

RAJA SHANKAR SHAH UNIVERSITY, CHHINDWARA (M.P.)

M.Sc. Industrial Chemistry

Session 2024-25 & Onwards

Semester - I											
Course Code	Papers	Title	Type	Theory Examination		Internal Assessment		Practical Examination			
				Max.	Mini	Max	Mini	Max	Mini		
MICH-101	I	Analytical Chemistry	Compulsory	40	14	10	4				
MICH-102	II	Organic Chemistry-I	Compulsory	40	14	10	4				
MICH-103	III	Physical Chemistry	Compulsory	40	14	10	4				
MICH-104(A)	IV	A. Paints & Pigments	Elective	40	14	10	4				
MICH-104(B)		B. Bio-Chemicals	Elective	40	14	10	4				
MICH-105	V	Laboratory-I	Compulsory								
MICH-106	VI	Laboratory-II	Compulsory					50	25		
MICH-107	VII	Assignment & Comprehensive viva-voce	Compulsory					50	25		
								Indian Knowledge System/ Personality Development/ Communication Skill/ Health, Fitness & Wellness/ Public Relation & Marketing Skill		50	25
Grand Total Maximum Marks 350											

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Approved

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RAJA SHANKAR SHAH UNIVERSITY, CHHINDWARA (M.P.)

M.Sc. Industrial Chemistry

Semester - I

Paper –I

MICH-101: ANALYTICAL CHEMISTRY

UNIT- I :-

Data Analysis

Types of errors, propagation of errors, accuracy and precision, significant figures, least square analysis, average, standard deviation, t test, standardization of analytical methods.

Titrimetric Methods of Analysis

General concept, stoichiometric calculations, acid-base titrations, titration curves, acid-base indicators, complexometric titration, metal ion indicator, precipitation titrations, adsorption indicators.

UNIT — II :-

Gravimetric Methods of Analysis

Principles of gravimetric analysis, formation and properties of precipitates, applications of gravimetric analysis.

Solvent Extraction

Theoretical principle, classification, factors favoring extraction, extraction equilibrium, instrumentation and application.

UNIT — III :-

Ion Exchange Chromatography

Theories, use of synthetic ion exchangers in separation, chelating ion exchange resins, liquid ion exchangers, experimental techniques and applications.

Separation Techniques

Classification of chromatographic techniques, difference between adsorption and partition chromatography, fundamentals of paper, thin layer, column and electrophoresis. Application of these techniques in qualitative and quantitative analysis.

UNIT — IV :-

Gas Chromatography

Gas solid chromatography (GSC): Principle, theory, instrumentation and applications
Gas liquid chromatography (GLC): Principle, theory, instrumentation, types of GLC columns and applications



HPLC

Principle, instrumentation, types of GLC columns and column materials, detector system, role of HPLC in qualitative and quantitative analysis, comparison of GC and HPLC.

UNIT — V :-

Nephelometry and Turbidimetry

Introduction, general principles, instrumentation and application.

Flame photometry

Introduction, theory, instrumentation, interferences and factors affecting flame photometry.

Atomic Absorption Spectroscopy

Theory of atomic absorption spectroscopy, instrumentation, application in quantitative analysis.

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RAJA SHANKAR SHAH UNIVERSITY, CHHINDWARA (M.P.)

M.Sc. Industrial Chemistry

Semester - I

Paper -II

MICH-102 : ORGANIC CHEMISTRY – I

UNIT – I :-

Reaction Mechanism

Structure and Reactivity: Type of mechanisms, type of reactions, thermodynamic and kinetic requirements, kinetic and thermodynamic control, Curtin — Hammett Principal. Potential energy diagrams, transition states and intermediates, methods of determining mechanism, isotope effects.

Generation, structure, stability and reactivity of carbocations, carbanions, free radicals, carbenes and nitrenes.

Effect of structure and reactivity — resonance and field effects, quantitative treatment. The Hammett equation and linear free energy relationships substituents and reaction constants. Taft equation.

UNIT – II :-

Aliphatic Electrophilic Substitution

Bimolecular mechanism — S_{E2} , S_{Ei} . The S_{E1} mechanism, electrophilic substitution accompanied by double bond shift. Effect of substrate leaving group and the solvent polarity on the reactivity.

Aromatic Electrophilic Substitution

The arenium ion mechanism, orientation and reactivity, energy profile diagram. Ipso attack.

UNIT – III :-

Aliphatic Nucleophilic Substitution

The S_{N2} , S_{N1} , mixed S_{N1} and S_{N2} and S_{Ni} mechanism. The neighbouring group participation of π and a bond. Reactivity effects of substrate structure, attacking nucleophile, leaving group and reaction medium, phase transfer catalysis and regioselectivity.

Aromatic Nucleophilic substitution

Mechanism, Effect of substrate structure, leaving group and attacking nucleophile.

UNIT – IV :-

Addition to carbon — carbon multiple bond

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Mechanistic and stereochemical aspects of addition reactions involving electrophiles, nucleophiles and free radicals, regio and chemoselectivity, orientation and reactivity. Hydrogenation of double and triple bonds, Hydrogenation of aromatic rings, Hydroboration.

Addition to Carbon — Hetero Multiple bond

Mechanism of metal hydride reduction of saturated and unsaturated carbonyl compounds, acids, esters and nitriles. Addition of Grignard reagents, organozinc and organolithium reagents to carbonyl compounds, Wittig reaction.

UNIT – V :-

Elimination Reactions

The E2, E1 and E1cB mechanism and their spectrum. Orientation of the double bond. Reactivity effect of substrate, structures, attacking base, the leaving group and the medium. Mechanism and orientation in Pyrolytic elimination.

Free Radical Reaction

Free radical substitution mechanism. Mechanism at an aromatic substrate, neighboring group assistance. Reactivity for aliphatic and aromatic substrates. The effect of solvent on reactivity. Allylic halogenation (NBS), Oxidation of aldehydes to carboxylic acid, auto oxidation. Sandmeyer's reaction, Hunsdiecker reaction.

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M.Sc. Industrial Chemistry

Semester – I

Paper –III

MICH-103 : PHYSICAL CHEMISTRY

UNIT – I :-

Surface Chemistry and Interfacial Phenomenon

Adsorption isotherm, estimation of surface area (BET), surface films of liquids, Sols, Gels, Emulsions, Microemulsions, Micelles, (CMC); factors affecting CMC, counter ion binding to micelles, aerosols, effect of surfactants, Hydrotropes.

UNIT – II :-

Catalysis

Introduction, types — homogeneous and heterogeneous, basic principles, mechanism, factor affecting the performance, introduction to phase transfer catalysis, Enzyme catalyzed, Micelle catalyzed reaction — rate model, industrially important reactions.

UNIT – III :-

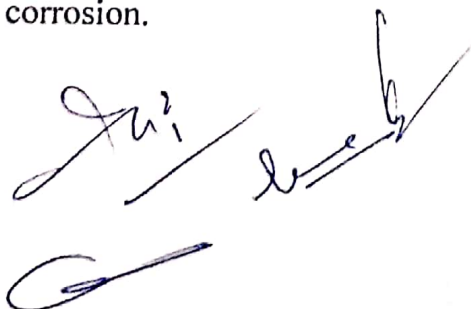
Kinetics

Method of determining rate laws, collision theory, ionic reactions, kinetic salt effects, steady state kinetics, kinetic and thermodynamic control of reactions, treatment of unimolecular reactions. Dynamic chain reaction (hydrogen bromine), photochemical reaction (hydrogen — bromine reaction), kinetics of enzyme-catalyzed reactions, study of fast reactions (stop flow method, relaxation method, flash photolysis, NMR method). Application of kinetics in finding out optimum conditions for different reaction.

UNIT – IV :-

Electro Chemistry

Standard electrode potential, galvanic series, galvanic cells, concentration cells, polarization, corrosion, classification, corrosion reactions, factors affecting corrosion, protection from corrosion.



Electroplating, applications of electroplating, mechanical preparation of surfaces, cleaning, rinsing, electroplating equipment and operating conditions, characteristics of electroplating wastes.

UNIT – V :-

Ionic Equilibria

The Ostwald's Dilution Law: concept of acids and bases; hard soft acids and basis; ionization constants of acids and bases; ionization of water (ionic product of water); the pH scale, common ion effect, buffer solutions, hydrolysis; Hydrogen ions (acid base) indicators; complex ion equilibria. The solubility product.

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RAJA SHANKAR SHAH UNIVERSITY, CHHINDWARA (M.P.)

M.Sc. Industrial Chemistry

Semester - I

Paper -IV (A),

MICH-104(A) : PAINTS AND PIGMENTS

UNIT – I :-**Pigments**

General characteristics of pigments, Types of pigments, Blue pigments, Red pigments, Yellow pigments, Green pigments and Black pigments, General properties and methods of preparations of white pigments.

UNIT – II :-**Dyes**

Introduction, General characteristics, colour and constitution, Basic operations in Dying Classification of dyes according to their mode of application and based on chemical constitution. Some commercial dyes viz. Azo dyes, Acid dyes, stilbeneazo dyes, Basic dyes, Indigo dyes, Reactive dyes, Disperse dyes.

UNIT- III :-**Printing Inks**

Introduction, properties and uses of printing inks, Raw materials used in printing inks, Types of printing inks, Lithographic, Gravure, Flexographic and Screen inks, General process of manufacture of printing inks.

UNIT – IV :-**Paints and Varnishes**

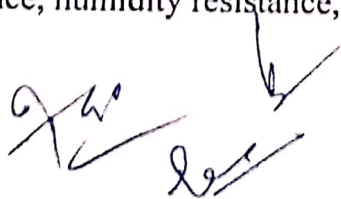
General characteristics of paint, varnishes and lacquers, their function, manufacture and classification. General account of enamel, emulsion paints, water based paints and japans.

UNIT –V :-**Paint & Varnish Formulations**

Function of vehicle, solvent, thinner, pigment, dyes, filler, resins, drier, insecticides and additives in paint formulations.

Testing of formulations/paints

Viscosity, brush ability, color measurement, color matching, light fastness, opacity, drying time, adhesion, elasticity hardness, gloss, film thickness, wet and dry, fineness of grind, water resistance, humidity resistance, salt spray resistance, durability, weather meters.



RAJA SHANKAR SHAH UNIVERSITY, CHHINDWARA (M.P.)

M.Sc. Industrial Chemistry

Semester – I

Paper - V

MICH-105 : Laboratory-I

General experiments (Minor)	1	To prepare molar and normal solutions.
	2	To prepare percent solution of given compound.
	3	To determine the strength of given solution of NaOH with N/10 oxalic acid.
	4	Determination of total acidity of given sample of water.
	5	Determination of total alkalinity of given sample of water.
	6	Determination of free CO ₂ in a given sample of water.
	7	To determine total hardness of given H ₂ O sample by complexometric method.
Volumetric analysis (Major)	8	To standardize NaOH solution using oxalic acid solution and determine the strength of given HCl solution with standard NaOH solution.
	9	To determine the strength of given K ₂ Cr ₂ O ₇ solution with N/10 sodium thiosulfate solution.
	10	Find out volumetrically the amount/lit. of FeSO ₄ (NH ₄)SO ₄ .6H ₂ O present in solution acidified with H ₂ SO ₄ .
	11	Determination of Temporary and Permanent Hardness of given sample of water.
	12	To determine the Ca ²⁺ and Mg ²⁺ hardness of given water sample.
	13	To determine the strength of a given CuSO ₄ solution with N/20 sodium thiosulphate solution.
	14	Determination of chloride content of a water sample by Mohr's method.

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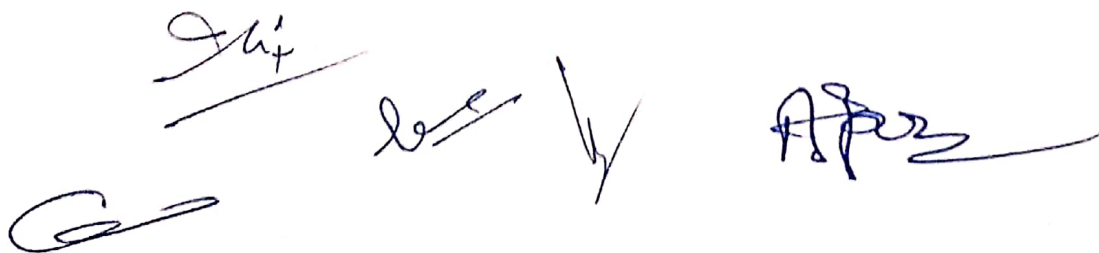
M.Sc. Industrial Chemistry

Semester – I

Paper- VI

MICH-106 : Laboratory-II

General experiments	1	Purification and distillation of tap water.
	2	To determine the moisture content of a given sample by oven heating method.
	3	Preparation of rose water by simple distillation.
	4	Preparation of urea formaldehyde resin.
	5	Preparation of phenol formaldehyde resin.
	6	Determine the degree of hydrolysis and hydrolysis constant of CH_3COONa .
	7	To determine the total alkalinity in a given sample of water using std. sulphuric acid.
	8	To determine the adsorption isotherm of acetic acid by activated charcoal.
Chromatography	9	To separate the given amino acid mixture by paper chromatography.
	10	To separate the given sugar mixture by paper chromatography



RAJA SHANKAR SHAH UNIVERSITY, CHHINDWARA (M.P.)

M.Sc. Industrial Chemistry

Semester – I

Paper- VII

MICH-107 : Assignment & Comprehensive viva-voce

- Indian Knowledge System/
- Personality Development/
- Communication Skill/
- Health, Fitness & Wellness/
- Public Relation & Marketing Skill

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