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

M.Sc. Industrial Chemistry

Session 2025-26 & Onwards

Semester - III									
Course Code	**Papers**	**Title**	**Type**	**Theory Examination**		**Internal Assessment**		**Practical Examination**	
				Max.	Mini	Max	Mini	Max	Mini
MICH-301	I	Spectroscopy	Compulsory	40	14	10	4		
MICH-302	II	Organic Chemistry-III	Compulsory	40	14	10	4		
MICH-303(A)	III	A. Pesticide Chemistry	Elective	40	14	10	4		
MICH-303(B)		B. Pharmaceutics	Elective	40	14	10	4		
MICH-304(A)	IV	A. Polymer Science-II	Elective	40	14	10	4		
MICH-304(B)		B. Medicinal Chemistry-II	Elective	40	14	10	4		
MICH-305	V	Laboratory-I	Compulsory					50	25
MICH-306	VI	Laboratory-II	Compulsory					50	25
MICH-307	VII	Assignment & Comprehensive viva-voce	Compulsory	Overview Report on - Regional/Local Industrial visit & Survey (Industrial Establishment, Financial, Quality, HR, Occupational stress management & Corporate Social Responsibility)				50	25

Grand Total Maximum Marks **350**

25/5/24
(online)

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

M.Sc. Industrial Chemistry

Semester - III

Paper –I

MICH-301 : SPECTROSCOPY

UNIT – I :-

UV-visible Spectroscopy

Theory, Instrumentation, Characteristic absorption of organic compounds. Woodward and Fiser rules for calculating A max, Interpretation of spectra, Application of UV-visible spectroscopy.

Photo electron spectroscopy

Theory and application of UV and X-Ray photo electron spectroscopy, general idea of auger photoelectron spectroscopy, applications of photoelectron spectroscopy and Auger spectroscopy to the study of surfaces.

UNIT-II :-

Infrared Spectroscopy

Introduction, Theory, vibration modes, degree of freedom for linear and non linear molecules, instrumentation (Dispersive and non dispersive), applications and interpretation of spectra, GC-IR analysis.

Raman Spectroscopy

Introduction, Stokes line, anti stokes line, Theory, Raman shift, applications.

UNIT – III :-

Nuclear Magnetic Resonance Spectroscopy

Theory, Chemical Shift, Spin-spin splitting, environmental effect on NMR spectra. Instrumentation, rules governing the interpretation of H^1 NMR spectra. Application quantitative analysis, A brief account of ^{31}P NMR

^{13}C NMR : Historical Development, various terms used in C^{13} NMR, application of C^{13} NMR to structure determination, two dimensional NMR spectroscopy, principle, the COSY experiment, three dimensional NMR experiment

UNIT – IV :-

ESR: Concept, comparison between NMR and ESR, theory, instrumentation, presentation of ESR spectra, application, ENDOR, ELDOR

NQR: Theory, interaction of nuclear quadrupole with electromagnetic radiation, Instrumentation & applications ofnuclear quadrupole spectroscopy .

UNIT –V :-

Mass Spectroscopy

Concepts in Mass spectroscopy, Instrumentation, rules of spectral interpretation and application of Mass spectroscopy, Mclafferty rearrangement, acylium ion, oxonium ion, tropolium ion, molecular ion and metastable ion, online GC/Mass and LC/Mass analysis

Mossbaur (Fe &Sn)

General theory, instrumentation and important applications of Mossbaur Spectroscopy.

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

M.Sc. Industrial Chemistry

Semester - III

Paper –II

MICH-302 : ORGANIC CHEMISTRY – III

UNIT – I :-

Reagents in organic synthesis

Complex metal hydrides, Gilman's reagents, lithium dimethyl cuprate, lithium disopropylamide, dicyclohexilecarbodimide 1,3 dithiane, tri methyl silyliodide, tri—nbutyl tin hydride, DDQ, Phase transfer catalyst, crown ethers, Wilkinson's catalyst, Baker's yeast.

UNIT –II :-

Heterocyclic Chemistry

Synthesis and reactivity of furan, Thiophene, pyrrole, pyridine, Quinoline, Isoquinilone and indoleskraup synthesis, Fiesherindole synthesis.

UNIT – III :-

Molecular Rearrangement

Pinacol/Pinecolone rearrangement, Wagner-meerwein rearrangement, wolff, hoffman, curtius, lossen, Schmidt, Backman, Favorskin, Aston, Fries, Claisen, Shapiro.

Protecting Groups

Protection of organic functional groups, protecting reagents and removal of protecting groups.

UNIT - IV :-

Organic Reactions

Friedal-craft, Cannizaro, Aldol, Perkin, Stobbe, Dieckmann condensation, Reimer-Tiemann, Reformatsky, Diels-Alder, Robbinson annulation, Favorksin, Stork-enamine reaction, Michael, Petersons synthesis, Chichibabin reaction.

UNIT – V :-

Organic Synthesis - A disconnection approach

Introduction of disconnection, concepts of synthesis, synthetic equivalent, functional group interconversion, concepts and design of synthesis, criteria of good disconnection.

One group disconnection

Disconnection and synthesis of alcohols, olefins, simple ketone and acids.

Two Group disconnection

Disconnection in 1,3dioxygenated skeletons, preparation of 13-hydroxycorbonyl compounds, disconnection and synthesis of acyclic and cyclic hetero compounds.

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Semester - III

Paper –III(A)

MICH-303(A) : PESTICIDE CHEMISTRY

UNIT - I :-

Classification of Pesticides structure, synthesis, mode of action and application of environmental impact of following:

Insecticide of Plant Origin: Nicotine, Pyrethroids, Allthrin.

Fungicides: Dichlone, Captan

UNIT – II :-

Structure, synthesis, mode of action, application, SAR& environmental impact of following:

Chlorinated hydrocarbon: BHC, Heptachlor, Aldrin, Dieldrin, Endosulfar

UNIT – III :-

Structure, synthesis, mode of action, application & environmental impact of following:

Organo Phosphorous insecticides: Dichlorovos, Paraoxon

Dithio phosphoric acid derivatives: Malathion,

Thio phosphoric acid: Parathion, Demetron, Chlorthion etc.

Pyrophosphoric acid derivative: TEPP

UNIT – IV :-

Structure, synthesis, mode of action, application & environmental impact of following:

Carbonate insecticides: Carbaryl, Baygon

Rhodenticide : Zinc Phosphide, Warfarin, Fluoroacetamide.

UNIT —V :-

Formulation of Pesticides

Dry formulations: Dusts, granules, we table powders, seed disinfectant.

Liquid formulation: Emulsions, suspensions, aerosols and sprays.

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M.Sc. Industrial Chemistry
Semester - III
Paper –III(B)
MICH-303(B) : PHARMACEUTICS

UNIT – I :-

The design of dosage forms and Preformulation

a) Design of Dosages Forms: Principles of dosage form design, biopharamaceuticals consideration in dosage form design, routes of drug administration, drugs factors in dosage form design, therepeutics consideration in dosage form design,

b) Preformulation: Concept of preformulations, Uxorious aspects of preformulations, spectroscopy, solubility, melting point, powder flow properties, assay development.

UNIT - II :-

Physiochemical Principles of Pharmaceutics

a) Viscocity, Rheology and the flow of fluids : Newtonian and Non-Newtonian fluids, viscosity values for Newtonian fluids, determination of the flow properties of simple fluids, types of non-Newtonian behaviour, determination of the flow properties of non-Newtonian fluids, the effects of rheological properties on bioavailabal ity.

b) Solubility and dissolution rate: Methods of expressing solubility, prediction of solubility, solubility of liquids in liquids, solids in solids, gases in liquids and solids in liquids, dissolution rate of solids in liquids, factors affecting dissolution rates, measurement of dissolution rates

UNIT-III :-

a) Disperse systems: Colloids, Preparation of colloids, properties of colloids, physical stability of colloidal systems, gels, surface active agents, micellizations, solubilization, detergency.

b) Biopharmaceutics: Concept of Bioavailbility and Biopharmaceutics, factor influencing bioavailability, assement of bioavailability, representation of bioavailability data, absolute and related bioavailability, one compartment open model of drug disposition in the body. Dosage regimens and their influence on the concentration, time profile of a drug in the body.

UNIT – IV :-

Study of Pharmaceutical Dosages Form Design Consideration

a) Tablets: Types of tablets, tablets ingredients, diluents, binders, disintegrants, lubricants, colors, flavours, sweeteners, types of coating.

b) Tablet Standardization: Hardness, friability, weight variations, disintegration, dissolution and content uniformity tests.

c) Capsules: Hard geletins capsules — capsules size formulation and preparation of filled hard gelatins capsules, soft geletin capsules (soft gels) —Manufacturing procedures, quality control of capsules.

UNIT – V :-

a) Pharmaceutical Preparations: Principles and procedures involved in the dispensing of following classes of pharmaceutical dosages form — solutions, aromatic water, syrups, elixirs, spirits, tinctures, mixtures, lotions, liniments, throat paints.

b) Suspensions: Introduction, flocculations and deflocculating, sedimentations parameters, role of wetting, suspension formulation, evaluation of suspension stability.

c) Emulsions: Introduction, types, detection, thermodynamic consideration.

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Semester - III

Paper –IV(A)

MICH-304(A) : POLYMER SCIENCE – II

UNIT – I :-

Polymer Rheology and Morphology

Introduction stress and strain, idel elastic solid, Newtonian and non-newtonian fluid. Apparent viscosity the power, low molecular hole concept, weissenberg effects, reheological properties of fluid, melt fracture and irregular, time dependent flow, viscoelastic behaviour, mechanical model of a viscoelastic material relaxation enhancement under constant stress. Hysteresis, creep and relaxation of typical plastics.

Physical & mechanical testing of Polymer

Stress-strain measurement, dynamic mechanical behaviour, stress cracking, hardness, tear strength or tear resistance, resilience's, flex cracking resistance, abrasion resistance, impact resistance.

UNIT-II :-

Polymer processing

Compression moulding, casting, extrusion, injection moulding, thermoforming, Fibrespinning(melt, dry and wet spinning)

Polymer Products

Belting, hoses, rubber footwear, Rubber to metal bonded components, cellular rubbers, sports goods, cables, latex products, rubber rollers, extruded and moulded products.

UNIT – III :-

Functions and example of compounding ingredients

(1) Activators
(2) Accelerators
(3) Blowing agents
(4) So ftners
(5) Pigments
(6) Tactifers
(7) Release agents
(8) Reclaimed rubber
(9) Tactics
(10) Ground crumb
(11) Mineral rubber
(12) Retardecs

Fillers

Carbon Black: Introduction manufacturer and morphology, Physical & chemical properties, effect of carbon black properties on compounding, mixing & dispersion.

Non Black Fillers: Introduction manufactures characteristics and application of calcium carbonate, clays, silica in the rubber industry.

UNIT – IV :-

Adhesives: Solvent based, water based and adhesives based on various polymers. Epoxide resins curing of epoxide resins. Dilutents and other additives and their applications.

Composite materials: properties, advantages and methods of preparation.

Blends: Preparation, processing, properties, uses and Industrial aspects.

UNIT – V :-

Chemical Testing

Identification of materials by; elemental and solubility analysis. Identification by colour tests. Estimation of specific chemical characteristics like; acid number, saponification value and hydroxyl value. Solvent extractions and its analysis for polymers

Analysis & Testing of Polymers

Thermal analysis: DSC, TGA, TMA, DTA

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Semester - III

Paper –IV(B)

MICH-304 (B) : MEDICINAL CHEMISTRY — II

UNIT – I :-

Drugs acting on gastrointestinal disorders

(a) Agents for control of gastric acidity and treatment of peptic ulcers: Classification, pharmacology, mode of action, adverse effects, synthesis and structure activity relationship of Ranitidine, Sodium bicarbonate, Magnesium Hydroxide, Aluminum Hydroxide Gel, Sucralfate.

(b) Emetics and Antiemetics drugs.

(c) Drugs for constipation and Diarrhoea: Classification, pharmacology, mode of action, adverse effects, synthesis of Bran, Ispaghula (Psyllium), Diphenylmethanes, Sulfasalazine, Codeine.

UNIT - II :-

Cardiovascular drugs

a) Cardiavascular Drugs: Classification, pharmacology, mode of action, adverse effects, synthesis and structure activity relationship of Digoxin, Digitoxin, Clonidine, Hydralazine, Methyldopa, Nitroglycerine, Isoxsuprine, Prenylamine, Disopyramide Phosphate, Procainamide Hydrochloride.

b) Hematopoietic Agents: Growth factors, minerals, anticoagulants, thrombolytic and antiplatelate drugs

UNIT – III :-

Drugs acting on Kidney

a) Diuretics: Classification, pharmacology, mode of action, adverse effects, synthesis and structure activity relationship of Chlormerodrin, Hydrochlorothiazide, Acetazolamide, Chlarthlidona, Furosemide, Spironolactone, Mannitol.

b) Antidiuretics: Classification, pharmacology, mode of action, adverse effects, synthesis and structure activity relationship of Lypressin, Amiloride, Carbamazepine.

UNIT – IV :-

(a) Drugs of Arthritides& Gout: Classification, pharmacology, mode of action, adverse effects, synthesis of d-Penicillamine and NSAIDs, synthesis and structure activity relationship of, Chloroquine, Sulfasalazine, Colchicine, Allopurinol.

(b) Drugs of Cough and Bronchial Asthama: Classification, pharmacology, mode of action, adverse effects, synthesis and structure activity relationship of Codeine, dextromethorphan, bromhexine, ambroxol, guaiphenesin, isoprenaline, salbutamol, Theophylline, Aminophylline, Atropinmethonitrate, ketotifen.

UNIT – V :-

a) Drugs acting on skins and mucous membrane: Demulcents (Glycerine), Emollients (Vegetable Oils), Adsorbents and protectives (Calamine, Zinc Oxide, Zinc/ Magnesium stearate, Dimethicone), Astringents (Tannia acid, alcohol, minerals), Melanizing Agents, Drugs of Psoriasis (Calcipotriol), Demelanizing Agents (Hydroquinone, Monobenzone), Sunscreens, Drugs for acne vulgaris (Benzoyl peroxide, Retinoic acids, Antibiotics, Isotretinoin).

b) Anti Fungal Drugs: Classification, pharmacology, mode of action, adverse effects, synthesis and structure activity relationship of amphotericin B, Ketoconazol, Griseofulvin, Itaraconazol.

c) Antiviral Drugs: Classification, pharmacology, mode of action, adverse effects, synthesis and structure activity relationship of Acyclovir, Amantidine hydrochloride, Zidovudine.

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Semester – III

Paper - V

MICH-305 : Laboratory - I

Minor experiments	**1**	Determination of acidity of water sample.
	2	Determination of acid value of oil.
	3	To determine density of given liquid with respect to water using pyknometer/RD bottle.
	4	To determine the relative viscosity of given liquid with respect to water by Ostwald's viscometer.
	5	To determine surface tension of given liquid by
Major experiments	6	To prepare buffer standardization of pH meter and determine the molarity of HC1 pH-metrically provided
	7	To verify Beer Lambert's law with the help of colorimeter and find out the concentration of
	8	To determine the turbidence of given unknown solution using Nephloturbidimeter.
	9	Determination of total alkality of given sample of water.
	10	To determine the Ca^{2}+ and Mg^{2}+ hardness of given water
	11	To determine total hardness of given H2O sample by complexometric Method.
	12	Determination of Temporary and Permanent Hardness of given sample of water.
	13	Determination of free CO2 in a given sample of water.

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Semester – III

Paper - VI

MICH-306 : Laboratory - II

Quality assurance of drugs	**1**	To determine hardness of given caplet.
	2	To determine the bulk density of given powder.
	3	To determine friability of given caplet and tablet.
	4	To determine % dissolution of given caplet and tablet.
	5	To determine the disintegration of given tablet and caplet.
	6	To determine the amount of acetic acid and present in a given sample of vinegar.
	7	To prepare alumina from potash alum.
	8	To prepare Di-nitro methylene tetra amine (DNPT) from
	9	To prepare Calcium Stearate from stearic acid.
	10	To analyse the Antacid Tablets provided to you.
	11	To prepare Aloe Vera gel.
	12	To determine the Acidity of the fruit provided to you.

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Semester – III

Paper - VII

MICH-307 : Assignment & Comprehensive viva-voce

Overview Report on - Regional/Local Industrial visit & Survey (Industrial Establishment, Financial, Quality, HR, Occupational stress management & Corporate Social Responsibility)