using conductometer

CO3: Student will explore how to estimate order of reaction and the catalysis

CO4: students can estimate refractive index and molecular weights of species.

CO5: Students can understand the estimation of equilibrium properties like redox potential, phase diagram etc

(C_{12}) Cos – Pos & PSOs mapping matrix (1-Low, 2-Medium, 3-High, 0-No correlation)

PO→ CO↓	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3

CO1	2	3	3	2	3	3	2	3	3
CO2	2	3	3	2	3	3	3	3	3
CO3	2	2	2	2	3	3	1	3	3
CO4	2	3	3	2	3	3	2	3	3
CO5	2	2	2	2	2	2	2	2	1
Total	10	13	13	10	14	14	10	14	13
Average(C_{12})	2	2.6	2.6	2	2.8	2.8	2	2.8	2.6

M.Sc. Part II, Semester III, Industrial Chemistry

Total credits = 12 (Core Papers) + 4 (Elective Paper) + 08 Practical = 24

No	Course Code		Title of the paper	Hours	Lecture (Per week)	Credits
1	IND-3.1	Core	Organic Chemical Industries-I	60	4	4
2	IND-3.2	Core	Inorganic Chemical Industries-I	60	4	4
3	IND-3.3	Core	Methods of Analysis in Industries	60	4	4
4	IND-E01	Elective	General Chemical Technology	60	4	4
5	IND-P3.1	Core	Practical V	60	-	4
6	IND-P3.2	Core	Practical VI	60	-	4

Course Outcomes:

IND-3.1: Organic Chemical Industries-I

CO1	Students will be able to ---------- Study the manufacturing process of dyes, pigments and intermediates
CO2	Gain basic idea regarding the food processing and importance of food additives in several industries
CO3	Learn the manufacturing of acetic acid, oxalic acid, citric acid, anhydrous alcohol from sugar cane molasses and its mechanism
CO4	Usages of organic chemicals for the synthesis of various essential oils, soaps, detergents, paints and varnishes

(C_{13}): Organic Chemical Industries-I

PO → CO↓	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**
CO1	1	2	3	1	2	3	2	3	1
CO2	3	2	3	2	2	3	2	3	2
CO3	2	3	2	2	3	2	2	2	1
CO4	2	2	3	1	2	2	1	3	2
Total	**8**	**9**	**11**	**6**	**9**	**10**	**7**	**11**	**6**
Average (C_{13})	**2.00**	**2.25**	**2.75**	**1.50**	**2.25**	**2.50**	**1.75**	**2.75**	**1.50**

IND- 3.2: Inorganic Chemical Industries-I

CO1	Students will be able to ---------- Know the different types of milk, milk products, and milk processing methods
CO2	Get the essential knowledge of chemistry which they utilize in cosmetic and perfume industries
CO3	Grab basic concept of nanomaterials and its potential applications in various industries
CO4	Expose various emerging new area of nanoparticles synthesis and its various applications in agriculture and biofertilizers

(C_{14}): Inorganic Chemical Industries-I

PO → CO↓	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3	2	1	3	3	3	2
CO2	2	3	2	2	2	2	2	3	3
CO3	2	1	3	3	2	1	2	3	2
CO4	3	2	2	3	2	2	3	3	2
Total	**10**	**8**	**10**	**10**	**7**	**8**	**10**	**12**	**9**
Average (C_{14})	**2.50**	**2.00**	**2.50**	**2.50**	**1.75**	**2.00**	**2.50**	**3.00**	**2.25**

IND-3.3: Methods of Analysis in Industries

CO1	Students will be able to ---------- Know the basic principles of different voltammetric techniques employed for sample analysis
CO2	nvestigate and determine the structure of typical organic chemical compounds using suitable nuclear magnetic resonance spectroscopy
CO3	Learn the theory behind surface chemical analysis using various tools, like XPS, ion scattering, secondary ion mass, Auger electron, and electron spectroscopy
CO4	Get emerging techniques like Bomb, Boy's calorimeter for the analysis of various fuels

(C_{15}): Methods of Analysis in Industries

PO → CO↓	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	2	1	3	3	2	3	2	2
CO2	3	2	3	2	2	3	3	3	2
CO3	3	1	2	2	2	3	3	3	2
CO4	1	2	1	1	2	1	3	3	2
Total	**9**	**7**	**7**	**8**	**9**	**9**	**12**	**11**	**8**
Average (C_{15})	**2.25**	**1.75**	**1.75**	**2.00**	**2.25**	**2.25**	**3.00**	**2.75**	**2.00**

IND-E01: General Chemical Technology

CO1	Students will be able to ---------- Know the various kinds of reactors and its chemical composition
CO2	Elucidate the nitration, sulphonation, amination reactions with its suitable mechanism
CO3	Explain the mechanism as well as kinetics of halogenation and oxidation reactions
CO4	Elucidate the esterification reactions with its suitable mechanism

(C_{16}): General Chemical Technology

PO → CO↓	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	2	2	1	3	1	1	2	2	1
CO2	1	2	2	3	2	3	1	3	2
CO3	2	3	2	2	2	2	2	2	1
CO4	2	2	2	2	1	3	2	3	1
Total	**7**	**9**	**7**	**10**	**6**	**9**	**7**	**10**	**5**
Average (C_{16})	**1.75**	**2.25**	**1.75**	**2.50**	**1.50**	**2.25**	**1.75**	**2.50**	**1.25**

IND-P3.1: Practical V

CO1	Students can be able to ---------- Learn how to use hazardous and non hazardous chemicals and safety precautions and practical skills for analysing materials using modern analytical methods and instruments
CO2	Quantitatively preparation of organic compounds as well as their derivatives and estimation of various compounds
CO3	Estimate various metal ions present in alloys by volumetric, colorimetric or

	gravimetric methods
CO4	Handle various instruments such as conductometer, potentiometer, pH meter, spectrophotometer, and polarimeter

(C_{17}): Practical V

PO → CO↓	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1	2	3	3	3	2	2
CO2	3	2	2	2	3	3	3	3	1
CO3	3	2	1	2	2	2	3	3	2
CO4	3	1	1	3	3	3	3	3	2
Total	**12**	**7**	**5**	**9**	**11**	**11**	**12**	**11**	**7**
Average (C_{17})	**3.00**	**1.75**	**1.25**	**2.25**	**2.75**	**2.75**	**3.00**	**2.75**	**1.75**

IND-P3.2: Practical VI

CO1	Students can be able to ---------- Learn how to use hazardous and non hazardous chemicals and safety precautions and practical skills for analysing materials using modern analytical methods and instruments
CO2	Quantitatively preparation of organic compounds as well as their derivatives and estimation of various compounds
CO3	Estimate various metal ions present in alloys by volumetric, colorimetric or gravimetric methods
CO4	Handle various instruments such as conductometer, potentiometer, pH meter, spectrophotometer, and polarimeter

(C_{18}): Practical VI

PO → CO↓	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1	2	3	3	3	2	2
CO2	3	2	2	2	3	3	3	3	1
CO3	3	2	1	2	2	2	3	3	2
CO4	3	1	1	3	3	3	3	3	2
Total	**12**	**7**	**5**	**9**	**11**	**11**	**12**	**11**	**7**
Average (C_{18})	**3.00**	**1.75**	**1.25**	**2.25**	**2.75**	**2.75**	**3.00**	**2.75**	**1.75**

M.Sc. Part II, Semester IV, Industrial Chemistry

Total credits = 12 (Core Papers) + 4 (Elective Paper) + 08 Practical = 24

No	Paper Code		Title of the paper	Hours	Lecture (Per week)	Credits
1	IND-4.1	Core	Drug and Pharmaceuticals	60	4	4
2	IND-4.2	Core	Inorganic Chemical Industries-II	60	4	4
3	IND-4.3	Core	Selected Topics in Industrial Chemistry	60	4	4
4	IND-E04	Elective	Environmental Chemistry	60	4	4
5	IND-P4.1	Core	Practical VII	60	-	4
6	IND-P4.2	Core	Practical VIII	60	-	4

Includes 50 Marks for Project

IND-4.1: Drugs and Pharmaceuticals

CO1	Students will be able to ---------- Study the different kinds of drug synthesis, classifications and their applications in medicinal fields
CO2	Explain how the anti-leprosy and sulpha drugs acts on infectious diseases
CO3	Obtain the knowledge related to different types of cancers with causes of cancer and therapy on it
CO4	Details mechanism of cancer therapy, antineoplastic drugs, anti-AIDS, cardiovascular and anti-diabetic drugs.

(C_{19}): Drugs and Pharmaceuticals

PO → CO↓	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3	3	2	1	2	3	3
CO2	2	3	2	2	3	2	3	3	2
CO3	2	2	3	2	2	2	3	3	2
CO4	2	2	2	3	2	2	3	3	1
Total	**9**	**9**	**10**	**10**	**9**	**7**	**11**	**12**	**8**
Average (C_{19})	**2.25**	**2.25**	**2.50**	**2.50**	**2.25**	**1.75**	**2.75**	**3.00**	**2.00**

IND-4.2: Inorganic Chemical Industries-II

CO1	Students will be able to ---------- Understand the detail information of the processing and applications of several

	minerals
CO2	Gain information about metal finishing technology, cladding, and products of chloralkli industries
CO3	Pointed out various applications of inorganic compounds in pharmaceutical chemistry
CO4	Explain manufacturing and industrial uses of H_2, O_2, N_2, CO_2& acetylene

(C_{20}): Inorganic Chemical Industries-II

PO → CO↓	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**
CO1	1	2	1	2	1	2	2	3	1
CO2	2	2	2	3	1	1	2	3	2
CO3	2	2	3	2	2	2	2	3	2
CO4	3	3	2	3	1	2	3	2	2
Total	**8**	**9**	**8**	**10**	**5**	**7**	**9**	**11**	**7**
Average (C_{20})	**2.00**	**2.25**	**2.00**	**2.50**	**1.25**	**1.75**	**2.25**	**2.75**	**1.75**

IND-4.3: Selected Topics in Industrial Chemistry

CO1	Students will be able to ---------- How to prepare various commercial industrial polymers such as HDP, LDP, PET, SBR, and PVC
CO2	Brief description of corrosion science and prevention methods of corrosion
CO3	Explain the mechanical and rheology properties of synthetic and natural polymers using different models
CO4	Get information about introduction, classification and applications of sensor technology

(C_{21}): Selected Topics in Industrial Chemistry

PO → CO↓	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	3	3	3	3	3
CO2	2	3	2	3	3	3	2	3	3
CO3	1	2	1	1	2	2	1	3	2
CO4	1	0	2	2	1	2	2	3	2
Total	**7**	**8**	**8**	**9**	**9**	**10**	**8**	**12**	**10**

Average (C_{21})	**1.75**	**2.00**	**2.00**	**2.25**	**2.25**	**2.50**	**2.00**	**3.00**	**2.50**

IND-E04: Environmental Chemistry

CO1	Students will be able to ---------- Get brief knowledge of conservation of water resources, water harvesting, water quality management, and waste water treatment
CO2	Know the idea about sources as well as effects of soil pollution and its control
CO3	Get brief knowledge of effects of air and noise pollution
CO4	Acquire the better information regarding removal of heavy various size, shape and mass based metals from different kinds of wastewater.

(C_{22}): Environmental Chemistry

PO → CO↓	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PSO1**	**PSO2**	**PSO3**
CO1	2	3	2	1	3	2	1	2	1
CO2	2	3	3	2	2	2	2	3	2
CO3	3	3	3	1	2	2	1	2	1
CO4	2	3	2	1	2	2	2	2	1
Total	**9**	**12**	**10**	**5**	**9**	**8**	**6**	**9**	**5**
Average (C_{22})	**2.25**	**3.00**	**2.50**	**1.25**	**2.25**	**2.00**	**1.50**	**2.25**	**1.25**

IND-P4.1: Practical-VII

CO1	Students can be able to ---------- Engage in problem solving by practical planning, performing experiments, interpreting data in different sectors
CO2	Acquire the knowledge of preparation of organic compounds as well as their derivatives and estimation of various compounds
CO3	Achieve the skills required to analyze the metal ions from ores and alloys by gravimetrically, complexometrically, iodometrically and volumetrically
CO4	Determine the dissociation constant, isoelectric point, critical micelle concentration, solubility, stability constant, and unknown concentration of various compounds using different instruments

(C_{23}): Practical-VII

PO → CO↓	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	1	2	1	2	2	3	3	3	2
CO2	3	2	3	2	3	3	2	3	2
CO3	2	3	1	2	1	1	3	3	2
CO4	3	1	1	3	3	3	2	3	2
Total	**9**	**8**	**6**	**9**	**9**	**10**	**10**	**12**	**8**
Average (C_{23})	**2.25**	**2.00**	**1.50**	**2.25**	**2.25**	**2.50**	**2.50**	**3.00**	**2.00**

IND-P4.1: Practical-VIII

CO1	Students can be able to ---------- Engage in problem solving by practical planning, performing experiments, interpreting data in different sectors
CO2	Acquire the knowledge of preparation of organic compounds as well as their derivatives and estimation of various compounds
CO3	Achieve the skills required to analyze the metal ions from ores and alloys by gravimetrically, complexometrically, iodometrically and volumetrically
CO4	Determine the dissociation constant, isoelectric point, critical micelle concentration, solubility, stability constant, and unknown concentration of various compounds using different instruments

(C_{24}): Practical-VIII

PO → CO↓	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
CO1	1	2	1	2	2	3	3	3	2
CO2	3	2	3	2	3	3	2	3	2
CO3	2	3	1	2	1	1	3	3	2
CO4	3	1	1	3	3	3	2	3	2
Total	**9**	**8**	**6**	**9**	**9**	**10**	**10**	**12**	**8**
Average (C_{24})	**2.25**	**2.00**	**1.50**	**2.25**	**2.25**	**2.50**	**2.50**	**3.00**	**2.00**

Course Articulation Matrix

Cos-Pos & PSOs mapping matrix (1-low, 2-medium, 3-high, 0-No correlation)

PO → CO↓	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
C_1	Inorganic Chemistry-I	2.8	2.2	3.0	1.8	2.0	2.2	3.0	2.0	2.2
C_2	Organic Chemistry-I	3.0	2.2	2.5	3.0	3.0	3.0	3.0	3.0	2.0
C_3	Physical Chemistry-I	2.9	2.5	1.0	3.0	2.9	2.2	1.5	1.9	2.6
C_4	Analytical Chemistry-I	3.0	2.2	2.5	3.0	3.0	3.0	3.0	3.0	2.0
C_5	Practical-I	2.0	3.0	3.0	2.0	3.0	3.0	2.0	3.0	3.0
C_6	Practical-II	2.0	2.6	2.6	1.8	2.8	2.6	2.0	2.8	2.6
C_7	Inorganic Chemistry-II	3.0	2.0	3.0	3.0	3.0	3.0	2.0	2.0	3.0
C_8	Organic Chemistry-II	3.0	2.2	2.2	3.0	3.0	3.0	3.0	2.7	1.7
C_9	Physical Chemistry-II	2.7	2.7	1.2	2.9	2.6	1.9	2.2	1.5	2.5
C_{10}	Analytical Chemistry-II	3.0	2.2	2.5	3.0	3.0	3.0	3.0	3.0	2.0
C_{11}	Practical-III	2.0	3.0	3.0	2.0	3.0	3.0	2.2	3.0	3.0
C_{12}	Practical-IV	2.0	2.6	2.6	2.0	2.8	2.8	2.0	2.8	2.6
C_{13}	Organic Chemical Industries-I	2.00	2.25	2.75	1.50	2.25	2.50	1.75	2.75	1.50
C_{14}	Inorganic Chemical Industries-I	2.50	2.00	2.50	2.50	1.75	2.00	2.50	3.00	2.25
C_{15}	Methods of Analysis in Industries	2.25	1.75	1.75	2.00	2.25	2.25	3.00	2.75	2.00
C_{16}	General Chemical Technology	1.75	2.25	1.75	2.50	1.50	2.25	1.75	2.50	1.25
C_{17}	Practical V	3.00	1.75	1.25	2.25	2.75	2.75	3.00	2.75	1.75
C_{18}	Practical VI	3.00	1.75	1.25	2.25	2.75	2.75	3.00	2.75	1.75
C_{19}	Drugs and Pharmaceuticals	2.25	2.25	2.50	2.50	2.25	1.75	2.75	3.00	2.00
C_{20}	Inorganic Chemical Industries-II	2.00	2.25	2.00	2.50	1.25	1.75	2.25	2.75	1.75
C_{21}	Selected Topics in Industrial Chemistry	1.75	2.00	2.00	2.25	2.25	2.50	2.00	3.00	2.50
C_{22}	Environmental Chemistry	2.25	3.00	2.50	1.25	2.25	2.00	1.50	2.25	1.25
C_{23}	Practical VII	2.25	2.00	1.50	2.25	2.25	2.50	2.50	3.00	2.00
C_{24}	Practical VIII	2.25	2.00	1.50	2.25	2.25	2.50	2.50	3.00	2.00

SHIVAJI UNIVERSITY, KOLHAPUR

Accredited By NAAC
Syllabus for
Master of Science in Industrial Chemistry (Part II)
(Choice Based Credit System)
(Subject to the modifications to be made from time to time)

Syllabus to be implemented from June 2020 onwards

June: 2020

SHIVAJI UNIVERSITY, KOLHAPUR

DEPARTMENT OF INDUSTRIAL CHEMISTRY

M.Sc. COURSE IN "INDUSTRIAL CHEMISTRY"

CONTENTS

1. About the Course: The Indian chemical industries occupy a unique position in the Indian economy interms of contribution to employment and export potential. In spite of a strong natural resource based India's share in the global market is meager one. The experts in Industrial Chemistry have emphasized the need for capital infusion capacity,

modernization and up gradation in various segments of industrial processes to bring about efficiencies and economies of scale in order to achieve in global markets. Keeping in view the need of Indian industries, Shivaji University has started M.Sc. course in Industrial Chemistry from academic year 1993-1994 in the Chemistry. Department to educate and train the science graduates in industrial chemistry to serve the industrial sector as a technical, R & D personnel and quality control production personnel to manage the industrial production and contribute to the development ofnation.

One of the objectives of the M.Sc. Industrial Chemistry Course is to attain new heights in industrial teaching and research and to provide trained man power to vast developing Indian industries to develop the young graduate as a premier precision tool for future creation.

M.Sc. course in industrial chemistry is a potential base provided by the Shivaji University on the University campus to educate the students from rural area who will get employment on large scale in Indian Chemical industries. Since last twelve years, M.Sc. industrial chemistry students have obtained employment on large scale in Indian chemical industries.

2. Eligibility Criteria for Admission: Admission to the M.Sc. Industrial Chemistry course will be open to candidates passing B.Sc. degree of Shivaji University or any other statutory university in India or abroad with minimum 55% marks and Chemistry as a principal subject of study.

3. Selection Procedure: Selection will be based on common entrance test of Chemistry Department and personal interview. Maximum '30' candidates will be admitted to M.Sc. Industrial Chemistry.

4. Fee Structure for the Course: For the detailed fee structure, please see our web site – unishivaji.ac.in

5. Strength of the students:

For M. Sc. Industrial Chemistry Course

36(18 Open + 18 Reserve) + 4(Other University) = Total 40.

5.2. For elective courses for students of other than Departments: Minimum 10 students per course and maximum 20 students

6. Duration of the Course: The duration of the M.Sc. Industrial Chemistry course is – two years consisting of '4' semesters, each semester spanning for 6' months of minimum 120 working days.

7. Teaching facilities:

1. Co-ordinator01, Assistant Professor : 2 Teaching Assistant.: 02

2. Inter and intra faculty, contributory staff, professors, readers, lecturers, M. Tech., B. Tech. Industrial personnel etc. qualification of the teacher for M.Sc. Industrial Chemistry will be M.Sc., M.Sc., Ph.D., M. Tech., B. Tech.etc.

Scheme of Examination / Assessment with scheme of standard of passing. The structure of M.Sc. Industrial Chemistry consists of –

1) Theory course
2) Practical course
3) Seminars
4) Industrial training#.

Each semester will have theory examination of four papers of 100 marks each
(80 marks university examination + 20 marks internal.)

Each Semester will have two practical courses of 100 marks each

Semester-IV will have two practical courses out of which one practical course will have 50 marks project work.

#Industrial Tour is compulsory for Semester III and IV Students.

8. Choice Based Credit System of M.Sc. Industrial Chemistry

The newly designed choice-based M. Sc. Industrial Chemistry Course consists of total 96 credits. In order to accommodate the excellence achieved by the student in various activities like sports, National Service Scheme, National Cadet Corps and other activities, extra credits of maximum four will be given to the students. The student has to produce sufficient proof in the form of certificate by the competent authority to earn credits for other activities. The Scheme of number of credits given for other activities will be according to the Shivaji University procedure. The total credits that can be earned by a student will be 100 including the credit for other activities. The course consists of Core (Theory, Practical, Seminar and Project) and Elective courses for the third and fourth semester. The elective courses are also offered to the students of other science departments. The M. Sc. Industrial Chemistry consists of total four semesters and the courses offered in the first and second semester are compulsory for students seeking admission. The student admitted to M. Sc. Industrial Chemistry must chose three core courses of theory (of 12 credits), two core courses of practical (of 8 credits) and or Project (of 2 credits) of Industrial Chemistry offered in the third and fourth semesters. He/ she is allowed to choose either the elective theory course of Industrial Chemistry or of other Department of 4 credits under the Choice Based Credit System in each semester. The minimum credits to be obtained by the student to obtain Postgraduate degree in Industrial Chemistry in all the four semesters will be 35% of total marks in each course (Core, Elective, Practical and Project) separately equivalent of 34 credits except for the credit of other activities.

L= Lecture, T = Tutorial, P = Practical, C = Credits

All core courses for each semester are compulsory for M. Sc. Industrial Chemistry Students. The students are allowed to choose supportive courses from other departments as an alternative for Elective courses of third and fourth semesters.

Total Credits for M. Sc. Industrial Chemistry

A) Sem I (24) (16 T + 8 P) + Sem II (24) (16 T + 8 P) + Sem III (24) (16 T + 8 P) + Sem IV (24) (16 T + 8 P) = 96 (64 T + 32 P) + 4 credits for other activities like sports, N. S. S., N.C.C., etc. = **100 credits.**

Minimum credits to be chosen from Industrial

Chemistry B) Sem I (24) (16 T + 8 P) Sem II (24) (16 T + 8 P) Sem III (20) (12 T + 8 P) Sem IV (20) (12 T + 8 P) **Total = 88(56 T + 32 P)**

Maximum credits to be chosen from courses offered by other departments

C) Sem III (4T) + Sem IV (4T) =8T

D) Credits for Other Activities =4

So that B + C + D = A

Grades and average grade point calculation

Grade	Marks	Grade points
O	**70 and above**	**7**
A	**60 to 69.99**	**6**
B	**55 to 59.99**	**5**
C	**50 to 54.99**	**4**
D	**45 to 49.99**	**3**
E	**40 to 44.99**	**2**
F(Fail/ Unsatisfactory)	**39.99 and below**	**0**

i) Semester grade point average (SGPA): Semester wise index grade of a student SGPA = $(g_1 \times c_1) + (g_2 \times c_2) + \text{--}(g_6 \times c_6)$/ Total credits of a semester.

ii) Cumulative grade point average (CGPA): Cumulative index grade point average. CGPA = $(g_1 \times c_1) + (g_2 \times c_2) + (g_6 \times c_6)$/ Total credits of a student up to and including semester for which cumulative average is required.

iii) Final grade point average (FGPA): Final Index of astudent FGPA = $(\sum g_i \times c_i) / (nc_T)$

{g_i = grade point secured by the student, c_i = credit of the course, c_T = number of credits and n = total number of courses.}

Illustration with a hypothetical case.

For M.Sc. I, Semester I

Papers	**I**	**II**	**III**	**IV**				
practical's					**I**	**II**		
Credits	**4**	**4**	**4**	**4**	**4**	**4**	**24**	
Grade points secured	**7**	**6**	**8**	**6**	**7**	**7**	**41**	
$\sum g_i \times c_i$	**28**	**24**	**32**	**32**	**28**	**28**	**164**	
$\sum g_i \times c_i / c_T$	**(164 / 24) = 6.83**							
Overall grade	**6.83**							

The cumulative grade point average is the sum of SGPA of a student of each semester. Suppose it is 164 (6.83) for a semester I, 170(7.08) for semester II, 168(7.0) for semester III and 176(7.33) for semester IV then the CGPA for semester I and II will be = [164 + 170] / 48 = 6.958 = 6.96
The FGPA for all semesters will be = [164 + 170 + 168 + 176] / 96 = 7.0265 = 7.03

M.Sc. Part II, Semester III, Industrial Chemistry

Total credits = 16 Theory + 6 Practical + 2 Seminar = 24,
Minimum Credits to be chosen = 12 Theory + 08 Practical = 20Credits to be chosen from the elective courses of other departments =4

No	Paper Code		Title of the paper	Hours	L	T	P	C
1	IND 3.1	Core	Organic Chemical Industries-I	60	4	-	-	4
2	IND 3.2	Core	Inorganic Chemical Industries-I	60	4	-	-	4
3	IND 3.3	Core	Methods of Analysis in Industries	60	4	-	-	4
4	IND E01	Elective	General Chemical Technology	60	4	-	-	4
5	IND E02	Elective	Advanced Analytical Techniques in Industry	60	4	-	-	4
6	IND E03	Elective	Chemical Analysis in Agro, Food and Pharmaceutical Industry	60	4	-	-	4
5	IND P05	Core	Practical V	60			8	4
6	IND P06	Core	Practical VI	60			8	4

M.Sc. Part II, Semester IV, Industrial Chemistry

Total credits = 16 Theory + 8 Practical = 24,
Minimum Credits to be chosen = 12 Theory + 08 Practical = 20
Credits to be chosen from the elective courses of other departments = 4

M. Sc. Part II, Semester IV

No	Paper Code		Title of the paper	Hours	L	T	P	C
1	IND 4.1	Core	Drug and Pharmaceuticals	60	4	-	-	4
2	IND 4.2	Core	Inorganic Chemical Industries-II	60	4	-	-	4
3	IND 4.3	Core	Selected Topics in Industrial Chemistry	60	4	-	-	4
4	IND E04	Elective	Environmental Chemistry	60	4	-	-	4
5	IND E05	Elective	Pharmaceutical Chemistry	60	4	-	-	4
6	IND E06	Elective	Chemistry of Industrially Important Materials	60	4	-	-	4
5	IND P07	Core	Practical VII	45			8	3
6	IND P08	Core	Practical VIII	45			8	3

**Includes 50 Marks for Project

M.Sc. Part-II, Semester-III

Paper IND 3.1 Organic Chemical Industries – I

Unit – I: Dyes and Pigments: 15 Hrs

Dyes, Pigments and Intermediates: Classification of Dyes, Preparation of important dye intermediates, Methods of preparation of commercial dyes of different classes with suitable examples. Typical manufacturing processes of few dyes, Fluorescent brightening agents, and Special dyes: Photosensitive dyes, dyes as food additives, natural dyes.

Unit – II: Food Processing and food Additives 15 Hrs

Classification, chemical composition and nutritional value of common food stuffs, properties of foods, food preservation and processing, food deterioration, methods of preservation and processing by heat, cold, chill storage, deep freezing, drying, concentration, fermentation, and radiation. Permitted food additives and their role; antioxidants, coluring agents, sweetners

Unit – III: Cane Sugar Based Chemistry **15 Hrs**

Introduction, manufacturing processes of Acetic acid, oxalic acid, citric acid, acetic anhydride, furfural from bagasse, anhydrous alcohol, sugar based chemical industries in India. Preparation of organic jaggery, analysis of jaggery

Unit – IV: Soap and Detergents **15 Hrs**

Oils, soaps and Detergents: Refining of edible oils, Manufacturing of soaps, Detergents,Liquid Soaps, aptholmic solution. Manufacturing of glycerol from fatty acids, greases from fatty acids, turkey – red oil.

Paints: Introduction, properties, manufacture of paint and applications

Varnishes and Inks: Constitutions, examples of preparation and applications.

REFERENCE BOOKS

1. K. Venkatraman: The Chemistry of Synthetic Dyes Vol. 1-7 (A.P)
2. Abranart: Dyes and Their intermediates (Pergaman)
3. Beech: Fiber reactive Dyes (Logos Press)
4. Frig and David – Dyes intermediate
5. Allan: Color Chemistry
6. Kent: Riehels Industries Chemistry.
7. M Ash & I Ash: A formulary of paints & other coatings.
8. M Ash & I Ash: A formulary of cosmetic preparation (Godwin)
9. P.H. Groggings: Unit Processes in organic synthesis (MGH)
10. Kiik& other: Encyclopedia of Chemical technology.
11. L. W. Aurand, A. E. Woods, Food Chemistry, AVI Publishing Inc.
12. L. H. Mayer, Food Chemistry, Affiliated East-West Press Ltd., New Delhi.
13. N. Shakuntala Manay, M. Shadakhsara Swamy, Foods-Facts and Principles.
14. John M. deMan, Principles of Food Chemistry.
15. The Complete Book on Sugarcane Processing and By-Products of Molasses (with Analysis of Sugar, Syrup and Molasses) -H. Panda

Paper IND 3.2 Inorganic Chemical Industries – I

Unit –I: **15 Hrs**

Dairy Chemistry: Milk and milk products, composition and structure of milk, milk proteins, enzymes, vitamins, minerals, density and viscosity of milk, effect of heat on milk, milk processing, basic milk categories, butter, ghee and clarified butter.

Leather Chemistry: Introduction, constituents of animal skin, manufacture and preparation of hides, cleaning, soaking, limiting and degreasing, finishing and sharing, tanning; leather, vegetable, chrome, tanning effluents; pollution and control

Unit – II **15 Hrs**

Cosmetics and Perfumes

A general study including preparation and uses of the following: Hair dye, hair spray, Shampoo, Sun-tan lotions, face powder, lipsticks, talcum powder, nail enamel, creams (cold, vanishing and shaving creams), antiperspirants and artificial flavours. Water: Special consideration for cosmetics use.

Surfactants: Classification and application in cosmetics – Foaming agents, emulsifiers, and solubilizers. Classification and application in cosmetics Antioxidants, antimicrobial and chelating agents used as preservatives,. Factors affecting effectiveness of antimicrobial preservatives

Unit–III **15 Hrs**

Preparations and applications of Nano materials-Synthesis of nano materials via –gas phase and liquid phase methods, high energy ball milling metal-semiconductor-ceramics and composites- size dependent properties - uniqueness in these properties compared to bulk and microscopic solids– nanomaterials and nanostructures in nature,TiO_2,ZnO,ZrO_2 , Composites and their applications.

Unit – IV **15 Hrs**

Nanotechnology in Agriculture - Precision farming, Smart delivery system – Nanofertilizers: Nanourea and mixed fertilizers, Nanofertigation - Nanopesticides, Nanoseed Science,organic manures, micronutrients,biopestiside, biofertilizers and agrochemicals.

REFERENCE BOOKS

1. F A Henglein: Chemical Technology (pergamon)
2. R.W. Thomas and P. Farago: Industrial Chemistry (HEB)
3. E. Stocchi: Industrial Chemistry, Vol -I, Ellis Horwood Ltd. UK
4. P.C. Jain, M. Jain: Engineering Chemistry, Dhanpat Rai & Sons, Delhi
5. Introduction to Nanoscience and Nanotechnology, Gabor .L et al
6. Fundamentals of Nanotechnology, Hornyak, G. Louis, Tibbals, H. F., Dutta, Joydeep, CRC Press, 2009
7.Nanomaterials: An introduction to synthesis, properties and application, Dieter Vollath, WILE-VCH, 2008
8. Lynn J. Frewer, WillehmNorde, R. H. Fischer and W. H. Kampers, Nanotechnology in the Agri-food
sector, Wiley-VCH Verlag, (2011)
9. B.K. Sharma: Industrial Chemistry, Goel Publishing House, Meerut

Paper IND 3.3 Methods of Analysis in Industries

Unit – IVoltammetry Techniques: **15 Hrs**

Introduction, Modified polarographic techniques, stationary electrode polarography, sinusoidal alternate current polarography, rapid scan polarography, pulse polarography, square wave polarography, Cyclic voltammetry, stripping voltammetry, numerical.

Unit – IINMR Spectroscopy: **15 Hrs**

General introduction and definition; chemical shift; spin –spin interaction; shielding mechanism of measurement; chemical shift values and correlation for protons bonded to carbons [aliphatic; olefinic; aldehydic and aromatic] and other nuclei [alcohols; phenols; enols; acids; ammines; amides and mercapto]; chemical exchange; effect of deuteration; complex spin-spin interaction between two; three; four; and five nuclei [first order spectra]; virtual coupling. Stereochemistry; hindered rotation; Karplus curve variation of coupling constant with dihedral angle. Simplification, Simplification of complex spectra; nuclear magnetic double resonance; shift reagent; solvent effect. Fourier transform

technique; nuclear overhauser effect [NOE] Resonance of other nuclei – F & P.

Unit – III:Chemical Analysis of surfaces: 15 Hrs

Introduction to photoelectron spectroscopy, Ion Scattering Spectroscopy, Secondary Ion Mass Spectrometry, Auger Electron Spectroscopy, Electron Spectroscopy for Chemical Analysis. Basic principles, Instrumentation and applications of these techniques

Unit – IVGas and Fuel analysis: 15 Hrs.

Modern concept of fuels, classification of fuels, characteristics of good fuels, Orsat apparatus and its use in gas analysis, Instrumentation and working of bomb calorimetry, boy's calorimeter and numerical, coal analysis, calorific value of fuels, determination of calorific value of a solid or liquid fuel, Flash point, determination of flash point by Abel's method.

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REFERENCE BOOKS

1. F. J. Welder: standard Methods of chemical analysis Voil. III Part A&B
2. H.A. Strobel chemical instrumentation (AW)
3. Willard, Merrit& Dean, Instrumental Methods of analysis (FWAP)
4. F.D. Snell, Encyclopedia of Industrial: Chemical Inorganic analysis Vol. 1 to 20 (J.W)
5. Hillebrand, Lhundell and Hoffman: Applied inorganic analysis (Interscience)
6. D.K. Chakrabarty: Solid state Chemistry
7. H. Kaur, Instrumental method of analysis.
8. .V.M. Parikh, Application spectroscopy of organic molecules. (Mehata)
9. D.W. Williams and Flemming, Spectroscopic methods of organic compound
10. Silverstein and Basallar, Spectroscopic identification of organic compounds
11. V. M. Parikh Absorption Spectroscopy for Organic Molecules (J. Wiley)
12. P.S. Kalsi Spectroscope of organic compounds (New age publisher)
13. Jackman and Sterneil , Application of NMR spectroscopy
14. J.D. Roberts, Nuclear magnetic resonance (J. Wiley)
15. D.L.Pavia, G.M.Lampman and G.S.Kriz, Introduction to Spectroscopy.
16. Analytical Chemistry-Gurudeep R. Chatwal Edited by Madhu Arora, Himalaya publication.
17. Instrumental method of chemical analysis- H. Kaur , Pragati prakashan

Paper IND E01: General Chemical Technology

Unit-I 15 Hrs

Chemical reactors and Unit Processes:

Classification of chemical reactors, continuous reactor and batch reactor, chemical composition of reactor.

Nitration: Nitrating agents, Kinetics and mechanism of nitration of aromatic compounds, Nitration of paraffinic hydrocarbons, Nitrate esters, N-nitro compounds, Process equipment. Typical industrial manufacturing processes

Unit-II **15 Hrs**

Sulphonation: Sulphonating agents, Kinetics and mechanism. Desulphonation Workup Procedures, Industrial equipment and technique, Batch and continuous processes,

Amination by reduction and ammonolysis: Methods of reduction to give amino compounds, Aminating Agents, Manufacture of amino compounds by reduction as well as by Ammonolysis

Unit-III **15 Hrs**

Halogenation: Kinetics and mechanism. Survey of methods, Catalytic chlorination, photohalogenation, Manufacturing processes for chlorohenzene, Chlorinated methanes, monochloroacetic acid, chloral

Oxidation: Oxidising agents with typical applications of each, Liquid phase oxidation with oxidising compounds, Typical manufacturing processes.

Unit-IV **15Hrs**

Esterification: Kinetics and mechanism. Esterification of carboxylic acid derivatives, Esters by addition to unsaturated systems, Industrial esterifications, Ethyl acetate, butyl acetate, Vinyl acetate, methyl methacrylate.

Petrochemicals: petroleum refining, outline of chemicals derived from ethylene, xylene and naphalene

REFERENCE BOOKS

1. P. H. Groggins: Unit Processes in Organic Synthesis (MGH)
2. F. A. Henglein: Chemical Technology (Pergamon)
3. M. G. Rao and M. Sittings: Outlines of Chemical Technology (EWP)
4. Clausen, Mattson: Principles of Industrial Chemistry
5. H A. Lowenheim and M. K. Moran: Industrial Chemicals
6. Kirk and Othmer: Encyclopedia of Chemical technology.
7. Kent, Riegel's Industrial Chemistry (N-R).
8. S. D. Shukla and G. N. Pandey: A Textbook of Chemical Technology, Vol-II
9. J. K Stille: Industrial Organic Chemistry (P.I I.).
10. Chemical Reactor Design, Optimization, and Scaleup-E. Bruce Newman 2nd Edition

Paper- IND E02- Advanced Analytical Techniques in Industries

Basic theory, Instrumentation, Laboratory technique and Applications of following

methods

Unit – I **15 Hrs**

X – ray Methods: Diffraction, Fluorescence, absorption, & emission spectroscopy.

Unit – II **15 Hrs**

Thermoanalytical Methods: Thermogravimetric Analysis, Differential Thermal Analysis, Differential scanning calorimetry.

Unit – III **15 Hrs**

ElectroAnalytical Methods: Coulometry, Polarography, Amperometry, electrogravimetry.

Unit – IV **15 Hrs**

Radiochemical Methods of analysis: Radiation Dosimetry, Radiolysis of water, Free Radicals in Water Radiolysis, Radiolysis of some aqueous solutions, A time scale of Radiolytic Events Radiation-induced Color Centers in Crystals: Storing and release of Energy.

REFERENCE BOOKS

1. H J Arnikar: Essential of Nuclear Chemistry
2. R.D. Braum, Introduction to Instrumental Analysis.
3. Willard, Deritt, Dean and Settle, Instrumental methods of Analysis
4. G.W. Ewing, Instrumental Methods of Analysis 4th and 5th editions.
5. Chatawal and Anand, Instrumental Methods of Analysis.

Paper- IND E03- Chemical Analysis in Agro, Food and Pharmaceutical Industries.

Unit – I **15 Hrs**

Analysis of soil: Moister, pH, total nitrogen, phosphorous, silica, lime, Magnesia, Manganese, sulfur & alkali salts.

Fuel analysis: Solid, liquid and Gas, ultimate and proximate analysis heating values, grading of cool, liquid fuels, flasks points, aniline point, octane number and carbon residue, gaseous fuels – producer gas and water gas – calorific value.

Unit- II **15 Hrs**

Clinical Chemistry and drug analysis: Composition of blood collection, and preparation of samples, clinical analysis – serum electrolytes, blood glucose, blood urea nitrogen, uric acid, albumin, globulin, barbiturates, acidic and alkaline phosphates, Immunoassay, principals of radioimmunoassay and applications, The blood- gas analysis – trace elements in the body.

Drug analysis: Narcotics and dangerous drugs, classification of drugs, screening by gas m thin layer chromatography and spectrophotometric analysis.

Unit – III **15 Hrs**

Food analysis: Moister, ash, crude protein, fat, crud fiber, carbohydrate, calcium, potassium, sodium, and phosphates, food adulteration – common adulteration in food, contamination of food stuffs, microscopic examination of foods for adulterants, Pesticide analysis in food products, Bxdraction and purification of sample, HPLC, gas chromatography for organo – phosphates, thin layer chromatography for identification of chlorinated pesticides in food products

Unit –IV **15Hrs**

Fluorescence in Biological, Medical and Drug Development: Fluorescence instrumentation for analysis, flurophors and their modification, pH – indicators, membrane potential probes, lipid membrane protein, labeling of protein and DNA.

REFERENCE BOOKS

1. Fundamentals of analytical chemistry by D. A. Skoog , D. M. West and F. J. Honer, W. B. Saunders.
2. Chromic phenomenon, The Technological application of color chemistry Peter Bamfield .

M.Sc. Part-II, Semester – III (Practical V/VI)
Physical Chemistry Practical's

1. Conductometry
Determination of percentage of acetic acid in commercial vinegar solution
2. Fluorimetry
To determine the amount of riboflavin in given B-complex tablet
3. Latent Heat of fusion
To determine the latent heat of fusion of given solid
4. Polarography
To study the effect of Oxygen supporting electrolyte and maximum suppressor and determine the half wave potential of Cd/Zn in given solution by Half wave potential method. Differential method and half wave equation method.
5. Potentiometry
To determine the dissociation constant of dibasic acid by potentiometric method
6. pH – metry
To determine the dissociation constant of dibasic acid pH – metrically.
7. pH – metry
To determine pH value of various buffer using pH meter and determination of dissociation constant of acetic acid.
8. Spectrophotometry:
To determine pK value of phenolphthalein indicator by spectrophotometric method.
9. Spectrophotometry:
To study the stoichiometry and stability of ferric sulphate complex by Job's method and Mole ratio method.

Organic Chemistry practical's

1. Preparation of p – amino benzoic acid from p – toluidine
2. Preparation of NBS (N – bromo Succinimides)
3. Preparation of p – iodonitrobenzene
4. Estimation of cu from copper fungicide
5. Estimation of Endosulfan

Inorganic Chemistry practical's

Alloy Analysis
1. Chrome -steel alloy
Analyze the given sample of chrome - steel alloy & determine the percentage of
i) Chromium ------ Calorimetrically.
ii) Nickel-------Gravimetrically.
2. Determine the amount of copper and zinc from given sample of **brass alloy**
i) Copper, Volumetrically/ Gravimetrically. ii) Zinc, Gravimetrically
3. Cement analysis:
Analyze the given sample of cement for its following constituents. i) SiO_2 - Gravimetrically

ii) Calcium, Volumetrically
iii) Iron, Volumetrically
iv) Magnesium, Complexometrically
36
v) Aluminium, Gravimetrically.
4. Find out the percentage of available chlorine in the given sample of bleaching powder
5. Determine the percentage of calcium present in a given sample of plaster of Paris volumetrically.
6. Find out the amount of Iron present in a given sample of Sulpha - drug; calorimetrically.
7. Determine the percentage of phosphorus present in terms of $\mathbf{P_2O_5}$ from a given fertilizer sample volumetrically.

M.Sc. Part-II Sem-IV

Paper- IND 4.1- Drugs and Pharmaceuticals

Unit – I **15 hrs**

Drugs, Pharmaceuticals and Pharmaceuticals analysis:

Introduction & classification of thedrugs based upon theirmode of action, Q-SAR, Molecular docking, Manufacturing processes of few important drugs, Aspirin, Ibuprofen, Paracetamol etc.

Unit– II **15hrs**

Drugs Acting on infectious diseases:

Anthelmintic agents; synthesis of diethyl carbazine, niclosamide

Antitubercular drugs; synthesis of isoniazid, p-amino salicylic acid ethambutol and thioacetazone

Anti-leprosy drugs; synthesis of dapsone and clofazimine.

Sulpha drugs; classification, mode of action, synthesis of sulfadiazine, sulphaisoxazole, sulfadimethoxine.

Unit – III **15 hrs**

Cancer therapy: Types of cancers, Causes of cancer and therapy: surgery, radiation therapy, immunotherapy, chemotherapy, combination therapy, adjuvant therapy.

Antineoplastic drugs: Mercaptopurines,6-thioguanine, 5-flurouracil, allopurinol, methotrexate. Alkylating agents, effect of alkylating agents on DNA, DNA intercalating agents. Antimitotic agents and othertherapeutic agents.

Unit– IV **15 hrs**

a) Anti-AIDS:

Introduction& mechanism of HIV multiplication, Pathogenicity of HIV diagnosis, ELISA test, transmission and preventions of HIV, Anti-AIDS drugs

b) Cardiovascular drugs:

Introduction, synthesis of amyl nitrate, methyldopa, sorbitrate.

c) Anti-diabetic drugs:

Introduction, synthesis of sequence of A and B chain of insulin, Glibenclamide, metformin.

REFERENCE BOOKS

1. Burger: Medicinal Chemistry (I.W.)
2. W. O. Foye: Principle of Medicinal Chemistry (I.E)
3. Lendieer and Metscher: The Organic Chemistry of Drug Synthesis (I.W.)
4. Essentials of Medicinal Chemistry; Editors Korolkovas and J. H. Burkhaltar, John Wiley &Sons
5. Wilson and Gisvold: Text Book of Organic Medicinal and PharmaceuticalChemistry.
6 O. D. Tyagi: SyntheticDrugs.
7. Medicinal Chemistry G. R. Chatwal.
8. Principles of medicinal chemistry (4th edition) W.D. Foye, T.L. Lemke, and D. A. Williams.
9. Organic chemistry of drug action and design R. B. Siwerman
10. Synthetic Drug G. R. Chatwal.
11. Handbook of Industrial Chemicals (Vol.-I) K. M. Shah
12. Principles of Medicinal Chemistry Vol. I, S. S. Kadam and K.G.Bothara
13. A Text Book of Medicinal Chemistry P. Parimo

Paper- IND 4.2-Inorganic Chemical Industries –II

Unit – I **15 Hrs**

Metallurgy: Minerals in India, Mineral processing, Ellingham diagrams, manufacture and applications of metal alloys and salts, techniques for using low grade minerals. Iron and steel (Iron, Steel alloy, tool steel and stainless steel), Copper and its alloys, Zinc, Nickel and Aluminum.

Unit II **15 Hrs**

Metal finish technology: Electro refining of metals, electroplating of nickel, chromium, copper, cadmium, silver and Gold, surface treatment technology, surface coats. Introduction, Electrodeposition, electroplating (Factors affecting, requirements and applications), hot dipping, metal cladding, immersion plating, metal spraying, vapour deposition and chemical and organic coating.

Chloralkali Industries: Soda Ash, Caustic Soda, Chlorine

Unit III **15 Hrs**

Applications of Inorganic compounds in Pharmaceutical chemistry: Introduction, imprities in pharmaceutical substances and their limit test, antioxidants, gastrointestinal agents, topical agents, dental products, inhalants, expectorants, respiratory stimulants. Compounds of iron, iodine and calcium, antidotes in poisoning, pharmaceutical aids

Unit IV **15 Hrs**

Glass and Refractory materials: Raw materials, Soda glass, borosilicate glass, Lead Glass, Colored Glass, Refractory: Raw materials, clay pots, Zeolites.

Industrial Gases: Manufacture and industrial uses of H_2, O_2, N_2, CO_2 & acetylene. Liquefaction of gases, production of low temperatures,

Chemicals of Utility: Inorganic fine chemicals, magnesia, alumina, AlCl3, calcium carbonate, sodium silicate, MnO_2,$FeSO_4$,PbO_2,Na_2HPO_4 and NaOH.

REFERENCE BOOKS

1. Lowenheim F A (1974) Modern Electroplating III Ed Chapman & Hall, Landon.
2. Gable, D: Principal of metal Treatment and protection. Pergamon, Press Oxford (1978)
3. G.A. Keneth: Electroplating for Engineering's A Hand Book IIIrdEdn Van NastradReinbold Co London
4. F A Lowinbein: Modern Electroplating, Electroplating Publication New Jersey
5. Burke Progess in ceramic science Vol. IV
6. R.R.Iash: afromulary of paints and other coating Vol. I
7. J.D. Gilchrist: Extraction Metallurgy (Pergamon)
8. W.H. Dennis: Foundation of steel and iron Metallurgy (Elsevier)
9. S.D. Shukla & G N Pandey: A text book of chemical technology Vol. 1
10. F A. Henglein: Chemical Technology (Pergamon)

Paper IND 4.3 Selected Topics in Industrial Chemistry

Unit – I Polymer Preparation: 15 Hrs.

Polyethylene (HDPE, MDPE, LDPE, LLDPE, UHMWPE, chlorinated PE), Polypropylene (PP), Polyisobutylene (PIB)), Acrylics (PMMA & PAN) Polyvinyl (PVC, PVDC & CPVC), Polystyrene & copolymer (HIPS, SBR, SAN & ABS), Poly (vinyl acetate) , Poly ethylene terphalate,(PET) High temperature polymers, Bakelite and other polymers

Unit-II 15 Hrs

Science of corrosion and corrosion control: Introduction, economic aspects of corrosion, theories of corrosion, factors affecting corrosion, kinetics of corrosion, Evans diagram, thermodynamics of corrosion, Fourbaix diagram, corrosion testing techniques, Evaluation of corrosion effect: XRD, ESCA, FTIR surface techniques.

Corrosion Prevention: Corrosion inhibitors, protective coating, cathodic and anodic protection. Corrosion problem in India.

Unit – III 15 Hrs

Mechanical and Rheological Properties of polymers: Mechanical Properties, tensile strength, stress and strain curves, Maxwell voit model, Boltzmann superposition principle, Impact strength, compressive strength, ultimate polymer properties and structure relationship, Elastomers, Fibers, and Plastics. Rheological Equation of state (RES) fluid – ideal, non-Newtonian, viscous flow, viscoelastic behavior, creep, stress relaxation, dynamic mechanical behavior, Maxwells model, mechanical spectra.

Unit – IV 15 Hrs

Sensor Technology: Introduction, recent trends, classification of sensors, Elector analytical sensors, sensor, electrodes, Metal Membrane electrode sensors, Ionic Conductors, Thin film and thick Film Sensors, Nano - sensors, Application of sensors in Industry.

REFERENCE BOOKS

1. Adamson: Surface Chemistry
2. D.D. Deshpande: Polymer science
3. Bilmayer: Polymer Science
4. N.B.Hanny: Solid state chemistry
5. S. Glastone: Physical chemistry
6. J.O.M..Bokries& A.K.N. Reddy: Modern Electrochemistry Vol – I & II
7. J.D.Lee: Inorganic Chemistry.
8. N.N.Greenwood: Chemistry of Elements
9. D. Patranabis: Sensor and Tranducers.

IND EO4 Environmental Chemistry

Unit I:Water pollution and wastewater management 15 Hrs.

Introduction, use and conservation of water resources, water qualitymanagement, rainwater harvesting, water management in agriculture rain fed systems,irrigated systems, industries. Water pollution: Definition, types of water pollution (Physical,Chemical, biological and physiological), water pollutants.Ground water pollution and its protection, Surface, river, sea and lake water pollution,effect of excess nutrients and oil on water pollution, Sea water for agriculture, remedial measures for water pollution.

Industrial waste treatment: Characteristics and types of industrial waste, principles of industrial waste treatment and disposal, protection of biosphere and surface water form industrial pollution.

Unit 2 Soil Pollution **15 Hrs**

Introduction, industrial, agricultural, radioactive, sewage, domestic, chemical and metallic wastes, soil pollution by mining, by sediments and biological agents, Effect of heavy metals, diseases caused by soil pollution and impact of soil pollution on airquality

Control of soil pollution:

Control of sewage, domestic and industrial waste, eco-farming and ecotechnology, biotechnology, integrated nutrient, pest, genetic resource and water management, land use systems

Unit 3: Air pollution **15 Hrs**

Definition, composition and reactions occurring in atmosphere, Sources of air pollution, units of measuring air pollutants. Classification and effect of air pollution; oxides of nitrogen, Sulphur and carbon, Hydrocarbons, organic and inorganic particulates and ozone as pollutants, WHO Standards, Indoor air pollution, occupational air pollution, outdoor air pollution, Air pollution episodes; Bhopal gas, Seveso, Chernobyltragedies.

Noise pollution:

Sources of Noise, Units and Measurements of Noise, Characterization of Noise from Construction, Mining, Transportation and Industrial Activities, Airport Noise, Auditory Effects, Non-Auditory Effects, Control of Noise Pollution.

Unit 4: Removal of Heavy toxic metals: **15 Hrs**

Chromium, mercury, lead, cadmium, arsenic, analytical methods of determination of small amounts of metal pollutants, copper recovery, treatment of waste water to remove heavy metals, recovery techniques.

Polymer Recycling:

Environment and polymer industry, recycling of polymer wastes

Reference:

1. F. A. Henglein: Chemical safety Management andEngineering (Pergamon).
2. B. K. Sharma EnvironmentChemistry,
3. M. K. Hill; Understanding Environmental Pollution A Primer, Cambridge University Press,2004.
4. I. L. Pepper, C. P. Gerba, M. L. Brusseau, Environmental & PollutionScience, Elsevier,2006.
5. G. M. Masters, Introduction to Environmental Engineering and Science, Pearson, 2004.
6. Antony Milne, “Noise Pollution: Impact and Counter Measures”, David & Charles PLC, 1979.
7. Peterson And E.Gross Jr., “Hand Book Of Noise Measurement”, 5 Th Edition, 1963

Paper- IND E05-Pharmaceutical Chemistry

Unit – I **15 Hrs**

Drug Design: Development of new drugs, procedures followed in drug design, concepts of lead compound and lead modification, concepts of prodrugs and soft drugs, structure-activity relationship (SAR), factors affecting bioavtivity, resonance, inductive effect, isosterism, non-isosterism, special considerations. Theroies of drug activity: occupuancy theory, rate theory, induced fit theory. Quantiative structure activity relationship. History and development of QSAR. Concepts of drug receptors. Elementary treatment of drug receptor ionization constants, steric, Shelton and surface activity parameters and redox potentials. Free-Wilson analysis, Hansch analysis, relationships between Free-Wilson and Hansch analysis. LD-50, ED-50 (Mathematical derivations of equations excluded).

Unit – II **15 Hrs**

Pharmacokinetics: Introduction to drug absorption, disposition, elimination using pharmacokinetics, important pharmacokinetic parameters in defining drug disposition and in therapeutics. Mention of uses of pharmacokinetics in drug development process. Pharmacodynamics: Introduction, elementary treatment of enzyme stimulation, enzyme inhibition, sulphonamides, membrane active drugs, drug metabolism, xenobiotics, biotransformation, significance of drug metabolism in medicinal chemistry. Antineoplastic Agents: Introduction, cancer chemotherapy, special problems, role of alkylating agents and antimetabolites in treatment of cancer. Mention of carcinolytic antibiotics and mitotic inhibitors. Sysnthesis of mechlorethamine, cyclophophamide, melphalan, uracil, mustards, and 6- mercaptopurine. Recent development in cancer chemotherapy. Hormone and natural products.

Unit – III **15 Hrs**

Cardiovascular Drugs: Introduction, cardiovascular diseases, drug inhibitors of peripheral sympathetic function, central intervention of cardiovascular ooutput. Direct acting arteriolar dilators. Synthesis of amyl nitrate, sorbitrate, diltiazem, quinidine, verapamil, methyldopa, atenolol. Local Antiinfective Drugs: Introduction and general mode of action. Synthesis of sulphonamides, furazolidone, nalidixic acid, ciprofloxacin, norfloxacin, dapsone, amino salicylic acid, isoniazid, ehtionamide, ethambutal, fluconazole, griseofulvin, chlroquinprimoquin.

Unit – IV **15 Hrs**

Psychoactive Drugs- The Chemotherapy of Mind: Introduction, neurotransmitters, CNS depressants, general anaesthetics, mode of action of hypnotics, sedatives, anti-anxiety drugs, benzodiazipines, buspirone, neurochemistry, of mental diseases. Antipsychotic drugs-the neuroleptics, antidepressants, butyrophenones, serendipity and drug development, stereochemical aspects of psychotropic drugs. Synthesis of diazepam,

oxazepam, chlorazepam, alprazolam, phenytoin, ethosuximide, trimthadione, barbiturates, thiopental sodium, glutethimide. Antibiotics: Cell wall biosynthesis, inhibitors, β-lactum rings, antibiotics inhibiting protein synthesis. Synthesis of penicillin G, penicillin V, ampicillin, amoxicillin, chloramphenicol, Cephalosporin, tetracycline and streptomycin.

REFERENCE BOOKS:

1. Introduction to medicinal chemistry, A Gringuage, Wiley- VCH.
2. Wilson Gisvold's Text book of organic Medicinal and pharmaceutical Chemistry, Ed. Robert F.Dorge.
3. An introduction to drug design, S. S. Pandeya and J. R. Dimmock, New age International.
4. Burger's Medicinal Chemistry and Drug Discovery Volume 1 (Chap. 9 and Chap.14), Ed.M.E. Wolff, John Wiley.
5. Goodman and Gilman's Pharmacological Basis of Therapeutics, Mc Graw-Hill.
6. The organic Chemistry of Drug Design and drug action, R.B. Silverman, Academic press.
7. Strategies for Organic Drug synthesis and Design, D. Lednicer, John Wiley.

Paper- IND E06- Chemistry of Industrially Important Materials

Unit – I **15 Hrs**

Industrial Materials: Glasses, Ceramics, Composites and Nonmaterial'sGlasssy state, glass formers and glass modifiers, applications. Ceramic structures, mechanical properties, clay products. Refractories, characterizations, properties and applications. Microscopic composites; dispersion-strengthened and particle-reinforced fibre- reinforced composites, macroscopic composites. Nanocrystalline phase, preparation phase, preparation procedures, special properties, applications. Thin Films and Langmuir-Blodgett Films: Preparation techniques, evaporation/sputtering, chemical processes, MOCVD, sol- gel etc., Langmuir-Blodgett(LB) film, growth techniques, photolithography properties and applications of thin and L-B films. Liquid crystals: Mesomorphic behaviour, thermotropic liquid crystals, positional order, bond orientational order, nematic and smectic mesophases, smectic – nematic transition and clearing temperature-homeotropic, planer and schlieren textures, twisted nematics, chiral nematics, molecular arrangement in smectic A and smectic B phasesopoptical properties of liquid crystals, Dielectric susceptibility and dielectric constants. Lytropic phases and their description of ordering in liquid crystals.

Unit- II **15 Hrs**

Polymeric Materials: Moleculr shape, structure and configuration, crystallinity, stressstrain behaviour, thermal behaviour, polymer types and their applications, conducting and ferro-electric polymers. Ionic Conductors: Types of ionic conductors, mechanism of ionic conduction, interstitial jumps(Frenkel); vacancy mechanism, diffusion superionic conductors; phase transitions and mechanism of conduction in superionic conductors, examples and applications of ionic conductors.

Unit – III **15 Hrs**

High Tc Materials: Defect perovskites, high Tc superconductivity in cuprates, preparation and characterization of 1-2-3 and 2-1-4 materials, normal state properties; anisotropy; temperature dependence of electrical resistance; optical phonon modes, superconducting state; heat capacity; coherence length, elastic constants, position lifetimes, microwave absorption–pairing and multigap structure in high Tc materials, applications of high Tc materials.

Unit – IV **15 Hrs**

Materials for Solid State Devices: Rectifiers, transistors, capacitors-IV-V compounds, low-dimensional quantum structures; optical properties. Organic Solids, Fullerenes, Molecular Devices: Conducting organics, organic superconductors, magnetism in organic materials. Fullerenes-dopped, fullerenes as superconductors. Molecular rectifiers and transistors, artificial photosynthetic devices, optical storage memory and switches- sensors. Nonlinear optical materials; nonlinear optical effects, second and third order- molecular hyperpolarisability and second order electric susceptibility, materials for second and third harmonic generation.

REFERENCE BOOKS:

1. Solid State Physics, N.W.Ashcroft and N.D.Mermin,Saunders College.
2. Material Science and Engineering,AnIntroduction,W.D.Callister,Wiley.
3. Principles of the Solid State,H.V.Keer,Wiley Eastern.
4. Materials Science ,J.C.Anerson,K.D.Leaver,J.M.Alexander and R.D.Rawlings.ELBS.
5. Thermotropic Liquid crystals,Ed.,G.W.Gray,John Wiley.
6. Handbook of Liquid Crystals,Kelker and Hatz,Chemie Verlag.

M.Sc. Part-II, Semester – IV (Practical VII/VIII)
Physical Chemistry Practicals

1. Potentiometry: Todetermine Solubility of PbI2 with Ag/AgI electrode by using potentiometry.
2. Potentiometry:Todeterminethedissociationconstantoftribasicacid(H_3PO_4) potentimetrically
3. Conductometry: To determine the critical micelle concentration of sodium laurylsulphate in aqueous solution conductmetrically.
4. Fluorometry: To estimate the Quinine sulphate in given sample byFlurometry.
5. pH – metry: To determine hydrolysis constant of aniline hydrochloride by pHmetry
6. pH – metry: To determine isoelectronic point and dissociation constant of aminoacid (Glycine) by pHmetry
7. Spectrophotometry: To determine stability constant of Ferric thiocynate complex byFrank Ostwald methodspectrophotometrically
8. Polarography: To determine unknown concentrations of Cd^{+2} ionin given solution by standard additionmethod

Organic Chemistry Practicals

1. Identification and separation of ternary organic mixtures by physical and chemical methods.
2. Preparation of benzanilide from benzophenone by use of Beckmann'srearrangement
3. Preparation of p- Bromo aniline fromacetanilide
4. Estimation of Vit –C
5. Estimation Sulfur from SulfurFungicide
6. Preparation of Anthranilic acid
7. Preparation of p-iodoazobenzene.

Inorganic Chemistry Practicals

1. Analyse the given sample of Magnalium alloy, determine the percentageof,
   i) Aluminiumgravimetrically
   ii) Magnesiumcomplexometrically.
2. Analyse the given sample of pyrolusite ore, determine the percentage of, i) Silica gravimetrically.
   ii) Ironvolumetrically.
   iii) Manganesevolumetrically.
3. Analyse the given sample of Bronze metal alloy, determine the percentageof,
   i) Tin as tin oxide gravimetrically. ii) Lead as lead sulfategravimetrically.
   iii) Copper Iodometrically iv) Zinc complexometrically.
4. Find out the amount / percentage of **Iron** per gram of soap samplecolorimetrically
5. To prepare **potash alum** & find out the percentage of **Aluminium**in thealum.
6. Find out the percentage of '**Magnesium**' in a given sample of Talcumpowder complexometrically.
7. Determine the concentration in mg/lit of sulphate ion in the given sample of water nephelometrically.

Department of Industrial Chemistry
Prorgamme Outcome

The main objective of the course is to provide students with the general criteria useful for an industrial chemical process planning and with the fundamental concepts that must be taken into account in designing a plant. To this aim, some industrial chemical processes are described and analyzed in terms of thermodynamic and kinetic aspects and are also highlighted the most important technology. Problems associated with the cost, sustainability and safety of an industrial process are also discussed.

Shivaji University , Kolhapur

Industrial chemistry is the link between the research and industrial-scale chemical engineering.Industrial chemists make use of their broad understanding of chemistry and environmental sustainability in areas like pharmaceutical companies, polymer manufacturing, petrochemical processing, food science, and manufacturing industries.

Industrial chemists can be found in the most unexpected places. They could be challenging the norm at the cutting edge of research, or taking responsibility for successful operations of some of Australia's largest companies in the chemical industry. In a general sense, industrial chemists are involved in:

Safety and efficiency – industrial chemists are constantly striving to improve the safety and efficiency of making important chemicals and materials.

Product development and innovation – industrial chemists create new chemical 'recipes' that meet identified needs. They will scrutinise the chemical composition of substances and then study the chemical changes which occur under different conditions and apply this to their end result.

Process optimization – an industrial chemist plays a part in optimising production to produce large amounts of a substance as cheaply as possible – but, unlike with engineers, they do so by making the 'chemistry' better and more efficient.

Environmental monitoring and control – industrial chemists work on the management and control of the environment during industrial processes, to ensure everything is being done to minimise the impact and work towards a clean and safe future.

Production plant design - in the construction of a new production plant, industrial chemists work in teams with other engineers like chemical engineers or control engineers to ensure the optimal outcomes.

Ideas, design, testing – making a product as good as it can be

Industrial chemistry is part of the long chain in the design and manufacturing process. Industrial chemists deal with the ideas, the design, the testing, and prototyping of new industrial products. In order to design something entirely new to help solve the major problems of the world their essential skills are, in-depth knowledge and application of chemistry and creativity with chemicals.

Whereas a chemical engineer deals with the whole process of changing raw materials into a useful, marketable product, an industrial chemist would look specifically at the nitty gritty science stuff, scrutinising the chemical components and designing a 'method' for the product then work out the best way to make it. The industrial chemist precedes the chemical engineer in the process of bringing something to market.

Basically, if you want to know exactly where a product comes from, you should ask an industrial chemist.

Where do industrial chemists work?

Industrial chemists work in many different industries – including petrochemicals, polymers, plastics food, cosmetics, pharmaceuticals, minerals and new materials.

You could find an industrial chemist wearing a number of different career titles including, research scientist, development chemist, technical representative, plant manager, development chemist, production process manager, operations manager, fuel development chemist, research scientist, production process manager or operations manager. You might also find an industrial chemist working in marketing or management in the chemical industry.

Outcomes of Programme:

The Industrial Chemistry Department has also identified specific objectives and outcomes for both the Masters and Ph.D. Graduate programs.

M.S. in Industyrial Chemistry

1. Students should have an advanced level understanding of at least three of the following areas of Chemistry - Analytical, Inorganic, Organic, and Physical Chemistry. They should have a graduate level understanding of their major area(s) of research.

2. Students should broaden their professional foundations through activities such as teaching, internships, and fellowships

3. Students should be able to communicate scientific results in writing and in oral presentation.

4. Students should acquire the basic tools needed to carry out independent chemical research. Students should become proficient in their specialized area of chemistry and successfully complete an advanced research project.